


Self-rated health before pregnancy and adverse birth outcomes in Sweden: A population-based register study

Frida Viirman BSc¹  | Susanne Hesselman PhD^{1,2} | Anna-Karin Wikström PhD¹ |
Agneta Skoog Svanberg PhD¹ | Alkistis Skalkidou PhD¹ | Inger Sundström Poromaa PhD¹ |
Anna Wikman PhD¹

¹Department of Women's and Children's Health, Uppsala University, Uppsala, Sweden

²Center for Clinical Research Dalarna, Falun, Sweden

Correspondence

Frida Viirman, Department of Women's and Children's Health, Uppsala University, Akademiska sjukhuset, SE-75185 Uppsala, Sweden.
Email: frida.viirman@kbh.uu.se

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Abstract

Background: Poor self-rated health (SRH) at time of childbirth has been associated with adverse birth outcomes. However, it is not known whether prepregnancy SRH contributes to these outcomes or whether SRH is a proxy for some other factors. Therefore, the purpose of this study was to explore the associations between poor SRH before pregnancy and adverse birth outcomes. In addition, maternal characteristics associated with SRH before pregnancy were explored.

Methods: A population-based register study encompassing 261 731 deliveries in Sweden between January 2013 and July 2017 was conducted. The associations between poor SRH before pregnancy, rated at first antenatal visit, and the adverse birth outcomes of stillbirth, small for gestational age (SGA), and preterm birth were investigated with logistic regression analyses and presented as crude (OR) and adjusted odds ratios (aOR) with 95% confidence intervals (CI).

Results: Poor SRH before pregnancy was largely characterized by a history of psychiatric care and was associated with stillbirth (OR 1.37, 95% CI 1.04-1.79), SGA birth (OR 1.29, 95% CI 1.19-1.39), and preterm birth (OR 1.41, 95% CI 1.32-1.50). Adjusting for established risk factors for adverse birth outcomes, poor SRH remained associated with SGA birth (aOR 1.16, 95% CI 1.07-1.26) and preterm birth (aOR 1.25, 95% CI 1.17-1.33), but not with stillbirth (aOR 1.08, 95% CI 0.81-1.43).

Conclusions: SRH assessments could be used in early pregnancy to identify women in need of more extensive follow-up, as SRH appears to capture something beyond currently known risk factors for adverse birth outcomes.

KEYWORDS

antenatal care, premature birth, small for gestational age

1 | INTRODUCTION

Self-rated health (SRH) is defined as a person's subjective assessment of their general health status. It is widely used as a health marker, as SRH has been shown to predict morbidity¹ and mortality² in nonpregnant populations, providing essential information not identified by other health measures.³ Capturing physical, emotional, and social well-being, SRH is concordant with WHO's holistic definition of health.⁴ Usually, SRH is assessed through a single-item question where the respondent rates their general health on a scale from very poor to very good. This simple and easy-to-use measure has been proven equivalent to other, potentially more time-consuming, SRH measures such as SF-36.^{5,6}

Poor SRH during pregnancy has been linked to psychological aspects such as depressive symptoms and perceived stress, objective physical diagnoses such as arthritis, asthma, and sexually transmitted infections, and high body mass index (BMI) and previous pregnancy loss.^{7,8} An association has also been reported between poor SRH and low education,^{8,9} whereas higher ratings of SRH during pregnancy have been associated with higher income, being married, and higher levels of education.¹⁰ However, research on SRH before pregnancy is scarce.

Higher ratings of SRH during pregnancy have been found to predict a lower likelihood of complications during birth, lower risk of cesarean birth, and fewer maternal health problems up to three years after delivery, suggesting that the predictive value of SRH for morbidity is relevant also for a pregnant population.¹¹ Established risk factors for stillbirth, small-for-gestational-age birth (SGA), and preterm birth include age, ethnicity, socioeconomic factors, BMI, and smoking.¹²⁻¹⁴ The contribution of SRH to these adverse birth outcomes is mostly unknown and largely based on small samples. Preterm labor was in one study associated with poor SRH during pregnancy.¹⁵ Another study, on low birthweight (LBW), found an association with poor SRH rated at the time of childbirth.¹⁶ Teoli and colleagues found that poor SRH at the time of birth was associated with LBW, preterm birth, and SGA,¹⁷ whereas Stepanikova and coworkers¹¹ found SRH during pregnancy to be of no predictive value for LBW.

