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# Real-world patient perspectives and confidence with regard to secondary lifestyle modification and knowledge of 'heart attack' symptoms following the percutaneous revascularization procedure

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# Real-world patient perspectives and confidence with regard to secondary lifestyle modification and knowledge of 'heart attack' symptoms following the percutaneous revascularization procedure

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**Keywords:** Coronary artery disease, patient perspective, confidence, lifestyle

## Abstract

**Objective:** To elucidate the real-world patient perspectives on secondary lifestyle modification and precise knowledge of 'heart attack' after percutaneous coronary intervention (PCI) in coronary artery disease (CAD).

**Design:** Observational cross-sectional designed study.

**Setting:** A single university-based hospital center in Japan.

**Participants:** Two hundred and thirty seven consecutive CAD patients who underwent PCI (age: 67.5±10.1 years; 14.8% female; 79.3% elective PCI). The survey questionnaire included confidence levels of (1) lifestyle modification at the time of discharge, and (2) appropriate recognition of 'heart attack' symptoms, and reaction to these symptoms, on a 4-point Likert scale (1 = 'Not confident' to 4 = 'completely confident').

**Primary outcome measure:** The primary outcome was patient confidence level of lifestyle modification and recognition of 'heart attack' symptom.

**Results:** Overall, patients had a high level of confidence ("confident" or "completely-confident" >75%) in terms of smoking cessation, alcohol restriction, and medication adherence. However, they had relatively low level of confidence (<50%) in maintenance of blood pressure control, healthy diet, body weight, and routine exercise (≥3 times/week). When adjusted, male sex (OR: 3.61; 95% CI: 1.11-11.8) and lower educational level (OR: 3.25; 95% CI: 1.70-6.23) were identified as factors associated with lower confidence levels. With regard to confidence in the recognition of 'heart

attack', almost all respondents answered 'yes' to the query "I should go to hospital, as soon as possible, when I have a heart attack", but only 28% responders were confident in the knowledge of distinction between 'heart attack' symptoms and other conditions.

**Conclusions:** There were substantial disparities in the confidence levels associated with lifestyle modification and recognition/response to 'heart attack'. These gaps need to be shared and solved with a multidisciplinary team for further improvement in overall cardiovascular care.

**Strengths and limitations of this study**

- We quantified patient confidence levels based upon behavior and knowledge for several risk factors of coronary artery disease, which could be related adherence to lifestyle modification.
- This study also evaluated whether there was substantial gap between recognition and actions towards 'heart attack'.
- This is a small study based in a single-center, and data were based upon subjective perceptions by patients.
- The cross-sectional design of this study limits our ability to clarify the impact of the patient's confidence level on long-term clinical outcomes.

## 1. Introduction

Lifestyle modifications including a balanced diet, smoking cessation, limited alcohol consumption, and increased physical activity are recommended as first line management for coronary artery disease (CAD) and the American Heart Association /American College of Cardiology guidelines recommend a healthy dietary pattern with emphasis on the intake of vegetables, fruits, and whole grains, along with vigorous physical activity (3-4 aerobic sessions per week).[1,2] Adhering to lifestyle modification, including higher-quality diets, or exercise rehabilitation, have been associated with a lower risk of all-cause mortality among patients with CAD.[3,4]

The recognition and confidence levels of patients with regards to symptoms and reactions to 'heart attack' are also important patient-related factors which influencing clinical outcomes in these patients. A previous nurse-led study revealed that education and counseling intervention led to increasingly positive attitudes in terms of patient response to 'heart attack',[5] suggesting that knowledge pertaining to 'heart attack' could also represent a modifiable factor in the optimization of CAD management. Furthermore, inappropriate understanding of the symptoms related to CAD could directly affect the action of patients in seeking prompt emergency care,[6-9] which is known to contribute to timely reperfusion therapy. Insufficient knowledge or confidence in lifestyle modifications, as well as awareness regarding 'heart attack', could therefore represent patient-related barriers in the optimization of CAD management.

Understanding patient perspective on these modifiable factors is essential to close the conception gap between the health care providers and patients, as well as providing appropriate instructions. Herein, our primary goal was to elucidate the confidence levels with regard to lifestyle modification and 'heart attack' symptom recognition, as well as their determinants, in the patients treated with percutaneous coronary intervention (PCI).

## 2. Methods

### *Study population*

We performed an observational cross-sectional designed study. The study population consisted of 237 consecutive patients who underwent PCI between October 2011 and September 2012 at a single university-based hospital center (Keio University Hospital, Tokyo, Japan). Our nurse team obtained the completed survey questionnaire after discharge instructions, which were typically provided 24-48 hours before discharge. At this time, patients also answered a number of questions on the survey regarding patient lifestyle after discharge.

We excluded one patient (0.4%) due to missing data in the questionnaire; our analysis thus included a total of 236 patients (99.6%) who had answered all of the survey questions. Within this final cohort of study patients, 55 patients (23.3%) with acute coronary syndrome (ST-elevation myocardial infarction n=28, Non-ST-elevation myocardial infarction and unstable angina n=27) and 181 patients (76.7%) with stable angina or silent ischemia were included. All patients provided written informed consent to participate. The study protocol conformed to the ethical guidelines of the 1975 Declaration of Helsinki as reflected in a priori approval by the institutional review board committee.

### *The survey questionnaire*

The survey included questions across a wide range of variables (Table 1).

**Table 1. Questionnaire for patients treated with percutaneous coronary intervention.**

| Domains | No. of questions | Questionnaire |
|---|---|---|
| **First domain** | **2** | **Satisfaction with our hospital educational program** |
| | | Are you satisfied with our lifestyle modification program? |
| | | Are you satisfied with our nutrition modification program? |
| **Second domain** | **12** | **Self-confidence level of lifestyle modification** |
| | **9** | **Behavior based questions** |
| | | I feel confident that I can avoid eating fatty food throughout the year. |
| | | I feel confident that I can avoid eating salty food throughout the year. |
| | | I feel confident that I can keep my blood pressure target. |
| | | I feel confident that I can keep my body weight target. |
| | | I feel confident that I can exercise regularly. |
| | | I feel confident that I can exercise more than 30 minutes in each session. |
| | | I feel confident that I can stop smoking. |
| | | I feel confident that I can limit alcohol intake. |
| | | I feel confident that I can properly take drugs without failure. |
| | **3** | **Knowledge based questions** |
| | | I feel confident that I understand well the risk of smoking. |
| | | I feel confident that I understand well the risk of alcohol intake. |
| | | I feel confident that I understand well the risk of depression, anxiety, and insomnia. |
| **Third domain** | **2** | **Action and recognition towards heart attack** |
| | | I should go to hospital as soon as possible when heart attack happens. |
| | | I feel confident that I can distinguish between heart attack and other disease. |

**Table 2. Demographical information of the study participants**

| Patient characteristics | *n* = 237 | % |
|---|---|---|
| Age, years | 67.5 ± 10.1 | |
| Male | 202 | 85.2 |
| BMI, kg/m$^2$ | 24.6 ± 3.4 | |
| University education or more | 118 | 49.8 |
| Married | 200 | 84.4 |
| Living alone | 31 | 13.1 |
| Coronary risk factors | | |
| Hypertension | 188 | 79.3 |
| Diabetes mellitus | 93 | 39.2 |
| Dyslipidemia | 179 | 75.5 |
| Smoking | 65 | 27.4 |
| Family history of CAD | 52 | 21.9 |
| Previous PCI | 96 | 40.5 |
| Previous CABG | 5 | 2.1 |
| Previous MI | 64 | 27 |
| Previous HF | 14 | 5.9 |
| CVD | 31 | 13.1 |
| PAD | 36 | 15.2 |
| COPD | 18 | 7.6 |
| ACS | 49 | 20.7 |
| Multivessel disease | 59 | 24.9 |
| Laboratory data | | |
| CRP, mg/dl | 0.49 ± 1.37 | |
| Cr, mg/dl | 1.32 ± 1.86 | |
| TG, mg/dl | 146.5 ± 79.5 | |
| HDL, mg/dl | 43.6 ± 12.5 | |
| LDL, mg/dl | 87.4 ± 29.5 | |
| Satisfaction with educational program; very useful or useful | | |
| Lifestyle modification | 168 | 70.8 |
| Nutrition guidance | 170 | 71.7 |

Data are shown as mean ± SD or number and %. BMI: body mass index, CAD: coronary artery disease, PCI: percutaneous coronary intervention, CABG: coronary artery bypass graft, MI: myocardial infarction, HF: heart failure, CVD: cerebrovascular disease, PAD: peripheral arterial

disease, COPD: chronic obstructive pulmonary disease, ACS: acute coronary syndrome, CRP: C-reactive protein, Cr: creatinine, TG: triglyceride, HDL: high density lipoprotein, LDL: low density lipoprotein.

**Table 3A. Determinants of low confidence level in lifestyle modification**

| | Univariate models | | | Multivariate models | | |
|---|---|---|---|---|---|---|
| Variables | OR | 95% CI | p Value | OR | 95% CI | p Value |
| Age | 0.98 | 0.95-1.01 | 0.10 | 0.98 | 0.95-1.02 | 0.30 |
| Male | 3.51 | 1.18-10.5 | 0.02 | 3.61 | 1.11-11.8 | 0.03 |
| Obesity (BMI>25) | 2.36 | 1.33-4.18 | 0.003 | 1.73 | 0.90-3.33 | 0.10 |
| High school graduation or less | 2.51 | 1.40-4.50 | 0.002 | 3.25 | 1.70-6.23 | <0.001 |
| Hypertension | 0.91 | 0.46-1.79 | 0.78 | 1.22 | 0.53-2.81 | 0.64 |
| Dyslipidemia | 0.54 | 0.29-1.01 | 0.05 | 0.61 | 0.30-1.27 | 0.19 |
| Diabetes mellitus | 1.14 | 0.65-2.01 | 0.65 | 1.22 | 0.64-2.30 | 0.55 |
| Previous MI | 1.03 | 0.55-1.92 | 0.93 | 0.96 | 0.47-1.96 | 0.90 |

OR: odds ratio, CI: confidence interval, BMI: body mass index, MI: myocardial infarction.

**Table 3B. Determinants of high confidence in precise recognition of heart attack**

| | Univariate models | | | Multivariate models | | |
|---|---|---|---|---|---|---|
| Variables | OR | 95% CI | p Value | OR | 95% CI | p Value |
| Age | 0.99 | 0.96-1.02 | 0.54 | 0.99 | 0.96-1.03 | 0.67 |
| Male | 0.71 | 0.32-1.58 | 0.40 | 0.60 | 0.24-1.52 | 0.28 |
| Obesity (BMI>25) | 1.22 | 0.69-2.15 | 0.50 | 1.51 | 0.78-2.90 | 0.22 |
| High school graduation or less | 1.10 | 0.62-1.96 | 0.74 | 0.69 | 0.36-1.32 | 0.26 |
| Hypertension | 1.53 | 0.73-3.20 | 0.26 | 1.36 | 0.60-3.07 | 0.46 |
| Dyslipidemia | 2.03 | 0.98-4.20 | 0.06 | 1.49 | 0.68-3.27 | 0.32 |
| Diabetes mellitus | 0.74 | 0.41-1.34 | 0.33 | 0.16 | 0.33-1.20 | 0.16 |
| Previous MI | 2.10 | 1.14-3.86 | 0.02 | 2.53 | 1.29-4.94 | 0.007 |

OR: odds ratio, CI: confidence interval, BMI: body mass index, MI: myocardial infarction.

Questions were grouped in three domains:

1) satisfaction level with the hospital educational program

2) self-confidence level in terms of lifestyle modification

3) confidence level in terms of the awareness of 'heart attack'.

For domain 1, patients were asked to rate their satisfaction level in terms of lifestyle and nutrition guidance by using a 5-point Likert-scale (1 = 'never-useful', 2 = 'not-useful', 3 = 'little-useful', 4 = 'useful', 5 = 'very-useful', or 'not provided with educational program'), and patients were divided into a useful group [4 or 5] and a useless group [1, 2, or 3]. For domain 2, the self-confidence level of lifestyle modification questionnaire contained 12 questions which were scored based on a 4-point Likert scale (1 = 'not-confident', 2 = 'less-confident', 3 = 'confident', 4 = 'completely-confident'), and patients were divided into a confident group [3 or 4] and a less-confident group [1 or 2]. These self-confidence questions consisted of 9 behavior-based confidence levels (drug adherence, alcohol restriction, smoking cessation, exercise over 30 minutes, regular exercise, keeping body weight, keeping blood pressure, avoiding salty food, avoiding fatty food) and three knowledge-based confidence levels (danger of smoking, alcohol, depression/ anxiety/ or insomnia). The sum of each confidence level in the 9 behavior-based questions in lifestyle modification were calculated as the overall confidence level in lifestyle modification, and we defined the lower tertile for this overall confidence level as a "low confidence group", and

surveyed the patient characteristics associated with this group of patients. For the final domain (domain 3), patients were asked to rate their recognition and action towards 'heart attack' by using a 4-point Likert-scale.

***Statistical analysis***

Continuous variables were summarized as mean and standard deviations (SD) and categorical variables as percentages. Logistic regression analyses were conducted to assess the association of patients' confidence in behavior-based lifestyle modification, as well as the precise recognition of 'heart attack' with various patient characteristics. For multivariate analysis, the variables submitted to the model included age, male, obesity, high school graduation or lower, hypertension, diabetes mellitus, dyslipidemia, and myocardial infarction (MI). Before multiple logistic regression analyses were performed, multicollinearity was assessed, and factors indicating serious multicollinearity were accordingly eliminated from the model. For all statistical analyses, significance was accepted at $P < 0.05$. Data analysis was performed using SPSS statistical software (SPSS Inc., Chicago, Illinois, USA).

## 3. Results

Demographic data and satisfaction level of participants with their educational program are shown in Table 2 (domain 1). Most of the participants were male, and approximately half of our participants had received university education or higher. Approximately 70% of patients considered their lifestyle modification program as useful ("very useful" 26%, "useful" 45%, "little-useful" 12%, "not-useful" 5%, "never useful" 9%). Nutritional guidance was also considered useful in approximately 70% of patients ("very useful" 28%, "useful" 44%, "little-useful" 15%, "not-useful" 4%, and "never useful" 6%).

Figure 1 shows the behavior- and knowledge-based confidence levels associated with lifestyle modification (domain 2). We categorized each item into high confidence ("confident" or "completely-confident" >75%) and low confidence ("confident" or "completely-confident" <50%). Most of the participants were highly confident in smoking cessation, alcohol restriction, and adherence to medication. However, they had low levels of confidence in blood pressure and cholesterol control, diet regulation, and body weight maintenance, as well as routine exercise (Figure 1A). In terms of knowledge-based confidence level of lifestyle modification, the majority of patients were confident in understanding the danger of smoking or alcohol, but were not confident in their understanding of the risk of depression, anxiety, and insomnia (Figure 1B).

