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Identifying Injuries and Trauma Severity in Large Databases

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In order to assess the cost and effectiveness of inpatient trauma care, trauma patients and their levels of severity must first be identified accurately using data from all hospitals, not just trauma centers. The present study provides the methodology to identify injuries and trauma severity using discharge abstract data collected routinely by all hospitals. In this study, the validity of defining trauma patients using routinely collected abstract data and two computerized patient classifications—Diagnosis Related Groups (DRGs) and Patient Management Categories (PMCs)—was tested using the trauma registry data of one major trauma center as the gold standard. Medical records were reviewed to assess whether patients were accurately classified as having injuries by each of the two systems and whether patients were incorrectly omitted from the registry. Results indicated that trauma patients are more accurately identified by PMCs (95.1% accuracy) than by either DRGs (44.4% accuracy) or the registry standard itself (91.8% accuracy). Because patients identified by DRGs as trauma were not likely to be injured (21.2% specificity), and many true injuries were not identified as such by DRGs (47.9% sensitivity), per case payments to hospitals are unpredictable, and management based on DRG data is misleading. By contrast, PMCs (97.8% sensitivity; 77.7% specificity) can be used to improve injury surveillance methods, to monitor outcomes in terms of morbidity and mortality, and to make hospital payment systems more equitable.

Although the concept of organizing emergency medical services (EMS) in regional systems is not new, the evaluation of patient outcomes that result from such systems is just beginning to receive attention. Even the process of regional trauma center designation has focused on the availability of services and staff to provide emergency medicine without a similar emphasis on the volume and characteristics of injured patients in the region. This lack of information about the injuries and outcomes of trauma care within a particular geographic area has been due primarily to the lack of analytic tools to organize the currently available patient data. Physicians and governmental agencies have been frustrated by the absence of computerized patient classification criteria, by the lack of clinical relevance and usefulness of existing ways of aggregating patient data, and by their inability to obtain even the most preliminary data on the trauma care provided in a given region. Without an appropriate, clinically specific classification of trauma patients, it has not been possible to identify the number and types of injuries that occur over time, nor has it been possible to assess the effectiveness of trauma systems that have been implemented.

Discharge abstract data have long been routinely collected but, until recently, have not been used extensively. Diagnosis Related Groups, or DRGs, are one attempt at using abstracted patient data in a system that pays for the average medical care provided over a large number of hospitals and geographic areas. There is a great deal of concern, however, that the use of the DRG classification as the basis for payment creates inappropriate financial consequences for certain types of hospitals. This is especially relevant for trauma centers that treat more resource-intense patients and may face closure because of inadequate reimbursement (13, 15).

There is even more concern about DRGs when they are suggested for quality assessment applications, where clinically specific categories for risk adjustment are required. This study examines an alternative patient classification system called Patient Management Categories (PMCs) to determine whether it is a more useful analytic tool for identifying clinically similar hospitalized patient types.

In this study, the validity of defining trauma patients using routinely collected patient abstract data was tested. The trauma patients identified by two computerized patient classification systems—DRGs and PMCs—were compared with the trauma patients included in the

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trauma registry of one Level I* trauma center. The types of injuries excluded or overrepresented by each classification were identified, and the accuracy of each classification and of the registry standard itself were determined through medical record review. The objective was to assess the usefulness of the computerized PMC Classification System, in contrast to the widely used DRGs and more narrowly used registries, for improving injury surveillance methods, monitoring the effectiveness of trauma care, and aiding the trauma center accreditation/designation process.

BACKGROUND

Trauma Patient Classification. General categories of patients who require Level I trauma care have been described in the past in various ways. The American College of Surgeons' Committee on Trauma (1) has developed a field categorization of trauma patients designed to facilitate transfer of patients to an appropriate facility for treatment. Patients requiring Level I trauma care include, for example, patients with combined system injuries, open fractures, uncontrolled hemorrhage, pelvic fractures, severe injuries in various sites, or prolonged loss of consciousness. Similarly, Boyd (4) has described Level I trauma cases as "severe injuries involving two or more body systems, head and spinal cord injuries, cardiac and great vessel injuries, uncontrolled shock from any trauma, multiple trauma with complications, severe facial and eye injuries, burns, and traumatic amputations." The major problem with these broad patient descriptions is that they have not been effectively operationalized. Until recently, criteria for assigning a patient to one or more of these categories have not been defined precisely enough to permit computerization of the categorization process. The result is that data describing the types of trauma patients admitted to all acute care facilities in a region have not been generally available for comparative outcome assessment or for guiding policy decisions regarding trauma center accreditation or designation.

DRGs are currently the most widely used patient classification primarily because they were adopted as the basis of hospital payment by Medicare's Prospective Payment System. By definition, however, DRGs are a statistically derived classification, not a clinically specific one. Further, since each patient is assigned only one DRG, comorbid conditions and complications are not identified specifically. This is particularly a problem when one is trying to identify severely injured trauma patients who are more likely than other patients to have multiple injuries and comorbidity.

