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RESEARCH ARTICLE



## Foreign-born women's lifestyle and health before and during early pregnancy in Sweden

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### ABSTRACT

**Objectives:** The aims of the study were to investigate foreign-born women's lifestyle and health before and during early pregnancy and compare them with those of Nordic-born women.

**Methods:** Women recruited at antenatal clinics in Sweden answered a questionnaire in Swedish, English or Arabic or by telephone interview with an interpreter. Questions covered pregnancy planning and periconceptional lifestyle and health. The responses of women born in or outside Europe were compared with those of Nordic-born women. The impact of religiousness and integration on periconceptional lifestyle and health was also investigated.

**Results:** Twelve percent of participants ( $N = 3389$ ) were foreign-born ( $n = 414$ ). Compared with Nordic women, European and non-European women consumed less alcohol before conception (respectively, adjusted odds ratio [aOR] 0.38; 95% confidence interval [CI] 0.24, 0.58 and aOR 0.14; 95% CI 0.10, 0.19) and during early pregnancy (respectively, aOR 0.61; 95% CI 0.40, 0.91 and aOR 0.20; 95% CI 0.14, 0.29). Non-European women used less tobacco and were less physically active, but body mass index (BMI) did not differ between groups. Self-perceived health, stress and anxiety during early pregnancy did not differ, but non-European women more often had depressive symptoms (aOR 1.67; 95% CI 1.12, 2.51). Non-European women's healthy lifestyle was associated with religiousness but not with the level of integration.

**Conclusions:** Non-European women were overall less likely to engage in harmful lifestyle habits before and during early pregnancy but were more likely to suffer from depressive symptoms in comparison with Nordic women.

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Foreign-born; immigrants; lifestyle; mental health; periconceptional health; preconception health; pregnancy; religiousness

### Introduction


As health and lifestyle around the time of conception (i.e., periconception) are strongly linked to pregnancy outcome, a sharper focus on preconception health-promoting interventions has been suggested [1]. Planning for a pregnancy is beneficial as it enables health-optimising actions in the periconceptional period. Chronic illness, medication, weight, diet and nutrition, high intake of caffeine and alcohol and tobacco use before and during pregnancy can influence pregnancy outcome [1]. The recommendations for women who are trying to conceive are to abstain from or limit intake of alcohol, stop smoking, exercise daily, eat a healthy and varied diet, maintain a healthy weight and take folic acid [2,3]. The same advice is given during pregnancy, but alcohol consumption should be stopped and caffeine intake limited to 300 mg (i.e., three cups of coffee) per day [3].

The number of immigrants globally has increased in recent years. Research on immigrants' reproductive health has been on the agenda in many settings, but there is a paucity of research on lifestyle, maternal mental health and pregnancy planning among immigrants [4]. Studies suggest a lower frequency of harmful lifestyle habits among

immigrants than among host country women [5–7]. According to the convergence hypothesis, unhealthy lifestyle habits are likely to be adopted by a foreign-born population with duration of residence and as the level of integration (i.e., inclusion of immigrants in society) increases [6–8]. Religiousness (i.e., 'an individual's conviction, devotion, and veneration towards a divinity' [9]) may also be important in certain populations. Religiousness has been associated with lower odds of harmful lifestyle habits, of depressive symptoms and of poor self-reported health [10,11]. Sweden is a highly secular country but many of its immigrants come from more religious countries such as Iran and Iraq.

In 2013, one out of four women giving birth in Sweden was foreign-born and the number has increased [12]. Immigrants perceive their health to be poorer than that of those with a Swedish background and they have an increased risk of poor mental health including depression [13,14]. Moreover, this group has an increased risk of perinatal death and babies born small for gestational age [15,16]. The differences in pregnancy outcomes are amplified by socioeconomic factors and depend on the country of birth, such that women with a lower level of education

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 Supplemental data for this article can be accessed [here](#).

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and women from sub-Saharan Africa suffer the greatest risks [15]. Knowledge in Sweden about foreign-born women's periconceptional lifestyle and health is lacking; however, knowledge of target groups is crucial for tailoring successful periconceptional health interventions [17]. The aim of our study was, therefore, to investigate lifestyle and health before and during early pregnancy among foreign-born women living in Sweden and to compare them with those of women born in the Nordic countries. Further, our aim was to investigate whether observed differences were associated with religiousness or level of integration.

