

Predictors of medication use during pregnancy: a cohort study

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ABSTRACT

Background: Sociodemographic characteristics and health behaviours are associated with medication use in pregnancy, but it is unclear if they are independent predictors because women's health status has hardly been accounted for. We aimed to identify predictors of use of medications and of iron/folic acid.

Methods: This cohort included pregnant women recruited in a prenatal clinic in Trieste, Italy, from 2007 to 2009. Dispensations were obtained from the regional outpatient dispensation database through record linkage. We calculated the Odds Ratio (OR), with 95% confidence interval (95%CI), of ≥ 1 dispensation of (a) any medication and (b) iron/folic acid, using unconditional logistic regression. The final model adjusted for age, partner education, housing size, comorbidities.

Findings: Of 767 women, 70.5% had ≥ 1 dispensation of any medication and 46.1% of iron/folic acid. Use of any medication was predicted by immigrant status of the woman (OR 1.21; 95%CI 0.57–2.53) or of her partner (1.51; 0.67–3.40), \leq high school degree of the woman (1.11; 0.61–2.03) or of her partner (1.21; 0.75–1.95), unemployment (1.47; 0.72–2.98), smoking (1.25; 0.65–2.40), alcohol consumption (≥ 5 drinks/week: 2.78; 1.78–4.34), and obesity (1.33; 0.59–2.99). Use of iron and/or folic acid was predicted by \leq high school degree (0.65; 0.40–1.08), smoking (0.80; 0.47–1.37), and obesity (0.62; 0.31–1.25).

Conclusion: In this cohort, characteristics including education, immigrant and employment status, smoking, alcohol consumption, and obesity independently predicted medication use.

Interventions to promote safe use of medications should carefully consider women's characteristics.

Key words: pregnancy; medication use; folic acid; sociodemographic characteristics; education; immigration; socio-economic status.

INTRODUCTION

Women frequently use medications during pregnancy. It has been estimated that 27% to 99% of women in developed countries use prescription medications during pregnancy [1] and about 67% used Over-the-Counter (OTC) agents [2]. However, the evidence on the risk-benefit profile in pregnant women is limited for most medications. Thus pregnant women often have concerns about using medicines [3,4] and their compliance with needed medication may be influenced by the perception of medication-related risks: in Northern Europe, about 70% of women avoided taking medication for fear of foetal adverse effects [5]. Younger women, those with a first pregnancy and those with lower educational level reported the highest perceived risk related to medication use [6]. Women reported receiving information on medications and supplements as one of their most important learning needs [7]. Clinicians, midwives and other personnel involved in providing healthcare to pregnant women play a key role in providing such information during antenatal visits as well as in medication management and counselling. It is thus important to assess predictors of medication use in order to identify those women who may benefit the most from active counselling or information initiatives. Moreover, such evidence is needed to plan interventions promoting safe medication use during pregnancy and to tailor such interventions to the specific characteristics of women.

Differences in medication use in pregnancy according to women's sociodemographic characteristics and health behaviours have been reported in prior studies but results were inconsistent, probably because factors such as the societal context and the healthcare system also play a relevant role. Thus, it is important to address this topic in specific and different contexts and countries. In a number of studies, use of medications increased with increasing maternal age [2,8,9], while in others, younger childbearing women were more likely to report the use of medications for acute/short-term illnesses [2] and of anti-asthmatics [10], as well as to fill prescriptions for antibiotics [11]. In some studies in Northern European countries, women with low education were more likely to use any medication [12] or antibiotics [12,13]; in an international survey, women with lower educational level were more likely to report the use of medications for chronic conditions [2]. Medication use was conversely higher in more educated women in a large cohort in the USA [8] and in a cross-sectional study in Belgium [9]. Use of medications was less likely in immigrant women in Western and Northern Europe [2,10], while a Belgian study found that use of medications was reported more frequently by non-immigrant women [9]. In Germany, female welfare recipients and unemployed women were more likely to fill prescriptions for antibiotics than those in white-blue collar occupations [11]. Regarding health behaviours, both smoking and alcohol consumption

during pregnancy have been consistently associated with increased use of medication [2,10,14].

