



Explaining frailty by lifestyle



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ABSTRACT

Objective: To determine whether the effects of lifestyle factors on frailty can be adequately addressed by asking a single self-report question.

Design: Cross-sectional study.

Setting: A sample of Dutch citizens completed the web-based questionnaire “Seniorenbarometer”.

Participants: 610 persons aged 50 years and older.

Measurements: Seven lifestyle factors were assessed: smoking, use of alcohol, intake of vegetables, intake of fruit, having breakfast, exercise, and teeth brushing. The single self-report question of lifestyle was: “Overall, how healthy would you say your lifestyle is?” Frailty was measured by the Tilburg Frailty Indicator.

Results: Age was positively associated with a healthy lifestyle (less smoking, more intake of vegetables, fruit and eating breakfast). The lifestyle factors did not improve the prediction of total, physical, psychological, and social frailty, after controlling for the single self-report question.

Conclusion: Our study suggests that one general self-report lifestyle question, rather than a list of specific lifestyle factors, suffices for predicting frailty.

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1. Introduction

Frailty is a dynamic state affecting an individual who experiences losses in one or more domains of human functioning (physical, psychological, social), which increases the risk of adverse outcomes, and is influenced by many variables (Gobbens, Luijckx, Wijnen-Sponselee, & Schols, 2010a, 2010b). Well-known adverse outcomes of frailty are activities of daily living disability (Boyd, Xue, Simpson, Guralnik, & Fried, 2005), hospitalization (Fried et al., 2001), institutionalization (Rockwood et al., 2005), and premature death (Fried et al., 2001). An unhealthy lifestyle, characterized by dietary problems, smoking and alcohol use can lead to the onset of frailty (Bortz, 2002; Fries, 2002; Morley, Haren, Rolland, & Kim, 2006; Woo, Chan, Leung, & Wong, 2010). Prevention of an unhealthy lifestyle by health care professionals such as general practitioners and nurses therefore could possibly limit frailty and adverse outcomes in the older population.

In the Tilburg Frailty Indicator (TFI), a self-report questionnaire for measuring frailty in older persons, lifestyle is assessed using the

question “Overall, how healthy would you say your lifestyle is?”, and offering three categories of answers (healthy, not healthy/not unhealthy, unhealthy). Previous research using the TFI confirmed that older people with an unhealthy lifestyle were more frail, also after controlling for sex, age, education, income and multimorbidity (Gobbens, van Assen, Luijckx, Wijnen-Sponselee, Schols, 2010a; Gobbens, van Assen, Luijckx, Wijnen-Sponselee, & Schols, 2012). One explanation for this association is attribution bias by the respondents; if the respondent feels bad, (s)he might reason that this is because (s)he has a poor lifestyle (Gobbens, van Assen et al., 2010a). The present study examines whether the TFI question incorporates the effects of lifestyle factors on frailty, and if it predicts frailty after controlling for effects of these lifestyle factors. The study's main contribution is to answer the question whether the effects of lifestyle factors on frailty can be adequately addressed by asking a single self-report question.

2. Methods

2.1. Study sample

The “Seniorenbarometer” is a web-based questionnaire (www.seniorenbarometer.nl) assessing the opinions of a panel of Dutch older people (aged 50 years and above) about different aspects of

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life. Older people can volunteer and participation is always without obligation (Gobbens, Luijkx, & van Assen, 2013). From May to June 2012, 837 respondents completed at least part of the questionnaire, of whom 610 filled out the part on background characteristics, frailty, and lifestyle. Medical-ethics approval was not necessary under Dutch legislation, as particular treatments or interventions were not offered or withheld from participants (Central Committee on Research inv. Human Subjects, 2010). Informed consent, in terms of information-giving and maintaining confidentiality, was respected.

2.2. Measures

2.2.1. Individual lifestyle factors

We assessed seven lifestyle factors: smoking, use of alcohol, intake of vegetables, intake of fruit, having breakfast, exercise, and tooth brushing (see Table 1 for operationalization).

