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Use of drugs to treat symptoms and acute conditions during pregnancy in outpatient care in Switzerland between 2014 and 2018: analysis of Swiss healthcare claims data

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Summary

BACKGROUND: Evidence on the use of drugs during pregnancy in Switzerland is lacking.

OBJECTIVES: To evaluate utilisation of prescribed drugs during pregnancy in outpatient care in Switzerland, focusing on treatments for pain, infections, gastro-oesophageal reflux, nausea/vomiting, and constipation.

METHODS: We conducted a descriptive study using the Swiss Helsana claims database (2014–2018). We established a cohort of pregnancies by identifying deliveries and estimating the date of the last menstrual period. We identified claims for the following drugs during pregnancy; analgesics (opioids, paracetamol, and nonsteroidal anti-inflammatory drugs [NSAIDs]), oral antibiotics, antacids, proton pump inhibitors (PPIs), anti-nausea drugs (propulsives and 5HT3-antagonists), and laxatives. Within these drug groups we quantified exposure prevalence to the most prescribed drugs (to >1% of pregnancies) during pregnancy as well as to specific potentially teratogenic or fetotoxic drugs during specific risk periods. Results were extrapolated relative to the demographic distribution of the Swiss population.

RESULTS: We identified an extrapolated population of 369,371 pregnancies, with a weighted mean maternal age of 32.0 years (weighted standard deviation 5.1). Analgesics were claimed in 34.5% (95% confidence interval [CI] 33.9–35.0%) of pregnancies, most frequently paracetamol (30.3%, 29.8–30.8%), followed by NSAIDs (8.6%, 8.3–8.8%), and opioids (2.6%, 2.4–2.8%). NSAIDs were claimed in 1.3% (1.2–1.4%) of pregnancies after week 24, and opioids were claimed in 1.3% (1.2–1.4%) in trimester 3. Antibiotics were dispensed in 26.3% (25.8–26.8%) of pregnancies, most frequently amoxicillin (14.6%, 95% CI 14.2–14.9%). Claims for potentially teratogenic or fetotoxic antibiotics during risk periods were each recorded in <0.6% of pregnancies. PPIs were claimed in 16.0% (15.6–16.3%) and antacids in 10.6% (10.3–11.0%) of pregnancies, but several antacid products are not reimbursed and thus not present in insurance claims. Anti-nausea drugs were claimed in 16.4% (16.0–16.7%) of pregnancies, most frequently metoclopramide in 14.4% (14.0–14.7%). Ondansetron was mainly dispensed in trimester 1, 1.0% (0.9–1.1%). In total, 6.4% (6.2–6.7%) of pregnancies had a claim for laxatives, most frequently for macrogol (2.4%, 95% CI 2.2–2.5%).

CONCLUSION: The observed pattern of claimed drugs during pregnancy is in line with existing treatment guidelines. Exposure to potentially teratogenic and fetotoxic drugs was small, but given the lack of recorded diagnosis, we cannot determine if their use was clinically indicated.

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Introduction

Pregnant women are typically excluded from interventional trials. Therefore, the safety of most drugs during pregnancy is not well characterised [1–4]. Nevertheless, many women require treatment of acute conditions, chronic illnesses, or obstetric complications during pregnancy. A study based on French national claims data reported that

90% of women filled at least one prescription for a drug during pregnancy between 2010 and 2013 [5], whereas 62% of pregnant women in Norway billed at least one drug to national health insurance between 2005 and 2015 [6]. In a multinational web-based survey [7], 81.2% of pregnant women reported using at least one drug, prescribed or over the counter (OTC), during pregnancy between 2011 and 2012. A total of 618 Swiss women took part in the survey, of whom 82.8% reportedly used at least one drug during pregnancy. However, these results may not be representative due to volunteer bias. The most frequently reported drugs were similar in all studies [5–7] and included analgesics (mainly paracetamol), antibiotics, drugs for gastro-oesophageal reflux disease and drugs for functional gastrointestinal disorders (mainly treatment of nausea). Iron, vitamins and folic acid were the most commonly used supplements.

We aimed to evaluate the utilisation of prescription drugs dispensed in outpatient care during pregnancy in Switzerland, using the data of the Helsana claims database. This study focuses on the utilisation of drugs (including potentially teratogenic/fetotoxic drugs) to treat acute conditions that frequently occur during pregnancy, such as pain of different origins, infections, gastro-oesophageal reflux, nausea and vomiting, and constipation. Utilisation of drugs to treat chronic illnesses will be evaluated in a separate study.

Methods

Data source

We conducted a descriptive study using data from the Swiss Helsana claims database between January 2014 and December 2018. The Helsana claims database includes data of approximately 1.1 million individuals from all 26 cantons in Switzerland (approximately 15% of the Swiss population) who are insured with Helsana mandatory insurance.

Recorded information includes outpatient medical encounters coded by the tariff system (TARMED), information on inpatient stays coded as Swiss Diagnosis Related Group (SwissDRG) codes as well as billing codes submitted by outpatient midwives. Furthermore, all reimbursed claims for drugs (recorded as Anatomical Therapeutic Chemical [ATC] codes) dispensed in outpatient care are captured [8].

Pregnancy cohort

Identification of pregnancies and delivery dates

This study population of pregnant women has been described previously [9]. To identify pregnancies, we captured all inpatient and outpatient deliveries between 2014 and 2018 using the SwissDRG, TARMED and midwife billing codes. Delivery codes that were recorded within 30 days following the first recorded delivery code were considered as pertaining to the same delivery and the date of the first record was defined as the delivery date. A delivery code recorded more than 300 days after an initial delivery code was considered as pertaining to a subsequent delivery. When two subsequent codes were separated by 30 to 300 days, the date of delivery was set at the SwissDRG code, whereas women (n = 80, crude number) were excluded if no SwissDRG code was recorded (fig. 1, flowchart of the unextrapolated study population). Thus, the same woman may have contributed several pregnancies to the cohort. Deliveries of twins were identified in the same way as deliveries of singletons and were counted as a single pregnancy.

Estimation of the date of the last menstrual period and pregnancy trimesters

Because the beginning of pregnancy is not recorded in claims data, we used an algorithm to estimate the date of the last menstrual period (LMP), which was validated in US administrative claims data [10]. If a billing code indicating preterm delivery (<37 gestational weeks, see appendix for respective SwissDRG codes) was recorded, we defined LMP as 245 days before the delivery date. For all other pregnancies, LMP was defined as 270 days before the delivery date. Each pregnancy trimester was defined as a 90-day period and in case of prematurity, the third trimester was shortened (i.e., trimester 1: LMP until 89 days after LMP; trimester 2: 90 days after LMP until 179 days after LMP; trimester 3: 180 days after LMP until delivery). We also defined a pre-pregnancy period, which started 90 days before LMP and ended one day before LMP (LMP–90 until LMP–1). We excluded women (n = 9535, crude number) who were not continuously covered by mandatory insurance at Helsana between the date of their last menstrual period and delivery (fig. 1).

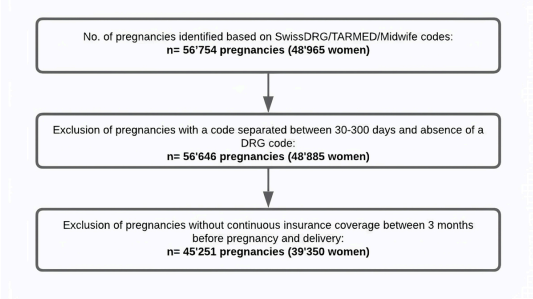
Demographics and characteristics

We extracted maternal age at delivery, the year of delivery and the mode of delivery (caesarean section vs vaginal delivery, see appendix for respective SwissDRG, TARMED and Midwife codes).

