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DOI: https://doi.org/10.3399/BJGPO.2022.0070

To access the most recent version of this article, please click the DOI URL in the line above.

Received 11 May 2022
Revised 28 August 2022
Accepted 20 September 2022

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Abstract

Background: Pregnancy and the postpartum period offer a unique opportunity to identify patients with, often unrecognized, risk factors leading to premature cardiovascular disease (CVD).

Aim: This study investigates self-reported prevalence of CV-related pregnancy complications and its documentation in Electronic Medical Records (EMRs) in an Academic Family Health Team.

Design & Setting: A retrospective cross-sectional survey conducted from 2016 to 2017 in an Academic Family Health Team.

Methods: The survey assessed self-reported pregnancy complications and obstetric history of adult women. EMRs of respondents who provided consent were appraised for documented pregnancy complications, and management of traditional cardiovascular risk factors post pregnancy.

Results: Out of the 211 respondents, 28.4% (n=60) had at least one pregnancy complication reported in the survey and/or in the EMR, of which 67.4% had the complication documented in their EMR. The most prevalent complications were preterm birth (12%), hypertensive disorders of pregnancy (HDP) (10%) and gestational diabetes mellitus (GDM) (7%). Twenty-nine percent of the patients with GDM had a 75g oral glucose tolerance test result documented post-pregnancy. Of those with HDP, 36% had a body mass index and 50% had a blood pressure measurement recorded after delivery.

Conclusion: There is a significant lack of documentation of pregnancy-related cardiovascular risk factors and subsequent management introducing a missed opportunity for early cardiovascular intervention. Adequate documentation of pregnancy complications in the EMR and better transitions in care between obstetric and primary care teams could potentially enable clinicians to intervene early and better manage women at increased risk of CVD.

Keywords: family practice, cardiovascular pregnancy complications, women's health, electronic health records, primary prevention, postpartum period

Abbreviations

AFHT- Academic Family Health Team
BMI - Body Mass Index
BP - Blood Pressure
CCS - Canadian Cardiovascular society
CPP - Cumulative Patient Profile
CVD - Cardiovascular Disease
EMR - Electronic Medical Records

GDM - Gestational Diabetes Mellitus
HDP - Hypertensive Disorders of Pregnancy
MPS - Maternal Placental Syndromes
IUGR -Intrauterine Growth Restriction
HELLP - Haemolysis, Elevated Liver Enzymes, Low Platelets
OCP - Obstetric Care Providers
OGTT - Oral Glucose Tolerance Test
PA - Placental Abruption
PCP - Primary Care Providers
PP - Placenta Previa
PTB - Preterm Birth
SOGC - Society of Obstetricians and Gynaecologists of Canada

How this fits in

There is robust evidence in the importance of capturing and follow-up on cardiovascular-related pregnancy complications. This study uniquely highlights the utility of electronic medical records in documenting CVD-related pregnancy complications, allowing for better clinical follow-up. This study also reveals the lack of information flow and communication across obstetrical and family health teams. The postpartum period provides a timely opportunity for family health teams to intervene and monitor maternal CV risk factors that could potentially lead to preterm cardiovascular disease; an opportunity that is easily missed in current practice.

Introduction

Cardiovascular disease (CVD) is the leading cause of death in women (1). Despite robust evidence highlighting the difference of CVD risk factors between sexes, its recognition in the clinical care of women has been slow or absent (2, 3). In particular, pregnancy-related factors, such as hypertensive disorders of pregnancy (HDP), gestational diabetes mellitus (GDM) and preterm birth (PTB) have all been established as independent risk factors associated with accelerated atherosclerosis and heart failure (4-6). The increased cardiometabolic demands of pregnancy may bring out early abnormalities that otherwise remain silent. With the recent inclusion of sex specific risk factors in Canadian clinical guidelines, clinicians are better equipped to integrate risk stratification, targeted screening, and follow-up management for sex-related CV risk factors into routine practice (7-13).