2.2.2. Frailty

Frailty was assessed using part B of the TFI (Gobbens, van Assen, Luijkx, Wijnen-Sponselee, & Schols, 2010b). Part B of the TFI contains fifteen self-reported questions on components of frailty, divided into the three domains physical (eight questions), psychological (four questions), and social frailty (three questions). One of the usual physical TFI components 'physically unhealthy' was replaced by 'physical inactivity' using the question 'Do you find that you can be sufficiently physically active?', as we did in a previous study (Gobbens et al., 2013). For further details regarding the TFI and its good psychometric properties, we refer the reader to previous studies (Coelho, Santos, Paul, Gobbens, & Fernandes, 2014; Gobbens, van Assen, Luijkx, & Schols, 2012a; Gobbens, van Assen et al., 2010b; Uchmanowicz et al., 2014). Moreover, a recent systematic review concluded that the TFI has the most robust evidence of reliability and validity of 38 frailty assessment instruments (Sutton et al., 2016).

2.2.3. Socio-demographic background characteristics and multimorbidity

The socio-demographic background characteristics considered were age (in years), sex, marital status (five categories), highest education attained (five categories) and satisfaction with respect to income (question 'Do you have enough money to meet your needs?', with five categories) (see Table 2). We assessed multimorbidity by asking 'Do you have two or more diseases and/or chronic disorders?' (yes/no).

2.3. Analysis strategies

Descriptive statistics were provided on all predictors (background characteristics and lifestyle factors) and dependent variables (total frailty and three frailty domains). We carried out logistic regression analyses with lifestyle factors as dependent and age and sex as independent variables, followed by regression analyses testing the effect of lifestyle on frailty. For our analyses, we created dummies for marital status ("1" married or cohabiting, and "0" rest), sex ("1" woman, "0" man), and multimorbidity ("1" yes, "0" no) (Gobbens et al., 2013; Gobbens, van Assen, Luijkx, & Schols, 2012b), and linear effects of age, education, and satisfaction with income were incorporated into the analyses.

We report results of both bivariate and sequential multiple regression analyses. The multiple regression analyses consisted of two blocks. The effect of the socio-demographic background characteristics, multimorbidity and one self-report question on lifestyle was estimated in the first block. In the second block seven individual lifestyle factors were added to the model, and using the increase in explained variance (ΔR^2), we tested whether these factors contributed to the explanation of frailty after controlling for the TFI lifestyle question (and other predictors). Using the regression coefficients of this final model we tested whether the TFI lifestyle question improved prediction of frailty after controlling for the lifestyle factors (and other predictors).

The analyses were performed using IBM SPSS Statistics 22.0 (IBM, Armonk, NY, USA).

3. Results

3.1. Participant characteristics

Table 2 shows the descriptive statistics of the 610 participants. The mean age of the participants was 70.6 years ($SD = 7.3$; range 52–89) with a median of 69 years. 61.6% were male, 13.8% had no or only primary education, 67.6% were married or cohabiting, and 9.3% found their income too little to meet their needs. Table 2 also presents the lifestyle characteristics of the participants.

3.2. Effects of age and sex on lifestyle

Table 3 presents the results of analyses on the effects of sex and age on the seven individual lifestyle factors. Sex (being a woman) was negatively associated with insufficiently intake of fruit and with insufficiently teeth brushing. Age was negatively associated with smoking, insufficient intake of vegetables, fruit and eating

Table 1
Operationalization of individual lifestyle factors.

Lifestyle factor	Question	Insufficient score
Smoking	How much do you smoke on average per day? (cigarettes, cigars, shag, pipe)	Smoking
Use of alcohol	How many glasses of alcohol do you drink on average per week?	Men > 21 drinks a week Women > 14 drinks a week
Intake of vegetables	How many times a week do you eat vegetables? (vegetables in casseroles also count, but a lettuce leaf on a sandwich, for example, does not count)	< 7 days a week
Intake of fruit	How many days a week do you eat fruit or drink a glass of juice?	< 7 days a week
Having breakfast	How many days a week do you eat breakfast? (breakfast-drink breakfast bar, muesli and the like, also count as breakfast)	< 7 days a week
Exercise	How many days in the week do you exercise for at least half an hour moderate to intensive? (cycling, hiking, sports, also count)	Persons aged < 55 years: ≥ 30 minutes a day Persons aged ≥ 55 years: ≥ 30 minutes at least five times a week
Tooth brushing	How often do you brush your teeth a week?	< 14 times a week

Table 2
Participant characteristics (N = 610).