Various injury severity measures [e.g., Abbreviated Injury Scale (AIS), Injury Severity Score (ISS), Trauma Score (TS)], have been suggested as potential solutions to the problem of identifying patients who require specialized trauma care. Extensive research has been conducted to develop these indices to improve prehospital and post-discharge categorization of injuries (2, 3, 5–7, 12). Some of these trauma patient scoring systems attempt to quantify the severity of single body system injuries (e.g., AIS ranges from 1 to 6 within a body region, such as head), while other systems attempt to derive a numerical value for single or multiple injury patients without identifying injury areas (e.g., a patient with an ISS of 13 or a TS of 15). None of these systems, however, provides a method of identifying clinically specific types of injuries, such as all patients with open pelvic ring fractures. In addition, since the amount and type of patient data necessary to assign a score to each patient are frequently not available in hospitals other than trauma centers, widespread implementation of these indices has not occurred.

In contrast to the systems mentioned above, the PMC Classification System is both clinically specific and linked to required levels of care. This classification, consisting of 852 PMCs (126 of which are injury PMCs), was developed with extensive physician consultation and panel review (HCFA Grant Number 18/P/97063-3, 1978–1985) and is computerized to operate using existing patient abstract databases, such as UB-82 claims databases and hospital abstract data systems. The injury PMCs were recently refined as part of a research project entitled "The Effectiveness of Inpatient Trauma Care" (NCHSR Grant Number HS 05532, 1986–1989). Each PMC has associated with it a patient managment path which delineates services required for the effective care of a typical patient in that category. A methodology was developed to use the relative costs of these services in multiple hospitals to derive a relative intensity score for each patient based on the patient's unique combination of specific injuries and comorbidities. That relative score reflects the type and intensity of services required for effective care of that patient and is referred to as the PMC Relative Intensity Score (17–20).

DRGs versus PMCs. Because this research compares the validity of injury identification using two computerized classifications, a brief description of the similarities and differences between the systems is included here as background. Since both PMCs and DRGs can be assigned to any patient database that is compatible with the Uniform Hospital Discharge Data Set (UHDDS), which virtually all hospitals collect, both systems are readily transportable. Although the DRG and PMC computer algorithms operate using the same data elements from abstracted patient records, the way in which these data are aggregated leads to quite different classification results: DRGs are statistically derived patient categories, whereas PMCs were designed by expert panels of physicians to represent clinically specific patient types, each requiring a distinct diagnostic and treatment strategy.

* Since 1973 and the national EMS legislation, hospitals have been designated as Level I, II, or III based on the availability of services and staff for emergency medicine. Level I is the highest level of technological and staff sophistication, with research and teaching components as well.

The PMC Classification System identifies multiple trauma by assigning a unique PMC for each important injury sustained by the patient. A multiple trauma patient will receive multiple PMC assignments, each of which identifies a clinically specific injury. This is in contrast to DRGs where each patient receives only one DRG assignment regardless of the number of injuries sustained or their combined severity. It is particularly important in analyzing trauma care to identify the relative intensity and costs of multiple injuries and particular combinations of injuries.

A more precise and complete clinical description of injuries and comorbidity is possible using PMCs because specific combinations of ICD-9-CM diagnosis and procedure codes are used in making one or more PMC assignments. The example shown in Table I illustrates the importance of using the combination of codes listed on the patient's abstract (disregarding sequence). In this case, five diagnosis codes recorded for one patient result in two injury PMCs: a full-thickness burn (PMC 0507) and a closed pelvic ring fracture (PMC 4802).

The PMC computerized algorithm searches the list of patient diagnosis and procedure codes to determine the body systems affected. In each injury area, the combination of specific codes that describe the injury is used to make the PMC assignment(s). For example, the three fracture codes together (listed in any order) define a closed pelvic ring fracture, which is significantly more severe than any one of the fractures listed alone. By contrast, since only one DRG assignment can be made for each patient, the DRG assignment for this patient will differ depending on the sequence in which diagnosis codes are listed. Specifically, if either of the two burn codes is listed first, the patient would be classified as a non-extensive burn without OR procedure (DRG 460). If any one of the three fracture codes is listed first, the patient would be assigned to DRG 236: Fracture of hip and pelvis. Using DRGs, a closed pelvic ring fracture cannot be identified, nor can the combination and severity of multiple injuries be identified. Note that this same problem exists when single ICD-9-CM codes or ranges of codes such as ICD-9-CM 800.00–959.90 are used (as is typical).

Within the PMC Classification System, there are 126 injury PMCs, each of which is assigned to one of the following levels of severity: minor, significant, or tertiary. This designation is shown for each injury PMC in Appendix A. These categories have also been aggregated into the following injury areas for analysis purposes:

Head injuries	Lower extremity injuries
Maxillofacial injuries	Femur/pelvic fractures
Spine injuries	Burn injuries
Abdominal injuries	Ophthalmic injuries
Thoracic injuries	Physical/chemical injuries
Upper extremity injuries	

In contrast to PMCs, the DRG classification does not specifically or separately identify injuries. Instead, injured patients are assigned to DRGs that include other disorders and diseases, making it difficult to clearly identify a subset of DRGs that might be useful in monitoring the incidence of hospitalized injuries. This lack of clinical structure also makes it nearly impossible, using DRGs as the classification tool, to identify the cost of trauma patient care at a particular hospital or across multiple institutions. Nevertheless, with clinical review and an empirical analysis of the DRGs assigned to injured patients, the 39 DRGs listed in Appendix B were designated as the DRGs that are most likely to include true injuries and exclude non-trauma patients. Subsequent analyses in this study will use these PMC and DRG trauma designations (Appendices A and B).