Exposure to drugs

We defined drug groups to treat acute conditions frequently associated with pregnancy using the ATC classification. Included drug groups were analgesics (opioids N02A, other analgesics N02B, antimigraine preparations N02C, and nonsteroidal anti-inflammatory drugs [NSAIDs] M01A), systemic antibiotics (J01), drugs for gastro-oesophageal reflux (antacids A02A, proton pump inhibitors [PPIs] A02BC, H2 inhibitors A02BA, and others A02BX), nausea drugs (anti-emetics A04A and propulsives A03FA, antihistamines are not reimbursed), and laxatives (A06).

Figure 1: Flowchart of the study population (crude numbers).



Within each drug group, we identified active substances dispensed to >1% of pregnancies. We further identified dispensations of active substances, which are potentially teratogenic or fetotoxic, or which have been associated with adverse events in the newborn. These substances were identified using the online teratogen information platforms 'Le CRAT' (Centre de Référence sur les Agents Tératogènes; French) [11] and 'Embryotox' (German) [12]. Additionally, we screened all warnings issued by Swissmedic (Swiss authorisation and supervisory authority for drugs and medical products [13]) between 2008 and 2020.

Finally, we evaluated the most prescribed supplements during pregnancy: folic acid (including multivitamins), intravenous iron and oral iron (not including multivitamins), vitamin D, and magnesium (not including multivitamins).

Descriptive analyses

We quantified the prevalence of exposure to different drug substances and supplements overall, during each pregnancy trimester, and during pre-pregnancy. Exposure to potentially teratogenic or fetotoxic substances was quantified during specific risk periods. Prevalence of exposure was defined as the proportion of pregnancies during which at least one prescription was filled for the respective active substance, divided by the total number of enrolled pregnancies during the respective time period.

Prevalence of exposure is presented as absolute numbers per 100 pregnancies and is presented separately for all drug groups and for all active substances dispensed in >1% of pregnancies (1% cut off does not apply to potentially teratogenic and fetotoxic substances).

To present results that are representative of the overall Swiss population, all results were extrapolated/weighted relative to the demographic distribution of the overall female population of Switzerland, taking into account calendar year, canton, age, and the sex distribution within cantons.

The weighted sums (extrapolated number of pregnancies), weighted mean and standard deviation of age were calculated using the survey package in R [14].

All data are anonymous, and all analyses were conducted by the Helsana Department of Health Sciences using the statistical programming language R (version 3.6.1, [15]).

Protocol approvals

Ethics committee approval was not required because data used for the study were anonymous.

Results

We identified an extrapolated population of 369,371 pregnancies from 323,632 women, with a weighted mean maternal age at delivery of 32.0 years (standard deviation 5.1 years). In total, 33.7% of all pregnancies resulted in caesarean section (table 1, unextrapolated pregnancy cohort is displayed in table S1 in the appendix).

Prevalence of drug exposure

Analgesics

Analgesics were the most frequently recorded drug group, with dispensing of prescribed analgesics during 34.5% (95% CI 33.9–35.0%) of pregnancies. The most frequently dispensed active substance was paracetamol (30.3%, 95% CI 29.8–30.8% of pregnancies) (fig. 2).

NSAIDs were dispensed in 8.6% (8.3–8.8%) of pregnancies, and 1.3% (1.2–1.4%) of pregnancies had a claim for an NSAID after week 24 (table 2, unextrapolated numbers are displayed in table S2). Ibuprofen was the most commonly dispensed NSAID (5.5%, 95% CI 5.3–5.7%). Opioids were recorded in 2.6% (2.4–2.8%) of pregnancies overall, with tramadol being the most frequently dispensed opioid (1.8%, 95% CI 1.6–1.9%). In total, 1.3% (1.2–1.4%) of pregnancies had a recorded claim for an opioid in trimester 3 (table 2).

Antibiotics

The prevalence of exposure to antibiotics in outpatient care during pregnancy was 26.3% (25.8–26.8%) with amoxicillin being the most frequently dispensed antibiotic (14.6%, 95% CI 14.2–14.9%) (table 3, unextrapolated numbers are displayed in table S3).

Regarding potentially teratogenic antibiotics, tetracycline antibiotics were dispensed in 0.1% (95% CI 0.0–0.1%) of pregnancies in trimester 2 and in 93 pregnancies (0.0%, 95% CI 0.0–0.0%) in trimester 3. Sulfonamide/trimethoprim was dispensed in 0.3% (95% CI 0.3–0.4%) of pregnancies in trimester 1 and quinolones were recorded in 0.6% (95% CI 0.5–0.6%) in trimester 1 (table 2).

Drugs for gastro-oesophageal reflux

Drugs for gastro-oesophageal reflux were dispensed during 24.7% of pregnancies (24.2–25.1%), most frequently in trimester 3 (15.2%, 95% CI 14.8–15.6%). Proton pump inhibitors were the most frequently dispensed drug class,

Table 1:
Description of the extrapolated/weighted study population.

Year	No. of extrapolated deliveries in our study population	Extrapolated mean age at delivery in the cohort (weighted SD)	Mean maternal age at delivery ins Switzerland (BfS)	Extrapolated percentage of caesarean sections in the cohort (%, 95% CI)	Percentage of caesarean section ins Switzerland (BfS)
2014	71,933	31.96 (5.04)	31.7	34.4 (33.4–35.5)	33.7
2015	71,844	31.97 (5.15)	31.8	34.3 (33.3–35.4)	33.3
2016	74,149	31.93 (5.11)	31.8	33.4 (32.4–34.5)	33.2
2017	79,610	32.06 (5.14)	31.9	33.4 (32.4–34.6)	32.3
2018	71,836	32.15 (5.00)	32.0	33.1 (32.0–34.2)	32.1

CI: confidence interval; BfS: Bundesamt für Statistik, Swiss Federal Statistical Office; SD: standard deviation

with claims during 16.0% (15.6–16.3%) of pregnancies (table 3).

Anti-nausea drugs

Anti-nausea drugs were claimed in 16.4% (95% CI 16.0–16.7%) of pregnancies, most frequently in trimester 1 (13.0%, 95% CI 12.7–13.4%), with metoclopramide (14.4%, 95% CI 14.0–14.7%) being the most frequently claimed drug. Ondansetron was claimed during 1.0% (95% CI 0.9–1.1%) of pregnancies in trimester 1 (table 3).

Laxatives

Laxatives were reimbursed by health insurance in 6.4% (95% CI 6.2–6.7%) of pregnancies, most frequently in trimester 2 (2.6%, 95% CI 2.4–2.8%). The most frequently dispensed laxative was macrogol (2.4%, 95% CI 2.2–2.5%) (table 3).

Claims for contact laxatives were recorded in 0.3% (95% CI 0.2–0.3%) of pregnancies in trimester 3, mostly for sodium picosulphate, which was dispensed in 36 pregnancies (0.0%, 95% CI 0.0–0.0%). No claims were recorded for senna (anthraquinone derivative) (table 2).

Supplements

Folic acid preparations were claimed to health insurance in 9.8% (9.5–10.1%) of pregnancies during pre-pregnancy and in 18.4% (18.0–18.8%) in trimester 1. In total, 18.5% (18.0–18.9%) and 45.9% (45.3–46.5%) of pregnancies had a recorded claim for intravenous and oral iron during pregnancy, most frequently in trimester 2 (6.1% and 26.3%) and 3 (13.1% and 27.2%) (table 4, unextrapolated numbers are displayed in table S4)

Discussion

This drug utilisation study used Swiss health care claims data to evaluate the use of prescription drugs dispensed in outpatient care to treat acute conditions frequently associated with pregnancy in Switzerland between 2014 and 2018. Our results allow a representative evaluation of

Figure 2: Exposure prevalence to the three most prescribed outpatient active substances per drug group during pregnancy (T1–T3) (extrapolated numbers).