Many Canadian women regularly access the health care system during pregnancy and childbirth and are particularly focused on promoting their infant's health. Therefore, the pregnancy and the postpartum period provide a unique opportunity for primary care physicians (PCPs) to intervene (14). However, with less than 10% of births being attended by PCPs (15), they are often unaware of their patients' pregnancy history (16). A 2015 survey of 504 randomly selected sample of Canadian physicians also revealed substantial gaps in knowledge regarding the prevalence and identification of heart disease among women. One third of the physicians reported that more males than females die from CVD each year when the prevalence is roughly equal and only 39% of PCPs were aware that preeclampsia doubles the risk of CVD after pregnancy (17). It is evident that along with gaps in practice, there are substantial deficiencies in knowledge regarding female-specific risk factors for CVD.

To tackle both gaps in knowledge and practice, electronic medical records (EMRs) have become the primary tool for physicians to document, monitor and manage patients (18). With most PCPs having access to EMRs in Ontario (19), electronic tools can be used to prompt physicians to ask patients about their medical and obstetric history and to ensure appropriate screening and management of CV risk factors. According to the 2014 National Physician Survey, 65% of doctors said patient care became better after their implemented electronic records due to the ease and improved availability of lab results (20). EMRs have been seen to reduce the number of duplicate tests ordered, adverse drug events and time spent on administrative tasks, as well as improve both disease management and preventative care (21, 22). While these electronic systems are being implemented in Ontario, they are often unique to one practice with lack of integration across health care systems (23).

This study seeks to (a) determine the prevalence of self-reported pregnancy-related complications in patients of an Academic Family Health Team (AFHT), (b) assess the current state of EMR documentation of pregnancy complications, (c) and assess whether follow-up is conducted in patients with pregnancy-related cardiovascular risk factors in an AFHT.

Methods

This study consisted of (a) a retrospective survey completed by patients who identified as females and were rostered to the AFHT and (b) a review of participant EMRs for documentation and assessment of pregnancy-related CV risk factors.

Setting

This study was conducted in an AFHT, situated in a primarily affluent neighbourhood in Toronto, Canada. This AFHT consists of 13 family physicians with varying practices in family medicine obstetrics, and a large cohort of family medicine residents and nurses. Obstetrical care within the FHT is provided by family doctors and family medicine residents along with shared care with obstetricians if needed. Patients may have been cared for by obstetricians, midwives, or family physicians outside the FHT. Patients of the AFHT have access to a wide array of dedicated interprofessional health providers including diabetes teams, dietitians and nurse practitioners in addition to the specialist and diagnostic services of the hospital.

Participants

All female patients registered with the AFHT were initially contacted by letter and e-mail, if available. Each patient was given a unique identifier number at the initial point of contact to match the responses to their pregnancy data. The letter gave patients the option to complete an online survey or an enclosed paper survey returned in a prepaid envelope. Responses were collected from December 2016 to March 2017. Due to the availability of the population, a convenience sample was used. Participants were eligible if they identified as females, aged 18 to 50 years, and had been pregnant and delivered at least once in their lifetime.

Survey

Maternal recall of obstetrical history have been seen to be an accurate characterization of past pregnancy complications (24). For this study, a maternal recall questionnaire was designed to assess obstetrical and postpartum history. It included questions on socio-demographics, obstetric care providers (OCPs) (PCP, midwife, or obstetrician), obstetric history including pregnancy complications, past medical history, level of physical activity, and information on postpartum visit including whether the patient recalls having a conversation about their obstetric history with their physician. The survey is included in Supplementary Box S2.

EMRs of all participants who provided written consent in the survey were accessed and reviewed, regardless of whether they self-reported a pregnancy complication in the survey. Data were extracted using the automated search feature and manual extraction (specified in Supplementary Box S3). Specifically, the cumulative patient profile (CPP), consult notes in text and attached pdfs were searched within the EMR used by the family practice. To ensure comprehensive audit, the central hospital EMR was searched to obtain any missing data on the cardiometabolic profile and laboratory results. Pregnancy complications were considered as 'documented' if they were explicitly written in any aspect of the EMR. Each patient ID was multiplied by a random factor to generate de-identified IDs for analyses purposes. Principal investigator and statistician were both blinded to the patient key.

