

# CREATING LONGITUDINAL HOSPITAL-LEVEL DATASETS

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## TABLE OF ABBREVIATIONS

ACLAIMS	Automated Certification and Licensing Administrative Information and Management System
ACLAIM_ID	Identifier assigned by Licensing and Certification to a given facility or sub-unit in a facility.
AHDR	Annual Hospital Disclosure Reports
AURH	Annual Utilization Review of Hospitals
CHOW	Change of Ownership
CMS	Centers for Medicare and Medicaid Services
CONSOL	Hospital Consolidations
DHS	Department of Health Services
EMTALA	Emergency Medical Treatment and Labor Act
ER	Emergency Room
FFS	Fee for Service
GACH	General Acute Care Hospitals
HISTHOSP	History of Hospitals
HOSTATA	Hospital Status Change File
HSA	Health Service Agency
HFPA	Health Facilities Planning Area
HRSA	Health Resources and Services Administration
ICD-9-CM	International Classification of Diseases, 9th Revision, Clinical Modification
ICU	Intensive Care Unit
IOM	Institute of Medicine
LCD	Licensing and Certification, Department of Health Services
MC	Managed Care
MCALID	Medi-Cal Contract Provider Number
MCARID	Medicare Provider Number
MD	Medical Doctor
MSA	Medical/Surgical Acute care
OSHPD	Office of Statewide Health Planning and Development
OSHPDID	6-digit identifier OSHPD assigns to facilities that report to it. The first 2-digits indicate the county where the hospital is located. The other is the identifier within the county.
PAC, PACU	Pediatric Acute Care (Unit)
PDD	Patient Discharge Data
PERM_ID	A longer version of the OSHPDID, that includes
PIC, PICU	Pediatric Intensive Care (Unit)
SPA	Service Provider Area
TDS	Total Daily Service

## **CREATING LONGITUDINAL HOSPITAL-LEVEL DATASETS**

A central part of the FHOP research agenda is to examine relationships between changes in the hospital infrastructure and changes in hospital outcomes for children and young adults. A fundamental infrastructure issue is whether hospitals are open and if so, whether they care for this population. We initially thought it would be simple to answer the question, "How many hospitals were open each year?" Answering this turned out to be one of the most time consuming research tasks we have undertaken. As our understanding grew, our task changed to ask the following: Is the facility open? Where is it geographically? Is it really a general acute care hospital (GACH)? Is it discharging children? What is the licensed bed capacity? Is it licensed to provide pediatric care? Who owns it?

Per California regulations, hospital licenses are based on a given physical location. When hospitals disappear from various data files the explanation is not readily apparent. We must determine whether it is because the facility closed, merged, converted to consolidated reporting, or moved, resulting in a new license ID. Yet another possibility is that a new license ID was assigned to a facility at the same location. We had to develop a series of decision rules to resolve such issues in a longitudinally consistent manner. These included rules to handle changes in hospital identifiers, physical location, consolidated data reporting, ownership, organizational type (nonprofit or public to profit), and structural capacity (bed types, emergency room availability). This document provides a full discussion of the issues encountered in creating the hospital-level datasets, their resolution, and the creation of related analysis datasets and variables.

### **PRIMARY HOSPITAL DATASETS**

#### **PATIENT DISCHARGE DATA.**

The Office of Statewide Health Planning and Development (OSHPD) provided confidential patient discharge data (PDD) from 1983 forward. All hospitals except certain state or federal hospitals are required to submit data summarizing each hospital discharge. These large annual datafiles contain arrays of diagnoses and procedures, as well as other information to describe the patient, geographic characteristics, and the clinical course of care for every patient discharged in a given year. A description of the methods used to create individual-level PDD datasets is available elsewhere.<sup>1</sup>

We summarize all PDD records for various purposes. One summary we always do tallies the numbers of discharges by hospital, type of care, admission source, and admission month. We use this summary file to identify hospitals actually providing care at a given time. It also allows us to empirically identify how hospitals specify the types of services provided, particularly of specialized (rehabilitation, psychiatric, long-term care). For these same purposes, we also make a similar summary file for children. These files are described elsewhere.<sup>1</sup>

#### **ANNUAL HOSPITAL DISCLOSURE REPORTS**

OSHPD requires every hospital to file the Annual Hospital Disclosure Report (AHDR), summarizing its financial and utilization characteristics. Unlike the PDD which is based on a calendar year, the AHDR is based on the hospital's fiscal year. About half the hospitals have a fiscal year that coincides with the calendar year. In a given year, a hospital may file one to  $n$  AHDR, depending on changes in fiscal year, ownership, or closings and reopenings. The AHDR provides summary information by hospital sub-unit. To examine structural changes, we use

AHDR files from June 1982 forward.<sup>2</sup> These files are updated annually as each year becomes available.

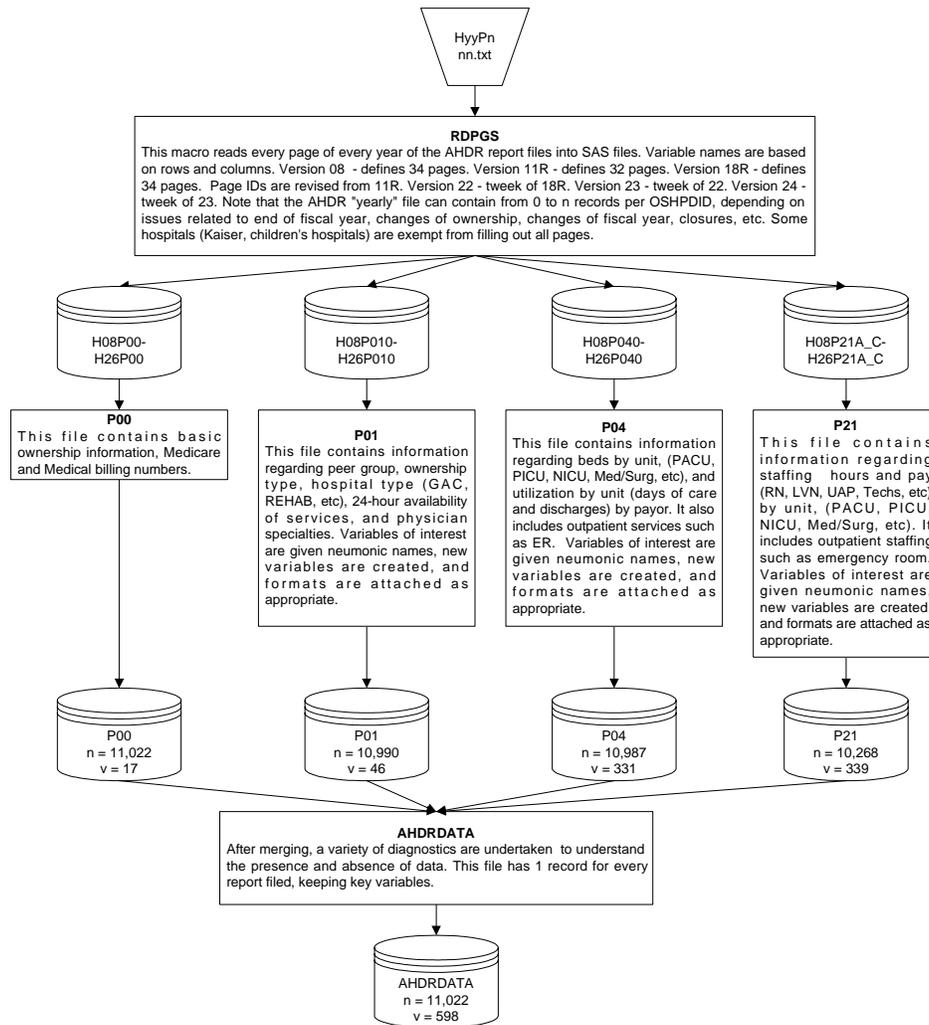
All California hospitals are not found in the AHDR. Some submit consolidated data for multiple facilities under one identifier. Others are exempt from filing all pages. As a result, the number of records varies, depending on reporting requirements. For both these reasons, one cannot know from the AHDR how many hospitals operated in California in a given period. Despite its complexities and deficiencies, this file provides the most detailed information available about overall structure (facilities, beds, staffing) and detailed financial information by hospital unit. The following are pages we have used, although we have read others into SAS.

1. **Page 0. General Information and Certification.** This page contains information regarding current and previous facility name, geographic data, owner name, and various identifiers.
2. **Page 1. Hospital Description.** This page contains information regarding type of care, type of control, 24-hour on premises coverage, and the active medical staff profile.
3. **Page 3. Hospital Owners and Governing Board Members.** This page contains information regarding hospital Directors, including whether any are owners or are compensated for their services.
4. **Page 4. Patient Census Statistics.** This page contains detailed information regarding number of beds, patient days, and patient discharges by daily hospital services units (Pediatric, Pediatric Intensive Care, etc). It also summarizes ER visits, including inpatient and outpatient ER visits by payor. This provides a hospital-level measure to examine the likelihood that poor patients were admitted, since we have from the discharge data the percent of poor children admitted.
5. **Page 21. Detail of Direct Payroll Costs.** This page contains information regarding hourly rates and productive hours by daily hospital services units. We focus on RN hours, skill mix, and use of registry nurses. Kaiser hospitals and children's hospitals are exempt from completing this page.

