

# Characteristics and motives of non-responders in a stepwise cardiometabolic disease prevention program in primary care

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**Background:** A high response rate is an important condition for effective prevention programs. We aimed at gaining insight into the characteristics and motives of non-responders in different stages of a stepwise prevention program for cardiometabolic diseases (CMD) in primary care. **Methods:** We performed a non-response analysis within a randomized controlled trial assessing the effectiveness of a stepwise CMD prevention program in the Netherlands. Patients between 45 and 70 years without known CMD were invited for stage 1 of the program, completing a CMD risk score. Patients with an increased risk were advised to visit their general practice for additional measurements, stage 2 of the program. We analyzed determinants of non-response using data from the risk score, electronic medical records, questionnaires and Statistics Netherlands. **Results:** Non-response in stage 1 was associated with a younger age, male sex, a migration background, a low prosperity score, self-employment, being single and having lower consultations rates in general practice. Non-response in stage 2 was associated with a low prosperity score, being employed, having no chronic illness, smoking, a normal waist circumference, a negative family history for cardiovascular disease or diabetes and having a lower consultation rate. More than half of the non-responders in stage 2 reported not visiting the GP because they did not expect to have any CMD, despite their increased risk. **Conclusions:** To achieve a larger and more equal uptake of prevention programs for CMD, we should use methods adapted to characteristics of non-responders, such as targeted invitation methods and improved risk communication.

## Introduction

Globally, cardiometabolic diseases (CMD), including cardiovascular disease (CVD), chronic kidney failure and diabetes mellitus type 2, are highly prevalent and the most common cause of mortality.<sup>1</sup> The incidence of CMD will increase in future in developed countries as a result of the aging population and an unhealthy lifestyle. To put a halt to rising costs and disease burden caused by CMD, there is an urgent need for effective prevention programs. Primary care is considered to be the most suitable setting for selective CMD prevention because GPs are easily accessible and are familiar with patients' medical background and social context. Therefore they can personalize treatment and offer ongoing counseling on a healthy lifestyle. A stepwise strategy in prevention programs seems to be the most effective way to screen for CMD in primary care, aimed at identifying and treating high-risk patients.<sup>2,3</sup>

Adequate participation and an optimal response rate are conditional for the (cost) effectiveness of prevention programs, programs often depend on a minimum percentage of participation by the target group.<sup>4</sup> Unfortunately response rates in CMD prevention programs show great variation, varying between extremes as 1.2%<sup>5</sup> and 84%.<sup>6</sup> Also, the right people need to be reached throughout the different steps of the program, to ensure that the program actually

reaches the indicated population, i.e. patients with an increased risk for CMD. A younger age, smoking and a low socioeconomic status (SES) are commonly reported as being associated with non-response in CMD prevention, but in the literature, there is wide heterogeneity in the characteristics of non-responders.<sup>7</sup> Therefore it is still unclear what the best strategy is to address and motivate sufficient high-risk patients to participate in a stepwise prevention program for CMD.

More knowledge about the characteristics and motives of non-responders and responders during the different steps of the program would help to better target individuals at CMD risk thereby improving response rates and increasing effectiveness of prevention programs. We reported the characteristics of non-responders among the participants of the INTEGRATE study,<sup>8</sup> a randomized controlled trial assessing the effectiveness of a stepwise CMD prevention program in the Netherlands.<sup>9</sup>

## Methods

### INTEGRATE study

The INTEGRATE study is a stepped-wedge randomized controlled trial conducted from 2014 to 2017. A total of 37 GP practices participated in the study. All patients between ages 45 and 70 without known

CMD, hypertension or hypercholesterolemia were approached to participate in a prevention program for CMD. Patients were invited through a letter, signed by their own GP, inviting them to calculate their risk for CMD by filling in an online risk score. Two weeks after the first invitation patients received a reminder letter that also included a paper version of the risk score. Patients with an increased risk received the advice to make an appointment at the general practice for a consultation including additional measurements. The GP or practice nurse would then provide the patient with personalized lifestyle advice and start medication when considered necessary. All patients who completed the risk score received an additional questionnaire, regardless of whether they consulted the GP. The detailed study design of the INTEGRATE study is described elsewhere.<sup>8</sup>

### Study population and outcome

For the non-response analysis, data of all invited patients from 36 of the 37 practices participating in the INTEGRATE study were available. One practice had to be excluded due to incomplete data from electronic health records (EHR).

