GYNECOLOGY

A data extraction algorithm for assessment of contraceptive counseling and provision

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BACKGROUND: Contraception counseling and provision is an essential preventative service. Real-time assessment of these services is critical for quality improvement and comparative study. Direct observation is not feasible on a large scale, so indirect measures (such as chart review) have been determined to be acceptable tools for this assessment. Computer-aided chart review has significant benefits over manual chart review as far as greater efficiency and ease of repeated measurements. The wide use of electronic medical records provides an opportunity to create a data extraction algorithm for computer-aided chart review that is sharable among institutions. We provide a useful schema for others who use electronic medical record systems and are interested in real-time assessment of contraception counseling and provision for the purposes of baseline assessment of services and quality improvement.

OBJECTIVE: The purpose of this study was to create a comprehensive and accurate data extraction algorithm that is useful in the assessment of contraception counseling and provision rates in the outpatient setting.

STUDY DESIGN: We included all visits between August 2015 and May 2016 at 8 outpatient clinics that are affiliated with a large, urban academic medical center in which nonpregnant women who were 14—45 years old were seen by a nurse practitioner, physician's assistant, or physician. Contraception-related prescriptions, International Classification of Diseases codes, current procedural terminology codes, and search-term capture were extracted with the use of structured query language from electronic medical record data that were stored in a relational database. The algorithm's hierarchy was designed to query prescription data first, followed by International Classification of Diseases and current procedural terminology codes, and finally search-term capture. Visits were censored when the first positive evidence of contraceptive service was obtained. Search terms were selected based on group discussion of investigators and providers. This algorithm was then compared with manual chart review and refined 3 times until high sensitivity and specificity, when compared with manual chart review, were achieved.

RESULTS: There were 22,134 visits of reproductive-aged women who our inclusion criteria. Electronic medical record evidence of contraception counseling or provision was found in 56.9% of these visits. Of these, 21.3% were captured by prescriptions; 8.9% were captured by International Classification of Diseases codes, and 69.7% were captured by search-term capture with the use of our algorithm. Among visits with evidence of contraception counseling without provision, 15.7% were captured by diagnosis codes and 84.3% were captured by search-term capture. When compared with manual chart review, sensitivity and specificity improved from 0.79 and 0.85 to 0.99 and 0.98, respectively, over the 3 rounds of testing and revision.

CONCLUSION: Data extraction algorithms can be used effectively for computer-aided chart review of contraception counseling and provision measures, but testing and refinement are extremely important. Search-term capture from unstructured data is a critical component of a comprehensive algorithm, especially for the capture of instances of contraception counseling without provision. The algorithm that we developed here could be used by others with an electronic medical record system who are interested in real-time assessment, quality improvement, and comparative study of the delivery of contraceptive services. The ease of execution of this algorithm also allows for its repeated use for ongoing assessments over time.

Key words: contraception, electronic medical record, family planning, quality assessment

In 2011, the Institute of Medicine designated contraceptive counseling and provision an essential preventative service.[1] Further, the American College of Obstetricians and Gynecologists have recommended that all women have unhindered access to affordable Food and Drug Administration—approved contraceptives and have called for funding of research to identify effective strategies to increase access to contraception.[2] To date, however, we do not have a standard efficient way to measure rates of contraceptive counseling and provision.

Assessment of rates of service provision aids in guiding quality assessment and performance improvement efforts and allows for comparison studies among providers, clinics, and institutions. Services can be assessed via direct observation, but such assessment is complicated by patient confidentiality, logistics, and cost, which severely limit its feasibility on a large scale.[3,4] Chart review, clinician self-report, and patient report provide alternate, acceptable, albeit indirect measures of services, each with their own limitations.[3,5]

In the era of widespread adoption of electronic medical record (EMR) systems, computer-aided chart review has shown promise against manual chart review in providing targeted data output.[6] Computer-aided chart review has the significant advantage of much greater efficiency compared with the labor-intensive and time-consuming nature of manual chart review. Additionally, once developed, these computer-aided review measures can be repeated easily at intervals to facilitate ongoing data assessment without significant effort. Although EMRs provide large volumes of clinical data, problems remain regarding the accuracy and completeness of their data for secondary use.[7,8] In an analysis from

Cite this article as: Roser BJ, Rubin SE, Nagarajan N, et al. A data extraction algorithm for assessment of contraceptive counseling and provision. Am J Obstet Gynecol 2018;●●●:●●●●.