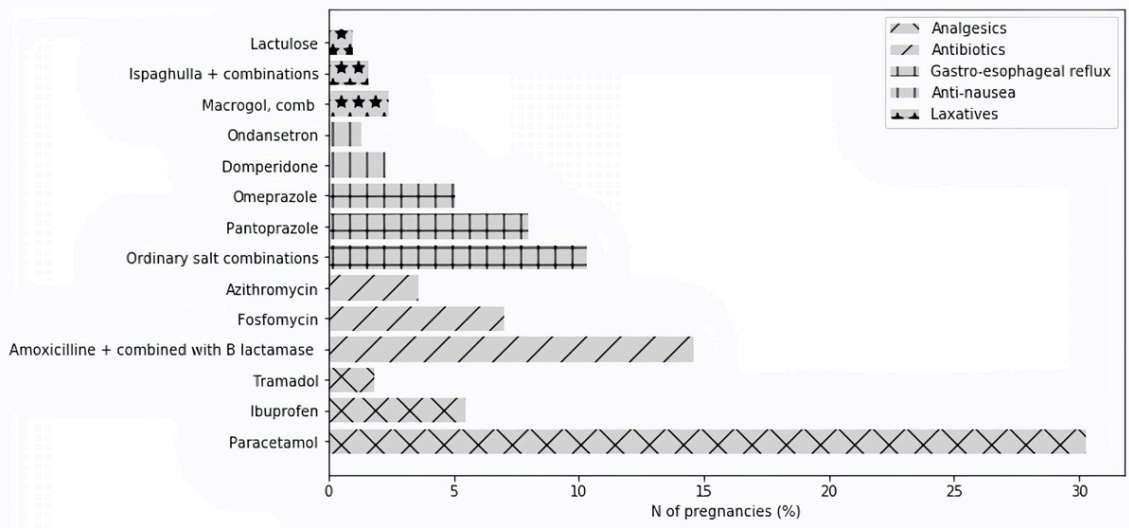


Table 2:
Exposure to potentially teratogenic or fetotoxic drugs during risk period and associated potential risks (extrapolated numbers).

Potentially teratogenic or fetotoxic drugs (ATC code)	Warnings regarding use during critical period	Risk period	Pregnancies exposed during risk period during study period (n)	Pregnancies exposed during risk period during study period (%, 95% CI)
NSAIDs (M01A)	Premature closure of ductus arteriosus and renal toxicity [19]	After week 24	4657	1.3 (1.2–1.4)
Opioids (N02A)	Neonatal abstinence syndrome and respiratory distress [20–23]	Trimester 3	4747	1.3 (1.2–1.4)
Trimethoprim/sulphonamide (J01E)	Risk of neural tube defects [25, 26]	Trimester 1	1257	0.3 (0.3–0.4)
Quinolone (J01M)	Cartilage and bone damage in animal studies but not found in human studies [29, 30]	Trimester 1	2093	0.6 (0.5–0.6)
Tetracycline (J01A)	Tooth staining [27, 28]	Trimester 2; trimester 3	185; 93	0.1 (0.0–0.1); 0.0 (0.0–0.0)
Ondansetron (A04AA01)	Potentially increased risk of orofacial clefts [37]	Trimester 1	3726	1.0 (0.9–1.1)
Contact laxatives (A06AB); especially senna (anthraquinone derivative, A06AB06)	Theoretical risk of intestinal and uterine contractions [42]	Trimester 3	943; 0	0.3 (0.2–0.3); 0.0 (0.0–0.0)

ATC: anatomic therapeutic chemical; CI: confidence interval: NSAID: nonsteroidal anti-inflammatory drug

which drugs are commonly prescribed to pregnant women in outpatient care in Switzerland.

We identified an extrapolated study population of 369,371 deliveries per year between 2014 and 2018. Mean maternal age at delivery (32.0 years) as well as the proportion of caesarean sections (33.7%) were consistent with results reported by the Swiss Federal Statistical Office for the overall population in Switzerland for this time period [16].

Table 3:
Exposure prevalence to different drug groups and active substances during pregnancy overall and within trimester of pregnancy and pre-pregnancy separately (extrapolated numbers).