We defined responders in stage 1 of the prevention program as patients who completed the risk score, either the online or the paper version. Non-responders in stage 1 did not participate in any part of the program. Responders for stage 2 of the program were defined as patients with an increased risk at the risk score who followed the advice of visiting the general practice for a consultation. All responders in stage 2 either had a case report form filled out by the GP or practice nurse, reported GP consultations in the questionnaire or had a recorded consultation in the GP's EHR. We searched the EHRs for consultations with a relevant code according to the International Classification of Primary Care (ICPCs) combined with a relevant measurement (e.g. blood pressure or blood test) within 6 months after the first invitation. Non-responders in stage 2 were the patients who filled in the risk score and had an increased risk but did not visit the general practice.

### Characteristics and motives of non-responders

We collected data on the characteristics of non-responders and responders from different sources, including the GP's EHR, the items of the risk score, the additional research questionnaire and by linking our data to data from Statistics Netherlands.

Data from the GP's EHR were available for all patients who were invited for the first stage of the prevention program. We used information about patients' gender, age, ICPC-coded medical diagnoses and primary healthcare use. Primary healthcare use was defined as the number of contacts with the general practice in the last 12 months. Chronic illness was defined as a recorded ICPC code for at least 1 of 109 possible diseases in which there is generally no prospect of full recovery.<sup>10</sup>

Data from the risk score were available for all patients who participated and filled out the risk score. The risk score contained items on age, gender, body mass index (BMI), waist circumference, family history of cardiovascular disease and/or diabetes mellitus type II. A family history of CVD was defined as having first degree relatives with a cardiovascular event before the age of 65. Family history of DM was defined as having first degree relatives with diabetes mellitus type 2. The additional research questionnaire contained items on reasons for not participating in stage 2 of the program.

We linked our data to data registers of Statistics Netherlands, which contains details about household composition, prosperity, educational level and migration background of all responders and non-responders. Prosperity was defined by Statistics Netherlands based on income and assets per household and was categorized as low (lower tertile of the Dutch households), high (upper tertile of the Dutch households) or middle (middle tertile). Data on education level (highest completed education) were available for 40% of our study population and included recorded data as well as data

imputed by Statistics Netherlands. Having a migration background was defined as not born in the Netherlands or having at least one parent who was not born in the Netherlands, with the country of birth being either western or non-western.

A question about the reason for non-response in stage 2 was added to the standard additional questionnaires during the last year when the study was conducted. Non-responders were presented with the question when they had an increased risk and had indicated that they did not visit the general practice for additional measurements. The reasons for non-response indicated by non-responders who consulted the practice at a later stadium were excluded.

### Statistical analysis

Descriptive analyses were used for all characteristics of the study population. We used univariate multilevel logistic regression analysis to compare the characteristics of non-responders and responders, reporting crude odd ratios and 95% confidence intervals. A multivariable multilevel logistic regression analysis was also performed, reporting adjusted odds ratios and 95% confidence intervals. Because of the high number of participants and events, all characteristics were included into the multivariable analysis, thereby correcting for all potential confounding. Multilevel techniques were used to adjust for clustering of patients within practices. Stata version 15 was used for all statistical analyses.

### Ethical consideration

The INTEGRATE study, with inclusion of this non-response analysis, was considered by the UMC Utrecht Institutional Review Board and exempted from full assessment under the Medical Research involving human subjects Act.<sup>8</sup>

### Results

In the 36 participating general practices, a total of 29 758 patients received an invitation letter for participation in the prevention program (Supplementary figure S1). Of these, 12 289 patients (41%) calculated their risk with the online or paper version of the risk score (responders stage 1). An increased risk was found in 5057 (41%) of the patients of whom 1648 patients (33%) visited the practice for a consultation and additional measurements (responders stage 2). This resulted in 17 469 non-responders in stage 1 of the program and 3409 non-responders in stage 2. Table 1 shows the response rates in stages 1 and 2 in different patient subgroups, ranging between 26% and 56%, respectively, 23% and 40%. The response rates between GP practices ranged from 27% to 55% for the response at stage 1 and 11% to 48% response at stage 2.

