

With "Big Data" Comes Big Responsibility: Outreach to North Carolina Medicaid Patients With 10 or More Computed Tomography Scans in 12 Months

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BACKGROUND Patients are being exposed to increasing levels of ionizing radiation, much of it from computed tomography (CT) scans.

METHODS Adults without a cancer diagnosis who received 10 or more CT scans in 2010 were identified from North Carolina Medicaid claims data and were sent a letter in July 2011 informing them of their radiation exposure; those who had undergone 20 or more CT scans in 2010 were also telephoned. The CT scan exposure of these high-exposure patients during the 12 months following these interventions was compared with that of adult Medicaid patients without cancer who had at least 1 CT scan but were not in the intervention population.

RESULTS The average number of CT scans per month for the high-exposure population decreased over time, but most of that reduction occurred 6–9 months before our interventions took place. At about the same time, the number of CT scans per month also decreased in adult Medicaid patients without cancer who had at least 1 CT scan but were not in the intervention population.

LIMITATIONS Our data do not include information about CT scans that may have been performed during times when patients were not covered by Medicaid. Some of our letters may not have been received or understood. Some high-exposure patients were unintentionally excluded from our study because organization of data on Medicaid claims varies by setting of care.

CONCLUSION Our patient education intervention was not temporally associated with significant decreases in subsequent CT exposure. Effecting behavior change to reduce exposure to ionizing radiation requires more than an educational letter or telephone call.

Computed tomography (CT) scans are indispensable in the diagnosis and monitoring of myriad conditions. However, uncoordinated imaging of the same patient across different care settings can result in increased radiation exposure and health care expenditures, some of which may be avoidable [1]. The utilization of CT scanning has increased impressively over the past few decades in the United States and around the world [2–6]. The increased use of CT scans is particularly notable in urgent or emergent care settings, where time to diagnose problems is short and radiology management preauthorization programs do not apply [6–10]. In a study of more than 3 million emergency department (ED) claims filed in 41 states in 2006, 16.7% of all adults who had been seen in an ED had undergone a CT scan during the visit [7].

Exposure to ionizing radiation is associated with an increased risk of various forms of cancer [2, 11–16]. The National Council on Radiation Protection and Measurement (NCRP) reported in 2009 that exposure to ionizing radiation from medical procedures in the United States had increased dramatically since 1980, with about half of that increase attributable to CT scans [2]. For industries that involve radiation exposure, the NCRP recommends an occupational dose limit of 50 millisieverts (mSv) in any 12-month period and a lifetime limit of 10 mSv multiplied by age in years [17]. There is currently no accepted dose limit for patients exposed to medical ionizing radiation, because such a limit might pose a hindrance to appropriate care. However, when an individual

undergoes a large number of CT scans, especially at a young age, the associated risks of radiation exposure become clinically significant [11, 14, 15].

There are multiple large-scale efforts under way to limit medical radiation exposure in a systematic way. The Image Wisely campaign offers physicians guidelines for when to order various types of advanced imaging [18]. The campaign also supports equipment-specific dose guidelines; the CT Dose Index Registry, which allows facilities to compare their CT dose indices to regional and national values; and the principle that radiation doses should be “as low as reasonably achievable” (ALARA) [18, 19]. Patient logs, “personal dose passports,” and “SmartCards” that patients can use to track their radiation exposure are available through the US Food and Drug Administration and from Siemens, a major manufacturer of CT scanners [11, 19–21].

A smaller effort, led by the radiation safety officer of 2 community hospitals in New Hampshire, involved putting a radiation safety advisory (RSA) flag on the medical charts of patients whose estimated radiation exposure was 50 mSv or more, as well as sending a letter to patients who had received 10 or more CT scans to educate them about

Electronically published March 11, 2014.

