Premier Healthcare Database:

Data That Informs and Performs

Premier Applied Sciences®,
the Research Division of Premier Inc.

March 2, 2020

This white paper provides a detailed description of the attributes and capabilities of the Premier Healthcare Database (PHD), which has been utilized by the pharmaceutical and device industries, academia, healthcare insurers and healthcare policy makers for clinical, financial and outcomes analyses. Since the year 2000, more than 600 publications in peer-reviewed journals – *the gold standard for publishing research* – have included more than 110 articles written by Premier staff in multiple therapeutic and quality improvement/patient safety areas (Premier Applied Sciences® website). Details on data source, type and scope are outlined. Premier Applied Sciences® is the Research Division of Premier Inc. and is responsible for leveraging the HIPAA-compliant PHD through its highly professional and experienced team.

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INTRODUCTION

Electronic healthcare databases house "big data" and offer several advantages as a robust research tool[1-3]. A comprehensive hospital-based healthcare history of each patient in the healthcare system may be available. Patients and physicians are not involved in data collection, thus eliminating potential bias that may come with being observed. Since data accrues from a large diverse population, rare outcomes and long-term effects can be studied. The data reflects the state of clinical practice in the general population. These real-world databases lend themselves to the creation of profiles of drug use and physician prescribing practices and the conduct of post-marketing studies on treatment effectiveness, safety issues and cost-effectiveness. Due to its electronic format, information is readily accessible. With appropriate approvals in place, healthcare databases from multiple sources including electronic medical records and claim databases may be able to be linked to provide additional analytic power. In addition, a new paradigm is emerging for use of real-world evidence from a variety of real-world data sources to supplement randomized clinical trials and support regulatory decision making for drugs and devices[4,5].

BACKGROUND

The Premier Healthcare Database (PHD) is one of the most comprehensive electronic healthcare databases. It originates from the merger of Premier with American Healthcare Systems and SunHealth in 1997, when the largest healthcare network of its time was created[6]. The Premier Alliance committed to investing significant financial resources into a database to improve quality of care[7]. Since that time, Premier Inc. has emerged as a leader in healthcare transformation. From Premier's early beginnings as a Group Purchasing Organization to its leadership in patient safety and quality improvement initiatives, the PHD has been a valuable resource to the pharmaceutical and device industries, academia, federal and national healthcare agencies (including the Centers for Disease Control and Prevention, Centers for Medicare Services[8], Food and Drug Administration[9], and National Institutes of Health), as well as to Premier's member hospitals and health systems to improve healthcare delivery and reduce costs. The PHD, formerly known as the Premier Research Database, Premier Hospital Database, Premier Perspective™ Database, Premier Perspective™ Comparative Hospital Database and Premier Analytical Database has more than 1,041 contributing hospitals/healthcare systems. The PHD provides a unique opportunity to use real-world data to

conduct evidence-based and population-based analyses of drugs, devices, other treatments, disease states, epidemiology, resource utilization, healthcare economics and clinical outcomes.