## Methods

### Setting and samples

Foreign-born women of reproductive age (15–44 years) living in Sweden in 2012–2013 were most commonly born in Poland, Bosnia Herzegovina and former Yugoslavia (European-born women) or Iraq, Iran, China and Syria (non-European-born women) [18]. Our data are cross-sectional from the baseline measurements in the Swedish Pregnancy Planning cohort study, described by Stern et al. [19]. Data were collected at antenatal clinics ( $n=153$ ) in 10 Swedish counties in the northern and middle parts of Sweden. To increase the number of foreign-born women, additional clinics in areas with many immigrants were included. Midwives recruited women who were registering for antenatal care. Participants could choose to answer a questionnaire, either at the clinic or at home, in Swedish, English or Arabic, or to be interviewed on the telephone by an interpreter using a shortened questionnaire (all other languages). The migration and health terms used in this study are, if not otherwise specified, in accordance with the glossary developed by Urquia et al. [8].

### Data collection

Data were collected between September 2012 and July 2013. The questionnaire included questions on background, lifestyle, health and pregnancy planning (Supplementary Text 1). Sociodemographic and socioeconomic questions included age, parity, body mass index (BMI), marital status, place of birth (Sweden/other Nordic countries/Europe/outside Europe), occupation, educational level, household income, Swedish language skills and the impact of religion on respondents' life. The last four variables mentioned were collected on ordinal scales and grouped into two or three categories. The impact of religion was measured by the question: 'How important a part does religion play in your life?' and Swedish language skills by 'How well can you read and understand written Swedish?' Both were answered on a 1–5 point Likert scale.

Questions on lifestyle covered intake of alcohol, tobacco and coffee, as well as of folic acid and multivitamins, and, finally, physical activity. The question on alcohol intake during pregnancy was formulated: 'Do you drink alcohol at the moment?' Women could choose to answer: 'Yes, I drink every week'/'Yes, but not every week'/'No, I stopped drinking alcohol after I found out that I was pregnant'/'No, I stopped drinking alcohol as soon as I found out that I was pregnant'/'No, I had stopped drinking alcohol before I

became pregnant'/'No, I have never drunk alcohol'. Smoking was measured in the same way except it was based on daily instead of weekly consumption. As most women are not aware of their pregnancy until gestational weeks 5–6, women who had quit smoking or drinking alcohol when they found out they were pregnant were included as having smoked or consumed alcohol in early pregnancy. Coffee and physical activity variables were collected on ordinal scales and grouped into two to four categories based on sample size or clinical relevance, e.g., coffee intake was divided into 'less than three cups' or 'three or more cups', based on the guidelines for caffeine intake during pregnancy [3].

Self-perceived health ('How would you describe your general health at the moment?') was answered on a 1–5 point Likert scale ranging from 'very good' to 'very poor'. Answers were grouped into three categories. The Perceived Stress Scale (PSS), the anxiety subscale of the Hospital Anxiety Depression Scale (HADS-A) and the Edinburgh Postnatal Depression Scale (EPDS) were used to measure mental health during early pregnancy [20–22]. Missing values were imputed as the individual mean of valid values [23]. If more than two values were missing for the PSS and HADS-A and more than one value was missing for the EPDS, the cases were excluded. The cut-off values for the scales were 27 for the PSS, 11 for the HADS-A and 13 for the EPDS. Participants reported if they had been diagnosed with a psychiatric disorder such as depression by ticking boxes with exemplified disorders or by writing free-text answers.

The London Measure of Unplanned Pregnancy was used to measure pregnancy intention [24]. The measure consists of six items, each scored from 0 to 2 up to a maximum of 12 points and pregnancies are categorised as unplanned (0–3 points), ambivalent (4–9 points) and planned (10–12 points). Missing values were imputed according to the instructions of Barrett et al. [24].

### Statistical analysis

The women were categorised into Nordic-born (reference group), European-born or non-European-born. Although most participants were Swedish residents, they are hereafter referred to as 'Nordic', 'European' or 'non-European'. 'Nordic' included women born in any of the Nordic countries, as they were considered to be living in a society with a similar culture, language and health status. International adoptees were labelled Nordic if they had been adopted before 15 years of age. To assess the generalisability of the sample, our data were compared with 2013 data from two national registers (the Swedish Medical Birth Register and the Swedish Pregnancy Register).

