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Ethnic differences in frailty: a cross-sectional study of pooled data from community-dwelling older persons in the Netherlands

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ABSTRACT

Objective Few European studies examined frailty among older persons from diverse ethnic backgrounds. We aimed to examine the association of ethnic background with frailty. In addition, we explored the association of ethnic background with distinct components that are considered to be relevant for frailty.

Design and setting This was a cross-sectional study of pooled data of The Older Persons and Informal Caregivers Survey Minimum DataSet (TOPICS) in the Netherlands.

Participants Community-dwelling persons aged 55 years and older with a Dutch, Indonesian, Surinamese, Moroccan or Turkish ethnic background were included (n=23 371).

Measurements Frailty was assessed with the validated TOPICS-Frailty Index that consisted of 45 items. The TOPICS-Frailty Index contained six components: morbidities, limitations in activities of daily living (ADL), limitations in instrumental ADL, health-related quality of life, psychosocial health and self-rated health. To examine the associations of ethnic background with frailty and with distinct frailty components, we estimated multilevel random-intercept models adjusted for confounders.

Results TOPICS-Frailty Index scores varied from 0.19 (SD=0.12) among persons with a Dutch background to 0.29 (SD=0.15) in persons with a Turkish background. After adjustment for age, sex, living arrangement and education level, persons with a Turkish, Moroccan or Surinamese background were frailer compared with persons with a Dutch background (p<0.001). There were no significant differences in frailty between persons with an Indonesian compared with a Dutch background. The IADL component scores were higher among all groups with a non-Dutch background compared with persons with a Dutch background (p<0.05 or lower for all groups).

Conclusions Compared with older persons with a Dutch background, persons with a Surinamese, Moroccan or Turkish ethnic background were frailer. Targeted intervention strategies should be developed for the prevention and reduction of frailty among these older immigrants.

Strengths and limitations of this study

- The main strength of this study is that we studied frailty with a validated Frailty Index among an ethnically diverse group of older persons, as research on frailty among older immigrants is scarce.
- The questionnaire used in this study was translated into the native languages of the main ethnic minority groups in the Netherlands and was cross-culturally adapted.
- There were relatively few persons included with a Turkish or Moroccan background.
- Although the use of a Frailty Index has been validated and extensively studied, the operationalisation of distinct components of a Frailty Index has not and should be further validated.

INTRODUCTION

The concept of frailty was introduced to capture the variability in the rate of ageing.[1] Frailty can be defined as a state of increased vulnerability to external stressors.[2 3] Frailty is an important risk factor for adverse outcomes such as institutionalisation and mortality.[1 4] Early intervention in frail older persons could improve functional health and reduce hospital admissions.[5 6] A widely used approach to measure frailty is the accumulation-of-deficits approach developed by Rockwood and Mitnitski that results in a Frailty Index.[7 8] Theou *et al* found that of eight commonly used approaches to measure frailty, frailty measured with a Frailty Index most accurately predicted mortality.[1] A standard procedure to construct a Frailty Index was developed by Searle *et al*, who recommended to include the following components in the index: morbidities, disability in activities of daily living (ADL) and instrumental ADL (IADL), restricted activity, impairments in general cognition and physical performance, psychological health and self-rated health (SRH).[9] The assessment of distinct components that are considered to be relevant for frailty could uncover important information about the specific domain in which a

person is frail. Yang and Gu have studied the associations between distinct components of frailty and mortality and found that IADL and ADL limitations components played an important role in the association between frailty and mortality.[10] In a previous study on socioeconomic inequalities in frailty and frailty components by our team, we found consistent educational inequalities in overall frailty, number of morbidities and SRH.[11]