In the AHDR, the same variable may be located in physically different fields or files, depending on revisions. Seemingly similar variables in the same location may in fact have different definitions. As a result of changing definitions, locations, and reporting requirements, all variables are not available over all years, as new variables are added or old variables are dropped. To handle this, we developed an Excel file to maintain control of changing locations and definitions. Then we wrote a SAS macro to read the ASCII files, giving consistent mnemonic names for the same variable regardless of physical location in a given yearly file.

Figure 1 summarizes graphically steps to create AHDR files and restructure them to one record per report period for the period June 1982 through June 2001. ASCII files from OSHPD are designated HyyPnn.txt. Datasets are shown with drum shapes. Inside the drums, the value "n=" is the number of records in the file, and the value "v=" is the number of variables. Arrows indicate the data flow direction. The rectangle names the program and summarizes its major tasks. The P\* files contain all variables in all years for a given AHDR page. The final file (AHDRDATA) in this datastream contains a subset of variables for our research, with one record per report period per hospital.

Figure 1. Create AURH Files and Restructure to One Record per Report Period

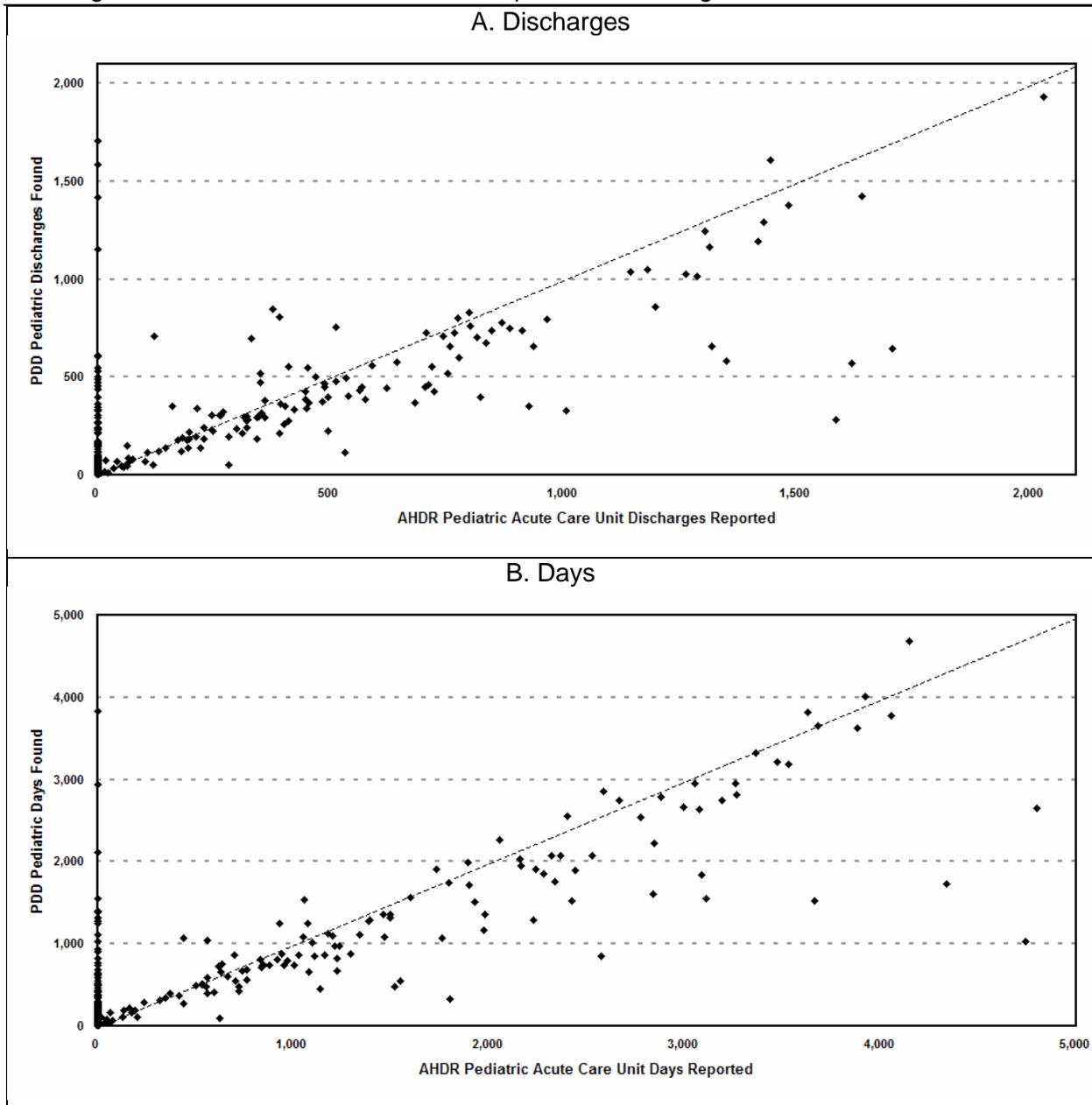


## DISCREPANCIES BETWEEN PDD AND AHDR

The AHDR contains a number of variables from which certain industry performance measures can be calculated. Fundamental to many of these are the utilization measures number of patient discharges and days. These are used together with structural measures such as beds and staffing to calculate occupancy rates, vacancy rates, and staffing ratios, among others.

Discharges and days are available in the PDD. As a basic validity test, we summarized PDD records from what we believed to be GACH hospitals by the report period in the AHDR. The PDD data was summarized for children 30 days to 13 years, the age limit for care in Pediatric Acute Care (PAC) beds.<sup>3</sup> We excluded GACH with Pediatric Intensive Care (PIC) beds so we would have no confusion as to where the children might be treated. Then we compared the numbers of cases in the PDD with numbers reported in the AHDR. Figure 2 shows 1997 results for GACH pediatric utilization measures discharges and days. The AHDR data is as reported within the report period for the given hospital.

Figure 2. Pediatric Utilization Comparison excluding GACH with PIC Beds, 1997



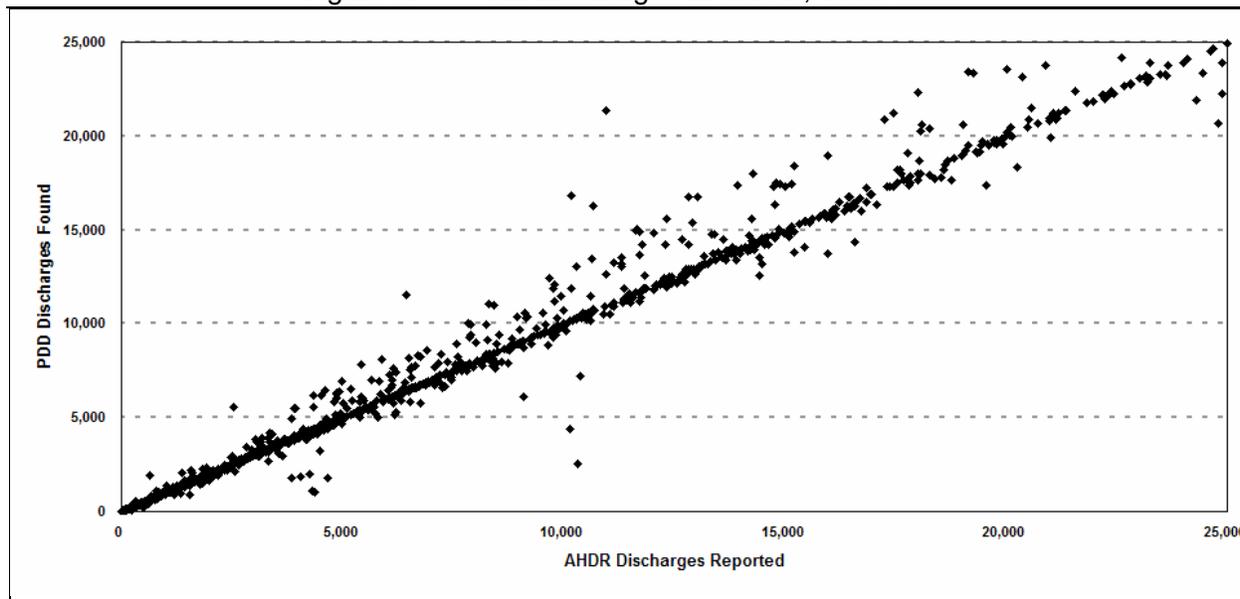
We had expected to see a close correspondence between numbers in the two datasets. Instead, of hospitals found in the PDD to be discharging children, only about half reported any pediatric discharges in the AHDR. These are indicated by the clustering of dots on the vertical axis. Over all years, in only 3.5% of reports did the numbers found in the PDD fall within plus(minus) 2.5% of those reported in the AHDR. Overall, 72.2% under-reported pediatric discharges which included the 50% that had reported none. Over-reporting discharges in the AHDR occurred in 24.3% of reports.

