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Completeness of Prenatal Records in Community Hospital Charts

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Abstract

We describe the completeness of prenatal data in maternal delivery records and the prevalence of selected medical conditions and complications among patients delivering at community hospitals around Atlanta, Georgia. Medical charts for 199 maternal-infant dyads (99 infants in normal newborn nurseries and 104 infants in newborn intensive care nurseries) were identified by medical records staff at 9 hospitals and abstracted on site. Ninety-eight percent of hospital charts included prenatal records, but over 20 percent were missing results for common laboratory tests and prenatal procedures. Forty-nine percent of women had a pre-existing medical condition, 64 percent had a prenatal complication, and 63 percent had a labor or delivery complication. Missing prenatal information limits the usefulness of these records for research and may result in unnecessary tests or procedures or inappropriate medical care.

Introduction

Giving birthing hospitals access to patients' prenatal records is essential to managing the care of delivering women and their neonates. For this reason, prenatal care providers send copies of a patient's prenatal records to the patient's expected delivery site before the expected delivery date. Although integrated, system-wide records make electronic prenatal records available to the birthing center in some medical systems; many prenatal records are standalone records that are transmitted to the birthing hospital when the patient is near term.

Several factors may affect the completeness of the prenatal records available in the hospital chart. Pregnant patients may be cared for by multiple obstetrical providers and by nonobstetrical providers who may not share information during the prenatal period or with the birthing hospital. Providers may send only those records that are expected to affect labor and delivery care but not routine laboratory tests or assessments with normal results. The patient may deliver before the records are sent or may deliver at a different facility than expected, resulting in limited records being available at the birthing hospital. After the patient has been discharged, researchers who are not associated with the medical facility often abstract data from the chart stored in medical records department, which may not contain all of the pieces of the prenatal chart that was received from the prenatal provider.

Studies that have examined the completeness of prenatal information in hospital charts have found them to be only moderately complete. A 2005 study of public and private hospitals examined the accuracy of reported perinatal conditions in the hospital charts and found that only 41 percent of the selected conditions had a sensitivity of 80 percent or more; neonatal conditions were more accurately reported than maternal conditions.[1] A 2006 study of records from three academic hospitals examined the reliability of documentation in the maternal medical chart of reported prenatal HIV testing and found that HIV status was documented in 55 percent of the charts and testing status was documented in 46 percent.[2]

Although the completeness of transmitted prenatal records is questionable, research studies often use them as sources for prenatal data; recent examples include studies of thyroid disease and adverse pregnancy outcomes,[3] eclampsia,[4] gestational weight gain,[5] and the association between maternal cigarette smoking and necrotizing enterocolitis in the newborn.[6] Many researchers are aware of the limitation of transmitted prenatal records, but accept them to avoid the difficulties and cost associated with abstracting records from multiple obstetric care providers. Researchers who have not previously used medical records data may have unrealistic expectations of the data quality, however, especially regarding data from electronic health records.

This study was conducted as a pilot of revised medical record abstraction forms for the National Children's Study.[7] The objective of the pilot was to evaluate the usability of the revised abstraction forms and the availability, completeness, and accuracy of the data collected using the forms. In this paper, we report on the completeness of prenatal information in the hospital charts and the prevalence of prenatal complications and pre-pregnancy medical conditions among a sample of patients that delivered at selected hospitals in or near Atlanta, Georgia.

Methods

Eleven hospitals around Atlanta, Georgia, were identified as potential study sites. Nine hospitals (DeKalb Medical Center; Newton Medical Center; Northside Hospitals Main, Cherokee, and Forsyth; Kennestone Hospital; Cobb General; Douglas General; and West Georgia Health) were selected based on their annual number of deliveries, the level of care available, the patient population served, our prior experience with their interest in participating in research, and the efficiency of their process for requesting and accessing medical records. Seven hospitals are in metropolitan Atlanta and two (Newton Medical Center and West Georgia Health) are in exurban communities within 2 hours of the Atlanta area. Table 1 shows the characteristics of the hospital birthing units.

