

# Using Electronic Prescribing Transaction Data to Estimate Electronic Health Record Adoption

Emily Ruth Maxson, BS; Melinda J. Beeuwkes Buntin, PhD; and Farzad Mostashari, MD, ScM

**Objective:** To determine whether electronic prescribing transaction data can be used to accurately and efficiently track national and regional electronic health record (EHR) adoption in order to evaluate progress toward national goals and identify and address regional disparities.

**Study Design:** This study compared national EHR use estimates derived from Surescripts electronic prescribing data for 2007 and 2008 with contemporary National Ambulatory Medical Care Survey (NAMCS) estimates.

**Methods:** The ratio of relative risks was adapted to test the statistical significance of the difference in the differences between Surescripts and NAMCS estimates in 2007 and 2008.

**Results:** In 2007, the relative ratio (RR) of NAMCS to Surescripts data was 3.73 (95% confidence interval [CI] = 3.27, 4.26). In 2008, the RR was 2.06 (95% CI = 1.75, 2.42). The ratio of RRs for 2007 compared with 2008 was 1.81 ( $P < .0001$ ), suggesting that Surescripts transactional data for providers prescribing through an EHR is becoming better aligned with accepted measures of EHR adoption in the United States with time. Surescripts-derived state estimates for EHR use ranged from less than 8% (North Dakota, New Jersey, New Mexico) to more than 37% (Minnesota, Wisconsin, Massachusetts, Iowa).

**Conclusions:** Surescripts transactional data may allow for the ongoing identification of regional trends and assist policy makers in identifying and mitigating emerging disparities in EHR adoption. Further analysis is needed to ensure that Surescripts data continue to correlate with NAMCS results for 2009-2010.

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Using an electronic health record system (EHR) can improve care coordination, care delivery, and patient health outcomes.<sup>1-3</sup> Although the potential benefits for patient care are well documented,<sup>1-3</sup> rates of EHR adoption and successful integration into clinical practice in the United States remain low.<sup>4,5</sup> A 2007 survey of 2758 physicians estimated that only 4% of physicians reported having an extensive EHR system, and 13% reported having a basic system.<sup>6</sup> Annual estimates from the National Ambulatory Medical Care Survey (NAMCS) show a trend from similar results in 2007 to greater penetration in 2008, with 6% using a fully functional EHR system and 20.5% using at least a basic system.<sup>7</sup>

The low rates of EHR use in this country likely reflect the difficulties of adopting and integrating technology into clinical practice. Providers face substantial financial, technical, and organizational barriers to achieving health information technology (HIT) goals.<sup>6</sup> The Health Information Technology for Economic and Clinical Health (HITECH) Act, a subset of the 2009 American Recovery and Reinvestment Act, represents an unprecedented financial and organizational commitment to the advancement of the HIT agenda, including the provision of funding for the creation of 60 regional extension centers to help spur adoption locally across the nation and an approximately \$19 billion incentive program to encourage “meaningful use” of certified EHR systems.<sup>8</sup>

The term “meaningful use” was coined by Congress to embody the use of health information and exchange to effectively inform clinical decision making at the point of care, reflecting the belief that providers must do more with their system than electronically document patient encounters and transmit billing information if they are to realize the potential of the systems. The requirements within meaningful use, determined by Centers for Medicare & Medicaid Services, form the basis for the incentive program outlined in the HITECH legislation.<sup>9</sup> Electronic prescribing, or the certified electronic submission and transfer of a patient’s prescription directly from the healthcare provider’s interface to the pharmacy’s system, is specifically highlighted in the legislation and will be a core requirement for a physician to achieve meaningful use.

Through the provision of financial incentives and individualized, practice-level technical assistance by the regional extension centers, the Office of the National Coordinator for Health Information Technology (ONC) aims to help physicians and staff members become meaningful users of ambulatory EHRs by 2012. In order to evaluate the

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efficacy of the regional extension centers and track the nation's progress, ONC must establish an accurate baseline of EHR adoption in this country and a national method of monitoring adoption. The ideal monitoring system would provide real-time, objective estimates with regional granularity.