PREMIER HEALTHCARE DATABASE

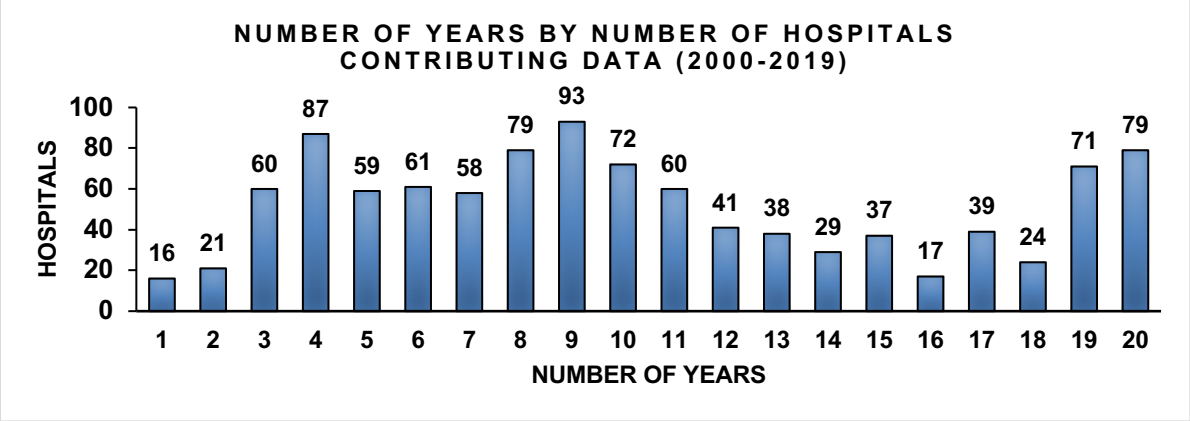
Overview

The PHD is a large, U.S. hospital-based, service-level, all-payer database that contains information on inpatient discharges, primarily from geographically diverse non-profit, non-governmental and community and teaching hospitals and health systems from rural and urban areas. Hospitals/healthcare systems submit administrative, healthcare utilization and financial data from patient encounters. Inpatient admissions include over 121 million* visits with more than 10 million* per year since 2012, representing approximately twenty-five percent of annual United States inpatient admissions (https://www.aha.org/system/files/2018-05/2018-chartbook-table-3-1.pdf). Outpatient encounters include over 897 million* outpatient visits, with more than 93 million* visits per year since 2012. Outpatient visits to emergency departments, ambulatory surgery centers and alternate sites of care are included. The PHD contains data from over 231 million* unique patients. Using a unique masked identifier, patients can be tracked in the same hospital across the inpatient and hospital-based outpatient settings, with the ability to assess hospital length of stay and readmissions to the same hospital. The PHD contains a subset of data from the Premier Quality Advisor™ Platform that offers de-identified, HIPAA compliant data. Depending upon the nature of the research, using PHD data may be considered exempt from Institutional Review Board (IRB) oversight as dictated by Title 45 Code of Federal Regulations, Part 46 of the United States, specifically 45 CFR 46.101(b)(4). In addition, in accordance with the HIPAA Privacy Rule, disclosed data from the PHD are considered de-identified per 45 CFR 164.506(d)(2)(ii)(B) through the "Expert Determination" method.

Premier's hospital quality improvement technology solution, Quality Advisor™, contains 45 percent of all United States discharges. Premier Quality Advisor™ measures and analyzes performance to improve patient outcomes and reduce costs by integration of quality, safety and financial data. This is accomplished through benchmarking clinical and financial outcomes against peer hospitals; comparing internal and external performances in shaping best decisions; identifying care practice variations; reducing mortality, complications, readmissions and hospital-associated conditions; monitoring ongoing efforts to improve quality, resource utilization, and efficiency; and complying with regulatory reporting requirements.

**Note: All metrics reported within the White Paper are based upon 2000 – June 30, 2019) data available March 2, 2020*

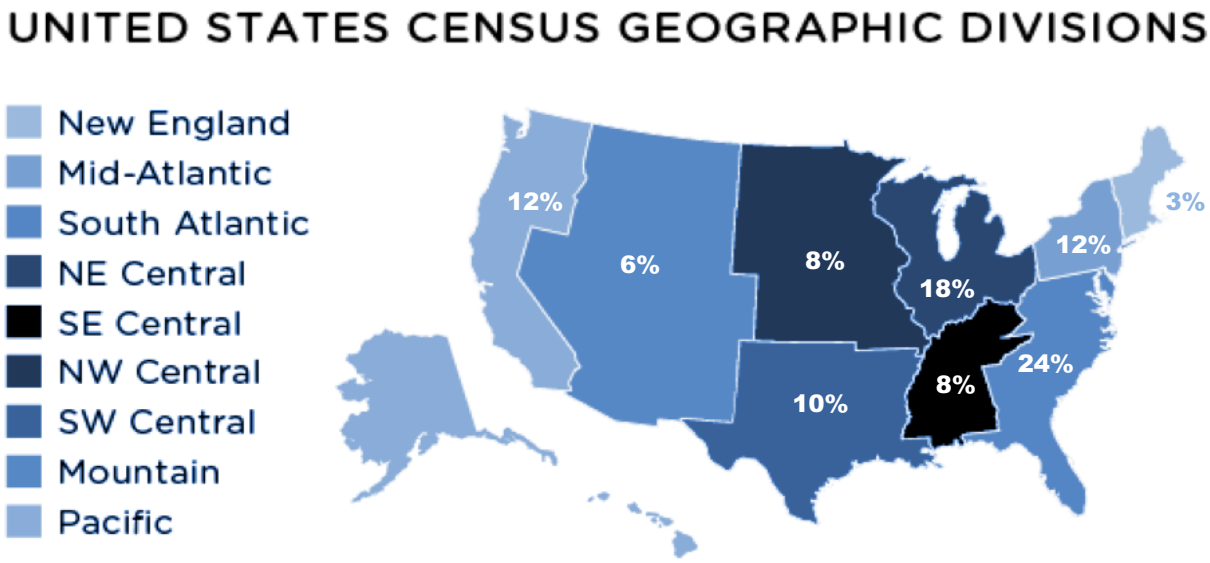
The PHD is a dynamic database that is updated weekly, with data accruing since January 2000. Since 2012, there have been more than 700 hospitals contributing data each year. To date, the PHD now maintains cumulative information from more than 1,041 hospitals. The number of years that hospitals/healthcare systems have been providing data to Premier, Inc. is represented in the longitudinal graph below.