The results of the multilevel analysis are shown in tables 2 and 3. Due to the high number of missing values, educational level was not included in the analysis. A younger age (age 45–49 vs. 65–70 years, OR 0.52), male sex (female vs. male OR 1.23), migration background (Dutch vs. non-western migrant OR 1.55), a low prosperity score (low vs. high score OR 0.55), self-employment (employee vs. self-employed OR 1.12), being single (single vs. married/with a partner with no children OR 0.68) and having a lower healthcare use of primary care (OR 0.99) were all associated with non-response in stage 1 of the CMD prevention program in the multivariate regression model. Another set of individual characteristics showed to be of importance in association with non-response in stage 2 of the program; being employed (employed vs. receiving benefits OR 0.83), a low prosperity score (low vs. high score OR 1.35), smoking (not smoking vs. smoking OR 1.39), an normal waist circumference (OR 0.80), a negative family history for CVD (negative vs. positive OR 0.81) or diabetes type 2 (negative vs. positive OR 1.54), having no chronic illness (no illness vs. illness OR 0.86) and a lower healthcare use of primary care (OR 0.98) were associated with a higher response in stage 2.

**Table 1** Response rates of stage 1 and stage 2 of the CMD prevention program by population characteristics

|                                                  | Response rate<br>stage 1<br>(n = 29 758) (%) | Response rate<br>stage 2<br>(n = 12 289) (%) |
|--------------------------------------------------|----------------------------------------------|----------------------------------------------|
| Overall                                          | 41                                           | 33                                           |
| Age                                              |                                              |                                              |
| 45–49                                            | 37                                           | 25                                           |
| 50–54                                            | 42                                           | 23                                           |
| 55–59                                            | 48                                           | 28                                           |
| 60–64                                            | 52                                           | 33                                           |
| 65+                                              | 56                                           | 36                                           |
| Sex                                              |                                              |                                              |
| Female                                           | 44                                           | 35                                           |
| Male                                             | 39                                           | 30                                           |
| Ethnicity                                        |                                              |                                              |
| Dutch                                            | 43                                           | 34                                           |
| Western migrant                                  | 38                                           | 35                                           |
| Non-western migrant                              | 26                                           | 34                                           |
| Educational level <sup>a</sup>                   |                                              |                                              |
| Low                                              | 32                                           | 30                                           |
| Middle                                           | 39                                           | 33                                           |
| High                                             | 45                                           | 33                                           |
| Work relationship                                |                                              |                                              |
| Employee                                         | 41                                           | 31                                           |
| Self-employed                                    | 39                                           | 28                                           |
| Not employed (receiving<br>benefits)             | 43                                           | 37                                           |
| No income                                        | 42                                           | 34                                           |
| Household composition                            |                                              |                                              |
| Single                                           | 34                                           | 34                                           |
| Married and/or living together,<br>no children   | 49                                           | 36                                           |
| Married and/or living together,<br>with children | 40                                           | 29                                           |
| Other multi-person household                     | 37                                           | 25                                           |
| Prosperity score                                 |                                              |                                              |
| Low                                              | 29                                           | 30                                           |
| Middle                                           | 38                                           | 35                                           |
| High                                             | 47                                           | 35                                           |
| Chronic illness                                  |                                              |                                              |
| No                                               | 40                                           | 30                                           |
| Yes                                              | 44                                           | 36                                           |
| Mental health problems                           |                                              |                                              |
| No                                               | 42                                           | 34                                           |
| Yes                                              | 39                                           | 34                                           |
| CMD risk factors                                 |                                              |                                              |
| Smoking status                                   |                                              |                                              |
| No                                               |                                              | 35                                           |
| Yes                                              |                                              | 24                                           |
| Body mass index                                  |                                              |                                              |
| <25                                              |                                              | 32                                           |
| 25–30                                            |                                              | 34                                           |
| >30                                              |                                              | 33                                           |
| Waist circumference                              |                                              |                                              |
| Normal                                           |                                              | 28                                           |
| Increased                                        |                                              | 33                                           |
| Family history CVD                               |                                              |                                              |
| No                                               |                                              | 31                                           |
| Yes                                              |                                              | 36                                           |
| Family history DM                                |                                              |                                              |
| No                                               |                                              | 31                                           |
| Yes                                              |                                              | 40                                           |

a: Data about educational level were available for 40% of the patients.