ATC code	Drug substance	Pre-pregnancy		Trimester 1		Trimester 2		Trimester 3		Trimesters 1 to 3	
		n (%)	95% CI	n (%)	95% CI	n (%)	95% CI	n(%)	95% CI	n (%)	95% CI
N02+M01A	**Analgesics**	67,143 (18.2)	17.8–18.6	63,289 (17.1)	16.7–17.5	61,167 (16.6)	16.2–17.0	48,105 (13.0)	12.7–13.4	127,353 (34.5)	33.9–35.0
N02B	Other analgesics	39,288 (10.6)	10.3–11.0	52,233 (14.1)	13.8–14.5	54,460 (14.7)	14.4–15.1	43,312 (11.7)	11.4–12.1	113,435 (30.7)	30.2–31.2
N02BE01	*Paracetamol*	34,415 (9.3)	9.0–9.6	50,470 (13.7)	13.3–14.0	54,071 (14.6)	14.3–15.0	43,045 (11.7)	11.3–12.0	111,869 (30.3)	29.8–30.8
N02BB02	*Metamizole*	9447 (2.6)	2.4–2.7	3008 (0.8)	0.7–0.9	627 (0.2)	0.1–0.2	627 (0.2)	0.1–0.1	3896 (1.1)	1.0–1.2
M01A	NSAIDs	45,169 (12.2)	11.9–12.6	19,216 (5.2)	5.0–5.4	11,205 (3.0)	2.9–3.2	4134 (1.1)	1.0–1.2	31,586 (8.6)	8.3–8.8
M01AE01	*Ibuprofen*	26,230 (7.1)	6.8–7.4	12,057 (3.3)	3.1–3.4	7589 (2.1)	1.9–2.1	2132 (0.6)	0.5–0.7	20,255 (5.5)	5.3–5.7
M01AG01	*Mefenamic acid*	8'848 (2.4)	2.2–2.5	3286 (0.9)	0.8–1.0	2066 (0.6)	0.5–0.6	1093 (0.3)	0.2–0.3	6088 (1.6)	1.5–1.8
M01AB05	*Diclofenac*	8918 (2.4)	2.3–2.6	2907 (0.8)	0.7–0.9	1232 (0.3)	0.3–0.4	570 (0.2)	0.1–0.2	4510 (1.2)	1.1–1.3
N02A	Opioids	5633 (1.5)	1.4–1.6	2962 (0.8)	0.7–0.9	2762 (0.7)	0.7–0.8	4747 (1.3)	1.2–1.4	9593 (2.6)	2.4–2.8
N02AX02	*Tramadol*	2521 (0.7)	0.6–0.8	1456(0.4)	0.3–0.5	1763(0.5)	0.4–0.5	3644 (1.0)	0.9–1.1	6471 (1.8)	1.6–1.9
J01	**Antibiotics**	34,237 (9.3)	9.0–9.6	39,265 (10.6)	10.3–10.9	43,859 (11.9)	11.5–12.2	39,001 (10.6)	10.2–10.9	97167 (26.3)	25.8–26.8
J01CR02+ J01CA04	*Amoxicillin + combined with beta-lactamase inhibitor*	11,494 (3.1)	2.9–3.3	18,137 (4.9)	4.7–5.1	23,114 (6.3)	6.0–6.5	20,326 (5.5)	5.3–5.7	53,871 (14.6))	14.2–14.9
J01XX01	*Fosfomycin*	5142 (1.4)	1.3–1.5	9188 (2.5)	2.3–2.6	11,101 (3.0)	2.8–3.2	9321 (2.5)	2.42.7	25,922 (7.0)	6.87.3
J01FA10	*Azithromycin*	4596 (1.2)	1.1–1.4	5012 (1.4)	1.2–1.5	5011 (1.4)	1.21.5	4457 (1.2)	1.1–1.3	13,116 (3.6)	3.4–3.7
J01DC02	*Cefuroxime*	2129 (0.6)	0.5–0.7	2222 (0.6)	0.5–0.7	2804 (0.8)	0.7–0.8	2618 (0.7)	0.6–0.8	6977 (1.9)	1.7–2.0
J01XE01	*Nitrofurantoin*	1301 (0.4)	0.3–0.4	2492 (0.7)	0.6–0.8	2953 (0.8)	0.7–0.9	2811 (0.8)	0.7–0.9	7342 (2.0)	1.8–2.1
J01FF01	*Clindamycin*	437 (0.1)	0.1–0.2	853 (0.2)	0.2–0.3	1710 (0.3)	0.4–0.5	2054 (0.6)	0.5–0.6	4369 (1.2)	1.1–1.3
A02	**Gastro-oesophageal reflux**	17,406 (4.7)	4.5–4,9	26,297 (7.1)	6.9–7.4	36,178 (9.8)	9.5–10.1	56,099 (15.2)	14.8–15.6	91,079 (24.7)	24.2–25.1
A02BC	Proton pump inhibitors	16,878 (4.6)	4.4–4.8	19,200 (5.2)	5.0–5.4	22,181 (6.0)	5.8–6.3	34,021 (9.2)	8.9–9.5	58,957 (16.0)	15.6–16.3
A02BC02	*Pantoprazole*	11,827 (3.2)	3.0–3.4	10,845 (2.9)	2.8–3.1	10,108 (2.7)	2.6–2.9	14,949 (4.0)	3.8–4.3	29,664 (8.0)	7.7–8.3
A02BC01	*Omeprazole*	1871 (0.5)	0.4–0.6	4568 (1.2)	1.1–1.3	7419 (2.0)	1.9–2.2	11,125 (3.0)	2.8–3.2	18,705 (5.1)	4.8–5.3
A02BC05	*Esomeprazole*	3428 (0.9)	0.8–1.0	4445 (1.2)	1.1–1.3	4700 (1.3)	1.2–1.4	7699 (2.1)	1.9–2.2	13,858 (3.8)	3.6–3.9
A02A	Antacids	682 (0.2)	0.1–0.2	8359 (2.3)	2.1–2.4	14,824 (4.0)	3.8–4.2	21,897 (5.9)	5.7–6.2	39,332 (10.6)	10.3–11.0
A02AD01	*Ordinary salt combinations*	522 (0.1)	0.1–0.2	7941 (2.1)	2.0–2.3	14,346 (3.9)	3.7–4.1	21,247 (5.8)	5.5–6.0	37,984 (10.3)	10.0–10.6
A02BA	H2 receptor antagonists (ranitidine only)	267 (0.1)	0.0–0.1	1158 (0.3)	0.3–0.4	2143 (0.6)	0.5–0.7	4789 (1.3)	1.2–1.4	6830 (1.8)	1.7–2.0
A03	**Anti-nausea drugs**	10,303 (2.8)	2.6–3.0	48,140 (13.0)	12.7–13.4	14,085 (3.8)	3.6–4.0	7380 (2.0)	1.9–2.1	60,404 (16.4)	16.0–16.7
A03FA01	*Metoclopramide*	4074 (1.1)	1.0–1.2	42,076 (11.4)	11.1–11.7	11,520 (3.1)	2.9–3.3	6242 (1.7)	1.6–1.8	53,021 (14.4)	14.0–14.7
A03FA03	*Domperidone*	4980 (1.3)	1.2–1.5	432 (1.7)	1.6–1.9	1596 (0.4)	0.4–0.5	765 (0.2)	0.2–0.3	8278 (2.2)	2.1–2.4
A04AA01	*Ondansetron*	1784 (0.5)	0.4–0.6	3726 (1.0)	0.9–1.1	1562 (0.4)	0.4–0.5	644 (0.2)	0.1–0.2	4659 (1.3)	1.2–1.4
A11HA02	*Pyridoxine**	116 (0.0)	0.0–0.0	446 (0.1)	0.1–0.2	72 (0.0)	0.0–0.0	45 (0.0)	0.0–0.0	522 (0.1)	0.1–0.2
A06	**Laxatives**	6030 (1.6)	1.5–1.8	10,139 (2.7)	2.6–2.9	9586 (2.6)	2.4–2.8	8374 (2.3)	2.1–2.4	23',821 (6.4)	6.2–6.7
A06AD	Osmotically active	3675 (1.0)	0.9–1.1	5713 (1.5)	1.4–1.7	4941 (1.3)	1.2–1.5	4480 (1.2)	1.1–1.3	13,167 (3.6)	3.4–3.8
A06AD15+ A06AD65	*Macrogol, comb + macrogol*	3026 (0.8)	0.7–0.9	3969 (1.1)	1.0–1.2	3166 (0.9)	0.8–0.9	2835 (0.8)	0.7–0.9	8756 (2.4)	2.2–2.5
A06AD11+ A06AD61	*Lactulose*	543 (0.1)	0.1–0.2	1499 (0.4)	0.3–0.5	1507 (0.4)	0.3–0.5	1217 (0.3)	0.3–0.4	3834 (1.0)	0.9–1.1
A06AC	Bulk forming laxatives	1352 (0.4)	0.3–0.4	3479 (0.9)	0.8–1.0	3528 (1.0)	0.9–1.1	2659 (0.7)	0.6–0.8	8593 (2.3)	2.2–2.5
A06AC01+ A06AC51	*Ispaghulla + combinations*	1057 (0.3)	0.2–0.3	2507 (0.7)	0.6–0.8	2534 (0.7)	0.6–0.8	1821 (0.5)	0.4–0.6	6033 (1.6)	1.5–1.8

ATC: anatomic therapeutic chemical; CI: confidence interval: NSAID: nonsteroidal anti-inflammatory drug

* Pyridoxine is shown even though <1% of pregnancies were exposed to it because it is a first line therapy to treat nausea and vomiting in pregancy

Thus, our extrapolated study population can be assumed to be representative of all pregnancies in Switzerland during this time period.

Analgesics

In our cohort of pregnant women, paracetamol, which is recommended as the first-line drug to treat pain during pregnancy [17], was the most frequently reimbursed analgesic during pregnancy (30.3%, 95% CI 29.8–30.8%), followed by NSAIDs (8.6%, 95% CI 8.3–8.8%). Lupattelli et al. reported that among pregnant women in Western Europe who responded to a web-based survey, 51.7% indicated having used OTC paracetamol and 2.2% used OTC NSAIDs at least once during pregnancy [7]. Even though such surveys may be affected by volunteer bias and may thus not be entirely representative, our study only captures dispensing of prescribed drugs and therefore, likely underestimates the actual use of analgesics during pregnancy in Switzerland, because paracetamol and most NSAIDs are available OTC [18], which is not captured in claims databases.