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N C Med J. 2014;75(2):102–109. ©2014 by the North Carolina Institute of Medicine and The Duke Endowment. All rights reserved. 0029-2559/2014/75202

their risks [22, 23]. Recently a large hospital system also launched a program that allows patients and physicians to get information from the patient's electronic health record about his or her radiation exposure within that hospital system [24]. However, the literature does not include any large-scale efforts by insurers to reach high-exposure patients, nor are there any follow-up studies of the effect of such outreach efforts.

Community Care of North Carolina (CCNC) is a nonprofit organization that partners with the North Carolina Division of Medical Assistance (DMA), which operates the state's Medicaid program. One of CCNC's goals is to promote wellness by reinforcing each Medicaid recipient's relationship with his or her primary care medical home [25]. Through 14 regional networks consisting of physicians, nurses, pharmacists, care managers, and other staff, CCNC has ongoing care improvement projects including state-level efforts, region-specific pilots, and projects focused on specific patient populations.

In one state-level project, a team of physicians, nurses, analysts, and DMA staff members review outlier claims to see whether unusual billing patterns indicate a need for changes in policies or care pathways. A physician on this team had seen a patient who questioned the safety of the high number of CT scans he had received during the past year, and this inspired a state-level query. After background research was completed, the team discussed the issue with the DMA's chief medical officer, who agreed that an outreach project was warranted and feasible.

The purpose of this paper is to describe this outreach project, which was designed to educate selected high-exposure patients about the risks of ionizing radiation and to help them become more informed health care consumers. We report the CT scan utilization patterns of these patients following their receipt of an informative letter and, in some cases, a follow-up telephone call.

Methods

Setting and participants. This was a prospective longitudinal study of a cohort of patients identified using Medicaid claims data. The study and the intervention were approved by the DMA's publication review panel, the DMA's Health Insurance Portability and Accountability Act (HIPAA) privacy officer, the Institutional Review Board of the University of North Carolina at Chapel Hill, and the leaders and privacy officers of CCNC. Our study included patients aged 18–64 years who were enrolled in the North Carolina Medicaid program during at least part of calendar year 2010. Patients older than 64 years were excluded because we were concerned that we would not get complete claims data for the follow-up year once these individuals acquired Medicare coverage. Children were excluded because the intervention was targeted to patients who make their own health care decisions.

Patients were identified using the DMA Medicaid claims database to select individuals who had claims for 10 or more

CT scans between January 1, 2010, and December 31, 2010. We excluded patients who had claims in 2009 or 2010 that included a cancer diagnosis (International Classification of Diseases, Ninth Revision, Clinical Modification [ICD-9-CM] codes 140.0–208.9) [26], because our letter would not apply to a patient whose CT scans were an intentional part of cancer surveillance and treatment.

Ten or more CT scans was selected as the cutoff point for intervention for several reasons: 10 scans would result in an estimated 20–100 mSv of radiation exposure, depending on what types of scans were performed; 10 CT scans was the threshold used in the only previous outreach effort of this kind of which we are aware [22]; and there was consensus among members of the project team and the DMA medical director that care-seeking patterns or health conditions that would result in the patient receiving 10 CT scans in 12 months merited some form of educational outreach to ensure that the patient was aware of potential risks. Twenty or more CT scans was selected somewhat arbitrarily as the cutoff for receiving a telephone call; it was double the amount we had established as the high-exposure threshold, and the number of patients identified as having 20 or more CT scans (55 individuals) was small enough that they could all be telephoned by 1 of the 3 physicians involved in that stage of the project.

Intervention. In July 2011, all eligible patients were mailed a letter that specified how many CT scans he or she had received during 2010, outlined the general risks and benefits of CT scans, and suggested that he or she contact a primary care provider (see Appendix 1; online version only). Patients were also instructed to bring this letter with them to future medical visits. Each patient letter contained the North Carolina Department of Health and Human Services Care-Line telephone number and a referral telephone number that patients could call to request assistance or ask questions in English or Spanish. We provided Care-Line leaders with information about this project for their staff.