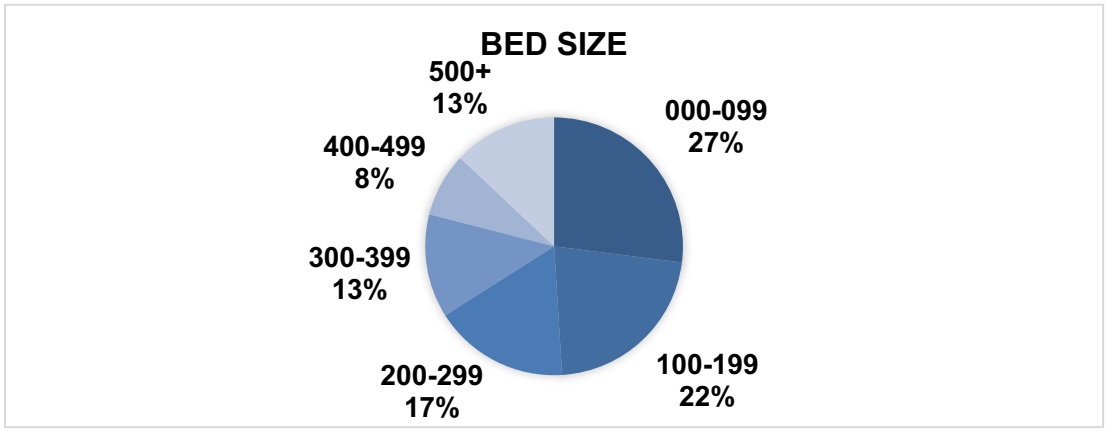
The PHD contains information on hospital and visit characteristics; admitting and attending physician specialties; healthcare payers; and patient data from standard hospital discharge billing files. This data includes demographics and disease states; admission and discharge diagnoses; information on billed services including costs at the departmental level such as medications and devices, laboratory tests performed, diagnostic and therapeutic services; microbiology test results (for a subset of hospitals); and patient disposition and discharge health status. For most data elements, less than one percent of patient records having missing information and for key elements, such as demographics and diagnostic information, less than 0.01 percent have missing data[10].

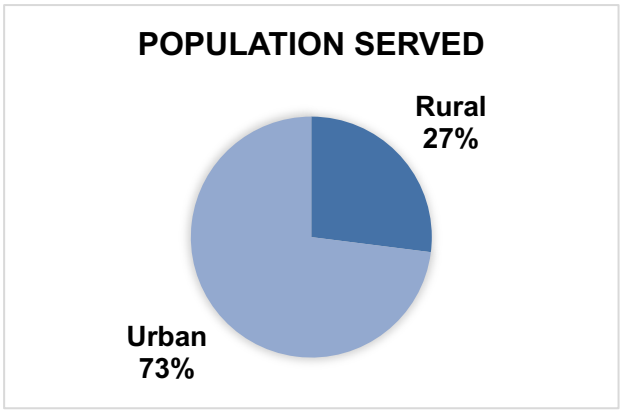
Hospital and Visit Characteristics

The PHD utilizes member hospital statistics provided through a combination of self-report and the American Hospital Association Annual Survey Database™. Hospitals in the PHD represent the four geographic regions and their respective divisions defined by the United States Census (Northeast: *New England, Middle Atlantic*; Midwest: *East North Central, West North Central*; South: *South Atlantic, East South Central, West South Central*; West: *Mountain, Pacific*).