MATERIALS AND METHODS

Data Sources. Two data sources were used for this analysis:

1) Statewide trauma registry data [Pennsylvania Trauma Outcome Study (PTOS)] for all trauma patients discharged during 1987 from one Level I trauma center (subsequently referred to as registry data); and

2) Discharge abstract data on all patients (trauma and non-trauma) discharged from the same Level I trauma center hospital during the same time period, calendar year 1987 (subsequently referred to as abstract data).

Certain clinical and demographic variables are included in

TABLE I
Example of multiple injury PMC assignments for one patient

ICD-9-CM Diagnoses	PMC Assignments
946.30 Full-thickness skin loss due to burn (third-degree NOS) of multiple specified sites 948.31 Burn (any degree) involving 30–39% of body surface with third-degree burn of 10–19%	0507 Burn: Full-thickness greater than 10% of body surface area
808.20 Closed fracture of pubis 808.41 Closed fracture of ilium 808.42 Closed fracture of ischium	4802 Femur/pelvic fracture: Closed pelvic ring fracture without open reduction internal fixation

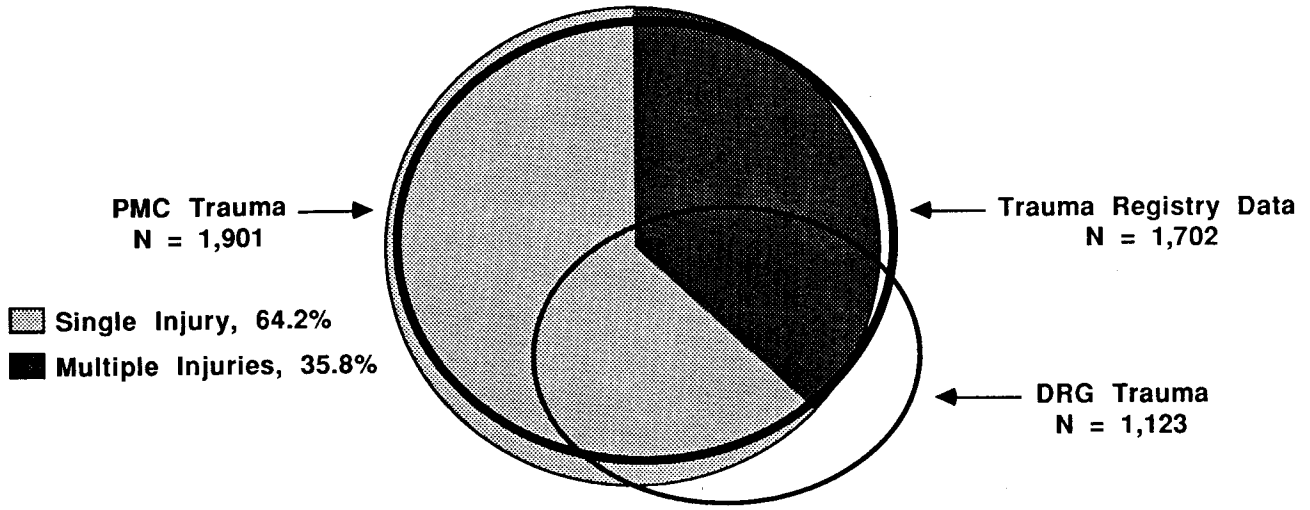

FIG. 1. Identification of trauma patients: PMCs versus DRGs versus registry.

