Key points

- Use of home-measured height, weight, waist circumference and derived BMI can be recommended in epidemiologic studies, when anthropometric data is needed for adolescents.
- Home-measured values are almost as accurate as and substantially less expensive than objectively measured.

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The prevalence and impact of risk factors for ethnic differences in loneliness

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Background: Previous studies have demonstrated that loneliness is more frequently present in citizens of ethnic minority groups than in natives. The current study investigates whether ethnic differences in emotional and social loneliness between Moroccan, Turkish, Surinamese and Dutch adults living in the Netherlands are due to ethnic differences in the presence and/or impact of an array of possible risk factors, such as partnership, health and socioeconomic status. **Methods:** The data were collected in 2012 as a part of a general health questionnaire of the Public Health Services in the four major cities of the Netherlands, containing 20.047 Dutch, 1.043 Moroccan, 1.197 Turkish and 1.900 Surinamese respondents. **Results:** Structural equation models showed that ethnic differences in emotional and social loneliness can be ascribed to ethnic differences in the prevalence and impact of several risk factors. Main findings were that all three ethnic minority groups reported feeling less healthy and more discriminated against than the Dutch group, which was related to increased loneliness. Perceived financial difficulties and people in the neighbourhood not getting along had more impact on feelings of loneliness for the Turkish group than loneliness for the other ethnic groups. Furthermore, members of the Turkish group were found more at risk to feel anxious or depressed, which was in turn related to increased loneliness. **Conclusions:** Policy makers are encouraged to develop multifaceted prevention strategies concerning those risk factors that are most changeable, thereby focusing per risk factor on those ethnic groups for which it is an important contribution to loneliness.

Introduction

Loneliness is a major public health problem, especially in large cities.[1] Feeling lonely is not only related to a decrease in personal wellbeing and a less healthy lifestyle[2] but also for elderly it leads to a decrease in mobility[3] and a higher chance of morbidity.[4] The high prevalence and substantive consequences of loneliness urge policy makers to diminish and prevent this problem, which evokes the need to point out which groups of citizens are at risk and why.

According to Weiss,[5] loneliness can be divided into emotional and social, where emotional loneliness refers to an experienced lack of a specific intimate relationship and social loneliness to a discrepancy between the admired and actual amount of social relations. In terms of prevention, this distinction is highly relevant because emotional and social loneliness can have different determinants.

Previous studies in several European countries have demonstrated that feelings of emotional and social loneliness are more frequently present in ethnic minority group members than in natives.[6,7] For instance, a study of the Public Health Service of Amsterdam showed that 26% of the Turkish citizens in Amsterdam feel severely lonely, compared with 15% of the Moroccan and Surinamese, and only 7% of the Dutch citizens.[8]

For the purpose of prevention, it is essential to know the cause of these ethnic differences in loneliness, but research on this topic is scarce[9] and exclusively concerns elderly. Fokkema and Naderi[6] showed that the higher prevalence of loneliness in Turkish-German elderly was entirely due to their low socioeconomic status and poor perceived health, thereby demonstrating a full mediation effect. Van Tilburg et al.[10] found that for elderly living in Italy, the absence of a partner was associated with more emotional loneliness than for elderly living in the Netherlands and Canada. Sundström et al.[11] instead demonstrated interaction effects for gender and perceived health. More research in more and different ethnic groups and a broader age range is needed to understand which risk factors are playing a mediating and/or moderating role in ethnic differences in loneliness.

The aim of the present study is to investigate whether ethnic differences in social and emotional loneliness can be explained by ethnic differences in the prevalence or impact of risk factors for loneliness, thereby focusing on Turkish, Moroccan, Surinamese and native Dutch citizens of 19 years and older living in the Netherlands. These ethnic minority groups are considered as the largest minority groups in the Netherlands. Turkish and Moroccan citizens are (children or spouses of) former 'guest workers', and Surinamese citizens are (children of) postcolonial migrants[12].

Methods

Participants and procedure

The data in this study were collected in 2012 as a part of a general health questionnaire of the Public Health Services in the four major cities of the Netherlands (Amsterdam, Rotterdam, The Hague and Utrecht). From the municipal population registers, random samples were drawn of 71.627 non-institutionalised residents aged 19 years and older. Ethnicity was determined by country of birth or, in case of second-generation immigrants, country of birth of the mother and/or father. Respondents received a letter in which they were asked to fill out the questionnaire on the internet or on paper in the Turkish or Dutch language. The translation of the Turkish questionnaire was in a back and forth manner by certified translators. Depending on the composition of the population in each city, non-respondents of the city's major ethnic minority groups were approached by telephone or by visiting the respondent's address. In some cases, face-to-face or telephonic interviews were conducted by a trained interviewer in the respondent's preferred language (Dutch, Turkish, Arabic, Berber and English). This procedure resulted in 20.047 Dutch (response rate: 48%), 1.043 Moroccan (26%), 1.197 Turkish (26%) and 1.900 Surinamese (28%) respondents.