Of all pregnancies, 1.3% (95% CI 1.2–1.4%) had a recorded claim for an NSAID after week 24. Use of NSAIDs after week 24 has been associated with premature closure of the ductus arteriosus and renal toxicity and is therefore not recommended. [19].

In our cohort, 1.3% (95% CI 1.2–1.4%) of pregnancies had a prescription for an opioid in trimester 3. Opioids have been associated with neonatal abstinence syndrome and neonatal respiratory distress, especially when administered near delivery [2023]. In clinical situations in which the use of opioids in trimester 3 is required, neonatal surveillance and special care during delivery and the early post-partum period should be provided.

Antibiotics

Infections are a frequent complication of pregnancy, which require treatment in order to prevent complications. The most frequently reported indications for antibiotic use during pregnancy are respiratory infections, pelvic inflammatory disease and urinary tract infections [24].

Exposure to antibiotics during pregnancy was 26.3% in our cohort, which is comparable to a Norwegian national claims-based study (27.9%) [6], but lower than in a French claims based study (40.6%) [5]. As opposed to analgesics, antibiotics cannot be purchased OTC and therefore we expect our results to accurately reflect exposure to antibiotics in outpatient care in Switzerland.

Overall, potentially teratogenic or fetotoxic antibiotics were rarely dispensed during risk periods; sulfonamide/trimethoprim, which is associated with a theoretical increased risk of neural tube defects if administered in trimester 1 [25, 26], was dispensed during 0.3% of pregnancies in trimester 1. Tetracyclines, which may cause tooth staining if administered after week 14 of pregnancy and especially in trimester 3 [27, 28], were dispensed during 0.1% of pregnancies in trimester 2 and in 93 pregnancies in trimester 3. Quinolones have been associated with cartilage and bone damage in animal models. Even though similar effects have not been found in human fetuses, quinolone use, especially in trimester 1, should be avoided unless better alternatives are lacking [29, 30]. In our cohort, quinolone exposure was recorded in 0.6% of pregnancies in trimester 1.

Gastro-oesophageal reflux

Gastro-oesophageal reflux is a common complication during pregnancy, which affects between 30% and 50% of pregnant women [31], especially towards the end of pregnancy. According to Le Crat [32], PPIs and antacids, which were the most frequently claimed drugs for gastro-oesophageal reflux in our cohort during pregnancy (16% and 10.6%) can be used safely throughout pregnancy. In Switzerland, antacids as well as some PPIs may be purchased OTC and many aluminum-free antacids are not reimbursed by health insurance (e.g., Riopan gel® (Magaldrat), Rennie® (salts of magnesium/calcium). Thus, the actual use of drugs for gastro-oesophageal reflux, and especially use of antacids, is likely underestimated in our cohort. Lupattelli et al. reported a high proportion of OTC antacids (14.7%) during pregnancy in Western Europe in their web-based survey [7]. Self-reported use of OTC PPIs was lower (1.2%) in that study [7].

Table 4:
Exposure prevalence to supplements (extrapolated numbers).

ATC code	Drug substance	Pre pregnancy n (%)	95% CI	T1 n (%)	95% CI	T2 n (%)	95% CI	T3 n (%)	95% CI	T1–T3 N (%)	95% CI
B03AC	IV iron	6891 (1.9)	1.7–2.0	299 (1.4)	1.3–1.5	22,635 (6.1)	5.9–6.4	48,265 (13.1)	12.7, 13.4	68,182 (18.5)	18.0–18.9
B03AA+ B03AB+ B03AD + B03AE	Oral iron	11,524 (3.1)	3.03.3	44,498 (12.0)	11.7–12.4	97,322 (26.3)	25.9–26.8	100,501 (27.2)	26.7, 27.7	169,563 (45.9)	45.3–46.5
Unspecified*	Unspecified	284 (0.1)	0.00.1	338 (0.1)	0.1–0.1	2185 (0.6)	0.5–0.7	4562 (1.2)	1.1, 1.3	6895 (1.9)	1.7–2.0
B03BB	Folic acid	36,350 (9.8)	9.510.1	67,974 (18.4)	18.0–18.8	8277 (2.2)	2.1–2.4	3735 (1.0)	0.9–1.1	71'913 (19.5)	19.1–19.9
A12CC	Magnesium	8804 (2.4)	2.22.5	93,188 (25.2)	24.8–25.7	160,337(43.4)	42.8–44.0	154,625 (41.9)	41.3–42.5	246'891 (66.8)	66.2–67.5
A11CC	Vitamin D	6772 (1.8)	1.72.0	14,965 (4.1)	3.9–4.2	11,627 (3.1)	3.0–3.3	7532 (2.0)	1.9–2.2	24'869 (6.7)	6.5–7.0

ATC: anatomic therapeutic chemical; CI: confidence interval: IV: intravenous; NSAID: nonsteroidal anti-inflammatory drug

* The form of iron dispensed (oral or intravenous) was not obtained from the ATC codes but from the information directly captured in the Helsana data. Therefore, for some prescriptions, this information was not available and is marked as “unspecified”.

Anti-nausea drugs

Nausea and vomiting during pregnancy affect up to 85% of pregnant women during trimester 1, and usually subside after week 14 of pregnancy [33]. Metoclopramide was the most frequently reimbursed nausea drug during pregnancy (14.4%, 95% CI 14.0–14,7%) in our cohort. Specific treatment guidelines for Switzerland are lacking. Both, the British Royal College of Obstetricians and Gynaecologists (RCOG) [34] and the American College of Obstetricians and Gynecologists (ACOG) [35] recommend metoclopramide as second- or third-line anti-nausea drug, after pyridoxine, as mono-preparation or in combination in an antihistamine (ACOG), or an antihistamine (RCOG). We observed claims for pyridoxine monopreparations in 0.1% (95% CI 0.1–0.2%) of pregnancies. Furthermore, in the web-based survey, pyridoxine was not among the four most frequently self-reported treatments against nausea in Western Europe, suggesting it is only rarely used [36]. In the same survey [36], 19.0% of Swiss women self-reported use of antihistamines during pregnancy, which was reportedly the most frequently used anti-nausea drug. In Switzerland, a combination of the antihistamine meclozine and pyridoxine is frequently prescribed to treat nausea and vomiting during pregnancy, but is not reimbursed by health insurance. Thus, our results underestimate the overall use of anti-nausea drugs during pregnancy and presumably only reflect exposure to second- and third-line anti-nausea drugs.

Ondansetron was claimed during 1.3% (95% CI 1.2–1.4%) of pregnancies in our cohort (1.0%, 95% CI 0.9-1.1% in trimester 1). In 2020, Swissmedic followed the EMA by issuing a warning regarding a potentially increased risk of orofacial clefts in association with ondansetron exposure in trimester 1 [37]. The warning was based on an observational study in US claims data, which observed a moderately increased risk of 3 additional cases of oral clefts per 10,000 children exposed to ondansetron during trimester 1 compared with unexposed children [38]. Debate on whether this reported association is causal or not is ongoing [39]. The US Food and Drug Administration (FDA) has not issued a comparable warning, although ondansetron has become the most frequently used anti-nausea drug during pregnancy in the US (22.2% of pregnancies in a US claims-based study in 2014) [40]. The RCOG classifies ondansetron as safe and effective to treat nausea and vomiting during pregnancy, but states that it should be reserved as a second-line therapy given the limited data [34], whereas the ACOG states that it should be reserved as a third-line therapy [35], for cases of persistent nausea and vomiting of pregnancy.

Laxatives

Constipation is one of the most common gastrointestinal complaints during pregnancy, affecting almost half of pregnant women, most commonly during the first and second trimester [31].

