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# The Effect of Health Education by Pharmacists on 10-Year Atherosclerotic Cardiovascular Disease Risk: A Cluster-Randomized Control Study in a Low Socioeconomic Status Javanese Population

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## Abstract

**Background:** Evidence from previous studies demonstrates that lifestyle modification reduces the incidence and complications of atherosclerotic cardiovascular disease. The study aimed to investigate the effect of a lifestyle intervention provided by pharmacists on the 10-year atherosclerotic cardiovascular disease (ASCVD) risk and quality of life (QoL) in a low socioeconomic status Javanese population. **Methods:** This research was a cluster-randomized controlled study of 1-year duration, conducted in a lower social economic community in the Sleman District of Yogyakarta, Indonesia. The eligible subjects were dichotomized into 2 groups: 40 to 55 years (n = 61 vs 65) and 56 to 70 years (n = 21 vs 43) for intervention and control subjects, respectively. The ASCVD score and risk factors within the age-based groups were analyzed using *T* test/Mann-Whitney test for continuous data or chi-square test for categorical data. **Results:** The intervention and control subjects had similar baseline characteristics ($P > .05$), including the ASCVD risk with the low- and high-risk classification for younger and elder subjects, respectively. At final follow-up, the younger intervention subjects had lower 10-year ASCVD risk ($P = .001$), higher high-density lipoprotein cholesterol ($P = .02$), smoking status ($P = .001$), persistence rate ($P = .03$), and QoL value for the physical and social function domains ($P < .05$) than the control subjects, whereas the elder intervention subjects only had better ASCVD risk score than controls ($P = .03$). Smoking interacting with intervention was the most influential variable on ASCVD risk in logistic regression analysis. **Conclusion:** The study demonstrates that the health education by the pharmacists produce significant outcomes of the ASCVD risk, smoking status, and QoL of physical and social function particularly in the younger group.

## Keywords

pharmacist, community pharmacist, ASCVD risk, low socioeconomic status, health education

## Introduction

Atherosclerotic cardiovascular diseases (ASCVDs), formerly known as cardiovascular diseases (CVDs),[1] showed a substantial decline worldwide due to the use of evidence-based therapy in heart disease.[2,3] Nevertheless, the highest mortality causes in Indonesia are related to the ASCVDs, including stroke, ischemic heart disease, and diabetes mellitus (DM), which are responsible for 21.2%, 8.9%, and 6.5%, respectively, of all death in Indonesia. High prevalence of hypertension, poor diet, and smoking status contribute to the development of the ASCVDs.[4]

Hypertension, DM, and hyperlipidemia are the most dominant ASCVD risk factors.[5] The 10-year ASCVD risk can be predicted using pooled cohort equations.[6] The risk prediction is effective to screen patient's disease and to initiate therapy.[7] The effect of therapy varies among different populations.[2] Pharmacists can participate in the ASCVD reduction with the lifestyle education, health promotion, and disease prevention.[8-12]

A review study found no particular intervention method emerged with better impact.[13] A community-based lifestyle intervention with a cultural approach showed greater

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reduction of the body mass index (BMI) and A1c than the education with printed materials among the lower health coverage subjects in the United States.[14] To the contrary, an intensive lifestyle modification for weight loss failed to minimize the cardiovascular events among obese type 2 DM subjects.[15] Regardless of the contradictive results, more evidence recently indicated that the ASCVDs were preventable with lifestyle modification.[16]

Sleman District, with 574 $km^2$ width and 1.1 million inhabitants, is the most populated district in the Yogyakarta Province, Indonesia. In a former research, Sleman population had high prevalence of hypertension, low disease awareness, and low blood pressure (BP) control rate despite the ownership of the universal health coverage.[17] The patient and health care provider factors affect more on the health outcomes than the financing system.[18] Based on the above description, we aimed to investigate the effect of a lifestyle modification with health education by pharmacists on the 10-year ASCVD risk and the quality of life (QoL) score. The health education was expected to be beneficial for the health knowledge enhancement and the ASCVD prevention in a low socioeconomic status population.

## Methods

### Design of Study and Intervention

This research was a cluster-randomized control study done of 1-year duration conducted in a lower socioeconomic community of the Sleman District of Yogyakarta. The study protocol was approved by the Ethics Committee of Universitas Gadjah Mada with Ref No. KE/FK/043/EC/2016. The open-labeled intervention involved with 2 main topics: (*a*) increase of cardiovascular risk awareness and (*b*) CVD prevention with healthy lifestyle and monitoring of BP, fasting blood glucose (FBG), high-density lipoprotein cholesterol (HDL-C), and total cholesterol (total-C).