We repeated this analysis, comparing all discharges. Results were better hospital-wide, with 16.2% of hospitals under-reporting and 15.4% over-reporting by greater than plus(minus) 2.5%. Then we asked colleagues to use their own methods to see what they obtained. Their results

were similar, even using data where hospital fiscal year ended with the calendar year, as does the PDD. There was no trend, that is, utilization data were not more nor less likely to be discrepant in 1983 than in 2000. Hospitals owned by certain healthcare systems were more likely to consistently under- or over-report.

Figure 3 shows the all-discharges results for 1996-1998. Notice in particular that although the percentages are approximately the same to over/under-report, that the distance is much greater on the under-reporting side, an error which would seriously distort statistics such as staffing ratios. A hospital that reports 10,000 discharges in the AHDR but actually discharges 15-20,000 will appear to have a significantly better staffing ratio and poorer occupancy than actually exists, and certainly lends credence to nurse complaints about short-staffing.

Figure 3. All Discharges in GACH, 1996-1998



This pattern of misreporting utilization measures significantly impacts the reliability of standard hospital industry ratios and calls into question the findings of many important research studies. We held a series of meetings about these findings with high-ranking OSHPD staff, health system executives, and union representatives. We learned that the state passed legislation in 1987 to permit hospitals to close, move, or consolidate without going through a state review and planning process.<sup>4 5</sup> Some with whom we met suggested our results might be explained in part by reassignments of hospital identifiers after moves or as a result of consolidated reporting.

We undertook a significant, extensive, rigorous effort to improve these figures. Our work, reported on the following pages, slightly decreased the number of hospitals reporting no pediatric discharges in the AHDR, but increased to only 5.4% the reports within plus(minus) 2.5% of the pediatric PDD numbers found. The strategies we developed made the hospital-wide numbers worse. We have concluded that these discrepancies are data quality errors of such magnitude that they call into significant question the findings of all studies that have used staffing patterns, occupancy and vacancy ratios, and related measures relying on AHDR days and discharges .

## RECONCILING MOVES, CONSOLIDATIONS, OPENINGS AND CLOSINGS

Despite our inability to improve the numbers we cared about the most, we are more confident about the results of work to reconcile openings, closings, consolidations, and moves, all intended to get a better number of the actual number of GACH discharging children and to examine the impact of these structural changes on children's hospital access and outcomes. The following identifies the files we used for this work, and the process we followed.

### SUPPLEMENTAL FILES

**Annual Utilization Report of Hospitals (AURH).** OSHPD requires every hospital to complete the AURH annually as of the calendar ending 31 December. It must be submitted regardless of when the facility fiscal year ends or whether other reporting is consolidated. The AURH summarizes numbers of discharges and days by large age categories and within licensed subunits, emergency room and other specialty utilization, and certain licensing and ownership characteristics. Because of consolidated reporting, the AURH is the readily available file to determine if a hospital is still operating. The AURH includes some data elements from the DHS Licensing File System. This includes: licensing status throughout the year (opened, closed, suspended, reopened, etc); consolidated reporting status and date (but not type, i.e., AHDR, PDD, or both); whether reports were filed, partially complete, or missing; hospital opening date, and physical address. These data elements are not available for hospitals that closed in previous years. These files are on the web for 1997 forward.<sup>6 7</sup> OSHPD distributes the AURH data as Excel files, with PIVOT tables to generate reports. We separate the data tab and read it into SAS. It uses the same formats as the AHDR.

**Hospital Status Changes (HOSSTATA).** OSHPD provided an Excel file they used internally to summarize hospital status from 1988 through March 1995 with the data confirmed in 1997 for use by the California Hospital Outcomes Project.<sup>8 9</sup> The file has 1 to N records for each identifier, tracking changes in name and address, and year-by-year tallies of the types of licenses held. If the license was suspended, closed, or revoked, the date was recorded. CHOP used this file to reconcile hospital status for its research through that period.

**History of Hospitals (HISTHOSP).** OSHPD provided an Excel file they use internally to monitor hospital financial and utilization reporting. It provides information on: consolidations, deconsolidations, and re-consolidations; parent or subsidiary status if consolidated; changes in ownership, and name changes.<sup>10</sup>

**Hospital Consolidations (CONSOL).** As part of its annual PDD documentation, OSHPD provides an excel file summarizing all hospital consolidations from 1979 forward.<sup>11</sup> This file has 2 to N records per consolidation. It identifies the consolidating hospitals, the parent or satellite relationships, former names, IDs of the consolidating hospitals, consolidation and unconsolidation dates, and if hospitals closed (typically the satellite) following consolidation, the closing date. A change in ownership can but does not necessarily result in consolidated reporting. Hospitals can consolidate reporting of discharges, annual hospital reports, both, or neither.

**Automated Certification and Licensing Administrative Information and Management System (ACLAIMS).** The Department of Health Services Licensing and Certification Division (DHS-LCD) maintains the relational ACLAIMS database to record all activities, findings and outcomes of licensing and certification activities as well as complaints about quality of care at nursing homes, hospitals, hospices, home care agencies, and other related facilities. The core

ACLAIMS file lists all facilities licensed in California since 1983, and if they are closed, the closing date. This file includes separate licenses for sub-units in hospitals, such as psychiatric, rehabilitation, or long-term care. Another file records the address of satellite locations, including those created by consolidations. We use these latter two files to corroborate the physical addresses and operating status of hospitals. Other files summarize information about complaints, facility visits, history of violations, and citations. DHS-LCD provided a copy (comma-separated ASCII) of the ACLAIMS for the period 1983 through 30 June 2003. These files require their own format library.

Effective April 2004, the ACLAIMS file has been phased out. LCD is in the process of implementing a new Federal file, but with the end of ACLAIMS, California will have lost its ability to track longitudinal changes in hospital complaints and regulatory violations.

**Changes in Hospital Ownership.** Joanne Spetz provided her data files tracking GACH changes in ownership (CHOW) between 1986 and 2000.<sup>12 13</sup> The CHOW dataset provides ownership change dates for all non-federal, short-term general acute care hospitals in California summarized from the AHDR year 11R (1985-86 fiscal year) through year 25 (1999-2000 fiscal year) files. In addition to the AHDR, Spetz (1) examined and compared data from OSHPD, American Hospital Association (AHA), and hospital corporate web pages; (2) searched the internet and Lexis-Nexis database to investigate and confirm suspected changes in ownership; and (3) directly contacted individual hospitals or the corporate offices of hospital systems to verify ownership changes. Spetz identified 251 hospitals with 1 to 5 ownership changes during this period.

## HOSPITAL IDENTIFIERS

A given facility can have numerous identifiers. A number assigned by a single agency may be unique to a given location or may be shared across facilities at widely dispersed geographic locations but having the same owner. An agency may assign different numbers to the same geographic location, with or without ownership changes, and may or may not allow a facility to keep an identifier if it moves. Licensed specialty units for a given facility may or may not be given a different ID from the main hospital, regardless of whether the subunits are at the same or a different physical location. As a result of these vagaries, over time, a given physical location may accumulate multiple identifiers from the same or multiple agencies. This complexity with respect to identifying numbers makes tracking longitudinal changes in hospital structure particularly challenging.

The Federal government assigns three primary numbers Medicare Provider Number (MCARID), Medi-Cal Contract Provider Number (MCALID), and Medi-Cal Non-Contract Provider Number (MCALNID). OSHPD assigns every facility with a unique ID purportedly based on its geographic location (OSHPDID). LCD uses yet a different facility identifier (ACLAIM\_ID). Some specialty unit ACLAIM\_ID records may or may not have an associated MCARID, and the MCARID may be the same as or different from other units of the same hospital. The following table summarizes various identifiers provided overtime for one (relatively simple) example hospital that has never moved from its original site.

Table 1. Example Identifiers for One Hospital

Identifier	OSHPD	ACLAIMS
Facility Number	106211006 211006	110000953 110000955 (Psy)
Medicare Provider	05_0360 05-0360 050360	050360 055360 (Psy)
Medi-Cal Provider	HSC00360G HSC00360	