Women's health status is a determinant of medication use during pregnancy. Women reporting health problems during pregnancy were more likely to use analgesics, anti-infectives and antihistamines than those who did not report problems [15]. Sociodemographic characteristics and health behaviours have a complex relation with maternal health status as well as with health care utilization during pregnancy, such as prenatal care visits and ultrasound evaluations. For instance, maternal education has been inversely associated with hypertension and preterm delivery [16-19] as well as with obesity [20]. A social gradient in health behaviours, such as smoking during pregnancy [16,21] has been reported as well. Few prior studies, however, accounted for women's health in assessing the relation of medication use with sociodemographic characteristics and health behaviours.

We conducted a prospective cohort study to identify predictors of the use of prescription medications as well as of folic acid and iron, adjusting for comorbidities before and during pregnancy.

PARTICIPANTS, ETHICS AND METHODS

Participants

The cohort included all pregnant women residents of the Friuli Venezia Giulia (FVG) region in Northeast Italy who had attended a prenatal visit between 20 and 22 weeks of gestation at the Institute for Maternal and Child Health IRCCS Burlo Garofolo in Trieste from April 3, 2007 to March 3, 2009. During the recruitment period, about 1,800 live births per year were recorded in Trieste and 9,000 in FVG [22]. Exclusion criteria were: age <18 years, poor Italian language skills, twin or complicated pregnancies. Complicated pregnancies were defined as those with maternal abnormalities of the reproductive tract (such as uterine fibroids), pre-existing chronic illness (such as cancer, AIDS, severe heart disease, severe kidney disease, severe Crohn's disease or ulcerative colitis), or foetal congenital defects.

All women filled out a self-administered questionnaire inquiring on: date of birth, marital status (woman cohabiting with the partner or living alone), housing size (<50 m², 50-100 m², ≥100 m²), smoking, alcohol consumption, comorbidities before and during pregnancy (diabetes, asthma, allergies, epilepsy, hypertension, vomiting, hypothyroidism, hyperthyroidism, lupus, rheumatic diseases, urinary tract infections, other infections, fevers, seizures, anaemia, cardiovascular diseases, neurological diseases), prior pregnancies (gravidity), number of prenatal visits and ultrasound examinations, height and weight before and during pregnancy, gestational age at birth and date of

delivery. For the woman and (if applicable) for her partner, we collected information on the country of origin, level of education (degree achieved: less than high school, high school, university or higher) and occupational status (on pre-birth maternity leave, employed, housewife, unemployed).

For each woman, we extracted the records of all dispensations between 2006 and 2012 from the outpatient prescription database of the FVG Region through record linkage using an individual identifier. This database records information on all prescribed, reimbursable medications dispensed to residents of FVG by pharmacies. All residents are registered with the Regional Health System, providing universal access to health care. A unique personal identifier links anonymized individual records. For each dispensation, the following information is recorded: date of redemption, active substance (description and Anatomical Therapeutic and Chemical - ATC - classification code [23]), brand, quantity, strength, dispensed form, number of units and number of refills. Information on the indication and the prescribed dosage regimen is not recorded. All dispensations from the estimated date of conception to the date of delivery were assumed to have occurred during pregnancy. The date of conception was estimated by subtracting gestational age at birth from the date of delivery.

Statistical analysis

We estimated the Odds Ratio (OR), with 95% confidence interval (95%CI), of having ≥ 1 dispensation for (a) any medication, (b) folic acid and iron, using unconditional logistic regression. The following variables were evaluated through uni- and multi-variate analysis: age at delivery (5 classes), education of women and of partners, occupational status of women and of partners, prior pregnancies, smoking, alcohol consumption, BMI before pregnancy (underweight below 18.5; normal weight 18.5–24.9; overweight 25.0–29.9; obesity 30.0 and more [24]), comorbidities before and during pregnancy (none, 1, 2+), country of origin of women and partners (Italy, other), marital status, number of visits and of ultrasound imaging, housing size. Variables with univariate $p \geq 0.20$ were entered individually in bi- and multi-variable models and only those that explained the variability or modified the regression coefficient estimators were retained. The final model included terms for age, paternal education, housing size and comorbidities. The statistical analysis was performed with SAS[®] software, version 9.3 (SAS, Cary, NC, USA).

Ethics Committee review

The study protocol was approved by the Ethics Committees of the University Hospital of Udine and of the

Institute for Maternal and Child Health of Trieste. Written informed consent for participation in the study was obtained.