NAMCS, which is conducted yearly by the Centers for Disease Control and Prevention's National Center for Health Statistics, is the most robust analysis of national adoption to date, but survey collection is annual and therefore impractical for use as a real-time monitoring system. In addition, current surveys are not designed to allow estimates for small geographic areas, making it difficult to understand progress at a local level.

A particularly promising alternative would be to use transactional data from EHRs to monitor national and regional EHR adoption. One such source is readily available electronic prescribing data from Surescripts. The Surescripts network processes 95% of all electronic prescriptions and enables electronic transmission of prescription benefit information and prescription history.<sup>10</sup> The 5% of electronic prescriptions not routed through Surescripts consist of those sent through servers with smaller market share, closed systems such as Kaiser Permanente, and Veterans Health Administration facilities.

This research compared Surescripts data from December 2007 and 2008 with 2008 and 2009 NAMCS results to test (1) whether Surescripts transactional data for electronic prescriptions sent through an EHR system can be used as a proxy for EHR adoption among US ambulatory care providers and (2) whether these data are more closely approximating traditional measures of EHR adoption with time.

## DATA AND METHODS

### Data Sources

Surescripts operates a certification program that ensures that the HIT systems of their network's prescribers meet certain privacy and security requirements; as of 2009, 30 stand-alone electronic prescribing systems and 104 EHR systems were certified to route prescriptions electronically.<sup>10</sup> Surescripts has the capability to distinguish between providers who have submitted their prescriptions through certified stand-alone systems used exclusively for electronic prescribing and those who have submitted their prescriptions through certified EHR systems.

The number of unique prescribers using a stand-alone electronic prescribing tool and the number of unique prescribers

### Take-Away Points

A monitoring system for national and regional electronic health record (EHR) adoption is needed to evaluate progress toward the nation's health information technology goals.

- Prior national estimates relied on survey administration, an expensive and lengthy process; no reliable, published regional estimates are available.
- Transactional data from the Surescripts electronic prescribing network may be used to estimate national and regional EHR adoption.
- Surescripts transactional data may allow for the ongoing identification of regional trends and assist policy makers in identifying and mitigating emerging disparities in EHR adoption.

obtained from Surescripts for 2007 and 2008. Our numerator included only those prescribing through an EHR.

The Surescripts denominator included office-based providers with prescribing privileges (excluding anesthesiologists, radiologists, emergency medicine physicians, and pathologists). These figures—503,000 office-based physicians, 60,000 office-based nurse practitioners, and 41,000 office-based physician assistants—all are estimates that were provided to Surescripts by the American Medical Association, the American Academy of Nurse Practitioners, and the American Academy of Physician Assistants.<sup>10</sup>

Specific data elements from the NAMCS database were requested for comparison. In order to more closely match the basic use parameters captured by Surescripts transactional data, we obtained data for the subset of the NAMCS population who had responded that they were (1) using at least a "basic" EHR system (including, at minimum, the capability to enter patient demographics, problem lists, clinical notes, and orders for prescriptions, and the ability to view laboratory and imaging results) and (2) sending prescriptions electronically. This cohort also came from a sample of ambulatory physicians. Physician assistants, nurse practitioners, anesthesiologists, radiologists, emergency medicine physicians, and pathologists were not among the population surveyed using the NAMCS HIT supplement. Federal and hospital-affiliated outpatient clinic physicians also were excluded.<sup>11</sup> NAMCS estimated the total number of physicians after the exclusion of these groups to be 324,074 for 2008 and 373,781 for 2009.

Though the NAMCS in-person survey administration ranges from the previous December to the December of the stated year, the mail supplement is administered from April to August of each year. The 2008 NAMCS data were paired with the December 2007 Surescripts data (referred to in aggregate as 2007), and the 2009 NAMCS data were paired with the December 2008 Surescripts data (referred to in aggregate as 2008) to more closely approximate the onset of the mail survey data collection. The NAMCS sample from 2008 represents individuals surveyed via a national probability sample survey, including the mail supplement, whereas the prelimi-

■ **Table 1.** Characterization of Data Sources and Electronic Health Record Adoption Estimates