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Table 1. Characteristics of selected abstraction sites

Name of facility	Annual births	Highest level of neonatal care[a]	Well-baby nursery dyads	Newborn intensive/ special care unit dyads
Northside Main	14,343	Newborn intensive care	5	17
Northside Forsyth	2,535	Newborn intensive care	4	16
Northside Cherokee	1,074	Special care nursery	10	10
Kennestone Hospital	5,488	Newborn intensive care	5	17
Cobb General Hospital	3,659	Newborn intensive care	5	15
Douglas General Hospital	476	Well-newborn nursery	30	0
DeKalb Medical Center	4,925	Newborn intensive care	5	15
West Georgia Health	991	Special care nursery	5	14
Newton Medical Center	665	Special care nursery	30	0

[a] As defined by the American Academy of Pediatrics.[8]

The study included deliveries that occurred between April 2012 and November 2013. The total target sample was 200 dyads: 100 dyads in which the infant was in the normal newborn nursery, and 100 dyads in which the infant was in an intermediate care nursery or neonatal intensive care unit (NICU). We did not have a list of deliveries, so medical record staff at the hospital chose the records for inclusion. The sample was not designed to be representative of all births in the region, as births at smaller hospitals and births where the infant was admitted to a NICU were deliberately overrepresented. Each facility was asked to randomly chose a targeted number of maternal–infant pairs in well-baby and NICU nurseries from deliveries within the study period (Table 1). The records were placed in a designated queue in the medical record reviewing system. Patient identifiers and demographic characteristics were not abstracted.

Each record was assigned a study identification code that was recorded on the abstraction form. The code and the patient's hospital-assigned medical record number were maintained on a log at the site to prevent duplicate or missed abstractions and enable 20 percent of records to be re-abstracted for quality assurance.

The abstraction form section on complications and medical conditions included checkboxes for none, missing, and could not obtain; a list of selected complications to be checked, if present; and a text field for unlisted complications. Abstracted data were entered into a Microsoft Access database.

We conducted descriptive analyses of counts and percentages. We compared findings from well-baby and NICU nursery admissions using z-tests for proportions. We did not attempt to identify other factors that might affect completeness, such as hospital or level of nursery available due to the small sample size and unrepresentativeness of the sample design. Data were analyzed using Microsoft Excel and Statistical Analysis Software (SAS), Version 10 of the SAS System for Windows.

Results

We abstracted records for 199 mothers and their 203 infants: 99 infants in normal newborn nurseries and 104 infants in NICUs. Four sampled births included twins. We could not obtain the medical record for one sampled mother.

Data Availability and Completeness

Two women did not receive prenatal care and one woman's chart was missing documentation of prenatal laboratory tests. For the remaining 196 women, the hospital chart included all major sections of the prenatal records. Because there is no standard form or order for the prenatal record, it was impossible to tell if individual pages or test results were missing. Data on prenatal complications were available for more than 90 percent of records (Table 2). Twenty-nine percent of abstractions explicitly noted the absence of complications, and 65 percent noted at least one listed complication. Information on preexisting conditions was available for 95 percent of women. Results of

Table 2. Record and data completeness

Prenatal			Labor and delivery		
	Complete			Complete	
Item	N	%	Item	N	%
Mother's date of birth	199	100	Membrane status	191	96.0
Date of first prenatal visit	165	83.0	Intact	152	76.8
Pre-pregnancy weight	141	71.0	Ruptured	39	19.7
Height	190	95.0	Type of labor	196	98.5
Amniocentesis or chorionic villi sampling	1	0.5	Spontaneous	86	43.2
Ultrasound 1	116	58.3	Augmented	26	13.1
Selected laboratory tests			No labor, scheduled C-section	41	20.6
Mother's blood type,	195	98.0	Induced delivery	92	46.2
Mother's blood type RH	195	98.0	Labor onset date	174	87.4
Initial antibody screen	184	92.5	Labor onset time	110	55.3
HIV	183	92.0	Mechanical dilation	61	30.7
Hemoglobin	180	90.4	Intrauterine pressure catheter	77	38.7
Hematocrit	180	90.4	Complete dilation date	137	68.8
Chlamydia	166	83.4	Complete dilation time	110	55.3
HI antibody titer (rubella)	165	82.9	Station at dilation		
Gonorrhea	162	81.4	+/–	87	43.7
One-hour glucose tolerance tests	131	65.8	Station number	79	39.7
Group B strep	138	69.3	Delivery date	198	99.5
Urine culture	132	66.3	Delivery time	90	45.2
Maternal blood antibody screen	130	65.3	Temperature before delivery	188	94.5
			Blood pressure	197	99.0
			Medications		
			None	0	0
			At least one	198	99.0
			Missing	0	0