RESULTS

The cohort included 767 women, 42.6% of whom were aged 30 to 34 years and mostly (91.4%) non-immigrants (Table 1). More than 45% held a high school degree or had a partner with a high school degree, 74.0% were on maternity leave and 92.7% had an employed partner. Only 9.5% smoked and 5.1% had 5 or more alcoholic drinks per week, 72.2% had a normal BMI but 14.6% were overweight and 5.5% obese; 45.6% were pregnant for the first time, 31.3% reported no comorbidities but 30.9% had 2 or more comorbidities, 44.2% had 9 or more prenatal visits and 27.0% had 8 or more ultrasound examinations.

A total of 541 (70.5%) women had ≥ 1 dispensation for any medication during pregnancy. Folic acid (36.0%) and iron (26.2%) were the most common medications, followed by non-opioid analgesics (6.2%), thyroid hormones (4.6%), medications for acid-related disorders (3.6%) and antithrombotics (3.2%) (Table 2).

Compared to women aged 25 to 29 years, those between the ages of 30 and 39 years were more than twice and those 40 years or above more than four times more likely to have ≥ 1 dispensation of any medication (excluding iron and folic acid) (Table 3). The likelihood of having ≥ 1 dispensation of any medication was increased in immigrant women (1.21; 95% CI 0.57–2.53) or those with an immigrant partner (1.51; 0.67–3.40), in women with less than a high school degree (1.11; 0.61–2.03) or with a partner having less than a high school (1.21; 0.75–1.95) or a high school degree (1.51; 0.97–2.35), in unemployed women (1.47; 0.72–2.98) or those with a living space ≤ 100 m² (1.51; 1.02–2.25).

Smoking (1.25; 0.65–2.40), alcohol consumption (<4 drinks/week: 1.92; 1.25–2.95 and ≥ 5 drinks/week: 2.78; 1.78–4.34) and being underweight (1.68; 0.82–3.44) or obese (1.33; 0.59–2.99) were also associated with an increased likelihood of having ≥ 1 dispensation of any medication.

Women with prior pregnancies were less likely to have ≥ 1 dispensation of any medication, while an increasing number of comorbidities and of prenatal ultrasound examinations increased the likelihood of having ≥ 1 dispensation of any medication.

Regarding folic acid and iron, the likelihood of having ≥ 1 dispensation was lower in women with less than a high school (0.65; 0.40–1.08) or a high school degree (0.80; 0.56–1.15), in smokers (0.80; 0.47–1.37) and ex-smokers (0.79; 0.57–1.09) as well as in those with obesity (0.62; 0.31–1.25) (Table 4).

TABLE 1. Characteristics of the women included in the cohort.

	DISPENSATION OF ANY MEDICATION ¹						
	None (N= 226)		At least one (N= 541)		Chi square p	Total (N= 767)	
	N	%	N	%		N	%
Indicators of socioeconomic status							
Age category (years)							
<25	11	4.9	31	5.7	0.1294	42	5.5
25-29	43	19.0	68	12.6		111	14.5
30-34	89	39.4	238	44.0		327	42.6
35-39	70	31.0	159	29.4		229	29.9
≥40	13	5.7	45	8.3		58	7.6
Country of origin of the woman							
Italy	211	93.4	490	90.6	0.3032	701	91.4
Other	14	6.2	45	8.3		59	7.7
Country of origin of the partner							
Italy	207	91.6	480	88.7	0.3844	687	89.6
Other	10	4.4	32	5.9		42	5.5
Marital status							
Married	201	88.9	482	89.1	0.7512	683	89.0
Single	24	10.6	53	9.8		77	10.0
Level of education of the woman (degree achieved)							
Less than high school	38	16.8	101	18.7	0.8141	139	18.1
High school	110	48.7	254	46.9		364	47.5
University	78	34.5	184	34.0		262	34.2
Level of education of the partner (degree achieved)							
Less than high school	69	30.5	155	28.6	0.0421	224	29.2
High school	88	38.9	260	48.1		348	45.4
University	64	28.3	116	21.4		180	23.5
Occupational status of the woman							
On pre-birth maternity leave	169	74.8	399	73.7	0.5563	568	74.0
Employed	20	8.8	37	6.8		57	7.4
Housewife	18	8.0	49	9.1		67	8.7
Unemployed	15	6.6	48	8.9		63	8.2
Occupational status of the partner							
Employed	209	92.5	502	92.8	0.5081	711	92.7
Unemployed	9	4.0	28	5.2		37	4.8
House size (m ²)							
>100	70	31.0	121	22.4	0.0148	191	24.9
≤100	155	68.6	412	76.2		567	73.9

¹ It includes folic acid and iron.