American studies have found that older persons from ethnic minority groups are frailer compared with European Americans.[12–14] In Western Europe, large ethnic minority groups consist of immigrants settled during the decades after the Second World War. These immigrants are ageing, however, little research on frailty has been conducted in this group. In the Netherlands, the number of immigrants aged 55 years or older increased threefold in the past 15 years.[15] The largest immigrant groups in the Netherlands have an Indonesian, Surinamese, Moroccan or Turkish ethnic background.[16] In the 1960s and early 1970s, many persons with a Moroccan or Turkish background came to the Netherlands as labour migrants.[17] Many Turkish or Moroccan 'first generation' immigrants have difficulties speaking and writing Dutch.[17] Many persons with a Surinamese background came to the Netherlands between 1970 and 1980, during the period of decolonisation of Suriname.[17] In general, persons with a Surinamese background are familiar with Dutch society and were taught Dutch language at school. Between 1945 and 1965, following the decolonisation of Indonesia, many persons migrated from Indonesia to the Netherlands.[17] Many of these persons have a Dutch or mixed Dutch and Indonesian ancestry and a similar socioeconomic status as native-born Dutch persons.[16] On average, older persons with a Turkish, Moroccan or Surinamese ethnic background have a lower socioeconomic status and more chronic health conditions compared with older persons with a Dutch background.[18–21] However, Dutch studies on the variation in frailty according to ethnic background are limited.[22] This increases the urgency to study the frailty level among these older immigrant groups. The aim of this study was therefore to examine the association of ethnic background with frailty among older persons aged 55 years and older. In addition, we explored the associations of ethnic background with distinct components that are considered to be relevant for frailty (morbidities, ADL, IADL, health-related quality of life (HRQoL), psychosocial health and SRH).

METHODS

Study design

We applied a cross-sectional study design using data from The Older Persons and Informal Caregivers Survey Minimum DataSet (TOPICS-MDS). The development and design of TOPICS-MDS has been described in more detail.[23] TOPICS-MDS is a database designed to capture information on the well-being of older persons in the Netherlands. TOPICS-MDS was developed to collect uniform information from studies funded under the National Care for older citizens programme.[24] Included survey items were based on the recommendations of experts from eight medical research centres in the Netherlands who identified key outcomes in older persons' health using validated instruments. Then, an independent multidisciplinary panel with expertise in gerontology, epidemiology, biostatistics and health services research evaluated and revised TOPICS-MDS. Dutch TOPICS-MDS questionnaires were piloted in four regions throughout the Netherlands. Misinterpretation of questions were identified and minor changes were made by a plain language expert. The Dutch version of TOPICS-MDS was translated into Turkish, the two Moroccan languages and the two Surinamese languages. Two independent translators, who were native speakers of the target language, translated all items and differences were reconciled in a consensus meeting. Another translator back translated the forward translation and discrepancies were discussed, which resulted in a final translation. Questionnaires were then cross-culturally validated by the three-step test-interview.[25] The translation and cross-cultural validation of TOPICS-MDS was done as part of the SYMBOL study and has been described in more detail.[26] Between 2010 and 2013, 50 studies were conducted in the Netherlands which applied the TOPICS-MDS questionnaire.[23] TOPICS-MDS consists of pooled data of these studies which differ across study design, sampling framework and inclusion criteria. TOPICS-MDS is a fully anonymised dataset.

Patient and public involvement

The research proposal of this study was presented to a forum of older persons and informal caregivers who are part of the geriatric network of Southwest Netherlands and was adapted according to their suggestions. The study design was presented at the 'TOPICS Special Interest Group Diversity', who advised on design and subgroup analyses. This interest group consisted of researchers, older persons and a representative of the Network of Organisations of Older Migrants in the Netherlands. The results of this study will be disseminated to participants on the TOPICS-MDS website https://topics-mds.eu/ and on the website of the Organisation of Health Research and Development (ZonMw) https://www.zonmw.nl/nl/.

Ethnic background

We defined ethnic background according to the classification of Statistics Netherlands.[27] The participant had a non-Dutch ethnic background if at least one of the parents was born in another country than the Netherlands. To determine the country of origin, the following was applied.[27] If the participant was also (as well as parent/parents) born outside of the Netherlands, the participants' country of birth determined the ethnic background. If the participant was born in the Netherlands but their mother was not, the country of birth of the mother determined the ethnic background. If the mother was born in the Netherlands but the father was not, the