The researchers, 3 pharmacists with 10 pharmacy students, conducted the intervention with 4 sessions of 90-minute long oral presentation and discussion, which were done consecutively every 1 to 2 months. Presentation covered the topics of hypertension, hyperlipidemia, and diabetes. Each of the subjects in the intervention group received 4 booklets covering the presentation topics and an activity manual, along with 3 posters about smoking cessation, exercise, and healthy food. The aforementioned printed materials were prepared to help the intervention subjects to better understand and maintain the knowledge. The intervention subjects were encouraged to participate in weekly exercise. We also recruited 5 active subjects in the intervention group as a local research team. The local team was trained for the measuring BP, peripheral FBG, and cholesterol technique by small group discussion with the aim to prepare them to continue the ASCVD prevention beyond the research period. The control subjects did not receive any health education, but obtained the monitoring report of HDL-C, total-C, and FBG.

### Study Sites and Subject Selection

The study sites of 4 villages were selected with multistage randomization within 17 subdistricts and were grouped into west and east clusters before the submission of the protocol to the ethics committee. We interviewed some respondents to know their responses and appointed the more cooperative cluster from the west side as the intervention group.

At baseline, we invited all adults regardless of the characteristics to each study site within a week prior to the study and with the instruction of 8- to 10-hour fasting. The 10-year ASCVD risk calculator has the criteria of 90 to 200 mm Hg for systolic blood pressure (SBP), 130 to 320 mg/dL for total-C, and 20 to 100 mg/dL for HDL-C.[19] All subjects who met the ASCVD calculator criteria and signed the informed consent were included, whereas pregnancy, CVDs (post-stroke, myocardial infarction, and coronary stent), and non-fasting subjects were excluded.

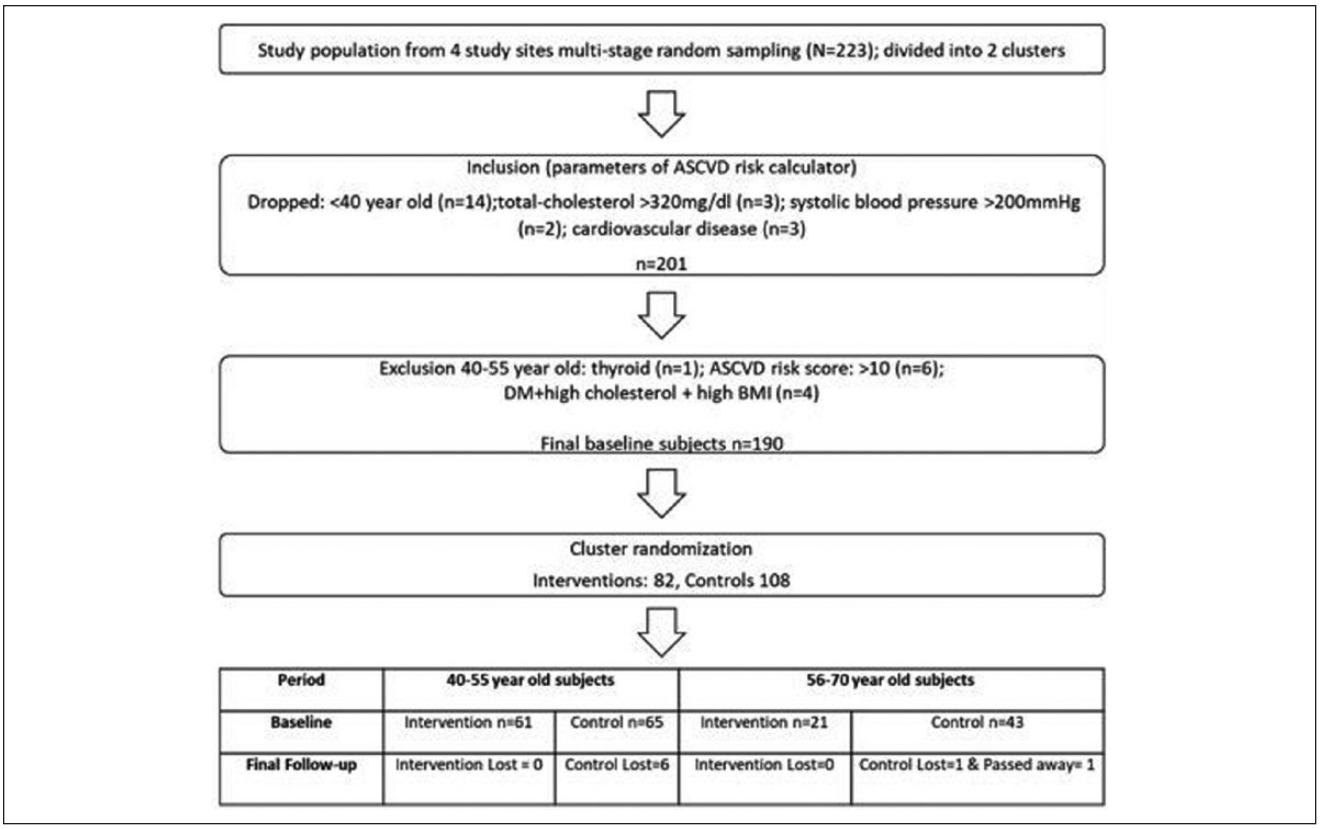
At baseline, of the 201 eligible subjects, we matched the groups and dropped 11 younger candidates from the control group due to hyperthyroidism (n = 1), outliers of ASCVD score (>10%), and DM plus high cholesterol/BMI (n = 10). Diabetes has been associated with low life satisfaction.[20] The final number of subjects (n = 190) consisted of the intervention (n=82) and control (n = 108) groups. Furthermore, the subjects in each group were divided based on the ages of 40 to 55 and 56 to 70 years (Figure 1).

