RESEARCH

A sample article title

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Abstract

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Introduction

The levels of many essential minerals decrease during pregnancy if un-supplemented, including calcium, iron, magnesium, selenium, zinc, and possibly chromium and iodine. Sub-optimal intake of minerals from preconception through pregnancy increases the risk of many pregnancy complications and infant health problems. In the U.S., dietary intake of minerals is often below the Recommended Dietary Allowance (RDA), especially for iodine and magnesium, and 28 percent of women develop iron deficiency anemia during their third trimester. The goal of this paper is to propose evidence-based recommendations for the optimal level of prenatal supplementation for each mineral for most women in the United States. Overall, the evidence suggests that optimal mineral supplementation can significantly reduce a wide range of pregnancy complications (including anemia, gestational hypertension, gestational diabetes, hyperthyroidism, miscarriage, and pre-eclampsia) and infant health problems (including anemia, asthma/wheeze, autism, cerebral palsy, hypothyroidism, intellectual disability, low birth weight, neural tube defects, preterm birth, rickets, and wheeze). [1].

Maternal and newborn care for all racial and socioeconomic groups is critical to nation's health as the evidence from epigenetic and microbiome studies have highlighted the potential mechanisms of life-long effects of fetal exposures. Though race is a social construct that has no biological meaning [2], racism is a powerful negative source in the society. The proportion of overweight adolescents has increased in the last 40 years and continues to rise, 25 per cent of girls in upper secondary school are overweight or obese [3]. 'High risk pregnancy' is typically defined as a pregnancy where pregnant woman, fetus or both have an increase risk of pregnancy complications, adverse events leading to morbidity or mortality. There is no exact definition of high risk. Though majority of the pregnancies today are not high risk, the rates of diabetes, hypertension, obesity and maternal age are increasing. An appropriate pregnancy risk assessment by qualified providers is therefore essential to provide high quality and safe maternal care. Importantly, the risk is not static and changes during pregnancy, the risk assessment therefore needs to be continuous. Demographic trends of higher age of first pregnancy, coupled with increased use of fertility treatments can contribute to higher risk profiles. The Internet has

become one of the most popular sources of information and women planning to get pregnant or pregnant first time are particularly keen. Fetal development and nutrition in pregnancy were the most often mentioned topics of interest [4]. Most women believed that the health information in Internet was useful and reliable and did not discuss the information they retrieved from the Internet with their health providers[4]. Thus, it is important that to develop web tools based on accurate and up to date information. Accordingly, there has been an effort to develop web applications to predict adverse pregnancy outcomes but these tools focus on only one pregnancy complication, e.g. early pregnancy risk prediction of gestational diabetes mellitus in nulliparous women [5]. These tools are helpful if the women are aware of possible pregnancy complications and their clinical names. From the perspective of an individual woman, it is useful to have a single web tool to provide risk factors for most common pregnancy complications. We collected risk factors for 10 most common pregnancy complications (affecting more than 1% of pregnancies on average) and thrombosis, though rare, is the leading cause of death in pregnancy. We have developed a web-based tool to estimate risk for developing these pregnancy complications

- Gestational Diabetes Mellitus - about 10% of pregnancies
- Preeclampsia - about 5% of pregnancies
- Pre-term birth – about 5% of pregnancies
- Miscarriage - about 10% of pregnancies
- Still birth - about 10% of pregnancies
- Caesarean section - about 15% of pregnancies
- Postpartum depression - about 10% of pregnancies
- Placental complications – about 2% of pregnancies
- Hyperemesis gravidarum - about 2% of pregnancies
- Antepartum haemorrhage – about 3% of pregnancies
- Thrombosis – about 0.1% of pregnancies (Leading cause of death)

It is important to note that the tool will provide you with the risk of an ‘average‘ woman with your health measures and NOT your personal risk score. It is also important to note that the model does not take into many other psycho-social factors affecting maternal outcome. We also note that these are most common pregnancy complications and NOT an exhaustive list. We have not included risk factors for many congenital abnormalities which are partly preventable. For example, neural tube defects can be prevented by folic acid supplementation (REF). We have excluded many other rare complications such as acute fatty liver of pregnancy is a very serious but rare complication affecting about 1 in 10,000 women in third trimester or at birth [6].

Methods

The underlying model for this web application is derived by integrating the risk calculations from the following peer reviewed scientific publications. Some of the risk factors might vary according to the individual circumstances e.g. socio-economic status, family background, emotional status etc. These analyses consider each risk variable separately in the risk factor calculation and is assumed to affect each pregnancy related complication independently. These assumptions are strong, as there

are likely confounding variables as well as many missing risk factors, but this is the most reasonable approximation based on currently available information. The information here will be regularly updated based on further knowledge generated from additional data.

