Psychometric properties of the HLS-eS, an instrument to measure self-efficacy associated with healthy lifestyle behaviours in women of reproductive age

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Student:	E.M. Salentijn
Student number:	3854469
State of the paper:	Final version
Date:	04-07-2014
Institute:	Utrecht University, University Medical Centre Utrecht
Master course:	Clinical Health Sciences
Master program:	Nursing Science
Supervisor:	Dr. Claudia Gamel
Course instructor:	Dr. Janneke de Man-van Ginkel
Internship institution:	University Medical Centre Utrecht, Division Woman and Baby
Targeted journal:	European Journal of Cardiovascular Nursing
Requirements targeted journal:	Vancouver, max 3500 words
Guidelines for transparent reporting:	COSMIN
Number of words:	3494
Number of words Dutch summary:	299
Number of words English abstract:	295

Samenvatting

Inleiding: Het meten van self-efficacy in relatie tot het onderhouden van een gezonde leefstijl bij vrouwen in de fertiele levensfase, kan verpleegkundigen en artsen helpen bij het behandelen van cardiovasculaire risicofactoren ter preventie van hart- en vaatziekten. Hiervoor was geen psychometrisch getest meetinstrument beschikbaar. Een nieuw meetinstrument is ontwikkeld, de Healthy Lifestyle Self-efficacy Scale (HLS-eS), bestaande uit drie subschalen (voeding, beweging en roken). De inhoudsvaliditeit en interne consistentie van dit meetinstrument zijn bepaald onder vrouwen met polycysteus ovariumsyndroom.

Doel en onderzoeksvraag: Het testen van de psychometrische eigenschappen van de HLS-eS bij vrouwen in de fertiele levensfase. De onderzoeksvraag was: 'Wat zijn de interne consistentie, test-hertest betrouwbaarheid en construct validiteit van de HLS-eS om self-efficacy in relatie tot het onderhouden van een gezonde leefstijl te meten bij vrouwen in de fertiele levensfase?'

Methode: Een methodologisch onderzoek is uitgevoerd om de interne consistentie (Cronbach's α), test-hertest betrouwbaarheid (Intra-class Correlation Coefficient) en construct validiteit (structurele validiteit en hypothese testen) te meten.

Resultaten: De HLS-eS is ingevuld door 194 vrouwen. Er waren 20 rokers, waardoor slechts twee subschalen van de HLS-eS konden worden onderzocht. Cronbach's α van de voeding subschaal was 0.96 en van de beweging subschaal 0.97. De Intra-class Correlation Coefficient tussen de test en de hertest was van de voeding subschaal 0.88 (95% BI: 0.83 tot 0.92) en van de beweging subschaal 0.92 (95% BI: 0.89 tot 0.95). De factoranalyse liet twee factoren zien. De HLS-eS was positief gecorreleerd met algemene self-efficacy (r = 0.25, p = 0.001).

Conclusie: De HLS-eS is betrouwbaar en valide voor het meten van twee domeinen van self-efficacy in relatie tot het onderhouden van een gezonde leefstijl (voeding en beweging) bij hoogopgeleide vrouwen van Nederlandse afkomst.

Aanbevelingen: Het aantal items moet worden gereduceerd en het instrument moet verder getest worden.

Trefwoorden

Self-efficacy, instrument, leefstijl, vrouwen, psychometrie

Abstract

Background: Determining self-efficacy associated with healthy lifestyle behaviours can help nurses and clinicians to treat cardiovascular risk factors in women of reproductive age to prevent them from cardiovascular disease. No psychometrically tested instrument is available yet. Instrument development resulted in the Healthy Lifestyle Self-efficacy Scale (HLS-eS), which included three subscales (diet, physical activity, and smoking). Content validity and internal consistency were assessed in women diagnosed with polycystic ovarian syndrome. Further testing on its psychometric properties was required.

Aim and research question: To determine the psychometric properties of the HLS-eS in women of reproductive age. The research question was: 'What is the internal consistency, test-retest reliability, and construct validity of the HLS-eS to measure self-efficacy associated with healthy lifestyle behaviours in women of reproductive age?'

Methods: A methodological study was conducted. The internal consistency (Cronbach's α), test-retest reliability (Intra-class Correlation Coefficient), and construct validity including structural validity and hypothesis testing were evaluated.

Results: The HLS-eS was administered by 194 reproductive-aged women. Since there were only 20 smokers, the HLS-eS included only two subscales in this study. Cronbach's α was 0.96 for the diet subscale and 0.97 for the physical activity subscale. The Intra-class Correlation Coefficient between the test and retest was 0.88 (95% CI: 0.83 to 0.92) for the diet subscale and 0.92 (95% CI: 0.89 to 0.95) for the physical activity subscale. Factor analysis identified two factors. Self-efficacy associated with healthy lifestyle behaviours was positively correlated to general self-efficacy (r = 0.25, p = 0.001).

Conclusion: The HLS-eS is reliable and valid to measure self-efficacy associated with two domains of healthy lifestyle behaviours (diet and physical activity) in highly educated, reproductive-aged women of Dutch descent.

Recommendations: Item reduction is indicated. Also further testing of the instrument is required.

Keywords

Self-efficacy, instrument, lifestyle, women, psychometrics

Introduction

Women's cardiovascular health has become a growing topic in preventive healthcare, since there is an increasing awareness of gender differences in cardiovascular risk factors (CVRFs), treatment, and prognosis of cardiovascular disease (CVD).[1] CVD is associated with modifiable CVRFs as well as non-modifiable CVRFs (Table 1).[2] Modifiable CVRFs are responsible for about 80% of CVDs.[3] Modifiable CVRFs in healthy women include, among others, unhealthy diets, smoking, and physical inactivity.[4] The presence of these CVRFs in women 50 years old is associated with high lifetime risk for CVD.[5]