A generic form of the letter was presented at the summer 2011 meeting of all CCNC network directors, along with a list of the patients in each network to whom the letter was sent, and network directors were asked to share this information with their local primary care providers. One of us (R.M.B.) also presented this project at the annual meeting of the North Carolina College of Emergency Physicians in June 2011.

Patients with 20 or more CT scans in 2010 received a telephone call from 1 of 3 physician investigators (H.B., R.M.B., or R.M.L.) in addition to receiving a copy of the letter; these patients were called 4–10 days after the letter was mailed. This call was partially scripted, and its purpose was to determine whether the letter had been received and understood. The patients who were contacted by phone were also offered a referral to case management services if they were enrolled in CCNC. If the patient accepted (or if they were enrolled in CCNC but were not reachable by phone), a secure message with a referral and details was sent to the care man-

ager associated with the patient's primary care physician. Upon receiving a referral, CCNC care managers contacted patients by telephone or in person (at doctors' visits, in the ED, or at the patient's home) and worked to educate them about their condition(s) and to establish and achieve mutually agreed-upon goals of care. We asked the care manager to discuss with these patients the goal of minimizing unnecessary ED visits and unnecessary radiation exposure.

Data collection and analysis. We used Medicaid claims data to extract patient demographic characteristics and limited clinical information for all Medicaid patients in North Carolina who had claims for 10 or more CT scans during 2010; we also collected claims data for these patients for the year following the intervention—July 1, 2011, through June 30, 2012 (fiscal year [FY] 2012). For more detailed information about the types of CT scans included in this study and an explanation of how the scans were counted, readers can refer to the article by Burke and colleagues on pages 95-101 of this issue [27].

Data were collected 3 months after the end of each measurement period (on April 1, 2011, and on October 1, 2012) to allow time for Medicaid claims to be filed and processed. Since patients gain and lose Medicaid coverage throughout the year, each month's enrollment information (obtained from the DMA Web site [28]) had to be included in our analyses. To calculate the average number of CT scans per member-month, we added up the number of CT scan claims in our population for each month and divided that sum by the number of patients in our population who were enrolled during that month.

In late 2011, we were reviewing cases with care managers and found 2 patients whose hospital records indicated that they had received more scans than our data showed. While reviewing their actual medical records and claim details, we found that inpatients CT scans that were read by an in-house radiologist were often bundled into the overall inpatient claim, which meant that our original claims query sometimes undercounted the number of CT scans. Further in-depth review of cases and claims revealed that some hospitals had ED and inpatient CT scans read by outside radiologists on nights and weekends, and some hospitals contracted with outside radiologists all of the time. In these situations, there was often a separate professional claim that made the CT scan "countable."

Another difficulty occurred when the CT scan was performed in an ED setting and the technical claim was submitted before midnight but the radiologist's professional claim was submitted after midnight; in this situation, our 2011 methodology resulted in the claim being counted twice. In 2012 our analyst rewrote the query to account for most of these exceptions; however, some of the inpatient claims were still bundled in such a way that they were not accessible to queries. We found that our original count of 640 high-exposure patients (shown in Figure 1) was too low; when we reran our query, we found that 2,646 Medicaid

patients without a cancer diagnosis had 10 or more CT scans in 2010 [27]. All CT scan counts presented in Table 1 (and in the companion paper by Burke and colleagues [27]) use the new 2012 methodology.

