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Accuracy of billing codes used in the therapeutic care of diabetic retinopathy

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Abstract

IMPORTANCE—Insurance billing claim databases represent a growing field of scientific inquiry within ophthalmology. Validating the accuracy of billing claim codes used during the care of diabetic retinopathy is a necessary precursor to fully understanding the underlying data and the subsequent results of these types of studies.

OBJECTIVE—To determine the accuracy of diagnostic, procedural and therapeutic billing codes used in the treatment of diabetic retinopathy

DESIGN—Retrospective chart review

SETTING—3 clinical practices: 1 academic, 2 private

PARTICIPANTS—Insured Diabetic Retinopathy patients seen by the practices noted above between 2011–2013. Each patient then had every visit for two years reviewed twice, once for billing data and the second for data from the medical chart.

MAIN OUTCOME MEASURES—The positive (PPV) and negative predictive values (NPV) for each code of interest. Sensitivity and specificity were secondary outcomes.

RESULTS—146 patients averaging 60.3 years old (SD±12.5) from 11 physicians had 1072 encounters reviewed over 2 calendar years. The patients were 49.3% female, 48.6% White, 37.0% Black, 18.5% Type I diabetics and had a hemeA1C level of 7.7 (SD±1.8). Nearly all codes of interest that were used frequently also had a high PPV (ranging from 89.5%–100%) and NPV (88.6%–100%) including billing codes for intravitreal injection, focal laser, panretinal

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photocoagulation, laterality of procedure, ranibizumab, bevacizumab, fundus photos, fluorescein angiography and optical coherence tomography. Codes that were used infrequently (<20 instances), but still had a high PPV (all 100%) and NPV (99.7%–100%) were codes for aflibercept, triamcinolone, and the dexamethasone implant. Only the codes for infrequently used subtenon's injection (PPV 69.6%) and B-scan ultrasound (PPV 100%, NPV 99.7%, but sensitivity of only 40%) were found to be of questionable accuracy. Other than B-scan ultrasounds (40%), all codes were also found to have a high sensitivity (range 87.6%–100%) and a high specificity (97.2%–100%).

CONCLUSION—These data suggest diagnostic, procedure and therapeutic codes derived from insurance billing claims accurately reflect the medical record for patients with diabetic retinopathy.

Keywords

Administrative billing claims; diabetic retinopathy; procedure codes; diagnosis codes

Introduction

The relative ease in obtaining data on millions of patients make insurance billing claim databases an appealing source for scientific inquiry. Verifying the accuracy of billing codes, however, is a necessary precursor to conducting these types of studies. Specific to ophthalmology, numerous diagnostic billing codes including those for diabetic retinopathy (DR), have already been deemed accurate.(1,2,3,4,5,6,7) Despite this verification, the codes for ancillary testing, therapeutic procedures or medications used during the care of DR have yet to be validated. The aim of this study is to test the accuracy of these codes.

Methods

A retrospective chart review was performed including 11 retina specialists across 3 practices (a university based academic practice and two private practices). Patients were selected from a list of insured DR patients from each practice (ICD-9 codes 362.01–362.07) that had a clinical encounter between 2011–2013. Starting with the first visit (index date), every encounter for the subsequent 2 calendar years was then reviewed twice. The first data abstraction collected the billing data. This included all Current Procedural Terminology(CPT-4) for diagnostic testing and therapeutic procedures (with laterality), as well as the Healthcare Common Procedure Coding System(HCPCS) for drugs used during each visit. The second data abstraction from the medical chart included all demographic information (at time of index visit), diagnostic test reports and procedure notes (including medications used). Diagnostic tests were only considered performed if a report was placed in the chart.

The billing and chart data were then compared for the following codes of interest: intravitreal injection, focal laser, panretinal photocoagulation (PRP), subtenon's injection, laterality of procedure, ranibizumab, bevacizumab, aflibercept, triamcinolone, dexamethasone implant, fundus photos, fluorescein angiography (FA), optical coherence tomography (OCT), and B-scan ultrasound.(See Supplemental Table 1 for all codes used in

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this study). For laterality, both the eye having the procedure and not having the procedure were counted since two possibilities for error could happen in the charting and billing of any procedure. The medical chart documentation was considered the ground truth for the presence or absence of an event. The positive predictive value (PPV) and negative predictive value (NPV) of the billings claims date were the main outcomes of the study. Sensitivity and specificity were also calculated as secondary outcomes. All statistical analyses were performed with STATA14® (College Station, TX). The University of Pennsylvania's Institutional Review Board approved this study.

Results

One hundred forty-six DR patients representing 1,072 encounters from 2011–2015 were included. The patients averaged 60.3 years old (SD±12.5), were 49.3% female, 48.6% White, 37.0% Black, 14.4% other/mixed race, 18.5% Type I diabetics and had a hemeA1C level of 7.7 (SD±1.8). Medicare was the most common insurance provider (35.0%) with 9 other insurers represented, including Medicaid (11.1%). Table 1 shows the raw numbers for each of the categories in terms of positive agreement (both bill and chart agree procedure was done), negative agreement (both bill and chart agree procedure was not done), and areas of disagreement (i.e. recorded in the medical chart, but not in the billing data, or vice versa). Of encounters with procedures, 1114 opportunities occurred for laterality to be assessed. Procedures or therapies that had less then 20 instances of occurrence were considered "low volume" and as such, have less confidence around the accuracy of their statistics. These included codes for B-scan ultrasonography, subtenon's injections, aflibercept, triamcinolone and the dexamethasone implant.