Efforts to treat CVRFs in young women (of reproductive age) should be encouraged to reduce mortality in women due to CVD. Lifestyle interventions are a main part of the primary prevention of CVD.[4] Lifestyle interventions promote a healthy lifestyle through behaviour change.[4] People's beliefs in their abilities to perform specific behaviours or 'self-efficacy' is one of the main determinants of behaviour that is included in several behavioural theories.[6-9] This concept was first introduced by Albert Bandura and it is defined as: '… people's judgement of their capabilities to organize and execute courses of action required to attain designated types of performances'.[10 p. 391] The concept self-efficacy has three dimensions, i.e. strength, magnitude and generality.[11] Strength reflects how certain one is of being able to perform a specific behaviour.[11] Magnitude refers to whether a person is capable of adopting a specific behaviour at various levels of difficulty.[11] Generality refers to the degree to which self-efficacy is positively related over the dimensions of concern.[11]

Women of reproductive age who work towards healthy lifestyle behaviours need to recognize their difficult situations in adopting and maintaining a healthy lifestyle. Determining self-efficacy is useful for this purpose, because it includes different difficult situations.[11] Furthermore, a reliable and valid instrument is of scientific relevance because the measurement helps to explain the effect of existing lifestyle interventions and to predict behaviour change outcomes.[11]

Multiple instruments measuring self-efficacy associated with lifestyle behaviours have been developed,[12-24] but these are limited for different reasons. In short, reliable and valid instruments for measuring all three dimensions of self-efficacy associated with three domains (i.e. diet, physical activity and smoking) of healthy lifestyle behaviours are lacking. None of the existing instruments is focused on women of reproductive age. For those reasons, instrument development was initiated.

The intention of the new instrument was to measure all three dimensions of the concept self-efficacy.[11] This instrument was intended for use with women of reproductive age who work towards healthy lifestyle behaviours in general and specifically those at possible high risk for CVD, for example women diagnosed with reproductive disorders such as polycystic ovarian syndrome (PCOS).

Initial development of the instrument included a literature search, and an assessment of the content validity following the Lynn procedure.[25] This procedure resulted in an instrument, the Healthy Lifestyle Self-efficacy Scale (HLS-eS), including 66 items divided among three subscales (i.e. diet, physical activity and smoking) with a Scale-Content Validity Index of 0.95. The first psychometric testing was performed on 55 Dutch women diagnosed with PCOS. As reported in an unpublished paper, this resulted in a Cronbach's α of 0.96 for the diet subscale and a Cronbach's α of 0.97 for the physical activity subscale. Cronbach's α was not calculated for the smoking subscale, since there were too few smokers.

To avoid the risk of imprecise or biased results, further testing of the HLS-eS on its psychometric properties was needed. Given the application of the instrument,[26] assessment of several measurement properties was indicated. Assessment of test-retest reliability was indicated, since this is required for every self-efficacy scale.[27] Internal consistency has already been assessed, but measuring it in a different population was required, since internal consistency is a sample-dependent characteristic.[28] Since there is an absence of an acceptable gold standard and therefore criterion validity was not possible to investigate, assessment of construct validity was indicated.[29] Determining construct validity included assessment of structural validity and hypothesis testing.[26]

Problem statement, aim and research question

A new self-administered instrument, the HLS-eS, was developed to help reproductive-aged women to recognize difficult situations in adopting and maintaining a healthy lifestyle. Content validity as well as internal consistency were assessed in women diagnosed with PCOS. However, the HLS-eS was not tested on the remaining psychometric properties.

Therefore, the aims of this study were to evaluate the psychometric properties of the HLS-eS in women of reproductive age and to make recommendations for further testing or use of the instrument. The ultimate aim was to support nurses and clinicians in the primary prevention of CVD in women of reproductive age who work towards healthy lifestyle behaviours in general and specifically those at possible high risk for CVD, by treating CVRFs.

The research question was:

'What is the internal consistency, test-retest reliability, and the construct validity (structural validity and hypothesis testing) of the HLS-eS to measure self-efficacy associated with healthy lifestyle behaviours in women of reproductive age?'

Methods

Design

This study can be described as a methodological study, since it concerns an investigation into the validation of an instrument.[30,31] A quantitative, observational[31], longitudinal[32] design was conducted to assess the instrument's psychometric properties.

A note wherein is described that the study does not fall within the scope of the Medical Research Involving Human Subjects Act (WMO), was obtained from the medical ethical committee of the University Medical Centre Utrecht (14-037/C). The study conforms to the principles outlined in the Declaration of Helsinki.[33]

Study population

The initial plan was to do psychometric testing with members of a patients' organization for women with fertility problems, because the focus of the instrument is on primary health in women of reproductive age, and since the treatment of CVRFs is a main subject within fertility care.[34] A convenience sampling method was used,[35] since potential subjects were recruited through the organizations' website. In spite of repeated requests on the website and sharing it across social media, an inadequate response was obtained. Therefore, the plan was modified and young women were recruited in different places, as in a gym and an University of Applied Sciences. Also acquaintances of the researcher, such as fellow students, friends and family, were asked to participate. A snowball sampling method was used,[36] since acquaintances of the researcher were asked to recruit subjects from among their acquaintances. Inclusion criteria were:

- reproductive-aged (18-45 years);
- without prior history of CVD;
- not treated for a disease for which a specific adjustment in lifestyle was needed, e.g. hypertension, hypercholesterolemia, or diabetes, because the focus of this study is on primary prevention.

Of the psychometric properties to be tested, structural validity required the largest sample size.[37] Rules of thumb for the number of participants required vary from four to 10 per item.[37] Since the instrument consists of 66 items, a minimum of 264 participants was required.

Data collection

Data collection was performed using online self-administered questionnaires. The online questionnaire was designed in a way that every question had to be answered. Sociodemographic data (i.e. age, mother country and education) from all participants were collected.

Responses on the HLS-eS were measured using an asymmetric 5-point rating scale (1 = 'probably no'; 2 = 'maybe yes', 'maybe no'; 3 = 'probably yes'; 4 = 'most probably yes'; 5 = 'yes, definitely'), since recent literature showed that asymmetric scales have less measurement bias than symmetric scales.[38]

Self-efficacy associated with healthy lifestyle behaviours was hypothesized to be positively correlated to general self-efficacy (GSE). GSE was measured with the Dutch version of the GSE scale, since this scale has been tested in different populations around the world and has proven to be reliable and valid.[39] This scale is also easy to administer, since it consists of only 10 items.[39] Responses were measured using a symmetric 4-point rating scale (1 = 'not at all true'; 2 = 'hardly true'; 3 = 'moderately true'; 4 = 'exactly true').