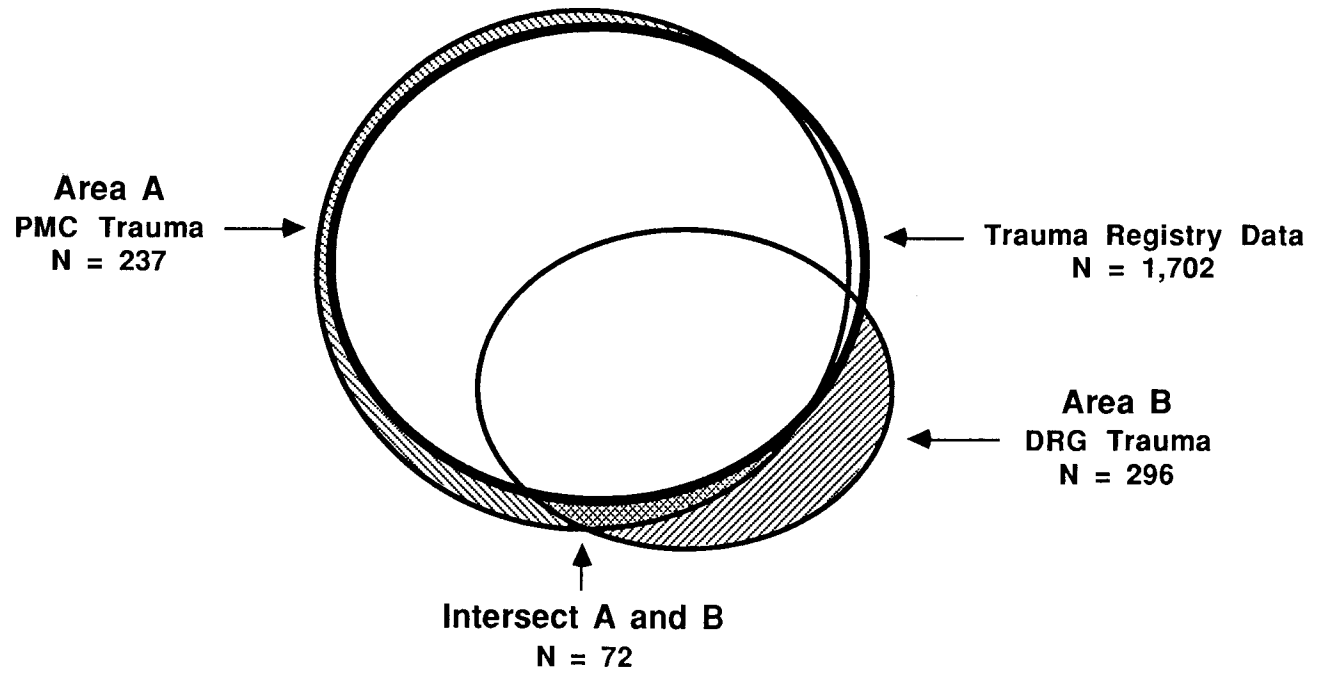

FIG. 2. Identification of trauma patients outside the registry: PMCs versus DRGs.

TABLE II
True injuries validated by medical record review

	N	Number of Patient Charts Reviewed	True Injuries
PMC trauma/outside registry (Figure 2, Area A)	237	47	72.3%
DRG trauma/outside registry (Figure 2, Area B)	296	59	23.7%

TABLE III
Accuracy, sensitivity, and specificity of PMCs, DRGs, and the registry in selecting trauma patients

	PMC	DRG	Registry
Accuracy	95.1%	44.4%	91.8%
Sensitivity	97.8	47.9	90.5
Specificity	77.7	21.2	100.0

both registry and abstract data, such as ICD-9-CM diagnoses, age, sex, length of stay, and discharge status (dead/alive/transferred). The statewide registry data include more physiologic data to calculate various trauma indices (e.g., Glasgow Coma Score, Trauma Score), but not procedure data. Conversely, the abstract data include up to five operative procedures, but no physiologic data. The hospital's internal registry system, which maintains more data than the PTOS data requirements (including ICD-9-CM procedure codes), was used to supplement the statewide registry and to permit PMC assignments to be made.

Methods. Since the Pennsylvania statewide registry excludes certain patients based primarily on the statistical criterion of length of stay (i.e., patients are excluded who stay less than 72 hours, unless they die, are transferred into the trauma

TABLE IV
Injured patients by PMC severity level

PMC Severity Level	Inside Registry			Outside Registry		
	No.	LOS	PMC-RIS	No.	LOS	PMC-RIS
Minor	151	4.5	0.97	*	*	*
Significant	902	9.2	2.00	178	9.9	2.18
Tertiary	611	16.2	4.60	59	15.6	4.06

* Minor injuries outside the registry were omitted from analyses.

center, or are admitted to an intensive care unit), this same criterion was applied to the hospital's abstract data. It was necessary to make the databases comparable for this analysis of the accuracy of trauma patient identification even though these criteria introduce biases for other purposes (14, 16). (The types of patients excluded when criteria such as these are imposed are discussed in another manuscript in preparation.)

The resultant abstracted patient discharge records were processed by the DRG Grouper and PMC Classification Software. The data elements necessary for categorization in both systems include diagnoses, procedures, age, sex, and discharge status. The injury categories listed in Appendices A and B for trauma PMCs and DRGs were used to select trauma patients from the abstract database. Abstract data for all hospitalized patients (trauma and non-trauma) were then merged with registry data, using medical record numbers and admission dates, to assess the validity of defining trauma patients and trauma severity using each of the two computerized classifications, PMCs and DRGs. Of the 1,751 records in the registry database, 2.8% (49 cases) were not able to be linked with a record in the abstract database and were excluded from subsequent analyses.

RESULTS

The trauma patients discharged from one large trauma center identified by using PMCs (n = 1,901) and DRGs (n = 1,123) were compared to the patients included in the statewide registry (n = 1,702) (Fig. 1). The total patient database includes 2,163 patients who met the statewide registry criteria for inclusion. The large shaded circle in Figure 1 represents the trauma patients identified by PMCs. Note that PMCs can differentiate single from multiple injury patients (in this case, 64.2 and 35.8%, respectively). The small elliptical shape represents the injured patients as identified using DRGs. Using the registry data (n = 1,702) as the criterion or gold standard, 97.8% of all hospitalized trauma patients at one Level I trauma center were accurately identified using PMCs and abstract data, whereas 48.6% of all injured patients were identified as such by DRGs.

Only 2.2% of trauma patients included in the registry (n = 38) were not identified as having injuries by using PMCs with discharge abstract data. The medical records of all 38 of these cases were reviewed to validate that they were in fact injuries and to determine why they were not identified as injuries using abstract data. Although these cases were injuries, in nearly all cases, injury diagnosis codes were either not recorded in the abstract data or, if recorded, they were not specific enough for classification by PMCs. Seven of the 38 cases were classified as injuries by DRGs.

By contrast, more than half of the trauma patients included in the registry (51.4% or 875 patients) were not identified as injuries by DRGs. These injured patients were assigned to a total of 147 DRGs that are not specific to trauma, such as DRG 217: wound debridement and skin graft, except hand, for musculoskeletal and connective tissue disease (n = 165); DRG 468: extensive OR procedure unrelated to principal diagnosis (n = 71); DRG 243: medical back problems (n = 49); and DRG 4: spinal procedures (n = 31). These 875 patients were not identified as trauma patients by DRGs primarily because the DRG classification algorithm (or grouper) is driven by the principal diagnosis code which, in more than half the cases, was not a diagnosis that leads to an injury DRG. These cases do not generally represent coding errors; rather, they reflect the fact that the DRG grouper systematically relies on the sequence of codes and thereby ignores the interrelatedness of ICD-9-CM diagnosis codes (8, 9, 21).