In Sweden, information on SRH has been collected nationwide by midwives in antenatal care since 2010; however, these data have not yet been used for research purposes. Given the paucity of research on prepregnancy SRH, there is a need to better understand what SRH ratings before pregnancy are actually capturing. To the best of our knowledge, there are no previous studies on the association between poor SRH before pregnancy and adverse birth outcomes. Therefore, the overall purpose of the study was to explore associations between SRH before pregnancy and stillbirth, SGA, and preterm birth. In addition, maternal characteristics associated with SRH before pregnancy were explored.

2 | METHODS

2.1 | Study design and data source

This cohort study used data retrieved from the Swedish Pregnancy Register (SPR) on deliveries that occurred between January 1, 2013, and July 31, 2017. At the time of this writing, the SPR captures 90% of all deliveries in Sweden,¹⁸ as four regions are not yet being included in the register. Data are prospectively collected and include demographic, reproductive, and maternal health data starting at first antenatal visit, which usually takes place between gestational weeks 9 and 12, and ending at the postnatal checkup at 8-16 weeks postpartum. At the first antenatal visit, the pregnancy-assigned midwife interviews the pregnant person about their medical history and sets up electronic medical records (EMR) for the pregnancy. She also collects some data exclusively for SPR and enters them manually in the register. The remaining data in the SPR are retrieved directly from the EMR.¹⁸ For this study, one pregnancy per woman and only singleton pregnancies were included. The latest pregnancy recorded in SPR was used, because of the increasing coverage of the register over the years. Pregnancies with no data from maternal health records ($n = 11\,468$, 3.5%) or missing SRH data before pregnancy ($n = 57\,857$, 17.5%) were excluded, resulting in a study population of 261 731 women (Figure 1).

2.2 | Exposure

Self-rated health before pregnancy was recorded at the first antenatal visit, most commonly carried out in pregnancy week 9.¹⁸ The single-item question "How would you summarize your health prior to pregnancy?" was used, and the timeframe "prior to pregnancy" was described as a period of up to three months before pregnancy. Five response options ("very good," "good," "neither good nor poor," "poor," and "very poor") were given. In line with previous studies, poor SRH was defined as ratings of "very poor," "poor," or "neither good nor poor," whereas good SRH was defined as ratings of "good" or "very good."^{19,20}

2.3 | Outcomes

Outcomes were stillbirth, SGA, and preterm birth. Stillbirth was defined as a delivery of a stillborn infant from gestational week 22 onwards, recorded in the electronic birth record. Small for gestational age was defined as birthweight more than two standard deviations beneath the mean birthweight for gestational age and sex, according to the Swedish fetal growth curve.²¹ The reference group consisted of infants with birthweight appropriate for gestational age and infants