A sample of 238 non-responders in stage 2 reported 267 reasons for non-response, shown in [table 4](#). This sample of non-responders was representative for the total group of non-responders 2 regarding age, sex, migration background, prosperity score, healthcare use of primary care and CMD risk factors (data not shown). More than half of the reported reasons stated that no visit to the practice was made because the patient did not expect to have any CMD despite their increased risk. In more than a quarter of the cases, the patient

forgot to make an appointment, had no time or did not understand the advice. Already being checked by a doctor regularly contributed to 17% of the reasons for non-response in stage 2 of the CMD prevention program.

## Discussion

### Summary of results

In this study, we aimed at gaining insight into the characteristics and motives of non-responders at different stages of a stepwise CMD prevention program. Non-response was in both steps of the CMD prevention program associated with individual demographic, socio-economic and healthcare consumption data. In a representative sample of non-responders in stage 2, more than half of the reported reasons for non-response were related to the expectation of not having any CMD despite an increased risk.

### Strengths and limitations

To our knowledge, this is the first study to investigate the characteristics and motives of non-responders at different stages of a stepwise CMD prevention program in the total target population. We managed to collect reliable data about a large amount of non-responders, providing us with important insights and input for strategies to enhance uptake and effectiveness of CMD prevention programs. This analysis was part of a large pragmatic trial, making the response rates representative for a realistic setting. A limitation of this study is that we were not able to use risk factors such as smoking and BMI in our analysis with the response at the first stage of the prevention program, as the EHRs contained mostly missing data about the CMD risk factors for the non-responders. Also, because of the high amount of missing values we were not able to use education level in our final models.

### Comparison with existing literature

Our results largely confirm earlier reports. Most large studies on CMD prevention programs and CMD risk scores report that a younger age and low SES are associated with non-response.<sup>6,7,11–16</sup> Although the results of studies reporting about associations between response and sex, migration background, social status and healthcare use are less consistent, male sex,<sup>6,12,16,17</sup> having a migration background,<sup>12,18</sup> being single<sup>6,12,13,17,19</sup> and not frequently consulting a doctor<sup>13,17,19,20</sup> have also shown to be associated with response in earlier studies. Our findings regarding the characteristics of the responders and non-responders in stage 1 are in line with these insights.

Only few studies report separate non response analysis for different steps of a CMD prevention program, making it harder to put the results about characteristics of non-responders in stage 2 into perspective. Nevertheless, with stepwise CMD prevention programs increasing in popularity it is important to gain more insight into how the different steps of the program are received.

Although migration background showed to be associated with non-response at stage 1, migration background seems to play no role in the response at stage 2. We did find a lower prosperity score (SES) to be associated with non-response in stage 2 of the program. This enforces the already smaller contribution of low SES patients to this stage because of the previous selective response in stage 1, making low SES patients extra vulnerable for dropping out during the program. Our study also showed an association between work status and non-response at both stages of the program, self-employed patients were less likely to participate in stage 1 and patients without work were less likely not to complete their risk profile with additional measurements. Dalsgaard *et al.*<sup>21</sup> also found a positive association between unemployment and response in stage 2 of a stepwise screening program for diabetes type 2. This seems to contradict with the association between low prosperity and non-