Instruments
Loneliness

For the measurement of loneliness, the 11-item De Jong Gierveld Loneliness Scale (DJGLS) was used,[13] consisting of five items on social loneliness and six items on emotional loneliness (Supplementary table 1). Response categories were 'no' (0), 'more or less' (1) and 'yes' (2). In line with previous studies, the psychometric properties of the DJGLS were satisfying[13–15]: exploratory and confirmatory factor analyses in Mplus showed a good fit of a two-factor structure with an emotional and social component (fit indices upon request). Furthermore, cultural measurement invariance of the scale was demonstrated: the configural model (free estimation of factor loadings and thresholds) was compared with a more restrictive model (factor loadings and thresholds constrained to be equal), showing the presence of strong invariance (ΔCFI = 0.001; ΔMcDonald's NCI = 0.0042; Supplementary table 2). Therefore, it can be concluded that Dutch, Moroccan, Turkish and Surinamese respondents interpreted the individual items of the DJGLS in the same way.

Demographic

Civil status distinguished between (0) living with a partner (spouse or living together) and (1) living without a partner (never married, divorced and widowed individuals).

Socioeconomic

Education reflected the highest obtained educational level and consisted of the categories 'none (primary school or lower)' (0), 'low (lower secondary education)' (1), 'middle (upper secondary education)' (2) and 'high (post secondary or tertiary education)' (3). In order to measure *perceived financial situation*, respondents were asked to state whether they could get by with their income 'comfortably' (0), 'fairly easy' (1), 'with some difficulties' (2), or 'with great difficulties' (3). *Employment situation* was measured by several questions, asking about whether or not the respondent was employed, retired, incapacitated, housewife/houseman, a student and/or receiving welfare, which were coded as no (0) or yes (1).

Health

Perceived health was measured by asking respondents to rate their general health from 'very bad' (0) to 'very good' (4). Based upon a list of 19 chronic diseases, respondents were classified into having no (0) or one or more *chronic disease(s)* (1). *Anxiety/depression* was measured by the Kessler Psychological Distress Scale (K10),[16] consisting of five items about anxiety and five items about depression, with answer categories ranging from 'never' (0) to 'always' (4). The K10 proved a valid and reliable instrument in Dutch as well as Moroccan and Turkish populations.[17–19]

Neighbourhood

Data of the municipal personal record database were used to determine whether (1) or not (0) respondents *live in a deprived neighbourhood*, i.e. a neighbourhoud with an accumulation of complex problems, such as unemployment, health deprivation and criminality.[20] For the measurement of *satisfaction with the neighbourhood*, respondents were asked to rate their living environment on a scale ranging from very unsatisfied (0) to very satisfied (9). In order to measure whether the *neighbours get along well*, respondents were asked to what extent they agreed with the proposition that the people in the neighbourhood, in general, get along well. Answer categories ranged from totally disagree (0) to totally agree (4). Respondents were asked whether (1) or not (0) they sometimes *help neighbours* and whether they (almost) never (0), sometimes (1) or often (2) have *contact with neighbours* living in their street.

Other factors

In order to measure *perceived discrimination* respondents were asked whether they ever felt discriminated against because of their religion, skin colour, sexual orientation or age. Answer categories were never

Table 1 Descriptive statistics for loneliness and risk factors for loneliness for the four ethnic groups separately and test statistics (χ^2 or F) for differences between the four groups