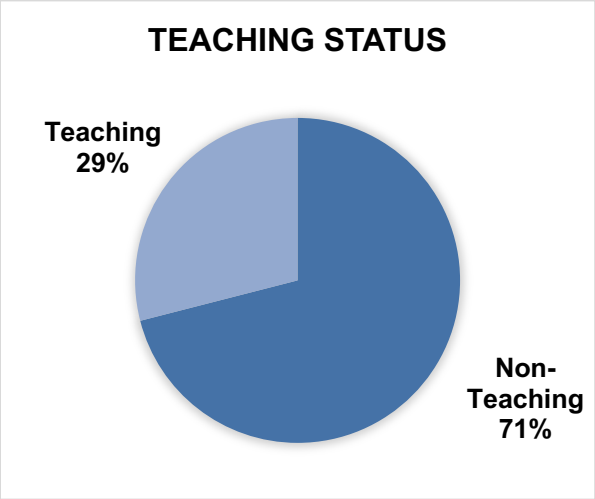


Hospital characteristics of bed capacity, urban and rural populations served, and teaching status are recorded for all hospitals contributing data.





The United States Census defines an urban area as a territory whose core census block groups or blocks have a population density of at least 1000 people per square mile, and surrounding census blocks have an overall density of at least 500 people per square mile. Rural areas are considered territory outside the definition of urban (https://www.census.gov/geo/reference/urban-rural.html).



A teaching facility has either a Medical school affiliation reported to the American Medical Association or a documented affiliation agreement with a medical school accredited by the Association of American Medical Colleges Liaison Committee on Medical Education. These organizations must sponsor or participate significantly in at least four approved active residency programs. At least two of the approved residency programs should be in medicine, surgery, obstetrics/gynecology, pediatrics, family practice, or psychiatry.

Comparisons of the 2018 member hospital characteristics from the PHD with those from the American Hospital Association (AHA) demonstrate a similar distribution, although the AHA has a greater number of smaller member hospitals.

	PHD (2018)	AHA DATABASE (2018)*
	N (%)	N (%)
All Facilities	766 (100)	4,364(100)
Provider Region		
Midwest	204 (26.6)	1,320 (30.2)
Northeast	115 (15.0)	534 (12.2)
South	336 (43.9)	1,632 (37.4)
West	111 (14.5	878 (20.1)
Rural/Urban		
Rural	228 (29.8)	1,051 (24.1)
Urban	538 (70.2)	3,313(75.9)
Beds		
000-099	229 (29.9)	2,220 (50.9)
100-199	173 (22.6)	891 (20.4)
200-299	119 (15.5)	509 (11.7)
300-399	95 (12.4)	294 (6.7)
400-499	51 (6.7)	164 (3.8)
500+	99 (12.9)	286 (6.6)
Teaching Status		
Non-Teaching	549 (71.7)	2,582 (59.2)
Teaching	217 (28.3)	1,782 (40.8)

**Latest available data from the AHA*

Hospital Level Data

Hospital level information available in the PHD includes admitting and attending physician specialties, point of origin, type of admission and discharge status (including mortality). Definitions are based on the elements found in hospital claims derived from the uniform billing form (UB-04) and categorized into Premier standard definitions, as well as Premier's proprietary Data Dictionary.