### Data Collection

Data collection was done at the study sites. Blood pressure (BP) was measured using digital sphygmomanometer Omron HEM-7120®. The second reading with <10 mm Hg difference from the first one was considered as BP, otherwise a third measurement was needed to determine mean BP from the 2 closest readings. High BP had the cut-point at ≥140/90 mm Hg and/or receiving hypertension medication. After collection of venous blood samples for FBG and cholesterol level, the samples were transported and analyzed in PL, an accredited clinical laboratory in Yogyakarta city. The FBG and cholesterol were determined with serum hexokinase and CHOD-PAP methods, respectively using the instrument of COBAS 311®. Diabetes was defined as blood glucose >125 mg/dL and/or receiving DM medication.

### Variables

Variables of this study consisted of continuous data and categorical profiles. The continuous data were comprised the ASCVD risk score,[19] age, BP, pulse, BMI, FBG, total-C, and HDL-C, and QoL using the SF-36 (Short Form–36 health questionnaire) instrument translated into Indonesian




| Period | 40-55 year old subjects | | 56-70 year old subjects | |
|---|---|---|---|---|
| Baseline | Intervention n=61 | Control n=65 | Intervention n=21 | Control n=43 |
| Final Follow-up | Intervention Lost = 0 | Control Lost=6 | Intervention Lost=0 | Control Lost=1 & Passed away= 1 |

**Figure 1.** Flow diagram of the sampling process and subject criteria.

language; whereas the categorical profiles were comprised of gender, education background, hypertension medication, diabetes status, ASCVD classification, and control of BP, BMI, FBG, and cholesterol.

The QoL was assessed with the SF-36 instrument.[21,22] The instrument consists of 36 questionnaires divided into 8 domains, namely physical functions, physical role, pain free, general health, social health, vitality, mental health, and emotional role. The QoL evaluation is preferably done on each domain of the QoL instead of the total score of SF-36.[23-25]

The BP target was standardized at <140/90 mm Hg and <150/90 mm Hg for <60 and ≥60 years subjects, respectively. The ASCVD risks were obtained from the ACC/AHA risk calculator[19] and were classified into <5% (low risk) and ≥5% (moderate to high risk). There is no exact BMI cut-point for Asian population,[26] and BMI at ≥23.0 kg/m$^2$ is defined as overweight. Smoking status covered the active, including ever smoking in a previous year and/or passive smoking at work or at home.

Race was not analyzed because the all subjects were from Javanese ethnicity. The meal and salt intake were not evaluated because the subjects had consumed similar proportions and style of diet with the preference of sweet flavored meals. The Indonesian population has a higher cholesterol consumption in their diet than other Asian countries.[4]

### *Statistical Analysis*

The data were analyzed by the Clinical Epidemiology & Biostatistics Unit, Faculty of Medicine, Universitas Gadjah Mada using the IBM program SPSS Statistics 22. The categorical data between groups were compared based on the odds ratio (OR) analyzed with either Pearson's chi-square or Fisher's exact test. Meanwhile, the continuous data were analyzed for the data normality with normal Q-Q plot description test and followed by either *T* test or Mann-Whitney test depending on the data normality. Finally, the logistic regression was performed to evaluate β coefficient (95% confident interval), *P* value, and coefficient determination of the variables in each age-based group. Prior to the regression analysis, bivariate analysis was done for the variables of age, SBP, Total-C, HDL-C, and FBG, BMI, education, gender, therapy of hypertension, and DM status and the variables in equations with $P < .25$ were continued for the regression analysis.

## Results

### *Baseline Profiles*

The characteristics of the overall and age-based subjects are presented in the categorical profiles (Table 1) and in the continuous data (Table 2). The analyses were done in the

