

Health risks among long-term immigrants in Norway with poor Norwegian language proficiency

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Abstract

Background: Poor health among immigrants has been associated with longer duration of residence in the host country, poor host language proficiency, and low education. However, the interplay among these factors is understudied.

Objective: To assess health among immigrants in Norway by combinations of duration of residence, Norwegian language proficiency and education.

Methods: In 2015/2016 Statistics Norway carried out two cross-sectional Living Conditions Surveys in the general adult population (N=5703, response rate 59%) and among immigrants from 12 countries, with ≥ 2 years of residence (N=3993, response rate 54%). Health outcomes (poor self-reported health, diabetes, cardiovascular disease, hypertension, obesity, mental health problems, back/neck pain) were assessed with logistic regressions according to combinations of duration of residence, Norwegian language proficiency, and education.

Results:

Negative health conditions were more common among immigrants than in the general population, and varied by duration of residence, proficiency in the Norwegian language and education. In age- and sex-adjusted regressions, immigrants had higher odds of all negative health conditions, except hypertension, regardless of their duration of residence, proficiency of the Norwegian language and educational level. Immigrants with a long duration of residence and poor proficiency in the Norwegian language had the highest odds of negative health conditions.

Conclusion: Special attention is warranted towards health among immigrants who have lived in Norway the longest without acquiring good Norwegian language proficiency.

Key words: immigrants, self-reported health, language proficiency, duration of residence

INTRODUCTION

Across Europe, immigrants have less favourable outcomes for various diseases and conditions compared to the general population (1). As important as such findings are for raising awareness about discrepancies in health outcomes between immigrant and non-immigrant groups, they may obscure within-group variation (2, 3). Upon arrival in a new country, immigrants tend to have particularly good health, but as the duration of residence increases, health often deteriorates (1). Differences in health between newly arrived immigrants and the host population may vary according to differences in health in the host population and immigrants' background, health situation, and reason for immigration (4, 5). How health develops after arrival in the host country is influenced by a range of factors, including economy, education, social networks, access to health services, lifestyle, and proficiency in the host language.

Education has established associations with health (6), influencing one's ability to find, understand, and use health-related information. As such, an individual's educational level is linked to their level of health literacy. Education is also related to social networks, occupation, and income (6). For immigrants, however, such associations may be disrupted (7) due to factors such as the host country's lack of recognition of their qualifications and language barriers. Limited proficiency in the host country's language has been associated with poor health in several studies (8-16), especially among older immigrants (9, 13-15). Low proficiency in the host language may obstruct immigrants' abilities to seek and understand health-related information (9), use health services, and receive high-quality care (9, 13). Host language proficiency may also be necessary for immigrants to take advantage of other health-promoting assets, such as social networks. Conversely, poor health may be a barrier to mastering the host language. Due to illness trajectories, the accumulated effects of poor host language proficiency are probably more adverse over a prolonged time than over a brief period after arrival (10). Nevertheless, studies on health outcomes have rarely related language proficiency with the length of stay (10, 17).

We know that health among immigrants varies by duration of residence, education, and proficiency in the host language. We hypothesize that there is an interplay between these three factors and that health is poorer among immigrants who have lived in the host country for a long time without acquiring proficiency in the host language, or who have lower education compared to other immigrants. Identifying underlying health risks and protective factors will allow interventions to be directed and tailored to where they are most needed.