For the current study, GDM was defined by clinical criteria or "gestational diabetes" written in the patient's chart by a clinical provider. Preeclampsia was defined by new-onset hypertension (systolic blood pressure [SBP] ‡ 140mm Hg or diastolic blood pressure [DBP] ‡ 90mm Hg) and proteinuria (> 300 mg in 24 hours or a protein-to-creatinine ratio > 0.20) after 20 weeks gestational age. Preterm delivery was defined as delivery prior to 37 weeks gestational age. Postpartum follow-up data extracted from the EMR included 75g oral glucose tolerance test (OGTT) 6 weeks to 6 months postpartum and maternal blood pressure and body mass index measured 6 weeks to 6 months post-delivery.

Data Analysis

Descriptive statistics were calculated to describe the characteristics of the participants, prevalence of pregnancy complications in the sample, and follow-up data. Although much of the data for the purposes of this study's analysis was complete, any missing data was managed via pairwise deletion. Data were analysed using MS Excel and SAS version 9.4. All electronic survey responses are stored on the OceanStudies server (an encrypted database on a Canadian data server) and all paper surveys are stored securely at the hospital's research unit for up to 7 years.

Results

With 234 responses (response rate of 11%), 11 (5%) had never been pregnant, resulting in 223 (95%) eligible participants. Of these respondents, 211 (95%) provided consent to access their EMR (Figure 1).

Patient Characteristics

On average, respondents were middle-aged, affluent, White-Caucasian, married with a post-secondary qualification, and reported excellent health status, closely representing the profile of the community served by the AFHT (Supplementary Box S1). One hundred and thirty seven (66%) of the respondents recalled discussing their obstetric history with their family doctor of which 61 (45%) were cared for by their regular family doctor during their pregnancy.

Pregnancy Complications

Of the 211 participants who consented to chart review, 60 (28%) had at least one complication self-reported in the survey and/or documented in the EMR. Most of the respondents experienced more than one pregnancy complication (Figure 2). In summary, 40 (67%) of the respondents with a complication (n=60) had it recorded in their EMR, regardless of their response (Figure 3). The complications most documented in the EMR were PTB, HDP and GDM as illustrated in Figure 4.

The odds of documentation of pregnancy complications in patients cared for by their primary family doctor during pregnancy was not statistically significant (odds ratio [OR], 0.74; 95% confidence interval [CI], 0.23 –2.32).

Follow-up of risk factors

Only 29% of respondents who experienced GDM had a postpartum 75g OGTT recorded in their chart. Of those who experienced HDP during pregnancy, 36% had a body mass index (BMI) and 50% had a blood pressure (BP) measurement recorded in their EMR post-pregnancy (Table 1).

Discussion

Summary

This study offers initial insights into the lack of documentation of pregnancy complications in EMRs, revealing a missed opportunity to identify and manage women at increased risk of CVD. EMRs function as an efficient tool to facilitate documentation of medical histories, which is the first step in enabling clinicians to better manage patient outcomes. In a survey assessing PCP knowledge, attitudes, and practices regarding pregnancy complications, only 50% of family physicians reported collecting pregnancy history from their patients (25). Similarly, only 62% of the participants in our sample who self-reported a pregnancy complication in the survey had it recorded in their EMR. Improvement of documentation of pregnancy complications in the EMR has the potential to ensure greater physician awareness of patient history and bridge transitions in care (18, 26).

The lack of communication between OCPs and PCPs likely plays a major role in suboptimal documentation of these patients. MacDonald et al. reported that 83% of the maternity care providers in Ontario claimed they inform PCPs about the patient's pregnancy complication notably HDP, which is incongruous with the 58% of the PCPs who reported they were informed of the same. There is a clear discrepancy between what the PCPs believe they are told and what the OCPs believe they are informing (16). Lack of information flow is amplified due to the absence of standardized transfer of care protocols that include pregnancy complications, contrary to protocols in midwifery care, for example (27). As a result, PCPs often rely on their patient and/or OCP to relay pregnancy-related information, which may not be sustainable or efficient for patient care.