Characteristic	n (%)
Age, mean \pm SD, range	70.6 \pm 7.3, 52–89
Sex, % of men	376 (61.6)
Marital status	
Married or cohabiting	412 (67.6)
Single	77 (12.6)
Divorced	36 (5.9)
Widowed	77 (12.6)
Living apart together	8 (1.3)
Ethnicity	
Dutch	589 (96.6)
Other	21 (3.4)
Education	
None	32 (5.2)
Primary	52 (8.6)
Secondary	251 (41.1)
Polytechnics and	
Higher vocational training	215 (35.2)
University	60 (9.9)
Income	
Far too little	10 (1.6)
Too little	47 (7.7)
Just enough	182 (29.8)
More than sufficient	328 (53.8)
More than enough	43 (7.1)
Multimorbidity, % Yes	278 (45.6)
Frailty, mean \pm SD, range	
Total	3.4 \pm 2.6, 0–12
Physical frailty	1.5 \pm 1.7, 0–7
Psychological frailty	.87 \pm 1.1, 0–4
Social frailty	1.0 \pm 0.92, 0–3
Lifestyle (TFI question)	
Healthy	394 (64.6)
Not healthy, not unhealthy	206 (33.8)
Unhealthy	10 (1.6)
Individual lifestyle factors, % Yes	
Smoking*	77 (13.2)
Excessive use of alcohol*	33 (5.6)
Insufficient intake of vegetables*	252 (43.3)
Insufficient intake of fruit*	161 (27.6)
Insufficient eating breakfast*	46 (7.9)
Lack of exercise*	180 (29.5)
Insufficient teeth brushing†	184 (41.3)

Note: * 22–30 cases (3.6%–4.9%) were missing; † 164 cases (26.9%) were missing.

breakfast, suggesting that older people generally had a healthier lifestyle. Both sex and age were not associated with excessive use of alcohol and lack of exercise.

3.3. Regression analyses

Table 4 shows the results of the linear regression analyses. The first and second of two columns of each frailty variable present the results of the bivariate and multiple regression analyses,

respectively. Lines ΔR^2 and R^2 (total) indicate how much of the variance was explained in addition to the first block, and by all predictors in the model, respectively. R^2 total (last row) demonstrates that all the variables in the model together explain a significant part of the variance of total, physical, psychological, and social frailty (13–26%).

Focusing on our research question, the ΔR^2 values of the second block show that all lifestyle factors together did not improve the prediction of frailty after controlling for the TFI lifestyle question (and other predictors); effect sizes were small and not statistically significant ($\Delta R^2 \leq 2.5\%$, with p -values ≥ 0.074). Finally, while TFI lifestyle significantly predicted all four frailty variables in the bivariate regression analyses (all $p < 0.001$), it also improved predicted of total frailty ($f^2 = 0.017$, $p = 0.007$), psychological frailty ($f^2 = 0.018$, $p = 0.008$), and social frailty ($f^2 = 0.014$, $p = 0.023$) after controlling for the seven lifestyle factors, but not physical frailty ($f^2 = 0.003$, $p = 0.385$). Effect sizes f^2 up to 0.02 represent small effects. To conclude, our results indicate that the seven lifestyle factors do not increase the prediction of frailty of the TFI lifestyle question, and this question improves the prediction of three frailty variables even after controlling for the seven factors.

Examining the other associations with frailty, of the background variables being a woman, higher age, less income, and multimorbidity were positively associated to higher scores on at least two of the frailty variables, after controlling for the other predictors. None of the lifestyle factors had an effect on more than one frailty variable in the multiple regression analysis. In the bivariate analyses, excessive use of alcohol and insufficient intake of vegetables had no effect, insufficient intake of fruit and breakfast and insufficient teeth brushing affected one frailty variable, smoking and lack of exercise affected three frailty variables.