Characteristics	Ethnicity Dutch $n = 19\ 318$	Moroccans $n = 1009$	Turks $n = 1164$	Surina-mese $n = 1803$	Significance test
Demographic					
Female	55.2	50.4	52.0	59.1	$\chi^2 = 25.29^*$
Age, mean (SD)	54.9 (20.8)[A]	45.5 (16.5)[B]	43.3 (16.6)[B]	51.1 (18.6)[C]	$F = 190.4^*$
Living without partner	44.2	26.8	34.9	63.5	$\chi^2 = 426.6^*$
Socioeconomic					
Education					$\chi^2 = 2041.3^*$
High	35.0	13.5	14.4	19.0	
Middle	24.4	20.0	24.7	27.4	
Low	31.1	19.9	21.6	31.7	
None/primary	9.5	46.6	39.4	21.9	
Perceived financial situation					$\chi^2 = 2251.8^*$
Comfortable	38.9	18.5	13.9	15.5	
Fairly easy	39.3	29.0	24.5	32.9	
Some difficulties	16.8	31.8	34.1	30.8	
Great difficulties	5.0	20.7	27.6	20.7	
Employment situation					
Paid job	48.7	37.0	43.7	48.1	$\chi^2 = 56.8^*$
Retired	33.0	14.6	11.3	22.9	$\chi^2 = 398.4^*$
Unemployed	2.9	6.3	7.3	8.1	$\chi^2 = 184.7^*$
Incapacitated	4.0	9.0	13.1	8.6	$\chi^2 = 261.9^*$
Welfare	1.6	10.6	8.8	9.3	$\chi^2 = 669.0^*$
Housewife/houseman	14.0	24.2	20.5	9.1	$\chi^2 = 146.5^*$
Student	9.2	8.5	10.5	9.4	$\chi^2 = 2.6$
Health					
Good perceived health	71.7	49.2	48.0	53.5	$\chi^2 = 665.7$
Chronic disease	63.7	67.5	72.2	72.0	$\chi^2 = 73.0^*$
Anxiety/depression[2]					$\chi^2 = 1185.9^*$
Moderate	37.1	43.4	45.7	41.0	
Severe	5.7	19.0	27.2	14.2	
Neighbourhood					
Living in deprived neighbourhood	33.7	78.6	79.6	65.2	$\chi^2 = 2171.9^*$
Satisfaction neighbourhood	6.63 (1.8)[A]	5.6 (2.3)[B]	5.5 (2.6)[B]	6.12 (2.1)[C]	$F = 231.2^*$
Neighbours get along well	62.2	45.6	45.7	42.4	$\chi^2 = 422.2^*$
Contact with neighbours					$\chi^2 = 147.3^*$
Frequent	72.9	68.7	67.9	65.0	
Sometimes	12.8	11.4	10.1	12.0	
(Almost) never	14.3	19.9	21.9	23.0	
Helping neighbours	63.6	55.9	59.8	45.2	$\chi^2 = 233.7^*$
Volunteer work	23.6	11.0	13.1	13.5	$\chi^2 = 215.4^*$
Perceived discrimination	9.6	46.2	47.7	40.5	$\chi^2 = 2921.4^*$
Loneliness					
Emotional (mean (SD); 0-10)[a]	2.1 (3.1)[A]	3.0 (3.5)[B]	4.5 (3.8)[C]	3.1 (3.7)[B]	$F = 257.1^*$
Social (mean (SD); 0-10)[a]	2.5 (2.9)[A]	3.7 (3.2)[B]	4.2 (3.2)[C]	3.7 (3.1)[B]	$F = 206.2^*$
Moderate or severe emotional loneliness[b]	28.8	39.5	58.7	40.4	$\chi^2 = 532.0^*$
Moderate or severe social loneliness[b]	39.2	53.0	63.1	56.2	$\chi^2 = 451.1^*$

Notes: Means with different higher case capital letter superscripts A, B and C within rows are significantly different at the $P < 0.05$ level based on Bonferroni *post hoc* comparisons. Means are based on a non-weighed sample.

a: To enhance the comparability of the sub-scales, ranges were transformed to 0–10.

b: For interpretation and comparability purposes, descriptive statistics of the observed scale are displayed. Cut-off values anxiety/depression: 19 (moderate) and 30 (severe). Cut-off values for moderate to severe loneliness: two or more times answered 'more or less' or 'yes'.

*: $P < 0.001$.

(0) and sometimes or often (1). *Volunteer work* was measured by a yes (1) or no (0) question.

Statistical analyses

Analyses were performed using structural equation modelling (SEM) in Mplus (version 7.11), which allows for multi-group analyses and regression analyses with latent variables, leading to more accurate estimations than other techniques.[21] Since the DJGLS contains three answering categories, a weighted least square estimator (WLSMV; DELTA parameterisation) was used[22]. Model parameters were estimated using pairwise present data.[23]

Ethnic differences in risk factors for loneliness were investigated with two separate regression analyses (interaction and mediation model) on the latent emotional and social loneliness scales. The root mean square error of approximation (RMSEA), Comparative Fit Index (CFI) and Tucker Lewis Index (TLI) were used as fit statistics. In general, a good fitting model has an RMSEA value ≤ 0.05 and CFI and TLI values ≥ 0.95,[24] whereas an RMSEA value ≤ 0.08 and CFI and TLI values ≥ 0.90 indicate reasonable fit. The commonly used χ^2 fit statistic was not used in this study to evaluate model fit because it is too sensitive to large sample sizes,[25] but it is still mentioned because it is involved in the computation of the other fit indices.