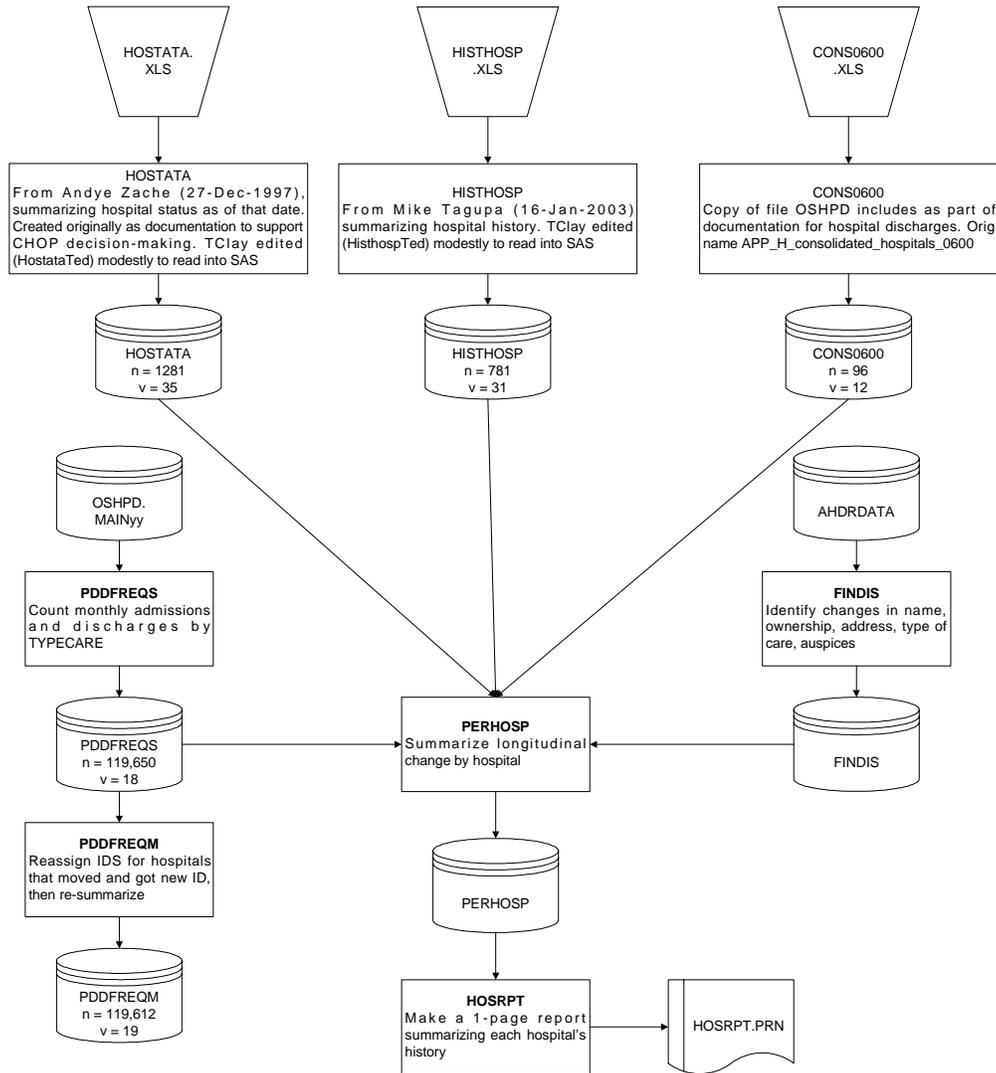
Depending on their availability on either side of a given crosswalk, these numbers can be used to merge across datasets. Unfortunately, a substantial number of datasets include a given identifier on only one side of a possible merge. Because of changing usages of the same ID, all merges must be checked carefully to be sure the linkage is to the same facility on both sides. This makes crosswalks into a complex undertaking in their own right.

Similarly, various files used various names for the same ID over time, and the same name for different IDs over time. Some name differences were due to typographic errors. Others reflected changes in types of care provided with or without an accompanying change in ownership (e.g., GAC to long-term nursing), and others were due to changes in ownership. We used all names for exploratory purposes, but attached the hospital name included in the most recent version of the PDD documentation in our analysis files.

#### SUMMARIZING ADMINISTRATIVE CHANGES BY HOSPITAL

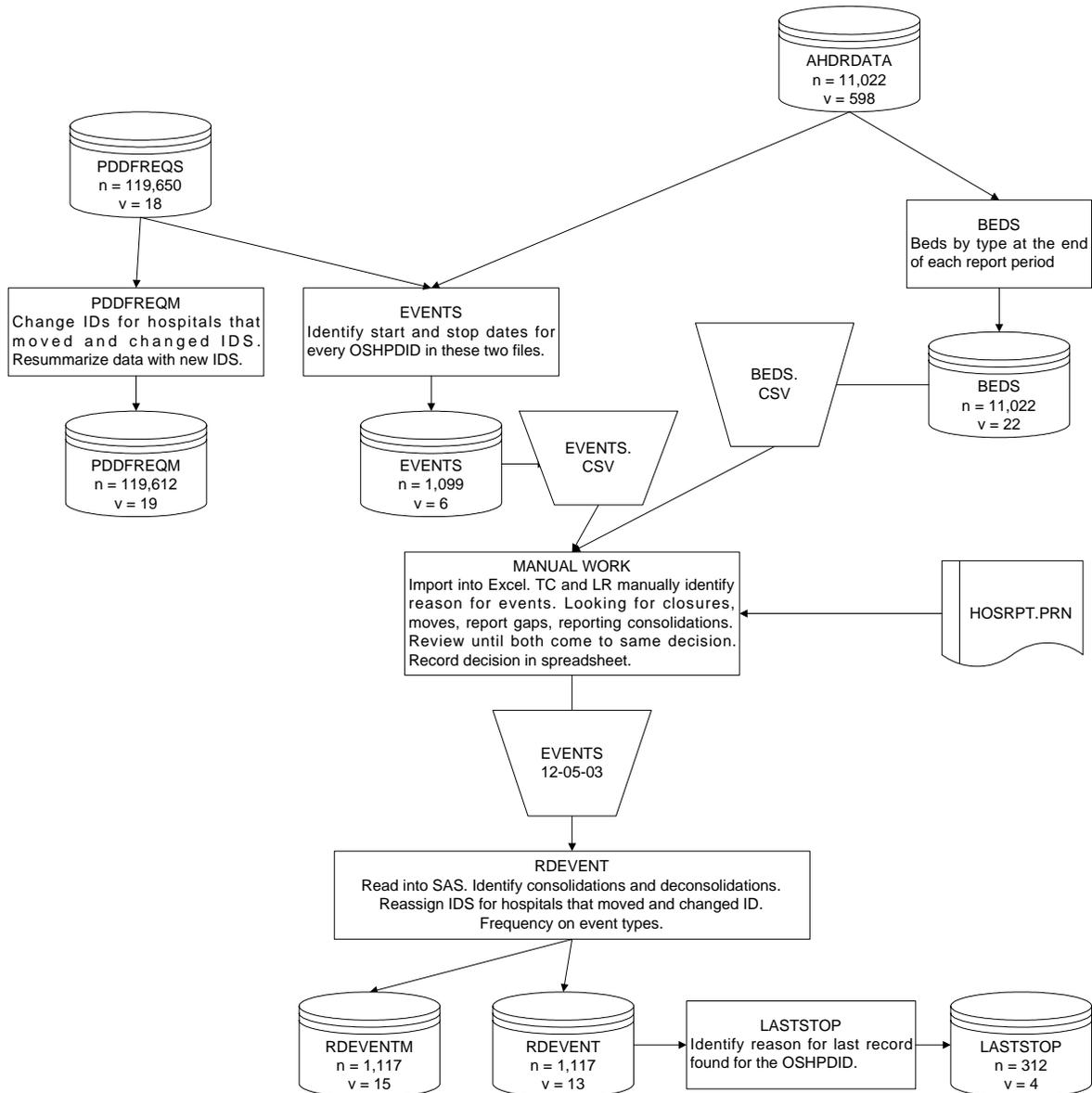
We read these additional files into SAS, then merged those from OSHPD to produce a one-page listing for each hospital. In this listing, we focused on moves, any indication of consolidated reporting, and changes in ownership, types of care provided, types of beds licensed, and evidence of hospital openings, closures, reopenings. Figure 4 diagrams the dataflow that resulted in the listing, which summarized potential administrative changes for every California hospital between 1983 and 2000.

Figure 4. Read in Supportive Files and Summarize Changes by Hospital



A key finding from the above sequence of programs was that different OSHPD data sources contained different information for essentially the same data elements, i.e., type of licenses held and when hospitals opened or closed, types of licensed beds, changed address or ownership or ownership type. Given these discrepant findings, we developed another sequence of programs, summarized in Figure 5, to come to agreement on hospital openings, closings, consolidations, and possible moves, based on the preponderance of information. The center of this sequence identifies an extended period of intense manual work to resolve discrepancies. Two members of the research team worked independently to decide what had happened, then worked together to resolve differences in opinions.

Figure 5. Openings, Closings, Consolidations, Moves



## RECONCILING MOVES

We defined a move as a facility physically relocating from one specific geographic location to a completely different location. We identified hospitals that had moved using multiple strategies. First, if a hospital closed and another opened in the same month in the same county, we checked to see if these events constituted a move or were a coincidence. If the hospital had the same type of control (non-profit, profit, public) and predominantly the same Board of Directors (Page 3 of the AHDR), we said the hospital had moved.

Second, we searched sequentially through Page 0 of the AHDR to find changes in the hospital address. After excluding address changes clearly due to different ways of entering the same

address and typographic errors, we were left with a list of about 100 hospitals that appeared to have moved. Resolving differences required referencing the ACLAIMS files and working on the internet. One member of the research team typed addresses for all pairs of candidate moves for what we believed to be GACH into ExpediaMap, to get driving directions from one address to the other. When the resulting map indicated that an address changed from a street on one side of the hospital to a street on another side of the hospital, or less than 0.2 miles from the first address, we concluded that the front door but not the hospital had moved and discarded the candidate move. We sent this list to OSHPD to verify whether hospitals had or had not moved.