METHODS

We used data from Statistics Norway's Living Conditions Survey in 2015 (18) and the Living Condition Survey for Immigrants in 2016 (7, 19). For the Living Conditions Survey, 14,000 persons aged 16-93 years from the general population were invited with a response rate of 59% (N= 8164). We excluded persons aged ≥ 67 years (N=1467), born outside Norway (N=766), or with missing information on education (N=228), leaving a sample of 5703. For the Living Condition Survey for Immigrants, a random sample of 8156 immigrants from the national population registry were invited, of whom 4435 (54%) agreed to participate and were interviewed by telephone (82%) or face-to-face (18%). Invited immigrants had at least two years of residence and were aged 16-74 years. We excluded participants aged ≥ 67 years (N=85) and participants with missing values for Norwegian language proficiency (6.3 %, N=272), education (2.3 %, N=100), and all health-related variables (0.0 %, N=1), leaving a sample of 3993 participants. Immigrants were defined as born outside Norway to two parents and four grandparents who were also born outside Norway. The immigrants were from Poland (response rate 55.6%), Bosnia-Herzegovina (58.2%), Kosovo (55.8%), Turkey (50.3%), Iraq (54.2%), Iran (58.6%), Afghanistan (58.1%), Pakistan (50.2%), Sri Lanka (61.3%), Vietnam (45.7%), Eritrea (62.4%), and Somalia (46.6%). In addition to Norwegian, the questionnaire was available in the primary language in each of these countries and in English.

Variables

Self-reported health

The survey included several questions on health. Firstly, *self-reported health* was assessed by the question «In general, do you consider your health to be 'very good,' 'good,' 'neither good nor poor,' 'poor' or 'very poor'?». We dichotomized this variable with 'very poor' and 'poor' classified as «poor self-rated health». Secondly, participants were asked whether they had experienced one or more of the following *health problems* during the last 12 months: «coronary heart disease», «stroke» and «angina pectoris» (merged into «cardiovascular disease (CVD)»); «hypertension»; «diabetes»; and «back problems» or «neck problems» (merged into «back or neck problems»). Thirdly, to capture *mental health problems*, the survey included the 5-point Hopkins Symptoms Checklist (20), including questions on 'nervousness or shakiness inside,' 'feeling fearful,' 'feeling hopeless about the future,' 'feeling blue', and 'worrying too much about things'. Participants could indicate the extent to which each of the symptoms had bothered them during the last 14 days: 'not at all (1 point)', 'a little (2)', 'quite a bit (3)' or 'extremely (4)'. We calculated mean scores for participants having answered at least four of the five questions; an average score >2 indicated symptoms of clinically significant mental health problems. Obesity was calculated based on self-reported weight and height. Based on these self-reported health problems, we defined the following variables: "Lifestyle-related disease" as having diabetes, CVD, and/or hypertension; ">1 negative health condition" as having two or more of the following: diabetes, CVD, hypertension, obesity, mental health problems, and back/neck pain; and "No health condition" as not reporting diabetes, CVD, hypertension, obesity, mental health problems, back/neck pain, or poor self-rated health.

Self-reported Norwegian language proficiency

Participants were asked whether they considered their Norwegian language proficiency to be 'very good', 'good', 'fair', 'poor' or 'very poor'. We dichotomized this variable, with 'very good', 'good' and 'fair' classified as «good» and 'very poor' and 'poor' as «poor».

Sociodemographic information

Sociodemographic variables included three groups of age in years («16-24», «25-44», «45-66») and level of education («primary school started or completed», «upper secondary completed» and «university/higher education started or completed»). As many of the youngest participants had not yet completed their education, we replaced the education of participants in the youngest group with the highest parental education attained if it was higher than the child's education. We were interested in the effect of low education (operationalized as primary school or lower) on health, thus, education was dichotomized into "primary" and "≥secondary". The survey noted the duration of residence in Norway (years) in five groups («2-3», «4-6», «7-10», «11-15», «16-20» and «≥21»). We operationalized "long duration of residence" as living in Norway longer than ten years, dichotomizing this variable into ">10 years" and "≤10 years".

Missing values

The proportion of missing values was between 0.1 and 0.4 % for health indicators, except for being obese (3.1 %). There were no missing values for age or duration of residence.

Analyses

We reported prevalence of diabetes, CVD, hypertension, lifestyle-related disease, obesity, mental health problems, back/neck problems, >1 negative health condition, and no health condition by duration of residence in Norway, self-reported Norwegian language proficiency, and education. We further reported sex- and age-adjusted odds ratios (95% confidence interval) from logistic regressions of the same variables by the duration of residence, Norwegian language proficiency, and

education, as well as combinations of those, with the reference group being the general Norwegian-born population and those with low levels of education in the general Norwegian-born population.