Characteristic	National Ambulatory Medical Care Survey	Surescripts
Date of collection	In person: calendar years 2008 and 2009 Mail supplement: April-August 2008 and 2009	December 2007 and 2008
Type of data	Survey	Transactional
Estimate source	Sample of ambulatory physician population	Census of 95% of the electronic prescribing population
Providers included	Office-based MDs and DOs	Office-based, actively electronically prescribing MDs, DOs, NPs, and PAs
Physicians excluded	Federal providers, hospital-affiliated outpatient physicians, anesthesiologists, radiologists, emergency medicine physicians, and pathologists	Anesthesiologists, radiologists, emergency medicine physicians, and pathologists
Office-based providers responding to survey	2008: 2233 physicians 2009: 1054 physicians	NA
Total estimated office-based providers in population	2008: 324,074 physicians 2009: 373,781 physicians	604,000 providers (503,000 physicians, 60,000 NPs, 41,000 PAs)
Level of EHR use captured	Basic + electronic prescribing	Electronic prescribing through an EHR system
Providers in sample who sent electronic prescriptions and used EHR	2008: 265 physicians 2009: 176 physicians	December 2007: 19,440 providers December 2008: 46,620 providers
EHR adoption estimate, by percentage of population	2008: 12.0% (weighted) 2009: 15.8% (weighted)	December 2007: 3.2% December 2008: 7.7%

DO indicates doctor of osteopathy; EHR, electronic health record; NA, not applicable; NP, nurse practitioner; PA, physician assistant.

nary NAMCS estimates for 2009 were derived from the mail supplement only. **Table 1** characterizes the Surescripts and NAMCS data sets, and details the general populations and the samples that were included for analysis in this study.

**Analysis**

In order to answer the question posed, namely, whether Surescripts transactional data are becoming a better proxy for EHR adoption over time when compared with NAMCS data, we adapted the ratio of relative risks test as described by Altman and Bland to test the statistical significance of the difference in the differences between Surescripts and NAMCS estimates in 2007 and 2008.<sup>12-14</sup> For these calculations, NAMCS data were adjusted for a design effect of 1.27 (the effective sample size was smaller than the number of physicians actually surveyed).

**RESULTS**

**Electronic Health Record Estimates for 2007**

According to the weighted NAMCS data for 2008, 38,888 out of 324,074 ambulatory physicians used at least a basic

EHR system and sent their prescriptions to the pharmacies electronically, yielding a national estimate of 12.0%. According to the Surescripts transactional data, 19,440 ambulatory physicians, nurse practitioners, and physician assistants out of the total estimated 604,000 ambulatory care providers sent electronic prescriptions through an EHR system, or 3.2% among this larger group of providers.

**Electronic Health Record Estimates for 2008**

The weighted NAMCS preliminary data for 2009 estimated that 59,057 out of 373,781 ambulatory physicians used at least a basic EHR system and sent their prescriptions to the pharmacies electronically, yielding a national estimate of 15.8% for 2008. The Surescripts transactional data for 2008 showed that 46,620 ambulatory physicians, nurse practitioners, and physician assistants sent electronic prescriptions through an EHR system out of the estimated 604,000 ambulatory care provider population, for an EHR use estimate of 7.7% (**Table 2B**).

**Comparison of 2007 With 2008**

The trends in the NAMCS and Surescripts estimates for 2007 and 2008 are graphically depicted in **Figure 1**, along with the Surescripts estimate for 2009 (18.1%).

## Using Electronic Prescribing Transaction Data

**Table 2A.** 2007 Contingency Table for Relative Ratio Calculations, Adjusted for Design Effect of 1.27

2007 <sup>a</sup>	NAMCS (A + C = 1630)	SURESCRIPTS (B + D = 604,000)
Prescribing through EHR (A + B)	A: 196	B: 19,440
Not prescribing through EHR (C + D)	C: 1434	D: 584,560
EHR indicates electronic health record; NAMCS, National Ambulatory Medical Care Survey. <sup>a</sup> Relative ratio = 3.73 (95% confidence interval = 3.27, 4.26).		

**Table 2B.** 2008 Contingency Table for Relative Ratio Calculations, Adjusted for Design Effect of 1.27

2008 <sup>a</sup>	NAMCS (A + C = 769)	SURESCRIPTS (B + D = 604,000)
Prescribing through EHR (A + B)	A: 122	B: 46,620
Not prescribing through EHR (C + D)	C: 647	D: 557,380
EHR indicates electronic health record; NAMCS, National Ambulatory Medical Care Survey. <sup>a</sup> Relative ratio = 2.06 (95% confidence interval = 1.75, 2.42)		

In 2007, the relative ratio (RR) of NAMCS to Surescripts data, adjusted for the NAMCS design effect, was 3.73 (95% confidence interval [CI] = 3.27, 4.26) (Table 2A). In 2008, the RR was 2.06 (95% CI = 1.75, 2.42) (Table 2B).