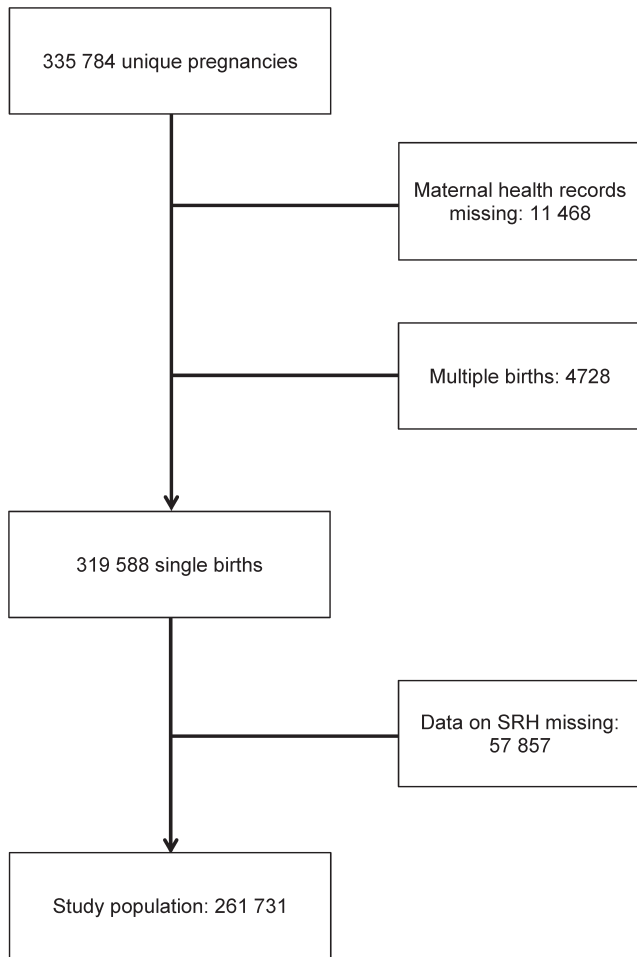


FIGURE 1 Flowchart of study population

born large for gestational age. Preterm birth was defined as delivery before 37 weeks of gestation and further explored as spontaneous (including preterm prelabor rupture of membranes, ICD-10 code O42) or iatrogenic (induced or prelabor cesarean birth) preterm birth.

2.4 | Covariates

Prepregnancy variables encompassed sociodemographic and maternal characteristics. Sociodemographic characteristics included age at delivery (categorized as ≤ 19 , 20-34, or ≥ 35 years), country of birth (categorized as low-income countries, lower middle-income countries, upper middle-income countries, or high-income countries according to the 2018 World Bank's classification²²), civil status (categorized as cohabitant with father of child, single mother or "other situation," which included living with same-sex partner or living in an extended family), education (categorized as ≤ 9 , 10-12, or > 12 years in school), and occupational status (categorized as working no or yes [n/y], specified as sick leave/receiving disability benefits/unemployed vs employed/parental leave/student). Maternal characteristics included body

mass index (BMI) calculated based on weight and height at first antenatal visit (categorized as < 18.5 , 18.5-24, 25-29, or ≥ 30 kg/m²), parity (0, 1-3 or ≥ 4), in vitro fertilization (IVF, [n/y]), alcohol use before conception (defined as score ≥ 6 on the alcohol use disorders identification test [AUDIT], indicating hazardous use [n/y]), and smoking at first antenatal visit, regardless of quantity (n/y).

History of psychiatric care (n/y) was retrieved from the midwife's registration in the EMR using predefined checkboxes at the first antenatal visit. At this visit, which usually takes place before 10 weeks of pregnancy, the midwife interviews the woman about her medical history in general. The checkbox indicating previous psychiatric care covers a broad range of psychiatric and psychological histories and may encompass counseling, psychotherapy, pharmaceutical treatment, or hospitalization at a psychiatric ward. Pregestational medical conditions are recorded in the EMR using checkboxes and/or using diagnosis codes from the International Classification of Diseases, tenth version (ICD-10).²³ For the purposes of the present study, diabetes, systemic lupus erythematosus (SLE), endocrine disorder, epilepsy, inflammatory bowel disease (IBD), and hypertension were included (Table S1). All medical conditions were categorized as absent or present (n/y) and reported both separately and as a summary variable indicating a pregestational condition, that is, any of the medical conditions diabetes, SLE, endocrine disorder, epilepsy, IBD, or hypertension.

2.5 | Statistical analyses

Descriptive statistics were used to describe sociodemographic and maternal characteristics and reported as means and standard deviations (SD) or numbers (n) and percentages (%). Associations between sociodemographic or maternal characteristics and SRH were explored using unadjusted logistic regression analyses and presented as crude odds ratios (ORs) with 95% confidence intervals (CI).