Bulk and osmotic laxatives are the first-line treatment of constipation during pregnancy [41]. Lubricants should be limited to short-term use since they may diminish absorption of lipophilic vitamins [41]. Exposure to prescribed laxatives during pregnancy was 6.4% (95% CI 6.2-6.7%) in our cohort, which likely underestimates overall use of laxatives during pregnancy in Switzerland. Lupattelli et al. observed a self-reported use of OTC laxatives (most laxatives are available OTC in Switzerland) of 7.5% during pregnancy in Western Europe in their web-based survey [7].

Claims for contact laxatives were recorded in 0.3% (95% CI 0.2–0.3%) of pregnancies in trimester 3. Contact laxatives are recommended for short-term use only, if osmotic and bulk laxatives were ineffective, especially senna preparations, which may cause intestinal and uterine contractions if taken in trimester 3 (0 exposed pregnancies in trimester 3) [42].

Supplements

Claims for folic acid were recorded in 9.8% (95% CI 9.5–10.1%) of pregnancies in pre-pregnancy and in 18.4% (95% CI 18.018.8%) in trimester 1. Folic acid supplementation is recommended for every woman who intends to become pregnant between 2–3 months before conception and until week 12 of pregnancy [43]. The observed exposure to folic acid in our cohort underestimates overall use of folic acid in pregnant women in Switzerland, as folic acid may be purchased OTC and most prenatal vitamins also include folic acid in an appropriate dose but are not reimbursed by basic health insurance in Switzerland. Thus, only one out of ten women in Switzerland is prescribed reimbursable folic acid prior to pregnancy and one out of five during trimester 1. Given the important role of folic acid in the prevention of neural tube defects, more comprehensive prescribing may be desirable to ensure sufficient folic acid supplementation around the time of conception.

According to the Swiss Society of Gynaecology and Obstetrics [44], iron deficiency without anaemia and iron deficiency anaemia should be screened for and supplemented during pregnancy. It has been reported that one in three pregnant women in Switzerland presents with iron deficiency and one in ten with anaemia due to iron deficiency [44]. In our cohort, 18.5% of women had a claim for intravenous iron and 45.9% for oral iron.

Strengths and limitations

To our knowledge, this study is the first to evaluate outpatient drug utilisation during pregnancy on a population-based level in Switzerland. Our findings originate from a representative claims database including longitudinal data on 15% of pregnancies in Switzerland. Data are recorded as a by-product of routine clinical care, independently of the research question, and our results are thus not vulnerable to volunteer or recall bias. However, some limitations need to be considered. First, our extrapolated study population is representative of the overall female population of Switzerland in terms of demographic factors. However, given the lack of socioeconomic information in claims data, we were not able to account for potential socioeconomic differences in the extrapolation process. Nevertheless, given that the average maternal age at delivery, which is a well-known proxy for socioeconomic status [45], was consistent between our extrapolated cohort and overall maternal age reported by the Swiss Federal Statistical Office, major channeling by socioeconomic status is

unlikely. Second, we only included pregnancies that ended in live births or stillbirths because early abortions and terminations are not reliably captured in healthcare claims data. This may have led to an underestimation of the prevalence of exposure to drugs that can cause spontaneous abortions due to early death of the embryo or fetus, or which are associated with an increased rate of medical or surgical abortions. Third, inpatient drug use could not be evaluated because of the bundled DRG-based reimbursement system for inpatient stays in Switzerland. In a survey among Swiss obstetric clinics, Schenkel et al. reported drugs that were routinely used to treat various pregnancy and post-partum indications [46]. Forth, gestational age at delivery is not recorded in Swiss claims data, and LMP and trimester dates had to be estimated based on relatively crude information on gestational age provided by DRG billing codes. The applied algorithm to estimate LMP has been validated in US claims data [10]. However, validation of the algorithm in Swiss claims data would require linkage of different external data sources providing exact information on gestational age at delivery. Unlike other countries, such linkage of different data sources is not routinely feasible in Switzerland yet, for legal and political reasons. Thus, some misclassification of the dispensing timing by trimester is possible. Fifth, healthcare claims data only provide information on when a prescribed drug was dispensed but not on actual drug use or drug adherence. Finally, the TARMED coding system for outpatient care does not capture medical diagnoses, and thus we cannot determine whether use of potentially teratogenic/fetotoxic drugs was clinically necessary.

Conclusion

The observed pattern of claimed drugs during pregnancy is in line with existing treatment guidelines. Exposure to potentially teratogenic or fetotoxic drugs was small, but given the lack of recorded diagnoses, we cannot determine if their use was clinically indicated. Our study demonstrates that Swiss healthcare claims databases are a valuable tool to evaluate drug utilization during pregnancy in Switzerland.

Pregnant women are a vulnerable and yet under-investigated patient population, and appropriate research methods and tools to further understand their medical needs are required.

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Competing interests

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflict of interest was disclosed.

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Appendix 1

Crude results

Table S1:
Description of the study population (crude numbers).

Year	No. of deliveries in the cohort	Mean of maternal age at delivery in the cohort (SD)	Mean maternal age at delivery in Switzerland (BfS)	Percentage of caesarean sections in the cohort	Percentage of caesarean sections in Switzerland (BfS)
2014	9560	32.09 (5.06)	31.7	34.6	33.7
2015	9409	32.10 (5.20)	31.8	34.8	33.3
2016	9163	32.03 (5.25)	31.8	34.1	33.2
2017	8811	32.12 (5.33)	31.9	33.8	32.3
2018	8300	32.09 (5.23)	32.0	33.4	32.1

CI: confidence interval; BfS: Bundesamt für Statistik, Swiss Federal Statistical Office; SD: standard deviation

Table S2:
Exposure to potentially teratogenic or fetotoxic drugs during risk period and associated potential risks (crude numbers).

Potentially teratogenic or fetotoxic drugs (ATC code)	Warnings regarding use during critical period	Risk period	Pregnancies exposed during risk period during study period (n, %)
NSAIDs (M01A)	Premature closure of ductus arteriosus and renal toxicity [19]	After week 24	710 (1.6)
Opioids (N02A)	Neonatal abstinence syndrome and respiratory distress [20–23]	Trimester 3	739 (1.6)
Trimethoprim/sulphonamide (J01E)	Risk of neural tube defects [25, 26]	Trimester 1	152 (0.3)
Quinolone (J01M)	Cartilage and bone damage in animal studies but not found in human studies [29, 30]	Trimester 1	252 (0.6)
Tetracycline (J01A)	Tooth staining [27, 28]	Trimester 2 and 3	25; 13 (0.1; 0.0)
Ondansetron (A04AA01)	Potentially increased risk of orofacial clefts [37]	Trimester 1	469 (1.0)
Contact laxatives (A06AB), especially senna (anthraquinone derivative, A06AB06)	Theoretical risk of intestinal and uterine contractions [42]	Trimester 3	27; 0 (0.1; 0.0)

ATC: anatomic therapeutic chemical; NSAID: nonsteroidal anti-inflammatory drug

Table S3:
Exposure prevalence to different drug groups and active substances during pregnancy overall and within trimester of pregnancy and pre-pregnancy separately (crude numbers).