The ratio of RRs for 2007 compared with 2008 was 1.81. The test of interaction yielded a  $\chi$  score of 5.56 ( $P < .0001$ ). This statistically significant value suggests a convergence of Surescripts estimates with NAMCS estimates from 2007 to 2008.

### Electronic Health Record Adoption by State

Figure 2 shows a state-level analysis of the number of unique physicians who submitted their prescriptions via EHR systems versus the total number of office-based physicians in each state. It provides an example of the level of detail possible with Surescripts data. The numerator represents 83.7% of providers in the state who prescribe through the Surescripts network using an EHR (Surescripts adjustment to account for physicians only). The denominator represents office-based physicians in each state. If this data source could be successfully validated as an accurate proxy of EHR adoption, it could be used to develop a solution to the ongoing challenge of efficiently monitoring EHR adoption trends in this country—with geographic granularity. A real-time surveillance system driven by Surescripts transactional data may allow for the ongoing identification of regional trends and assist policy makers in identifying and mitigating emerging disparities in EHR adoption. This would be especially timely given the nation's financial investment in programs to spur EHR adoption.

Our results support the hypothesis that, with time, Surescripts transactional data better approximate traditional EHR adoption estimates.

### LIMITATIONS

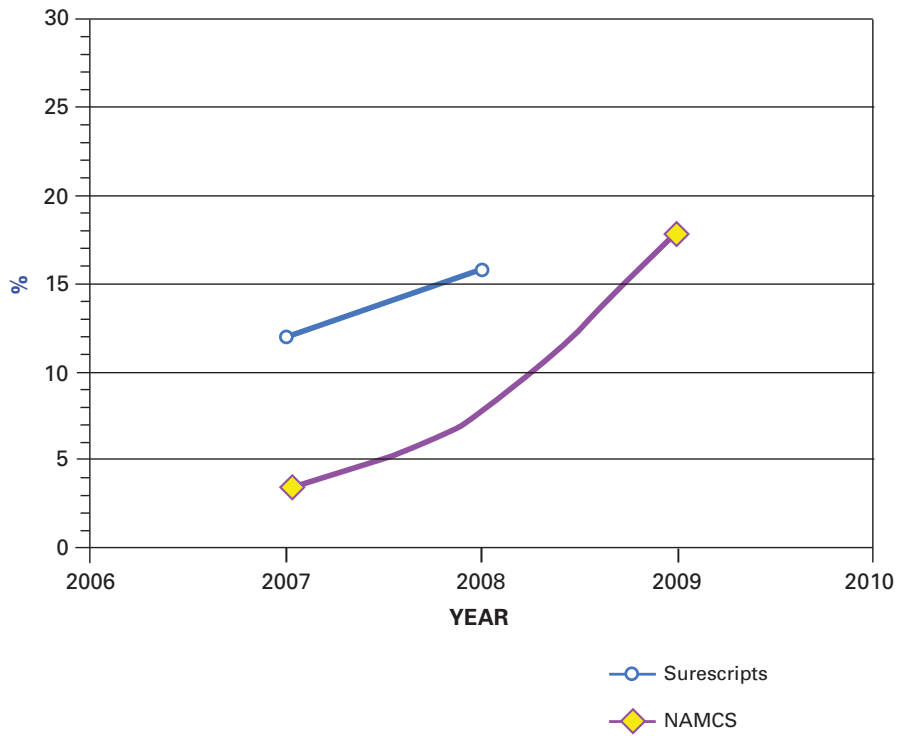
Several limitations of this study merit further discussion. The major limitation that potentially affects the results is

that the populations analyzed in NAMCS differed from those represented by the Surescripts data. Individuals surveyed by the NAMCS study included only active, nonfederal ambulatory care physicians; nurse practitioners, physician assistants, hospital-affiliated outpatient physicians, and non-ambulatory care physicians (radiologists, anesthesiologists, emergency medicine physicians, and pathologists) were excluded. Although the Surescripts transactional data excluded the same categories of non-ambulatory care physicians as NAMCS, its population included nurse practitioners and physician assistants in addition to ambulatory care physicians. Unfortunately, we did not have access to relative rates of electronic prescribing among provider groups. If nurse practitioners and physician assistants used EHRs proportionally more or less than their physician counterparts, the Surescripts data could have overestimated or underestimated EHR adoption among physicians and biased the ratio of RR calculation in either direction.