many routine laboratory tests such as serology, Venereal Disease Research Laboratory (VDRL), and rapid plasma reagin (RPR) were missing in up to 40 percent of the records. HIV testing results were available for more than 80 percent of records. Results of an initial ultrasound were missing in 42 percent of the records.

Information on labor and delivery complications, medications received in the hospital, and hospital discharge information was generally available. Admission date and time, membrane status, type of labor, and delivery date and time were available more than 95 percent of the time. The labor and delivery chart for one emergency delivery was incomplete. Data on labor and delivery complications, temperature, and blood pressure were available for 95 percent or more of women (Table 2). Labor onset and progress data were less consistently available: labor onset date was present for 87.4 percent, and onset time was recorded for 55.3 percent of women. There were no significance differences in completeness between records for dyads whose infants were in the well-baby nursery and those who were in a higher level of care nursery (data not shown).

Medical conditions and complications were common at all time points; 49 percent of women had a pre-existing medical condition, 64 percent had a prenatal complication, and 63 percent had a labor and delivery complication (Table 3).

Preexisting conditions. In total, 98 (49 percent) women reported 104 pre-pregnancy medical conditions that could impact pregnancy outcomes

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or long-term maternal or infant health outcomes (Table 3). The most common conditions were obesity or morbid obesity (9.5 percent), hypertension (8.5 percent), asthma (6.5 percent), and depression (5.0 percent) (Table 3).

Prenatal complications. A total of 164 prenatal complications were documented for 128 (64 percent) women. As shown in Table 3, the most common prenatal complications were preeclampsia/ pregnancy-induced hypertension (15 percent), preterm labor (10 percent), anemia (10 percent),

Table 3. Pre-existing and pregnancy complications

Pre-existing			Prenatal			Labor and delivery		
Complication	**N**	**%**	**Complication**	**N**	**%**	**Complication**	**N**	**%**
None	91	45.7	None	58	29.2	None	65	32.7
At least one	98	49.2	At least one	128	64.3	At least one	126	63.3
Missing	10	5.0	Missing	13	6.5	Missing	8	4.0
Selected complications[a]			**Selected complications[a]**			**Selected complications[a]**		
Hypertension	20	8.5	Gestational diabetes	16	8.0	Hypotension	1	0.5
Diabetes	3	1.5	Placenta previa	11	5.5	Hypertension	12	6.0
Type 1	0	0.0	Preeclampsia/pregnancy-induced hypertension (PIH)	30	15.1	Preeclampsia/PIH	27	13.6
Type 2	3	1.0	Preterm labor	19	10.0	Eclampsia	2	1.0
Thyroid	10	3.0	Preterm labor with bed rest	4	2.0	Arrest of descent/labor	13	6.5
Sickle cell disease	0	0.0	Preterm labor with tocolysis	9	4.5	Nonreassuring fetal heart rate	32	16.1
Asthma	13	6.5	Significant vaginal bleeding—not previa	3	0.5	Uterine rupture	0	0.0
Heart valvular disease	5	1.0				Cord prolapse	1	0.5
Seizure disorder	3	1.5				Laceration/episiotomy	59	29.6
Inflammatory bowel disease (IBD)	1	0.5				Sepsis	0	0.0
Crohn's disease	0	0.0				Chorioamnionitis	8	4.0
Pyelonephritis	0	0.0				Abruption	11	5.5
Pelvic inflammatory disease (PID)	0	0.0						
Fibroids/ myomectomy	7	2.5						
Rheumatoid arthritis (RA)	0	0.0						
Lupus	1	0.5						
Cancer	1	0.5						
Cancer site specified	1	0.5						
Other reported complications[b]	79	39.7	Other reported complications[b]	104	52.3	Other reported complications[b]	28	14.0
Obesity	19	9.5	Anemia	19	9.6	Premature rupture of membranes	11	5.5
Depression	9	5.0	Infection	17	8.5	Nuchal cord	7	3.5
Other	59	25.2	Intrauterine growth retardation	15	7.5	Oligohydramnios	6	3.0
			Hyperemesis	8	4.0	Other	4	2.0
			Oligohydramnios	7	3.5			
			Thrombocytopenia	6	3.0			
			Other	32	16.2			

[a] Complications listed as option on form.