Ethics approval and consent to participate

We made use of a secondary, anonymized dataset collected by Statistics Norway. Therefore, this study required no specific ethical approval according to the Norwegian Centre for Research Data. To use the data, a confidentiality agreement with the Norwegian Centre for Research Data was signed and we conducted the analyses following their data protection regulations.

RESULTS

Approximately half of the immigrants were in the middle age-group (25-44 years) and a third in the older age group (45-66) (Table 1). In the general population the age-distribution was reversed (Table 1). Among immigrants, one-third had primary education only. Almost one in ten immigrants reported having poor Norwegian language proficiency, and almost two in three reported having good Norwegian proficiency (Table 1). Among immigrants with a long duration of residence and poor Norwegian language proficiency, 85% were in the oldest age group, and none were in the youngest (not shown). Supplementary table 1 presents characteristics by country of origin.

Most immigrants (56%) reported no health problems (Table 2), but the proportion varied from 66 % among those with short duration of residence to 50% among those with long duration of residence. In comparison, 63 % of the general population reported no health problems. The prevalence of poor self-reported health and specific health problems varied substantially with duration of residence, Norwegian language proficiency, and education among immigrants, and with education in the general population (Table 2). Except for hypertension, negative health conditions were more

common among immigrants than in the general population, and more common among those with long duration of residence, poor Norwegian language proficiency, and low educational level.

In logistic regressions adjusted for age and sex, immigrants had higher odds for diabetes, CVD, mental health problems, back- or neck problems, and having >1 negative health condition than non-immigrants, and lower odds of reporting no health condition, regardless of duration of residence, Norwegian language proficiency, and educational level (Table 3). Immigrants with a long duration of residence or low education also had higher odds of obesity than non-immigrants (Table 3). Running these analyses stratified by sex showed that the odds ratios were generally the same for women and men. However, for “>1 negative health condition”, disparities between immigrants and non-immigrants were higher among women than men regardless of duration of residence, Norwegian language proficiencies, and educational level (not shown).

Immigrants with multiple social disadvantages in combination had the highest odds ratios of negative health conditions compared to the general population (Table 4), especially immigrants with a long duration of residence, poor Norwegian language proficiency, and primary education only. In this group, the odds were highest for poor self-reported health (10.13 (6.33, 16.19)) and CVD (8.72 (4.82, 15.77)) compared to non-immigrants with primary education only. Odds among those with long duration of residence and poor Norwegian language proficiency, regardless of education, were almost as high (Table 4). Compared to the general population with primary education only, immigrants without combinations of social disadvantage did not have higher odds of obesity, lifestyle-related disease, or back and neck problems (Table 4).

DISCUSSION

Most immigrants had no self-reported negative health conditions, with larger proportions among those with shorter duration of residence and/or fair or good proficiency in the Norwegian language.

Comparison to other studies

Among immigrants in Norway, health varied according to Norwegian language proficiency, duration of residence, and education; however, the association with education was the least, in line with previous literature (1, 7-16, 21, 22). Less is known about how these factors interact in their impact on health. Sentell et al. (8) found that immigrants with poor language proficiency and low health literacy had slightly poorer health than those with either poor language proficiency or low health literacy, resembling our results.

Possible explanations

Individual

Being a long-term immigrant with poor proficiency in the host country language indicates a less successful integration process. Although many immigrants in this situation may have close relationships within their own community, they risk feelings of isolation and being an outsider beyond this community. The long-term stress of being in this situation may itself lead to poor health (23). Most conditions we found associated with a long duration of residence and poor language proficiency were chronic ones, developing over time and with age. While advancing age could partly explain the association between duration of residence and poor health, associations generally exceed the effect of age alone (21). Poor health could also be a barrier to language learning, constraining participation in formal language learning programs, informal venues, the labour market, and social activities with Norwegian speakers. We cannot rule out that those who have lived in Norway without acquiring good proficiency in the Norwegian language had poorer health already on arrival.