Procedure

Women who were willing to participate received a patient information letter by e-mail. Within a week a personal link to the first online questionnaire was sent by e-mail. Informed consent was obtained through the first question of the questionnaire. The questionnaire was programmed such that informed consent must be given before questions were displayed. The 10 items of the GSE scale were also attached to the first questionnaire. A total of two follow-up reminders with the link were sent to those who had not completed the questionnaire. A second personal link for the retest was sent by e-mail to those who had completed the first questionnaire, followed by a reminder if necessery.

Data analysis

Statistical analysis was conducted using the Statistical Program for Social Sciences (SPSS) for Windows, version 20. Descriptive statistics were used to describe the participants' characteristics. Mean age of the participants was computed. Percentages were stated to describe mother country and education.

Internal consistency. Internal consistency was determined using Cronbach's α, since this is the most widely used method for evaluating internal consistency.[40] An instrument is considered to be reliable if Cronbach's α is between 0.70 and 0.90. Values ≥0.90 indicate a redundancy of items.[41] Cronbach's α was computed separate for each subscale.[40]

Test-retest reliability. Test-retest reliability was determined by Intra-class Correlation Coefficient (ICC), because of its sensitive detection of systematic error within the measured variables over time.[42] A time interval of two weeks was applied, since self-efficacy is a changeable psychological state.[27] An ICC with a 95% confidence interval (CI) was calculated according to Shrout and Fleiss[43] for each subscale, and on item level. A value of 0.70 is

considered acceptable.[44] Since calculating ICC is based on the ANOVA,[45] the assumption of normal distribution was checked using histograms for each subscale.[46] Also the distribution among the scores of each item was checked. The assumption of homogeneity of variance was checked with the Levene's test for equality of variances.

Construct validity. Construct validity of the HLS-eS was determined by assessment of structural validity and hypothesis testing. Structural validity was analysed using a Principal Component Analysis (PDA). The following criteria were used for determining the number of factors: factors must have eigenvalues ≥1.00; factors are included up to the point that a sharp drop appears in the screeplot;[47] factor loadings must have a value of ≥0.40.[48] Factorability of the data was assessed by inspection of the inter-item correlations for evidence of coefficients ≥0.30 and by performing Bartlett's test of sphericity, and the Kaiser-Meyer-Olkin measure of sampling adequacy.[49] Bartlett's test of sphericity must be significant and the minimum recommended value of Kaiser-Meyer-Olkin is 0.60.[49]

Self-efficacy associated with healthy lifestyle behaviours was hypothesized to be positively correlated to GSE. Correlation coefficient (*r*) was calculated for the relationship between mean self-efficacy associated with healthy lifestyle behaviours and mean GSE. The assumption of linearity was checked using a scatterplot.[50]

Results

Sample characteristics

Out of 277 women who were willing to participate in the study, 208 (75.1%) completed the online instrument. Of these 208, 14 women were excluded, because of different reasons (Figure 1). In total, the study population consisted of 194 women. Of these 194 participants, 106 (54.6%) took part in the retest (Figures 1 and 2).

The characteristics of the 194 participants are presented in Table 2. Their mean age was 27.1 years (SD = 6.3). The majority of women (94.8%) were ethnic Dutch, and had higher professional or academic education (85.1%). Most participants (88.1%) were working towards healthy lifestyle behaviours in the last six months.

Item analysis

The answer responses, mean and standard deviation of each item as well as the total score on the subscales are presented in Appendix 1, 2 and 3. Of the 194 participants, 11 participants (5.7%) only completed the diet subscale (Figure 2). There were no missing data at item level. The answers to almost all items were normally distributed among the scores, except for item 22 on the physical activity subscale (Appendix 2).

Out of 194 participants, 131 (67.5%) have never smoked, 32 (16.5%) stopped smoking, and 20 (10.3%) are smokers. Eleven participants (5.7%) did not complete this question. Since there were too few smokers, psychometric testing has not been performed for the smoking subscale. Therefore, total score for the HLS-eS was defined as the subscale scores of the diet subscale and of the physical activity subscale.

Internal consistency

Cronbach's α for the diet subscale was 0.96 and for the physical activity subscale 0.97. The item-total correlation for the diet subscale ranged from 0.59 to 0.78. The item-total correlation for the physical activity subscale ranged from 0.54 to 0.79.

Considering the high values of Cronbach's α, further analysis of the inter-item correlations was required. This resulted in 10 items on the diet subscale and seven items on the physical activity subscale with inter-item correlation >0.7. These items are emphasised by an asterisk in Appendix 1 and 2.

Test-retest reliability

ICC with a 2-week time interval for the diet subscale was 0.88 (95% CI: 0.83 to 0.92) and for the physical activity subscale 0.92 (95% CI: 0.89 to 0.95). ICC on item level ranged from 0.57 to 0.83 (Tables 3 and 4). The mean time between the measurements was 7.7 days (SD = 3.7).

Construct validity

Structural validity. Data from reproductive-aged women (n=183) as well as data from women diagnosed with PCOS from the first psychometric testing (n=55) were used for factor analysis to meet the required sample size (Figure 2). Subgroup analysis showed no difference in means of the subscale scores of women diagnosed with PCOS and participants from this study (diet subscale: t = 0.88, p = 0.38; physical activity subscale: t = -1.15, p = 0.25).

Inspection of the correlation matrix revealed the presence of many coefficients of ≥0.30. The Kaiser-Meyer-Olkin value was 0.95, and Bartlett's test of sphericity reached statistical significance. Principal components analysis revealed the presence of 7 factors with eigenvalues ≥1.00, explaining 42.1%, 13.0%, 4.3%, 3.3%, 2.4%, 2.2% and 2.0% of the variance respectively. Inspection of the screeplot revealed a clear break after the second factor. It was decided to retain two factors for further investigation.