DISCUSSION

This cohort included mostly women with a higher education, who were employed or had an employed partner, and had received prenatal care. About 70% of women were dispensed at least one medication during pregnancy, a prevalence in the range of developed countries [1]. Besides iron and folic acid, the most frequently dispensed medications were analgesic non-opioids and thyroid medications. This result supports the observation that women in this study were mostly healthy, as

only one in three women had more than one comorbidity. Moreover, the majority of women did not smoke, reported no or only occasional alcohol consumption and had normal weight. However, the limited number of women who were smokers, had a high alcohol consumption and were obese were more likely to have medications dispensed during pregnancy, probably because of poorer health. Higher BMI has been associated with higher use of prescription medications in prior studies [13,25]. Additionally, we found that women with obesity as well as smokers were also less likely to take folic acid and iron. These findings

TABLE 1 (CONTINUED). Characteristics of the women included in the cohort.

	DISPENSATION OF ANY MEDICATION ¹						
	None (N= 226)		At least one (N= 541)		Chi square p	Total (N= 767)	
	N	%	N	%		N	%
Indicators of health behaviour							
Smoking							
Never	119	52.6	317	58.6	0.2791	436	56.8
Smoker	21	9.3	52	9.6		73	9.5
Ex-smoker	82	36.3	166	30.7		248	32.3
Alcohol consumption (drinks/week)							
Abstainer	69	30.5	166	30.7	0.8448	235	30.6
<4	147	65.0	343	63.4		490	63.9
≥5	10	4.4	29	5.4		39	5.1
BMI (kg/m ²)							
<18.50 (underweight)	15	6.6	44	8.1	0.6145	59	7.7
18.50-24.99 (normal)	164	72.6	390	72.1		554	72.2
25-<30 (overweight)	37	16.4	75	13.9		112	14.6
≥30 (obese)	10	4.4	32	5.9		42	5.5
Indicators of pregnancy history, health status and healthcare use							
Prior pregnancies							
0	98	43.4	252	46.6	0.6131	350	45.6
1-2	112	49.6	247	45.7		359	46.8
≥3	16	7.1	42	7.8		58	7.6
Comorbidities during pregnancy (number)							
0	89	39.4	151	27.9	0.0055	240	31.3
1	76	33.6	198	36.6		274	35.7
≥2	57	25.2	180	33.3		237	30.9
Prenatal care visits (number)							
<7	33	14.6	68	12.6	0.112	101	13.2
7	35	15.5	80	14.8		115	15.0
8	58	25.7	104	19.2		162	21.1
≥9	87	38.5	252	46.6		339	44.2
Prenatal ultrasound imaging (number)							
<4	59	26.1	108	20.0	0.353	167	21.8
4	36	15.9	98	18.1		134	17.5
5-7	62	27.4	158	29.2		220	28.7
≥8	61	27.0	146	27.0		207	27.0

¹ It includes folic acid and iron.

underscore the importance of identifying subgroups of women with specific lifestyle habits and conditions which require the highest degree of counselling or intervention on medication use during pregnancy including recommended preventive agents.

In our study, sociodemographic characteristics also predicted the use of medications. Women younger than 25 and above 30 years were more likely to have at least one prescription medication dispensed during pregnancy. This is in line with prior studies showing higher use of medications in the oldest and youngest age categories compared to the intermediate age [2,8,9,25,26]. In FVG, the mean maternal age at delivery was 31.2 years in 2008 [27], suggesting that midwives should carefully

assess medication use during pre-natal visits, as many of their patients are likely to use at least one medication.

In our study, the use of any medication was more likely in women with lower education, or in those whose partner had lower education, and in unemployed women. These findings are consistent with some [2,11,12] but not all studies [8,9]. However, we found that women with lower education were less likely to take folic acid and iron. In our study, immigrant women, or those with an immigrant partner were more likely to use medications as well as folic acid and iron. Conversely, use of medications was less likely in immigrant women in Western and Northern Europe [2,10]. Our results have two important implications. First, medication use may be a reflection

TABLE 2. Women with at least one dispensation during pregnancy, by therapeutic class.