4. Discussion

We conducted a cross-sectional study on 610 Dutch citizens aged 50 years and older, using a web-based questionnaire in which we assessed background characteristics, seven lifestyle factors, and the Tilburg Frailty Indicator (TFI). Our main finding is that all lifestyle factors did not improve the prediction of any of the frailty variables after controlling for the self-report lifestyle question. This finding suggests that for assessing lifestyle factors and its effects on frailty, one self-report question rather than a detailed inventory may be sufficient.

Our second main finding is that the lifestyle question even improved the prediction of some frailty variables after controlling for the effects of the seven lifestyle factors. One explanation of this finding is that the lifestyle factors assessed in the study do not encompass all relevant aspects of lifestyle affecting frailty, such as e.g. overweight and obesity (Jepsen, Dogיסso, Dysvik, Andersen, & Natvig, 2014). The small correlation between the self-report question and the total score on all seven lifestyle factors ($r = 0.37$) provides at least some support for this explanation. A second explanation is attribution bias by the respondents; if (s)he feels bad and/or frail, whether because of poor lifestyle or another reason, (s)he may attribute this to poor lifestyle.

Table 3
Effects of sex and age on lifestyle factors.

	Smoking			Excessive use of alcohol			Insufficient intake of vegetables			Insufficient eating of fruit			Insufficient eating of breakfast			Lack of exercise			Insufficient teeth brushing		
	B	SE	p	B	SE	p	B	SE	p	B	SE	p	B	SE	p	B	SE	p	B	SE	p
Sex (women)	0.096	0.252	0.703	0.386	0.365	0.290	−0.221	0.176	0.208	−0.940	0.214	<0.001	−0.041	0.320	0.898	−0.93	0.187	0.619	−0.653	0.205	0.001
Age	−0.050	0.018	0.006	0.041	0.025	0.099	−0.033	0.012	0.006	−0.080	0.015	<0.001	−0.079	0.024	<0.001	−0.014	0.013	0.270	0.008	0.014	0.556

Table 4
Effects of socio-demographic background characteristics and lifestyle factors on total frailty and frailty domains.