Results

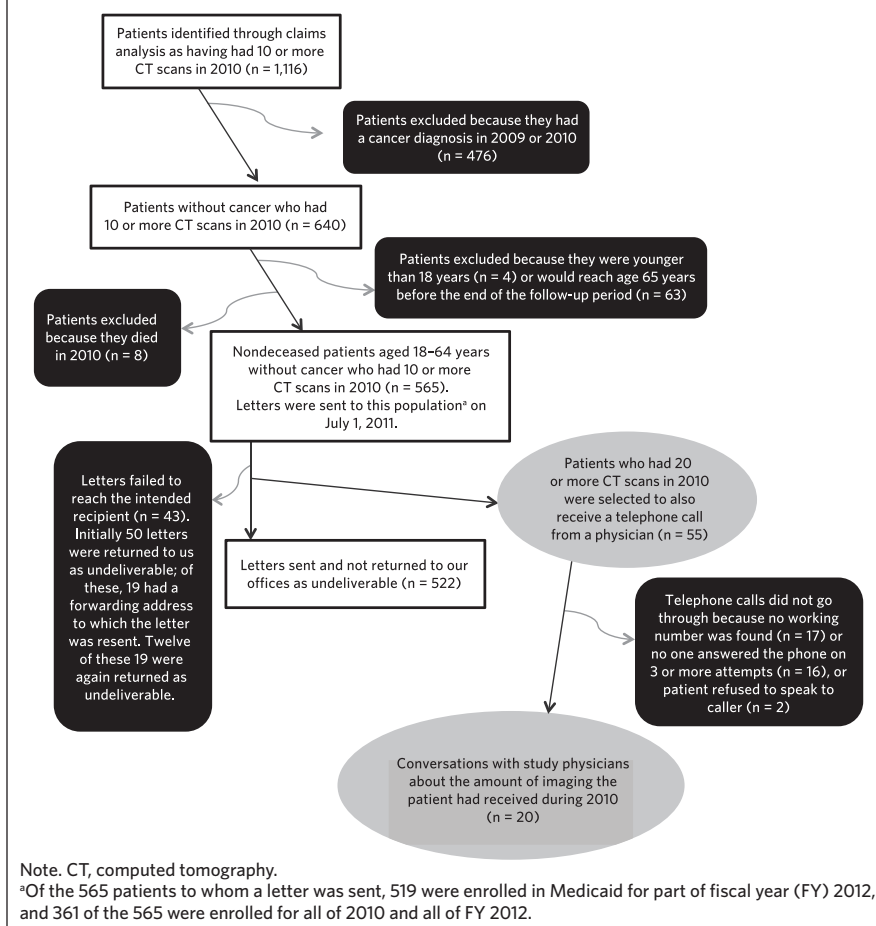
Our April 2011 query of the North Carolina Medicaid claims database identified 1,116 patients who appeared to have had 10 or more CT scans in 2010 (Figure 1). We excluded 476 patients who had a cancer diagnosis on a 2009 or 2010 claim. We also excluded 63 patients because they were going to reach the age of 65 years during our follow-up period, and we excluded 4 patients who were younger than 18 years. Eight patients were excluded because they died during 2010. After these exclusions, a total of 565 patients remained in the cohort. (When the number of CT scans was recalculated in 2012, 19 of these 565 patients were found to have actually had fewer than 10 scans in 2010, but none of those 19 patients had fewer than 7 scans.) A letter was mailed to each of these 565 patients on July 1, 2011.

High-exposure patients received an average of 17.4 CT scans (median of 16.0 CT scans) during 2010. In the "any-CT" group—adult Medicaid patients without cancer who had at least 1 CT scan in 2010 but were not in the group of 565 patients who were sent a letter—the median was 2.0 CT scans (Table 1). High-exposure patients were about the same age as patients in the any-CT group (median age, 39 years versus 41 years), but high-exposure patients were more likely to be white (73.8% versus 55.9%), more likely to be eligible for Medicaid due to a disability (63.9% versus 53.7%), and more likely to have chronic medical and behavioral health diagnoses. High-exposure patients also had a higher median number of outpatient office visits in 2010, and a greater proportion of high-exposure patients had inpatient admissions. Of note, high-exposure patients had many more ED visits in 2010 compared with patients in the any-CT group (median number of ED visits, 19.0 versus 2.0); high-exposure patients were more likely to have filled a prescription for a controlled substance using Medicaid (51.9% versus 18.0%); and high-exposure patients were less likely to have had an assigned primary care provider (65.8% versus 92.4%).