Health Services

Having poor Norwegian language proficiency would challenge one's ability to navigate the health system and to access and receive good quality health care (17). Communication is a prerequisite in all steps of getting health care. Effective communication with medical secretaries is needed to request, justify, and arrive at medical appointments on time. Communicating with physicians is needed, as the direct examination of the patient's body is contextualized by information only the patient can provide (e.g. the patient's history, motivations, concerns, the timing and quality of symptoms, what the patient has tried with and without success). Such communication underlies medical decision making which is the gateway to further tests, referrals, diagnosis, and treatment plans. Immigrants who have lived in the host country over a prolonged time without attaining sufficient language abilities to navigate these challenges may not be able to participate actively in their health care, increasing the chances of unaddressed health issues and delayed care.

Society

Proficiency in the host country's language opens doors to new social networks, education, work, and access to the most up-to-date local information, all of which are related to good health. Public health systems use multiple communication channels to disseminate health promotion information; poor proficiency in the host language may interfere with health literacy and whether immigrants notice, seek out, and access such information. Language barriers obstruct the benefit of such information (e.g. the role of nutrition and exercise), leaving immigrants vulnerable to adopting unhealthy behaviours in the host culture, while retaining unhealthy behaviours from their region of origin (24). Although higher education levels could facilitate knowledge-seeking strategies in their first language, such strategies would not necessarily enable immigrants to find information about their new country's health care system and norms.

Strengths and limitations

Data came from two national surveys with a reasonable number of participants and response rates (59% and 54%) (18, 19). Immigrant participants originated from twelve countries and represented about one-third of the 800.000 immigrants in Norway. Participants were drawn from the population register and did not include undocumented immigrants or persons temporarily working in Norway (19). Statistics Norway offered interviews in the primary language of participants' country of origin, but selection bias is likely, and immigrants with poor Norwegian language proficiency may still be underrepresented. Both samples may underrepresent participants with poor mental and physical health. Due to associations between proficiency in the Norwegian language and health, any underrepresentation of people with poor health may be larger among immigrants than among non-immigrants. This could have led to underestimating differences between groups. While we do not know whether self-reported health varies between immigrants and non-immigrants, the accuracy of self-reported health is prone to bias from participants in both groups (due to poor recall or a desire to withhold such information). The question about diabetes did not distinguish between type 1 and type 2 diabetes. However, as 91% of diabetes cases in Norway are type 2 (25), we assume this constitutes most cases.

As this was research based on a large survey, we used proxies for some variables. Self-reported language proficiency might not be the best measure for actual proficiency in Norwegian; however, it may relate to a sense of efficacy and confidence in the host language. Using parental education as a measure of education in the youngest age-group may be a limitation of our study, as social mobility is high among immigrants, and many children attain higher education than their parents. Moreover, education may vary by country background, but as we used broad groups, this likely did not affect our results substantially. How long an immigrant has lived in Norway is linked to country background and the circumstances around the period of arrival; thus differences in health and Norwegian language proficiency may relate to factors in the country of origin and in Norway (e.g. how Norwegian policies regarding language tuition for immigrants have developed over time).

Implications

In the current study, immigrants had higher odds than Norwegian-born of poor health regardless of duration of residence, proficiency in the Norwegian language, and education. However, as expected, differences from Norwegian-born were more pronounced among those with a long duration of residence, poor proficiency in the Norwegian language, and low education. These results indicate that targeted efforts are needed for groups of immigrants in general, but a specific focus is warranted both towards immigrants who have lived in Norway for a long time without acquiring good Norwegian language proficiency and towards newly arrived immigrants. Our results indicate that a successful integration trajectory involves acquirement of good host language proficiency which are bi-directionally related to health determinants. Those falling off that beneficial path are vulnerable to having poor health, especially for chronic conditions. Adequate language proficiency underpins seeking and obtaining health care, and may promote factors that support good health indirectly, such as social support or employment. For persons with poor Norwegian language proficiency, health care services adapted to their needs could facilitate adequate utilization and care of better quality (26, 27). Health care providers should be aware that immigrants with a long duration of residence who require such adaptations are at high risk of disease. Conversely, immigrants with health challenges may struggle more with language learning, and health care providers should take measures to ensure effective communication. Our results emphasize the importance of ensuring language tuition for immigrants with physical or mental health conditions, who do not benefit equally well from established or general arenas of language learning.