ATC code	Drug substance	Pre-pregnancy n (%)	T1 n (%)	T2 n (%)	T3 n (%)	T1–T3 n (%)
N02+M01A	Analgesics	8226 (18.2)	7713 (17.0)	7372 (16.3)	6318 (14.0)	15757 (34.8)
N02B	Other analgesics	4778 (10.6)	6324 (14.0)	6545 (14.5)	5616 (12.4)	13989 (30.9)
N02BE01	Paracetamol	4183 (9.2)	6109 (13.5)	6499 (14.4)	5582 (12.3)	13801 (30.5)
N02BB02	Metamizole	1140 (2.5)	366 (0.8)	74 (0.2)	45 (0.1)	470 (1.0)
M01A	NSAIDs	5550 (12.3)	2361 (5.2)	1354 (3.0)	568 (1.3)	3908 (8.6)
M01AE01	Ibuprofen	3204 (7.1)	1474 (3.3)	915 (2.0)	291 (0.6)	2486 (5.5)
M01AG01	Mefenamic acid	1082 (2.4)	400 (0.9)	260 (0.6)	153 (0.3)	766 (1.7)
M01AB05	Diclofenac	1125 (2.5)	364 (0.8)	148 (0.3)	84 (0.2)	570 (1.3)
N02A	Opioids	678 (1.5)	347 (0.8)	328 (0.7)	739 (1.6)	1308 (2.9)
N02AX02	Tramadol	298 (0.7)	159 (0.4)	209 (0.5)	593 (1.3)	911 (2.0)
J01	Antibiotics	4256 (9.4)	4853 (10.7)	5265 (11.6)	5010 (11.1)	12016 (26.6)
J01CR02+J01CA04	Amoxicillin + combined with beta lactamase inhibitor	1173 (2.6)	1912 (4.2)	2404 (5.3)	2236 (4.9)	5799 (12.8)
J01XX01	Fosfomycin	642 (1.4)	1101 (2.4)	1270 (2.8)	1161 (2.6)	3088 (6.8)
J01FA10	Azithromycin	567 (1.3)	644 (1.4)	620 (1.4)	544 (1.2)	1615 (3.6)
J01DC02	Cefuroxime	257 (0.6)	267 (0.6)	332 (0.7)	335 (0.7)	848 (1.9)
J01XE01	Nitrofurantoin	153 (0.3)	272 (0.6)	310 (0.7)	329 (0.7)	803 (1.8)
J01FF01	Clindamycin	57 (0.1)	105 (0.2)	217 (0.5)	286 (0.6)	579 (1.3)
A02	Gastro-oesophageal reflux	2601 (5.7)	3242 (7.2)	4374 (9.7)	7506 (16.6)	11651 (25.7)
A02BC	Proton pump inhibitors	2082 (4.6)	2285 (5.0)	2607 (5.8)	4212 (9.3)	7134 (15.8)
A02BC02	Pantoprazole	1434 (3.2)	1260 (2.8)	1157 (2.6)	1800 (4.0)	3491 (7.7)
A02BC01	Omeprazole	241 (0.5)	539 (1.2)	871 (1.9)	1344 (3.0)	2237 (4.9)
A02BC05	Esomeprazole	436 (1.0)	559 (1.2)	578 (1.3)	1059 (2.3)	1825 (4.0)
A02A	Antacids	80 (0.2)	1083 (2.4)	1848 (4.1)	2835 (6.3)	5008 (11.1)
A02AD01	Ordinary salt combinations	63 (0.1)	1030 (2.3)	1787 (3.9)	2754 (6.1)	4838 (10.7)
A02BA	H2 receptor antagonists (ranitidine only)	31 (0.1)	150 (0.3)	276 (0.6)	1176 (2.6)	1432 (3.2)
A03	Anti-nausea drugs	1235 (2.7)	5707 (12.6)	1702 (3.8)	971 (2.1)	7271 (16.1)
A03FA01	Metoclopramide	481 (1.1)	4962 (11.0)	1385 (3.1)	821 (1.8)	6350 (14.0)
A03FA03	Domperidone	603 (1.3)	778 (1.7)	203 (0.4)	107 (0.2)	1025 (2.3)
A04AA01	Ondansetron	211 (0.5)	469 (1.0)	196 (0.4)	83 (0.2)	592 (1.3)
A11HA02	Pyridoxine*	14 (0.0)	54 (0.1)	10 (0.0)	6 (0.0)	64 (0.1)
A06	Laxatives	746 (1.6)	1252 (2.8)	1170 (2.6)	1106 (2.4)	3000 (6.6)
A06AD	Osmotically active	446 (1.0)	689 (1.5)	585 (1.3)	563 (1.2)	1596 (3.5)
A06AD15+A06AD65	Macrogol, comb + macrogol	372 (0.8)	468 (1.0)	382 (0.8)	354 (0.8)	1061 (2.3)
A06AD11+ A06AD61	Lactulose	63 (0.1)	185 (0.4)	166 (0.4)	149 (0.3)	451 (1.0)
A06AC	Bulk forming laxatives	167 (0.4)	430 (1.0)	431 (1.0)	338 (0.7)	1069 (2.4)
A06AC01+ A06AC51	Ispaghulla + combinations	133 (0.3)	321 (0.7)	316 (0.7)	241 (0.5)	775 (1.7)

ATC: anatomic therapeutic chemical; NSAID: nonsteroidal anti-inflammatory drug

* Pyridoxine is shown even though <1% of pregnancies were exposed to it because it is a first-line therapy to treat nausea and vomiting in pregancy

Table S4:
Exposure prevalence to supplements (crude numbers).

ATC code	Drug substance	Pre-pregnancy n (%)	T1 n (%)	T2 n (%)	T3 n (%)	T1–T3 n (%)
B03AC	IV iron	837 (1.8)	667 (1.5)	2768 (6.1)	5789 (12.8)	8236 (18.2)
B03AA+ B03AB+ B03AD + B03AE	Oral iron	1399 (3.1)	5551 (12.3)	12075 (26.7)	12365 (27.3)	20960 (46.3)
Unspecified*	Unspecified	29 (0.1)	42 (0.1)	263 (0.6)	551 (1.2)	834 (1.8)
B03BB	Folic acid	4397 (9.7)	8337 (18.4)	1011 (2.2)	456 (1.0)	8826 (19.5)
A12CC	Magnesium	1100 (2.4)	11681 (25.8)	19614 (43.3)	19104 (42.2)	30333 (67.0)
A11CC	Vitamin D	836 (1.8)	1849 (4.1)	1416 (3.1)	977 (2.2)	3092 (6.8)

ATC: anatomic therapeutic chemical; CI: confidence interval: IV: intravenous; NSAID: nonsteroidal anti-inflammatory drug

* The form of iron dispensed (oral or intra venous) was not obtained from the ATC codes but from the information directly captured in the Helsana data. Therefore, for some prescriptions, this information was not available and is marked as “unspecified".

Appendix 2: Descriptive statistics

Weighting procedure

In order to represent numbers of all Switzerland and due to potential small biases in the Helsana data set, all results were extrapolated/weighted relative to the demographic distribution of the overall Swiss population, taking into account the stratification by calendar year, canton, age, and sex. The extrapolations/weightings were based on individual weighting factors (w_i), which were calculated as the inverse of the sampling probability ($p_i = N_{Helsana,i} / N_{Switzerland,i}$) of a given stratum (i): $w_i = 1 / p_i$. The strata are defined by a woman's demographic characteristics at the time of the delivery. The corresponding sample sizes ($N_{Helsana,i}$, $N_{Switzerland,i}$) for the different strata come from the risk equalization statistics [47].

Calculation of the 95% confidence intervals

The weighted sums (extrapolated number of pregnancies), weighted mean and standard deviation of age were calculated using the survey package in R [14]. The package uses a simple inverse-probability weighting as described above. Besides the weighted estimates, the survey package provides standard estimators that incorporate the effects of stratification. These are used to calculate normal-based 95% confidence intervals of the extrapolated number of pregnancies and corresponding prevalences.