Gestational Diabetes Mellitus

Gestational diabetes mellitus is defined as carbohydrate intolerance resulting in hyperglycaemia, including impaired glucose tolerance with first onset or detection during pregnancy and affects about 5-10% of pregnancies [7]]. Gestational diabetes increases the risk of complications for both mother and child during pregnancy, childbirth and beyond. Risk factors

- Age – 15 to 50 years (¡ 25 – 0 times, 26-35 – 2 times , ¿35 – 3 times)
- Parity – 0 to 7 (¿2 – 1.5 times)
- if parity ¿ 0, History of - GDM (yes – 10 times); congenital anomalies (yes – 2.5 times); stillbirth (yes – 2.5 times); miscarriage (yes – 2.5 times); preterm delivery (yes – 2.5 times); macrosomia (yes – 4 times),
- Weight – 20 to 120kg (BMI ¿ 25 – 2.5 times, ¿30 – 6 times)
- Ethnicity – (White – 0 times, any other – 2.5 times)
- Family history of diabetes – (yes – 3 times)
- Polycystic ovary syndrome – (yes – 2.5 times)
- High blood pressure – (yes – 2.5 times) if no Family history of hypertension/high blood pressure – (yes – 1.5 times)
- Diet (yes/no for each question, 5 or more times yes – 2 times) Non-varied diet: sugar/artificially sweetened beverages 5 times/week; sweets, ice cream, cakes, cookies 2.5 times/week; processed meat products 1 time/week; whole grain products ¡2 times/day; dairy 2 times/day and vitamin D intake 5 times/week
- Physical activity (yes/no for each question, 3 times no – 2 times) Daily walking 30min; vigorous physical activity; Daily stair climbing 10 stairs

(Fasting glucose – 3 to 8 Mmol/l, 2 hr glucose - 5 to 15 Mmol/l, HbA1C – 4 to 7.5Risk: (5% population average) Low – 0 to ¡3 times (about 5% of pregnancies) Increased – 3 to ¡6 times (about 15% of pregnancies) Moderate – 6 to ¡9 times (about 20% of pregnancies) High – 10 to 15 times (about 40% of pregnancies) Very High – over 15 times (over 50% of pregnancies)

References: [8, 9, 10]

Preeclampsia

Preeclampsia is a hypertensive disorder which usually occurs after 20 weeks of gestation, characterized by elevated blood pressure and protein in the urine. It is one of the leading cause of maternal and perinatal morbidity and mortality and is prevalent in about 5% pregnancies [11]. Risk factors

- Weight – 20 to 120kg (BMI ¿ 25 – 2 times, ¿30 – 5 times)
- hypertension (2 times, chronic - 6 times)
- Ethnicity-Afro-Caribbean= (2 times)
- Parous with previous PE (PPE) (6 times)
- Systemic lupus erythematosus or antiphospholipid syndrome (2 times)
- T2DM (2.5 times)

Reference [12], A much better review of preeclampsia risk factors - 10.1111/1471-0528.17320

Risk: (5% population average) Low – 0 to ¡3 times (about 5% of pregnancies) Increased – 3 to ¡6 times (about 15% of pregnancies) Moderate – 6 to ¡9 times (about 20% of pregnancies) High – 10 to 15 times (about 40% of pregnancies) Very High – over 15 times (over 50% of pregnancies)

Spontaneous pre-term delivery

Preterm birth imposes a considerable global public health burden, with substantial costs for families and health care systems and adverse impacts on the quality of life of babies who survive. It is prevalent in about 5% of pregnancies and causes of preterm birth remain unidentified in over 50% of spontaneous preterm cases [13].

- Age (¿35 1.4 times)
- Race (Black 1.4 times)
- BMI (¡18.5 1.3 times, 30-35 1.6 times, 35-40 2 times, ¿40 3 times)
- Smoking (1.4 times)
- Stress (2 times)
- Previous preterm (5 times)
- Cervical surgery, such as conization or trachelectomy (2 times)
- Multiple gestations (10 times)
- Hepatitis C (2 times)
- Diabetes (4 times)
- GDM (1.5 times)
- Hypertension (3 times)
- Eclampsia (7 times)
- Infertility treatment (5 times)
- Gonorhea/Syphilis (1.5 times)

References [14, 15]