Both the DRG and PMC systems, however, also identified injured patients that were not included in the registry data (Fig. 2). A total of 237 patients (representing 12.5% of the PMC trauma) were identified as injuries by PMCs, and, even though they met the statewide registry criteria, they were not included in the registry (Fig. 2, Area A). Similarly, 296 patients (representing 26.4% of the DRG trauma) were identified as injuries by DRGs, but were outside of the registry (Fig. 2, Area B). Only 72 of these cases were identified as injuries by both systems (Fig. 2, Intersect A and B).

To assess whether these cases were misclassified by each of the two systems or were in fact incorrectly omitted from the registry, a 20% random sample of each of the two subpopulations (237 patients assigned to injury PMCs and 296 patients assigned to injury DRGs) was selected for medical record review by the physician author. Results of this analysis are shown in Table II. All but one of the fourteen patients sampled from Intersect A and B were determined to be injuries and are included in the results of both systems in Table II. The one patient who did not have an injury was admitted for compartment syndrome due to a previous injury. Registries do not typically include readmissions due to complications or readmissions for subsequent phases of a patient's injury treatment plan. These discharges should be identified, however, and appended to the original injury record in order to have a complete account of treatment, resource use, and cost for a given patient type. This can be done retrospectively for inclusion in the registry by linking patient records. (It should be noted that, in another study conducted for the Pennsylvania Department of Health and the Pennsylvania Trauma Systems Foundation, the authors have successfully merged hospital abstract data with ambulance records to assess the impact of prehospital care on in-hospital outcomes) (10).

Most of the patients who were identified as injuries by

DRGs but were outside the registry (Fig. 2, Area B) were misclassified. In fact, based on medical record review, only 23.7% of these patients (14 of 59) were determined to be true injuries. Two-thirds of these cases were actually surgical and medical complications or bone and joint disorders that were inappropriately assigned to injury DRGs, especially DRGs 442 and 443: other OR procedures for injuries, and DRG 440: wound debridements for injuries. This misclassification occurs because, in the DRG system, both non-trauma patients and injured patients who have similar procedures are assigned to the same DRG.

By contrast, nearly three-fourths of the cases outside the registry, but identified by PMCs (Fig. 2, Area A), were true injuries and were incorrectly excluded from the registry. The small number of cases misclassified by PMCs were either joint disorders that were classified as periarticular soft-tissue injury repairs or iatrogenic injuries miscoded as externally caused injuries. The cases identified correctly by PMCs as injuries (72.3%) were inappropriately excluded from the registry because of the manual, but prospective identification process used in most hospitals for case finding. At minimum, PMCs could provide a retrospective check to assure the identification of all serious hospitalized injuries for registry abstraction.

Based on this analysis, the numbers of cases correctly and incorrectly identified by each method were ascertained and the overall accuracy, sensitivity, and specificity of each method were calculated (Table III). Trauma patients were more accurately identified by PMCs (95.1% accuracy) than by either DRGs (44.4% accuracy) or the trauma registry (91.8% accuracy). While the specificity for the registry is 100% (that is, all patients included did in fact have injuries), its sensitivity is 90.5%. By contrast, the sensitivity of PMCs is 97.8%, with 77.7% specificity, while the sensitivity of DRGs is much lower at 47.9%, with 21.2% specificity. That is, PMCs identified nearly all of the true injuries (97.8% sensitivity) with some false positives, while DRGs identified less than half of the true injuries (47.9% sensitivity) with many false positives (low specificity).

Even though most physicians have had concerns that DRGs do not classify patients accurately, this study has confirmed and quantified that suspicion. Not only do these results show that DRGs poorly classify injuries, but the low sensitivity of DRGs indicates that this problem will not be remedied by subdividing DRGs by other variables, including severity scores. The low sensitivity and specificity of DRGs also has major financial and management implications for hospitals. Because patients identified as injuries by DRGs are not likely to be injuries (low specificity) and many true injuries are not likely to be identified as such (low sensitivity), payments to hospitals (even if adequate) are unpredictable, and management based on DRG data would be misleading at best.

It is obviously desirable to have an injury classification that is both highly sensitive and highly specific. Both PMCs and the registry are high in both areas. The very important difference, however, is that PMCs can be used with existing databases to identify injuries and injury outcomes in both trauma centers and nontrauma centers. It is clearly important to define the total number of injuries in an area to use as the denominator for calculating injury specific morbidity and mortality rates. The high sensitivity of PMCs indicates that nearly all injuries would be identified. Given the types of cases that were false positives using PMCs, additional screens could also be created to improve the specificity of PMCs.

In addition to identifying seriously injured patients using abstract data, PMCs, because of their clinical specificity, permit the identification of severity levels as well. Table IV shows these PMC severity levels for injured patients who were included in the registry and for patients not identified by the registry. For each PMC severity level, average lengths of stay are shown along with the average PMC Relative Intensity Score (PMC-RIS) for the patients in that group. The tertiary severity level provides a computerized way of defining major trauma patients who require the specialized service availability of trauma centers.