[b] Complications written in to other specify field.

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infection (9 percent), and intrauterine growth retardation (8 percent). Several complications among women whose infants were in the normal newborn nursery were lower than those whose infants were in NICUs: gestational diabetes (7.1 versus 8.7 percent), hypertensive disorders of pregnancy (5.1 versus 24.0 percent), and placenta previa (4.0 versus 6.7 percent). None of the differences were statistically significant ($P > 0.1$). Fifty-two percent of women had a prenatal complication that was not one of the listed conditions.

Labor and delivery complications. The most common complications were nonreassuring fetal heart rate (16 percent), preeclampsia (14 percent), arrest of descent/labor (7 percent), hypertension (6 percent), abruption (6 percent), and chorioamnionitis (4 percent) (Table 3). At least one complication not listed on the form was reported for 14 percent of deliveries. The most common of these complications were premature rupture of membranes (6 percent), nuchal cord (4 percent), and oligohydramnios (3 percent).

Discussion

Prenatal records were available in 98.5 percent of the sampled hospital charts, but the completeness of specific items varied greatly. Documentation of prenatal procedures and laboratory tests was much less complete. Laboratory test results and prenatal procedures were missing in more than 20 percent of the records, and the results of many routine laboratory tests were missing in up to 40 percent of the records. Data on medical conditions before pregnancy and complications during pregnancy were available for more than 90 percent of women. Medical conditions and complications were common at all time points; almost half of the sampled women had a pre-existing medical condition, and more than 60 percent had prenatal complication or a labor and delivery complication.

The proportion of sampled hospital charts with prenatal records available was equal to that found by Bernstein et al. (98 percent) after implementation of a computerized intranet-based prenatal data collection record.[9] Before implementation of the computerized method, only 84 percent of the hospital charts contained prenatal records. Yudin et al.[2] found 92 percent of hospital charts had prenatal records, but Shaw et al. found that only 26 percent of charts had prenatal records, which required repeating numerous prenatal laboratory tests to effectively manage intrapartum care.[10]

Date of first prenatal care visit was missing in 17 percent of records. Although this seems surprisingly frequent, it is consistent with the findings of Martin et al.,[11] who found that the components of this date were missing more frequently in medical records than birth certificate data. Medical records in one state was missing a component of date of first prenatal care visit in 11 to 22 percent of cases. Laboratory test results were missing much more often in our sample than in that of Bernstein et al., who found 16 percent of test results were missing in paper-based records and none were missing in computerized records.[9] In contrast, HIV testing results were available in over 80 percent of records in our study, compared with 55 percent in the study by Yudin et al.[2] Our findings concur with those of Taylor et al., who found that hospital data had an 80 percent or greater sensitivity rate for only 17 of 41 conditions reviewed.[1]

The prevalence in our cohort of pre-existing hypertension was high compared with that found by a large multisite study (8.5 versus 3.0 percent) and that of diabetes was low (1.5 versus 2.2 percent).[12,13] The prevalence of asthma (6.5 versus 6.6 percent) and heart valvular disease (1.0 versus 0.7 percent) were very similar.[12]

The prevalence of prenatal complications was higher in our cohort than in that of Timofeev et al.[12] for all three conditions reported in both studies: gestational diabetes (8.0 versus 5.3 percent); hypertensive disorders of pregnancy (15.1 versus 8.3 percent); and placenta previa (5.5 versus 0.7 percent). The increased prevalence of complications most likely represents an increased representation of high-risk pregnancies due to the stratification on type of nursery care level. The increased prevalence of hypertensive complications in our cohort may also be due to differences in patient population, case definition, case management, or the source and format of the prenatal records.

We counted any case in which hypertension or preeclampsia was documented in the medical chart rather than defining hypertension based on blood pressure.