Appendix 3: Relevant codes to identify vaginal or caesarean delivery

Table S5:
Relevant codes to identify vaginal or caesarean delivery.

Codes	Definition	Type of delivery
TarMed codes version (V01.08.00, 01.08.01, 01.09)	**Grossesse et obstétrique**	
22.2110	Surveillance de la naissance et conduite de l'accouchement, risque normal	Vaginal delivery
22.2120	+ Césarienne secondaire	Cesarean delivery
22.2130	+ Hystérectomie lors d'une césarienne	Cesarean delivery
22.2200	Surveillance de la naissance et conduite de l'accouchement, haut risque	Vaginal delivery
22.2210	Surveillance de la naissance et conduite de l'accouchement, très haut risque	Vaginal delivery
22.2410	Césarienne, planifiée ou primaire	Cesarean delivery
22.2420	Césarienne itérative	Cesarean delivery
SwissDRG Codes	**MDC 14: Grossesse, naissance et suites de couches**	
O01A (V3.0, V4.0, V 5.0, V6.0)	Césarienne avec plusieurs diagnostics de complication, durée de la grossesse jusqu'à 25 semaines complètes ou avec thérapie intra-utérine	Cesarean delivery
O01A (V7.0)	Césarienne et dialyse, ou thérapie intra-utérine complexe du fœtus	Cesarean delivery
O01B (V3.0, V4.0)	Césarienne avec plusieurs diagnostics de complication, durée de la grossesse de 26 à 33 semaines complètes, sans thérapie intra-utérine ou avec diagnostic de complication, jusqu'à 25 semaines complètes, ou thromboembolie pendant la période de gestation avec procédure opératoire	Cesarean delivery
O01B (V5.0)	Césarienne avec plusieurs diagnostics de complication, durée de la grossesse de 26 à 33 semaines complètes, jusqu'à 25 semaines complètes, ou thromboembolie pendant la période de gestation avec procédure opératoire ou procédure complexe	Cesarean delivery
O01B (V6.0, V7.0)	Césarienne avec plusieurs diagnostics de complication, durée de la grossesse de 26 à 33 semaines ou CC extrêmement sévères ou diagnostic complexe ou procédure de complication, jusqu'à 33 semaines de grossesse ou diagnostic complexe et CC extrêmement sévères, ou jusqu'à 25 semaines de grossesse et diagnostic de complication	Cesarean delivery
O01C (V3.0, V4.0, V5.0)	Césarienne avec plusieurs diagnostics de complication, durée de la grossesse > 33 semaines complètes, sans thérapie intra-utérine ou avec diagnostic de complication, de 26 à 33 semaines ou avec diagnostic complexe ou jusqu'à 33 semaines ou avec diagnostic complexe, avec CC extrêmement sévères	Cesarean delivery
O01C (V6.0, V7.0)	Césarienne secondaire avec plusieurs diagnostics de complication ou procédure complexe, ou jusqu'à 33 semaines de grossesse ou diagnostic complexe ou diagnostic de complication et grossesse de 26 à 33 semaines ou diagnostic complexe	Cesarean delivery
O01D (V3.0, V4.0, V5.0)	Césarienne avec plusieurs diagnostics de complication, durée de la grossesse > 33 semaines complètes, sans thérapie intra-utérine ou avec diagnostic de complication, de 26 à 33 semaines ou avec diagnostic complexe ou jusqu'à 33 semaines ou avec diagnostic complexe, sans CC extrêmement sévères	Cesarean delivery
O01D (V6.0, V7.0)	Césarienne secondaire avec diagnostic de complication, durée de la grossesse plus de 33 semaines complètes	Cesarean delivery
O01E (V3.0, V4.0, V5.0)	Césarienne avec diagnostic de complication, durée de la grossesse plus de 33 semaines complètes, sans diagnostic complexe	Cesarean delivery
O01E (V6.0, V7.0)	Césarienne avec plusieurs diagnostics de complication ou procédure complexe, ou jusqu'à 33 semaines de grossesse ou diagnostic complexe, ou diagnostic de complication et grossesse de 26 à 33 semaines ou diagnostic complexe, ou césarienne secondaire	Cesarean delivery
O01F (V3.0, V4.0, V5.0)	Césarienne sans diagnostic de complication, durée de la grossesse plus de 33 semaines complètes, sans diagnostic complexe	Cesarean delivery
O01F (V6.0 V7.0)	Césarienne avec diagnostic de complication, durée de la grossesse plus de 33 semaines complètes	Cesarean delivery
O01G (V6.0, V7.0)	Césarienne, durée de la grossesse > 33 semaines complètes	Cesarean delivery
O01H (V7.0)	Césarienne, durée de la grossesse plus de 33 semaines complètes	Cesarean delivery
O02A (V3.0, V4.0)	Accouchement par voie basse avec procédure opératoire de complication, durée de la grossesse jusqu'à 33 semaines complètes ou avec thérapie intra-utérine	Vaginal delivery
O02A (V5.0, V6.0, V7.0)	Accouchement par voie basse avec procédure opératoire de complication, avec thérapie intra-utérine ou traitement complexe de soins intensifs > 119 points ou procédure de complication ou procédure complexe	Vaginal delivery
O02B (V3.0, V4.0)	Accouchement par voie basse avec procédure opératoire de complication, durée de la grossesse plus de 33 semaines complètes, sans thérapie intra-utérine	Vaginal delivery
O02B (V5.0, V6.0, V7.0)	Accouchement par voie basse avec procédure opératoire de complication	Vaginal delivery
O60A (V3.0)	Accouchement par voie basse avec plusieurs diagnostics de complication, au moins une complication sévère, durée de la grossesse jusqu'à 33 semaines complètes ou avec procédure de complication	Vaginal delivery
060A (V 4.0, V5.0, V6.0, V7.0)	Accouchement par voie basse avec plusieurs diagnostics de complication, au moins une complication sévère, durée de la grossesse jusqu'à 33 semaines complètes ou avec procédure de complication ou thromboembolie pendant la période de gestation	Vaginal delivery
060B (V3.0)	Accouchement par voie basse avec plusieurs diagnostics de complication, au moins une complication sévère, durée de la grossesse plus de 33 semaines complètes, sans procédure de complication ou thromboembolie pendant la période de gestation sans procédure opératoire	Vaginal delivery
060B (V4.0, V5.0)	Accouchement par voie basse avec plusieurs diagnostics de complication, au moins une complication sévère, durée de la grossesse plus de 33 semaines complètes, sans procédure de complication ou thromboembolie pendant la période de gestation	Vaginal delivery
O60B (V6.0, V7.0)	Accouchement par voie basse avec plusieurs diagnostics de complication, au moins une complication sévère, durée de la grossesse plus de 33 semaines complètes	Vaginal delivery
O60C (V3.0, V4.0, V5.0, V6.0, V7.0)	Accouchement par voie basse avec diagnostic de complication sévère ou moyennement sévère	Vaginal delivery

O60D (V3.0, V4.0)	Accouchement par voie basse sans diagnostic de complication	Vaginal delivery
060D (V5.0, V6.0, V7.0)	Accouchement par voie basse	Vaginal delivery
Midwife codes		
B1	Leitung einer ambulanten Geburt	Vaginal delivery
B2	Zweithebamme für ambulante Geburt oder Verlegung	Vaginal delivery
B3	Verbrauchsmaterial für unvollendete ambulante Geburt	Vaginal delivery
B4	Verbrauchsmaterial für ambulante Geburt	Vaginal delivery