**Table 2** Characteristics associated with non-response in stage 1 of the CMD prevention program

|                                               | Non-responders<br>stage 1 (n = 17 469)<br>n (%) | Responders<br>stage 1 (n = 12 289)<br>n (%) | Univariate  |             | Multivariate |             |
|-----------------------------------------------|-------------------------------------------------|---------------------------------------------|-------------|-------------|--------------|-------------|
|                                               |                                                 |                                             | OR          | 95% CI      | OR           | 95% CI      |
| Age                                           |                                                 |                                             |             |             |              |             |
| 45–49                                         | 4530 (30)                                       | 2702 (22)                                   | 1.00        |             | 1.00         |             |
| 50–54                                         | 4205 (28)                                       | 3017 (25)                                   | <b>0.86</b> | (0.80–0.92) | <b>0.86</b>  | (0.80–0.93) |
| 55–59                                         | 2778 (19)                                       | 2542 (21)                                   | <b>0.69</b> | (0.64–0.74) | <b>0.72</b>  | (0.66–0.78) |
| 60–64                                         | 1911 (13)                                       | 2055 (17)                                   | <b>0.59</b> | (0.55–0.64) | <b>0.61</b>  | (0.56–0.68) |
| 65+                                           | 1574 (11)                                       | 1973 (16)                                   | <b>0.51</b> | (0.47–0.55) | <b>0.52</b>  | (0.47–0.59) |
| Sex                                           |                                                 |                                             |             |             |              |             |
| Female                                        | 8497 (49)                                       | 6570 (54)                                   | 1.00        |             | 1.00         |             |
| Male                                          | 8972 (51)                                       | 5719 (46)                                   | <b>1.21</b> | (1.15–1.27) | <b>1.23</b>  | (1.16–1.30) |
| Ethnicity                                     |                                                 |                                             |             |             |              |             |
| Dutch                                         | 12 297 (82)                                     | 9316 (87)                                   | 1.00        |             | 1.00         |             |
| Western migrant                               | 1491 (10)                                       | 921 (9)                                     | <b>1.21</b> | (1.11–1.32) | <b>1.13</b>  | (1.03–1.24) |
| Non-western migrant                           | 1237 (8)                                        | 424 (4)                                     | <b>1.98</b> | (1.76–2.22) | <b>1.55</b>  | (1.37–1.75) |
| Work relationship                             |                                                 |                                             |             |             |              |             |
| Employee                                      | 8237 (55)                                       | 5821 (55)                                   | 1.00        |             | 1.00         |             |
| Self-employed                                 | 2147 (14)                                       | 1388 (13)                                   | 1.11        | (1.03–1.20) | <b>1.12</b>  | (1.03–1.21) |
| Not employed (receiving benefits)             | 3694 (25)                                       | 2831 (27)                                   | <b>0.93</b> | (0.88–0.99) | 1.06         | (0.98–1.15) |
| No income                                     | 845 (6)                                         | 605 (6)                                     | 1.01        | (0.91–1.13) | <b>1.14</b>  | (1.02–1.29) |
| Household composition                         |                                                 |                                             |             |             |              |             |
| Single                                        | 2661 (15)                                       | 1385 (11)                                   | 1.00        |             | 1.00         |             |
| Married and/or living together, no children   | 4445 (26)                                       | 4322 (35)                                   | <b>0.54</b> | (0.50–0.59) | <b>0.68</b>  | (0.63–0.75) |
| Married and/or living together, with children | 6388 (37)                                       | 4260 (35)                                   | <b>0.78</b> | (0.72–0.84) | <b>0.76</b>  | (0.70–0.83) |
| Other multiperson household                   | 3975 (23)                                       | 2322 (19)                                   | 1.03        | (0.94–1.14) | 1.00         | (0.89–1.12) |
| Prosperity score                              |                                                 |                                             |             |             |              |             |
| Low                                           | 2867 (19)                                       | 1183 (11)                                   | 1.00        |             | 1.00         |             |
| Middle                                        | 4729 (32)                                       | 2951 (28)                                   | <b>0.66</b> | (0.61–0.71) | <b>0.72</b>  | (0.670.79)  |
| High                                          | 7327 (49)                                       | 6511 (61)                                   | <b>0.47</b> | (0.44–0.51) | <b>0.55</b>  | (0.50–0.60) |
| Healthcare use primary care                   |                                                 |                                             |             |             |              |             |
| Average consultations per year                | 3.4                                             | 3.6                                         | <b>0.99</b> | (0.99–1.00) | <b>0.99</b>  | (0.98–0.99) |
| Chronic illness                               |                                                 |                                             |             |             |              |             |
| No                                            | 8171 (52)                                       | 5529 (49)                                   | 1.00        |             | 1.00         |             |
| Yes                                           | 7580 (48)                                       | 5873 (52)                                   | <b>0.88</b> | (0.84–0.93) | 0.96         | (0.91–1.01) |
| Mental health problems                        |                                                 |                                             |             |             |              |             |
| No                                            | 13 980 (89)                                     | 10 254 (90)                                 | 1.00        |             | 1.00         |             |
| Yes                                           | 1771 (11)                                       | 1148 (10)                                   | <b>1.13</b> | (1.05–1.23) | 1.09         | (1.00–1.20) |