The  $\chi^2$  test and Fisher's exact test were used for group comparisons. Dependent variables that significantly differed between groups were further analysed by logistic or ordinal regression tests, adjusting for sociodemographic factors (age and parity) and socioeconomic factors (educational level and household income). Owing to the small number of single women, it was not possible to adjust for marital status. To explore the differences in lifestyle and health among non-European women, we investigated whether their lifestyle and health were associated with

religiousness or integration. Religiousness was measured as the importance of religion; Swedish language skills were used as a proxy for integration, as integration is significantly determined by linguistic competence in the relevant national language [25]. A two-sided  $p$  value  $<.05$  was considered significant for all statistical analyses and all crude and adjusted odds ratios (OR and aOR) were presented with 95% confidence intervals (CI). Data were analysed using IBM SPSS Statistics for Windows, version 23 (IBM, Armonk, NY).

### Ethics approval

The regional ethics review board in Uppsala, Sweden, approved the study (2010/085, 2010-06-04). Midwives provided participants with verbal and written information and told them that they could not be identified via the paper and that their answers would be fully anonymised. For Swedish-speaking women, the return of the questionnaire was regarded as informed consent. Non-Swedish-speaking women provided written consent. There was no financial incentive to participate.

### Results

In total, 5797 women were eligible to participate, of whom 5494 were invited and 4969 accepted (a detailed flow chart of the study population is presented by Stern et al. [19]). Out of 4845 questionnaires in Swedish, 31% ( $n=1517$ ) were not returned. Of women not speaking Swedish ( $n=124$ ), half ( $n=62$ ) of the questionnaires were either not returned or participants could not be reached. In total, 3390 questionnaires were received, but, as one native English-speaking woman answered two questionnaires (one in Swedish and one in English), the Swedish questionnaire was excluded. Thus, the number of participants was 3389. Out of these, 2948 were born in Sweden or were adopted from abroad before the age of 15. A total of 59 women were born in other Nordic countries, 109 in other European countries and 246 outside Europe; 27 questionnaires had missing data on the origin. Thus, 10% ( $n=355$ ) of women were born outside the Nordic countries and 12% ( $n=414$ ) were born outside Sweden (excluding those who had been adopted from abroad). [Supplementary Table 1](#) shows a comparison of our data with data from the national registers.

Participants answered questionnaires in Swedish ( $n=3327$ ), English ( $n=13$ ) or Arabic ( $n=22$ ), or they were interviewed ( $n=27$ ) by telephone. As non-response to individual questions was only 0.3–5%, missing values were disregarded. Background data of the participants are presented in [Table 1](#). One month prior to conception, one-third of all women were overweight (22%) or obese (11%) ( $\text{BMI} \geq 25 \text{ kg/m}^2$ ); there were no significant differences between groups. Non-European women had a lower level of education, a lower household income and fewer were employed compared with Nordic women. Median years in Sweden were 9 (range 0–38 years) and median age on arrival in Sweden was 21 years. The median gestational week when answering the questionnaire was 11 for Nordic women, 13 for European women and 12 for non-European women.

Women's lifestyle is presented in [Table 2](#). A smaller proportion of both European and non-European women drank alcohol (58% and 27%) compared with Nordic women (80%) and fewer smoked and used oral tobacco prior to conception. Half of all women (53%,  $n=1785$ ) had consumed alcohol in early pregnancy, but only a fraction reported currently doing so (0.4%,  $n=14$ ). One out of five women (19%,  $n=644$ ) had drunk  $\geq 5$  standard units of alcohol on at least one occasion in early pregnancy. A smaller proportion of non-European women reported that they had taken folic acid supplements prior to pregnancy (24% vs. 33% for Nordic women). Non-European women were less physically active both prior to and during early pregnancy and they more commonly reported they had reduced their physical activity to prepare for pregnancy, compared with European or Nordic women (8% of non-European and 1% of both European and Nordic women).

Multivariable logistic regression analyses showed that both European and non-European women were less likely to consume alcohol 3 months before and during early pregnancy compared with Nordic women ([Table 3](#)). Non-European women were also less likely to smoke. As there were very few cases of oral tobacco use among European and non-European women ( $n=7$ ), it was not investigated further. Non-European women were less likely to undertake the recommended amount of physical activity both before and during early pregnancy.