The two-factor solution explained a total of 55.1% of the variance, with Factor 1 contributing 42.1% and Factor 2 13.0%. Oblimin rotation was performed. Analysis of the item

loadings on the two factors showed that items of the physical activity subscale were loading on Factor 1 and items of the diet subscale were loading on Factor 2 (Table 5).

Hypothesis testing. As hypothesised, self-efficacy associated with healthy lifestyle behaviours was positively correlated to GSE (r = 0.25, p = 0.001). Furthermore, each HLS-eS subscale was positively correlated to GSE (diet subscale: r = 0.24, p = 0.001; physical subscale: r = 0.23, p = 0.002).

Discussion

This study presents the psychometric evaluation of the diet subscale and the physical activity subscale of the HLS-eS administered by women of reproductive age. Internal consistency as well as test-retest reliability of both subscales were good. PDA supported the assumption that each subscale was unidimensional. The hypothesis that the HLS-eS was positively correlated to GSE was confirmed.

The high values of Cronbach's α were probably due to a redundancy of items.[41] Several items with inter-item correlation >0.7 were found, indicating that these items measure the same concept as other items. Bannink and van der Bijl[51] also found overlapping content of items testing the reliability and validity of a fruit- and a vegetable self-efficacy instrument for secondary-school students. They found that Cronbach's α decreased by removing items with an overlap with that of other items. Internal consistency of the HLS-eS might be improved by combining items with inter-item correlation >0.7. Furthermore, a reduction of the number of items might be useful to lower the respondent burden.

The findings with regard to the test-retest reliability of the HLS-eS can be evaluated as excellent (ICC ≥0.90)[52]. This is consistent with findings of other investigators[13,19,21] testing the psychometric properties of instruments measuring self-efficacy associated with lifestyle behaviours. The findings regarding the test-retest reliability indicate that scores on the HLS-eS for participants whose self-efficacy has not changed, are the same for repeated measurement over time.[29]

The finding that the HLS-eS measures two underlying factors support the use of the diet items and the physical activity items as separate subscales. All items showed factor loadings >0.5, indicating that they loaded on aspects of the construct self-efficacy.[53] Although the HLS-eS was positively correlated to GSE (p = 0.001), the correlation was weak (r = 0.25). However, a weak correlation was expected given the fact that the HLS-eS is a domain-related measure. This in contrast to the GSE scale, which measures generalized self-efficacy. Nevertheless, this finding provides evidence for construct validity.

Looking at the psychometric properties tested in this study, item reduction is required. The content of items 13, 14, 15 and 16 on the diet subscale (Appendix 1) seems to overlap, and

therefore it could be combined in one item concerning negative feelings. The same goes for items 11, 13 and 14 on the physical activity subscale (Appendix 2). The concent of item 20 on the diet subscale seems to overlap with that of item 21, and that of item 22 with item 23. The content of items 16 and 17 on the physical activity subscale seems to overlap. These six items could be combined in three items. The content of items 24 and 25 on the diet subscale seems to overlap, but these items vary in content. These items should therefore be retained. The same goes for items 17, 18 and 19 on the physical activity subscale. Finally, item 22 on the physical activity subscale showed the lowest factor loading. Since this item, unlike the other items, showed a negatively skewed distribution, it seems less relevant. Therefore, it could be removed.

The strength of this study is that the HLS-eS was administered in a large group of reproductive-aged women. The sample size exceeded the recommended number of 100 as an adequate sample size for determining internal consistency, test-retest reliability and hypothesis testing.[37] This study also had a high response rate (75.1%) among women who were willing to participate.[54] Although the required number of 264 participants for factor analysis was not reached, Bartlett's test of sphericity and the Kaiser-Meyer-Olkin measure of sampling adequacy provided sufficient evidence for factorability of the data.

The main limitation of this study was the sampling method used, which has implications for the generalizability. Women who were asked to participate were not necessarily at high risk for CVD. This limits the generalizability to this group, although no significant differences in subscale scores were found between the sample and a group of women diagnosed with PCOS. Although recruitment took place in different places, ethnicity and educational levels of the participants does not represent Dutch women. In this study, 94.8% of the participants were ethnic Dutch, compared with 88.1% of the women in the Dutch population.[55] Furthermore, 85.1% of the participants had higher professional or academic education, compared with 28.3% of the Dutch population.[56] Another result of the sampling method, is that social desirability response bias[57] may have occurred, because acquaintances of the researcher administered the HLS-eS. This may have influenced the results of the psychometric testing.

The intention of the new instrument was to include smoking as a domain of healthy lifestyle behaviours as well, since smoking is a major CVRF in women at risk for CVD.[58] It was not able to test the smoking subscale on its psychometric properties, since there were too few smokers. The small number of smokers may be due to sampling bias. Because of the great importance of smoking cessation,[59] future research is needed to test the smoking subscale on its psychometric properties.

Before use of the HLS-eS, a final decision regarding the combination and/or deletion of items should be taken by the experts that judged the instrument during the development.

Therefore, it is recommended to submit the final instrument, including the options to reduce the number of items, to the experts to judge the instrument as a whole.

Although the results of this study are promising, further testing of the instrument is required. First, since one of the aims of the new instrument is evaluative, assessment of responsiveness is indicated,[27] preferably in women receiving lifestyle interventions for primary prevention of CVD. Furthermore, because a brief and useful instrument is more likely to be used, investigation of the clinical utility is required[29] in nurses and clinicians working with women at risk for CVD. Finally, another aspect of practical use is interpretability.[60] It is necessary to investigate what (change in) score would be clinically meaningful.[60]

Conclusion

In conclusion, the HLS-eS is a reliable and valid instrument to measure self-efficacy associated with two domains of healthy lifestyle behaviours in highly educated, reproductive-aged women of Dutch descent. The psychometric evaluation of this new instrument is a valuable contribution to the primary prevention of CVD in women of reproductive age who work towards healthy lifestyle behaviours.

Recommendations

For use of the HLS-eS in clinical practice, a final decision regarding the reduction of items should be taken. Further testing of the HLS-eS is required, as well as a psychometric assessment of the smoking subscale.