In the end, we concluded that 21 hospitals discharging children we believed were GACH had moved as verified by OSHPD.<sup>14</sup> Most address changes tended to result in the hospital moving closer to freeway access. OSHPD had reassigned the facility identifier for 11, and allowed the remaining hospitals to keep their original identifier. We developed a special format to reassign the hospital identifier for all records associated with these facilities in all files.

One hospital moved to a different county. We treated the move as a closure in the first county and as a new hospital in the second. If the hospital moved within the county and received a new identifier, we replaced the older with the most recent in all source files in order to maintain continuity. This would result in no change in the number of hospitals in a given county.

We made two analysis variables to examine the impact of the move on hospital survival and pediatric outcomes: one identified if the hospital had ever moved (MOVHOS, no/yes) to use in the hospital survival analysis and a variable counting 24 months before and 24 months after the move (MOVMON) to use in the analysis of pediatric outcomes.

## RECONCILING BEDS

We wrote a program to display the number of beds licensed and discharges by hospital report period and bed type, which we imported into Excel. The resulting file was very helpful in reconciling the following issues:

**Did the hospital have licensed pediatric capacity?** Some hospitals would show up as having some type of pediatric capacity (newborn nursery, neonatal intensive care, pediatric acute care, pediatric intensive care) in one year but then would drop out. We would refer to this listing to distinguish data entry errors from real changes in capacity. Consistent with what Spetz reported for ownership information,<sup>13</sup> we found obvious data entry errors.

**Did the hospital continue operating after consolidated reporting began?** As one aspect to answering this, we compared the numbers and types of beds and discharges in the parent and subsidiary hospitals before and after consolidation. If the numbers of beds went up to approximately equal the number of beds reported by the two facilities before consolidation, we concluded the subsidiary hospital continued to operate. We found many instances where the number of beds did not go up in the parent hospital after consolidation. In these instances, we concluded that we should check further as to whether the subsidiary had closed.

**Did the hospital continue to serve children after consolidated reporting began?** We found many instances where the mix of beds changed, for example, dropping pediatric capacity of one kind or another in favor of specialty beds that children rarely occupy, but keeping about the same number of licensed beds. Again, in this situation, we would assume the hospital was still open. If we continued to find pediatric discharges in the PDD, we would conclude that the hospital continued to discharge children, but was no longer caring for them in appropriately

staffed pediatric beds. If we did not continue to find pediatric discharges but continued to find discharges, we concluded the hospital had stopped providing care to children.

**How many beds did the hospital have?** Over its history, the AHDR had four definitions of bed availability. We focused initially on two that were continuously available since 1983: total licensed (end of period) and staffed (average). An OSHPD report found the staffed beds measure to be unreliable, and recommended using total licensed beds.<sup>15</sup>

Our experience confirms this OSHPD recommendation. One hospital we know well always reported the same number (equal to 235 licensed beds) in all AHDR bed variables. When the hospital wishes to boast of its size, it touts itself as a 235-bed hospital. Yet when hospital administration seeks sympathetic local ears to accomplish changes advantageous to management but disadvantageous to the public, they disseminated bed numbers off as much as 50%. In public hearings, administrators disclosed they had moved about half the beds off the campus, to the east side of the freeway to a storage unit on filled land, where the beds would be inaccessible after an earthquake. After the discrepancy was made public, the hospital began to report an "average" number of beds more closely aligned with their public presentations but refused to return the moved beds to the hospital or to a safer location for emergency utilization. That hospital still is licensed for 235 beds.

In the end, we realized we could not answer the question of how many beds were available. Acting in a vacuum, but with some guidance from the prior OSHPD study, we decided to use total beds licensed (end of period) to calculate our population-based capacity measures. In a very messy data environment, this is the "hardest" measure of bed capacity. At least when the hospital opened, a state licensing official verified that the beds were physically in the facility. When we calculate our population rates using this, we are aware that our resulting statistics present a best case scenario, and that actual capacity could be off as much as 50%.

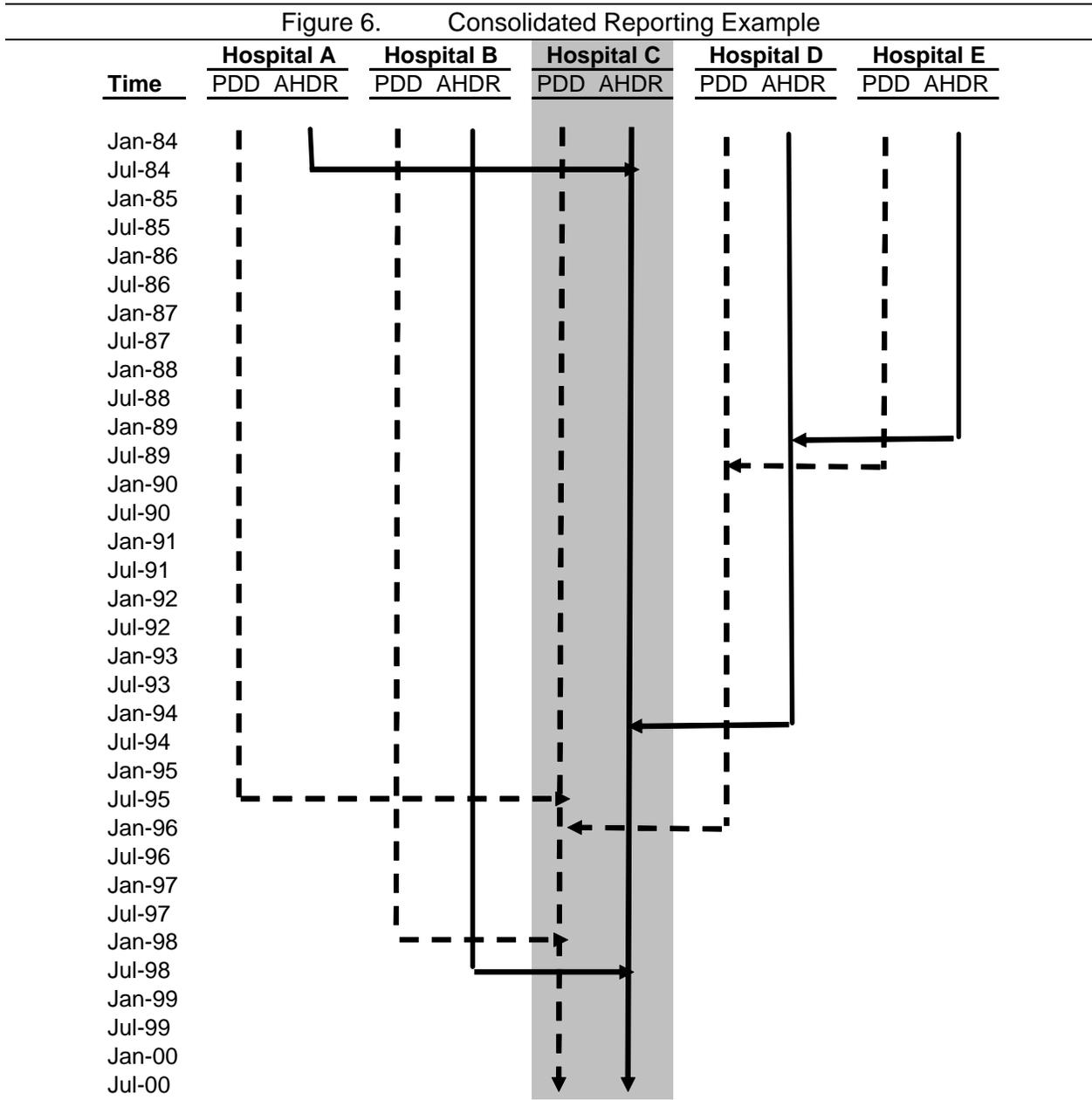
## RECONCILING CONSOLIDATED REPORTING

By this administrative action, OSHPD permits data from two or more facilities with common ownership but separate licenses to be submitted under the license of one facility for the AHDR or the PDD or both. We highlight that this type of consolidation is among hospitals with the same owner. Having the same owner may reflect a prior ownership change which some call consolidation. Here, however, we are talking about report consolidation and distinguish it from "consolidation" arising as a result of ownership change which we address separately.

In consolidated reporting, the hospital to submit the data is designated as the parent. The other(s) are designated as the subsidiary. OSHPD permits different types of consolidated reporting, and permits them to occur at different times. The AHDR may be consolidated, or the PDD may be consolidated, or both may be, and these events may occur on the same or different dates perhaps years apart. Of consolidations among what we believed to be GACH, 40 consolidated AHDR and PDD reporting; 39, AHDR only; 15, PDD only; and 1 consolidated the PDD only for all types of care other than GACH. All hospitals still licensed, whether operating or not, are required to submit AURH data. This is independent of whether hospitals consolidate reporting for the AHDR or PDD.

We traced activities for facilities that appeared to be involved in consolidation through all available databases. This process identified 95 consolidations, 17 deconsolidations, and 1 reconsolidation. When we finished tracking moves and selecting GACH to use for this analysis, we found most consolidations had occurred in specialty facilities. For our purposes, we included

38 GACH consolidations with one parent and one subsidiary each, involving 76 hospital pairs. In hospital-level files (i.e., 1 record per hospital over all years), we flag a hospital as having no consolidated reporting status, as a parent, or as a subsidiary. To illustrate the complexity of consolidations, Figure 6 shows the consolidated reporting sequences we found in the AHDR and PDD for one group of San Francisco hospitals. In 2000, all facilities were open according to ACLAIMS or the AURH, but we had PDD and AHDR data only for Hospital C.