To examine the association between poor SRH before pregnancy and adverse birth outcomes, unadjusted and adjusted logistic regression analyses were performed. Complete cases were used in the unadjusted analyses, and stillbirths were excluded from the analyses of SGA and preterm births. Directed acyclic graphs (DAGs) were used to identify which variables to include as confounders in the multivariable logistic regression model (Figures S1-S3). A DAG is a conceptual representation of assumed relationships between variables and can be created in the web application DAGitty.²⁴⁻²⁶ Variables in the models included age, country of birth, education, BMI, parity, IVF (not for stillbirth), smoking, history of psychiatric care, and the summary variable pregestational conditions. The DAG on stillbirth indicated the need to adjust for alcohol use. However, for comparison with the other outcomes and because

of the extent of missing data on this variable, the decision was made not to include alcohol in the logistic regression model. All associations are presented as crude and adjusted ORs with 95% CI, using good SRH as the reference group. In addition, the association between poor SRH and type of preterm birth (spontaneous or iatrogenic) was explored, using a multinomial logistic regression analysis adjusting for age, country of birth, education, BMI, parity, IVF, smoking, history of psychiatric care, and pregestational conditions. All statistical analyses were performed using IBM SPSS Statistics version 25.0 (IBM Corp., Armonk, NY, USA).

3 | RESULTS

3.1 | Sample characteristics

Prepregnancy characteristics of the study population are shown in Table 1. The women had a mean age of 31 years, and the majority were employed at the time of the first antenatal visit, which occurred at gestational week 9 on average (mean 9.3). Most women were born in a high-income country ($n = 205\,916$, 79.5%), of whom the vast majority were born in Sweden or another Nordic country ($n = 194\,753$, 94.6%). One tenth of the women ($n = 24\,793$, 9.5%) reported at least one pregestational medical condition, with endocrine disorders being the most common, and a history of psychiatric care was reported by 11.5% ($n = 30\,001$).

Prepregnancy characteristics in relation to SRH are shown in Table 1. Poor SRH before pregnancy was reported by one in ten women ($n = 25\,786$, 9.9%). Among those reporting poor SRH, history of psychiatric care ($n = 7312$, 28.4%) was twice as common as pregestational medical conditions ($n = 3479$, 13.5%). Several associations were observed between prepregnancy characteristics and poor SRH, as illustrated in Figure 2. The largest odds ratios were found for occupational status of not working (OR 4.44, 95% CI 4.28-4.61) and a history of psychiatric care (OR 3.72, 95% CI 3.61-3.84), followed by low education (OR 2.62, 95% CI 2.51-2.73) and being single (OR 2.62, 95% CI 2.45-2.81), whereas the association with pregestational medical conditions was somewhat weaker (OR 1.57, 95% CI 1.51-1.63).

3.2 | Poor SRH and adverse birth outcomes

Among the 638 women with stillbirths, 13.3% reported poor SRH before pregnancy. Similar proportions of women reporting poor SRH were observed among the 7761 women with SGA births and the 12 088 women experiencing preterm births (12.4% and 13.0%, respectively). Poor SRH before pregnancy was associated with stillbirth (OR 1.37, 95% CI 1.04-1.79), SGA (OR 1.29, 95% CI 1.19-1.39), and preterm

birth (OR 1.41, 95% CI 1.32-1.50) (Table 2). In the analysis adjusting for known risk factors, poor SRH was not associated with stillbirth (aOR 1.08, 95% CI 0.81-1.43), whereas association with SGA (aOR 1.16, 95% CI 1.07-1.26) and preterm birth (aOR 1.25, 95% CI 1.17-1.33) remained (Table 2). In a subanalysis, the majority of the preterm births (87.5%) had a spontaneous onset, whereas 12.5% were iatrogenic. Poor SRH was found to be associated with both iatrogenic preterm birth (aOR 1.58, 95% CI 1.35-1.85) and spontaneous preterm birth (aOR 1.21, 95% CI 1.12-1.29), compared with term birth (data not shown). Moreover, a range of sociodemographic and maternal characteristics was also associated with adverse birth outcomes, for instance, advanced maternal age, low education level, and smoking status. For stillbirth, an association was also found with being born in a low-income country and with obesity (BMI ≥ 30). For SGA and preterm birth, an association was also found with low BMI (Table S2).