Letter to patients with 10 or more CT scans in 2010. Of the 565 letters sent to high-exposure patients on July 1, 2011, a total of 43 letters (7.6%) were returned as undeliverable. Additionally, of the 565 patients to whom letters were sent, 46 patients (8.1%) were not enrolled in Medicaid for any part of FY 2012 and so were not included in our follow-up analyses.

When we compared CT scan exposure during 2010 (the index year that identified the high-exposure group) with exposure during the year after the letter was sent (FY 2012), we found that CT scan exposure in FY 2012 was significantly lower. However, most of the decrease in exposure appears to have occurred during the final months of 2010 and early

FIGURE 1.
Flow Diagram of North Carolina Medicaid Patients Selected for Interventions



in 2011 (see Figure 2), before the study interventions took place in July 2011.

In order to investigate this decrease, we separately analyzed data for the subgroup of 361 individuals who were enrolled in Medicaid for all 12 months of 2010 and for all 12 months of FY 2012, and we sought to determine whether patients who had undergone scans in 3 out of 4 quarters in 2010 (a pattern of more frequent or chronic exposure) had the same acute drop in CT utilization as patients who had undergone CT scans during a shorter time period. Of the 361 patients in this subgroup, 314 had undergone scans in 3 out of 4 quarters of 2010, and 183 had undergone scans in all 4 quarters of 2010. Both of these groups of chronic high-exposure patients had a drop in the number of CT claims per member-month during the same time period (late 2010).

To determine whether the same drop also occurred in the any-CT population, CT utilization in this group was graphed with a magnified y-axis. The drop in the number of CT claims in late 2010 appears to have been universal across all of the adult Medicaid subpopulations analyzed in this study.

Telephone calls to patients with 20 or more CT scans in 2010. We were unable to reach by telephone 35 of the 55 patients who had 20 or more CT scans in 2010. Specifically,

we were unable to find a working telephone number for 17 of these patients after searching multiple databases; another 16 patients did not answer the phone during any of 3 or more calls at different times of the day over a 2-week period; and 1 patient refused to come to the phone to speak to the physician and asked that he not be called again. Finally, 1 patient answered but stated that he could not talk because he was in the ED being evaluated at the time of the call; he did not respond to 3 later attempts to contact him by telephone.

Of the 20 patients who were contacted by phone and who agreed to talk about the issue of radiation exposure, 4 patients (20%) said that they had not received our letter, even though the letter had not been returned as undeliverable. Three patients spontaneously expressed surprise at the number of CT scans they had undergone in 2010 when the information in the letter was reiterated to them during the telephone call. Ten of the 20 patients volunteered information about an unmet medical need for which they were seeking care through the ED: 1 patient was being treated for frequent transient ischemic attacks; 1 patient had unexplained seizures; 2 patients had undiagnosed recurrent abdominal pain; 2 patients had frequent kidney stones; 2 patients were being treated for complica-

TABLE 1.
Baseline Characteristics of North Carolina Medicaid Patients Without Cancer Aged 18–64 Years in the High-Exposure^a and Any-CT^b Groups, 2010