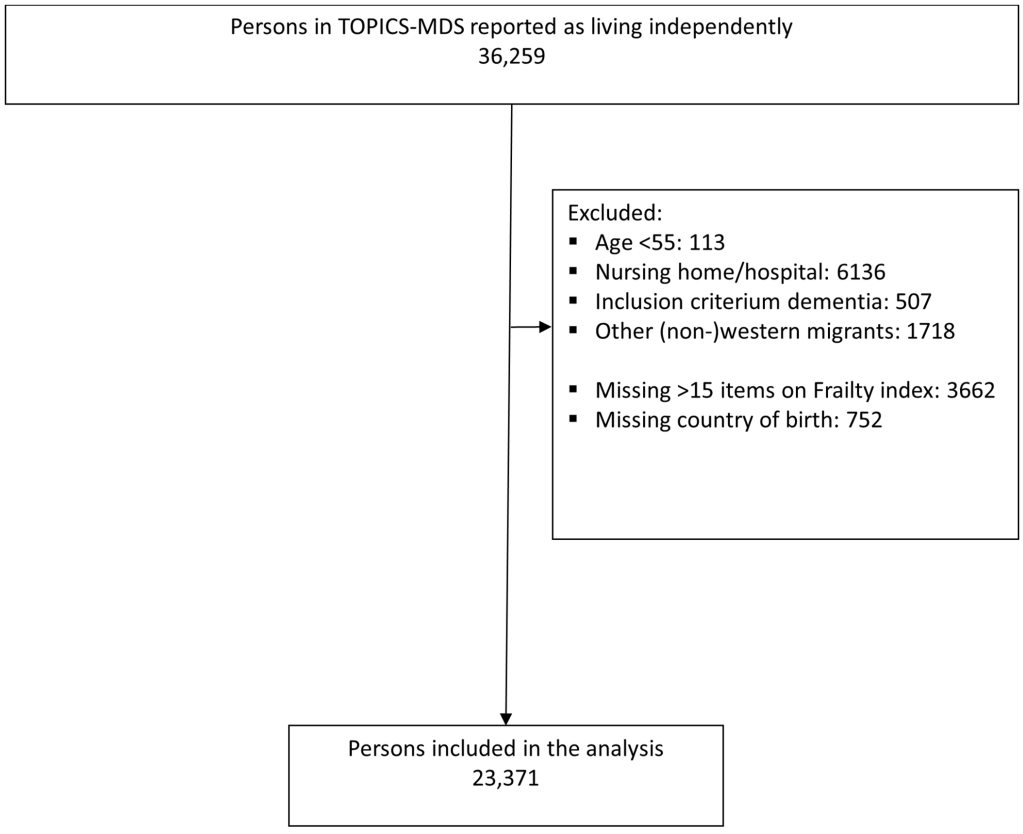

Figure 1 Population of analysis.

country of birth of the father determined the ethnic background. We categorised participants according to ethnic background: Dutch, Indonesian, Surinamese, Moroccan or Turkish ethnic background.

Population for analysis

We restricted our analysis to TOPICS-MDS data from studies on independently living persons aged 55 years and older with a Dutch, Indonesian, Surinamese, Moroccan or Turkish ethnic background. We included studies that recruited participants from the general population and from general practitioners' registries. We excluded studies among persons living in a nursing home, studies that recruited participants in a hospital setting (n=6136) and studies for persons with dementia (n=507). We excluded other ethnic groups due to small numbers (n=1718). We also excluded persons with more than 15 missing items for the TOPICS-Frailty Index (n=3662) and with missing country of birth (n=752). The final sample comprised data from 29 studies with data of 23 371 persons (see figure 1).

TOPICS-Frailty Index and components

Frailty was measured by the TOPICS-Frailty Index, which was developed and validated using data from the TOPICS-MDS questionnaire by Lutomski *et al*.[28] As described previously,[11] in our study we included the 45 item TOPICS-Frailty Index, after exclusion of the item measuring prostatism. Searle *et al* showed that a Frailty Index with 30–40 items is accurate for predicting adverse outcomes.[9 29] The TOPICS-Frailty Index was calculated when at least 30 items were available. Binary items were scored 0 when the deficit was absent and 1 when the deficit was present. For items with multiple response categories, responses were coded so that they could be mapped on the interval 0–1, as proposed by Searle *et al*.[9] For example, when the response categories were no/some/extreme, responses were coded 0/0.5/1, respectively. Then, the health deficits a person reported were added up and divided by the total health deficits measured for this person. This resulted in a score between 0 and 1. Persons were also grouped according to their TOPICS-Frailty Index score, we used a cut-off score ≥0.25 to indicate frailty as suggested by Rockwood *et al*.[30]