Due to opportunities for shared obstetric care in AFHT, several healthcare providers other than the PCP could be involved in a patient's intrapartum and postpartum care, which could potentially lead to increased gaps in communication and information flow. Several scenarios in shared care could lead to differences in documentation of pregnancy complications and communication. Patients may have been cared for by their primary FD with care transferred to an obstetrical provider prior to the complication occurring. Without detailed discharge summaries, documentation within the EMR or direct communication between the obstetrician and family physician, there are few possibilities to truly understand which of these scenarios each of the shared care patients falls under, thereby introducing numerous possibilities in the lack of documentation and follow-up (28).

Limitations

This study has several limitations, and in particular has implications on generalizability to other clinical and geographic settings. The participants in this sample were predominantly Caucasian, highly educated with adequate financial stability each month and had access to a Diabetes Education Centre, a Breastfeeding clinic, and an AFHT in a large tertiary care hospital. They likely had higher levels of health literacy and self-advocacy than the general public. Furthermore, 36% of them received obstetric care by their regular family doctor, facilitating ready access to information about complications. This is a higher rate than seen provincially or nationally (37). Even with in this high socioeconomic community with access to several tertiary care services, there was a notable gap in documentation of pregnancy complications and consequently follow-up. Thus, these findings could possibly be worse in settings with ethnic minorities and low socioeconomic strata. This inference further emphasizes the need to find solutions to bridge the lacunae in documentation and communication of pregnancy complications.

Maternal recall surveys have been shown to have high specificity and negative predictive value indicating that self-report of pregnancy complications experienced 3 to 6 years ago is likely to be accurate. Aspects of pregnancy such as birth weight, preterm delivery and preeclampsia have been seen to be accurately reported by women decades later (38). Despite that, there is still an element of recall bias since some of the pregnancies in this study dated back more than 10 years. There may also have been self-selection bias in completing the survey resulting in the low response rate and the small sample size. Although the prevalence of pregnancy complications in this study is mostly similar to national figures, a larger sample size would provide opportunity for regression analyses, where correlations between OCP and pregnancy complication follow-up could be further investigated.

Differences in EMR systems between the family practice and hospital departments is probably one of most notable limitations in ensuring adequate postpartum follow-up. In Canada, a patchwork of EMR systems has developed as a result of decentralized administration of health care from the federal government to individual provinces, and from the provinces to the local level. Due to lack of computer literacy, compatibility with other systems, time constraints and inadequate clinician involvement, the adoption of EMR across the nation has suffered (39). These barriers are seen at the provincial level as well (21). In Ontario, EMRs are most used in family practices, as is the case in the AFHT in this study (18). However, due to differences in software used between the family practice and the hospital, successful interdepartmental communication is inadequate resulting in missed opportunities of chronic disease prevention as evident in this study.

Comparison with existing literature

In this study, like national figures, there was a 7% and 10% overall prevalence of GDM and HDP respectively in all respondents. Gestational diabetes was reasonably well captured, which may be due to the early introduction of GDM management guidelines in 2008 and greater proportion of studies conducted on diabetes and GDM (29). Although GDM was well documented, postpartum 75g OGTT was suboptimal, despite access to comprehensive

programs in self-management of diabetes via Diabetes Education Centres (30), revealing a gap in practice.

HDP was not as well documented as GDM where only 50% of the participants had a BP documented within 6 months of delivery. HDP has only been established as an independent risk factor for CVD in the last decade (14, 31, 32). While the Society of Obstetricians and Gynaecologists (SOGC) has postpartum guidelines for monitoring patients with HDP, there is no guideline specific to primary care, which is where much of the postpartum CV risk management occurs (31, 32) . PCPs may lack awareness of SOGC guidelines possibly due to its specific target audience of obstetrical providers and gynaecologists (17). Since HDP was first recently added as a CV risk factor by the Canadian Cardiovascular Society (CCS) in 2016 and then by Hypertension Canada in 2018 (11, 12), the uptake of the clinical guidelines by PCPs will potentially be evident in the coming years.