Characteristic	High-exposure patients ^a (n = 565)	Any-CT population ^b (n = 103,645)
Median age in years (IQR)	39 (17)	41 (23)
Female sex, No. (%)	380 (67.2%)	69,582 (67.1%)
Race, No. (%)		
White	417 (73.8%)	57,906 (55.9%)
Black	122 (21.6%)	38,187 (36.8%)
Other	26 (4.6%)	7,552 (7.3%)
Ethnicity, No. (%)		
Not Hispanic	485 (85.8%)	84,250 (81.3%)
Hispanic	6 (1.1%)	3,132 (3.0%)
Unreported	74 (13.1%)	16,263 (15.7%)
Medicaid eligibility category, No. (%)		
Adults with disabilities	361 (63.9%)	55,608 (53.7%)
AFDC	168 (29.7%)	38,112 (36.7%)
Work First/TANF	10 (1.8%)	3,819 (3.7%)
Other	26 (4.6%)	6,106 (5.9%)
Number of CT scan claims		
Range	7–178	1–57
Median	16.0	2.0
IQR	8.0	2.0
Had an assigned PCP, No. (%)	372 (65.8%)	95,754 (92.4%)
Number of outpatient office visits		
Range	0–102	0–108
Median	16.0	9.0
IQR	14.0	11.0
Number of emergency department visits		
Range	1–208	0–68
Median	19.0	2.0
IQR	20.0	4.0
Number of outpatient mental health visits		
Range	0–34	0–200
Median	4.0	4.0
IQR	5.5	6.0
Inpatient admission for a behavioral health problem, No. (%)	72 (12.7%)	3,569 (3.5%)
Inpatient admission for a medical problem, No. (%)	386 (68.3%)	41,869 (40.4%)
Overall Medicaid cost		
Median	\$28,243	\$6,898
IQR	\$32,865	\$13,024
Overall Medicare cost (incomplete data)		
Median	\$46,412	\$13,520
IQR	\$40,044	\$23,498
Filled at least 1 prescription for a controlled substance using Medicaid, No. (%)	293 (51.9%)	18,671 (18.0%)
Had a diagnosis of diabetes, No. (%)	191 (33.8%)	24,232 (23.4%)
Had a diagnosis of chronic pulmonary disease ^c , No. (%)	252 (44.6%)	28,626 (27.7%)
Had a diagnosis of cardiovascular disease ^d , No. (%)	364 (64.4%)	50,497 (48.8%)
Had any mental health diagnosis, No. (%)	432 (76.5%)	43,056 (41.6%)

Note. AFDC, Aid to Families with Dependent Children; CT, computed tomography; IQR, interquartile range; PCP, primary care provider; TANF, Temporary Assistance for Needy Families.

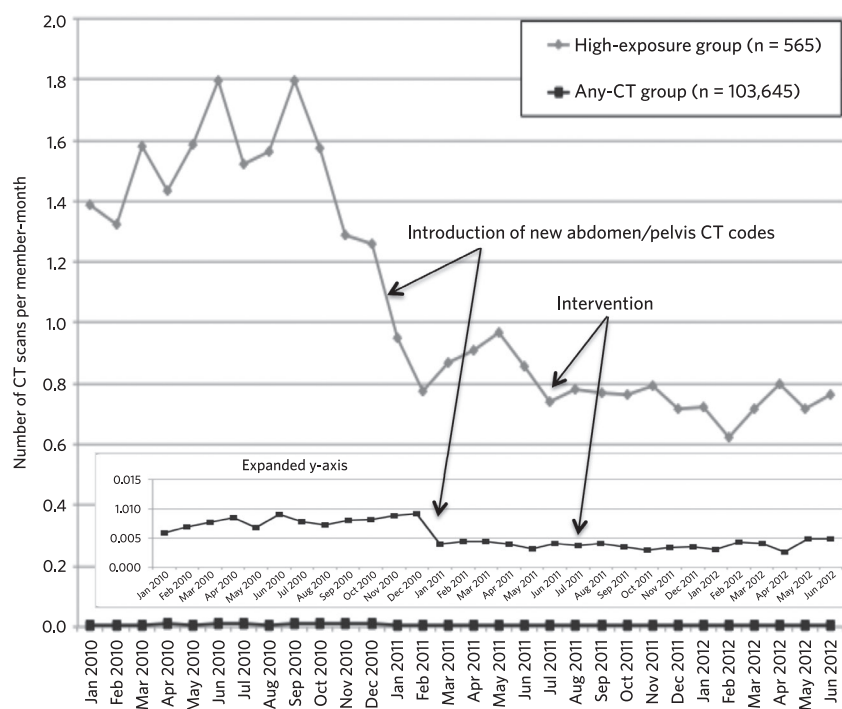
^aThe high-exposure group included patients without cancer aged 18–64 years who had North Carolina Medicaid claims for 10 or more CT scans in 2010. (When CT counts were recalculated in 2012, 19 of these 565 high-exposure patients were found to have actually had 7–9 CT scans.)