Miscarriage

Miscarriage is defined as a nonviable intrauterine pregnancy up to 20 weeks gestation and prevalent in about 10% of pregnancies. The risk of miscarriage was lowest in women aged 25-29 (10%), and rose rapidly after age 30, reaching 53% in women aged 45 and over. There was a strong recurrence risk of miscarriage, with age adjusted odds ratios of 1.54 (95% confidence interval 1.48 to 1.60) after one miscarriage, 2.21 (2.03 to 2.41) after two, and 3.97 (3.29 to 4.78) after three consecutive miscarriages. The risk of miscarriage was modestly increased if the previous birth ended in a preterm delivery (adjusted odds ratio 1.22, 95% confidence interval 1.12 to 1.29), stillbirth (1.30, 1.11 to 1.53), caesarean section (1.16, 1.12 to 1.21), or if the woman had gestational diabetes in the previous pregnancy (1.19, 1.05 to 1.36). PMID 30894356

- Age (¿30 2 times, ¿45 5 times)
- Other ethnic (1.3 times)
- No higher education (1.4 times)
- Nausea and vomiting in first trimester (half risk)
- Previous miscarriage (1 -1.5 times, 2 – 2.2 times, 3 - 4 times)

- Family history of miscarriage (yes - twice risk)
- Adverse childhood (¿3 yes – twice risk)
- Previous preeclampsia (yes- 2 times)
- Interpregnancy interval (¿ 3 months – 1.5 times)
- Frequency of night shift (¿1 night per weeks - ¿1.5 times)
- Alcohol (¿4 drinks per week – 2.5 times)
- Perceived stress (¿4 yes– 2 times) In the last month, (i) have you often been upset because of something that happened unexpectedly? (ii) have you often felt that you were unable to control the important things in your life? (iii) have you often felt that things were not going your way? (iv) have you often found that you could not cope with all the things that you had to do? (v) have you often been able to control irritations in your life? (vi)have you often felt that you were on top of things? (vii) have you often been angered because of things that happened that were outside of your control? (viii) have you often felt difficulties were piling up so high that you could not overcome them?
- stress (¿4 yes– 2 times) Have you (i) lived most of childhood in a single natural mother family, (ii) ever lived in institutions providing residential care for children (such as children's home) or with foster parents, (iii) separation from mother for 6 months at age 16 years, (iv) victim of serious physical attack/assault at age 16 years, (v) victim of sexual assault (including rape or harassment) at age 16 years, (vi) physically abusive parents at age ¡16 years, (vii) parents with substance abuse or mental health problems at age ¡16 years and (viii) parents argued or fought very often at age ¡16 years
- High energy no fatigue in first trimester (yes – 2 times)
- Chronic hypertension (yes – 2 times)

References: [16, 17, 18, 19, 20, 21]

Stillbirth

Stillbirth is one of the adverse births outcomes and represent major problem in both developing and developed countries but the definition prevalence of stillbirth varies across countries with 10% prevalence in developed countries [22].

- Gestational time: Over 41 weeks (4 times)
- Sex (male 1.1 times)
- Age (¡19 2 times, ¿44 2.5 times)
- Infection (Syphilis, Malaria – 2.5 times)
- Ethnicity (Black 2.5 times)
- Parity (0 1.5 times)
- BMI (¿30 1.5 times, ¿40 2.5 times)
- Smoker (1.5 times)
- Chronic hypertension (2.5 times)
- GDM (2.5 times)
- Preeclampsia or eclampsia (1.5 times)
- Rhesus disease (1.2 times)

References: [23, 24, 25, 15]

Post-partum depression

Postpartum depression is a mood disorder that affects about 10% of adult mothers yearly [25].

- Age (¡20 – 2 times),
- Parity (¿4 – 6 times)
- Ethnicity (nonwhite – 2 times)
- No higher education – (1.5 times)
- smokers (yes – 2 times)
- Going through an extremely stressful event, like a job loss, financial problems, or health problems over the past year – 3 times
- Had a mood disorder in the past, e.g. depression, postpartum depression, anxiety disorder, or bipolar disorder – 2 times
- Child with special needs or health problems (1.5 times)
- Gynecological disease during pregnancy (diabetes, hypertension/hypotension, hepatitis, chicken pox, and gynecological inflammation) – 1.5 times
- Infant birth weight ¡ 1.5kg (8 times)
- Lack of support from friends, family, and other members of your community (yes – 4 times)
- Infant admission to NICU at birth (yes – 2 times)
- Dealing with relationship problems with your partner or spouse (yes – 6 times)
- An unplanned or unwanted pregnancy (yes – 4 times)
- Diet (yes/no for each question, 5 or more times yes – 2 times) Non-varied diet; sugar/artificially sweetened beverages 5 times/week; sweets, ice cream, cakes, cookies 2.5 times/week; processed meat products 1 time/week; whole grain products ¡2 times/day; dairy ¡2 times/day and vitamin D intake ¡5 times/week
- previous history of depression (¿20 times) (PMID: 28098957)