Interestingly, the prevalence of PTB in this sample (12%) was higher than national figures (8%) (33). Upon further examination, one-third had a PTB pregnancy complicated by intrauterine growth restriction (IUGR), HDP, GDM, oligohydramnios etc.; all of which are established factors associated with PTB (34). Furthermore, of the respondents who experienced PTB due to factors other than HDP/GDM/IUGR, 41% were aged 35 years and older and were current/previous smokers which have been associated with an increased risk of PTB (35). Finally, the small sample number is likely playing an important role. Due to the heterogeneous factors associated with PTB (36), its prevalence may not accurately predict the isolated burden of the syndrome in our sample.

Implications for research and/or practice

Pregnancy offers a unique window to a woman's future health. The link between pregnancy complications and future CVD provides physicians with perhaps the earliest opportunity for disease prevention. PCPs deal with preventive medicine and motivational interviewing on a daily basis and hence, are well positioned to identify and counsel patients at increased risk of chronic disease. This study reinforced the need for a multifaceted approach to improve documentation and management of obstetric complications to improve future CV health. In addition to systemic changes that would facilitate or mandate sharing of information between care providers, there is a need for improved knowledge translation in primary care as well as tools to improve documentation and follow-up.

After this study, our team initiated several strategies to address some of these gaps. We developed patient education postcards that encouraged patients to share their pregnancy history with their family doctor. Additionally, a well-designed e-Module series on HDP is in development for family medicine residents as these topics receive scant attention within postgraduate curricula. Finally, our research team is leading an initiative to design and develop an EMR-based tool that facilitates information gathering, documentation, and management of pregnancy complications. Through multidisciplinary collaborations, we hope to enable women and their physicians to improve postpartum CV risk management and to achieve improved long term health goals.

Additional Information

Funding: This study was funded by the University of Toronto Practice-Based Research Network (UTOPIAN) Small Grant, Department of Family and Community Medicine, University of Toronto.

Ethical Approval: Ethics approval for the study was granted by the institution's Research Ethics Board.

Contributor's Statement: SB, DE and KF all contributed to the conception and design of the study. SB performed data acquisition, analysis and interpretation of data. SB and AP conducted data and statistical analyses. SB and DE drafted the article with input from all authors. All authors discussed the results, revised the article critically and finalized the manuscript.

Competing Interests: No conflicts of interest declared.

Acknowledgements: We would like to thank Dr Natasha Eardley for the initial conception, planning, and obtaining ethics approval required for this study; Ms. Heather Davidson for initial statistical analyses and interpretation of the data; and Ms. Samantha Woolven for her assistance in administering the survey during the first phase of the study.