Many studies of pregnancy complications and of record completeness are conducted in urban academic medical centers. This study reports on data completeness and the prevalence of complications among community hospitals. The strengths of the study are (1) the inclusion of hospitals with different intensity of nursery care levels and of both urban and rural locations, (2) the strong quality assurance protocol, and (3) the random selection of dyads within the facilities.

Limitations

The study also has several limitations. Although the sample design and size were adequate for the primary purpose of the study—the evaluation of the abstraction forms—the sample was underpowered to compare data completeness or complication rates among hospitals or patient subgroups. Also, the sample stratification on type of newborn nursery resulted in an overrepresentation of high-risk or complicated pregnancies.

Demographic and pregnancy history information was not collected, and we were unable to link to other data sources such as vital statistics data. Therefore, we could not compare the characteristics of our sample to the total population of births in the region or to other studies or compare completeness by race, ethnicity, parity, or other maternal factors. We would expect the sample to be racially and ethnically diverse and to overrepresent African-American women.

Because we did not review clinic or physician records, we were unable to determine whether the missing information was also missing in the clinic records or if only the records sent to the hospital were incomplete. The abstracted records were for patients who had been discharged, as is often true of cases being reviewed by external researchers. Hospital personnel accessing the records of active cases for treatment may had have access to additional information. We did not abstract data directly from prenatal care providers' records, so we are unable to determine whether the data on routine prenatal procedures or laboratory tests were missing because of a failure to do the procedures or document them in the prenatal chart or because of a failure to transmit the records to the hospital.

Although complete prenatal records are essential to providing quality intrapartum care, several factors influence the availability of these data. Although some health care facilities have implemented integrated data collection systems that include their providers, many providers continue to depend on their staff to duplicate or scan prenatal records and transmit them to the birth hospital. The human elements in this process can result in a failure to transmit a specific record or a failure to transmit all pages of the document. We observed poor quality duplication of the record and illegible documentation, which made the data in the chart not useable.

Prenatal records may also not be available at the birth hospital for women who deliver before the scheduled prenatal record transmission or who deliver in a different hospital than planned. Providers transmit records up to 4–5 weeks before the anticipated delivery date, which also limits hospital staff's access to information from the final weeks of the pregnancy, such as culture results, weight gain, and blood pressure. Bernstein et al.[9] found the last available prenatal visit documentation was 36 days before delivery for paper-based records and 4 days before delivery for electronic medical records (EMRs).

EMRs have the potential to improve care coordination, quality, safety, and efficiency in patient care and reduce health disparities. A study comparing charts before and after implementation of an EMR showed that adoption of an EMR was associated with an improved rate at which prenatal tests were ordered on time, present on the chart, and recorded on a prenatal flow sheet.[14] In 2014, researchers reviewed 460 paper prenatal admission charts for patients admitted to the labor and delivery unit.[15] Before implementing an electronic prenatal record system, 229 charts were reviewed, and 231 were reviewed after implementation. Of the pre-implementation charts, 78.2 percent contained maternal hepatitis B and HIV serology results and all post-implementation charts contained the results ($P < 0.001$).

Studies examining the benefits of EMRs are often based on systems that are completely electronic. We found that many prenatal records contained scanned copies of paper documents as well as data collected electronically. Although 78 percent of office-based physicians used EMRs as of 2013, 48 percent of office based physicians had a basic system.[16] The National Center for Health Statistics defines a basic EMR as a system that includes the following functionalities: patient history and demographics, patient problem lists, physician clinical notes, comprehensive list of patients' medications and allergies, computerized orders for prescriptions, and the ability to view laboratory and imaging results electronically.[16] Basic systems may lack the ability to share data share outside the office environment.[16] The electronic medical records found in the hospitals in this study had major limitations: data on routine prenatal and intrapartum care procedures and tests were frequently missing and the records had no standard organization, which resulted in lengthy searches to identify information and made obtaining a clear picture of the course of the pregnancy difficult.

Missing prenatal information limits the usefulness of hospital charts for research and, more crucially, may impede patient care and result in unnecessary tests or procedures or inappropriate medical care. Prenatal care providers and hospitals should work together to identify ways to improve the timely transmission of complete prenatal information from providers to hospitals.

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