**Table 1.** Age-Based and Overall Subjects' Characteristics at Baseline and Final Follow-up.[a]

| | Overall Subjects | | | 40- to 55-Year-Old Subjects | | | 56- to 70-Year-Old Subjects | | |
|---|---|---|---|---|---|---|---|---|---|
| Characteristics | n (%) | n (%) | *P*; OR (95% CI) | n (%) | n (%) | *P*; OR (95% CI) | n (%) | n (%) | *P*; OR (95% CI) |
| Profiles at baseline | | | | | | | | | |
| Gender | Male | Female | **.01; 0.35 (0.17-0.75)** | Male | Female | .13; 0.47 (0.18-1.26) | Male | Female | .05; 0.30 (0.09-1.03) |
| Interventions | 11 (13.4) | 71 (86.6) | | 7 (11.5) | 54 (88.5) | | 4 (19.0) | 17 (81.0) | |
| Controls | 33 (30.6) | 75 (69.4) | | 14 (21.5) | 51 (78.5) | | 19 (44.2) | 24 (55.8) | |
| Diabetes | DM | No | .35; 0.56 (0.17-1.90) | DM | No | .12[b]; 0.16 (0.02-1.40) | DM | No | .39[b]; 2.22 (0.41-12.1) |
| Interventions | 4 (4.9) | 78 (95.1) | | 1 (1.6) | 60 (98.4) | | 3 (14.3) | 18 (85.7) | |
| Controls | 9 (8.3) | 99 (91.7) | | 6 (9.2) | 59 (90.8) | | 3 (7.0) | 40 (93.0) | |
| Education | ≤Junior high | >Junior high | .36; 0.76 (0.41-1.38) | ≤Junior high | >Junior high | .89; 0.95 (0.47-1.93) | ≤Junior high | >Junior high | .43[b]; 0.69 (0.17-2.77) |
| Interventions | 51(62.2) | 31(37.8) | | 34 (55.7) | 27(44.3) | | 17(81.0) | 4(19.0) | |
| Controls | 74(68.5) | 34(31.5) | | 37(56.9) | 28(43.1) | | 37(86.0) | 6(14.0) | |
| Hypertension therapy | Therapy | No | .98; 0.99 (0.40-2.47) | Therapy | No | .40; 0.58 (0.16-2.10) | Therapy | No | .28[b]; 2.38 (0.60-9.35) |
| Interventions | 9 (11.0) | 73 (89.0) | | 4 (6.6) | 57 (93.4) | | 5 (23.8) | 16 (76.2) | |
| Controls | 12 (11.1) | 96 (88.9) | | 7 (10.8) | 58 (89.2) | | 5 (11.6) | 38 (88.4) | |
| Smoking | Smoking | No | .59; 0.85 (0.48-1.52) | Smoking | No | .83; 0.93 (0.46-1.87) | Smoking | No | .66; 0.79 (0.28-2.25) |
| Interventions | 37 (45.1) | 45 (54.9) | | 27 (44.3) | 34 (55.7) | | 10 (47.6) | 11 (52.4) | |
| Controls | 53 (49.1) | 55 (50.9) | | 30(46.2) | 35 (53.8) | | 23 (53.5) | 20 (46.5) | |
| ASCVD Risk <5% | Risk <5% | No | **.01; 2.35 (1.27-4.36)** | Risk <5% | No | .07; 2.52 (0.90-7.05) | Risk <5% | No | .47[b]; 1.61 (0.44-5.84) |
| Interventions | 60 (73.2) | 22 (26.8) | | 55 (90.2) | 6 (9.8) | | 5 (23.8) | 16 (76.2) | |
| Controls | 58 (53.7) | 50 (46.3) | | 51 (78.5) | 14 (21.5) | | 7 (18.8) | 36 (83.7) | |
| Outcomes at final follow-up | | | | | | | | | |
| Hypertension therapy | Therapy | No | .93 1.04 (0.44-2.46) | Therapy | No | .37; 1.78 (0.49-6.44) | Therapy | No | .79[b]; 0.84 (0.22-3.12) |
| Interventions | 11 (13.4) | 71 (86.6) | | 7 (11.5) | 54 (88.5) | | 4 (19.0) | 17 (81.0) | |
| Controls | 13 (13.0) | 87 (87.0) | | 4 (6.8) | 55 (93.2) | | 9 (22.0) | 32 (78.0) | |
| Blood pressure | Good control | No | **.03; 1.98 (1.07-3.67)** | Good control | No | .10; 2.26 (1.04-4.91) | Good control | No | .13; 2.38 (0.77-7.35) |
| Interventions | 58 (70.7) | 24 (29.3) | | 44 (72.1) | 34 (57.6) | | 15 (71.4) | 6 (28.6) | |
| Controls | 55 (55.0) | 45 (45.0) | | 17 (27.9) | 25 (42.4) | | 21 (51.2) | 20 (48.8) | |
| Blood glucose | <126 mg/dL | ≥126 mg/dL | .28; 1.93 (0.57-6.51) | <126 mg/dL | ≥126 mg/dL | .38[b]; 2.15 (0.38-12.18) | <126 mg/dL | ≥126 mg/dL | .75[b]; 1.32 (0.23-7.45) |
| Interventions | 78 (95.1) | 4 (4.9) | | 59 (96.7) | 2 (3.3) | | 19 (90.5) | 2 (9.5) | |
| Controls | 91 (91.0) | 9 (9.0) | | 55 (93.2) | 4 (6.8) | | 36 (87.8) | 5 (12.2) | |