Results

Descriptive statistics

Table 1 shows that the Dutch group was, on average, older and higher educated than the three ethnic minority groups. In

Table 2 Parameter estimates (standardised regression coefficients) of regression analyses on the relation between risk factors and (latent) social and emotional loneliness for the four ethnic groups separately and Wald test statistics for differences between the four groups (*n* = 17 850)

Risk factors	Emotional loneliness				Wald χ^2	Social loneliness				Wald χ^2
	Dutch (n = 15,005)	Moroccans (n = 749)	Turks (n = 836)	Surinamese (n = 1,260)		Dutch (n = 15,005)	Moroccans (n = 749)	Turks (n = 836)	Surinamese (n = 1,260)	
Demographic										
Female	−0.15***A	−0.35**B	−0.15AB	−0.24***AB	5.06	0.04*	0.03	−0.05	−0.05	2.88
Age	0.20***A	−0.06BC	−0.18**B	−0.03C	42.36***	0.05**	0.04	0.01	−0.02	1.45
Living without partner	0.21***A	0.11AB	−0.06B	0.13AB	9.27*	0.52***A	0.36**AB	0.22**B	0.24**AB	17.05**
Socioeconomic										
Education										
High (REF)										
Middle	0.18***	0.10	0.15	0.11	0.88	0.11***	−0.15	0.09	0.10	3.17
Low	0.23***	0.26	0.27*	0.32**	1.74	0.22***	−0.06	0.20	0.24*	3.93
None/primary	0.10***	0.30*	0.09	0.23*	2.74	0.29***A	−0.02B	−0.01B	0.49***A	14.75**
Perceived income										
Comfortable (REF)										
Fairly easy	0.03A	−0.14 AB	−0.25*B	−0.11AB	12.71***	−0.00A	−0.19AB	−0.30**B	−0.23**B	18.67***
Some difficulties	0.13***A	−0.07AB	−0.13B	0.00AB	12.42**	0.13***A	−0.11B	−0.17*B	−0.10B	22.46***
Great difficulties	0.53*** A	0.18B	0.54*A	0.18B	28.18***	0.60***AB	0.46 AB	0.65**A	0.21B	16.64***
Employment situation										
Paid job	−0.01	0.11	−0.14	−0.11	2.56	−0.02	−0.15	−0.12	−0.07	1.48
Retired	0.00	0.12	−0.14	−0.06	1.24	0.01	−0.14	−0.12	−0.07	1.34
Unemployed	0.22***A	0.64**B	−0.03C	0.16AC	7.35	0.27***	0. 17	−0.11	0.26*	6.92
Incapacitated	0.21***	0.70**	0.36**	0.14	7.54	0.20***	0.42*	0.38**	0.20	2.80
Welfare	0.33*** A	0.61**A	0.30*AB	−0.01B	11.10*	0.14*	0.08	0.14	0.05	0.33
Housewife/houseman	0.07	0.27	−0.01	0.03	2.10	0.07*	−0.12	0.19	0.18	3.67
Student	−0.14***	−0.01	−0.30	−0.07	1.94	−0.16***	−0.22	−0.36*	0.14	6.60
Health										
Good perceived health	−0.35***	−0.19	−0.40***	−0.31***	1.85	−0.48***	−0.39**	−0.45***	−0.53***	3.28
Chronic disease	0.07**	−0.01	0.16	0.14	1.75	0.07**	0.06	0.08	0.09	0.28
Anxiety/depression	0.25***	0.30***	0.27***	0.34***	3.25	0.38***AC	0.41***AB	0.42**B	0.44***C	16.52***
Neighbourhood										
Living in deprived neighbourhood	−0.08***	−0.08	−0.03	−0.04	0.67	−0.05*	−0.03	−0.02	−0.14*	2.46
Satisfaction neighbourhood	−0.12***	−0.09*	−0.10*	−0.08*	5.10	−0.11***	−0.04	−0.13**	−0.08**	5.11
Neighbours get along well	−0.11***A	−0.20*AB	−0.30***B	−0.02C	13.00**	−0.09***	−0.20*	−0.16*	−0.03	2.71
Contact with neighbours										
Frequent (REF)										
Sometimes	0.24***	0.41**	0.10	0.10	6.87	0.17***	0.30*	0.35*	0.19*	2.86
(Almost) never	0.30***	0.36**	0.38***	0.27**	4.26	0.23***	0.30**	0.44***	0.24**	5.08
Helping neighbours	−0.06*	−0.14	0.02	−0.11	2.90	−0.06*	−0.08	0.03	−0.05	1.43
Volunteer work	−0.10***	0.15	−0.06	−0.02	2.98	−0.12 ***	0.06	−0.04	−0.03	2.48
Perceived discrimination	0.30***	0.20*	0.08	0.28***	5.34	0.30***	0.16	0.17*	0.27***	5.10