Acknowledgements

The author would like to thank Dr. Claudia Gamel, Dr. Jaap van der Bijl, and Dr. Janneke de Man-van Ginkel for their time and enthusiastic guidance and advice. The author would also like to thank all participants for their time, and friends and fellow students for recruiting participants for this study.

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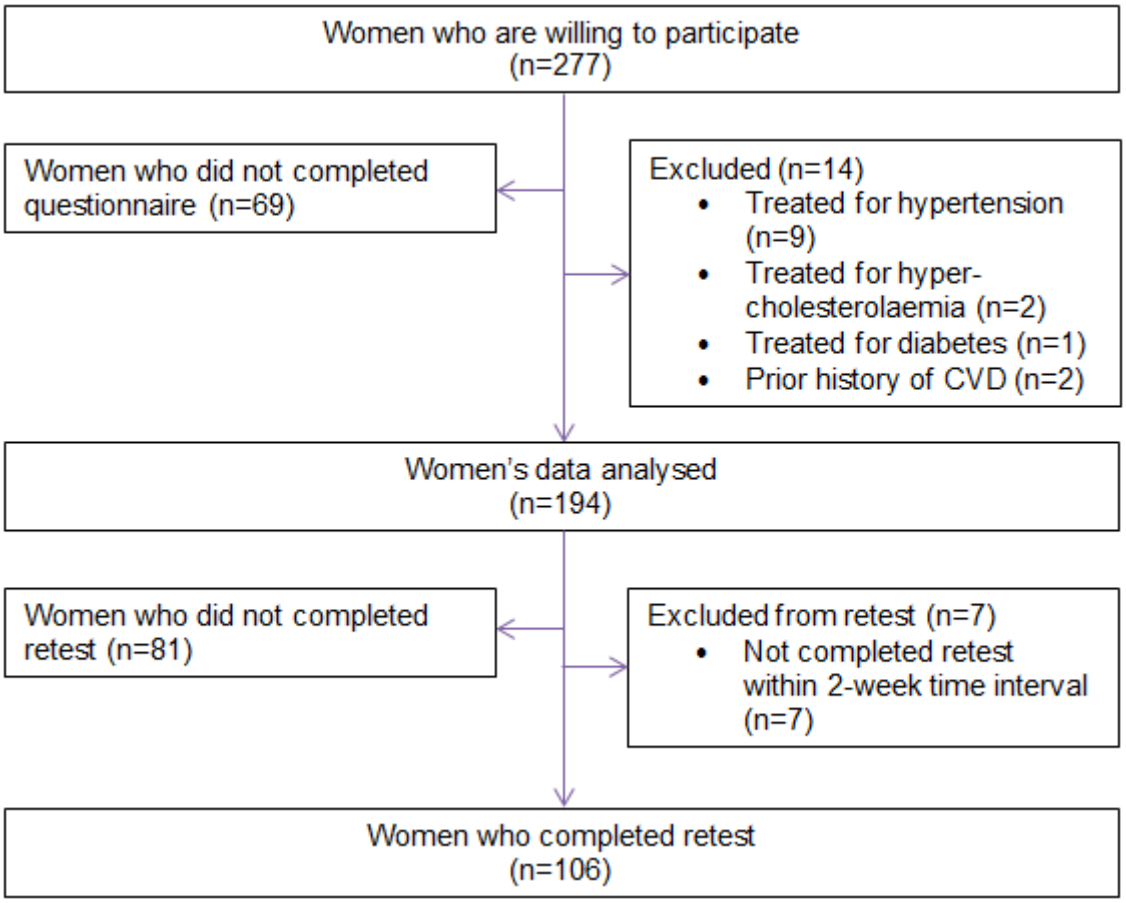

Figure 1. Patient flowchart.

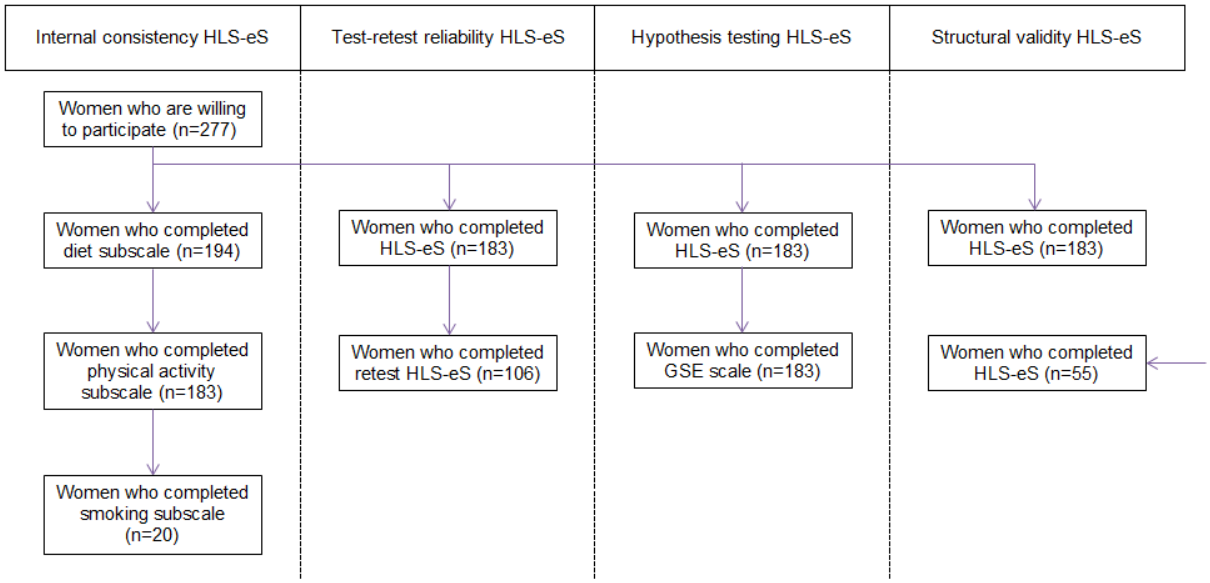

Figure 2. Data collection flowchart.