Based on the data included in the registry in 1987, the hospital in this study had 611 major trauma patients (tertiary) and 902 other significantly injured patients. There were also 151 minor injuries that met the statewide length of stay criteria for inclusion. There were, however, an additional 59 major trauma patients who were overlooked in the selection process of patients for registry abstraction. Even after the exclusionary criteria used by the state of Pennsylvania were imposed, this one hospital treated closer to 1,900 significantly injured patients per year as opposed to the 1,700 that are in the Pennsylvania Trauma Outcome Study (PTOS) and national Major Trauma Outcome Study (MTOS) trauma databases.

In each PMC severity level, the patients outside the registry were very similar to those included in the registry in terms of average lengths of stay and the PMC Relative Intensity Score (Table IV), indicating the resource use expected for that level of severity. Based on the data collected at this one trauma center, trauma patients are more accurately identified by PMCs and abstract data than they are by either DRGs and abstract data or the subjective process used to select cases for the registry.

DISCUSSION

It is difficult to establish the level of care required for trauma patients and evaluate its effectiveness without having information that is complete and clinically specific enough to use in making policy decisions. The present report provides the methodology to identify injuries present in *all* hospitals in an area, facilitate the accreditation/designation process, and evaluate the ef-

fectiveness of regionalized trauma care systems after their implementation.

Duplication in a regional trauma system is not only costly but also has implications for the quality and timeliness of the care delivered. Incorporating patient mix and volume criteria in the trauma center designation process is critical for moving what is now primarily a political process toward a systematic assessment of patterns of trauma care.

Until now, the lack of a clinically based patient classification that identifies trauma patients has impeded efforts to describe varying levels of trauma managed at different hospitals, and has also prevented efforts to evaluate the effectiveness of trauma centers in terms of patient outcomes and costs. The use of PMCs to analyze the costs and effectiveness of inpatient trauma care has the potential to close this research gap and contribute to regional and national policy development. PMCs can be used to analyze data available from virtually all hospitals, categorize injury types and measure trauma severity, and examine the local, regional, and national patterns of trauma care in the United States. The potential uses of such a tool seem endless.

Because PMCs can accurately identify hospitalized injuries by severity level using large existing databases, they have the potential to increase substantially the amount of information we have about the epidemiology of injuries and to evaluate outcomes of trauma care with comparative data. PMCs, unlike DRGs, can be used to improve injury surveillance, monitor morbidity and mortality outcomes, and make hospital payment systems more equitable. Although PMCs can be incorporated into trauma registries to identify specific types of injuries and severity levels of patients at trauma centers, they can also be readily implemented and used with existing non-trauma-center data and with large claims databases.

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APPENDIX A

TRAUMA PATIENT MANAGEMENT CATEGORIES BY LEVEL

RELEASE 3.2

PMC Number	PMC Description	Level
0501	Burn: Partial Thickness < 10 percent with Vital Site	Significant
0502	Burn: Partial Thickness 10-30 percent without Vital Site	Significant
0503	Burn: Partial Thickness 10-30 percent with Vital Site	Tertiary
0504	Burn: Partial Thickness > 30 percent	Tertiary
0505	Burn: Full Thickness ≤ 10 percent with Vital Site	Tertiary
0506	Burn: Full Thickness ≤ 10 percent without Vital Site	Significant
0507	Burn: Full Thickness > 10 percent	Tertiary
0508	Burn: Smoke Inhalation with Inhalation Injury	Tertiary
0509	Burn: Smoke Inhalation without Inhalation Injury	Minor
0512	Burn: Unspecified/Minor Burn	Minor
0513	Burn: Electrocution Injury with Minor Burn	Significant
2201	Maxillofacial Frx: Mandible/Maxilla Fracture	Significant
2202	Maxillofacial Frx: Nasal Fracture	Minor
2203	Maxillofacial Frx: Orbital Fracture with Operation	Significant
2204	Maxillofacial Frx: Orbital Fracture without Operation	Minor
2205	Maxillofacial Frx: Zygomatic Fracture	Significant
2206	Maxillofacial Frx: Multiple Facial Fractures	Tertiary
2211	Maxillofacial Frx: Superficial Facial Injury	Minor
2801	Ophthalmic Injury: Eye Burn	Tertiary
2802	Ophthalmic Injury: Lacrimal System Laceration	Minor
2803	Ophthalmic Injury: Laceration/Rupture of Cornea/Sclera	Tertiary
2804	Ophthalmic Injury: Blunt Globe Trauma with Operation	Tertiary
2805	Ophthalmic Injury: Blunt Globe Trauma without Operation	Minor
2901	Upper Extremity: Dislocated Elbow/Shoulder with ORIF	Significant
2902	Upper Extremity: Dislocated Elbow/Shoulder without ORIF	Significant
2903	Upper Extremity: Closed Frx Proximal/Head Humerus with ORIF	Significant
2904	Upper Extremity: Closed Frx Proximal/Head Humerus without ORIF	Significant
2905	Upper Extremity: Closed Frx Shaft Humerus with ORIF	Significant
2906	Upper Extremity: Closed Frx Shaft Humerus without ORIF	Significant
2907	Upper Extremity: Closed Frx Distal Humerus/Elbow with ORIF/Pinning	Significant
2908	Upper Extremity: Closed Frx Distal Humerus with Traction	Significant
2909	Upper Extremity: Closed Frx Distal Humerus with Closed Reduction	Significant
2910	Upper Extremity: Closed Frx Ulna with Dislocated Radial Head	Significant
2911	Upper Extremity: Closed Frx Forearm/Wrist with ORIF	Significant
2912	Upper Extremity: Closed Frx Forearm/Wrist without ORIF	Significant
2913	Upper Extremity: Open Fracture Hand, Crush Injury Fingers	Significant
2914	Upper Extremity: Open Fracture Radius/Ulna/Humerus	Significant
2915	Upper Extremity: Crush Injury Hand/Arm	Tertiary
2916	Upper Extremity: Nerve Laceration, Upper Extremity	Significant
2917	Upper Extremity: Fingertip Evulsion with Pedicle Graft	Significant
2918	Upper Extremity: Fingertip Evulsion without Pedicle Graft	Minor
2919	Upper Extremity: Digit Loss with Reattachment	Tertiary
2920	Upper Extremity: Digit Loss without Reattachment	Significant
2921	Upper Extremity: Other Traumatic Amputation	Tertiary
2922	Upper Extremity: Periarticular Soft Tissue Injury with Operation	Significant
2923	Upper Extremity: Periarticular Soft Tissue Injury without Operation	Minor
2925	Upper Extremity: Closed Frx/Dislocation Hand with ORIF	Minor
2926	Upper Extremity: Closed Frx/Dislocation Hand without ORIF	Minor
2927	Upper Extremity: Vascular Injury	Significant
3001	Lower Extremity: Torn Meniscus/Knee Cartilage	Significant
3002	Lower Extremity: Periarticular Soft Tissue Injury with Operation	Significant
3003	Lower Extremity: Compartment Syndrome	Significant
3004	Lower Extremity: Dislocated Knee	Significant
3005	Lower Extremity: Dislocated Patella	Significant