^bThe any-CT group included patients without cancer aged 18–64 years who had at least 1 North Carolina Medicaid claim for a CT scan in 2010 but were not included in the group of 565 high-exposure patients who received letters.

^cPatients with chronic pulmonary disease included those with an International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) code for chronic obstructive pulmonary disease or asthma.

^dPatients with cardiovascular disease included those with a diagnosis of hypertension, congestive heart failure, or ischemic vascular disease.

FIGURE 2.
Number of Computed Tomography (CT) Scans per Member-Month for North Carolina Medicaid Patients Without Cancer Aged 18–64 Years in the High-Exposure^a and Any-CT^b Groups, 2010



Note. The number of individuals enrolled in North Carolina Medicaid changed monthly. If an individual was not enrolled in a given month, there was no data included in the numerator (number of CT scan claims) or in the denominator (number of member-months).

^aThe high-exposure group consisted of 565 patients without cancer aged 18–64 years who received 10 or more CT scans in 2010.

^bThe any-CT group included patients without cancer aged 18–64 years who had at least 1 North Carolina Medicaid claim for a CT scan in 2010 but were not included in the group of 565 high-exposure patients who received letters.

tions of abdominal or pelvic surgery; and 2 patients had chronic musculoskeletal pain. One patient stated that after undergoing more than 30 CT scans, her problem had finally been diagnosed (although she was still visiting the ED frequently at the time of the call). The 9 remaining patients did not volunteer any reason for their ED visits, but 3 of these patients said that they had taken the letter to their physician to discuss it. One patient reported having taken the letter with him to the ED and having subsequently received a plain radiograph instead of a CT scan. During this call, patients were encouraged to follow up with their primary care provider; the 13 patients who were still covered by Medicaid and were enrolled in CCNC at the time of the call were also offered a referral to a CCNC care manager. Of the 20 patients who had a telephone conversation with one of the study physicians about the risks and benefits of their individual CT utilization, 85.0% had a lower number of CT scans in the year after the phone call, compared with 76.6% of the 35 patients who did not have such a conversation.

Discussion

The goal of this study was to evaluate whether patient education could decrease subsequent radiation exposure.

Overall, CT utilization in the high-exposure population did decrease, but most of the decrease occurred prior to our interventions. There are several possible explanations for this observation: Some high-exposure patients may have had a self-limited traumatic injury or other health crisis in 2010 that resulted in multiple CT scans during that year, but which then resolved before FY 2012 (regression to the mean). Decreases in CT utilization could also have been the result of ED clinicians ordering fewer scans, either due to increasing attention to the issue of medical radiation on the part of the media and professional societies [29], or in response to the DMA chief medical officer's talk about this issue at the annual meeting of North Carolina's emergency medical providers [1, 18, 23]. Another possibility is that there may have been a concomitant rise in the use of ultrasound or magnetic resonance imaging in these patients, trading one imaging modality for another, but our study did not address this question.

Finally, 3 new current procedural terminology (CPT) codes were added in January 2011 for combined CT scans of the abdomen and pelvis [30]. CT scan counts before and after January 2011 were double-checked to ensure that the new combined abdomen/pelvis codes were counted as 2 scans,

so that data before and after the coding change could be accurately compared. However, there was controversy nationally over the reduction in the relative value units assigned to the new combined abdomen/pelvis codes [31]. It is possible that the low reimbursement rate for the new codes may have had systemic ramifications after January 2011 that encouraged clinicians to consider whether scans of both the abdomen and the pelvis were needed, rather than a scan of just one or the other.

We consider this patient safety project to have been a success in that the DMA and CCNC worked collaboratively and used “big data” to raise awareness among patients who had high exposure to CT radiation in a single year. However, it does not appear that sending a letter to high-exposure patients or telephoning them effected any behavior change on their part. Although this finding is disappointing, it is not surprising; the volume of literature on behavior change strongly suggests that more work would be needed to effect true behavior change on the part of patients.