The total confidence score was calculated from the sum of the previously described nine behavior-based confidence levels in lifestyle modification (maximum score was 36 points). Patients

scoring less than the first tertile for total confidence (<23 points) were defined as the low confidence group. Univariate regression analysis showed that male sex, obesity, and lower education level were associated with the low confidence group with respect to lifestyle modification. In multivariate regression analysis adjusted by age, sex, obesity, educational level, coronary risk factors, and previous MI, we found that male sex (OR 3.61, 95% CI 1.11-11.8), and lower educational level (OR 3.25, 95% CI 1.70-6.23), were independent determinants of the low confidence group (Table 3A). The significant association between obesity and low confidence level in lifestyle modification disappeared following adjustment with covariates (OR 1.73, 95% CI 0.90-3.33).

Patients' recognition towards 'heart attack' is shown in Figure 2 (domain 3). When questioned whether they agreed with the idea of going promptly to hospital after heart attack, 233 patients (98%) agreed with the idea ("completely-agree" 50% and "agree" 48%), while one and two patients disagreed and completely disagreed with the idea, respectively. On the other hand, only 28% were confident in distinguishing between 'heart attack' and other diseases ("completely-confident" 5% and "confident" 23%), while 100 patients (42%) were "less-confident" and 67 (28%) patients were "not-confident".

Within this domain, univariate logistic regression analysis revealed that patients who had high confidence in awareness regarding 'heart attack' were associated with a previous history of MI, and that this association remained significant after adjustment for age, sex, and coronary risk factors (OR 2.53, 95% CI 1.29-4.94; Table 3B).

## 4. Discussion

The present study demonstrated the following key points: 1) the confidence levels in terms of lifestyle modification were different across the various risk factors for CAD patients, and patients had low confidence in blood pressure and cholesterol control, diet regulation, and body weight maintenance, as well as routine exercise; 2) low confidence in overall lifestyle modification was associated with male sex and low education level; and 3) there was a substantial gap between recognition and action towards 'heart attack'.

Much of the existing research on lifestyle modification has focused on single behaviors, e.g., smoking cessation, but the accomplishment level of lifestyle modification can vary among the main modifiable risk factors, including alcohol restriction, dyslipidemia, obesity, physical inactivity, hypertension, and diabetes. The strength of this study is that we quantified patient confidence levels based upon behavior for several risk factors of CAD, which could be related to adherence to lifestyle modification. Although patient education is known to be an important intervention in enhancing the adherence of lifestyle modification,[10] the challenge is how effective education programs could be offered to CAD patients given limited human resources, as well as the limited duration of hospitalization or outpatient consultation. We demonstrated that CAD patients were not confident in adhering to regular and sufficient amounts of exercise after discharge. The adherence to exercise training was reported as being low, approximately less than 60% in patients with heart failure (HF),[11,12] which is consistent with our data. Cardiologists need to emphasize its importance, and

pursue strategies to promote regular exercise, such as more extensive referral for cardiac rehabilitation and structured nurse- or therapist-led contact.[13] Our patients were also less confident in terms of the factors related to dietary and nutrition. Several previous studies reported poor adherence to salt or diet restriction among patients with chronic diseases, such as HF or diabetes mellitus,[14-16] suggesting that the difficulties in adherence to diet modification could be universal. Despite its powerful opportunities to reduce adverse health, confusion surrounding nutritional guidance sometimes emerges because of the rapid advances in dietary and nutrition science.[17] Continuous education, performed by multidisciplinary teams, especially nutritionists and diabetologists, could be essential in improving lifestyle modification.

Knowledge of predisposing risk factors is an important step in the modification of lifestyle behaviors. Our study demonstrated that most responders understood the risk of smoking or excessive alcohol intake and were confident in their restriction. This robust knowledge was most likely due to repeated public health promotion, leading to patient motivation for restriction with relative ease.[18,19] In fact, the prevalence of smoking and alcohol consumption in Japan has declined over the last 10 year.[20,21] Considering these results, the importance of promoting smoking cessation and alcohol restriction through educational programs might be low relative to several other modifiable risk factors. On the other hand, psychological and sleep disturbances are known to be under-recognized and undertreated in cardiovascular patients by cardiologists despite its significance in the development and progression of various cardiovascular conditions, including CAD.[22,23] In

parallel with these circumstances, patient knowledge relating to depression, anxiety, and insomnia as risk factors for CAD, was relatively low in our study population. Educational campaigns, directed at cardiologists and patients, are now needed to improve awareness of psychological and sleep disturbances as risk factors for CAD patients.

It is common for patients to have limited knowledge of 'heart attack' symptoms, and the lack of awareness in this regard represented a significant barrier to patients taking action and seeking medical care.[6] In our study, most of the participants had low confidence in distinguishing between 'heart attack' and other disease. Patients with a history of MI were associated with high confidence in their precise recognition of 'heart attack', possibly because of their intense previous experience of this condition. Therefore, education on 'heart attack' in CAD patients without previous MI is recommended.

There were some limitations to the present study that should be considered while interpreting the results. First, this was a small study based in a single-center. Therefore, the study involved a small number of patients; consequently, statistical power may not have been sufficient to detect any negative outcomes. Second, the cross-sectional design of this study limits our ability to clarify the impact of the patient's confidence level on lifestyle modification and awareness of 'heart attack' on long-term clinical outcomes. Third, our study population included only those who underwent PCI, thus excluding patients who were not eligible for coronary revascularization that could have caused potential selection bias. Finally, data are based upon subjective perceptions by

patients, and not objective measurements, and thus confidence levels are subject to individual bias.

## 5. Conclusions

There were substantial disparities in the confidence level of lifestyle modification, as well as awareness of 'heart attack', in patients treated with PCI. These disparities need to be shared and solved with the help of a multidisciplinary team for further improvement in overall cardiovascular care.



**Abbreviations List**

| | |
|---|---|
| ACS | acute coronary syndrome |
| BMI | body mass index |
| CABG | coronary artery bypass graft |
| CAD | coronary artery disease |
| CI | confidence interval |
| COPD | chronic obstructive pulmonary disease |
| Cr | creatinine |
| CRP | C-reactive protein |
| CVD | cerebrovascular disease |
| HDL | high density lipoprotein |
| HF | heart failure |

| | |
|---|---|
| LDL | low density lipoprotein |
| MI | myocardial infarction |
| OR | odds ratio |
| PAD | peripheral arterial disease |
| PCI | percutaneous coronary intervention |
| SD | standard deviations |
| TG | triglyceride |

**Ethical Approval and Consent to participate**

This study was approved by the ethics committee of Keio University School of Medicine. Informed consent was obtained from patients before they answered the questionnaire.

**Consent for publication**

Not applicable.

**Data sharing statement**

The dataset analyzed during this study are available from the corresponding author Takashi Kohno (kohno.a2@keio.jp) on reasonable request.

## Competing interests

The authors report no relationships that could be construed as a conflict of interest including related consultancies, shareholdings, and funding grants.

## Sources of Funding

No financial support was received for this study.

## Authors' contributions

HK and TK had full access to all data and were responsible for the integrity and the accuracy of the data analysis. Study design; HK, TK, and SK, Acquisition and analysis of data: HK, TK, FF, NN, and RF. Interpretation of data; HK, TK, SK, SY, and YM. Drafting of the manuscript; HK, TK, and SK. Critical revision of the manuscript for intellectual content: SY, YM, and KF.

## Authors' information

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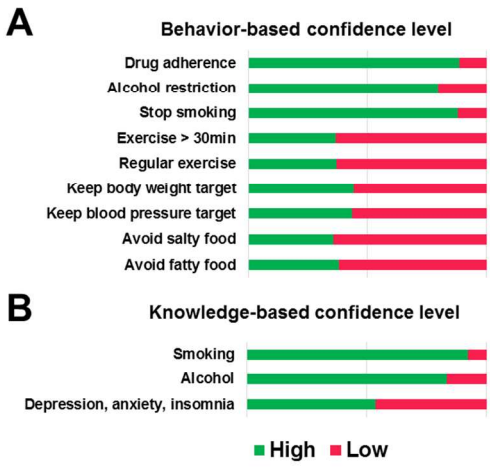
**Figure legend**

Figure 1: Self-confidence level in terms of lifestyle modification (A; behavior-based and B; knowledge based confidence level)

Figure 2: Patients' perception and recognition towards heart attack

# Figure 1

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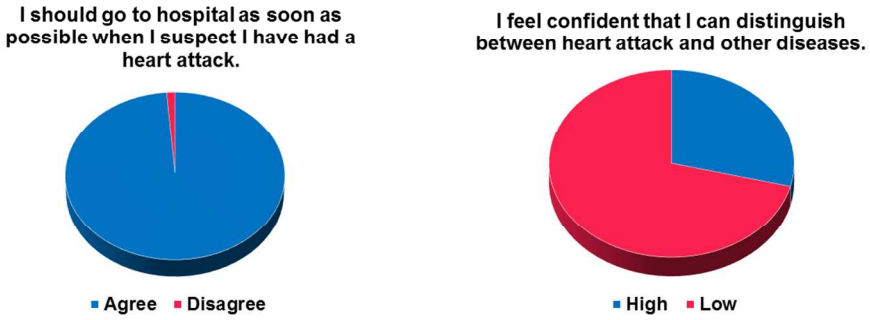
## Figure 2

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STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

| | Item No | Recommendation | Page in Manuscript |
|---|---|---|---|
| **Title and abstract** | 1 | (*a*) Indicate the study's design with a commonly used term in the title or the abstract | **Page 2~~1~~** |
| | | (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found | **Page 2** |
| **Introduction** | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | **Page 5** |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses | **Page 5, 6** |
| **Methods** | | | |
| Study design | 4 | Present key elements of study design early in the paper | **Page 7** |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | **Page 7** |
| Participants | 6 | (*a*) Give the eligibility criteria, and the sources and methods of selection of participants | **Page 7** |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | **Page 7, 8, 9** |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | **Page 7, 8** |
| Bias | 9 | Describe any efforts to address potential sources of bias | **Page 7** |
| Study size | 10 | Explain how the study size was arrived at | **Page 7** |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | **Page ~~7~~8** |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding | **Page ~~9~~8** |
| | | (*b*) Describe any methods used to examine subgroups and interactions | **NA~~Page 8~~** |
| | | (*c*) Explain how missing data were addressed | **Page 7** |
| | | (*d*) If applicable, describe analytical methods taking account of sampling strategy | **NA** |
| | | (*e*) Describe any sensitivity analyses | **NA** |
| **Results** | | | |
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | **Page 7, 10~~1~~** |
| | | (b) Give reasons for non-participation at each stage | **Page 7** |
| | | (c) Consider use of a flow diagram | **NA** |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg | **Page 10, Table 2** |

| | | | |
|---|---|---|---|
| | | demographic, clinical, social) and information on exposures and potential confounders | |
| | | (b) Indicate number of participants with missing data for each variable of interest | Page 7~~NA~~ |
| Outcome data | 15* | Report numbers of outcome events or summary measures | **Page 10, 11** |
| Main results | 16 | (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | **Page 10,11** |
| | | (*b*) Report category boundaries when continuous variables were categorized | **Page 10,11** |
| | | (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | **NA** |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | **NA** |
| **Discussion** | | | |
| Key results | 18 | Summarise key results with reference to study objectives | **Page 12** |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | **Page 14** |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | **Page 12,13,14** |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | **Page 12** |
| **Other information** | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | **Page ~~15,~~16** |

*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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# Patients' confidence with regard to secondary lifestyle modification and knowledge of "heart attack" symptoms following percutaneous revascularization in Japan: A cross-sectional study



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| | |

# Patients' confidence with regard to secondary lifestyle modification and knowledge of "heart attack" symptoms following percutaneous revascularization in Japan: A cross-sectional study

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**Word counts:** Text: 3612 words (Introduction–Conclusion, including tables); Abstract: 298 words

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**Keywords:** Coronary artery disease, patient perspective, confidence, lifestyle

## Abstract

**Objective:** To assess patient perspectives on secondary lifestyle modification and knowledge of "heart attack" after percutaneous coronary intervention (PCI) for coronary artery disease (CAD).

**Design:** Observational cross-sectional study.

**Setting:** A single university-based hospital center in Japan.

**Participants:** Two hundred thirty-six consecutive patients with CAD who underwent PCI and completed the questionnaire (age, 67.4 ± 10.1 years; women, 14.8%; elective PCI, 75.4%). The survey questionnaire included questions related to confidence levels about 1) lifestyle modification at the time of discharge and 2) appropriate recognition of heart attack symptoms, and reaction to these symptoms, on a four-point Likert scale (1 = Not confident to 4 = Completely confident).

**Primary outcome measure:** The primary outcome assessed was the patients' confidence level about lifestyle modification and recognition of heart attack symptoms based on the original questionnaire.

**Results:** Overall, patients had a high level of confidence (Confident or Completely confident, >75%) concerning smoking cessation, alcohol restriction, and medication adherence. However, they had relatively low level of confidence (<50%) in maintenance of blood pressure control, healthy diet, body weight, and routine exercise (≥3 times/week). After adjustment, male sex (odds ratio [OR] 3.61, 95% confidence interval [CI] 1.11–11.8) and lower educational level (OR 3.25; 95% CI 1.70–6.23) were identified as factors associated with lower confidence levels. With regard to confidence in the recognition of heart attack, almost all respondents answered "yes" to the item "I should go to the

hospital as soon as possible when I have a heart attack"; however, only 28% of the responders were confident in their knowledge of distinction between heart attack symptoms and other conditions.

**Conclusions:** There were substantial disparities in the confidence levels associated with lifestyle modification and recognition/response to heart attack. These gaps need to be further studied and disseminated to further improve cardiovascular care.

**Strengths and limitations of this study**

**Strengths:**

- We quantified patient confidence levels based on their behavior toward and knowledge of several risk factors for coronary artery disease, which could be related to adherence to lifestyle modification.
- We also evaluated whether there was a substantial gap between patients' recognition and actions toward "heart attack".

**Limitations:**

- This is a small study conducted in a single center, and data were based on subjective perceptions by patients.
- The cross-sectional design of this study limits its ability to clarify the impact of the patients' confidence level on long-term clinical outcomes.

## 1. Introduction

Lifestyle modifications including a balanced diet, smoking cessation, limited alcohol consumption, and increased physical activity are recommended as the first-line management for coronary artery disease (CAD). The American Heart Association/American College of Cardiology guidelines recommend a healthy dietary pattern with emphasis on the intake of vegetables, fruits, and whole grains, along with vigorous physical activity (three to four aerobic sessions per week).[1, 2] Adhering to lifestyle modification, including higher-quality diets or exercise rehabilitation, has been associated with a lower risk of all-cause mortality among patients with CAD.[3, 4]

The recognition and confidence levels of patients with regard to symptoms and reactions to "heart attack" are also important patient-related factors influencing clinical outcomes. A previous nurse-led study revealed that education and counseling intervention led to increasingly positive attitudes in terms of patient response to heart attack,[5] suggesting that knowledge pertaining to heart attack could also represent a modifiable factor in the optimization of CAD management. Furthermore, inappropriate understanding of the symptoms related to CAD could directly affect the action of patients in seeking prompt emergency care,[6-9] which is known to contribute to timely reperfusion therapy.