To handle longitudinal analysis needs, we assign the facility identifier of records associated with the subsidiary to the parent identifier from what we establish to be the consolidation date forward. Then we treat all data for the consolidated facilities as one. In cases where AHDR data continues to be reported but we have no discharge data, we developed decision rules based on variable type (categorical or continuous) to role the AHDR data into one record.

## RECONCILING HOSPITAL CLOSURES

The work to resolve moves and consolidations was closely related to the work to reconcile hospital closures. About half the hospitals that moved subsequently closed, that is, moving was not a successful survival strategy, and so far as we were able to determine, all but 5 subsidiary facilities in consolidation pairs closed. Thus consolidation also appears to be an unsuccessful survival strategy.

We verified closures by checking the ACLAIMS database by hospital name and all known addresses. We concluded that a hospital was closed when we no longer had any discharges from the PDD, no reports in the AURH and/or an indication in the one more other reports that the hospital had closed. Some hospitals were closed for our purposes, that is, they no longer discharged children. These hospitals were still open, but had converted to specialty care and were no longer available to care for children.

The work to reconcile moves, consolidations, and closures involved about half of California hospitals. The results highlight significant sources of error in other research focusing on hospital closures and reopenings, since a good number of apparent closures are moves or consolidations. Consolidated reporting and OSHPD's inconsistencies in assigning identifiers makes it virtually impossible to track what is going on at both the hospital and patient levels.

These varying consolidations obscure our ability to answer fundamental infrastructure issues such as whether hospitals are open and if so, where are they physically located and if they have licensed facilities at that address to care for the pediatric population they are discharging. Consolidated reporting hides the existence of hospitals and makes it exceedingly difficult to know which of multiple physical locations under the same consolidated report are discharging children. When closures follow consolidations, the closure event may be hidden. Finally, reporting can become unconsolidated, when mergers are undone or one of the subsidiaries is sold and reemerges as a stand-alone facility or as a member of another hospital grouping. In this complex environment, we used the following decision rules, incorporating the reality of consolidated reporting.

- **Permanent closure with no evidence of consolidated reporting.** If (1) reporting stopped permanently in AHDR, AURH, HAFD, and PDD, and (2) HOSTATA or ACLAIMS or CONSOL said the facility was closed or the license was suspended, and (3) neither HOSTATA nor CONSOL nor ACLAIMS indicated that the facility had become a subsidiary, then we counted it as closed. We established closure date using the following rules. If two dates in HOSTATA or ACLAIMS or CONSOL agreed, we used that date. Otherwise, we used the earliest date given in HOSTATA or ACLAIMS or CONSOL. If a PDD admission date was before the closure date and discharge occurred within 15 days of the closure date, we kept the PDD record in the dataset. Otherwise, we deleted the discharge record.
- **Closure followed by reopening with no evidence of consolidated reporting.** If (1) we found a time gap in the summarized PDD, and/or (2) AHDR report periods showed a gap or a report about the time PDD discharges stopped, and we had no evidence of consolidated reporting in HOSTATA or ACLAIMS or CONSOL, and (4) the facility subsequently reopened as measured by discharges, we presumed the facility had temporarily suspended operations. If the closure and reopening occurred in the same calendar year, this would have no impact on the number of hospitals in the area in that year. If the closure and reopening occurred in two different calendar years, the county count would be affected plus

or minus one in each year. If we found PDD data during what seemed to be a closure period, we used the same rules as if the hospital had closed.

- **Consolidated reporting in the AHDR and PDD with no deconsolidation.** In 40 of 95 consolidations, the AHDR and PDD stopped at the same time and we found evidence of consolidation in HOSTATA and/or CONSOL. In this case, we used the earliest of the AHDR report date, or the consolidation date in HOSTATA or CONSOL as the consolidation date. We used the AHDR and AURH to compare the number of beds in the parent and (now) satellite hospitals before and after consolidated reporting began. So long as the hospital continued to report to the AURH we concluded that the hospital continued to exist and to discharge patients. We were able to separate out some differences in terms of types of beds licensed using the AURH and AHDR consistent with a pattern of bed conversions following consolidation. We were not able to determine which children were discharged from which hospital in the PDD, since both hospitals would be using the same identifier. In this case, we used combined structural characteristics in the parent for modeling.
- **Consolidated reporting in the AHDR and PDD with subsequent closure.** We looked in AURH, HOSTATA, ACLAIMS, and CONSOL for evidence of closure after consolidation. If we found this we decreased the count of the number of hospitals in the county by one using the earliest date found. All PDD reported using the parent identifier were presumed to be from the parent with no satellite contribution. All but 3 consolidations involving hospitals discharging children resulted in closure shortly after consolidation. In the analysis of hospital survival, we used the fact that the hospital was a parent (yes or no) as a predictor.
- **Consolidated reporting in the AHDR but not in the PDD.** In this case, we assigned all PDD records to the surviving hospital from the consolidation forward, and used that facility's AHDR data to understand changes in hospital characteristics and pediatric outcomes.
- **Consolidated reporting in the PDD but not in the AHDR.** In these cases, we combined the AHDR data from the two facilities and calculated hospital-level variables for the individual-level models using only the parent ID. If either hospital had pediatric capacity, we presumed the child was treated in those units.
- **Deconsolidated reporting.** When hospitals deconsolidated, we used the structural characteristics the facility reported upon deconsolidation. If the hospital had not consolidated PDD reporting, we were able to relate summarized patient outcomes to the hospital structural characteristics. If the hospital had consolidated both sides of their reporting obligations, we had to use the consolidated structural characteristics of the parent during the consolidation period, then resume with the deconsolidated characteristics subsequently.

## RECONCILING CHANGES IN OWNERSHIP AND ORGANIZATIONAL TYPE

Change of ownership (CHOW) occurs when hospital ownership control changes from one entity (typically a corporation or governmental agency) to another entity. We explicitly differentiate CHOW from a change in ownership control type (i.e., public to non-profit, or non-profit to investor) (CHCNT).

### CHANGE OF OWNERSHIP

Our work on CHOW was made somewhat easier by Joanne Spetz, who graciously provided her data tracking CHOW in GACH between 1986 and 2000.<sup>13</sup> We augmented her file by adding

certain data for 1983, 1984, and fiscal year 2001 that includes year-end December 2000. Using H08-H111, and H26 AHDR files, we augmented the Spetz CHOW file to add ownership changes between 1983 and 1986 and after June 2000. Using legal, tax and corporate documents in our possession for hospitals that had been part of California Healthcare System and other hospitals that had merged with Sutter Healthcare, we added CHOW that the AHDR data do not document well.<sup>16</sup> We reviewed and confirmed CHOW changes that occurred outside Spetz' study window by examining membership on the Board of Directors as reported in the AHDR, together with data from HOSTATA and CONSOL. We also visited websites to confirm certain changes.

Between 1983 and 2000, we identified 1 to 6 CHOW for 238 facilities that had discharged our target population. We made two analysis variables to examine the impact of CHOW on pediatric outcomes: one identifying if the hospital ever had a CHOW (no/yes) to use in the analysis of hospital survival and a variable counting 24 months before and 24 months after each CHOW (CHOWMON) to use in the analysis of pediatric outcomes. In the hospital-level analysis we indicate simply whether the hospital ever had any CHOW.