Another notable limitation was that the statistical analysis was executed evaluating 2 different types of populations. The NAMCS data reflect the responses of a survey sample used to make generalizations about the population from which they were selected. The Surescripts data were real-time, transactional data for every active electronic prescriber on the Surescripts network. The EHR estimates from the Surescripts data therefore reflect a census rather than an estimate; Surescripts knows exactly how many individuals prescribe electronically from the practices they serve, and from what type of system.

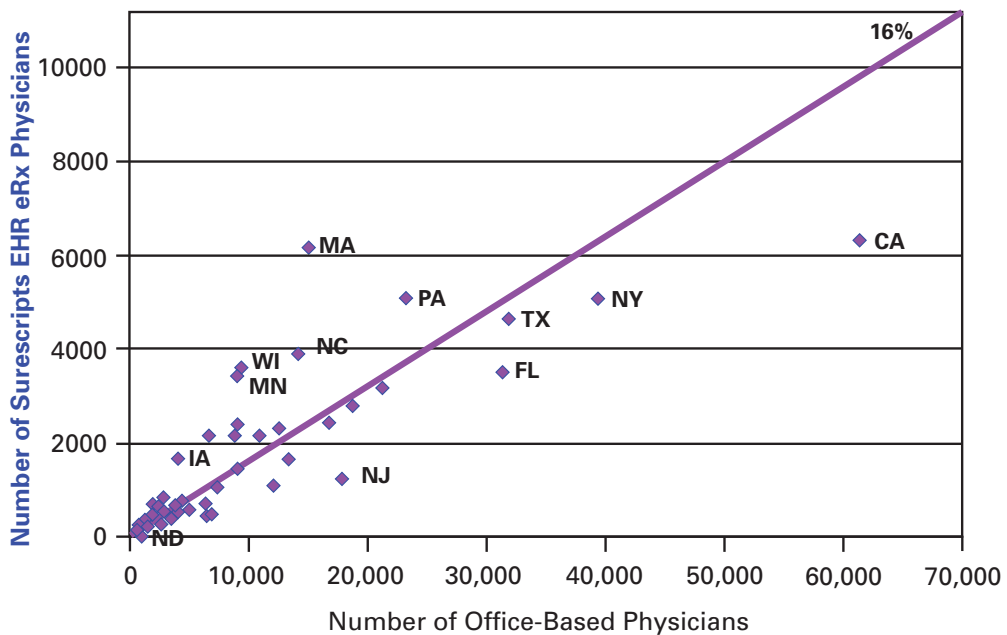
Additional limitations are summarized in Figure 3, as well as the direction of bias they could contribute. The majority of the limitations in the Surescripts transactional data trend toward underestimation, and the majority of the limitations in NAMCS data source trend toward overestimation. The net effect of these limitations is therefore to promote convergence, strengthening rather than detracting from the results of this study and supporting the viability of Surescripts transactional data as a proxy for EHR adoption.

■ **Figure 1.** Estimates of Nationwide Adoption of Electronic Health Records



NAMCS indicates National Ambulatory Medical Care Survey.

■ **Figure 2.** Comparison of Office-Based Physicians and 2009 Physicians Prescribing Through Surescripts Network by Electronic Health Record by State<sup>a</sup>



EHR indicates electronic health record.

<sup>a</sup>Data source: *Physician Characteristics and Distribution in the U.S., 2008*.<sup>15</sup> State data represent 2007 office-based physicians and exclude anesthesiologists, diagnostic radiologists, emergency medicine physicians, pathologists, and radiologists.