HOSPITAL LEVEL DATA
POINT OF ORIGIN NON-HEALTHCARE FACILITY • Patients coming from home or workplace, or patients receiving care at home (such as home health service) CLINIC OR PHYSICIAN'S OFFICE TRANSFER • Ambulatory Surgery Center; another Home Health Agency • Distinct unit to another in same hospital with separate claim • Healthcare facility or Born outside hospital • Hospice, under plan or enrolled • Skilled nursing facility • Hospital (different facility) • Other/unknown such as born inside hospital, Court/Law Enforcement, Information not available
TYPE OF ADMISSION EMERGENCY • Patient requires immediate medical intervention as a result of severe, life threatening or potentially disabling conditions. Generally, the patient was admitted through the emergency room URGENT • Patient required immediate attention for the care and treatment of a physical or mental disorder. Generally, the patient was admitted to the first available and suitable accommodation TRAUMA CENTER • Visits to a trauma center/hospital as licensed or designated by the State or local government authority authorized to do so, or as verified by the American College of Surgeons and involving a trauma activation ELECTIVE • Patient's condition permitted adequate time to schedule the availability of suitable accommodations. OTHER/UNKNOWN • Newborn • Information not available
DISCHARGE STATUS TRANSFER TO ANOTHER HEALTH CARE FACILITY • Discharged/transferred to another type of health care institution not defined elsewhere in this list with or without a planned acute care hospital inpatient readmission • Nursing facility certified under Medicaid but not certified under Medicare with or without a planned acute care hospital inpatient readmission • Facility that provides custodial or supportive care with or without a planned acute care hospital inpatient readmission • Short term general hospital for inpatient care with or without a planned acute care hospital inpatient readmission • Skilled nursing facility (SNF) with Medicare certification with or without a planned acute care hospital inpatient readmission • Designated cancer center or children's hospital with or without a planned acute care hospital inpatient readmission • Federal health care facility with or without a planned acute care hospital inpatient readmission • Inpatient rehabilitation facility (IRF) including rehabilitation distinct part units of a hospital with or without a planned acute care hospital inpatient readmission • Medicare certified long term care hospital (LTCH) with a planned acute care hospital inpatient readmission • Critical Access Hospital (CAH) • Other short term general hospital for inpatient care

TRANSFER TO ANOTHER CARE FACILITY (CONTINUED)

- Intermediate care facility (ICF)
- Another type of institution for inpatient care (including distinct parts); Psychiatric hospital or psychiatric distinct unit of a hospital
- Skilled nursing facility (SNF) with Medicare certification in anticipation of covered skilled care
- Within this institution to a hospital-based Medicare approved swing bed, nursing facility, designated cancer center or children's hospital; another type of health care institution not defined elsewhere in code list; long term care hospitals; another rehabilitation facility

HOME

- Home/self care
- Home or self-care with a planned acute care hospital readmission
- Home care of organized home health service organization
- Home under care of organized home health service organization with a planned acute care hospital inpatient readmission

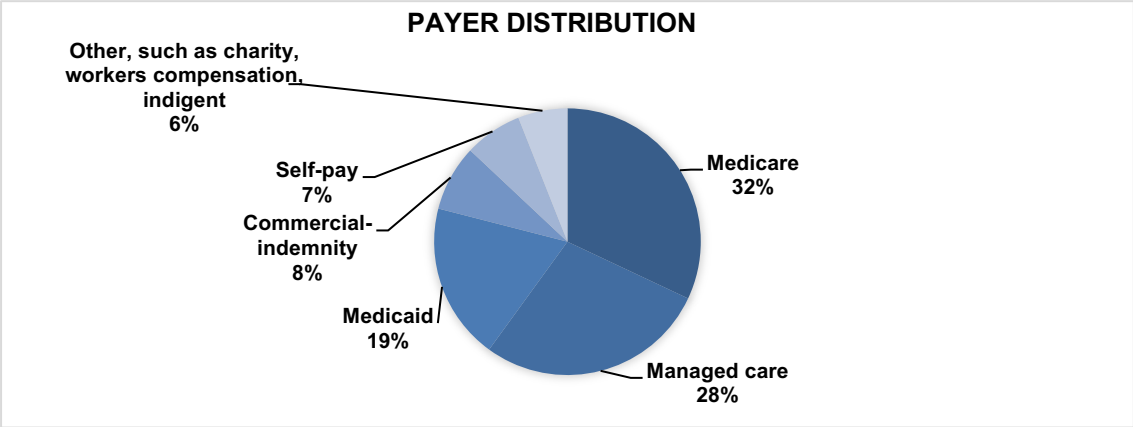
HOSPICE

EXPIRED

OTHER/UNKNOWN

- Left against medical advice
- Court/law enforcement with or without a planned acute care hospital inpatient readmission
- Still patient or expected to return for outpatient services
- Information not available

Type of primary payer coverage information adds an important dimension to the PHD and is a useful surrogate for socioeconomic status of patient.