Therapeutic class	ATC ¹	Users (N=541)	
		N	% ²
Alimentary tract and metabolism			
Medications for acid related disorders	A02	27	3.6
Vitamins and mineral supplements	A11, A12	18	2.4
Blood and blood forming organs			
Antithrombotic agents	B01	24	3.2
Iron	B03A	199	26.2
Folic acid	B03B	273	36.0
Cardiovascular system			
Antihypertensive medications	C02, C07, C08, C09A	6	0.8
Genitourinary system and sex hormones			
Gynaecological anti-infectives - antiseptics	G01A	7	0.9
Sympathomimetics, labour repressants	G02CA	10	1.3
Systemic hormonal preparations			
Thyroid preparations	H03	35	4.6
Anti-infective agents			
Antibiotics, systemic	J01	20	2.6
Antimycotics, systemic	J02	1	0.1
Antivirals, systemic	J05	1	0.1
Musculoskeletal system			
Non-steroidal anti-inflammatory drugs	M01A	2	0.3
Nervous system			
Non-opioid analgesics	N02BE	47	6.2
Antidepressants - selective serotonin agonists	N02CC	1	0.1
Antiepileptic medications	N03	1	0.1
Respiratory system			
Medications for obstructive airway disease	R03	7	0.9
Adrenergic inhalants	R03A	5	0.7
Other inhalants	R03B	1	0.1
Adrenergics, systemic	R03CA	1	0.1
Antihistamines for systemic use	R06A	3	0.4

¹ *Anatomic and Therapeutic Classification.*

² *Percentage of the total number of cohort members.*

of poor health and indicate higher information needs on health and safe use of medications in pregnancy. Second, it underscores the importance of fine-tuning the delivery of this information to the educational and cultural background of women.

Of note, we found that women currently employed during pregnancy were less likely to have dispensations of any medication than those in pre-birth maternity leave. The 'healthy worker effect' may partially explain this result, because women experiencing less health problems,

and thus using medication less frequently, may remain employed during pregnancy.

Women who had prior pregnancies were less likely to use any medication as well as iron and folic acid. Concordantly, many studies have reported that use of prescription medication was lower in women with more than one prior pregnancy [28]. However, other studies had different results: in one, women with prior pregnancies were more likely to report the use of medications for acute/short-term illnesses, but not for chronic or long-term

TABLE 3. Odds Ratio (OR), with 95% Confidence Interval (95%CI), of having ≥ 1 dispensation of any medication¹ during pregnancy, by socio-demographic characteristics.

	≥ 1 dispensation of any medication ¹				Univariate		Multivariate ²			
	No (N= 226)		Yes (N= 359)		OR	95%CI	OR	95%CI		
	N	%	N	%						
Indicators of socioeconomic status										
Age category (years)										
<25	11	4.87	20	5.57	1.96	0.83	4.58	2.93	1.08	7.94
25-29 ³	43	19.03	40	11.14	1.00	-	-	1.00	-	-
30-34	89	39.38	151	42.06	1.82	1.10	3.02	2.25	1.32	3.84
35-39	70	30.97	115	32.03	1.77	1.05	2.98	2.19	1.25	3.82
≥ 40	13	5.75	33	9.19	2.73	1.26	5.91	4.15	1.76	9.78
Country of origin of the woman										
Italy ³	211	93.36	329	91.64	1.00	-	-	1.00	-	-
Other	14	6.19	25	6.96	1.15	0.58	2.25	1.21	0.57	2.53
Country of origin of the partner										
Italy ³	207	91.59	316	88.02	1.00	-	-	1.00	-	-
Other	10	4.42	22	6.13	1.44	0.67	3.11	1.51	0.67	3.40
Marital status										
Married ³	201	88.94	318	88.58	1.00	-	-	1.00	-	-
Single	24	10.62	37	10.31	0.97	0.57	1.68	0.86	0.46	1.60
Level of education of the woman (degree achieved)										
Less than high school	38	16.81	67	18.66	1.10	0.68	1.79	1.11	0.61	2.03
High school	110	48.67	165	45.96	0.94	0.65	1.36	0.92	0.60	1.41
University ³	78	34.51	125	34.82	1.00	-	-	1.00	-	-
Level of education of the partner (degree achieved)										
Less than high school	69	30.53	103	28.69	1.11	0.71	1.73	1.21	0.75	1.95
High school	88	38.94	165	45.96	1.40	0.92	2.11	1.51	0.97	2.35
University ³	64	28.32	86	23.96	1.00	-	-	1.00	-	-
Occupational status of the woman										
On pre-birth maternity leave ³	169	74.78	274	76.32	1.00	-	-	1.00	-	-
Employed	20	8.85	23	6.41	0.71	0.38	1.33	0.79	0.40	1.55
Housewife	18	7.96	26	7.24	0.89	0.47	1.67	1.04	0.52	2.06
Unemployed	15	6.64	31	8.64	1.28	0.67	2.43	1.47	0.72	2.98
Occupational status of the partner										
Employed ³	209	92.48	336	93.59	1.00	-	-	1.00	-	-
Unemployed	9	3.98	18	5.01	1.24	0.55	2.82	1.02	0.43	2.45
House size (m ²)										
>100 ³	70	30.97	85	23.68	1.00	-	-	1.00	-	-
≤ 100	155	68.58	270	75.21	1.44	0.99	2.08	1.51	1.02	2.25