APPENDIX A (cont.)

PMC Number	PMC Description	Level
3006	Lower Extremity: Closed Frx Patella with Operation	Significant
3007	Lower Extremity: Closed Frx Patella without Operation	Significant
3008	Lower Extremity: Closed Frx Tibial Plateau with ORIF	Significant
3010	Lower Extremity: Closed Frx Tibial Plateau without ORIF	Significant
3011	Lower Extremity: Closed Frx Tibia/Fibula Shaft with ORIF	Significant
3012	Lower Extremity: Closed Frx Tibia/Fibula Shaft without ORIF	Significant
3013	Lower Extremity: Ankle Dislocation/Closed Fracture	Significant
3014	Lower Extremity: Calcaneus Fracture with ORIF	Significant
3016	Lower Extremity: Calcaneus Fracture without ORIF	Significant
3017	Lower Extremity: Closed Frx/Dislocation Foot with ORIF	Minor
3018	Lower Extremity: Closed Frx/Dislocation Foot without ORIF	Minor
3019	Lower Extremity: Open Frx Ankle/Tibia/Fibula	Significant
3020	Lower Extremity: Crush Injury Foot/Leg	Tertiary
3021	Lower Extremity: Traumatic Amputation Foot/Leg	Tertiary
3022	Lower Extremity: Periarticular Soft Tissue Injury without Operation	Minor
3023	Lower Extremity: Open Frx Foot, Crush Injury/Amputation Toes	Significant
3025	Lower Extremity: Vascular Injury	Significant
3103	Physical/Chemical Injury: Near Drowning	Tertiary
3104	Physical/Chemical injury: Frostbite	Significant
3105	Physical/Chemical Injury: Hypothermia	Tertiary
3106	Physical/Chemical Injury: Caustic Injury of GI Tract with Operation	Tertiary
3107	Physical/Chemical Injury: Caustic Injury of GI Tract without Operation	Minor
3201	Abdominal Injury: Minor Organ without Operation	Significant
3202	Abdominal Injury: Minor Organ with Exp	Tertiary
3203	Abdominal Injury: Minor Organ with Operation	Tertiary
3204	Abdominal Injury: Major Organ Injury	Tertiary
3205	Abdominal Injury: Vascular Injury	Tertiary
3206	Abdominal Injury: Abdominal/Perineal Laceration/Contusion	Minor
3301	Thoracic Injury: Laceration/Contusion of Chest Wall	Minor
3303	Thoracic Injury: Rib Frx/Pulmonary Contusion	Significant
3304	Thoracic Injury: Myocardial Contusion	Tertiary
3305	Thoracic Injury: Pneumothorax/Hemothorax with Operation	Tertiary
3306	Thoracic Injury: Pneumothorax/Hemothorax without Operation	Significant
3307	Thoracic Injury: Vascular Injury	Tertiary
3308	Thoracic Injury: Penetrating Cardiac Injury	Tertiary
3309	Thoracic Injury: Trachea/Broncheal/Esophagus Injury with Operation	Tertiary
3310	Thoracic Injury: Trachea/Broncheal/Esophagus Injury without Operation	Significant
3312	Thoracic Injury: Penetrating Neck Injury with Operation	Tertiary
3313	Thoracic Injury: Penetrating Neck Injury without Operation	Minor
3314	Thoracic Injury: Flail Chest	Tertiary
3315	Thoracic Injury: Foreign Body Trachea/Bronchus/Esophagus	Minor
3401	Spine Injury: Vertebral Dislocation	Significant
3402	Spine Injury: Cord Injury without Fracture/Dislocation	Tertiary
3403	Spine Injury: Fracture with Cord Injury with Operation	Tertiary
3404	Spine Injury: Fracture with Cord Injury without Operation	Tertiary
3405	Spine Injury: Fracture without Cord Injury with Operation	Tertiary
3406	Spine Injury: Fracture without Cord Injury without Operation	Minor
3501	Head Injury: Superficial Head Injury	Minor
3502	Head Injury: Linear Frx/Concussion with No/Brief LOC	Significant
3503	Head Injury: Linear Frx/Concussion with Moderate/Prolonged LOC	Tertiary
3504	Head Injury: Depressed Skull Frx with Operation	Tertiary
3505	Head Injury: Hematoma/Edema with No/Brief LOC with Operation	Tertiary
3506	Head Injury: Hematoma/Edema with No/Brief LOC without Operation	Tertiary
3507	Head Injury: Hematoma/Edema with Moderate/Prolonged LOC with Operation	Tertiary
3508	Head Injury: Hematoma/Edema with Moderate/Prolonged LOC without Operation	Tertiary
4720	Supplementary Category: Uncomplicated Contusions/Superficial Wound	Minor
4721	Supplementary Category: Uncomplicated Sprain/Strain	Minor
4801	Femur/Pelvic Frx: Closed Pelvic Ring Frx with ORIF	Tertiary
4802	Femur/Pelvic Frx: Closed Pelvic Ring Frx without ORIF	Significant
4803	Femur/Pelvic Frx: Open Pelvic Ring Frx	Tertiary