Statistically significant values are set in bold.

response, but it may be explained by the fact that unemployed patients have more time for a practice visit.

A characteristic that was associated with non-participation in both stages of the prevention program was healthcare use of primary care. Earlier studies also showed a positive association between frequent consultations of the general practice and participation in a prevention program for CMD.<sup>13,17,19,20</sup> Patients who have more contact with their GP might feel more inclined to accept an invitation for a CMD risk score and feel less of a threshold to visit the practice. The same reasoning can be made for patients with a chronic illness. This also means that there is a considerable overlap between the patients who eventually end up visiting the GP when being invited and the patients who would be reached with case finding by the GP.

Smoking, a major risk factor for CMD, was associated with non-response in stage 2. Although this finding is not surprising, for smoking is a factor frequently found to be associated with non-response in CMD prevention programs,<sup>6,12,13,16,17,19</sup> the effect is undesirable because it leads to relatively more healthier individuals participating in the program.

Furthermore, we found that patients with a positive family history of CVD or diabetes were more likely to participate in stage 2 of the prevention program. This is in line with an earlier report from our group where we showed that family history is a significant factor in CMD risk perception<sup>22</sup> and has an important role in the decision to visit the GP in the context of a prevention program.<sup>23</sup>

Earlier we reported an overview of the reasons for non-response in stage 1,<sup>24</sup> almost half of all the reported reasons for non-

participation were categorized as 'having a lack of time or haven forgotten it'. For the non-response in stage 2 other motives prevailed, more than half of all the reported reasons for non-response were categorized as 'not expecting to have any CMD'. Risk perception for CMD seems to be low, even when patients had an increased risk. This finding is interchangeable with the conclusion of our earlier article on risk perception in which we showed that patients with a high-risk score structurally underestimate their own risk for CMD.<sup>22</sup> This discrepancy between perceived and calculated risk is the main reason for non-response of high-risk patients. Possibly a healthcare professional is needed to communicate the CMD risk, advocating a more personalized approach in this group.

Overall the results of this study describe an image of overrepresentation of socially vulnerable groups amongst the non-responders for CMD prevention programs, including individuals with a low SES and a migration background, as well as individuals with a higher risk for CMD based on their smoking status, especially at the first stage of the program. This endorses the phenomenon of the inverse care law,<sup>25</sup> patients with a low SES suffer the most disease burden and would potentially benefit most from prevention, but are less likely to get involved with prevention programs. Reaching the underserved population with a CMD prevention program might be possible with adapted and targeted invitation methods.<sup>7,26,27</sup> As we reported earlier, almost three-quarter of the non-responders in stage 1 would reconsider participation if invited differently, for instance by means of a personal approach by the GP or with the help of advertisements and informative campaigns.<sup>24</sup> The effectiveness of these response enhancing strategies have yet to be determined.