The TOPICS-Frailty Index consists of 45 items of the TOPICS-MDS questionnaire that belong to six components, each measured by validated instruments: morbidities, ADL, IADL, HRQoL, psychosocial health and SRH.[9] The component 'morbidities' was measured by 16 items regarding the self-reported presence (yes/no) of diabetes, stroke, heart failure, cancer, respiratory condition (asthma, chronic bronchitis, lung emphysema or Chronic obstructive pulmonary disease), incontinence, joint damage of hips or knees, osteoporosis, hip fracture, fractures other than hip, dizziness with falling, depression, anxiety/panic disorder, dementia, hearing problems, vision problems. The component 'ADL limitations' was measured by six

Table 1 Sociodemographic characteristics by ethnic background of 23 371 persons of The Older Persons and Informal Caregivers Survey Minimum DataSet

	Dutch n=22 360	Indonesian n=519	Surinamese n=214	Moroccan n=137	Turkish n=141	P values*
Age in years (mean, SD)	78.0 (6.8)	78.7 (7.3)	72.0 (9.2)	67.4 (8.5)	65.9 (7.6)	<0.001
Sex, n (%)						0.003
Male	9251 (41.4)	193 (37.2)	85 (39.7)	45 (32.8)	41 (29.1)	
Female	13 109 (58.6)	326 (62.8)	129 (60.3)	92 (67.2)	100 (70.9)	
Living arrangement, n (%)						
Alone	9961 (44.5)	256 (49.3)	126 (58.9)	32 (23.4)	24 (17.0)	<0.001
With others	12 399 (55.5)	263 (50.7)	88 (41.1)	105 (76.6)	117 (83.0)	
Marital status, n (%)						
Married/cohabitant partners	12 053 (53.9)	242 (46.6)	75 (35.0)	97 (70.8)	109 (77.3)	<0.001
Divorced	1371 (6.1)	50 (9.6)	45 (21.0)	13 (9.5)	7 (5.0)	
Widowed	7901 (35.3)	192 (37.0)	61 (28.5)	26 (19.0)	22 (15.6)	
Single	1035 (4.6)	35 (6.7)	33 (15.4)	1 (0.7)	3 (2.1)	
Generation of immigration						<0.001
First generation	NA	432 (83.2)	206 (96.3)	135 (98.5)	141 (100.0)	
Second generation	NA	87 (16.8)	8 (3.7)	2 (1.5)	0 (0.0)	
Education level, n (%)						<0.001
Secondary or higher	15 023 (67.2)	420 (80.8)	135 (63.1)	18 (13.1)	10 (7.3)	
Primary or less	7337 (32.8)	99 (19.2)	79 (36.9)	119 (86.9)	129 (92.7)	
SES neighbourhood, n (%)						
First quartile	6395 (28.6)	174 (33.5)	22 (10.3)	7 (5.1)	9 (6.4)	<0.001
Second quartile	6010 (26.9)	130 (25.0)	35 (16.4)	4 (2.9)	0 (0.0)	
Third quartile	4733 (21.2)	98 (18.9)	22 (10.3)	12 (8.8)	23 (16.3)	
Fourth quartile	5222 (23.3)	116 (22.5)	135 (63.1)	113 (82.5)	109 (77.3)	

*P values are based on χ^2 test for categorical variables and one-way analysis of variance for continues variables. Missing N (%) for variables: age=574 (2%); sex=9 (<1%); living arrangement=0 (0%); marital status=49 (<1%); generation of immigration=0 (0%); education level=193 (1%); SES neighbourhood=386 (2%).
NA, not applicable; SES, socioeconomic status.

items using a modified version of the Katz *et al* instrument.[31 32] Persons could indicate whether they needed help (yes/no) with the following activities: bathing, dressing, toileting, incontinence, sitting down, eating. The component 'IADL limitations' was measured by nine items using a modified version of the Katz *et al* instrument.[31 32] Persons could indicate whether they needed help (yes/no) with the following activities: using the telephone, travelling, shopping, preparing a meal, cleaning, taking medications, handling finance, brushing hair and walking. The component 'HRQoL' was measured by using the six items of the EuroQol 5D+C.[33] Persons could indicate whether they had problems (no/some/extreme) with the following: mobility, self-care, usual activities, pain/discomfort, anxiety/depression and cognition. The component 'psychosocial health' was measured with five items of the RAND-36.[34] Persons could indicate how much of the time in the past month (none/a little/some/a good bit/most/all) they had been the following: nervous, calm, downhearted, happy and down in the dumps, and how much time (none/a little/some/most/all) health problems had interfered with social activities. The component 'SRH' was measured with two items of the RAND-36,[34] one regarding perceived current health status (poor/fair/good/very good/excellent) and one regarding perceived changes in health in the past year (much worse/slightly worse/about the same/a little better/much better). The score for distinct components of the TOPICS-Frailty Index was calculated analogous to the TOPICS-Frailty Index, by adding up the health deficits within the component that a person had, divided by the total of possible health deficits included in the component.[9] Higher scores represent a higher proportion of health deficits for that component. We accepted no missing variables for the SRH component score and a maximum of one of three missing variables for the other frailty component scores.