APPENDIX A (cont.)

PMC Number	PMC Description	Level
4804	Femur/Pelvic Frx: Acetabular Frx with ORIF	Tertiary
4805	Femur/Pelvic Frx: Acetabular Frx without ORIF	Significant
4806	Femur/Pelvic Frx: Dislocated Hip	Significant
4807	Femur/Pelvic Frx: Transcervical/Intertrochanteric Frx	Significant
4808	Femur/Pelvic Frx: Impacted Subcapital Frx with Operation	Significant
4809	Femur/Pelvic Frx: Impacted Subcapital Frx without Operation	Significant
4810	Femur/Pelvic Frx: Supracondylar/Intracondylar Frx with ORIF	Significant
4811	Femur/Pelvic Frx: Supracondylar/Intracondylar Frx without ORIF	Significant
4813	Femur/Pelvic Frx: Shaft/Distal Femur Frx with ORIF	Significant
4814	Femur/Pelvic Frx: Shaft/Distal Femur Frx without ORIF > Age 5	Significant
4815	Femur/Pelvic Frx: Shaft/Distal Femur Frx without ORIF $\leq$ Age 5	Significant
4823	Femur/Pelvic Frx: Vascular Injury	Significant

APPENDIX B

DRG TRAUMA LISTING

DRG Number	DRG Description
2	Craniotomy for Trauma Age > 17
9	Spinal Disorders and Injuries
27	Traumatic Stupor and Coma, Coma > 1 Hour
28	Traumatic Stupor and Coma, Coma < 1 Hour Age > 17 with CC
29	Traumatic Stupor and Coma, Coma < 1 Hour Age > 17 without CC
30	Traumatic Stupor and Coma, Coma < 1 Hour Age 0-17
32	Concussion Age > 17 without CC
33	Concussion Age 0-17
72	Nasal Trauma and Deformity
83	Major Chest Trauma with CC
84	Major Chest Trauma without CC
210	Hip and Femur Procedures except Major Joint Age > 17 with CC
211	Hip and Femur Procedures except Major Joint Age > 17 without CC
212	Hip and Femur Procedures except Major Joint Age 0-17
218	Lower Extremity and Humerus Procedure except Hip, Foot, Femur Age > 17 with CC
219	Lower Extremity and Humerus Procedure except Hip, Foot, Femur Age > 17 without CC
220	Lower Extremity and Humerus Procedure except Hip, Foot, Femur Age 0-17
235	Fractures of Femur
236	Fractures of Hip and Pelvis
237	Sprains, Strains, and Dislocations of Hip, Pelvis and Thigh
250	Fractures, Sprains, Strains, and Dislocations of Forearm, Hand, Foot Age > 17 with CC
251	Fractures, Sprains, Strains, and Dislocations of Forearm, Hand, Foot Age > 17 without CC
252	Fractures, Sprains, Strains, and Dislocations of Forearm, Hand, Foot Age 0-17
253	Fractures, Sprains, Strains, and Dislocations of Upper Arm, Lower Leg except Foot Age > 17 with CC
254	Fractures, Sprains, Strains, and Dislocations of Upper Arm, Lower Let except Foot Age > 17 without CC
255	Fractures, Sprains, Strains, and Dislocations of Upper Arm, Lower Leg except Foot Age 0-17
280	Trauma to the Skin, Subcutaneous Tissue and Breast Age > 17 with CC
281	Trauma to the Skin, Subcutaneous Tissue and Breast Age > 17 without CC
282	Trauma to the Skin, Subcutaneous Tissue and Breast Age 0-17
439	Skin Grafts for Injuries
440	Wound Debridements for Injuries
441	Hand Procedures for Injuries
442	Other O.R. Procedures for Injuries with CC
443	Other O.R. Procedures for Injuries without CC
444	Multiple Trauma Age > 17 with CC
445	Multiple Trauma Age > 17 without CC
446	Multiple Trauma Age 0-17
454	Other Injury, Poisoning and Toxic Effect Diagnosis with CC
455	Other Injury, Poisoning and Toxic Effect Diagnosis without CC