4 | DISCUSSION

In this study, we describe associations between poor SRH before pregnancy and adverse birth outcomes, and the clinical characteristics of women with poor SRH. Following adjustment for established risk factors for adverse birth outcomes, poor SRH remained associated with SGA and preterm birth, but not with stillbirth. Women with a history of psychiatric care had a fourfold higher odds ratios for reporting poor SRH, and similar odds ratios were noted among women who were on sick leave, received disability benefits, or were unemployed before pregnancy. In addition, single mothers and women with low educational attainment more commonly reported poor SRH.

The association between indicators of low socioeconomic status, such as low level of income and/or education, and poor SRH has been observed in the general population^{27,28} and in pregnant populations.⁸ In line with these results, the present study found women who were unemployed to be more likely to report poor SRH. In Sweden, both parents commonly contribute to the household income, and parental benefits are based on an individual's recent income. Not being able to contribute to the household economy may act as a stressor affecting the general health of mothers. On the other hand, poor health as captured by SRH may affect an individual's ability to work. In one previous Swedish study,¹⁹ unemployment before pregnancy was the only sociodemographic factor that was associated with poor SRH after childbirth. Together with our findings, this suggests that occupational status influences SRH over a time span that stretches from before pregnancy until after the postpartum period. Considering occupational status as a proxy for economic status, this finding is also in line with

TABLE 1 Prepregnancy characteristics for the total sample and by self-rated health (SRH) before pregnancy

	Total n (%)	Good SRH n (%) 235 945 (90.1)	Poor SRH n (%) 25 786 (9.9)
Age, years			
Mean \pm SD	31.0 \pm 5.1	31.0 \pm 5.1	31.1 \pm 5.5
\leq 19	2414 (0.9)	1983 (0.8)	431 (1.7)
20-34	199 958 (76.4)	181 211 (76.8)	18 747 (72.7)
\geq 35	59 350 (22.7)	52 742 (22.4)	6608 (25.6)
Country of birth			
Low-income countries	16 270 (6.3)	13 902 (6.0)	2368 (9.3)
Lower middle-income countries	9381 (3.6)	8251 (3.5)	1130 (4.4)
Upper middle-income countries	27 331 (10.6)	24 063 (10.3)	3268 (12.8)
High-income countries	205 916 (79.5)	187 200 (80.2)	18 716 (73.4)
Civil status			
Cohabitant	236 780 (93.5)	214 925 (94.1)	21 855 (87.8)
Single mother	5119 (2.0)	4041 (1.8)	1078 (4.3)
Other situation	11 343 (4.5)	9380 (4.1)	1963 (7.9)
Education, years			
\leq 9	20 282 (8.4)	16 678 (7.6)	3604 (15.4)
10-12	94 481 (39.1)	84 367 (38.7)	10 114 (43.3)
>12	126 707 (52.5)	117 049 (53.7)	9658 (41.3)
Occupational status			
Employed, parental leave, student	233 672 (93.7)	214 710 (95.0)	18 962 (81.0)
Sick leave/receiving disability benefits, unemployed	15 810 (6.3)	11 356 (5.0)	4454 (19.0)
BMI, kg/m²			
Mean \pm SD	24.7 \pm 4.7	24.6 \pm 4.6	25.7 \pm 5.4
<18.5	6557 (2.6)	5774 (2.5)	783 (3.2)
18.5-24	149 489 (59.2)	137 242 (60.2)	12 247 (49.5)
25-29	63 923 (25.3)	56 994 (25.0)	6929 (28.0)
\geq 30	32 727 (13.0)	27 933 (12.3)	4794 (19.4)
Parity			
0	118 097 (45.1)	107 271 (45.5)	10 826 (42.0)
1-3	138 007 (52.7)	124 009 (52.6)	13 998 (54.3)
\geq 4	5626 (2.1)	4664 (2.0)	962 (3.7)
IVF			
No	249 612 (95.5)	225 186 (95.5)	24 426 (94.8)
Yes	11 875 (4.5)	10 547 (4.5)	1328 (5.2)
Alcohol, AUDIT \geq6			
No	195 161 (95.2)	176 465 (95.4)	18 696 (93.1)
Yes	9922 (4.8)	8544 (4.6)	1378 (6.9)
Smoking			
No	219 724 (94.7)	199 418 (95.3)	20 306 (89.5)
Yes	12 213 (5.3)	9835 (4.7)	2378 (10.5)
History of psychiatric care			
No	231 730 (88.5)	213 256 (90.4)	18 474 (71.6)