	Total frailty						Physical frailty						Psychological frailty						Social frailty					
	Bivariate			Multiple			Bivariate			Multiple			Bivariate			Multiple			Bivariate			Multiple		
	B	SE	p	B	SE	p	B	SE	p	B	SE	p	B	SE	p	B	SE	p	B	SE	p	B	SE	p
Background characteristics																								
Sex (women)	1.219	0.216	<0.001	1.213	0.242	<0.001	0.520	0.139	<0.001	0.566	0.165	<0.001	0.218	0.088	0.013	0.077	0.114	0.499	0.481	0.074	<0.001	0.492	0.092	<0.001
Age	0.001	0.015	0.943	0.031	0.017	0.059	0.025	0.009	0.008	0.037	0.011	<0.001	−0.025	0.006	<0.001	−0.017	0.007	0.023	0.001	0.005	0.848	0.009	0.006	0.137
Marital status (married) ^a							−0.464	0.145	0.001	−0.108	0.168	0.522	−0.184	0.091	0.044	−0.110	0.117	0.347						
Education	−0.385	0.112	<0.001	−0.072	0.126	0.567	−0.175	0.071	0.014	0.011	0.080	0.894	−0.107	0.045	0.017	−0.052	0.055	0.342	−0.102	0.039	0.008	−0.033	0.048	0.486
Income	−1.035	0.128	<0.001	−0.748	0.157	<0.001	−0.476	0.084	<0.001	−0.397	0.100	<0.001	−0.296	0.052	<0.001	−0.171	0.069	0.014	−0.262	0.045	<0.001	−0.168	0.060	0.005
Multimorbidity	1.804	0.204	<0.001	1.216	0.240	<0.001	1.203	0.129	<0.001	0.828	0.152	<0.001	0.353	0.085	<0.001	0.263	0.106	0.013	0.249	0.074	<0.001	0.125	0.091	0.173
Lifestyle	1.714	0.197	<0.001	0.697	0.258	0.007	0.857	0.128	<0.001	0.143	0.165	0.385	0.495	0.081	<0.001	0.304	0.114	0.008	0.362	0.071	<0.001	0.223	0.098	0.023
R ²				0.250		<0.001				0.203		<0.001				0.115		<0.001				0.136		<0.001
Lifestyle factors																								
Smoking	0.888	0.325	0.006	0.041	0.368	0.912	0.357	0.206	0.084	0.023	0.234	0.923	0.273	0.130	0.035	−0.102	0.163	0.531	0.258	0.112	0.022	0.088	0.140	0.527
Excessive use of alcohol	−0.694	0.477	0.146	−0.799	0.488	0.103	−0.321	0.303	0.290	−0.511	0.309	0.099	−0.304	0.190	0.111	−0.241	0.214	0.261	−0.070	0.165	0.672	−0.048	0.185	0.795
Insufficient intake of vegetables	0.402	0.221	0.069	−0.048	0.244	0.844	0.195	0.141	0.167	0.073	0.155	0.635	0.098	0.089	0.267	−0.177	0.107	0.099	0.109	0.076	0.155	0.052	0.093	0.578
Insufficient intake of fruit	0.439	0.244	0.073	0.291	0.280	0.298	0.135	0.155	0.384	−0.020	0.177	0.911	0.272	0.098	0.006	0.266	0.123	0.031	0.032	0.085	0.704	0.035	0.106	0.744
Insufficient eating breakfast	0.788	0.405	0.052	0.174	0.436	0.691	0.580	0.259	0.025	0.297	0.276	0.282	0.199	0.163	0.223	−0.004	0.192	0.984	0.010	0.141	0.945	−0.108	0.165	0.514
Lack of exercise	1.058	0.233	<0.001	0.394	0.274	0.151	0.776	0.148	<0.001	0.420	0.173	0.016	0.212	0.095	0.026	−0.030	0.120	0.806	0.070	0.082	0.392	0.003	0.104	0.978
Insufficient teeth brushing	0.365	0.251	0.148	0.066	0.243	0.786	0.357	0.155	0.021	0.134	0.154	0.384	0.070	0.101	0.491	0.007	0.107	0.948	−0.062	0.089	0.486	−0.064	0.092	0.488
ΔR ²				0.012		0.466				0.025		0.074				0.016		0.367				0.004		0.975
R ² total				0.262		<0.001				0.228		<0.001				0.131		<0.001				0.139		<0.001

^a Since 'living alone' is one of social frailty's components 'marital status' is excluded in the prediction of total frailty and social frailty.

Of the seven lifestyle factors, only lack of exercise and smoking were associated with three of the four frailty variables. There is growing evidence suggesting that physical exercise therapy has a positive effect on mobility and physical functioning (de Vries et al., 2012; Theou et al., 2011). A recent systematic review also provided evidence that smoking is a predictor of higher frailty (Kojima, Iliffe, & Walters, 2015).

Surprisingly, age was associated with a healthier lifestyle of participants in our sample. A possible (partial) explanation for this finding is that people with an unhealthy lifestyle may have died at a younger age. This is supported by the “Healthy Ageing: Longitudinal study in Europe (HALE) project”, which found that, among individuals aged 70–90 years, adherence to a Mediterranean diet (containing a lot of fruit, vegetables, cereals, and fish) and healthy lifestyle was associated with a more than 50% lower rate of mortality (Knoops et al., 2004).

A limitation of this study is the cross-sectional nature. This does not allow strict cause-effect interpretations of the associations between sex and age and lifestyle on the one hand, and lifestyle and frailty on the other hand. A second limitation is the rather crude measurement of lifestyle. Although we believe we assessed the most relevant lifestyle factors, each of them was assessed with only one, dichotomous item. Future research should assess lifestyle factors using more items, preferably with one of more continuous scales. A final limitation is that the sample may be biased due to the exclusion of people without Internet access.

In conclusion, our study suggests that one general self-report lifestyle question, rather than a list of specific lifestyle factors, suffices for predicting frailty.

Conflict of interest

Authors declare no conflict of interest.

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