¹ It excludes folic acid and iron.

² Multivariate model adjusted for: age, partner education, housing size, comorbidities.

³ Reference category.

TABLE 3 (CONTINUED). Odds Ratio (OR), with 95% Confidence Interval (95%CI), of having ≥ 1 dispensation of any medication¹ during pregnancy, by socio-demographic characteristics.

	≥ 1 dispensation of any medication ¹				Univariate		Multivariate ²			
	No (N= 226)		Yes (N= 359)		OR	95%CI	OR	95%CI		
	N	%	N	%						
Indicators of health behaviour										
Smoking										
Never ³	119	52.65	209	58.22	1.00	-	-	1.00	-	-
Smoker	21	9.29	38	10.58	1.03	0.58	1.84	1.25	0.65	2.40
Ex-smoker	82	36.28	107	29.81	0.74	0.52	1.07	0.81	0.55	1.21
Alcohol consumption (drinks/week)										
Abstainer ³	69	30.53	112	31.20	1.00	-	-	1.00	-	-
<4	147	65.04	226	62.95	0.95	0.66	1.36	1.92	1.25	2.95
≥ 5	10	4.42	18	5.01	1.11	0.48	2.54	2.78	1.78	4.34
BMI (kg/m ²)										
<18.50 (underweight)	15	6.64	31	8.64	1.32	0.69	2.52	1.68	0.82	3.44
18.50-24.99 (normal ³)	164	72.57	257	71.59	1.00	-	-	1.00	-	-
25-<30 (overweight)	37	16.37	46	12.81	0.79	0.49	1.28	0.83	0.49	1.39
≥ 30 (obese)	10	4.42	25	6.96	1.60	0.75	3.41	1.33	0.59	2.99
Indicators of pregnancy history, health status and healthcare use										
Prior pregnancies										
0 ³	98	43.36	167	46.52	1.00	-	-	1.00	-	-
1-2	112	49.56	165	45.96	0.87	0.61	1.22	0.78	0.54	1.14
≥ 3	16	7.08	27	7.52	0.99	0.51	1.93	0.80	0.39	1.67
Comorbidities during pregnancy (number)										
None ³	89	39.38	85	23.68	1.00	-	-	1.00	-	-
1	76	33.63	125	34.82	1.72	1.14	2.60	1.92	1.25	2.95
≥ 2	57	25.22	141	39.28	2.59	1.69	3.97	2.74	1.76	4.27
Prenatal care visits (number)										
<7 ³	33	14.60	39	10.86	1.00	-	-	1.00	-	-
7	35	15.49	50	13.93	1.21	0.64	2.28	1.15	0.58	2.28
8	58	25.66	69	19.22	1.01	0.56	1.80	0.93	0.50	1.73
≥ 9	87	38.50	175	48.75	1.70	1.00	2.89	1.56	0.88	2.76
Prenatal ultrasound imaging (number)										
<4 ³	59	26.11	56	15.60	1.00	-	-	1.00	-	-
4	36	15.93	60	16.71	1.76	1.01	3.05	1.73	0.96	3.11
5-7	62	27.43	109	30.36	1.85	1.15	3.00	1.89	1.13	3.16
≥ 8	61	26.99	116	32.31	2.00	1.24	3.24	2.28	1.36	3.81

¹ It excludes folic acid and iron.

