User's Guide to Inpatient Monograph Tables

Inpatient Data Collection in Vermont

Inpatient discharge data have been the core of the *Vermont Hospital Monograph Series* since 1975. These data have been helpful in hospital planning and have provided a longitudinal view of hospital utilization and the health of Vermonters.

Units of Measure

The inpatient Monographs use three measures of hospital utilization:

A ***discharge*** is an individual inpatient hospitalization. Discharge dates, not admission dates, are used to indicate when a case is reported. A count of discharges measures how often care is sought. The same individual will be counted as more than one discharge if hospitalized more than once during the time studied.

A ***patient day*** is defined as a stay in a hospital for all or part of a day. Patient days are one way of measuring the amount of care provided.

The ***average length of stay*** is the total patient days divided by the number of discharges in a selected category. It is a rough measure of the amount of care provided during a typical hospital stay.

Hospital Service Area Analyses

The majority of the eight inpatient Monographs compare data for residents of hospital service areas (HSAs). Each HSA is defined by the geographically distinct population of Vermonters who are highly dependent on a hospital or group of hospitals. Each inpatient record is assigned to an HSA. This permits comparison of hospital utilization patterns for residents of the various HSAs, regardless of where they are hospitalized.

Statistics for HSA analyses include population-based rates that are adjusted for differences such as age distribution in population characteristics from one HSA to another. Using population-based rates, especially age-adjusted rates, differences in hospitalization patterns for residents of different regions of the state can be identified. See pages 11-13 for two detailed examples.

HSAs are less relevant for certain services that have historically been regionalized such as acute inpatient mental health services for persons with severe mental illness. In 2005, four out of the fourteen Vermont community hospitals had dedicated inpatient psychiatric units in addition to Retreat Healthcare and the Vermont State Hospital.

Hospitals take interest in HSAs because residents of their HSAs are usually their principal Vermont consumers. Analysis of anomalies and trends within its service area can aid a hospital in identifying practice variations and in strategic planning. Finally, the size and shape of an HSA can be indicative of a hospital's market penetration and the environment in which it operates.

Vermont hospitals near Vermont's borders may provide care to people in neighboring, non-Vermont towns. However, out-of-state residents are excluded from the population-based HSA comparisons. In order to include out-of-state residents in a hospital service area, information would need to be collected on <u>all</u> hospitalizations of the residents in those areas, including use of non-Vermont hospitals. In contrast to the HSA comparisons, out-of-state residents using Vermont hospitals are included in the hospital-based comparisons.

While hospitals may provide the majority of care within their

service area, a substantial quantity of the care received by the population may also come from other hospitals. If the hospital is a regional referral center, the hospital may be providing the majority of care to residents within its service area while also providing specialty care to residents from other service areas.

Fourth Version of Hospital Service Areas

Due to changes in technology, financing and reimbursement, population characteristics, and the economy, the health care system serving Vermonters constantly changes. The hospital service area (HSA) definitions used in the Monographs have been modified three times to reflect changing discharge patterns.

Starting with the 2002 Monograph, HSAs are based on inpatient discharges, where the diagnosis indicated the need for immediate care, for the years 1997-2001. Prior definitions of HSAs have been based on all inpatient stays (except for newborns) and have used a strict decision rule for inclusion of ZipTowns which are towns or groups of towns (see definition below for ZipTowns) in a hospital's service area. Use of a strict inclusion rule meant that there were always towns that were not assigned to any HSA and were labeled "contested."

In preparing for this fourth version of HSAs, rules used to define the 3rd version of HSAs were applied to 1997-2001 data. The number of contested towns rose from 54 to 80, nearly a third of all Vermont towns. This resulted in the loss of one hospital service area and a serious erosion of others. As a result of this increase in contested towns, two major changes were made to the process of defining HSAs. In addition to these definitional changes, HSA names were changed. To distinguish these new HSAs from previous ones, HSAs were given the name of the most populous town in their area.