Our results also indicate that a large proportion of immigrants in Norway have good proficiency in the Norwegian language. This study strengthens the argument that continued accessible and effective language learning programmes are vital for promoting good health among newly arrived immigrants.

Poor health among immigrants who have lived in the host country for many years without acquiring good host language proficiency is a complex challenge, related to socio-economy, language situation, isolation, and mental health. All efforts to promote good health should consider the heterogeneity among immigrants, their socio-economic situation, sociocultural background, language proficiency, and personal characteristics. From this study, we suggest that developing programs targeting health and integration in relation to each other would be beneficial. Further, indications as to where to direct future efforts to prevent ill health among immigrants could emerge from mobilizing the experiences of immigrants who have lived in Norway a long time, who have integrated successfully, and who have good health. The relationships between determinants of health reported here suggest the utility of longitudinal investigations of the effect of immigrants taking part in integration programmes, language courses, and health status over time, possibly shedding light on positive, or adverse, effects.

Conclusions

A large proportion of immigrants have good health. However, immigrants with a long duration of residence and poor proficiency in the Norwegian language are at higher risk than other immigrants for poor health. Attention should be paid to the health challenges among immigrants in this situation. Moreover, efforts should be made to prevent others following this undesirable trajectory, by continuing facilitating and improving proper language training in combination with continued efforts to reduce linguistic barriers to accessing health information and services.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Table 1. Characteristics of the study population.

	Immigrants, total (N=3993)	Short duration of residence (N=1570)	Long duration of residence (N=2423)	Non-immigrants (N=5703)
			N (%)	
Men	2194 (55.0)	873 (55.6)	1321 (54.5)	2856 (50.1)
Women	1799 (45.0)	697 (44.4)	1102 (44.5)	2847 (49.9)
<i>Age group</i>				
16-24 years	551 (13.8)	325 (20.7)	226 (9.3)	916 (16.1)
25-44 years	2096 (52.5)	1007 (64.2)	1089 (44.9)	2003 (35.1)
45-66 years	1346 (33.7)	238 (15.1)	1108 (45.7)	2784 (48.8)
<i>Education</i>				
Primary	1489 (37.3)	660 (42.0)	829 (34.2)	1340 (23.5)
Upper secondary completed	1185 (29.7)	460 (29.3)	725 (29.9)	1930 (33.8)
University/higher education started/completed	1319 (33.0)	450 (28.7)	869 (35.9)	2433 (42.7)
<i>Norwegian language proficiency</i>				
Very poor	100 (2.5)	76 (4.8)	24 (1.0)	
Poor	268 (6.7)	190 (12.1)	78 (3.2)	
Fair	1111 (27.8)	606 (38.6)	505 (20.8)	
Good	1355 (33.9)	516 (32.9)	839 (34.6)	
Very good	1159 (29.0)	182 (11.6)	977 (40.3)	
<i>Self-reported health</i>				
Very good	1186 (29.7)	526 (33.6)	660 (27.3)	1916 (33.6)
Good	1658 (41.6)	718 (45.8)	940 (38.8)	2750 (48.2)
Neither good nor poor	644 (16.2)	205 (13.1)	439 (18.1)	704 (12.4)
Poor	389 (9.8)	95 (6.1)	294 (12.2)	276 (4.8)
Very poor	111 (2.8)	24 (1.5)	87 (3.6)	55 (1.0)

Table 2. Proportion (% (N)) with self-reported poor health, diabetes, cardiovascular disease (CVD), lifestyle-related disease, hypertension, obesity, mental health problems, back/neck problems or >1 negative health condition in full sample, and in those with advantaged/disadvantaged socioeconomic position.