(Continues)

TABLE 1 (Continued)

	Total n (%)	Good SRH n (%) 235 945 (90.1)	Poor SRH n (%) 25 786 (9.9)
Yes	30 001 (11.5)	22 689 (9.6)	7312 (28.4)
Pregestational conditions ^a			
No	236 938 (90.5)	214 631 (91.0)	22 307 (86.5)
Yes	24 793 (9.5)	21 314 (9.0)	3479 (13.5)
Diabetes			
No	259 669 (99.2)	234 176 (99.3)	25 493 (98.9)
Yes	2062 (0.8)	1769 (0.7)	293 (1.1)
SLE			
No	261 319 (99.8)	235 605 (99.9)	25 714 (99.7)
Yes	412 (0.2)	340 (0.1)	72 (0.3)
Endocrine disorder			
No	243 446 (93.0)	220 149 (93.3)	23 297 (90.3)
Yes	18 285 (7.0)	15 796 (6.7)	2489 (9.7)
Epilepsy			
No	260 171 (99.4)	234 613 (99.4)	25 558 (99.1)
Yes	1560 (0.6)	1332 (0.6)	228 (0.9)
IBD			
No	259 465 (99.1)	234 037 (99.2)	25 428 (98.6)
Yes	2266 (0.9)	1908 (0.8)	358 (1.4)
Hypertension			
No	259 609 (99.2)	234 150 (99.2)	25 459 (98.7)
Yes	2122 (0.8)	1795 (0.8)	327 (1.3)

Note: Missing on variables, n (%)—age: 9 (0.0), country of birth: 2833 (1.1), civil status: 8489 (3.2), education: 20 261 (7.7), occupational status: 12 249 (4.7), BMI: 9035 (3.5), parity: 1 (0.0), IVF: 244 (0.1), alcohol: 56 648 (21.6), and smoking: 29 794 (11.4).

Abbreviations: AUDIT, alcohol use disorders identification test; ≥ 6 points indicate hazardous use of alcohol; BMI, body mass index; IBD, inflammatory bowel disease; IVF, in vitro fertilization; SD, standard deviation; SLE, systemic lupus erythematosus; SRH, self-rated health.

^aSummary variable including any of the medical conditions diabetes, SLE, endocrine disorder, epilepsy, IBD, or hypertension.

one previous study reporting high income to be associated with good SRH during pregnancy.¹⁰ The same study found marriage to be connected to good SRH, which corresponds with our finding that single status was associated with poor SRH before pregnancy. Other studies have reported associations between maternal characteristics, such as overweight or physical disorders, and poor SRH during pregnancy.⁷ In line with these results, women in the present study who were overweight or underweight, or had a pregestational medical condition, were more likely to report poor SRH.

In line with previous studies of poor SRH during pregnancy, which have found associations with psychological factors,^{7,8} we observed a history of psychiatric care to be strongly associated with poor SRH at first antenatal visit. A broad definition of psychiatric care was used and women with experience of any such care were almost four times more likely to report poor SRH before pregnancy. The association between poor SRH and prior psychiatric care appeared stronger than the association observed with pregestational medical

conditions. This is in line with findings from studies of university students and of elderly people, where mental health was found to contribute more than physical health to ratings of general health.^{29,30} To the best of our knowledge, this has not been seen in the general population or studied in a pregnant population.