Notes: The CFI and TLI values indicate moderate fit of the model, but the RMSEA is good (χ^2 (2912) = 25326.24, *P* < 0.001; RMSEA = 0.04; CFI = 0.88, TLI = 0.87). Significant p-values indicate a relation between a risk factor and loneliness for the specific ethnic group. Significant Wald tests indicate interaction effects between the groups, specified with higher case superscripts (A, B, C) for which group(s) the found interaction effect holds (on a *P* < 0.05 level).
'Great difficulties with making ends meet' and 'anxiety/depression' were allowed to covary, which is theoretically justified, since poverty has been found as a risk factor for depression.[26]
***P* < 0.001; ***P* < 0.01; *P* < 0.05.

addition, considerable ethnic differences were found for perceived financial situation, anxiety/depression, living in a deprived neighbourhood and perceived discrimination. As expected, Turkish respondents experienced, on average, significantly more emotional and social loneliness than Moroccan and Surinamese respondents, who in turn felt, on average, lonelier than Dutch respondents.

Interaction effects

Table 2 shows significant group differences for the relation between several risk factors and emotional and social loneliness. For *emotional loneliness*, interaction effects were found for age, partnership, financial situation, living on welfare and neighbours getting along. More specifically, for Turks emotional loneliness decreased with age (β = −0.18), whereas for the Dutch, the opposite was true (β = 0.20). For Dutch respondents, living without a partner was related to feeling lonely (β = 0.21), whereas no such relationship

was found for Turks. Regarding the financial situation, Dutch and Turkish respondents who perceived great financial difficulties had a higher chance to feel lonely than respondents who got by comfortably (β = 0.53 and β = 0.54, respectively). Living on welfare was related to more loneliness for Moroccans (β = 0.61), Dutch (β = 0.33) and, to a lesser extent, Turks (β = 0.30). Finally, when neighbours did not get along well, this was more strongly negatively related to loneliness for Turks (β = −0.30) than it was for Dutch (β = −0.11), and Moroccans were in between these two groups (β = −0.20).

For *social loneliness*, differences between the ethnic groups were found for partnership, education, financial situation and anxiety/depression. More specifically, living without a partner was related to more loneliness for Dutch (β = 0.52) than for Turkish respondents (β = 0.22). For Dutch and Surinamese, having no or only primary education was related to more loneliness (β = 0.29 and β = 0.49, respectively). Regarding great perceived financial

Table 3 Indirect effects of ethnicity (columns) on social and emotional loneliness (broader columns), mediated by several risk factors (rows) (n = 17 850; Dutch = reference group)