	Immigrants						General population			
	Total	Duration of residence		Norwegian language proficiency		Education		Total	Education	
		≤10 years	>10 years	Poor	Fair/good	Primary	≥Secondary		Primary	≥Secondary
N	3993	1570	2423	368	3625	1489	2504	5703	1340	4363
Poor health	12.5 (500)	7.6 (119)	15.7 (381)	18.9 (69)	11.9 (431)	17.2 (255)	9.8 (245)	5.8 (331)	11.9 (159)	3.9 (172)
Diabetes	5.3 (211)	2.6 (41)	7.0 (170)	8.2 (30)	5.0 (181)	6.6 (98)	4.5 (113)	3.0 (168)	5.1 (68)	2.3 (100)
CVD	3.8 (151)	2.0 (32)	4.9 (119)	7.1 (170)	3.5 (125)	4.9 (73)	3.1 (78)	2.0 (116)	4.6 (62)	1.2 (54)
Hypertension	7.4 (294)	3.6 (57)	9.8 (237)	11.7 (43)	6.9 (251)	7.9 (118)	7.0 (176)	9.3 (532)	15.5 (207)	7.5 (325)
Lifestyle-related disease	13.1 (521)	7.1 (111)	16.9 (410)	19.0 (70)	12.4 (451)	14.8 (221)	12.0 (300)	12.4 (707)	21.0 (281)	9.8 (426)
Obesity	14.4 (557)	11.3 (171)	16.4 (386)	20.3 (71)	13.8 (486)	16.1 (228)	13.4 (329)	13.1 (736)	16.1 (211)	12.2 (525)
Mental health problem	12.8 (510)	11.6 (182)	13.6 (182)	14.5 (53)	12.7 (457)	14.7 (218)	11.7 (292)	4.5 (254)	7.0 (93)	3.7 (161)
Back/neck problems	23.2 (924)	16.4 (257)	27.6 (667)	23.6 (87)	23.1 (837)	25.1 (373)	22.1 (551)	18.2 (1038)	27.9 (374)	15.2 (664)
>1 negative health condition	16.5 (634)	10.9 (165)	20.1 (469)	24.1 (84)	15.7 (550)	19.5 (359)	14.7 (275)	10.3 (574)	18.2 (236)	7.9 (338)
No health condition	56.2 (2245)	66.0 (1036)	49.9 (1209)	49.7 (183)	56.9 (2062)	52.4 (780)	58.5 (1465)	62.5 (3563)	47.7 (639)	67.0 (2924)

Table 3. Odds Ratio (95% CI) of self-reported poor health, diabetes, cardiovascular disease (CVD), lifestyle-related disease, hypertension, obesity, mental health problems, back/neck problems or >1 negative health condition among immigrants with advantaged/disadvantaged socioeconomic position. Reference group: the general population. Adjusted for sex and age

	Duration of residence		Norwegian language Proficiency		Education	
	≤10 years	>10 years	Poor	Fair/good	Primary	≥Secondary
Poor health	1.99 (1.58, 2.50)	3.16 (2.70, 3.70)	3.90 (2.92, 5.22)	2.67 (2.29, 3.12)	4.08 (3.41, 4.89)	2.11 (1.77, 2.51)
Diabetes	1.58 (1.10, 2.27)	2.53 (2.02, 3.16)	2.80 (1.85, 4.22)	2.22 (1.78, 2.76)	2.96 (2.27, 3.85)	1.90 (1.48, 2.44)
CVD	1.94 (1.28, 2.93)	2.52 (1.93, 3.28)	3.50 (2.23, 5.48)	2.23 (1.71, 2.90)	3.22 (2.37, 4.37)	1.91 (1.42, 2.57)
Hypertension	0.69 (0.51, 0.92)	1.07 (0.91, 1.26)	1.25 (0.89, 1.76)	0.93 (0.79, 1.10)	1.06 (0.85, 1.32)	0.92 (0.76, 1.00)
Lifestyle related disease	1.01 (0.81, 1.27)	1.49 (1.30, 1.71)	1.63 (1.22, 2.16)	1.32 (1.16, 1.51)	1.62 (1.36, 1.93)	1.21 (1.04, 1.41)
Obesity	1.06 (0.88, 1.27)	1.29 (1.13, 1.48)	1.58 (1.20, 2.09)	1.17 (1.03, 1.33)	1.39 (1.18, 1.64)	1.11 (0.96, 1.28)
Mental health problem	2.90 (2.37, 3.56)	3.45 (2.91, 4.10)	3.92 (2.84, 5.39)	3.18 (2.71, 3.73)	3.80 (3.13, 4.60)	2.93 (2.45, 3.49)
Back/neck problems	1.25 (1.07, 1.46)	1.77 (1.58, 1.99)	1.41 (1.09, 1.81)	1.61 (1.45, 1.79)	1.76 (1.53, 2.03)	1.49 (1.32, 1.68)
>1 negative health condition	1.77 (1.46, 2.15)	2.30 (2.01, 2.64)	2.81 (2.15, 3.68)	2.07 (1.81, 2.36)	2.67 (2.27, 3.15)	1.86 (1.60, 2.15)
No health condition	0.83 (0.74, 0.94)	0.58 (0.52, 0.65)	0.61 (0.49, 0.76)	0.67 (0.62, 0.74)	0.73 (0.66, 0.81)	0.56 (0.50, 0.64)