*(continued)*

**Table 1. (continued)**

| | Overall Subjects | | | 40- to 55-Year-Old Subjects | | | 56- to 70-Year-Old Subjects | | |
|---|---|---|---|---|---|---|---|---|---|
| Characteristics | n (%) | n (%) | *P*; OR (95% CI) | n (%) | n (%) | *P*; OR (95% CI) | n (%) | n (%) | *P*; OR (95% CI) |
| Total cholesterol | <200 mg/dL | ≥200 mg/dL | .69; 0.89 (0.49-1.59) | <200 mg/dL | ≥200 mg/dL | .45; 0.76 (0.37-1.56) | <200 mg/dL | ≥200 mg/dL | .94; 0.96 (0.33-2.77) |
| Interventions | 41 (50.0) | 41 (50.0) | | 32 (52.5) | 29 (47.5) | | 9 (42.9) | 12 (57.1) | |
| Controls | 53 (53.0) | 47 (47.0) | | 35 (59.3) | 24 (40.7) | | 18 (43.9) | 23 (56.1) | |
| HDL cholesterol | ≥40 mg/dL | <40 mg/dL | .34; 1.71 (0.56-5.22) | ≥40 mg/dL | <40 mg/dL | .17[b]; 2.6 (0.64-10.59) | ≥40 mg/dL | <40 mg/dL | .76[b]; 0.75 (0.12-4.88) |
| Interventions | 77 (93.9) | 5 (6.1) | | 58 (95.1) | 3 (4.9) | | 19 (90.5) | 2 (9.5) | |
| Controls | 90 (90.0) | 10 (10.0) | | 52 (88.1) | 7 (11.9) | | 38 (92.7) | 3 (7.3) | |
| Smoking status | Nonsmoking | Smoking | .07; 1.71 (0.95-3.08) | Nonsmoking | Smoking | **.001; 3.76 (1.76-8.03)** | Nonsmoking | Smoking | .12; 2.31 (0.79-6.76) |
| Interventions | 47(57.3) | 35 (42.7) | | 38 (62.3) | 23 (37.7) | | 12 (57.1) | 9 (42.9) | |
| Controls | 44 (44.0) | 56 (56.0) | | 18 (30.5) | 41 (69.5) | | 15 (36.6) | 26 (63.4) | |
| ASCVD score | Low risk | Medium-high risk | **<.001; 4.01 (2.14-7.51)** | Low risk | Medium-high risk | **.001; 4.23 (1.71-10.51)** | Low risk | Medium-high risk | **.03[b]; 5.07 (1.12-22.92)** |
| Interventions | 59 (72.0) | 23 (28.0) | | 53 (86.9) | 8 (13.1) | | 6 (28.6) | 15 (71.4) | |
| Controls | 39(39.0) | 61 (61.0) | | 36 (61.0) | 23 (39.0) | | 3 (7.3) | 38 (92.7) | |
| Persistence[c] | Persistence | No | **.01; 1.08 (1.02-1.14)** | Persistence | No | **.03[b]; 1.10 (1.02-1.19)** | Persistence | No | .32; 1.05 (0.98-1.20) |
| Interventions | 82 (100.0) | 0 (0.0) | | 61 (100.0) | 0 (0.0) | | 21(100.0) | 0 (0.0) | |
| Controls | 100 (92.6) | 8 (7.4) | | 59 (90.8) | 6 (9.2) | | 41 (95.3) | 2 (4.7) | |

Abbreviations: OR, odds ratio; CI, confidence interval; DM, diabetes mellitus; HDL, high-density lipoprotein; ASCVD, atherosclerotic cardiovascular disease.

[a]*P* values calculated using chi-square. Values in boldface indicate statistical significance. OR > 1: interventions with higher proportion than controls. Hypertension therapy: good control of blood pressure <140/90 mm Hg except for ≥60-year-old subjects <150/90 mm Hg.

[b]*P* values calculated using Fisher's exact test.

[c]RR relative risk; persistence rate: comparison between final follow-up and baseline.