Table 1. Cardiovascular risk factors.[2]

Modifiable risk factors	Non-modifiable risk factors
High blood pressure	Age
Abnormal blood lipids	Gender
Tobacco use	Family history
Physical inactivity	Ethnicity
Obesity	
Unhealthy diets	
Diabetes mellitus	

Table 2. Subject characteristics.

Subject (n=194)	n (%)
Age (years)	27.1 (6.3)*
Mother country	
Netherlands	184 (94.8)
Belgium	2 (1.0)
Colombia	1 (0.5)
Curacao	1 (0.5)
England	1 (0.5)
Saint Martin	1 (0.5)
Sri Lanka	1 (0.5)
Surinam	2 (1.0)
South Korea	1 (0.5)
Education	
No higher professional or academic education	29 (14.9)
Higher professional or academic education	165 (85.1)
Working towards healthy lifestyle behaviours in the last six months	
Yes, by trying to eat healthy	30 (15.5)
Yes, by trying to exercise adequate	24 (12.4)
Yes, by trying to eat healthy, and to exercise adequate	106 (54.6)
Yes, by trying to eat healthy, and to quit smoking	1 (0.5)
Yes, by trying to eat healthy, to exercise adequate, and to quit smoking	10 (5.2)
No	23 (11.9)

*Mean (SD)

Table 3. Test-retest reliability of the diet subscale (n=106).

Item #	Item description	ICC	95% CI
1	Watching TV	0.69	0.57-0.78*
2	Eat at an restaurant	0.70	0.59-0.78*
3	Sit back and enjoy food	0.63	0.50-0.73*
4	Strong urge to eat unhealthy food	0.63	0.50-0.73*
5	Unhealthy food is available	0.66	0.53-0.75*
6	Under normal circumstances	0.58	0.43-0.69*
7	Being away from home	0.65	0.52-0.75*
8	During vacations	0.77	0.68-0.84*
9	Want some variety in your diet	0.64	0.51-0.74*
10	Costs extra time	0.67	0.55-0.76*
11	Eat alone	0.74	0.64-0.81*
12	Eat differently than what you have always done	0.66	0.54-0.76*
13	Feel stressed	0.75	0.65-0.82*
14	Feel bored	0.72	0.61-0.80*
15	Feel angry	0.76	0.67-0.83*
16	Feel depressed	0.80	0.71-0.86*
17	During holidays and celebrations	0.75	0.66-0.82*
18	Feel like celebrating with others	0.81	0.73-0.86*
19	Being at a reception or a party	0.68	0.56-0.77*
20	Your family don't consider your diet	0.69	0.55-0.76*
21	Your friends don't consider your diet	0.62	0.48-0.72*
22	Without support from family	0.60	0.49-0.71*
23	Without support from friends	0.69	0.58-0.78*
24	Without medical advice	0.57	0.42-0.69*
25	Spend more money	0.69	0.57-0.78*

*p <0.001

Table 4. Test-retest reliability of the physical activity subscale (n=106).

Item #	Item description	ICC	95% CI
1	Exercise alone	0.76	0.66-0.83*
2	Feel exercising is not fun	0.74	0.63-0.81*
3	Being away from home	0.73	0.63-0.81*
4	During vacations	0.80	0.71-0.86*
5	Don't experience improvement	0.71	0.60-0.79*
6	Under normal circumstances	0.73	0.62-0.81*
7	Tempted to skip it once in a while	0.66	0.54-0.76*
8	Difficulties to break daily routines	0.73	0.62-0.81*
9	Lack of discipline	0.76	0.69-0.84*
10	Feel self-conscious	0.73	0.63-0.81*
11	Feel stressed, tense or anxious	0.71	0.60-0.79*
12	Feel tired or fatigued	0.76	0.67-0.83*
13	Have problems	0.62	0.48-0.72*
14	Feel depressed	0.69	0.58-0.78*
15	In my daily routine	0.71	0.60-0.79*
16	Without support from family	0.79	0.71-0.85*
17	Without support from friends	0.81	0.73-0.87*
18	Without medical advice	0.83	0.76-0.88*
19	Without any encouragement from an instructor	0.81	0.73-0.87*
20	Not enough opportunities	0.70	0.58-0.78*
21	Feel physical discomfort	0.73	0.62-0.81*
22	Feel sick or are ill	0.76	0.69-0.83*
23	The weather is not fit	0.77	0.68-0.84*
24	Worried about money	0.70	0.59-0.78*
25	Too busy with other activities	0.75	0.65-0.82*
26	Family commitments	0.63	0.49-0.73*

*p <0.001

Table 5. Factor loadings for the two extracted factors (n=238).

Item #	Item description	Factor 1	Factor 2
Factor 1: Physical activity			
16	Without support from family	0.855	
18	Without medical advice	0.834	
17	Without support from friends	0.821	
6	Under normal circumstances	0.821	
12	Feel tired or fatigued	0.816	
1	Exercise alone	0.808	
25	Too busy with other activities	0.805	
8	Difficulties to break daily routines	0.790	
11	Feel stressed, tense or anxious	0.774	
2	Feel exercising is not fun	0.773	
19	Without any encouragement from an instructor	0.770	
3	Being away from home	0.759	
13	Have problems	0.758	
14	Feel depressed	0.755	
20	Not enough opportunities	0.754	
26	Family commitments	0.752	
5	Don't experience improvement	0.747	
23	The weather is not fit	0.744	
7	Tempted to skip it once in a while	0.735	
15	In my daily routine	0.722	
9	Lack of discipline	0.706	
21	Feel physical discomfort	0.697	
24	Worried about money	0.666	
10	Feel self-conscious	0.658	
4	During vacations	0.564	
22	Feel sick or are ill	0.557	
Factor 2: Diet			
1	Watching TV		0.817
5	Unhealthy food is available		0.808
15	Feel angry		0.798
12	Eat differently than what you have always done		0.789
14	Feel bored		0.785
3	Sit back and enjoy food		0.756
23	Without support from friends		0.754
13	Feel stressed		0.740
9	Want some variety in your diet		0.738
4	Strong urge to eat unhealthy food		0.724
7	Being away from home		0.712
18	Feel like celebrating with others		0.711
8	During vacations		0.711

10	Costs extra time	0.705
6	Under normal circumstances	0.701
24	Without medical advice	0.695
11	Eat alone	0.688
22	Without support from family	0.685
21	Your friends don't consider your diet	0.678
2	Eat at an restaurant	0.671
20	Your family don't consider your diet	0.664
25	Spend more money	0.664
19	Being at a reception or a party	0.660
16	Feel depressed	0.656
17	During holidays and celebrations	0.605

Appendix 1

Table 6. Responses to each item for the diet subscale (n=194).