**Table 3** Characteristics associated with non-response in stage 2 of the CMD prevention program

|                                               | Non-responders 2<br>(n = 3409)<br>n (%) | Responders 2<br>(n = 1648)<br>n (%) | Univariate  |             | Multivariate |             |
|-----------------------------------------------|-----------------------------------------|-------------------------------------|-------------|-------------|--------------|-------------|
|                                               |                                         |                                     | OR          | 95% CI      | OR           | 95% CI      |
| Age                                           |                                         |                                     |             |             |              |             |
| 45–49                                         | 59 (2)                                  | 20 (1)                              | 1.00        |             | 1.00         |             |
| 50–54                                         | 255 (8)                                 | 77 (5)                              | 1.12        | (0.63–1.99) | 1.02         | (0.54–1.95) |
| 55–59                                         | 608 (18)                                | 241 (14)                            | 0.86        | (0.51–1.47) | 0.91         | (0.49–1.68) |
| 60–64                                         | 1230 (36)                               | 594 (36)                            | 0.70        | (0.42–1.19) | 0.73         | (0.39–1.37) |
| 65+                                           | 1257 (37)                               | 716 (44)                            | 0.60        | (0.36–1.01) | 0.72         | (0.38–1.38) |
| Sex                                           |                                         |                                     |             |             |              |             |
| Female                                        | 1622 (48)                               | 881 (54)                            | 1.00        |             | 1.00         |             |
| Male                                          | 1787 (52)                               | 767 (47)                            | 1.25        | (1.10–1.41) | 1.05         | (0.91–1.20) |
| Ethnicity                                     |                                         |                                     |             |             |              |             |
| Dutch                                         | 2583 (89)                               | 1321 (89)                           | 1.00        |             | 1.00         |             |
| Western migrant                               | 231 (8)                                 | 122 (8)                             | 0.97        | (0.77–1.22) | 0.94         | (0.74–1.19) |
| Non-western migrant                           | 79 (3)                                  | 41 (3)                              | 0.98        | (0.67–1.45) | 0.96         | (0.64–1.44) |
| Work relationship                             |                                         |                                     |             |             |              |             |
| Employee                                      | 1068 (37)                               | 477 (32)                            | 1.00        |             | 1.00         |             |
| Self-employed                                 | 290 (10)                                | 111 (8)                             | 1.13        | (0.89–1.46) | 1.12         | (0.88–1.45) |
| Not employed (receiving benefits)             | 1356 (47)                               | 808 (55)                            | <b>0.75</b> | (0.65–0.87) | <b>0.83</b>  | (0.69–0.99) |
| No income                                     | 173 (6)                                 | 88 (6)                              | 0.88        | (0.67–1.17) | 0.97         | (0.72–1.31) |
| Household composition                         |                                         |                                     |             |             |              |             |
| Single                                        | 468 (14)                                | 238 (14)                            | 1.00        |             | 1.00         |             |
| Married and/or living together, no children   | 1694 (50)                               | 950 (58)                            | 0.93        | (0.78–1.11) | 1.03         | (0.85–1.24) |
| Married and/or living together, with children | 601 (18)                                | 242 (15)                            | <b>1.26</b> | (1.02–1.58) | 1.15         | (0.90–1.46) |
| Other multiperson household                   | 646 (19)                                | 218 (13)                            | 1.58        | (1.23–2.05) | 1.15         | (0.80–1.67) |
| Prosperity score                              |                                         |                                     |             |             |              |             |
| Low                                           | 399 (14)                                | 167 (11)                            | 1.00        |             | 1.00         |             |
| Middle                                        | 810 (28)                                | 433 (29)                            | <b>0.78</b> | (0.63–0.97) | <b>0.74</b>  | (0.59–0.92) |
| High                                          | 1678 (58)                               | 884 (60)                            | <b>0.80</b> | (0.65–0.98) | <b>0.74</b>  | (0.59–0.92) |
| Healthcare use primary care                   |                                         |                                     |             |             |              |             |
| Average consultations per year                | 3.6                                     | 4.3                                 | <b>0.97</b> | (0.96–0.99) | <b>0.98</b>  | (0.96–0.99) |
| Chronic illness                               |                                         |                                     |             |             |              |             |
| No                                            | 1351 (43)                               | 582 (37)                            | 1.00        |             |              |             |
| Yes                                           | 1767 (57)                               | 1004 (63)                           | <b>0.77</b> | (0.68–0.87) | <b>0.86</b>  | (0.75–0.99) |
| Mental health problems                        |                                         |                                     |             |             |              |             |
| No                                            | 2775 (89)                               | 1410 (89)                           | 1.00        |             |              |             |
| Yes                                           | 343 (11)                                | 176 (11)                            | 1.00        | (0.82–1.21) | 1.12         | (0.90–1.40) |
| CM risk factors                               |                                         |                                     |             |             |              |             |
| Smoking status                                |                                         |                                     |             |             |              |             |
| No                                            | 2569 (75)                               | 1385 (84)                           | 1.00        |             |              |             |
| Yes                                           | 840 (25)                                | 263 (16)                            | <b>1.73</b> | (1.48–2.02) | <b>1.39</b>  | (1.15–1.68) |
| Body mass index                               |                                         |                                     |             |             |              |             |
| <25                                           | 1574 (46)                               | 731 (44)                            | 1.00        |             |              |             |
| 25–30                                         | 1390 (41)                               | 703 (43)                            | 0.92        | (0.81–1.04) | 0.89         | (0.77–1.04) |
| >30                                           | 443 (13)                                | 214 (13)                            | 0.96        | (0.80–1.16) | 0.95         | (0.76–1.20) |
| Waist circumference                           |                                         |                                     |             |             |              |             |
| Normal                                        | 480 (14)                                | 184 (11)                            | 1.00        |             |              |             |
| Increased                                     | 2929 (86)                               | 1464 (89)                           | <b>0.76</b> | (0.64–0.92) | <b>0.80</b>  | (0.64–0.99) |
| Family history CVD                            |                                         |                                     |             |             |              |             |
| No                                            | 2243 (66)                               | 997 (61)                            | 1.00        |             |              |             |
| Yes                                           | 1165 (34)                               | 651 (40)                            | <b>0.80</b> | (0.70–0.90) | <b>0.81</b>  | (0.71–0.93) |
| Family history DM                             |                                         |                                     |             |             |              |             |
| No                                            | 2757 (81)                               | 1216 (74)                           | 1.00        |             |              |             |
| Yes                                           | 651 (19)                                | 432 (26)                            | <b>0.66</b> | (0.58–0.76) | <b>0.65</b>  | (0.55–0.76) |