Poor SRH before pregnancy was independently associated with both SGA and preterm birth. These results are in line with previous research on SRH at the time of childbirth¹⁷ and suggest that poor SRH may indeed capture important health aspects beyond the known risk factors for SGA and preterm birth. One possible explanation for the observed association between poor SRH and adverse birth outcomes may relate to inflammatory components, since altered inflammatory markers have been found to be associated with poor SRH in both nonpregnant³¹ and pregnant women.⁷ Another option is that poor SRH in this study is partly an expression of maternal stress, which has been associated with preterm birth.³² This may also be reflected by the overlap between poor SRH and

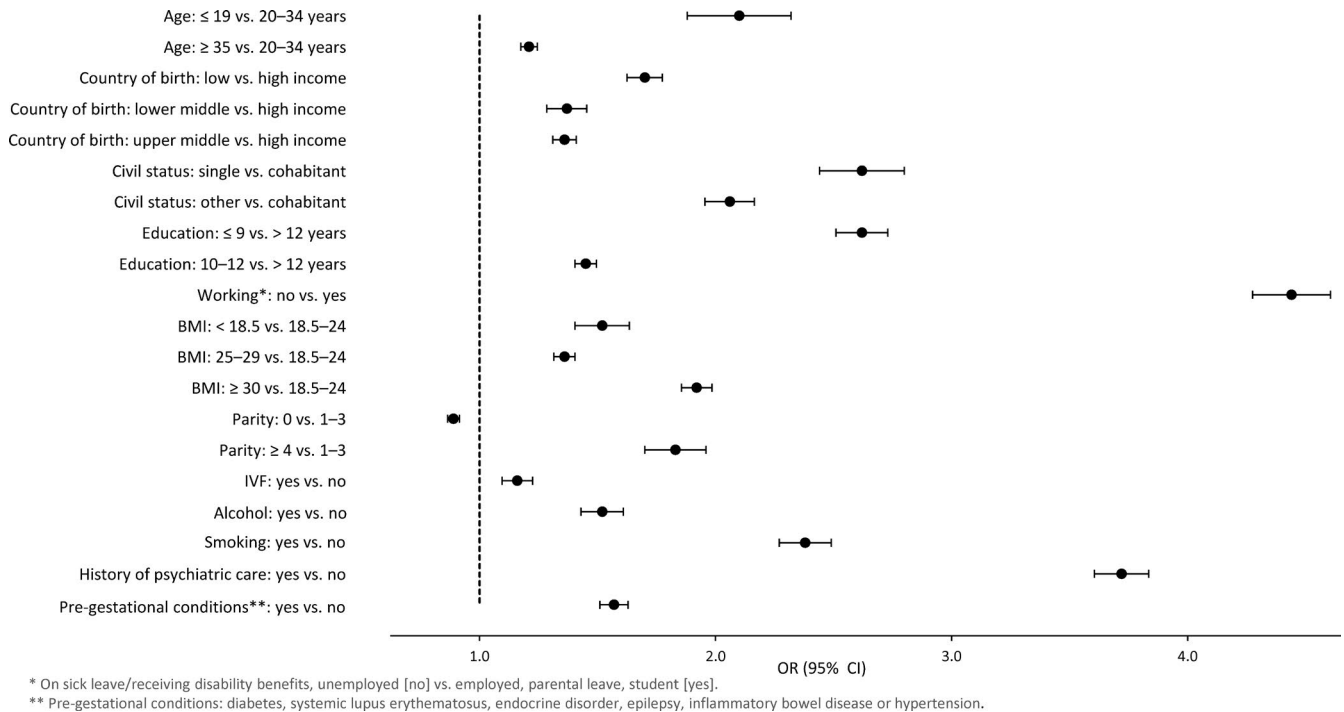


FIGURE 2 Pre-pregnancy characteristics associated with poor self-rated health recorded at first antenatal visit

TABLE 2 Associations between poor self-rated health (SRH) before pregnancy recorded at first antenatal visit and adverse pregnancy outcomes

	Stillbirth ^a n = 474 (0.2%)		SGA birth ^b n = 5998 (2.9%)		Preterm birth ^c n = 9353 (4.5%)	
	OR (95% CI)	aOR (95% CI)	OR (95% CI)	aOR (95% CI)	OR (95% CI)	aOR (95% CI)
SRH						
Good	1	1	1	1	1	1
Poor	1.37 (1.04-1.79)	1.08 (0.81-1.43)	1.29 (1.19-1.39)	1.16 (1.07-1.26)	1.41 (1.32-1.50)	1.25 (1.17-1.33)

Note: Adjusted odds ratios (aOR) retrieved by logistic regression adjusted for age, country of birth, education, body mass index, parity, in vitro fertilization (not for stillbirth), smoking, history of psychiatric care, and pregestational medical conditions (diabetes and/or systemic lupus erythematosus and/or endocrine disorder and/or epilepsy and/or inflammatory bowel disease and/or hypertension).