References: [26, 27, 28, 29, 30, 31, 32, 33]

Risk: (10% population average) Low – 0 to ¡3 times (about 10% of pregnancies) Increased – 3 to ¡6 times (about 25% of pregnancies) Moderate – 6 to ¡9 times (about 40% of pregnancies) High – over 10 times (over half of pregnancies)

Caesearean delivery

- Age (¿ 32 – 1.5 times, ¿37 – 2 times, ¿40 – 2.5 times)
- Height (¡157 – 1.5 times, ¡ 153 – 2 times, ¡ 149 - 3 times, ¡144 – 6 times)
- Week of Gestation – (¿41 – 1.5 times)
- Sex of fetus – (male -1.2 times)

References: [34]

Risk: (15% population average) Low – 0 to ¡3 times (about 15% of pregnancies) Increased – 3 to ¡6 times (about 30% of pregnancies) Moderate – 6 to ¡9 times (about 45% of pregnancies) High – over 10 times (over 60% of pregnancies)

Placenta praevia

- Maternal age (¿39 9 times)
- Parity (1-4 1.4 times, ¿4 3.5 times)
- multiparity (¿1 1.9 ¿4 2.3)
- previous Cesarean delivery (2.7)

- abortion (1.9)
- Alcohol during pregnancy (1.6)
- Gynacological diseases (2.4)
- smoking and cocaine use during pregnancy (1.6)
- previous history of evacuation of the uterus or dilation and curettage (3.6),
- delivery by caesarean section in previous pregnancy (19.9),
- recurrent vaginal bleeding during the current pregnancy (7.3).

References: [35, 36, 37]

Placental abruption

- Hypertension during pregnancy (2 times)
- Preeclampsia (2 times)
- Fetal Growth Reduction (3 times)
- age (35 years – 1.5 times)
- Irregular prenatal care (3 times)
- Parity (1 or 2 – 2 times, 3 – 3 times)
- Anemia (Mild anemia 2, Moderate anemia 3, Severe anemia 5)
- Premature rupture of the membranes (2 times)
- Antepartum haemorrhage (25 times)
- Placenta Paevia (3 times)

References [38]

Thrombosis - deep vein thrombosis (DVT) and pulmonary embolism (PE)

Though thrombosis affects only about 0.1 cases per 100 deliveries, it is 5–10 times higher rate than that observed in nonpregnant women. Moreover, it is a leading cause (in 20%) of pregnancy-related deaths, higher than other pregnancy-related complications, such as hemorrhage, infections, and pregnancy-induced hypertension [39]. Over past 25 years, there has been greatest rise for antenatal DVTs, postnatal DVTs, on the other hand, declined over the period [40]

- age ¿35 (2.3 times)
- cesaerean section (2.8 times)
- parity (¿3 1.3)
- black (1.6 times)
- Antenatal Haemorrhage (1.6)
- Hypertension 1.8
- Heart disease 7.1
- Thrombophilia 51.8
- History of thrombosis 24.8
- Antiphospholipid syndrome 15.8
- Sickle cell disease 6.7
- Lupus 8.7
- Diabetes 2.0
- Obesity 4.4
- Smoking 1.7

References: [40, 41, 42]

Hyperemesis gravidarum:

The incidence of HG is only 0.3–1.5%. After preterm labor, hyperemesis gravidarum is the second most common reason for hospital admission during the first half of pregnancy.

- Parity (0 1.2times)
- multiple pregnancies (yes 2.4times)
- female fetus (1.3 times)
- pre-pregnancy underweight (BMI ¡ 18, 1.2 times)
- Hyperthyroid disorders (4.5 times),
- psychiatric illness (4.1 times),
- previous molar pregnancy (3.3 times),
- preexisting diabetes (2.6 times),
- gastrointestinal disorders (2.5 times),
- asthma (1.5 times)

References: [43, 44]

Antepartum haemorrhage

The main causes of ante-partum haemorrhage are placenta praevia (31%) and abruptio placenta (22%). The other causes (47%) include other bleeding complications such as marginal sinus bleeding 60% and heavy show 20%.

- Age (¿35 4 times)
- Previous c section (4.7 times)
- Previous abortion (2 times)
- Education (primary or below – 1.7 times)
- Family history of G6PD (1.9 times)
- Family history of down syndrome (1.9 times)

References: [45, 46]

Competing interests
The authors declare that they have no competing interests.

Author's contributions
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Figures

Figure 1 Sample figure title. A short description of the figure content should go here.

Figure 2 Sample figure title. Figure legend text.

Table 1 Sample table title. This is where the description of the table should go.

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A2	...	..	.
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Tables

Additional Files

Additional file 1 — Sample additional file title
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