Hospital Encounter Level Data

Patient demographics include age, sex, race (white, black, other) and ethnicity (Hispanic, non-Hispanic). International Classification of Diseases (ICD) Diagnosis Codes for each hospital encounter (ICD-9 for discharge dates prior to10/1/2015 or ICD-10 for discharge dates on or after 10/1/2015) identify disease states and comorbid conditions. ICD procedure codes (version 9 and 10 as described above) as well as hospital submitted Current Procedural Terminology (CPT) and Healthcare Common Procedure Coding System (HCPCS) codes identify diagnostic and therapeutic procedures ordered during hospital encounters. There is no limit on the number of ICD diagnosis codes that are provided, therefore, all codes provided by the hospital are

contained within the PHD.

Detailed pharmacy data including brand/generic drug names, strength, dosing, route of administration, day of service charge, and quantity charged are available in the PHD. Medical devices and supply utilization can also be identified with day of service charge. The PHD also contains microbiology laboratory result data from over 370 hospitals, including specimen ID, test name, test day of service and time, specimen source, result, sensitivity data, and observation status (ie, final, corrected) cumulatively from 2009 forward.

The PHD has the required data necessary for the generation of several clinical algorithms. 3M™ All Patient Refined™ Diagnosis Related Group (APR™-DRG), Severity of Illness (APR-SOI), and Risk of Mortality (APR-ROM) accounts for age, procedures and clinical severity of primary diagnosis and all secondary diagnoses assigned in the course of hospitalization and are computed for each patient at the time of hospital discharge[11]. Elixhauser Comorbidity Index measures patient comorbidity based on ICD-9 and ICD-10 diagnosis codes and has been found to be predictive of hospital resource use and in-hospital mortality[12-14]. Charlson Comorbidity Index measures overall health status through assessment of comorbidities at time of discharge[14-16]. Each comorbidity category has an associated weight based on the adjusted risk of one-year mortality, and the sum of all the weights results in a single comorbidity score for a patient. A score of zero indicates that no comorbidities were found. The higher the score, the more likely the predicted outcome will result in higher resource use or mortality. Cunningham Bleeding Score identifies oral anticoagulant bleeding-related hospitalizations calculated from a primary discharge[17].

Billing and Financial Data

Costs (fixed and variable) to the hospital and charges to the payer can be determined from the PHD. The PHD charge master (CDM) is a comprehensive table of items billable to a hospital patient or a patient's health insurance provider. It includes hospital services, medical procedures, equipment fees, supplies, drugs and diagnostic evaluations such as imaging and laboratory tests. Days of services/supplies/drugs ordered, delivered/administered, and billed are documented. Each item in the CDM is assigned a unique identifier code and a set price that is used to generate patient bills. Each hospital system maintains its own CDM. Reimbursement data is unavailable within these data, as it remains proprietary information held by the hospitals and payers.