Tables and Figures

Figure 1: Study participants flow chart

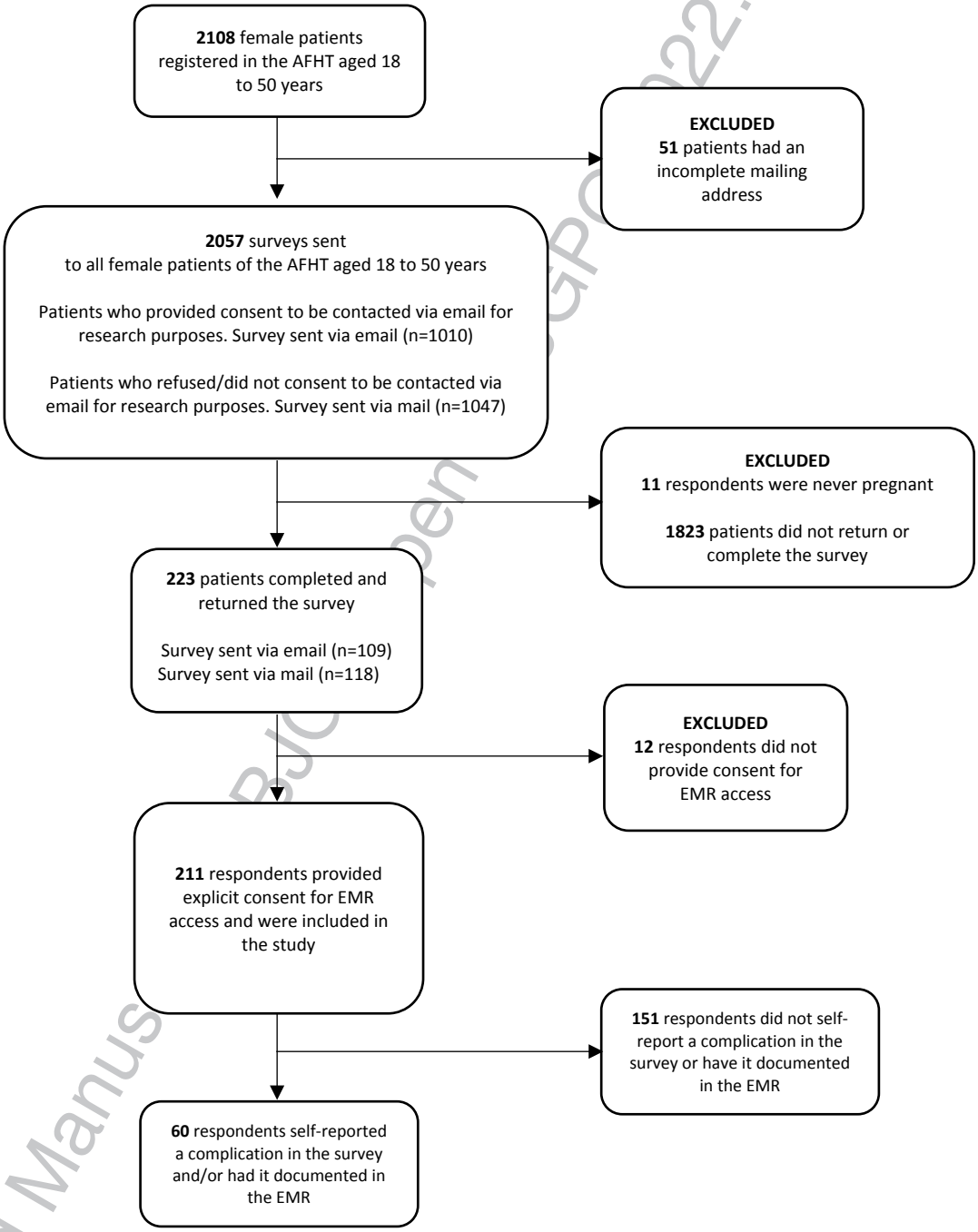
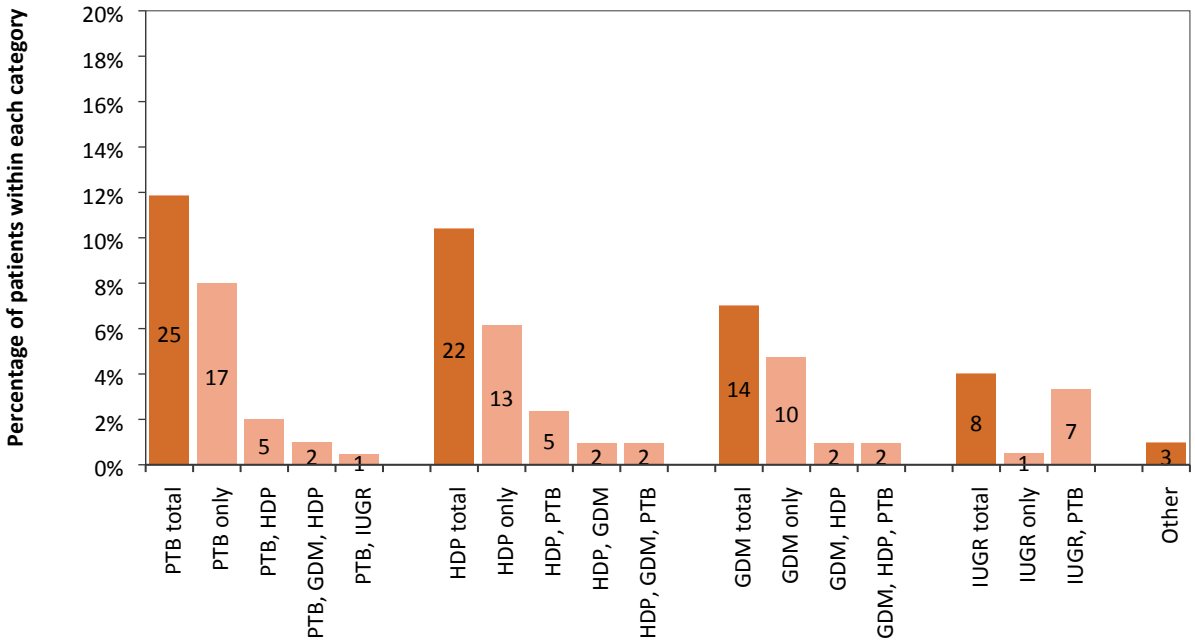