Risk factors	Emotional loneliness			Social loneliness		
	Moroccans	Turks	Surinamese	Moroccans	Turks	Surinamese
Total effect[a]	0.44***	0.59***	0.41***	0.33***	0.80***	0.38***
Total indirect effect	0.98***	1.14***	0.87***	1.22***	1.49***	1.13***
Direct effect[b]	−0.54***	−0.55***	−0.46***	−0.89***	−0.69***	−0.75***
Background variables						
Female	0.01	0.00	−0.00	−0.00	−0.00	0.00
Age	−0.02***	−0.03***	−0.01***	−0.02***	−0.02***	−0.01***
Living without partner	−0.03**	−0.02**	0.04**	−0.09**	−0.05**	0.10***
Socioeconomic						
Education	0.04***	0.04***	0.02***	0.05***	0.04***	0.03***
High (REF)						
Middle	0.00	0.00	−0.00	0.00	0.00	−0.00
Low	−0.03***	−0.03***	0.01	−0.03***	−0.02***	0.00
None/primary	0.13***	0.11***	0.04***	0.19***	0.15***	0.06***
Perceived income						
Comfortable (REF)						
Fairly easy	0.01**	0.01**	0.00*	0.01**	0.02**	0.01**
Some difficulties	0.03***	0.03***	0.03***	0.04***	0.04***	0.03***
Great difficulties	0.03***	0.05***	0.03***	0.02***	0.03***	0.02***
Employment situation						
Paid job	0.05	0.02	0.00	0.06	0.02	0.00
Retired	−0.05***	−0.06***	−0.03***	−0.03***	−0.04***	−0.02***
Unemployed	0.01***	0.01***	0.02***	0.01***	0.02***	0.02***
Incapacitated	0.03***	0.05***	0.03***	0.03***	0.06***	0.03***
Welfare	0.06***	0.05***	0.05***	0.07***	0.05***	0.06***
Housewife/houseman	0.01***	0.01***	−0.01**	0.02***	0.01***	−0.01***
Student	0.00	−0.00	−0.00	0.00	−0.00	0.00
Health						
Good perceived health	0.14***	0.15***	0.12***	0.17***	0.18***	0.14***
Chronic disease	0.02	0.04**	0.04**	0.02	0.04**	0.04**
Anxiety/depression	0.25***	0.42***	0.18***	0.35***	0.59***	0.25***
Neighbourhood						
Living in deprived neighbourhood	0.06***	0.06***	0.04***	0.08***	0.08***	0.06***
Satisfaction neighbourhood	0.10***	0.10***	0.05***	0.02***	0.02***	0.01***
Neighbours get along well	0.06	0.06	0.07	0.06	0.06	0.07
Contact with neighbours						
Frequent (REF)						
Sometimes	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00
Never	0.02***	0.03***	0.04***	0.03***	0.03***	0.04***
Helping neighbours	0.02	0.01	0.04	0.02	0.01	0.05
Volunteer work	0.02***	0.02***	0.02***	0.03***	0.02***	0.02***
Perceived discrimination	0.16***	0.17***	0.14***	0.16***	0.16***	0.13***

Notes: The model fits the data reasonably well (χ^2 (1055) = 7273.22, $P < 0.001$; RMSEA = 0.02; CFI = 0.94, TLI = 0.93). 'Great difficulties with making ends meet' and 'anxiety/depression' were allowed to covary, which is theoretically justified, since poverty has been found as a risk factor for depression.[26]
a: The sum of all indirect and direct effects.
b: Total effect of ethnicity on loneliness minus the total indirect effect.
*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.

difficulties, Turks experienced more loneliness ($\beta = 0.65$) than respondents who got by comfortably, thereby significantly differing from the Surinamese group, for which there was no such relation. For all ethnic groups, anxiety/depression was related to more social loneliness.

Mediation effects

A found significant indirect effect in the mediation model (table 3) means that there was a significant partial mediation by the corresponding risk factor.[27] The total effect was positive for all ethnic groups, whereas the direct effect was negative, indicating that, after taking all the risk factors of this study into account, Moroccan, Turkish and Surinamese respondents experienced substantially less emotional and social loneliness than the Dutch group. The risk factors causing the largest indirect effects ($\beta > 0.10$) were, for social and emotional loneliness, education, perceived health, anxiety/depression and perceived discrimination. Further inspection (not shown in the table) of these indirect effects

revealed that Moroccan, Turkish and Surinamese respondents had a higher chance than the Dutch to perceive their health as moderate to bad ($\beta = 0.23$, 0.24, and 0.18, respectively), which was in turn related to more emotional ($\beta = 0.63$) and social ($\beta = 0.76$) loneliness. Furthermore, Moroccans, Surinamese and, especially, Turks had a higher chance than the Dutch group to experience anxiety/depression ($\beta = 0.59$, 0.43 and 1.01, respectively), which was in turn related to more emotional ($\beta = 0.41$) and social ($\beta = 0.59$) loneliness. Also, Moroccan, Turkish and Surinamese respondents had a higher chance than the Dutch to feel discriminated against ($\beta = 0.37$, 0.38 and 0.31, respectively), which was in turn related to more emotional ($\beta = 0.43$) and social ($\beta = 0.45$) loneliness. Finally, Moroccan and Turkish respondents had a higher chance than the Dutch to have no or a very low education ($\beta = 0.37$ and 0.30, respectively), which was in turn related to more emotional ($\beta = 0.35$) and social ($\beta = 0.51$) loneliness. It must be noted, however, that the relation between education and *social loneliness* solely held for the Dutch and Surinamese group (see the regression coefficients in table 2). Therefore, we conclude that there

was, in fact, no indirect effect of no/low education on *social loneliness* for the Moroccan and Turkish group. For *emotional* loneliness, having no/primary education was still a (real) indirect effect for the Moroccan and the Turkish group.