### CHANGE IN OWNERSHIP CONTROL TYPE

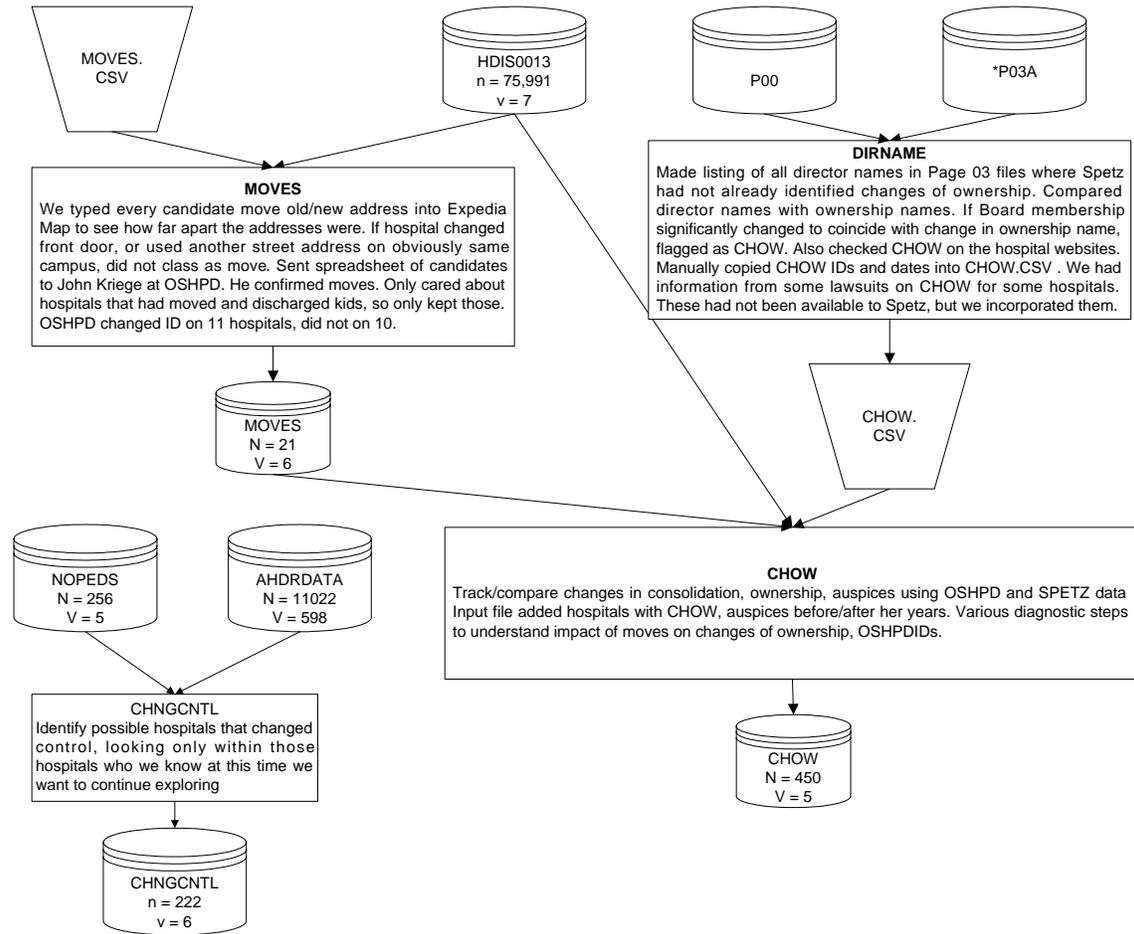
CHOW typically coincide with changes in administrators and administrative policies, but not necessarily changes in type of control (CHCNT), or organizational mission. A non-profit corporation operating a hospital may "merge" or "consolidate" with another non-profit corporation operating a second hospital without any CHCNT for either hospital and with or without a move to consolidate reporting. Via a lease or other administrative agreement, the Board of Directors of a public hospital may enter into an administrative agreement with a for-profit corporation to provide day-to-day management without any change in ownership and or mission. On the other hand, the transfer of a hospital owned by a non-profit corporation to an investor corporation, of a hospital owned by a District to a non-profit corporation, or by an investor corporation to a District would be a CHCNT.

We collapsed the AHDR's 11-category Type of Control variable into the following major classes representing very different social and organizational missions: public (university, district, city/county, state), non-profit, religious or church-based, non-profit including religious, and profit or investor. We summarized these over time to identify possible mission changes. We then referred to the Spetz CHOW file to flag changes, updating events occurring before and after her file ended, augmented by information in our other supporting files. We wish to highlight that all CHCNT did not coincide temporally with CHOW. For example, we identified investor hospitals that changed to non-profit without any change the Board of Directors, and vice versa.

We identified 75 facilities with 1 to 4 CHCNT between 1983 and 2000, for a total of 95 CHCNT. We concur with findings by Spetz and her colleagues that a number of apparent CHCNT in the AHDR reflect data errors.<sup>13</sup> This became even more apparent when we compared data among our various other files.

We made three analysis variables to examine the impact of CHCNT: one reflecting the CNT in effect in a given period, another identifying if the hospital ever had a CHCNT (no/yes) to use in the analysis of hospital survival and a variable counting 24 months before and 24 months after each CHCNT (CHCNTMON) to understand the effect of CHCNT on pediatric outcomes. Figure 7 summarizes the major program flow and activities that resulted in identifying changes in ownership and type of control.

Figure 7. Reconciling Changes in Ownership and Organizational Type



## SYSTEM OWNERSHIP

Hospitals may "merge" or "consolidate" with an over-arching corporation to form a membership-based "hospital system" without changing type of control (non-profit or religious or investor) or corporate identity (retaining corporate name). In this case, the "system" owns hospitals (typically as the "sole member" of the local hospital corporation) and exerts considerable system-wide control over day-to-day activities of its "affiliates" in terms of fiscal, staffing, and caregiving policies that impact families and children. For example, in 2000, Sutter Health controlled 29 hospital corporations,<sup>17</sup> and had a system-wide policy limiting services to MediCal patients.<sup>18</sup> Catholic Healthcare West controlled 47 hospital corporations and has a system-wide policy restricting certain reproductive health services.<sup>19</sup> Typically, systems have many privately-held, for-profit subsidiaries in addition to the hospitals, and the financial performance of these entities are not open to public scrutiny.

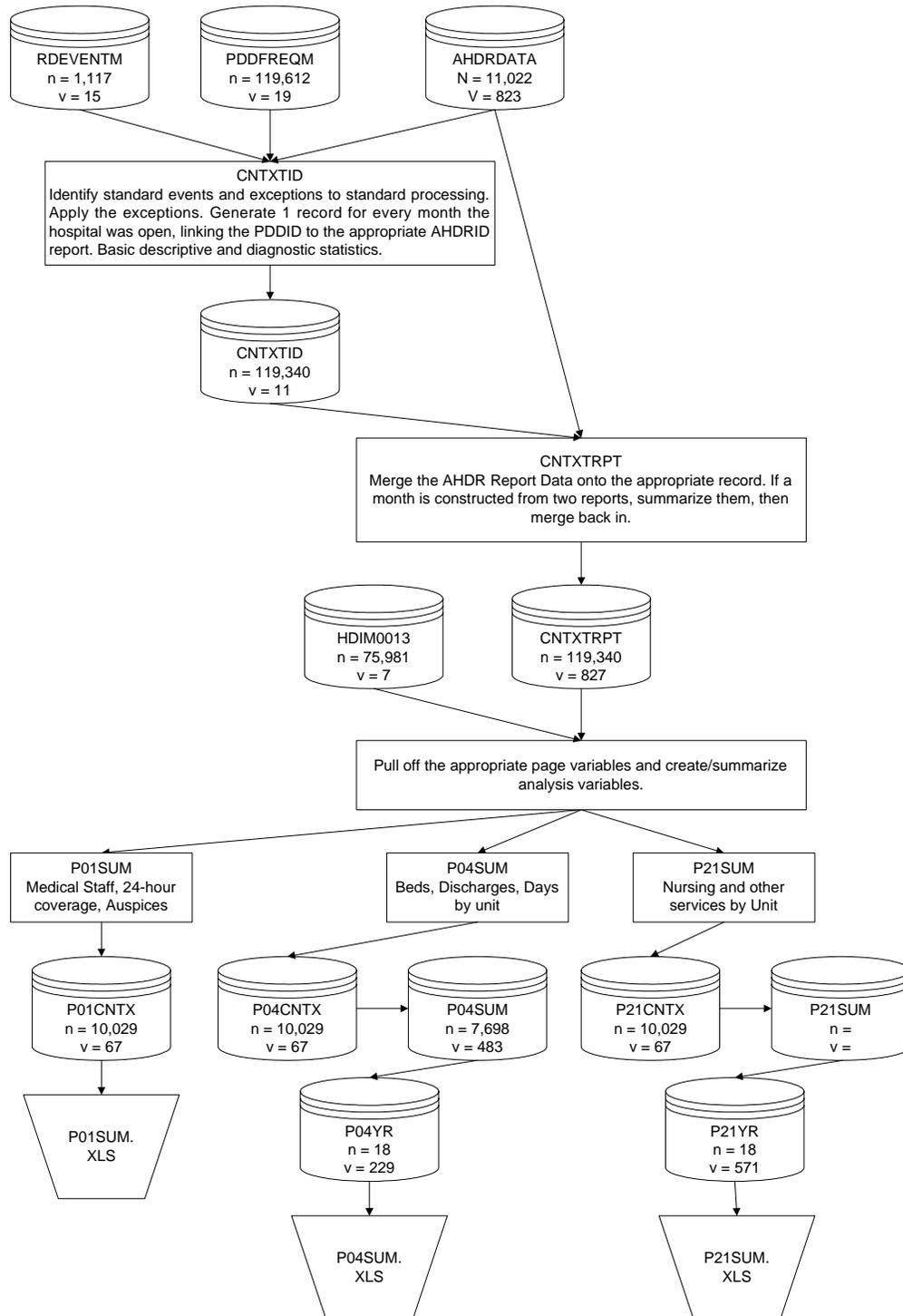
Other than Kaiser, hospital "systems" did not exist in California before 1983. For example, Catholic hospitals tended to be controlled by specific religious orders rather than an overarching system of Catholic hospitals. We used the last system ownership reported in the AURH files for 1996 through 2000. If the hospital closed before that date, we used the CHOW file. Otherwise we use the system ownership variable found on Page 0 of the last AHDR report for the FACID.