Figure 2: All pregnancy complications reported in survey and/or listed in the EMR of patients who consented to chart review (n=211). Number of patients specified as labels.



PTB – preterm birth, HDP – hypertensive disorders of pregnancy, GDM – gestational diabetes mellitus, IUGR – intrauterine growth restriction

Figure 3: Diagram indicating whether the pregnancy complication (PC) was reported in the survey and/or EMR of all respondents who had a pregnancy complication and consented to chart review (N=60).

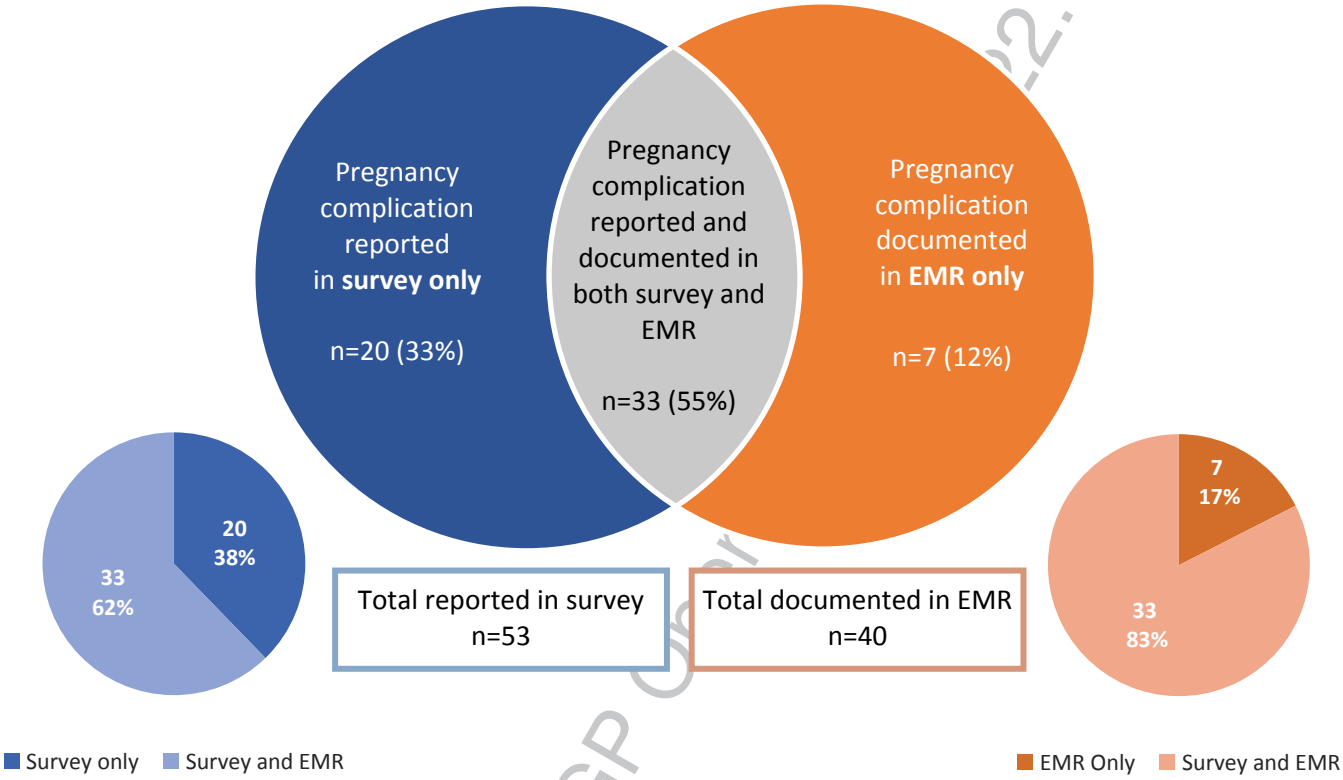
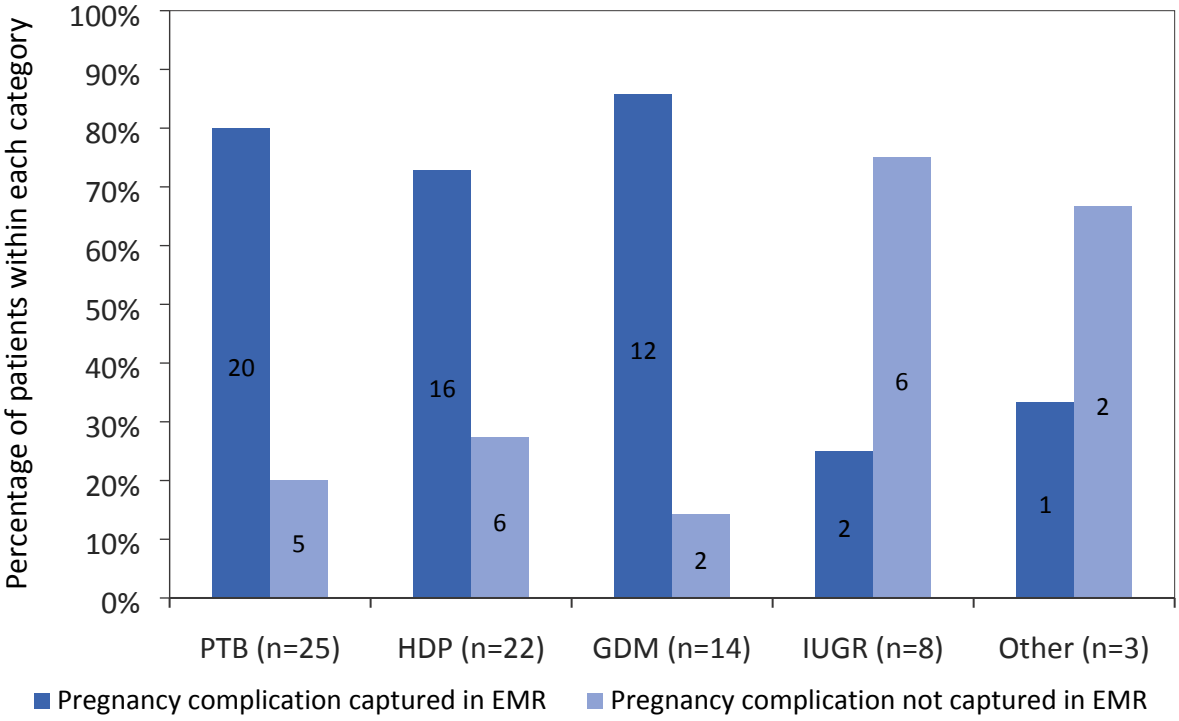


Figure 4: Documentation of pregnancy complications according to type of pregnancy complication.



PTB – Preterm birth, HDP – hypertensive disorders of pregnancy, GDM – gestational diabetes mellitus, IUGR – intrauterine growth restriction

Tables

Table 1: Post-pregnancy follow-up of essential risk factors documented in the EMR

Description	n (%) recorded in EMR Postpartum
GDM	14
75g OGTT result	4 (29%)
HDP	22
Blood Pressure measurement	11 (50%)
Recent systolic BP ≥130mmHg	6 (27%)
BMI	8 (36%)

EMR – electronic medical record, GDM – gestational diabetes mellitus, OGTT – oral glucose tolerance test, BP – blood pressure, BMI – body mass index

**Percentage is reported out of the number of respondents with the particular pregnancy complication*

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