Most pregnancies were planned (70%,  $n=2307$ ), 29% ( $n=950$ ) were ambivalent and 2% ( $n=56$ ) were unplanned. In the univariable analysis, non-European women were more likely to have either an ambivalent intention or an unplanned pregnancy (grouped together because there were few cases) (OR 2.01; 95% CI 1.52, 2.65;  $p<.000$ ). The association was weakened in the multivariable analyses (OR 1.37; 95% CI 1.01, 1.88;  $p=.046$ ). There were no differences in ambivalent intention or unplanned pregnancies when comparing European women with Nordic women ( $p=.997$ ).

Self-perceived health during early pregnancy did not differ between groups ([Table 2](#)). At registration, fewer non-European women reported a diagnosis of depression compared with Nordic women (1% [ $n=3$ ] and 6% [ $n=168$ ], respectively), but a greater proportion suffered from depressive symptoms (18% and 10%, respectively: OR 2.09; 95% CI 1.46, 3.00). The result remained significant in the multivariable analyses ([Table 3](#)). Women's self-perceived health, anxiety and stress during early pregnancy did not differ between the groups.

[Table 4](#) shows the associations between religiousness or integration and lifestyle, health-promoting behaviours and health among non-European women. Responding that religion plays a quite important or very important role was associated with significantly lower odds of having consumed alcohol or smoked both before and during early pregnancy. Swedish language skills were not significantly associated with any lifestyle habits. Depressive symptoms were not associated with religiousness nor with Swedish language skills.

### Discussion

#### Findings and interpretation

Non-European women's lifestyle was better than Nordic women's lifestyle in most investigated aspects according to



**Table 1.** Characteristics of the study population ( $N = 3389$ ) of Nordic ( $n = 3007$ ), European ( $n = 109$ ) and non-European ( $n = 246$ ) pregnant women living in Sweden.

Characteristic	Total $N$ (%)	Nordic $n$ (%)	European $n$ (%)	Non-European $n$ (%)	$p$ Value <sup>a</sup>
Age, years	3284	2910	108	239	.229
≤25	741 (23)	657 (23)	17 (16)	54 (23)	–
26–35	2139 (65)	1904 (65)	75 (69)	148 (62)	–
≥36	404 (12)	349 (12)	16 (15)	37 (15)	–
Gestational week	3318	2942	108	242	.002
≤7	285 (9)	253 (9)	9 (8)	21 (9)	–
8–14	2431 (73)	2186 (74)	75 (69)	155 (64)	–
≥15	602 (18)	503 (17)	24 (22)	66 (27)	–
BMI <sup>b</sup>	3223	2892	101	218	.190
Underweight (<18.5 kg/m <sup>2</sup> )	106 (3)	88 (3)	4 (4)	12 (6)	–
Normal weight (≥18.5 to <25 kg/m <sup>2</sup> )	2041 (63)	1841 (64)	66 (65)	126 (58)	–
Overweight (≥25 to <30 kg/m <sup>2</sup> )	709 (22)	628 (22)	20 (20)	59 (27)	–
Obese (≥30 kg/m <sup>2</sup> )	367 (11)	335 (12)	11 (11)	21 (10)	–
Parity	3353	2982	104	241	.537
Nulliparous	1508 (45)	1342 (45)	42 (40)	113 (47)	–
Multiparous	1845 (55)	1640 (55)	62 (60)	128 (53)	–
Marital status <sup>b</sup>	3350	3006	103	225	.911
No partner	41 (1)	37 (1)	1 (1)	3 (1)	–
Partner	3309 (99)	2969 (99)	102 (99)	222 (99)	–
Level of education <sup>b</sup>	3330	2951	108	245	<.000
Lower	229 (7)	153 (5)	11 (10)	61 (25)	–
Middle	1276 (38)	1167 (40)	20 (19)	78 (32)	–
High	1825 (55)	1631 (55)	77 (71)	106 (43)	–
Occupation <sup>b</sup>	3063	2764	93	188	<.000
≥50% employed	2848 (93)	2598 (94)	86 (92)	148 (79)	–
Other	215 (7)	166 (6)	7 (8)	40 (21)	–
Household income/month, in SEK <sup>b</sup>	3254	2919	100	211	<.000
≤39,999	441 (14)	311 (11)	22 (22)	97 (46)	–
40,000–79,999	1851 (57)	1712 (59)	54 (54)	78 (37)	–
≥80,000	962 (30)	896 (31)	24 (24)	36 (17)	–
Swedish language skills	3388	3007	109	246	<.000
Very or fairly good	3316 (98)	2999 (100)	99 (91)	196 (80)	–
Average	28 (1)	6 (0)	1 (1)	18 (7)	–
Fairly or very bad	44 (1)	2 (0)	9 (8)	32 (13)	–
Importance of religion in life <sup>b</sup>	3335	2991	103	225	<.000
Quite or very important	455 (14)	260 (9)	38 (37)	146 (65)	–
Average	760 (23)	693 (23)	30 (29)	36 (16)	–
Quite or very unimportant	2120 (64)	2038 (68)	35 (34)	43 (19)	–