Potential confounders

We incorporated the following potential confounders in this study: gender, age, living arrangement, marital

Table 2 Frailty and frailty components by ethnic background of 23 371 persons of The Older Persons and Informal Caregivers Survey Minimum DataSet

	Dutch n=22 360	Indonesian n=519	Surinamese n=214	Moroccan n=137	Turkish n=141	P values*
FI, mean (SD)†	0.19 (0.12)	0.20 (0.12)	0.22 (0.16)	0.24 (0.12)	0.29 (0.15)	<0.001
Frailty, % (95% CI)‡	28.0 (27.4 to 28.6)	32.2 (28.3 to 36.3)	36.9 (30.7 to 43.6)	43.1 (35.0 to 51.5)	58.2 (49.9 to 66.0)	<0.001
Morbidities, mean FI (SD)†	0.16 (0.12)	0.17 (0.13)	0.18 (0.15)	0.16 (0.09)	0.21 (0.14)	<0.001
No morbidities, mean (SD)	2.51 (1.88)	2.68 (2.01)	2.75 (2.34)	2.50 (1.43)	3.28 (2.28)	<0.001
ADL limitations, mean FI (SD)†	0.09 (0.16)	0.09 (0.15)	0.10 (0.20)	0.09 (0.18)	0.14 (0.23)	0.002
No ADL limitations, mean (SD)	0.52 (0.93)	0.51 (0.90)	0.63 (1.20)	0.52 (1.05)	0.83 (1.38)	0.002
IADL limitations, mean FI (SD)†	0.20 (0.24)	0.24 (0.26)	0.25 (0.30)	0.36 (0.29)	0.40 (0.28)	<0.001
No IADL limitations, mean (SD)	1.36 (1.63)	1.67 (1.78)	1.78 (2.08)	2.50 (2.06)	2.77 (1.94)	<0.001
HRQoL, mean FI (SD)†	0.21 (0.16)	0.21 (0.16)	0.24 (0.20)	0.26 (0.18)	0.35 (0.23)	<0.001
Psychosocial health, mean FI (SD)†	0.25 (0.18)	0.25 (0.17)	0.29 (0.21)	0.39 (0.15)	0.40 (0.16)	<0.001
Self-rated health, mean FI (SD)†	0.57 (0.17)	0.58 (0.18)	0.62 (0.18)	0.64 (0.17)	0.67 (0.19)	<0.001

*P values are based on one-way analysis of variance for continues variables and X^2 test for categoical variable.
† Mean FI = mean number of health deficits reported/total health deficits measured in instrument; score between 0 and 1 where higher scores represent worse health.
‡ Scores ≥ 0.25 indicate frailty. Missing N (%) for variables: morbidities=542 (2%); ADL=43 (<1%); IADL=76 (<1%); psychosocial health=465 (2%); HRQoL=534 (2%); self-rated health=72 (<1%).
ADL, activities of daily living; FI, Frailty Index; HRQoL, health-related quality of life; IADL, instrumental activities of daily living.

Table 3 Association of ethnic background with frailty among 23 371 persons of The Older Persons and Informal Caregivers Survey Minimum DataSet

	N	Frailty Index (score 0–1) B (95% CI)†	Frailty (yes) OR (95% CI)‡
Dutch	22 360	Ref	Ref
Indonesian	519	0.003 (–0.006 to 0.012)	1.09 (0.89 to 1.34)
Surinamese	214	0.042* (0.026 to 0.058)	1.98* (1.42 to 2.78)
Moroccan	137	0.065* (0.041 to 0.089)	2.86* (1.73 to 4.72)
Turkish	141	0.121* (0.098 to 0.143)	6.18* (3.86 to 9.88)

*P<0.001.
†Values are derived from multilevel multivariable linear regression.
‡Frailty Index score ≥0.25; values are derived from multilevel multivariable logistic regression. The models are adjusted for: age, sex, living arrangement (alone/not alone) and education level.