If the goal is to decrease radiation exposure in the high-exposure population, it may be more effective to educate providers than to educate patients. When we divided the list of 565 patients who would be receiving letters by network, in order to distribute these names to CCNC care managers, we noted that high-exposure patients more often received care in certain geographic areas. We then analyzed data for the any-CT population and found that a few specific EDs and a few specific ordering physicians had a higher ratio of CT scans to ED visits than their peers. Two of us (R.M.B., who is the DMA's chief medical officer, and H.B., who is a CCNC physician consultant) provided this data to the leaders of the facilities with high CT utilization ratios; at the facility with the highest ratio, we also met with the chief executive officer, the chief financial officer, and the director of imaging to go over the data. That facility has made a commitment to address possible overuse of CT scans through an internal patient safety project.

Two other facilities heard about this project from the quality improvement director of their local CCNC network, and they are working with CCNC to better understand their data and decide how best to address the issue of appropriate CT utilization in the ED setting. One of us (J.B., who is an ED imaging expert) has offered to tailor educational materials to meet the needs of these facilities. As more systems begin to attend to or morph into accountable care organizations, we expect them to express greater interest in looking at data for facilities and individual physicians. CCNC networks have also implemented a number of local interventions to reduce ED visits among patients who frequently utilize the ED, and these interventions may help minimize CT utilization, because the majority of CT scans are performed in the ED [32].

Lastly, the North Carolina Health Information Exchange (HIE) offers a potential platform for patient safety efforts of this sort. The chief executive officer of the HIE has expressed interest in studying the feasibility of a statewide RSA flag like

the one used in New Hampshire for patients whose radiation exposure or number of scans exceeds a certain threshold [22]. Serving a function similar to that of an allergy flag on the patient's health record, an RSA flag could alert providers to the patient's prior radiation exposure.

Limitations. This study had several limitations. First, it was difficult to identify CT scan claims, because scans were codified differently depending on the type of facility, the type of visit, whether the scan was read by an in-house radiologist or an outside consultant, and whether the patient had other insurance. Second, lack of continuous coverage for a large portion of our patient population meant that CT exposure was likely underestimated, because any CT scans performed when an individual was not enrolled in Medicaid would not be counted. Third, we do not know what proportion of the letters we sent were actually read and understood by the intended recipient; based on anecdotal evidence from our follow-up phone calls, we know that many patients who were sent a letter did not receive it, did not read it, or did not understand it. Finally, because of the short time horizon of this project, we do not yet know what future outcomes (cancers, further medical costs, lawsuits) may have been averted (or caused) by our interventions. For example, if patients begin asking for and receiving magnetic resonance imaging instead of CT scans, this might limit radiation exposure but could result in increased costs, incidental findings, and other unforeseen outcomes.

Conclusions and Implications

This study shows that when statewide data are put into the hands of clinically oriented leaders, North Carolina can plan and implement a large-scale patient safety outreach program. This realization has implications for patients, ED physicians, primary care providers, care managers, and policymakers. Patients should be made aware that there are risks associated with receiving high numbers of CT scans and episodic care in an ED setting. However, based on our results, sending a letter to patients does not seem to change this care pattern. ED physicians should be aware that patients who are high utilizers of EDs are more likely to be exposed to high levels of medical radiation, and these physicians should use evidence-based imaging protocols whenever possible. In this era of “big data,” policymakers should be aware that much can and should be done with these data, and they should consider how current relationships can support such efforts. Collaboration and sharing of data via the new HIE may offer opportunities for health care providers to consider this information more readily at the point of care, thus allowing them to better safeguard patients' health. NCMJ

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Acknowledgments

The authors would like to thank David Cale, who initiated this project; Susan Cole and Shane Stoyer, for working out the original outlier code; and Julian Thomas, for statistical advice and assistance.

Potential conflicts of interest. All authors have no relevant conflicts of interest.

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