<sup>a</sup>The  $\chi^2$  test or Fisher's exact test was used to detect differences between groups.<sup>b</sup>Not answered by those interviewed by telephone.

current recommendations [1–3], as they were less likely to consume alcohol, tobacco and coffee prior to and during early pregnancy. However, depressive symptoms were almost twice as common among non-European compared with Nordic women. European women were similar to Nordic women in most aspects of lifestyle and health.

### Future research and comparison with other study findings

A lower frequency of harmful lifestyles among immigrant or foreign-born women has been previously demonstrated [5–7]. We found that lower alcohol consumption and smoking among non-European women were associated with religiousness. An association between religiousness and lower odds of harmful lifestyle habits is known and religious service attendance has been associated with less smoking and less substance use [10,26]. Lifestyle habits are also connected to source country culture. As an example, smoking has been much affected by gender roles and has been positively associated with women's emancipation [27]. As we lack information on country of origin, we do not know whether these theories hold true for our study sample. The difference in lifestyle among non-European women in this sample was not associated with the level of integration. Our estimation of integration was limited to skills in reading and understanding

written Swedish. In future studies, additional aspects of integration should be investigated.

We did not investigate associations between lifestyle factors and outcomes, but our results do not suggest that the increased risk of poor pregnancy outcomes among immigrants may be explained by lifestyle factors. The reasons for the increased risk of poor pregnancy outcome in Sweden is not known, but communication barriers may be important [15,16]. As host country policies and health care factors are likely to affect outcomes, studies specifically from Sweden are needed to identify these reasons. Furthermore, investigating other aspects of lifestyle and health as well as reasons for poor pregnancy outcome in some subgroups would be of value.

There was no difference in pregnancy planning between European, non-European and Nordic women in the multi-variable analyses. Stern et al. [19] investigated determinants of pregnancy planning using the same data but measured pregnancy planning on a 1–5 point Likert scale. They found an association with education, household income and relationship length but not with ethnic origin. Using a Likert scale, the prevalence of unplanned pregnancies was higher (12%) than was found in this study (2%) using the London Measure of Unplanned Pregnancy. Discrepancies between the two measurements have been discussed elsewhere [28].

**Table 2.** Lifestyle, health-promoting behaviours and health 3 months before and during early pregnancy among Nordic ( $n = 3007$ ), European ( $n = 109$ ) and non-European ( $n = 246$ ) women.