status, generation of immigration, education level and socioeconomic status of the neighbourhood. Age in years was assessed by asking year of birth. Living arrangement was assessed by asking whether participants were living: independent alone or independent with others. We categorised answers into 'not alone' and 'alone'. Marital status was assessed by asking whether participants were: married, divorced, widowed, unmarried, long-term cohabitation unmarried. We categorised answers into 'married/cohabitant partners', 'divorced', 'widowed' and 'single'. Generation of immigration was assessed by country of birth of participant and his/her parents. We categorised answers into 'first generation' when the person was born in a country other than the Netherlands and 'second generation' if the person was born in the Netherlands and (one of) the parents were born in another country. Socioeconomic status was assessed with both education level and neighbourhood socioeconomic status. TOPICS-MDS uses the 1997 International Standard Classification of Education[35] to assess education level; participants were asked whether they had completed: fewer than 6 years of primary school; 6 years of primary school; primary school without further completed education; vocational school; secondary professional education or university entrance level or tertiary education. We categorised the level of education into 'primary education or less' and 'secondary education or higher'. For the neighbourhood socioeconomic status, the 2006 reference scores for area codes were used, as calculated by the Netherlands Institute for Social Research[36] based on the education level, income and labour market position of persons living in each area code. We categorised scores into quartiles: quartile 1 is the least deprived quartile and quartile 4 is the most deprived.

Statistical analysis

We calculated the statistical significance of differences in sociodemographic characteristics, frailty and frailty components (morbidities, ADL limitations, IADL limitations, psychosocial health, HRQoL and SRH) by ethnic background using χ^2 tests for categorical variables and one-way analysis of variance for continues variables.

To examine the association of ethnic background with frailty and with distinct frailty components, we estimated multilevel random-intercept models because data were clustered in studies.[37] As such dependency between the observations of participants of a study (because of sampling design and or inclusion criteria) was taken into account. We built one multilevel linear regression model for the continues TOPICS-Frailty Index outcome and one multilevel logistic regression model for the dichotomous outcome 'frailty', with ethnic background as independent variable. We furthermore built six separate multilevel linear regression models for the six frailty component outcomes with ethnic background as independent variable. Only potential confounders that led to a substantial change in effect estimates in the association between ethnic background and frailty (ie, ≥10% change) were included in all models: age, sex, living arrangement (alone/not alone) and education level.[38] Marital status was excluded due to multicollinearity with living arrangement. Interaction effects of ethnic background with age, sex, living arrangement and education level on frailty and the six frailty components were assessed.

Percentages of missing values in the covariates were 2% or less (table 1). Because the missing values were not completely at random, multiple imputation was used to deal with the missing values in the covariates. Five imputed datasets were created using a fully conditional specified model, thus taking into account the uncertainty of imputed values.[39] We used pooled estimates from these five imputed datasets to report regression coefficients and their 95% CIs. We considered a p value of. 05 or lower to be statistically significant and used Bonferroni correction for testing explorative interactions (p value=0.05/4).[40] Descriptive analyses were performed using SPSS V.23.0 (IBM SPSS. Multilevel linear regression analyses were performed using R- V.3.3.2 using lme4 package.

Non-response analysis

A comparison of persons included in the study (n=23 371) with persons not included due to missing values for the TOPICS-Frailty Index and/or country of birth (n=4414) did not indicate significant differences in terms of age (p=0.872), sex (p=0.779), living arrangement (p=0.444) and marital status (p=0.166). However, excluded persons were more often living in rural areas and in deprived neighbourhoods (p<0.001) than persons included in the study.

RESULTS

Table 1 presents the characteristics according to ethnic background. The mean age was 77.8 years (SD=7.0 years) and 58.9% were female. Four per cent of the sample had a non-Dutch ethnic background and the majority of these persons (90.4%) were first-generation immigrants. Sex differed between the ethnic groups (p=0.003), as did age, living arrangement, marital status, generation of immigration, education level and the socioeconomic status of the neighbourhood persons were living in (all p<0.001).

The proportion of persons who were frail differed according to ethnic background (p<0.001; table 2). Mean TOPICS-Frailty Index scores varied from 0.19 (SD=0.12) among persons with a Dutch background to 0.29 (SD=0.15) in persons with a Turkish background. The distinct frailty component scores also differed according to ethnic background (p≤0.002 or lower; table 2).