0002-9378/$36.00

https://doi.org/10.1016/j.ajog.2017.11.578

2012, more than one-half of 126 studies that used data from EMR systems for research had to be supplemented with other data sources to obtain satisfactory results.[9] The integration of multiple data sources to achieve satisfactory completeness can be cumbersome. Creating a robust algorithm to extract multiple data elements from a single data source is a useful, replicable alternative.

With any effort to assess completely and accurately the full spectrum of contraceptive services, attention must be paid both to instances of receipt of a prescribed or administered method and to instances of counseling or choice of nonprescription method (eg, condom) as well. Client-centered contraceptive counseling has been recognized as an important component of care that influences the subsequent use of contraception and has been proposed as a performance measure in family planning. Current National Quality Forum—endorsed contraceptive care measures rely on claims data or prescription codes to reflect rates of contraceptive provision.[10] This does not allow for evaluation of the counseling services that may have been provided but not coded in claims data. Assessment of counseling without provision is also critical in a primary care setting where there may be a referral model for contraceptive access. Comprehensive assessment of the spectrum of services to include counseling is valuable and demands a more complex approach.

We describe here the creation and refinement of a data extraction algorithm to assess rates of contraception counseling and provision in the outpatient primary care setting. In doing so, we provide a useful schema for others who use EMR systems and who are interested in real-time assessment of contraception counseling and provision for the baseline assessment of services and quality improvement.

FIGURE 1
Extraction criteria

Contraceptive Service	Epic Pharmacy Codes	ICD9 Codes	ICD10 Codes	CPT Codes	Text
Sterilization		V25.09, V25.2	Z30.09, Z30.2	58565 58600 58615 58670 58671	"Sterilization" "Tubal ligation" "BTL"
Intrauterine Device	Class C 482	V25.11, V25.42, V25.13, V25.12	Z30.014, Z30.430, Z30.431, Z30.433, Z30.432	58300 58301 76856	"Paragard" "Mirena" "Skyla"
Implant	Class C 463	V25.02, V25.5, V25.43	Z30.019, Z30.019, Z30.40	11976 11981 11982 11983	"Nexplanon" "Implanon"
Injection	Class C 472	V25.9, V25.40	Z30.013, Z30.42		
Patch	Class C 875	V25.9, V25.40	Z30.019, Z30.40		
Ring	Class C 883	V25.9, V25.40	Z30.019, Z30.40		"Nuvaring"
Oral Contraceptive Pills	Class C 110	V25.01, V25.41	Z30.011, Z30.41		
Emergency Contraception	Sub-Class C 111, 112, 1183, 2441, 2442	V25.03	Z30.012		
Condoms		V25.04	Z30.02		"Condom*"
Counseling/ Surveillance		V25.09	Z30.09	99384FP 99385FP 99386FP 99394FP 99395FP 99396FP 99403FP 99211FP	"Pregnancy prevention" "Abstinence" "Birth Control" "Contracept*" ***And all method text terms without evidence of provision .***

Specific components of data sources comprising data extraction algorithm.
BTL, bilateral tubal ligation.
Roser et al. Contraception assessment with a data extraction algorithm. Am J Obstet Gynecol 2018.

Materials and Methods

As a member of the New York City Department of Health's Quality Improvement Network for Contraceptive Access, we sought to assess rates of contraceptive counseling and provision at 8 urban, outpatient family medicine, general obstetrics and gynecology, and family planning sites that are affiliated with 1 urban academic medical center.

We included all nonprenatal care visits between August 2015 and May 2016 in which women, aged 14-45 years, were seen by a nurse practitioner, physician's assistant, or physician at any of the 8 sites. Pregnancy visits were excluded to focus on visits in which contraception provision was possible. We also excluded visits in which patients were seen exclusively by a nurse, medical assistant, nutritionist, psychiatrist or psychologist, social worker, health educator, or other nonclinical staff. Each visit within the given time period was treated as an individual sampling unit. Therefore, a single patient with multiple visits may have contributed multiple data points. This approach was believed to better discriminate provision differences over shorter time periods.

Using contraception-related prescriptions classified by Epic EMR