Discussion

To date, this study is the first to thoroughly examine ethnic differences in emotional and social loneliness. First, the study is large-scale and captures a very broad age range. Second, no other studies to date have investigated differences in risk factors for loneliness between four ethnic groups living in the same country. Finally, by examining the cultural sensitivity of the measurement instrument, followed by an investigation of ethnic differences in the presence (mediation) *and* impact (interaction) of an array of risk factors, this study draws the most complete picture of the reasons behind ethnic differences in loneliness until now.

The results show that ethnic differences in loneliness are due to ethnic differences in several domains: demographic, socioeconomic, health, neighbourhood and perceived discrimination. After the risk factors were added to the mediation model, ethnic differences disappeared and minority group members seemed on average even less lonely than the Dutch group.

The results of this study suggest that the Turkish group living in large cities in The Netherlands is worse off than the other ethnic groups on several risk factors for loneliness. Turks were more prone to feeling emotionally lonely when perceiving financial difficulties and living in a neighbourhood where neighbours do not get along than Moroccan, Surinamese and Dutch citizens. Turks were also more at risk to feel anxious or depressed, which in turn was related to emotional and social loneliness. Moreover, the presence of a partner was to a much lesser extent protective against emotional and social loneliness for the Turkish group than it was for the Dutch group. Furthermore, Turks and Moroccans were more often very low or not at all educated, resulting in a higher risk for emotional loneliness than the Dutch. Finally, Turks, Moroccans and Surinamese reported to feel less healthy and more often discriminated against than the Dutch, which in turn was related to more social and emotional loneliness. Found ethnic differences cannot be ascribed to cultural bias of the measurement instrument because our analyses showed strong measurement invariance and good psychometric properties.

The result that lower socioeconomic status and poorer health left the Turkish group more prone to loneliness is in line with the findings of Fokkema and Naderi[6]. However, in the latter study, ethnic differences were fully explained by these factors, whereas our study shows that other risk factors play a role as well. For example, the sensitivity of Turks to neighbours not getting along. The latter could be explained by the idea that the Turkish group is the most collectivistic of the four ethnic groups in this study[28] and that people from collective cultures are in turn more sensitive to social exclusion (e.g. a neighbourhood with low social cohesion).[29] It remains unclear though, why this sensitivity was not found for social loneliness.

The finding that the Moroccan, Surinamese and, especially, Turkish group had a higher risk on feelings of anxiety/depression than the Dutch group, and therefore experienced more loneliness, is in line with previous research showing ethnic differences in anxiety and depression[16,30] and a relation between anxiety/depression and feelings of loneliness.[31,32]

Living without a partner and old age are frequently found risk factors for loneliness in populations of Western countries.[33] The results of the current study suggest that these risk factors are not, or less, important for ethnic minority groups. Perhaps, for these groups, the family and community are more important protective factors against loneliness than the partner. Regarding ethnic differences in age, more research is needed: First, the research samples of the ethnic minority groups probably did not contain enough

≥75 elderly to thoroughly test the effect of (very) old age on loneliness. Second, it is unclear why younger Turks reported more emotional loneliness than older Turks.

Because the data used in this study were cross-sectional, no statements of causality can be made. This leaves the question whether anxiety/depression causes loneliness or vice versa. Some studies have found a causal effect of loneliness on depression,[34,35] but another study found both variables to act in a synergistic effect.[31] The same applies for perceived health, perceived financial difficulties and perceived discrimination. Longitudinal studies are needed to shed more light on these questions.

Because response rates of the ethnic minority groups were lower than that of the native Dutch, the results of this study are less generalisable to each entire ethnic group. Members of ethnic minority groups are in general less inclined to participate in surveys.[36] In this regard, this study is comparable to other large-scale survey studies concerning ethnic minority groups.[6,37] Furthermore, the oversampling and active approach of hard-to reach ethnic groups and age categories improved the generalisability of the results.

To conclude, this study shows that ethnic differences in loneliness can be ascribed to ethnic differences in *the prevalence of* risk factors in several domains, such as demographic, socioeconomic, health and neighbourhood aspects. Furthermore, some ethnic groups are also *more sensitive* to certain risk factors than other groups. For instance, Turks were more prone to feeling emotionally lonely when perceiving financial difficulties than the other three ethnic groups.

We recommend policy makers to focus on those risk factors that are modifiable through prevention programmes, e.g. stimulating the social cohesion in the neighbourhood or offering financial counselling. Ideally, multifaceted prevention strategies are implemented because risk factors are often related. In doing so, the distinction between emotional and social loneliness should always be kept in mind because these separate types of loneliness not only concern different desired outcomes (an intimate relationship vs. a broadened social network), but are often also associated with different risk factors.