In recent years, the patients' perspective on lifestyle modification or disease recognition has been the subject of much research in the field of cardiovascular diseases.[10, 11] Understanding patient perspective on these modifiable factors is essential to close the perception gap between

health-care providers and patients in terms of patients' confidence level about lifestyle modification or disease recognition. These approaches also could help identify imbalances in the composition of patient education programs and assess their appropriateness. Herein, our primary goal was to elucidate the perspectives on secondary lifestyle modification and precise knowledge of heart attack in patients treated with percutaneous coronary intervention (PCI) in Japan.

## 2. Methods

### *Study population and data collection*

We performed an observational cross-sectional study. The study population consisted of 237 consecutive patients who underwent PCI between October 2011 and September 2012 at a single university-based hospital center (Keio University Hospital, Tokyo, Japan). Our nurse team obtained the completed survey questionnaires immediately after a group educational program and provision of discharge instructions, which are typically conducted 24–48 h before discharge. Patient education was conducted by nurses and nutritionists by using video and literature materials for lifestyle modification and nutritional guidance, which was followed by face-to-face counseling by a nurse. At this time, the nurses answered a number of questions related to the survey questionnaire from the patients.

We excluded one patient (0.4%) owing to missing questionnaire data; thus, our analysis included a total of 236 patients (99.6%) who had answered all of the survey questions. Within this final cohort of study patients, 55 patients (23.3%) were diagnosed with acute coronary syndrome (ACS)(ST-elevation myocardial infarction, n = 28; non-ST-elevation myocardial infarction and unstable angina, n = 27), and 181 patients (76.7%) were diagnosed with stable angina or silent ischemia. Patients hospitalized for stable angina had more previous PCI than those hospitalized for ACS (n = 90 [49.7%] vs. n = 6 [10.9%], $p < 0.001$). All patients provided written informed consent to participate. The study protocol conformed to the ethical guidelines of the 1975 Declaration of

Helsinki as reflected in a prior approval by the Keio University School of Medicine Ethics Committee (approval no. 20110263).

***Survey questionnaire***

The survey included questions across a wide range of variables (Table 1).

**Table 1. Questionnaire for patients treated with percutaneous coronary intervention**

| Domains | Educational content |
|---|---|
| **First domain** | **Usefulness of our hospital educational program** |
| | **(Likert scale: 1 = Never useful to 5 = Very useful)** |
| | Do you think our lifestyle modification program was useful? |
| | Do you think our nutrition modification program was useful? |
| **Second domain** | **Self-confidence level of lifestyle modification** |
| | **Behavior-based questions** |
| | **(Likert scale: 1 = Not confident to 4 = Completely confident)** |
| | I feel confident that I can avoid eating fatty food throughout the year. |
| | I feel confident that I can avoid eating salty food throughout the year. |
| | I feel confident that I can keep my blood pressure target. |
| | I feel confident that I can keep my body weight target. |
| | I feel confident that I can exercise regularly. |
| | I feel confident that I can exercise more than 30 min in each session. |
| | I feel confident that I can stop smoking. |
| | I feel confident that I can limit my alcohol intake. |
| | I feel confident that I can properly take drugs without failure. |
| | **Knowledge-based questions** |
| | **(Likert scale: 1 = Not confident to 4 = Completely confident)** |
| | I feel confident that I understand well the risk of smoking. |
| | I feel confident that I understand well the risk of alcohol intake. |
| | I feel confident that I understand well the risk of depression, anxiety, and insomnia. |
| **Third domain** | **Action and recognition toward heart attack** |
| | I should go to the hospital as soon as possible when heart attack occurs. |
| | **(Likert scale: 1 = Never agree to 4 = Completely agree)** |

I feel confident that I can distinguish between heart attack and other disease.

**(Likert scale: 1 = Not confident to 4 = Completely confident)**

The questions were grouped into three domains:

1) Usefulness of the hospital educational program;

2) Self-confidence level in terms of lifestyle modification;

3) Confidence level in terms of the awareness of heart attack.

The questionnaire was originally designed after an in-depth discussion among board-certified cardiologists and nurses in our institute for this study, and was largely based on the recommendations from the Japanese Circulation Society (JCS) guideline.[12] We first generated two major domains; (1) lifestyle modification, and (2) action and recognition towards heart attack. The components of lifestyle modification were initially chosen from this JCS guideline Class I recommendations (plus Class IIa if no Class I recommendations are available). The latter questionnaires for action and recognition towards heart attack were specifically developed from the investigators for the present study. We chose the words heart attack that was commonly used in clinical practice, not medical jargon (e.g., myocardial infarction), which could help the patients understand the questionnaire with ease.[13] In order to evaluate and validate the preliminary questionnaire, we then conducted pilot study with 17 patients (not included in the final analysis). Upon reviewing the responses, the main adjustments were made with the addition of questions related to the usefulness of our hospital education program. For domain 1, patients were asked to rate the usefulness of lifestyle and nutrition

guidance by using a five-point Likert scale (1 = Never useful, 2 = Not useful, 3 = Little useful, 4 = Useful, 5 = Very useful, or not provided with the educational program), and patients were divided into a useful group (4 or 5) and a not useful group (1, 2, or 3). For domain 2, the questionnaire about self-confidence level with regard to lifestyle modification contained 12 questions that were scored based on a four-point Likert scale (1 = Not confident, 2 = Less confident, 3 = Confident, 4 = Completely confident), and the patients were divided into a confident group (3 or 4) and a less confident group (1 or 2). These self-confidence questions consisted of nine behavior-based confidence levels (drug adherence, alcohol restriction, smoking cessation, exercise >30 min, regular exercise, keeping body weight, keeping blood pressure, avoiding salty food, and avoiding fatty food) and three knowledge-based confidence levels (danger of smoking, alcohol, depression/anxiety, or insomnia). The sum of each confidence level in the nine behavior-based questions on lifestyle modification was calculated as the overall confidence level in lifestyle modification, and we defined the lower tertile for this overall confidence level as a "low confidence group," and surveyed the characteristics associated with this group of patients. For the final domain (domain 3), patients were asked to rate their recognition and action toward heart attack by using a four-point Likert scale.

***Statistical analysis***

Continuous variables were summarized as means and standard deviations, and categorical variables as percentages. Logistic regression analyses were conducted to assess the association of the

patients' confidence in behavior-based lifestyle modification, as well as their precise recognition of heart attack with various patient characteristics. For multivariate analysis, the variables submitted to the model included age, male sex, obesity, high school graduation or less, hypertension, diabetes mellitus, dyslipidemia, and previous myocardial infarction (MI) or PCI. Before multiple logistic regression analyses were performed, multicollinearity was assessed, and factors indicating serious multicollinearity were accordingly eliminated from the model. For all statistical analyses, significance was accepted at $p < 0.05$. Data analysis was performed using SPSS statistical software (SPSS Inc., Chicago, IL, USA).

## 3. Results

Demographic data and rating of the usefulness of the educational program by participants are shown in Table 2 (domain 1). Most of the participants were men, and approximately half of them had received university education or higher. Approximately 70% of patients considered their lifestyle modification program as useful (Very useful, 26%; Useful, 45%; Little useful, 12%; Not useful, 5%; Never useful, 9%). Nutritional guidance was also considered useful by approximately 70% of the patients (Very useful, 28%; Useful, 44%; Little useful, 15%; Not useful, 4%; Never useful, 6%).

Figure 1 shows the behavior- and knowledge-based confidence levels associated with lifestyle modification (domain 2). We categorized each item into high confidence (Confident or Completely confident, >75%) and low confidence (Confident or Completely confident, <50%). Most of the participants were highly confident in smoking cessation, alcohol restriction, and adherence to medication. However, they had low levels of confidence in blood pressure and cholesterol control, diet regulation, body weight maintenance, and routine exercise (Figure 1A). In terms of knowledge-based confidence level of lifestyle modification, most of the patients were confident in their understanding of the danger of smoking or alcohol, but were not confident in their understanding of the risk of depression, anxiety, and insomnia (Figure 1B).

The total confidence score was calculated from the sum of the previously described nine behavior-based confidence levels in lifestyle modification (maximum score, 36 points). Patients scoring lower than the first tertile for total confidence (<23 points) were defined as the low

confidence group. Univariate regression analysis showed that male sex, obesity, and lower education level were associated with the low confidence group with respect to lifestyle modification. In multivariate regression analysis adjusted for age, sex, obesity, educational level, coronary risk factors, and previous MI or previous PCI, we found that male sex (odds ratio [OR] 3.61, 95% confidence interval [CI] 1.11–11.8) and lower education level (OR 3.25, 95% CI 1.70–6.23) were independent determinants of the low confidence group (Table 3A). The significant association between obesity and low confidence level in lifestyle modification disappeared after adjustment for covariates (OR 1.73, 95% CI 0.90–3.33).

The patients' recognition of heart attack is shown in Figure 2 (domain 3). When questioned whether they agreed with the idea of promptly going to the hospital after a heart attack, 233 patients (98%) agreed with the idea (Completely agree, 50%; Agree, 48%), whereas one and two patients disagreed and completely disagreed with the idea, respectively. On the other hand, only 28% were confident in distinguishing between heart attack and other diseases (Completely confident, 5%; Confident, 23%), whereas 100 patients (42%) were Less confident and 67 (28%) patients were Not confident.

Within this domain, univariate logistic regression analysis revealed that patients who had high confidence in their awareness about heart attack were associated with a previous MI or PCI, and that this association remained significant after adjustment for age, sex, and coronary risk factors (previous MI: OR 2.51, 95% CI 1.29–4.91; previous PCI: OR 2.04, 95% CI 1.09–3.80; Table 3B).

**Table 2. Demographic information of study participants**

| Patient characteristics | n = 236 | % |
|---|---|---|
| Age, years | 67.4 ± 10.1 | |
| Male | 201 | 85.2 |
| BMI, kg/m$^2$ | 24.7 ± 3.4 | |
| University education or more | 117 | 49.6 |
| Married | 199 | 84.3 |
| Living alone | 31 | 13.1 |
| Coronary risk factors | | |
| Hypertension | 187 | 79.2 |
| Diabetes mellitus | 93 | 39.4 |
| Dyslipidemia | 179 | 75.8 |
| Smoking | 65 | 27.5 |
| Family history of CAD | 52 | 22.0 |
| Previous PCI | 96 | 40.7 |
| Previous CABG | 5 | 2.3 |
| Previous MI | 64 | 27.1 |
| Previous HF | 14 | 5.9 |
| CVD | 30 | 12.7 |
| PAD | 36 | 15.3 |
| COPD | 18 | 7.6 |
| ACS | 55 | 23.3 |
| Multivessel disease | 59 | 25.0 |
| Laboratory data | | |
| CRP, mg/dL | 0.49 ± 1.37 | |
| Cr, mg/dL | 1.32 ± 1.87 | |
| TG, mg/dL | 146.5 ± 79.5 | |
| HDL, mg/dL | 43.6 ± 12.5 | |
| LDL, mg/dL | 87.4 ± 29.5 | |
| Usefulness of educational program: very useful or useful | | |
| Lifestyle modification (%) | 168 | 71.2 |
| Nutrition guidance (%) | 170 | 72.0 |

Data are shown as mean ± standard deviation or number and percentage. BMI: body mass index, CAD: coronary artery disease, PCI: percutaneous coronary intervention, CABG: coronary artery bypass graft, MI: myocardial infarction, HF: heart failure, CVD: cerebrovascular disease, PAD:

peripheral arterial disease, COPD: chronic obstructive pulmonary disease, ACS: acute coronary syndrome, CRP: C-reactive protein, Cr: creatinine, TG: triglyceride, HDL: high-density lipoprotein, LDL: low-density lipoprotein.

**Table 3A. Determinants of low confidence level in lifestyle modification**

| | Univariate models | | Multivariate models | | | |
|---|---|---|---|---|---|---|
| | | | Model 1 | | Model 2 | |
| Variables | OR 95% CI | p Value | OR 95% CI | p Value | OR 95% CI | p Value |
| Age | 0.98 0.95–1.01 | 0.10 | 0.98 0.95–1.02 | 0.30 | 0.98 0.95–1.02 | 0.30 |
| Male | 3.51 1.18–10.5 | 0.02 | 3.61 1.11–11.8 | 0.03 | 3.50 1.07–11.4 | 0.04 |
| Obesity (BMI >25 kg/m$^2$) | 2.36 1.33–4.18 | 0.003 | 1.73 0.90–3.33 | 0.10 | 1.75 0.92–3.36 | 0.09 |
| High school graduation or less | 2.51 1.40–4.51 | 0.002 | 3.25 1.70–6.23 | <0.001 | 3.26 1.71–6.22 | <0.001 |
| Hypertension | 0.91 0.46–1.79 | 0.78 | 1.22 0.53–2.81 | 0.64 | 1.21 0.52–2.79 | 0.66 |
| Dyslipidemia | 0.54 0.29–1.01 | 0.05 | 0.61 0.30–2.30 | 0.19 | 0.60 0.29–1.24 | 0.17 |
| Diabetes mellitus | 1.14 0.65–2.01 | 0.65 | 1.22 0.64–2.30 | 0.55 | 1.22 0.65–2.29 | 0.55 |
| Previous MI | 1.03 0.55–1.92 | 0.93 | 0.96 0.47–1.96 | 0.90 | | |
| Previous PCI | 0.97 0.55–1.70 | 0.910 | | | 1.10 0.57–2.11 | 0.026 |

OR: odds ratio, CI: confidence interval, BMI: body mass index, MI: myocardial infarction, PCI: percutaneous coronary intervention.

Standard covariates = age, male sex, obesity, educational level, coronary risk factors (hypertension, dyslipidemia, diabetes mellitus).

Model 1 = standard covariates + previous MI.

Model 2 = standard covariates + previous PCI.