Statistically significant values are set in bold.

**Table 4** Reasons for non-response in stage 2 of the CMD prevention program

| Reasons non-response (n = 267)                        | n   | %  |
|-------------------------------------------------------|-----|----|
| I don't expect to have any CMD                        | 143 | 54 |
| I don't expect to have CVD, DM or kidney damage       | 121 | 45 |
| I don't agree with the results of the risk score      | 11  | 4  |
| I feel healthy                                        | 11  | 4  |
| Forgot/no time/misunderstood                          | 74  | 28 |
| I forgot                                              | 21  | 8  |
| I had no time                                         | 24  | 9  |
| I didn't understand that I had to make an appointment | 29  | 11 |
| Other                                                 | 50  | 19 |
| I'm regularly checked by a doctor                     | 45  | 17 |
| I already started working on my lifestyle by myself   | 2   | 1  |
| I depend on others to bring me to the GP              | 1   | 0  |
| I'm afraid to know my risk                            | 1   | 0  |
| Due to other health issues                            | 1   | 0  |

## Conclusion

The results of the non-response analysis at the first stage of our stepwise prevention program for CMD reinforce the inverse care law principle, showing that a collective invitation method leads to underuse of exactly those groups of patients we know to bear the greatest disease burden in our society. After the stage of selecting high-risk patients risk perception may play a major role, a large part of the patients with an increased risk for CMD perceive their risk as low and therefore refrain from further action. To achieve a larger and more equally divided uptake of CMD prevention programs, targeting our invitation methods and improve manners of risk communication may be future directions.

## Supplementary data

Supplementary data are available at *EURPUB* online.

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## Key points

- In this study, we gained insight into the characteristics and motives of non-responders in different stages of a stepwise prevention program for cardiometabolic diseases (CMD) in primary care.
- Non-response was in both steps of the CMD prevention program associated with individual demographic, socio-economic and healthcare consumption data.
- More than half of the reported reasons for non-response were related to the expectation of not having any CMD despite an increased risk.
- To achieve a larger and more equal uptake of prevention programs for CMD, we should use methods adapted to characteristics of non-responders, such as targeted invitation methods and improved risk communication.

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