Multilevel regression analyses adjusted for age, sex, living arrangement and education level showed that persons with a Turkish, Moroccan or Surinamese background were frailer compared with persons with a Dutch background (p<0.001 for all groups; table 3). There were no significant differences in frailty between persons with a Dutch background and persons with an Indonesian background.

The associations of ethnic background with six distinct frailty component scores are presented in table 4. All groups with a non-Dutch background had higher IADL limitations scores compared with persons with a Dutch background (p<0.05 or lower for all groups). Psychosocial and SRH scores were only higher among persons with a Moroccan or Turkish background compared with persons with a Dutch background (p<0.001 for both groups). Out of all groups with a non-Dutch background, only persons with a Turkish background had higher scores for all frailty components compared with persons with a Dutch background (p<0.001 for all components).

We found significant effect modification by education level and age in the association of ethnic background with frailty (p<0.01 for both). We, therefore, present results stratified by education level in online supplementary table S1 and stratified by age in online supplementary table S2.

DISCUSSION

We found that older persons with a Turkish, Moroccan or Surinamese background were frailer compared with persons with a Dutch background. We did not find differences in frailty in persons with an Indonesian background compared with persons with a Dutch background. Studying distinct components of frailty separately showed that all groups with a non-Dutch background had more IADL limitations compared with persons with a Dutch background.

In our study, ethnic differences in frailty persisted after controlling for age, sex, living arrangement and education level. Van Assen *et al*, who used the Tilburg

Table 4 Association of ethnic background with six distinct frailty components; among 23 371 persons of The Older Persons and Informal Caregivers Survey Minimum DataSet

	N	Morbidities		ADL limitations		IADL limitations		Psychosocial health		Health-related quality of life		Self-rated health	
		B	(95% CI)	B	(95% CI)	B	(95% CI)	B	(95% CI)	B	(95% CI)	B	(95% CI)
Dutch	22 360	Ref		Ref		Ref		Ref		Ref		Ref	
Indonesian	519	0.002	(−0.008 to 0.012)	−0.007	(−0.020 to 0.006)	0.019*	(0.001 to 0.036)	−0.003	(−0.018 to 0.011)	−0.001	(−0.014 to 0.013)	0.001	(−0.013 to 0.015)
Surinamese	214	0.020*	(0.004 to 0.036)	0.046**	(0.024 to 0.067)	0.100**	(0.070 to 0.130)	0.017	(−0.012 to 0.046)	0.041**	(0.018 to 0.063)	0.013	(−0.010 to 0.037)
Moroccan	137	0.041**	(0.016 to 0.066)	0.010	(−0.021 to 0.042)	0.150**	(0.104 to 0.195)	0.078**	(0.025 to 0.130)	0.066**	(0.031 to 0.100)	0.070**	(0.034 to 0.106)
Turkish	141	0.098**	(0.075 to 0.122)	0.067**	(0.037 to 0.098)	0.203**	(0.159 to 0.247)	0.092**	(0.043 to 0.142)	0.161**	(0.129 to 0.194)	0.098**	(0.063 to 0.132)

Values are derived from multilevel multivariable linear regression. The models are adjusted for confounders: age, sex, living arrangement (alone/not alone) and education level.
*P<0.05; **P<0.001.
ADL, activities of daily living; IADL, instrumental activities of daily living.

Frailty Index to measure frailty, also found that persons with a Surinamese, Moroccan or Turkish background were frailer compared with persons with a Dutch background.[22] A European study found that in Northern and Western Europe, immigrants who were born in low-income or middle-income countries demonstrated higher levels of frailty compared with native-born Europeans and immigrants born in high-income countries.[41] However, while socioeconomic disadvantage among these immigrant groups plays an important role in the explanation of these differences, other factors such as poor healthcare experience and discrimination are also thought to be important.[42–44] Communication with healthcare providers can be challenging and care is often not adapted to specific needs of immigrant groups.[45] This high level of frailty among these older immigrants could therefore reflect the accumulation of health risks over the life course. A recent Dutch study found that cardiovascular and psychiatric diseases contributed most strongly to the disease burden among non-Western immigrants.[18] They estimated that their disease burden will increase stronger in the coming decades compared with persons with a Dutch background.[18] Targeted health interventions should therefore be developed in order to reach these immigrant groups, at older age, and at younger ages in order to prevent frailty and reduce functional decline.