**Table 2.** Subjects' Characteristics of the Overall and Age-Based Group Subjects at Baseline and Final Follow-up.[a]

| | Baseline (Mean ± SD) | | | Final Follow-up (Mean ± SD) | | |
|---|---|---|---|---|---|---|
| Characteristics | Overall Subjects | 40- to 55-Year-Old Subjects | 56- to 70-Year-Old Subjects | Overall Subjects | 40- to 55-Year-Old Subjects | 56- to 70-Year-Old Subjects |
| Age (years) | | | | | | |
| Interventions | 50.4 ± 7.6 | 46.8 ± 5.0 | 60.7 ± 3.5 | 50.4 ± 7.6 | 46.8 ± 5.0 | 60.7 ± 3.5 |
| Controls | 52.3 ± 8.6 | 46.3 ± 4.7 | 61.4 ± 3.4 | 52.6 ± 8.5 | 46.5 ± 4.8 | 61.3 ± 3.4 |
| Systolic BP (mm Hg) | | | | | | |
| Interventions | 138.0 ± 20.5 | 134.0 ± 18.0 | 149.4 ± 23.2 | 132.8 ± 19.2 | 128.8 ± 16.4 | 144.5 ± 22.2 |
| Controls | 142.4 ± 22.6 | 137.8 ± 22.4 | 150.4 ± 21.1 | 136.6 ± 20.4 | 131.8 ± 19.3 | 143.4 ± 20.2 |
| Diastolic BP (mm Hg) | | | | | | |
| Interventions | 80.4 ± 10.4[b] | 80.3 ± 10.1 | 80.7 ± 11.6 | 83.5 ± 10.3 | 83.6 ± 10.4 | 83.2 ± 10.2 |
| Controls | 83.8 ± 12.2 | 82.7 ± 12.8 | 85.7 ± 10.9 | 85.7 ± 11.5 | 85.8 ± 12.8 | 85.7 ± 9.5 |
| Pulse (/min) | | | | | | |
| Interventions | 83.4 ± 11.2 | 83.4 ± 11.6 | 83.2 ± 10.3 | 80.6 ± 13.2 | 80.6 ± 13.4 | 80.7 ± 12.9 |
| Controls | 82.2 ± 13.7 | 83.2 ± 15.0 | 80.7 ± 11.3 | 79.3 ± 14.0 | 79.7 ± 16.2 | 79.2 ± 10.3 |
| BMI ($kg/m^2$) | | | | | | |
| Interventions | 23.6 ± 4.7 | 23.0 ± 4.5 | 22.1 ± 4.8 | 24.1 ± 4.5 | 24.7 ± 4.4 | 22.4 ± 4.4 |
| Controls | 23.8 ± 4.7 | 24.4 ± 4.7 | 22.8 ± 4.7 | 24.0 ± 4.4 | 24.8 ± 4.3 | 22.8 ± 4.4 |
| FBG (mg/dL) | | | | | | |
| Interventions | 92.9 ± 23.6 | 91.8 ± 24.9 | 96.1 ± 19.1 | 92.5 ± 19.9 | 90.7 ± 19.0 | 97.6 ± 22.1 |
| Controls | 99.9 ± 44.5 | 101.4 ± 53.0 | 97.0 ± 26.5 | 94.7 ± 40.6 | 92.9 ± 42.1 | 97.4 ± 38.7 |
| Total-C (mg/dL) | | | | | | |
| Interventions | 193.1 ± 34.0[c] | 192.3 ± 33.4 | 195.2 ± 36.3 | 200.1 ± 32.8 | 196.4 ± 30.1 | 210.9 ± 38.2 |
| Controls | 204.9 ± 36.4 | 199.8 ± 33.1 | 213.2 ± 39.7 | 200.5 ± 32.9 | 199.5 ± 34.0 | 201.9 ± 31.8 |
| HDL-C (mg/dL) | | | | | | |
| Interventions | 55.7 ± 13.1 | 56.1 ± 12.7 | 54.5 ± 14.4 | 57.7 ± 12.9[d] | 57.5 ± 12.8[f] | 58.2 ± 13.5 |
| Controls | 56.4 ± 12.3 | 55.0 ± 11.7 | 58.2 ± 13.0 | 52.3 ± 11.9 | 52.0 ± 11.9 | 52.8 ± 11.9 |
| ASCVD risk (%) | | | | | | |
| Interventions | 5.0 ± 7.9 | 2.5 ± 1.9 | 12.4 ± 12.7 | 4.2 ± 4.8[e] | 2.4 ± 1.9[g] | 9.3 ± 6.8[h] |
| Controls | 7.2 ± 7.6 | 3.3 ± 2.5 | 13.2 ± 8.8 | 8.1 ± 7.3 | 4.1 ± 2.9 | 13.8 ± 7.9 |

Abbreviations: BP, blood pressure; BMI, body mass index; FBG, fasting blood glucose; Total-C, total cholesterol; HDL-C, high-density lipoprotein cholesterol; ASCVD, atherosclerotic cardiovascular disease.

[a] *P* values calculated using *T* test

[b] $P = .04$.

[c] $P = .02$.

[d] $P = .004$.

[e] $P < .001$.

[f] $P = .02$.

[g] $P < .001$.

[h] $P = .03$.

age-based group because the younger and older subjects had ASCVD score at <5% (low risk) and >7.5% (high risk), respectively. Moreover, age is a natural risk factor of ASCVD. The profiles of the intervention and control subjects within age-based groups were similar at baseline ($P > .05$) with 2 variables exceeded the normal range, namely mean SBP ≥140 mm Hg in younger subjects and BMI >23 $kg/m^2$.