Item #	Item description	Mean (±SD)	1	2	3	4	5
1	Watching TV	3.37 (1.18)	14 (7.2%)	33 (17.0%)	52 (26.8%)	58 (29.9%)	37 (19.1%)
2	Eat at an restaurant	2.79 (1.28)	39 (20.1%)	45 (23.2%)	48 (24.7%)	42 (21.6%)	20 (10.3%)
3	Sit back and enjoy food	3.09 (1.21)	26 (13.4%)	32 (16.5%)	58 (29.9%)	55 (28.4%)	23 (11.9%)
4	Strong urge to eat unhealthy food	2.23 (1.22)	64 (33.0%)	71 (36.6%)	23 (11.9%)	23 (11.9%)	13 (6.7%)
5	Unhealthy food is available	2.78 (1.16)	23 (11.9%)	71 (36.6%)	41 (21.1%)	44 (22.7%)	15 (7.7%)
6	Under normal circumstances	3.69 (1.15)	9 (4.6%)	24 (12.4%)	40 (20.6%)	66 (34.0%)	55 (28.4%)
7	Being away from home	3.27 (1.04)	12 (6.2%)	32 (16.5%)	60 (30.9%)	72 (37.1%)	18 (9.3%)
8	During vacations	2.61 (1.26)	46 (23.7%)	53 (27.3%)	40 (20.6%)	41 (21.1%)	14 (7.2%)
9	Want some variety in your diet	3.77 (1.04)	3 (1.5%)	21 (10.8%)	51 (26.3%)	61 (31.4%)	58 (29.9%)
10	Costs extra time	3.36 (1.20)	11 (5.7%)	41 (21.1%)	52 (26.8%)	47 (24.2%)	43 (22.2%)
11	Eat alone	3.42 (1.17)	13 (6.7%)	29 (14.9%)	56 (28.9%)	56 (28.9%)	40 (20.6%)
12	Eat differently than what you have always done	3.28 (1.07)	10 (5.2%)	35 (18.0%)	66 (34.0%)	57 (29.4%)	26 (13.4%)
13	Feel stressed*	2.72 (1.25)	37 (19.1%)	55 (28.4%)	45 (23.2%)	39 (20.1%)	18 (9.3%)
14	Feel bored*	2.86 (1.27)	32 (16.5%)	50 (25.8%)	50 (25.8%)	37 (19.1%)	25 (12.9%)
15	Feel angry*	3.07 (1.30)	32 (16.5%)	33 (17.0%)	48 (24.7%)	52 (26.8%)	29 (14.9%)
16	Feel depressed*	2.64 (1.33)	50 (25.8%)	47 (24.2%)	41 (21.1%)	35 (18.0%)	21 (10.8%)
17	During holidays and celebrations	2.25 (1.20)	66 (34.0%)	57 (29.4%)	38 (19.6%)	22 (11.3%)	11 (5.7%)
18	Feel like celebrating with others	2.52 (1.23)	47 (24.2%)	60 (30.9%)	41 (21.1%)	32 (16.5%)	14 (7.2%)
19	Being at a reception or a party	2.45 (1.13)	44 (22.7%)	62 (32.0%)	54 (27.8%)	24 (12.4%)	10 (5.2%)
20	Your family don't consider your diet*	2.50 (1.23)	48 (24.7%)	60 (30.9%)	41 (21.1%)	31 (16.0%)	14 (7.2%)
21	Your friends don't consider your diet*	2.59 (1.27)	46 (23.7%)	55 (28.4%)	44 (22.7%)	31 (16.0%)	18 (9.3%)
22	Without support from family*	2.93 (1.15)	19 (9.8%)	59 (30.4%)	53 (27.3%)	43 (22.2%)	20 (10.3%)
23	Without support from friends*	3.24 (1.11)	11 (5.7%)	40 (20.6%)	64 (33.0%)	50 (25.8%)	29 (14.9%)
24	Without medical advice*	3.92 (1.02)	2 (1.0%)	16 (8.2%)	49 (25.3%)	56 (28.9%)	71 (36.6%)

25	Spend more money*	3.38 (1.21)	14 (7.2%)	33 (17.0%)	56 (28.9%)	47 (24.2%)	44 (22.7%)
Total score		74.71 (21.37)					
Minimum total score		25					
Maximum total score		125					

Appendix 2

Table 7. Responses to each item for the physical activity subscale (n=183).