**Table 3B. Determinants of high confidence in precise recognition of heart attack**

| | Univariate models | | Multivariate models | | | |
|---|---|---|---|---|---|---|
| | | | Model 1 | | Model 2 | |
| Variables | OR 95% CI | p Value | OR 95% CI | p Value | OR 95% CI | p Value |
| Age | 0.99 0.97–1.02 | 0.57 | 0.99 0.96–1.03 | 0.69 | 0.99 0.96–1.02 | 0.61 |
| Male | 0.72 0.32–1.59 | 0.41 | 0.6 0.24–1.52 | 0.28 | 0.63 0.25–1.59 | 0.33 |
| Obesity (BMI >25 kg/m$^2$) | 1.20 0.68–2.13 | 0.53 | 1.5 0.78–2.88 | 0.23 | 1.35 0.71–2.56 | 0.36 |
| High school graduation or less | 1.12 0.63–1.98 | 0.70 | 0.68 0.36–1.31 | 0.25 | 0.82 0.43–1.54 | 0.53 |
| Hypertension | 1.54 0.73–3.25 | 0.25 | 1.37 0.61–3.11 | 0.45 | 1.36 0.60–3.06 | 0.46 |
| Dyslipidemia | 1.99 0.96–4.12 | 0.07 | 1.46 0.66–3.19 | 0.35 | 1.43 0.65–3.15 | 0.38 |
| Diabetes mellitus | 0.74 0.41–1.33 | 0.31 | 0.63 0.33–1.20 | 0.16 | 0.58 0.31–1.11 | 0.10 |
| Previous MI | 2.10 1.14–3.83 | 0.02 | 2.51 1.29–4.91 | 0.007 | | |
| Previous PCI | 2.04 1.15–3.62 | 0.015 | | | 2.04 1.09–3.80 | 0.026 |

OR: odds ratio, CI: confidence interval, BMI: body mass index, MI: myocardial infarction, PCI: percutaneous coronary intervention.

Standard covariates = age, male sex, obesity, education level, coronary risk factors (hypertension, dyslipidemia, diabetes mellitus).

Model 1 = standard covariates + previous MI.

Model 2 = standard covariates + previous PCI.

## 4. Discussion

The present study demonstrated the following key points: 1) the confidence levels in terms of lifestyle modification were different across the various risk factors for patients with CAD, and patients had low confidence in their blood pressure and cholesterol control, diet regulation, body weight maintenance, and routine exercise; 2) low confidence in overall lifestyle modification was associated with male sex and low education level; and 3) there was a substantial gap between recognition and action toward heart attack.

Much of the existing research on lifestyle modification has focused on single behaviors, e.g., smoking cessation; however, the accomplishment level of lifestyle modification can vary among the main modifiable risk factors, including alcohol restriction, dyslipidemia, obesity, physical inactivity, hypertension, and diabetes. The strength of this study is that we quantified patient confidence levels based on their behavior toward several risk factors for CAD, which could be related to adherence to lifestyle modification. Although patient education is known to be an important intervention in enhancing the adherence to lifestyle modification,[14] the challenge is how effectively could education programs be offered to patients with CAD given the limited human resources, as well as the limited duration of hospitalization or outpatient consultation. We demonstrated that patients with CAD were not confident in adhering to regular and sufficient amounts of exercise after discharge. The adherence to exercise training was reported as being low, i.e., approximately <60% in patients with heart failure (HF),[15, 16] which is consistent with our data. Cardiologists need to emphasize

the importance of exercise training, and pursue strategies to promote regular exercise, such as more extensive referral for cardiac rehabilitation and structured nurse- or therapist-led contact.[17] Our patients were also less confident about factors related to dietary and nutrition. Several previous studies reported poor adherence to salt or diet restriction among patients with chronic diseases, such as HF or diabetes mellitus,[18-20] suggesting that the difficulties in adherence to diet modification could be universal. Despite its powerful opportunities to reduce adverse health, confusion surrounding nutritional guidance sometimes emerges because of the rapid advances in dietary and nutrition science.[21] Continuous education, performed by multidisciplinary teams, especially nutritionists and diabetologists, could be essential in improving lifestyle modification.

Knowledge of predisposing risk factors is an important step in the modification of lifestyle behaviors. Our study demonstrated that most responders understood the risk of smoking or excessive alcohol intake, and were confident in their restriction. This robust knowledge was most likely due to repeated public health promotion, leading to patient motivation for restriction with relative ease.[22, 23] In fact, the prevalence of smoking and alcohol consumption in Japan has declined during the last 10 years.[24, 25] Considering these results, the importance of promoting smoking cessation and alcohol restriction through educational programs might be low relative to several other modifiable risk factors. On the other hand, psychological and sleep disturbances are known to be under-recognized and undertreated in patients with cardiovascular disease despite its significance in the development and progression of various cardiovascular conditions, including CAD.[26, 27] In

parallel with these circumstances, patient knowledge relating to depression, anxiety, and insomnia as risk factors for CAD was relatively low in our study population. Educational campaigns, directed at cardiologists and patients, are needed to improve awareness of psychological and sleep disturbances as risk factors for CAD.

Several studies have been conducted to clarify the sex difference in the achievement of secondary prevention in cardiovascular disease, with mixed and inconsistent results.[28-30] Interestingly, there were regional variations in the sex difference in the achievement of lifestyle modification.[31, 32] Although lifestyle modification for the secondary prevention of CAD was generally worse in women than in men, women in Asia were more likely than men to be adherent to lifestyle modification, especially in terms of adequate physical activities, with opposing results in Europe and the Middle East.[32] Consistent with the regional variation with its achievement, patient perspective concerning secondary prevention could differ. Although a high confidence on lifestyle modification was associated with the female sex in patients with CAD in Japan according to our data, the knowledge and awareness of cardiovascular disease among women is inadequate in a nationwide survey from the United States.[33] Although it remains unknown why regional variations occur in the sex difference in the attitude toward and achievement of lifestyle medication, this might be explained by the social background of women (e.g., education level).[34] These assessments are warranted to clarify which subpopulation should be targeted for education in each region. Moreover, regular surveys of patients' perspective will also be needed in the future.

It is common for patients to have limited knowledge of heart attack symptoms, and the lack of awareness in this regard represents a significant barrier to patients taking action and seeking medical care.[6] In our study, most of the participants had low confidence in distinguishing between heart attack and other disease. Patients with a history of MI or PCI were associated with high confidence in their precise recognition of heart attack, possibly because of their previous experience of heart attack, PCI, or repeated education. It is difficult to conclude which factors affect the confidence level about heart attack from our data; however, education focusing on heart attack in patients with CAD without previous MI or PCI is recommended.

The present study has some limitations that should be considered when interpreting the results. First, this was a small study based in a single center. Therefore, the study involved a small number of patients; consequently, its statistical power may not have been sufficient to detect any negative outcomes. Second, the cross-sectional design of this study limits its ability to clarify the impact of the patients' confidence level on lifestyle modification and awareness of heart attack on postdischarge behaviors and long-term clinical outcomes. Third, our study population included only patients who underwent PCI; thus, patients who were not eligible for coronary revascularization, which could have caused potential selection bias, were excluded. Finally, our data were based on subjective perceptions by patients, and not objective measurements; thus, the confidence levels are subject to individual bias.

## 5. Conclusions

There were substantial disparities in the confidence level about lifestyle modification, as well as awareness of heart attack, in patients treated with PCI. Male sex and lower educational level were associated with lower confidence levels with regard to lifestyle modification. There was a substantial gap between recognition and action toward heart attack, and a history of MI was associated with higher confidence in awareness about heart attack. Medical providers should disseminate and solve these substantial disparities with the help of a multidisciplinary team for further improvement in overall cardiovascular care.

**Abbreviations list**

ACS: acute coronary syndrome

BMI: body mass index

CABG: coronary artery bypass graft

CAD: coronary artery disease

CI: confidence interval

COPD: chronic obstructive pulmonary disease

Cr: creatinine

CRP: C-reactive protein

CVD: cerebrovascular disease

HDL: high-density lipoprotein

HF: heart failure

LDL: low-density lipoprotein

MI: myocardial infarction

OR: odds ratio

PAD: peripheral arterial disease

PCI: percutaneous coronary intervention

SD: standard deviation

TG: triglyceride

### Ethical approval and consent to participate

This study was approved by the Keio University School of Medicine Ethics Committee. Informed consent was obtained from patients before they answered the questionnaire.

### Consent for publication

Not applicable.

### Data sharing statement

The dataset analyzed during this study are available from the corresponding author (Takashi Kohno, kohno.a2@keio.jp) on reasonable request.

### Competing interests

The authors report no relationships that could be construed as a conflict of interest, including related consultancies, shareholdings, and funding grants.

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No financial support was received for this study.

### Authors' contributions

HK and TK had full access to all data and were responsible for the integrity and accuracy of data analysis. Study design: HK, TK, and SK. Acquisition and analysis of data: HK, TK, FF, NN, and RF. Interpretation of data: HK, TK, SK, SY, and YM. Drafting of the manuscript: HK, TK, and SK. Critical revision of the manuscript for intellectual content: SY, YM, and KF.

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**Figure legends**

Figure 1: Self-confidence level of lifestyle modification (A: behavior-based and B: knowledge-based confidence level)

Figure 2: Patients' perception and recognition of heart attack

**Figure 1: Self-confidence level of lifestyle modification**

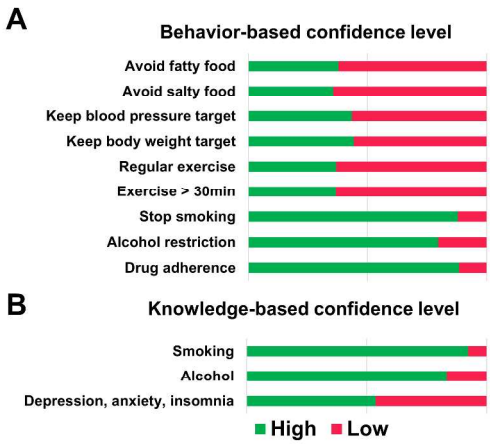


Figure 1: Self-confidence level of lifestyle modification (A: behavior-based and B: knowledge-based confidence level)

338x190mm (300 x 300 DPI)

**Figure 2: Patients' perception and recognition of heart attack**

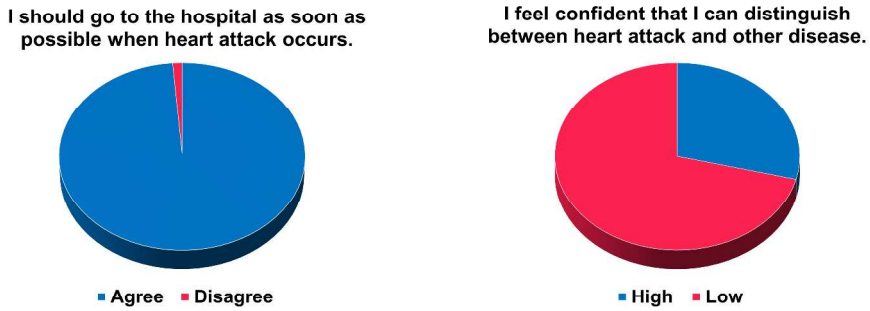


Figure 2: Patients' perception and recognition of heart attack

338x190mm (300 x 300 DPI)

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

| | Item No | Recommendation | Page in Manuscript |
|---|---|---|---|
| **Title and abstract** | 1 | (*a*) Indicate the study's design with a commonly used term in the title or the abstract | **Page 1, 2** |
| | | (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found | **Page 2** |
| **Introduction** | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | **Page 5** |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses | **Page 5, 6** |
| **Methods** | | | |
| Study design | 4 | Present key elements of study design early in the paper | **Page 7** |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | **Page 7** |
| Participants | 6 | (*a*) Give the eligibility criteria, and the sources and methods of selection of participants | **Page 7** |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | **Page 7, 8, 9, 10** |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | **Page 7, 8, 9, 10** |
| Bias | 9 | Describe any efforts to address potential sources of bias | **Page 10, 11** |
| Study size | 10 | Explain how the study size was arrived at | **Page 7** |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | **Page 9, 10** |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding | **Page 10, 11** |
| | | (*b*) Describe any methods used to examine subgroups and interactions | **NA** |
| | | (*c*) Explain how missing data were addressed | **Page 7** |
| | | (*d*) If applicable, describe analytical methods taking account of sampling strategy | **NA** |
| | | (*e*) Describe any sensitivity analyses | **NA** |
| **Results** | | | |
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | **Page 7, 14** |
| | | (b) Give reasons for non-participation at each stage | **Page 7** |
| | | (c) Consider use of a flow diagram | **NA** |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg | **Page 14, Table 2** |

| | | | |
|---|---|---|---|
| | | demographic, clinical, social) and information on exposures and potential confounders | |
| | | (b) Indicate number of participants with missing data for each variable of interest | **Page 7** |
| Outcome data | 15* | Report numbers of outcome events or summary measures | **Page 12, 13** |
| Main results | 16 | (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | **Page 12,13** |
| | | (*b*) Report category boundaries when continuous variables were categorized | **Page 12,13** |
| | | (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | **NA** |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | **NA** |
| **Discussion** | | | |
| Key results | 18 | Summarise key results with reference to study objectives | **Page 17** |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | **Page 20** |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | **Page 19, 20** |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | **Page 20** |
| **Other information** | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | **Page 23** |

*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

# Patient confidence regarding secondary lifestyle modification and knowledge of "heart attack" symptoms following percutaneous revascularization in Japan: A cross-sectional study



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| | |

# Patient confidence regarding secondary lifestyle modification and knowledge of "heart attack" symptoms following percutaneous revascularization in Japan: A cross-sectional study

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**Word counts:** Text: 3668 words (Introduction–Conclusion, including tables); Abstract: 297 words

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**Keywords:** Coronary artery disease, patient perspective, confidence, lifestyle

## Abstract

**Objective:** To assess patient perspectives on secondary lifestyle modification and knowledge of "heart attack" after percutaneous coronary intervention (PCI) for coronary artery disease (CAD).

**Design:** Observational cross-sectional study.

**Setting:** A single university-based hospital center in Japan.

**Participants:** In total, 236 consecutive patients with CAD who underwent PCI completed a questionnaire (age, 67.4 ± 10.1 years; women, 14.8%; elective PCI, 75.4%). The survey questionnaire included questions related to confidence levels about 1) lifestyle modification at the time of discharge and 2) appropriate recognition of heart attack symptoms and reactions to these symptoms on a four-point Likert scale (1 = not confident to 4 = completely confident).

**Primary outcome measure:** The primary outcome assessed was the patients' confidence level regarding lifestyle modification and the recognition of heart attack symptoms.

**Results:** Overall, patients had a high level of confidence (confident or completely confident, > 75%) about smoking cessation, alcohol restriction, and medication adherence. However, they had a relatively low level of confidence (< 50%) about the maintenance of blood pressure control, healthy diet, body weight, and routine exercise (≥ 3 times/week). After adjustment, male sex (odds ratio [OR] 3.61, 95% confidence interval [CI] 1.11–11.8) and lower educational level (OR 3.25; 95% CI 1.70–6.23) were identified as factors associated with lower confidence levels. In terms of confidence in the recognition of heart attack, almost all respondents answered "yes" to the item "I should go to

the hospital as soon as possible when I have a heart attack"; however, only 28% of the responders were confident in their ability to distinguish between heart attack symptoms and other conditions.

**Conclusions:** There were substantial disparities in the confidence levels associated with lifestyle modification and recognition/response to heart attack. These gaps need to be studied further and disseminated to improve cardiovascular care.