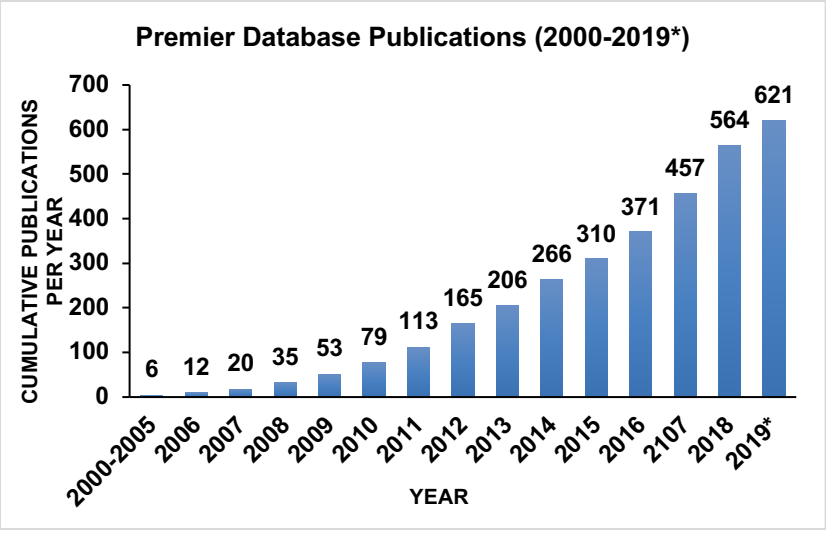
Two versions of cost are available. Procedural costs are determined by each hospital using their own cost accounting systems. For hospitals that are identified as ratios of costs to charges

(RCC), the hospitals provide Premier with the charge data, and teams at Premier work with the hospitals to assign Medicare Cost to Charge Ratios (MCCR) to the data provided. Regardless of the source of the cost and charge data, they are reviewed and validated against the data from the hospital at the visit and total numbers within certain variances, before use within the database.

Uses of Data

Data from the PHD provides insights into patient characteristics, patient care patterns, outcomes and burden of illness over time, and for a wide range of therapeutic areas and products/devices. Market assessments, comparative effectiveness analyses, cost analysis and cost-effectiveness studies are frequently conducted using the PHD. Data licensing permits external companies to perform analytics using the data. While the PHD data cannot be used for linking with other databases, additional approvals may be obtained for specific projects that would allow the healthcare database to be linked to other databases such as electronic medical records and claim databases (see ***PHD-Optum linked database***). Member hospitals can assess resource utilization, patient outcomes and clinical and benchmark performances. These metrics satisfy ORYX® reporting requirements and core performance measurements of The Joint Commission, formerly known as Joint Commission on Accreditation of Healthcare Organizations (JCAHO).

To date, a total of 621 Premier Database publications appear in refereed journals. The graph below highlights the progressive increase of publications using Premier data† from 2000 through 2019*.



112 publications authored by a Premier researcher appear in 75 peer-reviewed journals between 2006 and December 2019. 509 publications that did not have a Premier researcher as an author appear in 207 peer-reviewed journals from 2000 to March/April 2019.

†Small number of publications utilize Premier data sources (i.e., Operation Advisor, QUEST) other than the PHD
**2019 (partial year for publications without a Premier author)*

PHD-Optum Linked Database

Through an agreement with Optum, Premier and Optum have created a HIPAA compliant, de-identified, matched research dataset with the PHD and claims data from Optum. For the subset of applicable patients in the PHD, detailed hospital reported data is augmented with outpatient claims, prescription claims, inpatient encounters in non-PHD hospitals, and selected laboratory test results from Optum, providing a unique resource for longitudinal analyses, including analyses of the patient journey.

The current matched dataset contains over 3 million matched inpatient encounters from 1003 hospitals between May 2000 through December 2018 for over 2 million unique patients. In addition, all other applicable inpatient and outpatient encounters and claims for these patients are included in the dataset. During these 20 years, 94% of matched inpatient encounters had at least one follow up encounter from the Optum data, and 17% of matched inpatient encounters were pregnancy or newborn related. The table below summarizes the distribution of patient demographics and hospitals characteristics of the matched inpatient encounters in the PHD-Optum database.

CHARACTERISTICS OF THE MATCHED INPATIENT ENCOUNTERS IN THE PHD-OPTUM DATABASE			
PATIENT DEMOGRAPHICS % of Encounters*		HOSPITAL CHARACTERISTICS % of Encounters*	
Age Groups (years)		Teaching Status	
0	3.1%	Non-teaching	58%
1-12	1.5%	Teaching	42%
13-18	1.5%	Populations Served	
19-29	8.9%	Rural	7%
30-39	12.4%	Urban	93%
40-49	9.4%	Bed Size	
50-59	13.8%	0-99	4%
60-64	8.0%	100-199	13%
65-74	18.3%	200-299	15%
75-80	9.5%	300-399	18%
>80	13.5%	400-499	14%
Sex		>500	36%
Female	60%		
Male	40%		
Race/Ethnicity			
Black	11%		
Hispanic	2%		
Other	13%		
Unknown	1%		
White	73%		