## *Outcomes at Final Follow-up*

All intervention subjects completed the study. Whereas, the control group was less persistent with a drop-out rate of 6 (9.2%) from the younger ($P = .03$) and 2 (4.7%) from the older including 1 deceased subject ($P = .32$) (Table 1). At final follow-up, the younger intervention subjects had better outcomes for the mean 10-year ASCVD score ($P < .001$) and mean HDL-C ($P = .02$) (Table 2) and proportion of ASCVD score <5% ($P = .001$), and smoking status ($P = .001$) (Table 1); whereas the older intervention subjects had only better outcome for the ASCVD risk score ($P = .03$) (Table 1).

We performed the logistic regression to evaluate the most influential variables on ASCVD. In the younger subjects, the variables of intervention, age, smoking status, SBP, total-C, HDL-C, gender, FBG, and therapy for hypertension had significant correlation with ASCVD risk in

**Table 3.** The Age-Based and Overall Subjects' Quality of Life at Baseline and Final Follow-up.[a]

| Quality of Life Domain | Baseline | | | Final Follow-up | | |
|---|---|---|---|---|---|---|
| | Overall Subjects | 40- to 55-Year-Old Subjects | 56- to 70-Year-Old Subjects | Overall Subjects | 40- to 55-Year-Old Subjects | 56- to 70-Year-Old Subjects |
| Physical function | | | | | | |
| Interventions | 95 (10-100) | 95 (10-100) | 80 (10-100) | 100 (50-100)[b] | 100 (60-100)[c] | 100 (50-100) |
| Controls | 95 (0-100) | 95 (40-100) | 90 (0-100) | 100 (0-100) | 100 (0-100) | 95 (0-100) |
| Physical role | | | | | | |
| Interventions | 100 (0-100) | 100 (0-100) | 100 (0-100) | 100 (0-100) | 100 (0-100) | 100 (0-100) |
| Controls | 100 (0-100) | 100 (0-100) | 100 (0-100) | 100 (0-100) | 100 (0-100) | 100 (0-100) |
| Pain free | | | | | | |
| Interventions | 67.5 (10-100) | 100 (0-100) | 67.5 (10-100) | 80 (32.5-100) | 80 (32.5-100) | 80 (42.5-100) |
| Controls | 67.5 (0-100) | 100 (0-100) | 67.5 (10-100) | 70 (0-100) | 77.5 (20-100) | 67.5 (0-100) |
| General health | | | | | | |
| Interventions | 62.5 (25-90) | 60 (25-90) | 65 (25-80) | 70 (25-95) | 70 (25-95) | 70 (30-90) |
| Controls | 60 (25-90) | 65 (25-90) | 60 (30-90) | 65 (15-100) | 65 (25-100) | 65 (15-95) |
| Social health | | | | | | |
| Interventions | 100 (25-100) | 100 (25-100) | 100 (37.5-100) | 100 (50-100)[d] | 100 (50-100)[e] | 100 (50-100) |
| Controls | 67.5 (25-100) | 87.5 (37.5-100) | 87.5 (25-100) | 100 (0-100) | 87.5 (0-100) | 100 (12.5-100) |
| Vitality | | | | | | |
| Interventions | 75(30-100) | 75 (30-100) | 85 (45-100)[f] | 80 (40-100) | 80 (40-100) | 85 (50-100) |
| Controls | 70 (30-100) | 70 (30-100) | 75 (30-100) | 75 (20-100) | 75 (20-100) | 75 (30-100) |
| Mental health | | | | | | |
| Interventions | 84 (32-100) | 80 (32-100) | 92 (56-100) | 88 (36-100) | 88 (36-100) | 100 (40-100) |
| Controls | 80 (28-100) | 76 (28-100) | 84 (35-100) | 86 (40-100) | 84 (48-100) | 88 (40-100) |
| Emotional role | | | | | | |
| Interventions | 100 (0-100) | 100 (0-100) | 100 (0-100) | 100 (0-100) | 100 (0-100) | 100 (0-100) |
| Controls | 100 (0-100) | 100 (0-100) | 100 (0-100) | 100 (0-100) | 100 (0-100) | 100 (0-100) |

[a] *P* values calculated using Mann-Whitney test.
[b] $P = .003$.
[c] $P = .01$.
[d] $P = .005$.
[e] $P = .008$.
[f] $P = .02$.

bivariate analysis ($P < .25$) and the variables were input for regression analysis. Pharmacist intervention in bivariate analysis has significant effect on ASCVD ($P = .002$ and $R^2 = 12.6\%$), when the intervention was adjusted with other variables, it became insignificant for ASCVD ($P = .71$). Finally, the intervention was found interacting significantly with age, SBP, HDL-C, and smoking status, and these variables together with total-C and gender produced significant outcome on ASCVD risk ($P = .01$ and $R^2 = .859$). In this study, the variables of the intervention interacting with smoking contributed the greatest effect on ASCVD according to the β coefficient in the logistic regression. In the older subjects, the variables intervention, age, smoking status, SBP, BMI, categorical total-C, and HDL-C had significant effect on ASCVD in bivariate analysis, but all variables were insignificant in logistic regression analysis (Supplementary File: Table of Logistic Regression Summary).