Table 2 demonstrates the accuracy of each specific code studied in the billing data. With the exception of B-scan ultrasonography (69.6%), all codes had at least an 89.5% PPV (range 89.5–100%). Similarly, all codes had a NPV of at least 88.6% (88.6%–100%). Sensitivity for all codes was also extremely high (88.9%–100%), with the exception of subtenon's injections (40%). Correspondingly, the specificity was also very high for all codes (97.2–100%).

Discussion

Within this study focused on retina-clinic patients, each of the high volume DR codes evaluated, the billing data accurately represented the medical chart in all instances. Less data were able to be collected on the low volume procedures, making predictions of accuracy more difficult. Only subtenon's injections and B-scan ultrasounds did not have accuracy levels suitable for future research use. This study validates therapeutic codes used in the care of DR patients as a reliable proxy for most procedures.

Although our focus was therapeutic codes used in DR, we chose to include all DR patients. By not restricting study patients to only those who had a procedure, we limited selection bias and permitted the calculation of an accurate NPV. Clearly, when performing administrative billing claims database studies, understanding the accuracy of the code being studied is paramount (via the PPV). Conversely, it can be just as important to know when a

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code is not seen in the database, that the likelihood of the procedure being performed but not captured, is also very low (via the NPV). In statistical terms, sensitivity and specificity are considered constant, meaning their values are independent of the underlying prevalence of the population. This is in contrast to the PPV and NPV, whose calculation is directly related to the population prevalence. For this reason, we feel the PPV and NPV are stronger accuracy indicators than sensitivity and specificity. However, given we only studied patients from retina clinics, it is likely our calculated PPVs would decrease (and the NPVs would increase), if a broader patient population were studied with a lower prevalence of DR procedures.

Due to our study's observation window, a paucity of data was generated on aflibercept (FDA approved for DME in 2014). Others have demonstrated the accuracy of a code often depends largely on reimbursement rate (6,8,9,10). The general guideline is that the more a procedure reimburses, the more likely it will be coded accurately (8,9). This could easily apply to aflibercept, where the high upfront cost incentivizes providers to not under-bill it, yet conversely, fear of committing fraud also incentivizes to not over-bill. Extrapolating this data to aflibercept warrants caution, but it would not be surprising to expect a larger study of aflibercept to have comparable results as the other anti-VEGF agents seen here.

This study has limitations that need to be considered when reviewing its results. First, since claims databases are typically created by insurers, only insured patients were included. Therefore accuracy of coding may not generalize to the uninsured. Additionally, recent reports have called into question how accurately the medical chart reflects patient's symptoms.(11) Although possible, in comparison to patient symptoms, medical chart accuracy is likely to be less of an issue for procedure billing since it is often documented in multiple areas within the chart. Next, we only had access to electronic medical records for this study. It is unclear how codes in paper records would fare in a similarly designed study. Lastly, this study was limited to encounters from retinal physicians. Although 11 doctors contributed data, these results may not be indicative of other retina or other non-retina physicians who provide DR therapy.

These data suggest diagnostic, procedure and therapeutic codes derived from insurance billing claims accurately reflect the medical record for patients with DR. Going forward, researchers may use these procedure codes with greater assurances that the claims data accurately represents the events of a medical encounter.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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The senior author, Brian VanderBeek, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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Key points

Question

Do the codes seen in administrative billing claims data accurately represent the medical chart for procedures, therapies and diagnostic testing used in the care of diabetic retinopathy?

Findings

Nearly all codes used in the care of diabetic retinopathy have high positive and negative predictive values as well as high sensitivity and specificity.

Meaning

Diagnostic, procedure and therapeutic codes derived from insurance billing claims accurately reflect the medical record for patients with diabetic retinopathy.

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Table 1

Total numbers from the medical chart and billing data

Category*	Medical chart, billing data agree		Medical chart, billing data disagree	
	+Chart/+Bill	−Chart/−Bill	+Chart /−Bill	−Chart /+Bill
Intravitreal Injection	426	631	3	11
Subtenon's Injection	2	1043	3	0
Focal Laser	48	997	3	0
PRP[1]	93	953	2	0
Ranibizumab	219	813	3	23
Bevacizumab	154	884	5	18
Aflibercept	3	1045	0	0
Triamcinolone	8	1039	1	0
Dexamethasone Implant	9	1039	0	0
Fundus Photography	64	977	5	4
Fluorescein Angiography	89	955	3	3
OCT[2]	606	407	23	14
B-scan Ultrasound	16	1026	1	7
Procedure Laterality	494	545	5	70

*Totals may vary from the 1072 total visits

[1]Panretinal Photocoagulation

[2]Optical Coherence Tomography

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Table 2

Accuracy of Diabetic Retinopathy related billing codes reflecting the medical chart through positive (PPV) and negative (NPV) predictive values, sensitivity and specificity

	PPV	NPV	Sensitivity	Specificity
High volume				
Intravitreal Injection	97.5%	99.5%	99.3%	98.3%
Focal Laser	100%	99.7%	94.1%	100%
Panretinal Photocoagulation	100%	99.8%	97.9%	100%
Ranibizumab	90.5%	99.6%	98.6%	97.2%
Bevacizumab	89.5%	99.4%	96.9%	98.0%
Fundus Photography	94.1%	99.5%	92.8%	99.6%
Fluorescein Angiography	96.7%	99.7%	96.7%	99.7%
Optical Coherence Tomography	97.7%	94.7%	96.3%	96.7%
Procedure Laterality	99.0%	88.6%	87.6%	99.1%
Low volume				
Aflibercept	100%	100%	100%	100%
Triamcinolone	100%	99.9%	88.9%	100%
Dexamethasone implant	100%	100%	100%	100%
Subtenons Injection	100%	99.7%	40.0%	100%
B-scan Ultrasound	69.6%	99.9%	94.1%	99.3%