Variable	Total <i>N</i> (%)	Nordic <i>n</i> (%)	European <i>n</i> (%)	Non-European <i>n</i> (%)	<i>p</i> Value <sup>a</sup>
<b>Lifestyle</b>					
Alcohol before conception	3371	2995	109	241	<.000
Yes	2540 (75)	2400 (80)	63 (58)	66 (27)	–
No	831 (25)	595 (20)	46 (42)	175 (73)	–
Alcohol during pregnancy	3361	2989	108	238	<.000
Yes	1785 (53)	1689 (57)	45 (42)	42 (18)	–
No	1576 (47)	1300 (43)	63 (58)	196 (82)	–
Smoking before conception	3375	2996	109	244	.004
Yes	659 (20)	607 (20)	20 (18)	28 (11)	–
No	2716 (80)	2389 (80)	89 (82)	216 (89)	–
Smoking during pregnancy	3357	2985	107	239	.005
Yes	509 (15)	471 (16)	18 (17)	19 (8)	–
No	2848 (85)	2514 (84)	89 (83)	220 (92)	–
Oral tobacco before conception <sup>b</sup>	3321	2973	102	220	<.000
Yes	322 (10)	315 (11)	2 (2)	5 (2)	–
No	2999 (90)	2658 (89)	100 (98)	215 (98)	–
Oral tobacco during pregnancy <sup>b</sup>	3322	2983	102	211	<.000
Yes	240 (7)	238 (8)	1 (1)	1 (0)	–
No	3082 (93)	2745 (92)	101 (99)	210 (100)	–
Coffee before conception <sup>b</sup>	3346	2994	102	223	<.000
<3 cups	2695 (81)	2384 (80)	83 (81)	204 (91)	–
≥3 cups	651 (19)	610 (20)	19 (19)	19 (9)	–
Coffee during pregnancy <sup>b</sup>	3344	2991	103	223	.656
<3 cups	3289 (98)	2941 (98)	101 (98)	221 (99)	–
≥3 cups	55 (2)	50 (2)	2 (2)	2 (1)	–
<b>Health-promoting behaviour</b>					
Folic acid	3333	2985	102	220	.007
Yes	1090 (33)	991 (33)	39 (38)	52 (24)	–
No	2243 (67)	1994 (67)	63 (62)	168 (76)	–
Vitamins	3335	2988	101	221	.367
Yes	594 (18)	537 (18)	20 (20)	32 (14)	–
No	2741 (82)	2451 (82)	81 (80)	189 (86)	–
Physical activity before conception, h/week <sup>b</sup>	3318	2973	102	219	<.000
0	326 (10)	244 (8)	10 (10)	69 (32)	–
1–2	1178 (36)	1075 (36)	30 (29)	66 (30)	–
3–4	1131 (34)	1030 (35)	41 (40)	51 (23)	–
≥5	683 (21)	624 (21)	21 (21)	33 (15)	–
Physical activity during pregnancy, h/week <sup>b</sup>	3323	2985	101	211	<.000
0	626 (19)	526 (18)	17 (17)	78 (37)	–
1–2	1595 (48)	1455 (49)	50 (50)	79 (37)	–
3–4	706 (21)	650 (22)	21 (21)	30 (14)	–
≥5	396 (12)	354 (12)	13 (13)	24 (11)	–
<b>Health</b>					
Self-perceived health during pregnancy	3376	2999	109	243	.471
Very or quite good	2876 (85)	2561 (85)	90 (83)	202 (83)	–
Average	350 (10)	310 (10)	11 (10)	27 (11)	–
Quite or very poor	150 (4)	128 (4)	8 (7)	14 (6)	–
PSS <sup>b</sup>	3331	2982	103	220	.451
High stress	140 (4)	129 (4)	2 (2)	8 (4)	–
Ref: score < 27	3191 (96)	2853 (96)	101 (98)	212 (96)	–
HADS <sup>b</sup>	3340	2988	103	222	.924
Anxiety	241 (7)	212 (7)	8 (8)	17 (8)	–
Ref: score < 11	3099 (93)	2776 (93)	95 (92)	205 (92)	–
EPDS <sup>b</sup>	3337	2985	103	223	<.000
Depressive symptoms	343 (10)	290 (10)	8 (8)	41 (18)	–
Ref: score < 13	2994 (90)	2695 (90)	95 (92)	182 (82)	–

<sup>a</sup>The  $\chi^2$  test or Fisher's exact test was used to detect differences between groups.<sup>b</sup>Not answered by those interviewed by telephone.

Non-European women were more likely to suffer from depressive symptoms during early pregnancy compared with Nordic women, even after adjusting for confounders, but there was no difference between European and Nordic women. In line with our results, other studies have shown that female immigrants in Sweden have an increased risk of mental disorders and depressive symptoms but that the risk varies according to the source country and its economic status [13,29,30]. Women from Iran and Iraq have a higher prevalence of depression compared with Nordic women [13]. These countries were the two most common countries of origin of women of reproductive age in Sweden when the data were collected [18]. Despite a

higher proportion of depressive symptoms during early pregnancy among non-European women, a smaller proportion reported having been diagnosed with depression compared with Nordic women. This suggests that non-European women may be underdiagnosed. Future studies are needed to confirm these results and to investigate whether this potential underdiagnosis may be explained by factors related to the health care system or health care providers, to the patient or to other factors. Religiousness has generally been associated with lower rates of depression [31], but this was not found in our study. Future studies in similar contexts are needed to confirm or reject this finding. There was no difference in self-

**Table 3.** Being born in Europe or outside Europe as a predictor of lifestyle, health-promoting behaviours and health before and during early pregnancy (logistic regression showing unadjusted and adjusted results).