■ **Figure 3.** Limitations of Data Sources and Their Implications

	<b>Surescripts Factors</b>	<b>NAMCS Factors</b>
<b>Lend to Overestimation</b>	<ul style="list-style-type: none"> <li>• Inclusion of providers who prescribe electronically through an EHR system but do not use any other functionalities</li> </ul>	<ul style="list-style-type: none"> <li>• Socially desirable response bias may lead to misclassification of physicians who do not actually use EHRs</li> <li>• Survey responses: Misunderstanding of true definition of EHR and/or electronic prescribing</li> </ul>
<b>Lend to Underestimation</b>	<ul style="list-style-type: none"> <li>• Denominator includes providers in federal settings and closed systems (high proportion of EHR users) but numerator does not include them</li> <li>• Exclusion of 5% of electronic prescribing</li> <li>• Exclusion of providers who use EHRs but electronically prescribe through a separate, stand-alone tool</li> </ul>	<ul style="list-style-type: none"> <li>• Failure to include populations with high proportion of EHR users (federal providers, hospital outpatient affiliated providers)</li> </ul>

EHR indicates electronic health record; NAMCS, National Ambulatory Medical Care Survey.

## DISCUSSION

Our results indicate that the Surescripts estimate was more similar to the NAMCS estimate in 2008 than in 2007, suggesting a convergence.

One potential explanation for this convergence is that physicians' understanding of EHRs is increasing over time, thus reducing the number of physicians in the 2009 NAMCS who incorrectly responded that they were EHR users. Also decreasing with time should be the tendency of Surescripts to underestimate the true rate of EHR adoption due to its exclusion of groups with traditionally high adoption (providers in federal settings and closed systems). As the overall proportion of other EHR adopters increases, the contributions of federal and closed system providers becomes less significant.

A shift in the predominant model of healthcare delivery could introduce the opposite bias. Healthcare systems functioning as accountable care organizations and integrated delivery networks may prefer closed systems of electronic prescribing, excluding their providers from the Surescripts database. If a greater proportion of physicians begin to prescribe in

closed systems, the overall penetrance of Surescripts could decrease to below 95%, decreasing the proxy's accuracy. That also would be the case if other companies that provide similar services were to gain a greater proportion of the market.

This proxy may be most useful in the immediate future, as the HIT movement gains momentum and physicians across the country continue to transition from paper to electronic systems. After the majority of US physicians have adopted the EHRs, measuring the proportion of meaningful users will be more relevant than measuring adoption. The Surescripts proxy provides insight into one key meaningful use objective: electronic prescribing. Eventually, we may be able to track meaningful use more comprehensively as physicians and hospitals provide attestation and reports for meaningful use incentive payments.

At present, the analysis is limited by the availability of only 2 years of corresponding data. The 2010 NAMCS report that we would use to garner information about EHR use in 2009 is not yet avail-

able. We will need to repeat the analysis once these results become available to ensure that Surescripts and NAMCS estimates continue to converge with time. If this is true, Surescripts transactional data might be used to establish a real-time monitoring system for national levels of EHR adoption. That would assist ONC in evaluating the success of its HIT programs on a national level. However, more research is needed to affirm the validity of Surescripts transactional data as a proxy for regional progress.

Ongoing work will validate whether monthly e-prescribing data aggregated at a local level may be used to track trends in EHR adoption by region. Current estimates of electronic prescribing through EHR systems vary by state, from less than 8% in North Dakota, New Jersey, and New Mexico to more than 37% in Minnesota, Wisconsin, Massachusetts, and Iowa. Though Surescripts processes 95% of all electronic prescriptions nationally, regional discrepancies in Surescripts penetrance may cause EHR adoption to look artificially higher or lower in a given region. This issue remains a notable challenge and merits further investigation. We currently do not have a metric against which to test the regional data. However, as the 60 regional extension centers are deployed throughout the United States and

gradually become regional experts on HIT adoption, we may be able to look to these organizations for updated regional estimates against which to test the Surescripts transactional data.

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**Author Affiliations:** From Duke University School of Medicine (ERM), Durham, NC; Office of the National Coordinator (MJBB, FM), US Department of Health and Human Services, Washington, DC; and RAND Corp (FM), Washington, DC.

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**Address correspondence to:** Emily R. Maxson, BS, Duke University School of Medicine, 407 N Gregson St, Apt 3, Durham, NC 27701. E-mail: erm@duke.edu.

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