Table 4. Odds Ratio of self-reported poor health, diabetes, cardiovascular disease (CVD), lifestyle-related disease, hypertension, obesity, mental health problems, back/neck problems or >1 negative health condition among immigrants with combinations of disadvantaged socioeconomic position. Reference group: the general population/general population with primary education only. Adjusted for sex and age

	Duration of residence and Norwegian language proficiency		Duration of residence and education		Norwegian language proficiency and education		Duration of residence and Norwegian language proficiency and education	
	Long+poor	Other immigrants	Long+low	Other immigrants	Poor+low	Other immigrants	Long+poor +low	Other immigrants
N	102	3891	829	3164	173	3820	77	3916
Reference: General population, total								
Poor health	8.57 (5.65, 13.00)	2.62 (2.25, 3.05)	5.16 (4.22, 6.29)	2.14 (1.81, 2.56)	6.48 (4.56, 9.22)	2.61 (2.24, 3.05)	10.13 (6.33, 16.19)	2.64 (2.27, 3.07)
Diabetes	4.62 (2.70, 7.92)	2.17 (1.74, 2.70)	3.44 (2.58, 4.57)	1.89 (1.49, 2.41)	3.73 (2.26, 6.15)	2.19 (1.76, 2.72)	4.16 (2.19, 7.92)	2.22 (1.79, 2.75)
CVD	7.62 (4.48, 12.96)	2.13 (1.64, 2.77)	3.56 (2.56, 4.97)	1.96 (1.48, 2.61)	5.15 (3.05, 8.68)	2.20 (1.70, 2.85)	8.72 (4.82, 15.77)	2.17 (1.68, 2.81)
Hypertension	1.88 (1.17, 3.01)	0.93 (0.79, 1.08)	1.25 (0.98, 1.59)	0.87 (0.73, 1.04)	1.52 (0.98, 2.34)	0.93 (0.80, 1.10)	1.79 (1.03, 3.11)	0.94 (0.80, 1.10)
Lifestyle-related disease	3.29 (2.18, 4.98)	1.29 (1.13, 1.47)	1.91 (1.57, 2.32)	1.18 (1.02, 1.37)	2.17 (1.50, 3.12)	1.31 (1.14, 1.50)	3.37 (2.09, 5.43)	1.30 (1.14, 1.49)
Obesity	1.54 (0.95, 2.51)	1.20 (1.06, 1.35)	1.67 (1.38, 2.03)	1.08 (0.95, 1.24)	1.54 (1.04, 2.28)	1.19 (1.05, 1.35)	1.98 (1.17, 3.35)	1.19 (1.05, 1.35)
Mental health problem	4.92 (2.93, 8.27)	3.20 (2.73, 3.75)	4.29 (3.42, 5.37)	2.97 (2.51, 3.51)	4.54 (3.00, 6.89)	3.18 (2.72, 3.73)	5.04 (2.82, 9.03)	3.20 (2.73, 3.76)
Back/neck problems	2.03 (1.35, 3.06)	1.57 (1.42, 1.75)	2.25 (1.91, 2.65)	1.41 (1.26, 1.58)	1.30 (0.91, 1.86)	1.61 (1.45, 1.79)	1.97 (1.23, 3.16)	1.58 (1.42, 1.75)
>1 negative health condition	4.81 (3.16, 7.34)	2.06 (1.80, 2.34)	3.22 (2.67, 3.88)	1.84 (1.60, 2.11)	3.54 (2.48, 5.07)	2.07 (1.82, 2.36)	4.83 (2.99, 7.81)	2.08 (1.82, 2.36)
No health condition	0.28 (0.17, 0.44)	0.68 (0.62, 0.74)	0.41 (0.36, 0.48)	0.76 (0.69, 0.83)	0.54 (0.39, 0.74)	0.67 (0.62, 0.73)	0.43 (0.27, 0.68)	1.03 (0.90, 1.18)