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Key points

- This is the first study to investigate differences in loneliness between four ethnic groups living in the same country. By examining the cultural sensitivity of the measurement instrument, followed by an investigation of ethnic

differences in the strength (interaction) *and* presence (mediation) of an array of risk factors in different domains, this study draws the most complete picture of the reasons behind ethnic differences in loneliness until now.
- The results show that ethnic differences in emotional and social loneliness are explained by ethnic differences in the strength and prevalence of risk factors in several domains.
- Ideally, multifaceted prevention strategies are developed, covering several risk factors at once. In designing these strategies, the distinction between emotional and social loneliness should always be kept in mind, as well as differences in the strength and presence of risk factors between the ethnic groups.

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Inclusion of migrants and ethnic minorities in European birth cohort studies—a scoping review

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Background: Migrant and ethnic minority groups constitute substantial parts of European populations. They frequently experience health disadvantages relative to the respective majority populations. Birth cohort studies can help to disentangle social and biological factors producing these health inequalities over the life course. We investigated whether birth cohorts in European countries (i) assess migration history and ethnicity in the study design; and (ii) use this information in data analyses. **Methods:** A scoping review was performed in which European birth cohort studies were identified using dedicated web-based registries, MEDLINE and EMBASE. Two reviewers systematically assessed all identified birth cohorts and selected those fulfilling defined inclusion criteria (e.g. enrolment after 1980). Publications and websites were screened for information on the inclusion of migrants and ethnic minorities. To obtain more detailed information, researchers of enrolled birth cohorts were contacted individually. **Results:** Eighty-eight birth cohorts were identified in 20 European countries, with more than 486 250 children enrolled in total. Sixty-two studies (70.5%) reported collecting data about migration history or ethnic background. Twenty-three studies (26%) used information on migration history or ethnicity for data analyses or plan to do so in future. **Conclusion:** The majority of European birth cohorts assessed participants' migration history or ethnic background; however, this information was seldom used for comparative analyses in trying to disentangle reasons for health inequalities. Also, heterogeneous indicators were used. Better use of data already available, as well as harmonization of data collection on migration history and ethnicity, could yield interesting insights into the production of health inequalities.

Introduction

Birth cohort studies can be a powerful tool to investigate biological, environmental and social influences on health.[1] They help with understanding diseases from a life-course perspective as several aspects of health status in later life are associated with early-life exposures.[2,3] They allow researchers to disentangle the contributions of individual and contextual factors to inequalities in health.[2] Including diverse population groups in birth cohort studies enables researchers to study the respective influences of "nature" (genetics, with increased phenotypical richness) and "nurture" (environment and culture, including social determinants), as well as their interaction, on health.[1,4] When birth cohort studies aim to investigate the production of health inequalities, it is particularly important that diverse and potentially disadvantaged population groups are enrolled. Examples of such groups are migrants and ethnic minorities.[5]

Throughout Europe, the diversity of populations is increasing, largely as a consequence of past and present migration movements. In 2011, ∼10.1% of the EU population were either foreign-born or citizen of a country other than that in which they resided.[6] In Western European countries, a considerable part of new-borns have parents with a migration history or are part of an ethnic minority. This is of concern for public health as being a migrant or member of an ethnic minority can have an impact on health and has been associated with health inequalities.[7,8] Even though migrants are often initially healthier (the so-called healthy migrant effect), they tend to experience health inequalities with increasing duration of residence in the host country. Socioeconomic disadvantages, language barriers and other access barriers to health services contribute to health inequalities;[7,9,10] the effect of such exposures may accumulate over the life course.[4] Elucidating the underlying mechanisms can help to identify starting points for interventions.[11] Within the last decades, awareness has grown and researchers in Europe are increasingly enrolling migrants and ethnic minority populations in epidemiological studies. However, in many studies migrants and ethnic minorities are still excluded, underrepresented or their migration status is not clearly defined or assessed.[5,12]

The aim of this article is to evaluate how birth cohort studies in Europe are handling diversity in terms of migration history and ethnic background. The main research questions refer to whether birth cohorts in European countries (i) assess ethnicity and migration history in the study design; and (ii) use this information in data analyses. More specifically, we assessed what proportion of birth cohort studies in Europe considers migration history or ethnicity in their study design; how they define it; and whether this information, if available, has been (or will be) used for comparative analyses of health differentials.

Methods

We conducted a scoping review with the aim of identifying all European birth cohort studies and describing whether and how they have considered migrants and ethnic minorities; it was not