Bold values are used to highlight outcomes associated with the exposure also after adjustment for other variables.

Abbreviations: CI, confidence interval; OR, odds ratio; SGA, small-for-gestational age.

^an in model: 207 930.

^bn in model: 205 695.

^cn in model: 207 431.

a history of psychiatric care. In addition, it must be noted that several associations with known risk factors for SGA and preterm birth, such as advanced maternal age, low education level, low BMI, and smoking,^{13,14} were also observed in this study.

The present results indicate that SRH could be of clinical value during pregnancy as a simple and easy-to-administer screening tool for potential adverse birth outcomes, highlighting a need for extended antenatal follow-up. In Sweden, midwives independently handle pregnancies as long as no complications occur, and SRH is routinely collected in antenatal care. However, the extent to which the information

on SRH is used in antenatal care is unknown. In a study of midwives' perspectives on the Swedish maternal health care register, the measurement of SRH was considered unnecessary to include in the register,³³ indicating that few midwives viewed the measurement as useful. The clinical value of SRH has been pointed out by Jylhä, who suggested that SRH, "is likely to support the doctor-patient relationship in allowing the patient to generate a perspective genuinely his or her own. (...) in general practice, self-rated health can hardly replace more specific assessment tools, but it does yield information that cannot be reached by any specific tool."³⁴ (pp. 313-314) Accessing a pregnant woman's

own beliefs about her health is of importance for individualizing antenatal care, and SRH seems to capture other issues than the midwife usually asks about. The present study highlights the possibility for midwives in antenatal care to use SRH measurements at enrollment in antenatal care as a tool to identify those in need of extra care and additional supports during pregnancy.

4.1 | Strengths and limitations

To date, no previous study has examined SRH and adverse birth outcomes in a national population-based sample of this size. However, the findings may not be applicable in other populations with different risk profiles for these adverse outcomes. A particular strength is our use of prepregnancy SRH recorded at enrollment in antenatal care as the exposure, as this enabled us to examine its role as a potential predictor for adverse birth outcomes. This assessment point is likely little affected by the pregnancy itself, compared with assessments of SRH at time of childbirth, as used in other studies. Several established risk factors for adverse birth outcomes were included as confounders. Yet, information on, for instance, stress levels or stressful life events was not available, which could contribute to residual confounding. Moreover, the potentially mediating effects of pregnancy-related causes of SGA and preterm birth, such as preeclampsia and infections, were not accounted for in the present study, which focused on delineating associations with poor SRH before pregnancy as a potential risk factor for adverse outcomes. Information on previous stillbirth, SGA, and preterm birth was not included in the analyses, since only one pregnancy per woman was used and information on previous pregnancies was available only if any prior pregnancies occurred during the study period. Furthermore, malformations and chromosome aberrations were not excluded from the analysis.

4.2 | Conclusions

Poor SRH before pregnancy was largely characterized by a history of psychiatric care and was found to be independently associated with SGA and preterm birth. The SRH measurement appears to capture something of clinical importance beyond the known risk factors for adverse birth outcomes and should be further investigated in other health care contexts. Our findings highlight the potential for using SRH assessments to identify women in need of more extensive antenatal follow-up. However, the specific way in which the information gathered by measuring SRH could be used in antenatal care to further support women with poor SRH warrants further exploration.

ETHICAL APPROVAL

The Regional Ethical Board in Uppsala approved the study on September 13, 2017 (Dnr 2017/276).

DATA AVAILABILITY STATEMENT

Data available on request due to privacy/ethical restrictions.

ORCID

Frida Viirman  <https://orcid.org/0000-0003-1384-3181>

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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