**denominator=3.04 million*

The PHD-Optum linked database can provide a more comprehensive view of health care services and prescriptive medications utilization before and after the matched inpatient encounter. This is particularly advantageous when following postsurgical patients requiring prescribed therapies and physician follow-up; patients with chronic diseases (such as

cardiovascular, diabetes, chronic obstructive disease, and cancer); and drug adherence and refill patterns. While the PHD provides details contained in the hospital charge master (service-day level information for medications, procedures, and microbiology laboratory results), Optum claims data provides a wide range of information on outpatient visits to physician offices, laboratory and diagnostic services, therapy, and outpatient pharmacy services. In addition, mortality may be more widely captured through multiple resources available from Optum.

The PHD-Optum linked database also provides a comprehensive look at financial data for both inpatient and outpatient costs, charges, and payments to more fully understand the economic burden of illness. While the PHD provides detailed overall, departmental, and service level costs for inpatient and outpatient encounters that are reported by the hospital, Optum provides charge data based on insurance charges and final payments. Outsourced services including those of contracting physicians or claims costs not directly incurred by the hospital can be identified. Insights into resource utilization and physician charges in the inpatient and outpatient settings could be helpful to understand the full economic impact of care.

ABOUT PREMIER APPLIED SCIENCES

Premier Applied Sciences (PAS) is the Research Division of Premier Inc. with a dedicated staff of skilled professionals (https://www.premierinc.com/transforming-healthcare/healthcare-performance-improvement/premier-applied-sciences/) with diverse education, expertise and working experience.

The PAS Research and Analytics team consists of highly specialized professionals formally trained in Medicine, Pharmacy, Epidemiology, Public Health, Economics and Statistics. This team provides an experienced and uniquely qualified interface and partnership between clients and the PHD to create robust analytic output in a timely manner. The *Research Scientists,* with complete knowledge of the data available from the PHD, work closely with our clients to create customized research protocols and statistical analysis plans ranging from descriptive studies to advanced statistical models used in adjusted analysis to provide high quality, real-world evidence. Reports summarizing the work and results are provided to our clients with slide decks, if requested. The *Analysts* on the team create programs to extract data from the PHD and create analytic files, generate tables, figures and graphs, and provide statistical programming support.

The PAS Intervention team partners with clients and stakeholders from across the healthcare spectrum to develop, orchestrate, and test approaches that address key challenges in health

care. Our experienced healthcare professionals have backgrounds in qualitative research, implementation and improvement science, population health management, system theory, and evidence-based medicine. This team promotes the practical application of performance improvement, patient engagement, and shared learning in the efficient implementation and management of all aspects of real-world evidence projects in healthcare. *Intervention Research Specialists* work closely with clients to outline goals, approaches, and methods to develop responsive project plans on population health improvement projects that include standard literature reviews; quantitative and qualitative pre/post assessments; interventions that include development of standardized tools and educational content; assessment of practice barriers and knowledge gaps at the patient, provider, and system levels; and quality measure development to support monitoring quality improvement. *Design and Intervention Specialists* work with clients to support the initial project concepts, create the standardized tools and educational content to facilitate improvement activities and lead the application of improvement science best practices. The *Recruitment* team serves as a liaison between the Intervention Research team, the Design and Intervention team, the client, and Premier members who may wish to participate in projects. The PAS Intervention and PAS Research and Analytics teams work together to disseminate findings and outcomes through publications, conferences and existing Premier products and services.

In addition to the Research and Analytics team and Intervention team, a full-time experienced *Medical Communication Specialist* is on staff to assist with abstracts, posters, manuscripts, and journal submissions. The *Program Directors* and *Strategic Account Directors* are a team of seasoned sales professionals who liaison between clients and PAS to ensure constant dialogue about current and future project needs. Their experience in the pharmaceutical, medical device, and healthcare industries enhances their ability to assist clients in utilizing the PHD to obtain information to support market access and value-based propositions and drive product use through real-world outcomes data.

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