² Multivariate model adjusted for: age, partner education, housing size, comorbidities.

³ Reference category.

TABLE 4. Odds Ratio (OR), with 95% Confidence Interval (95%CI), of having ≥ 1 dispensation of folic acid and/or iron during pregnancy, by socio-demographic characteristics.

	Dispensations of folic acid and/or iron				Univariate			Multivariate ¹		
	None (N= 413)		At least one (N= 354)		OR	95%CI		OR	95%CI	
Indicators of socioeconomic status										
Age category (years)	N	%	N	%						
<25	20	4.8	22	6.2	1.50	0.73	3.06	1.79	0.83	3.85
25-29 ²	64	15.5	47	13.3	1.00	-	-	1.00	-	-
30-34	171	41.4	156	44.1	1.24	0.80	1.92	1.33	0.85	2.09
35-39	129	31.2	100	28.2	1.06	0.67	1.67	1.15	0.71	1.86
≥ 40	29	7.0	29	8.2	1.36	0.72	2.58	1.70	0.86	3.34
Country of origin of the woman										
Italy ²	384	93.0	317	89.5	1.00	-	-	1.00	-	-
Other	24	5.8	35	9.9	1.77	1.03	3.03	1.57	0.88	2.80
Country of origin of the partner										
Italy ²	371	89.8	316	89.3	1.00	-	-	1.00	-	-
Other	19	4.6	23	6.5	1.42	0.76	2.66	1.35	0.71	2.59
Marital status										
Married ²	367	88.9	316	89.3	1.00	-	-	1.00	-	-
Single	41	9.9	36	10.2	1.02	0.64	1.63	0.89	0.52	1.51
Level of education of the woman (degree achieved)										
Less than high school	78	18.9	61	17.2	0.79	0.52	1.20	0.65	0.40	1.08
High school	202	48.9	162	45.8	0.81	0.59	1.12	0.80	0.56	1.15
University ²	132	32.0	130	36.7	1.00	-	-	1.00	-	-
Level of education of the partner (degree achieved)										
Less than high school	124	30.0	100	28.2	1.03	0.70	1.53	1.04	0.69	1.57
High school	181	43.8	167	47.2	1.18	0.82	1.69	1.17	0.80	1.71
University ²	101	24.5	79	22.3	1.00	-	-	1.00	-	-
Occupational status of the woman										
On pre-birth maternity leave ²	308	74.6	260	73.4	1.00	-	-	1.00	-	-
Employed	31	7.5	26	7.3	0.99	0.57	1.72	0.98	0.55	1.75
Housewife	36	8.7	31	8.8	1.02	0.61	1.69	1.03	0.60	1.76
Unemployed	29	7.0	34	9.6	1.39	0.82	2.34	1.44	0.83	2.50
Occupational status of the partner										
Employed ²	386	93.5	325	91.8	1.00	-	-	1.00	-	-
Unemployed	16	3.9	21	5.9	1.56	0.80	3.04	1.62	0.81	3.24
House size (m ²)										
>100 ²	113	27.4	78	22.0	1.00	-	-	1.00	-	-
≤ 100	296	71.7	271	76.6	1.33	0.95	1.85	1.36	0.97	1.92

¹ Multivariate model adjusted for: age, partner education, house, comorbidities.

² Reference category.

TABLE 4 (CONTINUED). Odds Ratio (OR), with 95% Confidence Interval (95%CI), of having ≥ 1 dispensation of folic acid and/or iron during pregnancy, by socio-demographic characteristics.