Item #	Item description	Mean (±SD)	1	2	3	4	5
1	Exercise alone	3.64 (1.25)	13 (7.1%)	23 (12.6%)	40 (21.9%)	47 (25.7%)	60 (32.8%)
2	Feel exercising is not fun	3.07 (1.41)	33 (18.0%)	37 (20.2%)	36 (19.7%)	39 (21.3%)	38 (20.8%)
3	Being away from home	2.99 (1.30)	26 (14.2%)	46 (25.1%)	46 (25.1%)	34 (18.6%)	31 (16.9%)
4	During vacations	3.05 (1.45)	34 (18.6%)	40 (21.9%)	36 (19.7%)	29 (15.8%)	44 (24.0%)
5	Don't experience improvement	3.04 (1.29)	23 (12.6%)	48 (26.2%)	41 (22.4%)	40 (21.9%)	31 (16.9%)
6	Under normal circumstances	3.68 (1.20)	11 (6.0%)	22 (12.0%)	37 (20.2%)	57 (31.1%)	56 (30.6%)
7	Tempted to skip it once in a while	2.88 (1.20)	25 (13.7%)	50 (27.3%)	49 (26.8%)	40 (21.9%)	19 (10.4%)
8	Difficulties to break daily routines	3.19 (1.13)	9 (4.9%)	46 (25.1%)	57 (31.1%)	43 (23.5%)	28 (15.3%)
9	Lack of discipline	2.44 (1.20)	49 (26.8%)	52 (28.4%)	45 (24.6%)	26 (14.2%)	11 (6.0%)
10	Feel self-conscious	3.74 (1.17)	9 (4.9%)	23 (12.6%)	32 (17.5%)	62 (33.9%)	57 (31.1%)
11	Feel stressed, tense or anxious*	3.31 (1.28)	20 (10.9%)	30 (16.4%)	46 (25.1%)	47 (25.7%)	40 (21.9%)
12	Feel tired or fatigued	2.36 (1.20)	50 (27.3%)	65 (33.5%)	34 (18.6%)	21 (11.5%)	13 (7.1%)
13	Have problems*	3.20 (1.21)	17 (9.3%)	36 (19.7%)	56 (30.6%)	42 (23.0%)	32 (17.5%)
14	Feel depressed*	2.83 (1.33)	38 (20.8%)	41 (22.4%)	44 (24.0%)	35 (19.1%)	25 (13.7%)
15	In my daily routine	3.49 (1.24)	14 (7.7%)	26 (14.2%)	49 (26.8%)	44 (24.0%)	50 (27.3%)
16	Without support from family*	3.28 (1.23)	14 (7.7%)	40 (21.9%)	46 (25.1%)	46 (25.1%)	37 (20.2%)
17	Without support from friends*	3.52 (1.23)	14 (7.7%)	22 (12.0%)	52 (28.4%)	44 (24.0%)	51 (27.9%)
18	Without medical advice*	3.97 (1.11)	6 (3.3%)	13 (7.1%)	39 (21.3%)	47 (25.7%)	78 (42.6%)
19	Without any encouragement from an instructor*	3.79 (1.22)	11 (6.0%)	17 (9.3%)	42 (23.0%)	42 (23.0%)	71 (38.8%)
20	Not enough opportunities	2.78 (1.20)	29 (15.8%)	52 (28.4%)	51 (27.9%)	33 (18.0%)	18 (9.8%)
21	Feel physical discomfort	2.52 (1.25)	44 (24.0%)	58 (31.7%)	39 (21.3%)	25 (13.7%)	17 (9.3%)
22	Feel sick or are ill	1.58 (0.93)	115 (62.8%)	45 (24.9%)	11 (6.0%)	9 (4.9%)	3 (1.6%)
23	The weather is not fit	2.73 (1.34)	38 (20.8%)	55 (30.1%)	36 (19.7%)	27 (14.8%)	27 (14.8%)

24	Worried about money	3.04 (1.30)	27 (14.8%)	39 (21.3%)	46 (25.1%)	42 (23.0%)	29 (15.8%)
25	Too busy with other activities	2.56 (1.32)	43 (23.5%)	61 (33.3%)	37 (20.2%)	17 (9.3%)	25 (13.7%)
26	Family commitments	2.56 (1.14)	32 (17.5%)	67 (36.6%)	48 (26.2%)	22 (12.0%)	14 (7.7%)
Total score		79.25 (23.99)					
Minimum total score		26					
Maximum total score		130					

Appendix 3

Table 8. Responses to each item for the smoking subscale (n=20).

Item #	Item description	Mean (±SD)	1	2	3	4	5
1	Under normal circumstances	3.35 (1.66)	5 (25.0%)	2 (10.0%)	1 (5.0%)	5 (25.0%)	7 (35.0%)
2	Seeing someone enjoy smoking	3.00 (1.34)	4 (20.0%)	3 (15.0%)	4 (20.0%)	7 (35.0%)	2 (10.0%)
3	After a meal	3.15 (1.39)	3 (15.0%)	4 (20.0%)	4 (20.0%)	5 (25.0%)	4 (20.0%)
4	Having coffee or tea	4.00 (1.21)	1 (5.0%)	1 (5.0%)	5 (25.0%)	3 (15.0%)	10 (50.0%)
5	Feel stressed, tense or anxious	2.30 (1.42)	8 (40.0%)	5 (25.0%)	2 (10.0%)	3 (15.0%)	2 (10.0%)
6	Feel mad	2.55 (1.43)	7 (35.0%)	3 (15.0%)	4 (20.0%)	4 (20.0%)	2 (10.0%)
7	Feel depressed	2.85 (1.46)	6 (30.0%)	2 (10.0%)	3 (15.0%)	7 (35.0%)	2 (10.0%)
8	Want to think about a problem	3.35 (1.50)	4 (20.0%)	1 (5.0%)	5 (25.0%)	4 (20.0%)	6 (30.0%)
9	Feel the urge to smoke	2.35 (1.31)	7 (35.0%)	5 (25.0%)	3 (15.0%)	4 (20.0%)	1 (5.0%)
10	Are going out	2.10 (1.45)	10 (50.0%)	4 (20.0%)	3 (15.0%)	0 (0.0%)	3 (15.0%)
11	Are with smokers	2.10 (1.25)	8 (40.0%)	6 (30.0%)	4 (20.0%)	0 (0.0%)	2 (10.0%)
12	Cigarette of your favourite brand is presented to you	2.85 (1.42)	3 (15.0%)	7 (35.0%)	5 (25.0%)	0 (0.0%)	5 (25.0%)
13	Without medical advice	3.10 (1.45)	3 (15.0%)	5 (25.0%)	4 (20.0%)	3 (15.0%)	5 (25.0%)
14	Drinking alcohol	2.70 (1.53)	7 (35.0%)	2 (10.0%)	4 (20.0%)	4 (20.0%)	3 (15.0%)
15	Family or friends are smokers	2.55 (1.23)	4 (20.0%)	7 (35.0%)	5 (25.0%)	2 (10.0%)	2 (10.0%)
Total score		42.3 (16.23)					
Minimum total score		15					
Maximum total score		69					