**Strengths and limitations of this study**

**Strengths:**

- We quantified patient confidence levels in their behavior toward and knowledge of several risk factors for coronary artery disease that could be related to adherence to lifestyle modification.
- We also evaluated whether there was a substantial gap between patients' recognition and actions toward "heart attack."

**Limitations:**

- This is a small study conducted in a single center and the data were based on the subjective perceptions of patients.
- The cross-sectional design of this study limits its ability to clarify the impact of a patient's confidence level on their long-term clinical outcome.

## 1. Introduction

Lifestyle modifications, including a balanced diet, smoking cessation, limited alcohol consumption, and increased physical activity, are recommended for the first-line management for coronary artery disease (CAD). The American Heart Association/American College of Cardiology guidelines recommend a healthy diet with an emphasis on vegetables, fruits, and whole grains along with vigorous physical activity (three to four aerobic sessions per week).[1, 2] Adhering to lifestyle modifications, including higher-quality diets or exercise rehabilitation, has been associated with a lower risk of all-cause mortality among patients with CAD.[3, 4]

The recognition and confidence levels of patients with respect to symptoms and reactions to "heart attack" are also important patient-related factors influencing clinical outcomes. A previous nurse-led study revealed that education and counseling intervention led to increasingly positive attitudes in terms of patient response to heart attack,[5] suggesting that knowledge of heart attack could also represent a modifiable factor in the optimization of CAD management. Furthermore, inappropriate understanding of the symptoms of CAD could directly affect the action of patients in seeking prompt emergency care,[6-9] which is known to contribute to timely reperfusion therapy.

In recent years, patient perspectives on lifestyle modification or disease recognition have been the subject of much research in the field of cardiovascular diseases.[10, 11] Understanding patient perspectives on these modifiable factors is essential to close the perception gap between health-care providers and patients in terms of patients' confidence levels regarding lifestyle

modification or disease recognition. These approaches could also help to identify imbalances in the composition of patient education programs and assess the appropriateness of such programs. In this study, our primary goal was to elucidate the perspectives on secondary lifestyle modification and precise knowledge of heart attack in patients treated with percutaneous coronary intervention (PCI) in Japan.

## 2. Methods

### *Study population and data collection*

We performed an observational cross-sectional study. The study population consisted of 237 consecutive patients who underwent PCI between October 2011 and September 2012 at a single university-based hospital center (Keio University Hospital, Tokyo, Japan). Our nursing team obtained the completed survey questionnaires immediately after a group educational program and the provision of discharge instructions, which are typically conducted 24–48 h before discharge. Patient education was conducted by nurses and nutritionists using video and literature materials for lifestyle modification and nutritional guidance, which was followed by face-to-face counseling by a nurse. At this time, the nurses answered several questions related to the survey questionnaire from the patients.

The response rate to the survey questionnaire was 99.6% and we excluded one patient (0.4%) due to missing questionnaire data. Thus, our analysis included a total of 236 patients who answered all the survey questions. Within this final cohort of study patients, 55 patients (23.3%) were diagnosed with acute coronary syndrome (ACS) (ST-elevation myocardial infarction, n = 28; non-ST-elevation myocardial infarction and unstable angina, n = 27) and 181 patients (76.7%) were diagnosed with stable angina or silent ischemia. More patients hospitalized for stable angina had a history of previous PCI than those hospitalized for ACS (n = 90 [49.7%] vs. n = 6 [10.9%], $p < 0.001$). All patients provided written informed consent to participate in the study. The study protocol conformed to the ethical guidelines of the 1975 Declaration of Helsinki as reflected by the prior

approval by the Keio University School of Medicine Ethics Committee (approval no. 20110263).

***Survey questionnaire***

The survey included questions covering a wide range of variables (Table 1).

**Table 1. Questionnaire for patients treated with percutaneous coronary intervention**

| Domains | Educational content |
|---|---|
| **First domain** | **Usefulness of our hospital educational program** |
| | **(Likert scale: 1 = never useful to 5 = very useful)** |
| | Do you think our lifestyle modification program was useful? |
| | Do you think our nutrition modification program was useful? |
| **Second domain** | **Self-confidence level of lifestyle modification** |
| | **Behavior-based questions** |
| | **(Likert scale: 1 = not confident to 4 = completely confident)** |
| | I feel confident that I can avoid eating fatty food throughout the year. |
| | I feel confident that I can avoid eating salty food throughout the year. |
| | I feel confident that I can keep my blood pressure target. |
| | I feel confident that I can keep my body weight target. |
| | I feel confident that I can exercise regularly. |
| | I feel confident that I can exercise more than 30 min in each session. |
| | I feel confident that I can stop smoking. |
| | I feel confident that I can limit my alcohol intake. |
| | I feel confident that I can properly take drugs without failure. |
| | **Knowledge-based questions** |
| | **(Likert scale: 1 = not confident to 4 = completely confident)** |
| | I feel confident that I understand well the risk of smoking. |
| | I feel confident that I understand well the risk of alcohol intake. |
| | I feel confident that I understand well the risk of depression, anxiety, and insomnia. |
| **Third domain** | **Action and recognition toward heart attack** |
| | I should go to the hospital as soon as possible when heart attack occurs. |
| | **(Likert scale: 1 = never agree to 4 = completely agree)** |
| | I feel confident that I can distinguish between heart attack and other disease. |
| | **(Likert scale: 1 = not confident to 4 = completely confident)** |

The questions were grouped into three domains:

1) Usefulness of the hospital educational program;

2) Self-confidence level in terms of lifestyle modification;

3) Confidence level in terms of the awareness of heart attack.

The questionnaire was originally designed after an in-depth discussion among board-certified cardiologists and nurses at our institute for this study and was largely based on the recommendations of the Japanese Circulation Society (JCS) guidelines.[12] We first generated two major domains: (1) lifestyle modification and (2) action and recognition regarding heart attack. The components of lifestyle modification were initially chosen from the JCS guidelines class-I recommendations (plus class IIa if no class-I recommendations were available). The latter questionnaires for action and recognition regarding heart attack were specifically developed by the investigators of the present study. We chose the term “heart attack”, which is commonly used in clinical practice, rather than medical jargon (e.g., myocardial infarction). This was to help the patients to understand the questionnaire more easily.[13] To evaluate and validate the preliminary questionnaire, we then conducted a pilot study with 17 patients (not included in the final analysis). Upon reviewing the responses to the pilot study, some adjustments were made, including the addition of questions related to the usefulness of our hospital education program. For domain 1, patients were asked to rate the

usefulness of lifestyle and nutrition guidance using a five-point Likert scale (1 = never useful, 2 = not useful, 3 = little useful, 4 = useful, 5 = very useful, or not provided with an educational program) and patients were divided into the useful group (4 or 5) and not useful group (1, 2, or 3). For domain 2, the questionnaire concerning self-confidence level about lifestyle modification contained 12 questions that were scored based on a four-point Likert scale (1 = not confident, 2 = less confident, 3 = confident, 4 = completely confident) and the patients were divided into the high confidence group (3 or 4) and low confidence group (1 or 2). These self-confidence questions consisted of nine behavior-based confidence levels (drug adherence, alcohol restriction, smoking cessation, exercise > 30 min, regular exercise, keeping body weight, keeping blood pressure, avoiding salty food, and avoiding fatty food) and three knowledge-based confidence levels (danger of smoking, alcohol, depression/anxiety, or insomnia). The sum of each confidence level in the nine behavior-based questions on lifestyle modification was calculated as the overall confidence level in lifestyle modification and we defined the lower tertile for this overall confidence level as the "low confidence group" and surveyed the characteristics associated with this group. For the final domain (domain 3), patients were asked to rate their recognition and action toward heart attack using a four-point Likert scale.

***Statistical analysis***

Continuous variables were summarized as means and standard deviations and categorical variables

as percentages. Logistic regression analyses were conducted to assess the association of the patients' confidence in behavior-based lifestyle modification as well as their precise recognition of heart attack with various patient characteristics. For multivariate analysis, the variables entered in the model included age, male sex, obesity, high school graduation or less, hypertension, diabetes mellitus, dyslipidemia, and previous myocardial infarction (MI) or PCI. Before multiple logistic regression analyses were performed, multicollinearity was assessed and factors indicating serious multicollinearity were accordingly eliminated from the model. C-statistics were used to evaluate the predictability of the models used for multivariate regression analysis. For all statistical analyses, statistical significance was accepted at $p < 0.05$. Data analysis was performed using SPSS 23.0 for Windows (SPSS Inc., Chicago, IL, USA).

## 3. Results

Demographic data and usefulness ratings of the educational program by participants are shown in Table 2 (domain 1). Most of the participants were men and approximately half of them had received university education or higher. Approximately 70% of patients considered their lifestyle modification program as useful (very useful, 26%; useful, 45%). Nutritional guidance was also considered useful by approximately 70% of the patients (very useful, 28%; useful, 44%).

Figure 1 shows the behavior- and knowledge-based confidence levels associated with lifestyle modification (domain 2). Most of the participants were highly confident (confident or completely confident, > 75%) in smoking cessation, alcohol restriction, and adherence to medication. However, they had low levels of confidence (confident or completely confident, < 50%) in blood pressure and cholesterol control, diet regulation, body weight maintenance, and routine exercise (Figure 1A). In terms of knowledge-based confidence level of lifestyle modification, most of the patients were confident in their understanding of the danger of smoking or alcohol but were not confident in their understanding of the risk of depression, anxiety, and insomnia (Figure 1B).

The total confidence score was calculated from the sum of the previously described nine behavior-based confidence levels in lifestyle modification (maximum score, 36 points). Patients scoring lower than the first tertile for total confidence (< 23 points) were defined as the low confidence group. Univariate regression analysis showed that male sex, obesity, and lower education level were associated with the low confidence group with respect to lifestyle modification. In

multivariate regression analysis adjusted for age, sex, obesity, educational level, coronary risk factors, and previous MI or previous PCI, we found that male sex (odds ratio [OR] 3.61, 95% confidence interval [CI] 1.11–11.8) and lower education level (OR 3.25, 95% CI 1.70–6.23) were independent determinants of inclusion in the low confidence group (Table 3A). The significant association between obesity and low confidence level in lifestyle modification disappeared after adjustment for covariates (OR 1.73, 95% CI 0.90–3.33). The c-statistics of model 1 and 2 were 0.72 (95% CI 0.65–0.80) and 0.72 (95% CI 0.64–0.79), respectively.

The data concerning patients' recognition of heart attack are shown in Figure 2 (domain 3). When questioned about whether they agreed with the idea of promptly going to the hospital after a heart attack, 233 patients (98%) agreed (completely agree, 50%; agree, 48%), whereas one and two patients disagreed and completely disagreed with the idea, respectively. In contrast, only 28% were confident in distinguishing between heart attack and other diseases (completely confident, 5%; confident, 23%), whereas 100 patients (42%) were less confident and 67 (28%) patients were not confident. Within this domain, univariate logistic regression analysis revealed that patients who had high confidence in their awareness of heart attack were associated with a previous MI or PCI and this association remained significant after adjustment for age, sex, and coronary risk factors (previous MI: OR 2.51, 95% CI 1.29–4.91; previous PCI: OR 2.04, 95% CI 1.09–3.80; Table 3B). The c-statistics of model 1 and 2 were 0.67 (CI 0.59–0.75) and 0.65 (95% CI 0.57–0.73), respectively.

**Table 2. Demographic data of the study participants**

| Patient characteristics | n = 236 | % |
|---|---|---|
| Age, years | 67.4 ± 10.1 | |
| Male | 201 | 85.2 |
| BMI, kg/m$^2$ | 24.7 ± 3.4 | |
| University education or more | 117 | 49.6 |
| Married | 199 | 84.3 |
| Living alone | 31 | 13.1 |
| Coronary risk factors | | |
| Hypertension | 187 | 79.2 |
| Diabetes mellitus | 93 | 39.4 |
| Dyslipidemia | 179 | 75.8 |
| Smoking | 65 | 27.5 |
| Family history of CAD | 52 | 22.0 |
| Previous PCI | 96 | 40.7 |
| Previous CABG | 5 | 2.3 |
| Previous MI | 64 | 27.1 |
| Previous HF | 14 | 5.9 |
| CVD | 30 | 12.7 |
| PAD | 36 | 15.3 |
| COPD | 18 | 7.6 |
| ACS | 55 | 23.3 |
| Multivessel disease | 59 | 25.0 |
| Laboratory data | | |
| CRP, mg/dL | 0.49 ± 1.37 | |
| Cr, mg/dL | 1.32 ± 1.87 | |
| TG, mg/dL | 146.5 ± 79.5 | |
| HDL, mg/dL | 43.6 ± 12.5 | |
| LDL, mg/dL | 87.4 ± 29.5 | |
| Usefulness of educational program: very useful or useful | | |
| Lifestyle modification (%) | 168 | 71.2 |
| Nutrition guidance (%) | 170 | 72.0 |

Data are shown as mean ± standard deviation or number and percentage. BMI: body mass index, CAD: coronary artery disease, PCI: percutaneous coronary intervention, CABG: coronary artery bypass graft, MI: myocardial infarction, HF: heart failure, CVD: cerebrovascular disease, PAD:

peripheral arterial disease, COPD: chronic obstructive pulmonary disease, ACS: acute coronary syndrome, CRP: C-reactive protein, Cr: creatinine, TG: triglyceride, HDL: high-density lipoprotein, LDL: low-density lipoprotein.

**Table 3A. Determinants of low confidence level in lifestyle modification**

| | Univariate models | | Multivariate models | | | |
|---|---|---|---|---|---|---|
| | | | Model 1 | | Model 2 | |
| Variables | OR 95% CI | p-value | OR 95% CI | p-value | OR 95% CI | p-value |
| Age | 0.98 0.95–1.01 | 0.10 | 0.98 0.95–1.02 | 0.30 | 0.98 0.95–1.02 | 0.30 |
| Male | 3.51 1.18–10.5 | 0.02 | 3.61 1.11–11.8 | 0.03 | 3.50 1.07–11.4 | 0.04 |
| Obesity (BMI > 25 kg/m$^2$) | 2.36 1.33–4.18 | 0.003 | 1.73 0.90–3.33 | 0.10 | 1.75 0.92–3.36 | 0.09 |
| High school graduation or less | 2.51 1.40–4.51 | 0.002 | 3.25 1.70–6.23 | <0.001 | 3.26 1.71–6.22 | <0.001 |
| Hypertension | 0.91 0.46–1.79 | 0.78 | 1.22 0.53–2.81 | 0.64 | 1.21 0.52–2.79 | 0.66 |
| Dyslipidemia | 0.54 0.29–1.01 | 0.05 | 0.61 0.30–2.30 | 0.19 | 0.60 0.29–1.24 | 0.17 |
| Diabetes mellitus | 1.14 0.65–2.01 | 0.65 | 1.22 0.64–2.30 | 0.55 | 1.22 0.65–2.29 | 0.55 |
| Previous MI | 1.03 0.55–1.92 | 0.93 | 0.96 0.47–1.96 | 0.90 | | |
| Previous PCI | 0.97 0.55–1.70 | 0.91 | | | 1.10 0.57–2.11 | 0.78 |

OR: odds ratio, CI: confidence interval, BMI: body mass index, MI: myocardial infarction, PCI: percutaneous coronary intervention.