	Dispensations of folic acid and/or iron				Univariate			Multivariate ¹		
	None (N= 413)		At least one (N= 354)		OR	95%CI		OR	95%CI	
Indicators of health behaviour										
Smoking										
Never ²	221	53.5	215	60.7	1.00	-	-	1.00	-	-
Smoker	42	10.2	31	8.8	0.76	0.46	1.25	0.80	0.47	1.37
Ex-smoker	140	33.9	108	30.5	0.79	0.58	1.08	0.79	0.57	1.09
Alcohol consumption (drinks/week)										
Abstainer ²	126	30.5	109	30.8	1.00	-	-	1.00	-	-
<4	265	64.2	225	63.6	0.98	0.72	1.34	0.99	0.72	1.38
≥ 5	19	4.6	20	5.6	1.22	0.62	2.34	1.35	0.66	2.78
BMI (kg/m ²)										
<18.50 (underweight)	33	8.0	26	7.3	0.87	0.51	1.50	0.99	0.56	1.74
18.50-24.99 (normal ²)	291	70.5	263	74.3	1.00	-	-	1.00	-	-
25-<30 (overweight)	64	15.5	48	13.6	0.83	0.55	1.25	0.87	0.57	1.34
≥ 30 (obese)	25	6.1	17	4.8	0.75	0.40	1.42	0.62	0.31	1.25
Indicators of pregnancy history, health status and healthcare use										
Prior pregnancies										
0 ²	175	42.4	175	49.4	1.00	-	-	1.00	-	-
1-2	207	50.1	152	42.9	0.73	0.55	0.99	0.76	0.55	1.04
≥ 3	31	7.5	27	7.6	0.87	0.50	1.52	0.93	0.52	1.68
Comorbidities during pregnancy (number)										
None ²	143	34.6	97	27.4	1.00	-	-	1.00	-	-
1	145	35.1	129	36.4	1.31	0.92	1.86	1.32	0.92	1.90
≥ 2	115	27.8	122	34.5	1.56	1.09	2.25	1.49	1.03	2.15
Prenatal care visits (number)										
<7 ²	59	14.3	42	11.9	1.00	-	-	1.00	-	-
7	57	13.8	58	16.4	1.43	0.83	2.45	1.47	0.84	2.58
8	91	22.0	71	20.1	1.10	0.66	1.81	1.14	0.68	1.93
≥ 9	182	44.1	157	44.4	1.21	0.77	1.90	1.16	0.72	1.86
Prenatal ultrasound imaging (number)										
<4 ²	87	21.1	80	22.6	1.00	-	-	1.00	-	-
4	64	15.5	70	19.8	1.19	0.75	1.87	1.18	0.73	1.89
5 to 7	120	29.1	100	28.2	0.91	0.61	1.36	0.90	0.60	1.37
≥ 8	126	4.8	81	22.9	0.70	0.46	1.06	0.70	0.46	1.08

¹ Multivariate model adjusted for: age, partner education, house, comorbidities.

² Reference category.

conditions [2]; in another study, use of medication was less frequent in women during their first pregnancy than in those with prior pregnancies [9].

In our cohort, women with a higher number of prenatal care visits and ultrasound examinations were more likely to

use medication, probably because the more intensive use of healthcare is an indicator of poor health. Concordantly, in a Dutch cohort, the number of General Practitioner visits was a strong predictor of OTC medication use [29].

Limitations and strengths

We assessed medication use through dispensation data. On the one hand, dispensations are only a proxy for medication use because dispensed medications may actually not be taken [30] or because of noncompliance and medication borrowing or sharing [31]. On the other hand, however, dispensations represent objective information not affected by recall bias. Recall bias may limit the accuracy of medication use collected through questionnaires depending on data collection methods and questionnaire design [32-34] and it has been associated positively with women's educational level [35,36].

The prescription database used in our study covers the entire resident population, without any exclusion according to occupational or socioeconomic status. All women in the cohort were linked to dispensing records without omissions of population subgroups (e.g., unemployed or immigrant women). The potential for information bias is thus reduced.

As measures of socio-economic status, we collected information on education and occupational status, but not on household income. However, education as a measure of socioeconomic status captures both the dimension of knowledge and earning capacity through the professional position.

We accounted for the health status of the women, a strong determinant of medication use during pregnancy, through adjustment for comorbidities. Moreover, the study also evaluates the effect of characteristics of the partner, such as educational level, occupational and immigration status.

CONCLUSION

In this cohort, lower education and immigrant status of women and their partners, women's unemployment, smoking, higher alcohol consumption and being underweight or obese were independent predictors of the use of medications during pregnancy, adjusting for women's age and comorbidities. Careful assessment of medication use is an important routine component of midwifery, particularly in women more likely to use medications. Medication assessment and interventions to promote safe use of medications should be carefully tailored to specific women's backgrounds and cultural preferences.

Women's lower education, smoking and obesity independently predicted lower use of folic acid and iron. Specific interventions should target women of childbearing age as well as pregnant women to promote folic and iron supplementation during pregnancy. These interventions offer also an opportunity to promote healthy lifestyle habits.

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Competing Interests

The authors declare that they have no competing interests.

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