Variable	European						Non-European					
	OR	95% CI	p Value	aOR	95% CI	p Value	OR	95% CI	p Value	aOR	95% CI	p Value
<b>Lifestyle</b>												
Alcohol before conception	0.34	0.23, 0.50	<.000	0.38	0.24, 0.58	<.000	0.09	0.07, 0.13	<.000	0.14	0.10, 0.19	<.000
Alcohol during pregnancy	0.55	0.37, 0.81	.003	0.61	0.40, 0.91	.017	0.16	0.12, 0.23	<.000	0.20	0.14, 0.29	<.000
Smoking before conception	0.88	0.54, 1.45	.625	1.08	0.62, 1.86	.792	0.51	0.34, 0.76	.001	0.30	0.18, 0.49	<.000
Smoking during pregnancy	1.08	0.64, 1.81	.771	1.27	0.71, 2.27	.418	0.46	0.29, 0.74	.002	0.25	0.14, 0.44	<.000
≥3 cups coffee before conception	0.89	0.54, 1.48	.667	0.90	0.54, 1.51	.691	0.36	0.23, 0.59	<.000	0.29	0.17, 0.49	<.000
<b>Health-promoting behaviours</b>												
Folic acid	1.25	0.83, 1.87	.290	1.14	0.75, 1.75	.539	0.62	0.45, 0.86	.004	0.74	0.52, 1.06	.099
Physical activity before conception <sup>a</sup>	1.09	0.76, 1.56	.636	1.12	0.78, 1.62	.546	0.36	0.28, 0.47	<.000	0.36	0.28, 0.48	<.000
Physical activity during pregnancy <sup>a</sup>	1.03	0.71, 1.49	.872	1.00	0.69, 1.46	.991	0.48	0.37, 0.63	<.000	0.47	0.35, 0.62	<.000
<b>Health</b>												
Depressive symptoms (EPDS score ≥13)	0.78	0.38, 1.63	.511	0.83	0.40, 1.75	.628	2.09	1.46, 3.00	<.000	1.67	1.12, 2.51	.013

Reference category: Nordic women; adjusted for age, parity, education and household's income.

<sup>a</sup>Ordinal regression.**Table 4.** Importance of religion and level of integration as a predictor for lifestyle, health-promoting behaviours and health among non-European women.

Variable	Importance of religion						Integration measured through Swedish language skills					
	Average importance <sup>a</sup>			Very or quite important <sup>a</sup>			Average <sup>b</sup>			Quite or very poor <sup>b</sup>		
	OR	95% CI	p Value	OR	95% CI	p Value	OR	95% CI	p Value	OR	95% CI	p Value
<b>Lifestyle</b>												
Alcohol before conception	0.60	0.24, 1.51	.281	0.08	0.03, 0.17	<.000	0.72	0.22, 2.29	.573	0.34	0.12, 1.03	.057
Alcohol during pregnancy	1.19	0.46, 3.07	.714	0.19	0.08, 0.46	<.000	0.59	0.13, 2.70	.497	0.85	0.31, 2.37	.759
Smoking before conception	0.73	0.25, 2.13	.561	0.22	0.08, 0.55	.001	0.93	0.20, 4.31	.925	0.77	0.22, 2.73	.684
Smoking during pregnancy	0.47	0.13, 1.69	.250	0.16	0.05, 0.49	.001	0.68	0.08, 5.49	.719	1.20	0.33, 4.41	.783
≥3 cups coffee before conception	0.99	0.28, 3.57	.993	0.36	0.12, 1.11	.076	0.61	0.08, 4.89	.644	1.04	0.13, 8.63	.970
<b>Health-promoting behaviours</b>												
Physical activity before conception <sup>c</sup>	0.64	0.29, 1.43	.275	0.75	0.41, 1.40	.372	0.74	0.29, 1.87	.212	0.49	0.16, 1.51	.527
Physical activity during pregnancy <sup>c</sup>	0.73	0.32, 1.68	.461	0.91	0.48, 1.72	.764	1.15	0.44, 3.01	.771	0.31	0.09, 1.06	.062
<b>Health</b>												
Depressive symptoms (EPDS score ≥ 13)	1.26	0.29, 5.44	.759	2.87	0.96, 8.63	.060	1.34	0.42, 4.34	.620	1.76	0.45, 7.00	.419

Logistic regression was used.