Standard covariates = age, male sex, obesity, educational level, coronary risk factors (hypertension, dyslipidemia, diabetes mellitus).

Model 1 = standard covariates + previous MI.

Model 2 = standard covariates + previous PCI.

**Table 3B. Determinants of high confidence in precise recognition of heart attack**

| | Univariate models | | Multivariate models | | | |
|---|---|---|---|---|---|---|
| | | | Model 1 | | Model 2 | |
| Variables | OR<br>95% CI | p-value | OR<br>95% CI | p-value | OR<br>95% CI | p-value |
| Age | 0.99<br>0.97–1.02 | 0.57 | 0.99<br>0.96–1.03 | 0.69 | 0.99<br>0.96–1.02 | 0.61 |
| Male | 0.72<br>0.32–1.59 | 0.41 | 0.6<br>0.24–1.52 | 0.28 | 0.63<br>0.25–1.59 | 0.33 |
| Obesity (BMI > 25 kg/m$^2$) | 1.20<br>0.68–2.13 | 0.53 | 1.5<br>0.78–2.88 | 0.23 | 1.35<br>0.71–2.56 | 0.36 |
| High school graduation or less | 1.12<br>0.63–1.98 | 0.70 | 0.68<br>0.36–1.31 | 0.25 | 0.82<br>0.43–1.54 | 0.53 |
| Hypertension | 1.54<br>0.73–3.25 | 0.25 | 1.37<br>0.61–3.11 | 0.45 | 1.36<br>0.60–3.06 | 0.46 |
| Dyslipidemia | 1.99<br>0.96–4.12 | 0.07 | 1.46<br>0.66–3.19 | 0.35 | 1.43<br>0.65–3.15 | 0.38 |
| Diabetes mellitus | 0.74<br>0.41–1.33 | 0.31 | 0.63<br>0.33–1.20 | 0.16 | 0.58<br>0.31–1.11 | 0.10 |
| Previous MI | 2.10<br>1.14–3.83 | 0.02 | 2.51<br>1.29–4.91 | 0.007 | | |
| Previous PCI | 2.04<br>1.15–3.62 | 0.02 | | | 2.04<br>1.09–3.80 | 0.03 |

OR: odds ratio, CI: confidence interval, BMI: body mass index, MI: myocardial infarction, PCI: percutaneous coronary intervention.

Standard covariates = age, male sex, obesity, education level, coronary risk factors (hypertension, dyslipidemia, diabetes mellitus).

Model 1 = standard covariates + previous MI.

Model 2 = standard covariates + previous PCI.

## 4. Discussion

The present study demonstrated the following key points: 1) confidence levels in lifestyle modification were different across the various risk factors for patients with CAD and patients had low confidence in their blood pressure and cholesterol control, diet regulation, body weight maintenance, and routine exercise; 2) low confidence in overall lifestyle modification was associated with male sex and lower education level; and 3) there was a substantial gap between recognition of and action toward heart attack.

Much of the existing research on lifestyle modification has focused on single behaviors, e.g., smoking cessation. However, the level of accomplishment regarding lifestyle modification can vary among the main modifiable risk factors, including alcohol restriction, dyslipidemia, obesity, physical inactivity, hypertension, and diabetes. The strength of this study is that we quantified patient confidence levels based on patient behavior toward several risk factors for CAD that could be related to adherence to lifestyle modification. Although patient education is known to be an important intervention in enhancing the adherence to lifestyle modification,[14] the challenge is how to effectively deliver education programs to patients with CAD given limited human resources and limited duration of hospitalization or outpatient consultation. We demonstrated that patients with CAD were not confident in adhering to regular and sufficient exercise after discharge. The adherence to exercise training has been reported as low in previous studies, i.e., approximately < 60% in patients with heart failure (HF),[15, 16] which is consistent with our data. Cardiologists need to

emphasize the importance of exercise training and pursue strategies to promote regular exercise, such as more extensive referral for cardiac rehabilitation and structured nurse- or therapist-led contact.[17] Our patients were also less confident about factors related to dietary and nutritional factors. Several previous studies reported poor adherence to salt restriction or diet restriction in general among patients with chronic diseases such as HF or diabetes mellitus,[18-20] suggesting that the difficulties in adhering to dietary modification could be universal. Despite its powerful opportunities to reduce adverse health, confusion surrounding nutritional guidance sometimes emerges because of the rapid advances in dietary and nutrition science.[21] Continuous education performed by multidisciplinary teams, especially nutritionists and diabetologists, could be essential in improving lifestyle modification.

Knowledge of predisposing risk factors is an important step in the modification of lifestyle behaviors. Our study demonstrated that most responders understood the risk of smoking or excessive alcohol intake and were confident in restricting these activities. This robust patient knowledge was most likely due to repeated public health promotion, leading to patient motivation to adhere to smoking cessation and alcohol restriction with relative ease.[22, 23] In fact, the prevalence of smoking and alcohol consumption in Japan has declined during the last 10 years.[24, 25] Considering these results, the importance of promoting smoking cessation and alcohol restriction through educational programs might be low relative to several other modifiable risk factors. However, psychological and sleep disturbances are known to be under-recognized and under-treated

in patients with cardiovascular disease despite their significance in the development and progression of various cardiovascular conditions, including CAD.[26, 27] In parallel with these circumstances, patient knowledge relating to depression, anxiety, and insomnia as risk factors for CAD was relatively poor in our study population. Educational campaigns directed at cardiologists and patients are needed to improve awareness of psychological and sleep disturbances as risk factors for CAD.

Several studies have been conducted to clarify sex differences in the achievement of the secondary prevention of cardiovascular disease, with mixed and inconsistent results.[28-30] Interestingly, there were regional variations in the sex differences in the achievement of lifestyle modification.[31, 32] Although lifestyle modification for the secondary prevention of CAD is generally worse in women than in men, women in Asia are more likely than men to be adherent to lifestyle modification, especially in terms of adequate physical activity, with opposite results in Europe and the Middle East.[32] Consistent with these regional variations, patient perspectives concerning secondary prevention could differ. Although a high confidence in lifestyle modification was associated with the female sex in patients with CAD in Japan according to our data, the knowledge and awareness of cardiovascular disease among women was inadequate in a nationwide survey from the United States.[33] Although it remains unknown why regional variations occur in the sex differences in the attitude toward and achievement of lifestyle modification, this might be explained by the social background of women (e.g., education level).[34] These assessments are warranted to clarify which subpopulations should be targeted for education in each region. Moreover,

regular surveys of patients' perspectives will also be needed in the future.

It is common for patients to have limited knowledge of heart attack symptoms. The lack of awareness in this regard represents a significant barrier to patients taking action and seeking medical care.[6] In our study, most of the participants had low confidence in distinguishing between heart attack and other diseases. Patients with a history of MI or PCI were relatively confidence in their ability to precisely recognize a heart attack, possibly because of their previous experience of heart attack, PCI, or exposure to repeated education. It is difficult to conclude which factors affect the confidence level concerning heart attack from our data; however, education focusing on heart attack in patients with CAD without previous MI or PCI is recommended.

The present study has some limitations that should be considered when interpreting the results. First, this was a small study based on data from a single center. Therefore, the study involved a small number of patients. No formal power analysis of the results of the pilot study to determine the optimal sample size was performed. Consequently, its statistical power may not have been sufficient to detect any negative outcomes. Second, the cross-sectional design of this study limits its ability to clarify the impact of a patient's confidence level on lifestyle modification and awareness of heart attack on post-discharge behaviors and long-term clinical outcomes. Third, our study population included only patients who underwent PCI. Thus, patients who were not eligible for coronary revascularization were excluded, which could have caused potential selection bias. Finally, our data were based on subjective patient perceptions rather than objective evaluations. Thus, the

confidence levels are subject to individual bias.

## 5. Conclusions

There were substantial disparities in the confidence level concerning lifestyle modification and awareness of heart attack in patients treated with PCI. Male sex and lower educational level were associated with lower confidence levels concerning lifestyle modification. There was a substantial gap between recognition of and action toward heart attack. A history of MI and PCI were associated with higher confidence in the awareness of heart attack. Medical providers should bring these disparities to light aim to solve them with help of a multidisciplinary team to improve overall cardiovascular care.

## Ethical approval and consent to participate

This study was approved by the Keio University School of Medicine Ethics Committee. Informed consent was obtained from patients before they answered the questionnaire.

## Consent for publication

Not applicable.

## Data sharing statement

The dataset analyzed during this study are available from the corresponding author (Takashi Kohno, kohno.a2@keio.jp) on reasonable request.

## Competing interests

The authors report no relationships that could be construed as a conflict of interest, including related consultancies, shareholdings, and funding grants.

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## Authors' contributions

HK and TK had full access to all data and were responsible for the integrity and accuracy of data analysis. Study design: HK, TK, and SK. Acquisition and analysis of data: HK, TK, JF, NN, and RF. Interpretation of data: HK, TK, SK, SY, and YM. Drafting of the manuscript: HK, TK, and SK. Critical revision of the manuscript for intellectual content: SY, YM, and KF.

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## Figure legends

Figure 1: Self-confidence level regarding lifestyle modification (A: behavior-based and B: knowledge-based confidence level)

Figure 2: Patient perception and recognition of heart attack

**Figure 1: Self-confidence level regarding lifestyle modification**

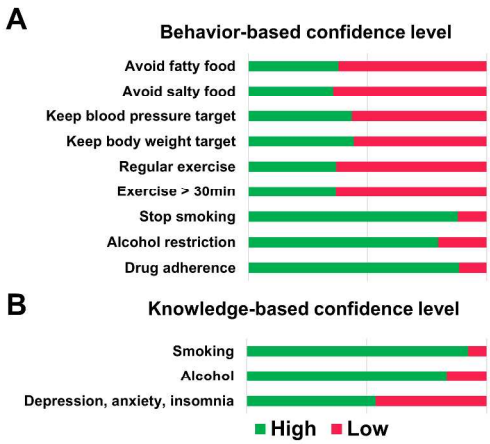


Figure 1: Self-confidence level regarding lifestyle modification (A: behavior-based and B: knowledge-based confidence level)

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**Figure 2: Patient perception and recognition of heart attack**

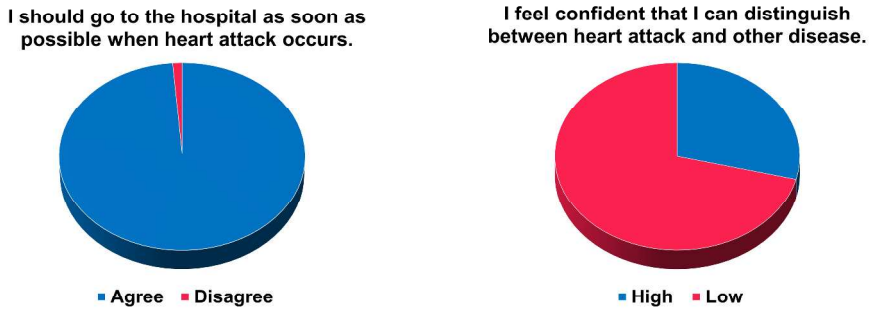


Figure 2: Patient perception and recognition of heart attack

338x190mm (300 x 300 DPI)

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

| | Item No | Recommendation | Page in Manuscript |
|---|---|---|---|
| **Title and abstract** | 1 | (*a*) Indicate the study's design with a commonly used term in the title or the abstract | **Page 1, 2** |
| | | (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found | **Page 2** |
| **Introduction** | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | **Page 5** |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses | **Page 5, 6** |
| **Methods** | | | |
| Study design | 4 | Present key elements of study design early in the paper | **Page 7** |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | **Page 7** |
| Participants | 6 | (*a*) Give the eligibility criteria, and the sources and methods of selection of participants | **Page 7** |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | **Page 7, 8, 9, 10** |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | **Page 7, 8, 9, 10** |
| Bias | 9 | Describe any efforts to address potential sources of bias | **Page 10, 11** |
| Study size | 10 | Explain how the study size was arrived at | **Page 7** |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | **Page 9, 10** |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding | **Page 10, 11** |
| | | (*b*) Describe any methods used to examine subgroups and interactions | **NA** |
| | | (*c*) Explain how missing data were addressed | **Page 7** |
| | | (*d*) If applicable, describe analytical methods taking account of sampling strategy | **NA** |
| | | (*e*) Describe any sensitivity analyses | **NA** |
| **Results** | | | |
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | **Page 7, 15** |
| | | (b) Give reasons for non-participation at each stage | **Page 7** |
| | | (c) Consider use of a flow diagram | **NA** |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg | **Page 15, Table 2** |

| | | | |
|---|---|---|---|
| | | demographic, clinical, social) and information on exposures and potential confounders | |
| | | (b) Indicate number of participants with missing data for each variable of interest | **Page 7** |
| Outcome data | 15* | Report numbers of outcome events or summary measures | **Page 12, 13,14** |
| Main results | 16 | (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | **Page 12,13,14** |
| | | (*b*) Report category boundaries when continuous variables were categorized | **Page 12,13,14** |
| | | (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | **NA** |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | **NA** |
| **Discussion** | | | |
| Key results | 18 | Summarise key results with reference to study objectives | **Page 18** |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | **Page 21** |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | **Page 20,21** |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | **Page 19,20,21** |
| **Other information** | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | **Page 23** |

*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

# Patient confidence regarding secondary lifestyle modification and knowledge of "heart attack" symptoms following percutaneous revascularization in Japan: A cross-sectional study



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| Keywords: | Coronary artery disease, patient perspective, confidence, lifestyle, patient education |
| | |

# Patient confidence regarding secondary lifestyle modification and knowledge of "heart attack" symptoms following percutaneous revascularization in Japan: A cross-sectional study

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**Word counts:** Text: 3668 words (Introduction–Conclusion, including tables); Abstract: 297 words

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**Keywords:** Coronary artery disease, patient perspective, confidence, lifestyle

## Abstract

**Objective:** To assess patient perspectives on secondary lifestyle modification and knowledge of "heart attack" after percutaneous coronary intervention (PCI) for coronary artery disease (CAD).

**Design:** Observational cross-sectional study.

**Setting:** A single university-based hospital center in Japan.

**Participants:** In total, 236 consecutive patients with CAD who underwent PCI completed a questionnaire (age, 67.4 ± 10.1 years; women, 14.8%; elective PCI, 75.4%). The survey questionnaire included questions related to confidence levels about 1) lifestyle modification at the time of discharge and 2) appropriate recognition of heart attack symptoms and reactions to these symptoms on a four-point Likert scale (1 = not confident to 4 = completely confident).