### *Quality of Life*

The QoL values were similar between groups at baseline except for a higher score of vitality among older intervention subjects ($P < .02$). At final follow-up, the QoL increased for the physical ($P = .005$) and social function domains ($P = .008$) among the younger intervention subjects; whereas the QoL were similar among the older subjects ($P > .05$) (Table 3).

## Discussion

The study was held in a low socioeconomic status setting. More than 50% of the younger subjects and >80% of the elder subjects had the formal education of junior high school or lower similar in intervention and control groups (Table 1). Mostly, the male subjects had the profession as farmers or construction workers. Meanwhile, the female subjects were housewives with sedentary lifestyle and only

small proportion worked as part-time farmers. Some negative lifestyles included smoking in public areas or in the house and no routine exercise. Activities in daily work were considered to be a form of exercise for most subjects.

The intervention produced more intense outcomes among the younger than older subjects in both intervention and control groups due to poorer education background in the elder subjects. Moreover, the younger subjects were likely have better capacity to absorb the information and the physiological factors.

Prevalence of hypertension and diabetes in Yogyakarta Province in 2013 based on the National Basic Health Research (*Riskesdas* 2013) were 25.7% and 2.6%, respectively.[27] At the final follow-up, the proportion of subjects with uncontrolled BP and FBG were higher than the provincial morbidity rate for both intervention and control groups. The low socioeconomic status including education background became an obstacle in the absorption of information provided for the intervention subjects.

### *Positive Outcome of Intervention*

At final follow-up, the intervention subjects had fewer smokers and the subjects persistently participated in the weekly exercise established during the baseline period. The intervention subjects also had significantly higher mean HDL-C, though the HDL-C increase was not as good as the finding from a CVD prevention research which showed the biggest contribution of exercise on HDL-C with up to 53% elevation.[11]

Better mean ASCVD risk scores among the intervention subjects were attributed to the improvement of the healthy lifestyle and some ASCVD variables. Although the mean ASCVD risk score was significantly lower in the intervention than the control subjects in each age-based groups, the ASCVD risk classification within each age-based group was not different between groups, being low risk for the younger subjects (ASCVD <5%) and high to extremely high risk for the older subjects (ASCVD score at >7.5%).

Exercise was significantly correlated to higher life satisfaction.[20] In this study, the exercise activity among the intervention subjects were likely related to the higher QoL particularly among the younger group. The finding was even superior to a previous study that demonstrated that the exercise improved only the physical function.[28] The result was also similar to another study that showed that a supervised exercise improved the subject's functional capacity.[29] Interestingly, the weekly exercise among the intervention subjects still continues at the time of this article's submission. The higher persistent rate at final follow-up in the intervention subjects was supported by the active subjects.

### *Less Successful Outcome of Intervention*

The proportion of subjects who received routine therapy for hypertension remained the same at final follow-up. The subjects who were not in routine therapy, they only took the antihypertensive medicine for the symptoms of headaches and neck stiffness. One former study in the district showed that the universal health coverage increased the proportion of hypertension therapy.[17] The ownership of health financial support was similar between groups, but there were fewer healthcare facilities near the intervention than the control group. The control subjects had 2 hospitals with 30 beds, whereas the intervention subjects had only the primary care center as their nearest health care facility.

Previous references have demonstrated that physical activities improve the ASCVD outcomes,[16,30] as well as produce greater reductions in all ASCVD risk except for LDL-C levels and the primary ASCVD outcome.[15] The intervention in this study covered the education about fat and calorie restriction and physical exercise, but it did not reduce the BMI and total-C. The subjects were aware of being overweight but were not successful in the BMI and total-C control.

The intervention and control groups were not statistically different in mean BP at final follow-up. These results were similar to a previous study done in the Sleman District that revealed the BP control deficiency among the subjects.[17] The result was inferior to another study done among DM with hypertension patients which had demonstrated significant BP improvement after a pharmacist intervention.[31]

We hope that the improvement of the ASCVD risk will lead to the decline of ASCVD morbidity and mortality rate. Further study is needed to observe the long-term impact of the pharmacist intervention on the ASCVD outcomes in the Sleman District of Yogyakarta.

### *Limitation of the Study*

The simple randomization method could not be applied in this study because the ASCVD risk profiles were not available in the population. Determination of the intervention group was done with nonproprietary method. At baseline, the overall subjects in the intervention group had lower DBP, total-C, and lower score of ASCVD risk than the control group, though the variables were not statistically different within the age-based groups. The analysis was performed within the age-based group in this study.

## Conclusion

The younger intervention subjects had better 10-year ASCVD risk, smoking status, HDL-cholesterol, and quality of life for the physical and social function domains than the

controls, whereas the elder intervention subjects had lower 10-year ASCVD risk than the controls. Although the health promotion and education provided by the pharmacists in this study produced a positive outcome on the ASCVD risk, the results of this study cannot be generalized to other population or different setting.

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## Supplemental Material

Supplementary material is available for this article online.

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