<sup>a</sup>Reference category is 'quite or very unimportant'.<sup>b</sup>Reference category is 'quite or very good'.<sup>c</sup>Ordinal regression.

perceived health in our sample, but previous studies found that female immigrants in Sweden reported poorer health [29,32]. The results might, therefore, be explained by the selection bias of women answering the questionnaire.

### Implications for policy-makers and health care providers

The high prevalence of harmful lifestyle habits found among Nordic women presents important implications for public health initiatives. More than half of all women had consumed alcohol during early pregnancy, with potential consequences for the unborn child, as a safe lower limit for alcohol intake is unknown [33]. The Swedish National Food Agency states: 'The foetus is more sensitive to alcohol than you are, so refrain from alcohol as soon as you believe that you are pregnant' [3]. Other European countries such as Italy, Denmark and the Netherlands recommend that women stop consuming alcohol when they start trying to conceive [34]. We suggest Sweden should follow their example and update its current recommendations. More than one in five Nordic women used tobacco in early pregnancy and the prevalence of smoking was higher than numbers from the national registers (Supplementary Table 1) both 3 months prior to pregnancy (20% and 14%) and in early pregnancy (15% and 6%) [12]. The reason for these discrepancies is probably that the national registers report daily smoking [12], but we reported any smoking

and included women who stopped smoking when they found they were pregnant. Furthermore, a substantial proportion of all participants were overweight or obese. Analysis from two international cohort studies showed that women trying to conceive had a higher BMI and reported a lower level of physical activity compared with women who used contraception or did not plan to become pregnant within a year [1]. We speculate that those women are unaware of the health consequences of obesity or perceive weight loss as being too difficult to achieve.

Knowledge about health and lifestyle is not necessarily translated into practice. Furthermore, most women are not aware of their pregnancy until gestational weeks 5–6. Public educational efforts for all women of reproductive age should, therefore, be combined with the identification and counselling of women who intend to conceive or who are at risk of conceiving [17]. This can be achieved by using counselling tools such as the Reproductive Life Plan or One Key Question, enabling tailored counselling based on women's needs [34,35].

### Strengths and weaknesses

This study focussed on foreign-born women's lifestyle and health in connection with pregnancy. Many aspects of this concept were investigated and the results were controlled for potential confounders. Validated instruments for measuring mental health and pregnancy intention were used.

The study sample was large and had a good geographical spread. Despite substantial efforts to include foreign-born women, the proportion was nevertheless much lower in our sample than in the Swedish population and this created a selection bias. Women who declined to participate may be the most vulnerable, but by adjusting for sociodemographic and socioeconomic factors we tried to minimise this bias. In their article, Stern et al. [19] explained that reasons for not approaching women and for women declining participation included time constraints and language barriers/problems with interpreters. Midwives also suggested that fear of answering questionnaires may be a reason for non-participation. In a Danish study, an ethnic background other than Danish was associated with non-response of both face-to-face and self-administrated health survey modes [36]. A study carried out in the same context succeeded in recruiting a high proportion of foreign-born women [37]. In that study, the researcher personally informed women about the study in the clinic waiting room, separate to the clinical encounter. This is a resource-demanding but successful strategy for limited sample sizes. For big sample sizes, including a few more questions in the antenatal care records and adding these data to the national registers may be feasible. These strategies would yield more information about the entire pregnant population, including foreign-born women.

The use of tools, validated for specific populations, on a population as diverse as that of Sweden is a challenge and interpretations should be made with caution. For example, we used the London Measure of Unplanned Pregnancy version validated for a British context, giving credits for pregnancy preparations if women had given up alcohol or smoking, but this may have little significance to some groups of foreign-born women. Another important limitation is the categorisation of women as Nordic, European or non-European, as they migrated at different times, for various reasons and from different countries. Future studies should investigate lifestyle and health among women from different regions separately.

## Conclusion

Non-European women generally had a healthier lifestyle compared with Nordic women, which was partly explained by a higher level of religiousness. More non-European women suffered from depressive symptoms in early pregnancy. As few foreign-born women participated in the study, researchers should try other ways of approaching this group and investigate other aspects of their lifestyle and health. Finally, harmful lifestyle habits were common in the preconception period and during early pregnancy in Sweden, suggesting that stronger efforts should be made to encourage health-promoting behaviour.

## Disclosure statement

The authors declare no conflicts of interest.

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