**Primary outcome measure:** The primary outcome assessed was the patients' confidence level regarding lifestyle modification and the recognition of heart attack symptoms.

**Results:** Overall, patients had a high level of confidence (confident or completely confident, > 75%) about smoking cessation, alcohol restriction, and medication adherence. However, they had a relatively low level of confidence (< 50%) about the maintenance of blood pressure control, healthy diet, body weight, and routine exercise (≥ 3 times/week). After adjustment, male sex (odds ratio [OR] 3.61, 95% confidence interval [CI] 1.11–11.8) and lower educational level (OR 3.25; 95% CI 1.70–6.23) were identified as factors associated with lower confidence levels. In terms of confidence in the recognition of heart attack, almost all respondents answered "yes" to the item "I should go to

the hospital as soon as possible when I have a heart attack"; however, only 28% of the responders were confident in their ability to distinguish between heart attack symptoms and other conditions.

**Conclusions:** There were substantial disparities in the confidence levels associated with lifestyle modification and recognition/response to heart attack. These gaps need to be studied further and disseminated to improve cardiovascular care.

**Strengths and limitations of this study**

**Strengths:**

- To date, many trials have focused on improving clinical outcomes in CAD patients via various interventions; however, few studies have investigated the patients' perspectives, which this survey unveils.
- This study enables medical providers to address the needs of the patient through a more comprehensive understanding of the latter's perspectives, resulting in improvement of clinical outcomes.

**Limitations:**

- This is a small study conducted in a single center and the data were based on the subjective perceptions of patients.
- The cross-sectional design of this study limits its ability to clarify the impact of a patient's confidence level on their long-term clinical outcome.

## 1. Introduction

Lifestyle modifications, including a balanced diet, smoking cessation, limited alcohol consumption, and increased physical activity, are recommended for the first-line management for coronary artery disease (CAD). The American Heart Association/American College of Cardiology guidelines recommend a healthy diet with an emphasis on vegetables, fruits, and whole grains along with vigorous physical activity (three to four aerobic sessions per week).[1, 2] Adhering to lifestyle modifications, including higher-quality diets or exercise rehabilitation, has been associated with a lower risk of all-cause mortality among patients with CAD.[3, 4]

The recognition and confidence levels of patients with respect to symptoms and reactions to "heart attack" are also important patient-related factors influencing clinical outcomes. A previous nurse-led study revealed that education and counseling intervention led to increasingly positive attitudes in terms of patient response to heart attack,[5] suggesting that knowledge of heart attack could also represent a modifiable factor in the optimization of CAD management. Furthermore, inappropriate understanding of the symptoms of CAD could directly affect the action of patients in seeking prompt emergency care,[6-9] which is known to contribute to timely reperfusion therapy.

In recent years, patient perspectives on lifestyle modification or disease recognition have been the subject of much research in the field of cardiovascular diseases.[10, 11] Understanding patient perspectives on these modifiable factors is essential to close the perception gap between health-care providers and patients in terms of patients' confidence levels regarding lifestyle

modification or disease recognition. These approaches could also help to identify imbalances in the composition of patient education programs and assess the appropriateness of such programs. In this study, our primary goal was to elucidate the perspectives on secondary lifestyle modification and precise knowledge of heart attack in patients treated with percutaneous coronary intervention (PCI) in Japan.

## 2. Methods

### *Study population and data collection*

We performed an observational cross-sectional study. The study population consisted of 237 consecutive patients who underwent PCI between October 2011 and September 2012 at a single university-based hospital center (Keio University Hospital, Tokyo, Japan). Our nursing team obtained the completed survey questionnaires immediately after a group educational program and the provision of discharge instructions, which are typically conducted 24–48 h before discharge. Patient education was conducted by nurses and nutritionists using video and literature materials for lifestyle modification and nutritional guidance, which was followed by face-to-face counseling by a nurse. At this time, the nurses answered several questions related to the survey questionnaire from the patients.

The response rate to the survey questionnaire was 99.6% and we excluded one patient (0.4%) due to missing questionnaire data. Thus, our analysis included a total of 236 patients who answered all the survey questions. Within this final cohort of study patients, 55 patients (23.3%) were diagnosed with acute coronary syndrome (ACS) (ST-elevation myocardial infarction, n = 28; non-ST-elevation myocardial infarction and unstable angina, n = 27) and 181 patients (76.7%) were diagnosed with stable angina or silent ischemia. More patients hospitalized for stable angina had a history of previous PCI than those hospitalized for ACS (n = 90 [49.7%] vs. n = 6 [10.9%], $p < 0.001$). All patients provided written informed consent to participate in the study. The study protocol conformed to the ethical guidelines of the 1975 Declaration of Helsinki as reflected by the prior

approval by the Keio University School of Medicine Ethics Committee (approval no. 20110263).

***Survey questionnaire***

The survey included questions covering a wide range of variables (Table 1).

**Table 1. Questionnaire for patients treated with percutaneous coronary intervention**

| Domains | Educational content |
|---|---|
| **First domain** | **Usefulness of our hospital educational program** |
| | **(Likert scale: 1 = never useful to 5 = very useful)** |
| | Do you think our lifestyle modification program was useful? |
| | Do you think our nutrition modification program was useful? |
| **Second domain** | **Self-confidence level of lifestyle modification** |
| | **Behavior-based questions** |
| | **(Likert scale: 1 = not confident to 4 = completely confident)** |
| | I feel confident that I can avoid eating fatty food throughout the year. |
| | I feel confident that I can avoid eating salty food throughout the year. |
| | I feel confident that I can keep my blood pressure target. |
| | I feel confident that I can keep my body weight target. |
| | I feel confident that I can exercise regularly. |
| | I feel confident that I can exercise more than 30 min in each session. |
| | I feel confident that I can stop smoking. |
| | I feel confident that I can limit my alcohol intake. |
| | I feel confident that I can properly take drugs without failure. |
| | **Knowledge-based questions** |
| | **(Likert scale: 1 = not confident to 4 = completely confident)** |
| | I feel confident that I understand well the risk of smoking. |
| | I feel confident that I understand well the risk of alcohol intake. |
| | I feel confident that I understand well the risk of depression, anxiety, and insomnia. |
| **Third domain** | **Action and recognition toward heart attack** |
| | I should go to the hospital as soon as possible when heart attack occurs. |
| | **(Likert scale: 1 = never agree to 4 = completely agree)** |
| | I feel confident that I can distinguish between heart attack and other disease. |
| | **(Likert scale: 1 = not confident to 4 = completely confident)** |

The questions were grouped into three domains:

1) Usefulness of the hospital educational program;

2) Self-confidence level in terms of lifestyle modification;

3) Confidence level in terms of the awareness of heart attack.

The questionnaire was originally designed after an in-depth discussion among board-certified cardiologists and nurses at our institute for this study and was largely based on the recommendations of the Japanese Circulation Society (JCS) guidelines.[12] We first generated two major domains: (1) lifestyle modification and (2) action and recognition regarding heart attack. The components of lifestyle modification were initially chosen from the JCS guidelines class-I recommendations (plus class IIa if no class-I recommendations were available). The latter questionnaires for action and recognition regarding heart attack were specifically developed by the investigators of the present study. We chose the term “heart attack”, which is commonly used in clinical practice, rather than medical jargon (e.g., myocardial infarction). This was to help the patients to understand the questionnaire more easily.[13] To evaluate and validate the preliminary questionnaire, we then conducted a pilot study with 17 patients (not included in the final analysis). Upon reviewing the responses to the pilot study, some adjustments were made, including the addition of questions related to the usefulness of our hospital education program. For domain 1, patients were asked to rate the

usefulness of lifestyle and nutrition guidance using a five-point Likert scale (1 = never useful, 2 = not useful, 3 = little useful, 4 = useful, 5 = very useful, or not provided with an educational program) and patients were divided into the useful group (4 or 5) and not useful group (1, 2, or 3). For domain 2, the questionnaire concerning self-confidence level about lifestyle modification contained 12 questions that were scored based on a four-point Likert scale (1 = not confident, 2 = less confident, 3 = confident, 4 = completely confident) and the patients were divided into the high confidence group (3 or 4) and low confidence group (1 or 2). These self-confidence questions consisted of nine behavior-based confidence levels (drug adherence, alcohol restriction, smoking cessation, exercise > 30 min, regular exercise, keeping body weight, keeping blood pressure, avoiding salty food, and avoiding fatty food) and three knowledge-based confidence levels (danger of smoking, alcohol, depression/anxiety, or insomnia). The sum of each confidence level in the nine behavior-based questions on lifestyle modification was calculated as the overall confidence level in lifestyle modification and we defined the lower tertile for this overall confidence level as the "low confidence group" and surveyed the characteristics associated with this group. For the final domain (domain 3), patients were asked to rate their recognition and action toward heart attack using a four-point Likert scale.

***Statistical analysis***

Continuous variables were summarized as means and standard deviations and categorical variables

as percentages. Logistic regression analyses were conducted to assess the association of the patients' confidence in behavior-based lifestyle modification as well as their precise recognition of heart attack with various patient characteristics. For multivariate analysis, the variables entered in the model included age, male sex, obesity, high school graduation or less, hypertension, diabetes mellitus, dyslipidemia, and previous myocardial infarction (MI) or PCI. Before multiple logistic regression analyses were performed, multicollinearity was assessed and factors indicating serious multicollinearity were accordingly eliminated from the model. C-statistics were used to evaluate the predictability of the models used for multivariate regression analysis. For all statistical analyses, statistical significance was accepted at $p < 0.05$. Data analysis was performed using SPSS 23.0 for Windows (SPSS Inc., Chicago, IL, USA).

## 3. Results

Demographic data and usefulness ratings of the educational program by participants are shown in Table 2 (domain 1). Most of the participants were men and approximately half of them had received university education or higher. Approximately 70% of patients considered their lifestyle modification program as useful (very useful, 26%; useful, 45%). Nutritional guidance was also considered useful by approximately 70% of the patients (very useful, 28%; useful, 44%).

Figure 1 shows the behavior- and knowledge-based confidence levels associated with lifestyle modification (domain 2). Most of the participants were highly confident (confident or completely confident, > 75%) in smoking cessation, alcohol restriction, and adherence to medication. However, they had low levels of confidence (confident or completely confident, < 50%) in blood pressure and cholesterol control, diet regulation, body weight maintenance, and routine exercise (Figure 1A). In terms of knowledge-based confidence level of lifestyle modification, most of the patients were confident in their understanding of the danger of smoking or alcohol but were not confident in their understanding of the risk of depression, anxiety, and insomnia (Figure 1B).

The total confidence score was calculated from the sum of the previously described nine behavior-based confidence levels in lifestyle modification (maximum score, 36 points). Patients scoring lower than the first tertile for total confidence (< 23 points) were defined as the low confidence group. Univariate regression analysis showed that male sex, obesity, and lower education level were associated with the low confidence group with respect to lifestyle modification. In

multivariate regression analysis adjusted for age, sex, obesity, educational level, coronary risk factors, and previous MI or previous PCI, we found that male sex (odds ratio [OR] 3.61, 95% confidence interval [CI] 1.11–11.8) and lower education level (OR 3.25, 95% CI 1.70–6.23) were independent determinants of inclusion in the low confidence group (Table 3A). The significant association between obesity and low confidence level in lifestyle modification disappeared after adjustment for covariates (OR 1.73, 95% CI 0.90–3.33). The c-statistics of models 1 and 2 were 0.72 (95% CI 0.65–0.80) and 0.72 (95% CI 0.64–0.79), respectively.

The data concerning patients' recognition of heart attack are shown in Figure 2 (domain 3). When questioned about whether they agreed with the idea of promptly going to the hospital after a heart attack, 233 patients (98%) agreed (completely agree, 50%; agree, 48%), whereas one and two patients disagreed and completely disagreed with the idea, respectively. In contrast, only 28% were confident in distinguishing between heart attack and other diseases (completely confident, 5%; confident, 23%), whereas 100 patients (42%) were less confident and 67 (28%) patients were not confident. Within this domain, univariate logistic regression analysis revealed that patients who had high confidence in their awareness of heart attack were associated with a previous MI or PCI and this association remained significant after adjustment for age, sex, and coronary risk factors (previous MI: OR 2.51, 95% CI 1.29–4.91; previous PCI: OR 2.04, 95% CI 1.09–3.80; Table 3B). The c-statistics of models 1 and 2 were 0.67 (CI 0.59–0.75) and 0.65 (95% CI 0.57–0.73), respectively.

**Table 2. Demographic data of the study participants**

| Patient characteristics | n = 236 | % |
|---|---|---|
| Age, years | 67.4 ± 10.1 | |
| Male | 201 | 85.2 |
| BMI, kg/m$^2$ | 24.7 ± 3.4 | |
| University education or more | 117 | 49.6 |
| Married | 199 | 84.3 |
| Living alone | 31 | 13.1 |
| Coronary risk factors | | |
| Hypertension | 187 | 79.2 |
| Diabetes mellitus | 93 | 39.4 |
| Dyslipidemia | 179 | 75.8 |
| Smoking | 65 | 27.5 |
| Family history of CAD | 52 | 22.0 |
| Previous PCI | 96 | 40.7 |
| Previous CABG | 5 | 2.3 |
| Previous MI | 64 | 27.1 |
| Previous HF | 14 | 5.9 |
| CVD | 30 | 12.7 |
| PAD | 36 | 15.3 |
| COPD | 18 | 7.6 |
| ACS | 55 | 23.3 |
| Multivessel disease | 59 | 25.0 |
| Laboratory data | | |
| CRP, mg/dL | 0.49 ± 1.37 | |
| Cr, mg/dL | 1.32 ± 1.87 | |
| TG, mg/dL | 146.5 ± 79.5 | |
| HDL, mg/dL | 43.6 ± 12.5 | |
| LDL, mg/dL | 87.4 ± 29.5 | |
| Usefulness of educational program: very useful or useful | | |
| Lifestyle modification (%) | 168 | 71.2 |
| Nutrition guidance (%) | 170 | 72.0 |

Data are shown as mean ± standard deviation or number and percentage. BMI: body mass index, CAD: coronary artery disease, PCI: percutaneous coronary intervention, CABG: coronary artery bypass graft, MI: myocardial infarction, HF: heart failure, CVD: cerebrovascular disease, PAD:

peripheral arterial disease, COPD: chronic obstructive pulmonary disease, ACS: acute coronary syndrome, CRP: C-reactive protein, Cr: creatinine, TG: triglyceride, HDL: high-density lipoprotein, LDL: low-density lipoprotein.