### **LINK TO APPROPRIATE AHDR REPORT PERIOD**

The AHDR is reported for the fiscal year of a given hospital, while the PDD is reported for the calendar year. Thus, for hospitals with a fiscal year different from the calendar year, timeframes over which data were collected differ. This requires a mechanism to estimate continuous hospital variables such as nurse staffing levels, or utilization measures available in both the PDD and the AHDR, which we discussed earlier. Because OSHPD allows multiple reports per year, the mechanism must generalize across reports of different lengths.

Initially, we summarized the PDD by the AHDR report period, but when we discovered the data quality issues, we thought a method described by Needleman might be worth pursuing.<sup>20</sup> Accordingly, we made a file defining standard events we were monitoring for changes, merged with the PDD summary file of one record per month and the yearly AHDR data. We then merged the result back with the AHDR, pulled off the hospitals and variables that interested us, and calculated various ratios and statistics by page. This is summarized in Figure 8.

Figure 8. Correct AHDR Data and Link to Appropriate Identifier and Report Period



This dataflow sequence through the CNTXTRPT step creates a basic "well" from which AHDR data can be pulled for a given study. At the end of that step, inconsistencies as identified in this

paper have been reconciled, the correct hospital identifier to be used has been established, and the foundation is laid to link the AHDR data with the discharge data.

The rest of the diagram shows a short sequence of steps to pull primary variables of interest and calculate analysis variables for any given study. In this case, it shows the preliminary steps we implemented for the longitudinal study of children's access to hospital care. Initially, this set of programs was implemented immediately after the preparation of files indicated in Figure 1. Now these programs are submitted after going through all the subsequent steps identified. These programs are submitted from the study-specific directory and the results are stored there.

## PAGE VARIABLES USED

**Page 1. Physicians.** From the array of physicians with hospital practice privileges, we identify if a hospital has any family/general practice, pediatricians and pediatric specialists, overall, community-based (i.e., non-hospital-based) and hospital-based.

**24-hour capacity.** We identify hospitals with any 24-hour services (emergency room, trauma care, diagnostic [radiology, laboratory, physician], and treatment capacity [operating room, anesthesiologist, pharmacy])

**Control.** We classify the type of control and ownership, and changes in these.

**Page 4 Beds.** We flag whether the hospital had any of various types of beds: intensive care , pediatric intensive care, medical-surgical acute care, pediatric acute care, newborn nursery, neonatal intensive care and other specialty beds.

**Number of beds.** We believe all measures of bed capacity are unreliable. Nonetheless, the total number of beds licensed for a given type of care represents the "best case" scenario for hospital structural capacity, and that is what we recommend.

**Utilization.** We do not use days or discharges for the reasons discussed earlier.

**Page 21 Staffing.** We calculated staffing ratios using days and discharges found in the AHDR. We no longer believe this is appropriate, because of our recent understanding that the utilization measures days and discharges are not accurately reported, and we have no idea how accurately the staffing measures are reported. We do have some strategies in mind to try with this file, but will wait to express our ideas until we test them.

## SUMMARY AND CONCLUSIONS

This working paper described the steps taken to create hospital-level files examining longitudinal changes in structural characteristics. We identified significant over- and under-reporting of the hospital utilization measures patient days and discharges. The results of our work calls into question the findings of all studies (which we have admired very much) that used the AHDR data to examine occupancy, vacancy, and staffing patterns and their relationship to patient outcomes.

We received help from many people to reconcile hospital moves, consolidations, and closures, and we are much more satisfied with the results of that work.

We recommend that the legislature authorize OSHPD to undertake a rigorous effort to validate information in hospital-level datasets and implement strategies to maintain high quality data. This is critical if the impact of health policy changes are to be evaluated. At the least, we recommend reconciling the numbers of discharges and days reported in the various hospital-level datasets to those actually found in the PDD. Reconciling numbers of beds to those actually available in the hospitals should be a simple matter. Licensing and Certification could validate this information as part of the bi-annual CALS survey. Staffing measures should be reconciled with actual staffing data collected realtime as part of payroll activities. Similarly, we recommend reconciling numbers reported in federal tax returns, bond applications, and annual financial statements with those submitted to OSHPD. Hospitals found to systematically under- or over-report should be fined.

Hospital consolidations and consolidated reporting completely obscures how many hospitals are open and where they are physically located. One OSHPD official we interviewed said that the state had no idea how many hospitals or emergency rooms or beds actually existed in California or where they were physically located and called the situation a "disaster waiting to happen." The use of different numbers for the same facilities for different purposes (Licensing and Certification, OSHPD, Medi-Cal, etc) should be reconsidered. One uniform number should be instituted, with sub-numbering to specify the exact geographic location of the specialized unit, including a measure of latitude and longitude. The number should be assigned to the physical location and should not change with ownership or type of care provided.

Only by interviewing people and engaging colleagues across the state and nation were we able to get information that would lead us to know where to look to be able to even begin to understand what was happening. The overall problem seems to be one of transparency, the fact that it is so difficult to clarify and resolve (to the extent we were able) the data problems we encountered. Opaqueness benefits hospitals and thwarts legitimate public information needs.

## ENDNOTES

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- <sup>1</sup> Remy L, Clay T, Oliva G. (June 2004) Methods – Hospital Patient Discharge Data. Available at: [http://www.ucsf.edu/FHOP/METH\\_PDD.PDF](http://www.ucsf.edu/FHOP/METH_PDD.PDF)
- <sup>2</sup> Hospital Annual Disclosure Report CD-Rom Format Documentation. For 26th Year. Report periods ended June 30, 1999 through June 29, 2000. State of California Office of Statewide Health Planning and Development, May 2000. Forms available at: <http://www.oshpd.ca.gov/hid/HID/hospital/finance/annual/index.htm>.
- <sup>3</sup> Title 22, Social Security. Division 5. Licensing and Certification of Health Facilities, Home Health Agencies, Clinics, and Referral Agencies, Chapter 1. General Acute Care Hospitals, §70537. Pediatric Service General Requirements. (d) Patients beyond the age of 13 shall not be admitted to or cared for in spaces approved for pediatric beds unless approved by the pediatrician in unusual circumstances and the reason documented in the patient's medical record.
- <sup>4</sup> California Health and Safety Code Sections 127150, 127295, 127300.
- <sup>5</sup> California Health and Safety Code Section 1250.8.
- <sup>6</sup> Accessed 31Dec03 at: <http://www.oshpd.ca.gov/hid/HID/hospital/util/index.htm>.
- <sup>7</sup> Accessed 31Dec03 at <http://www.oshpd.ca.gov/HQAD/HIRC/hospital/util/index.htm>.
- <sup>8</sup> Romano PS, Remy LL, Luft HS. Report of the California Hospital Outcomes Project, Volume Two: Technical Appendix. California Office of Statewide Health Planning and Development. May 1996. Last accessed 24 Apr 2004 at: <http://www.oshpd.ca.gov/HQAD/HIRC/hospital/Outcomes/HeartAttacks/index.htm>.
- <sup>9</sup> Personal transmission from A. Zache, OSHPD to L. Remy 27 Dec 1997.
- <sup>10</sup> Personal transmission from M. Tagupa to L. Remy 15 Jan 2003. Linda, This is an internal listing that is used by our Accounting & Reporting Unit to monitor the Annual Hospital Financial and Hospital Utilization Reporting. Some abbreviations and footnotes are noted at the bottom of the document. I will forward any discrepancies that you might find (or be aware of) to that unit; however, you must be aware that their historical records, and their internal resources to confirm discrepancies, may be limited.
- <sup>11</sup> Office of Statewide Health Planning and Development (2000). Discharge Data Documentation. Appendix H. Consolidations.
- <sup>12</sup> Spetz J, Mitchell S, Seago JA. The growth of multihospital firms in California. *Health Affairs* 19:6 (Nov-Dec 2000), 224:230.
- <sup>13</sup> Mitchell S, Spetz J, Seago JA. Errors in data on hospital ownership. *Inquiry* 38: 432-439 (Winter 2001/2002).
- <sup>14</sup> J. Kriege, OSHPD, personal communication, 28 Aug 2003, 20 Nov 2003.
- <sup>15</sup> Simonson L and MacDonald M. (1998). Hospital Closures and Changes in Ownership Status in California, 1988-1997: A look at the data and issues. Sacramento, CA: Office of Statewide Health Policy and Development.
- <sup>16</sup> Marin Healthcare District, etc. v. Sutter Health et al. Case No. C034127, District 3.
- <sup>17</sup> AURH\_2000\_PROFILE.XLS, in aurh1200pivot.exe. Downloaded 23 Mar 2002 from: <http://www.oshpd.ca.gov/HQAD/HIRC/hospital/util/index.htm>
- <sup>18</sup> Get citation
- <sup>19</sup> A Collision of Medicine and Faith, Los Angeles Times, v Monday, January 3, 2000 COLUMN ONE. Accessed 08Jan2000 at: <http://www.latimes.com/class/employ/healthcare/20000103/t000000766.html>
- <sup>20</sup> Needleman J, Buerhaus PI, Mattke S, Stewart M, Zelevinsky K. Nurse staffing and patient outcomes in hospitals. Final Report for Health Resources Services Administration Contract No. 230-99-0021. February 28, 2001.