All groups with a non-Dutch ethnic background had higher IADL limitations component scores compared with persons with a Dutch background. A Swedish study found an increased risk of impaired IADL among older immigrants from low-income and middle-income countries compared with persons with a Swedish background.[46] In frailty instruments that do not take into account IADL limitations, such as the Fried phenotype or the Tilburg Frailty instrument, ethnic inequalities in frailty might be smaller. However, it is likely that help provided by the social network of an older person in performing instrumental activities differs culturally. Van Assen *et al* found that social frailty was higher in older persons with a Turkish or Surinamese, but lower in those with a Moroccan background compared with persons with a Dutch background.[22] Interventions should take into account whether additional support is needed for older immigrants to live independently and to what extent there is a burden for their caregivers.

This study also found important differences between immigrant groups. Psychosocial health component scores were higher among persons with a Turkish or Moroccan background but not among persons with a Surinamese background compared with those with a Dutch background. Other studies have found that both psychological frailty as well as psychiatric diseases are more common among Turkish and Moroccan immigrants than among Surinamese immigrants.[18 20 22] It has been suggested that a lower acculturation, higher discrimination and the distinct nature of the migration history of Turkish and Moroccan immigrants compared with Surinamese immigrants might be at the root of these differences.[18 20 46] These findings emphasise the importance of studying immigrant groups separately and developing intervention strategies targeted at specific needs of different immigrant groups.

The main strength of this study is that we were able to study frailty with a validated Frailty Index among an ethnically diverse group of older persons, as research on frailty among older immigrants is scarce. Furthermore, the TOPICS-MDS questionnaire was translated into the native languages of the main ethnic minority groups in the Netherlands as well as cross-culturally adapted. This study has some limitations. Although the TOPICS-MDS is a large database, there were relatively few persons with a Turkish or Moroccan background. Exploratory stratified analyses by education level and age therefore had less power, but could provide a starting point for future studies. Future studies among older persons should include more persons from ethnic minority groups to study ethnic differences in frailty in subgroups by sociodemographic characteristics such as age and education level. Second, although the operationalisation of the TOPICS-Frailty Index used in this study was validated, the operationalisation of the distinct frailty components as used in this study was not. These components consisted of validated tools such as the Katz *et al* instrument[31 32] and the EuroQol 5D+C,[33] but were operationalised with an accumulation-of-deficits approach. The operationalisation of individual frailty components should therefore be validated in further research. Third, our study used data from 29 studies with samples that varied regarding sampling frame, inclusion criteria, study design, sample size and data collection method. In the main analyses, we used meta-analyses techniques to correct for clustering between subjects in projects. However, we believe that these pooled data are likely to reflect reality better than data from a single project based on one non-random sample. Last, ethnic background was determined by country of birth, which is the standard in the Netherlands. This may be less reliable in some groups such as Surinamese who are ethnically diverse.

In conclusion, older persons with a Turkish, Moroccan or Surinamese background were frailer compared with persons with a Dutch background. Targeted intervention strategies should be developed for the prevention and reduction of frailty among these older immigrants. These strategies should also be targeted at the younger–old and meet the specific needs of different immigrant groups, such as psychosocial health among older persons with a Turkish or Moroccan background.

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Contributors CBF designed the study and was the project administrator, did data curation and quantitative analyses for the study, and wrote the first draft and final draft of the manuscript. HR designed the study and advised on the interpretation of findings, made critical revisions and approved the final version. AvG advised on study design and interpretation of findings, made critical revisions and approved the final version. JACR advised on study design, made critical revisions and approved the final version. LQ did data curation for the TOPICS-MDS database, made critical revisions and approved the final version of the manuscript. RJFM made critical revisions and approved the final version of the manuscript.

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Competing interests None declared.

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Data sharing statement Studies using the TOPICS-MDS data are subject to the Dutch law on medical research among humans (Wet Medisch-Wetenschappelijk Onderzoek met mensen, WMO). It is not allowed by the WMO law that de-identified data are provided to others without restriction. The research ethics committee of the Radboud University Medical Center has approved the use of TOPICS-MDS data and supervises research leaders to conduct accordingly. The data are only available on request after signing a data usage agreement form of the TOPICS-MDS data repository (http://topics-mds.eu/). Applications are assessed by the TOPICS Project Group and TOPICS Societal board, who may be contacted at topics-mds@radboudumc.nl.

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