**Table 3A. Determinants of low confidence level in lifestyle modification**

| | Univariate models | | Multivariate models | | | |
|---|---|---|---|---|---|---|
| | | | Model 1 | | Model 2 | |
| Variables | OR 95% CI | p-value | OR 95% CI | p-value | OR 95% CI | p-value |
| Age | 0.98 0.95–1.01 | 0.10 | 0.98 0.95–1.02 | 0.30 | 0.98 0.95–1.02 | 0.30 |
| Male | 3.51 1.18–10.5 | 0.02 | 3.61 1.11–11.8 | 0.03 | 3.50 1.07–11.4 | 0.04 |
| Obesity (BMI > 25 kg/m$^2$) | 2.36 1.33–4.18 | 0.003 | 1.73 0.90–3.33 | 0.10 | 1.75 0.92–3.36 | 0.09 |
| High school graduation or less | 2.51 1.40–4.51 | 0.002 | 3.25 1.70–6.23 | <0.001 | 3.26 1.71–6.22 | <0.001 |
| Hypertension | 0.91 0.46–1.79 | 0.78 | 1.22 0.53–2.81 | 0.64 | 1.21 0.52–2.79 | 0.66 |
| Dyslipidemia | 0.54 0.29–1.01 | 0.05 | 0.61 0.30–2.30 | 0.19 | 0.60 0.29–1.24 | 0.17 |
| Diabetes mellitus | 1.14 0.65–2.01 | 0.65 | 1.22 0.64–2.30 | 0.55 | 1.22 0.65–2.29 | 0.55 |
| Previous MI | 1.03 0.55–1.92 | 0.93 | 0.96 0.47–1.96 | 0.90 | | |
| Previous PCI | 0.97 0.55–1.70 | 0.91 | | | 1.10 0.57–2.11 | 0.78 |

OR: odds ratio, CI: confidence interval, BMI: body mass index, MI: myocardial infarction, PCI: percutaneous coronary intervention.

Standard covariates = age, male sex, obesity, educational level, coronary risk factors (hypertension, dyslipidemia, diabetes mellitus).

Model 1 = standard covariates + previous MI.

Model 2 = standard covariates + previous PCI.

**Table 3B. Determinants of high confidence in precise recognition of heart attack**

| | Univariate models | | Multivariate models | | | |
|---|---|---|---|---|---|---|
| | | | Model 1 | | Model 2 | |
| Variables | OR<br>95% CI | p-value | OR<br>95% CI | p-value | OR<br>95% CI | p-value |
| Age | 0.99<br>0.97–1.02 | 0.57 | 0.99<br>0.96–1.03 | 0.69 | 0.99<br>0.96–1.02 | 0.61 |
| Male | 0.72<br>0.32–1.59 | 0.41 | 0.6<br>0.24–1.52 | 0.28 | 0.63<br>0.25–1.59 | 0.33 |
| Obesity (BMI > 25 kg/m$^2$) | 1.20<br>0.68–2.13 | 0.53 | 1.5<br>0.78–2.88 | 0.23 | 1.35<br>0.71–2.56 | 0.36 |
| High school graduation or less | 1.12<br>0.63–1.98 | 0.70 | 0.68<br>0.36–1.31 | 0.25 | 0.82<br>0.43–1.54 | 0.53 |
| Hypertension | 1.54<br>0.73–3.25 | 0.25 | 1.37<br>0.61–3.11 | 0.45 | 1.36<br>0.60–3.06 | 0.46 |
| Dyslipidemia | 1.99<br>0.96–4.12 | 0.07 | 1.46<br>0.66–3.19 | 0.35 | 1.43<br>0.65–3.15 | 0.38 |
| Diabetes mellitus | 0.74<br>0.41–1.33 | 0.31 | 0.63<br>0.33–1.20 | 0.16 | 0.58<br>0.31–1.11 | 0.10 |
| Previous MI | 2.10<br>1.14–3.83 | 0.02 | 2.51<br>1.29–4.91 | 0.007 | | |
| Previous PCI | 2.04<br>1.15–3.62 | 0.02 | | | 2.04<br>1.09–3.80 | 0.03 |

OR: odds ratio, CI: confidence interval, BMI: body mass index, MI: myocardial infarction, PCI: percutaneous coronary intervention.

Standard covariates = age, male sex, obesity, education level, coronary risk factors (hypertension, dyslipidemia, diabetes mellitus).

Model 1 = standard covariates + previous MI.

Model 2 = standard covariates + previous PCI.

## 4. Discussion

The present study demonstrated the following key points: 1) confidence levels in lifestyle modification were different across the various risk factors for patients with CAD and patients had low confidence in their blood pressure and cholesterol control, diet regulation, body weight maintenance, and routine exercise; 2) low confidence in overall lifestyle modification was associated with male sex and lower education level; and 3) there was a substantial gap between recognition of and action toward heart attack.

Much of the existing research on lifestyle modification has focused on single behaviors, e.g., smoking cessation. However, the level of accomplishment regarding lifestyle modification can vary among the main modifiable risk factors, including alcohol restriction, dyslipidemia, obesity, physical inactivity, hypertension, and diabetes. The strength of this study is that we quantified patient confidence levels based on patient behavior toward several risk factors for CAD that could be related to adherence to lifestyle modification. Although patient education is known to be an important intervention in enhancing the adherence to lifestyle modification,[14] the challenge is how to effectively deliver education programs to patients with CAD given limited human resources and limited duration of hospitalization or outpatient consultation. We demonstrated that patients with CAD were not confident in adhering to regular and sufficient exercise after discharge. The adherence to exercise training has been reported as low in previous studies, i.e., approximately < 60% in patients with heart failure (HF),[15, 16] which is consistent with our data. Cardiologists need to

emphasize the importance of exercise training and pursue strategies to promote regular exercise, such as more extensive referral for cardiac rehabilitation and structured nurse- or therapist-led contact.[17] Our patients were also less confident about factors related to dietary and nutritional factors. Several previous studies reported poor adherence to salt restriction or diet restriction in general among patients with chronic diseases such as HF or diabetes mellitus,[18-20] suggesting that the difficulties in adhering to dietary modification could be universal. Despite its powerful opportunities to reduce adverse health, confusion surrounding nutritional guidance sometimes emerges because of the rapid advances in dietary and nutrition science.[21] Continuous education performed by multidisciplinary teams, especially nutritionists and diabetologists, could be essential in improving lifestyle modification.

Knowledge of predisposing risk factors is an important step in the modification of lifestyle behaviors. Our study demonstrated that most responders understood the risk of smoking or excessive alcohol intake and were confident in restricting these activities. This robust patient knowledge was most likely due to repeated public health promotion, leading to patient motivation to adhere to smoking cessation and alcohol restriction with relative ease.[22, 23] In fact, the prevalence of smoking and alcohol consumption in Japan has declined during the last 10 years.[24, 25] Considering these results, the importance of promoting smoking cessation and alcohol restriction through educational programs might be low relative to several other modifiable risk factors. However, psychological and sleep disturbances are known to be under-recognized and under-treated

in patients with cardiovascular disease despite their significance in the development and progression of various cardiovascular conditions, including CAD.[26, 27] In parallel with these circumstances, patient knowledge relating to depression, anxiety, and insomnia as risk factors for CAD was relatively poor in our study population. Educational campaigns directed at cardiologists and patients are needed to improve awareness of psychological and sleep disturbances as risk factors for CAD.

Several studies have been conducted to clarify sex differences in the achievement of the secondary prevention of cardiovascular disease, with mixed and inconsistent results.[28-30] Interestingly, there were regional variations in the sex differences in the achievement of lifestyle modification.[31, 32] Although lifestyle modification for the secondary prevention of CAD is generally worse in women than in men, women in Asia are more likely than men to be adherent to lifestyle modification, especially in terms of adequate physical activity, with opposite results in Europe and the Middle East.[32] Consistent with these regional variations, patient perspectives concerning secondary prevention could differ. While our study revealed that the male sex was associated with low confidence in lifestyle modification for CAD in Japan, a nationwide survey from the United States demonstrated that women have less knowledge and awareness of cardiovascular disease than men.[33] Although it remains unknown why regional variations occur in the sex differences in the attitude toward and achievement of lifestyle modification, this might be explained by the social background of women (e.g., education level).[34] These assessments are warranted to clarify which subpopulations should be targeted for education in each region. Moreover, regular

surveys of patients' perspectives will also be needed in the future.

It is common for patients to have limited knowledge of heart attack symptoms. The lack of awareness in this regard represents a significant barrier to patients taking action and seeking medical care.[6] In our study, most of the participants had low confidence in distinguishing between heart attack and other diseases. Patients with a history of MI or PCI were relatively confidence in their ability to precisely recognize a heart attack, possibly because of their previous experience of heart attack, PCI, or exposure to repeated education. It is difficult to conclude which factors affect the confidence level concerning heart attack from our data; however, education focusing on heart attack in patients with CAD without previous MI or PCI is recommended.

The present study has some limitations that should be considered when interpreting the results. First, this was a small study based on data from a single center. Therefore, the study involved a small number of patients. No formal power analysis of the results of the pilot study to determine the optimal sample size was performed. Consequently, its statistical power may not have been sufficient to detect any negative outcomes. Second, the cross-sectional design of this study limits its ability to clarify the impact of a patient's confidence level on lifestyle modification and awareness of heart attack on post-discharge behaviors and long-term clinical outcomes. Third, our study population included only patients who underwent PCI. Thus, patients who were not eligible for coronary revascularization were excluded, which could have caused potential selection bias. Finally, our data were based on subjective patient perceptions rather than objective evaluations. Thus, the

confidence levels are subject to individual bias.

## 5. Conclusions

There were substantial disparities in the confidence level concerning lifestyle modification and awareness of heart attack in patients treated with PCI. Male sex and lower educational level were associated with lower confidence levels concerning lifestyle modification. There was a substantial gap between recognition of and action toward heart attack. A history of MI and PCI were associated with higher confidence in the awareness of heart attack. Medical providers should bring these disparities to light aim to solve them with help of a multidisciplinary team to improve overall cardiovascular care.

## Ethical approval and consent to participate

This study was approved by the Keio University School of Medicine Ethics Committee. Informed consent was obtained from patients before they answered the questionnaire.

## Consent for publication

Not applicable.

## Data sharing statement

The dataset analyzed during this study are available from the corresponding author (Takashi Kohno, kohno.a2@keio.jp) on reasonable request.

## Competing interests

The authors report no relationships that could be construed as a conflict of interest, including related consultancies, shareholdings, and funding grants.

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## Authors' contributions

HK and TK had full access to all data and were responsible for the integrity and accuracy of data analysis. Study design: HK, TK, and SK. Acquisition and analysis of data: HK, TK, JF, NN, and RF. Interpretation of data: HK, TK, SK, SY, and YM. Drafting of the manuscript: HK, TK, and SK. Critical revision of the manuscript for intellectual content: SY, YM, and KF.

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## Figure legends

Figure 1: Self-confidence level regarding lifestyle modification (A: behavior-based and B: knowledge-based confidence level)

Figure 2: Patient perception and recognition of heart attack

**Figure 1: Self-confidence level regarding lifestyle modification (A: behavior-based and B: knowledge-based confidence level)**

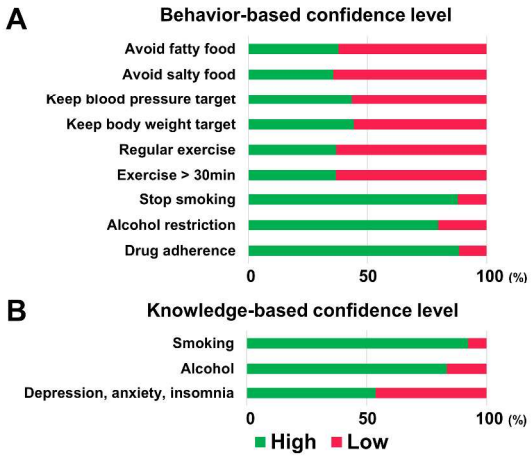


Figure 1: Self-confidence level regarding lifestyle modification (A: behavior-based and B: knowledge-based confidence level)

338x190mm (300 x 300 DPI)

**Figure 2: Patient perception and recognition of heart attack**

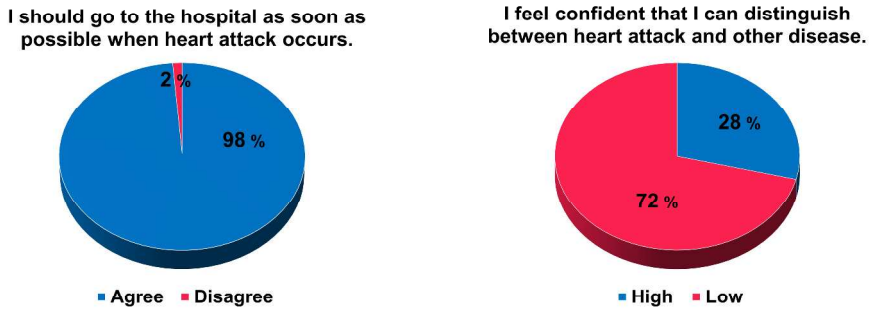


Figure 2: Patient perception and recognition of heart attack

338x190mm (300 x 300 DPI)

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

| | Item No | Recommendation | Page in Manuscript |
|---|---|---|---|
| **Title and abstract** | 1 | (*a*) Indicate the study's design with a commonly used term in the title or the abstract | **Page 1, 2** |
| | | (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found | **Page 2** |
| **Introduction** | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | **Page 5** |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses | **Page 5, 6** |
| **Methods** | | | |
| Study design | 4 | Present key elements of study design early in the paper | **Page 7** |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | **Page 7** |
| Participants | 6 | (*a*) Give the eligibility criteria, and the sources and methods of selection of participants | **Page 7** |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | **Page 7, 8, 9, 10** |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | **Page 7, 8, 9, 10** |
| Bias | 9 | Describe any efforts to address potential sources of bias | **Page 10, 11** |
| Study size | 10 | Explain how the study size was arrived at | **Page 7** |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | **Page 9, 10** |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding | **Page 10, 11** |
| | | (*b*) Describe any methods used to examine subgroups and interactions | **NA** |
| | | (*c*) Explain how missing data were addressed | **Page 7** |
| | | (*d*) If applicable, describe analytical methods taking account of sampling strategy | **NA** |
| | | (*e*) Describe any sensitivity analyses | **NA** |
| **Results** | | | |
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | **Page 7, 15** |
| | | (b) Give reasons for non-participation at each stage | **Page 7** |
| | | (c) Consider use of a flow diagram | **NA** |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg | **Page 15, Table 2** |

| | | | |
|---|---|---|---|
| | | demographic, clinical, social) and information on exposures and potential confounders | |
| | | (b) Indicate number of participants with missing data for each variable of interest | **Page 7** |
| Outcome data | 15* | Report numbers of outcome events or summary measures | **Page 12, 13,14** |
| Main results | 16 | (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | **Page 12,13,14** |
| | | (*b*) Report category boundaries when continuous variables were categorized | **Page 12,13,14** |
| | | (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | **NA** |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | **NA** |
| **Discussion** | | | |
| Key results | 18 | Summarise key results with reference to study objectives | **Page 18** |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | **Page 21** |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | **Page 20,21** |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | **Page 19,20,21** |
| **Other information** | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | **Page 23** |

*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.