Reference: General population with low education								
Poor health	4.71 (3.06, 7.28)	1.47 (1.20, 1.81)	2.87 (2.27, 3.65)	1.20 (0.97, 1.50)	3.62 (2.49, 5.26)	1.48 (1.21, 1.81)	5.57 (3.43, 9.06)	1.49 (1.22, 1.82)
Diabetes	3.34 (1.89, 5.92)	1.65 (1.22, 2.21)	2.56 (1.81, 3.62)	1.44 (1.05, 1.96)	2.74 (1.60, 4.69)	1.66 (1.24, 2.23)	3.01 (1.54, 5.88)	1.68 (1.25, 2.26)
CVD	4.21 (2.40, 7.36)	1.18 (0.85, 1.62)	1.97 (1.35, 2.88)	1.09 (0.77, 1.53)	2.84 (1.63, 4.94)	1.22 (0.88, 1.68)	4.79 (2.58, 8.88)	1.20 (0.87, 1.65)
Hypertension	1.41 (0.86, 2.29)	0.67 (0.54, 0.82)	0.91 (0.70, 1.19)	0.63 (0.50, 0.78)	1.11 (0.71, 1.74)	0.67 (0.55, 0.83)	1.32 (0.75, 2.32)	0.68 (0.55, .83)
Lifestyle-related disease	2.29 (1.50, 3.51)	0.89 (0.75, 1.06)	1.32 (1.06, 1.66)	0.82 (0.68, 0.99)	1.50 (1.02, 2.20)	0.91 (0.76, 1.09)	2.33 (1.43, 3.79)	0.90 (0.76, 1.08)
Obesity	1.38 (0.83, 2.27)	1.12 (0.93, 1.34)	1.53 (1.21, 1.93)	1.00 (0.83, 1.21)	1.39 (0.92, 2.11)	1.10 (0.92, 1.33)	1.77 (1.03, 3.03)	1.11 (0.92, 1.33)
Mental health problem	3.02 (1.75, 5.20)	2.06 (1.62, 2.61)	2.69 (2.03, 3.57)	2.06 (1.62, 2.61)	2.85 (1.82, 4.46)	2.05 (1.61, 2.60)	x	x
Back/neck problems	1.38 (0.91, 2.11)	1.10 (0.94, 1.28)	1.55 (1.28, 1.88)	0.98 (0.83, 1.14)	0.90 (0.62, 1.30)	1.13 (0.97, 1.31)	1.35 (0.83, 2.18)	1.10 (0.95, 1.28)
>1 negative health condition	3.12 (2.02, 4.83)	1.33 (1.11, 1.59)	2.08 (1.66, 2.60)	1.18 (0.98, 1.43)	2.29 (1.57, 3.33)	1.34 (1.12, 1.60)	3.10 (1.89, 5.08)	1.34 (1.12, 1.61)
No health condition	0.43 (0.27, 0.68)	1.03 (0.90, 1.18)	0.63 (0.53, 0.76)	1.15 (1.00, 1.32)	0.82 (0.59, 1.14)	1.01 (0.88, 1.16)	0.34 (0.19, 0.60)	1.03 (0.90, 1.17)