The first major change was that selection of records was limited to those discharges with diagnoses considered to require immediate hospitalization as described by Newton and Goldacre in their 1994 article, "How many patients are admitted in districts other than their own, and why?" (Journal of Public Health Medicine, 1994, Vol. 16, No. 2, pp. 159-164). Newton and Goldacre used records of patients with acute conditions that require immediate hospitalization, because patients with these conditions tend to go to the hospital nearest to them when they become ill. The authors excluded newborns and patients transferred from another hospital. The authors included records with the following acute conditions as their primary diagnoses:

appendicitis (ICD-9-CM codes 530-543),
abcess of anal and rectal regions (ICD-9-CM codes 566),
peritonitis (ICD-9-CM codes 567),
acute myocardial infarction (ICD-9-CM codes 410),
pneumococcal pneumonia (ICD-9-CM codes 481), and
asthma (ICD-9-CM codes 493).

The second major change was the shift to a plurality rule in assigning ZipTowns to HSAs, so that all towns are assigned to an HSA with none remaining contested. ZipTowns are towns or groups of towns with over 1,000 residents and relatively contained ZIP code boundaries (see Appendix E for a list of ZipTowns in each HSA). ZipTowns were assigned to hospital service areas as follows:

1) If the plurality of a ZipTown's discharges were from a Vermont hospital or Dartmouth Hitchcock Medical Center (DHMC) in Lebanon, New Hampshire, the ZipTown was assigned to that hospital's service area.
2) If the plurality of a ZipTown's discharges were from a non-Vermont hospital other than DHMC, the ZipTown was assigned to the HSA of the Vermont hospital (or DHMC) with the next highest number of discharges.

One ZipTown called Guildhall, made up of five towns in Essex County which were previously designated as contested, had only four discharges to a nearby Vermont hospital. All four discharges were

Lunenburg residents discharged from Northeastern Vermont Regional Hospital in St. Johnsbury. Using the plurality rule, Lunenberg was added to the Burke area ZipTown which is assigned to the St. Johnsbury HSA. The remaining four towns in the Guildhall ZipTown had no discharges to a nearby Vermont hospital. These four towns were assigned to HSAs based on a decision to follow the boundaries used for the Health Department's Community Public Health District Offices. Using this approach, Guildhall and Maidstone were also assigned to the Burke area ZipTown in the St. Johnsbury HSA. The remaining towns of Bloomfield and Brunswick were assigned to the Canaan area ZipTown in the Newport HSA.

The HSAs continue to include two multi-hospital areas: the White River Junction HSA (Dartmouth Hitchcock Medical Center, Mt. Ascutney Hospital, and the Veterans Administration Hospital) and the Brattleboro HSA (Brattleboro Memorial Hospital and Grace Cottage Hospital). These HSAs include multiple hospitals because resident hospitalizations are split among the hospitals with no clear majority of inpatient discharges concentrated at any one hospital.

Color maps of HSAs and a complete description of the process used to define the current service areas are found in the *2002 Vermont Hospital Monograph Companion*. Black and white maps of Vermont towns and HSAs are also shown on page 6 of the Introduction to this Monograph.

Hospital Service Area Analyses Using Population-Based Rates

The rates reported in this volume combine information about hospitalizations and information about populations "at risk" of being hospitalized. Rates enable the comparison of areas that differ in population and HSAs are the population areas used in these comparisons.

Simple or "crude" rates are typically expressed as the number of events per some large number of people, such as 1,000. This rate is called *crude* because it only compensates for relative population size. *Adjusted* rates incorporate additional variables, such as age, into the calculation.

For example, the "crude" discharge rate for residents of an HSA would be calculated by multiplying 1,000 times the following:

$$\frac{\text{hospitalizations of HSA residents in any VT, MA, NH, or NY hospital}}{\text{population of the HSA}}$$

To compare hospitalizations for Heart and Circulatory Diseases (MDC 5) in two HSAs, Burlington and Rutland, the number of hospitalizations (the numerator for the rate) would need to be established:[1]

Discharges for Heart and Circulatory Diseases, 2005

Burlington HSA	1,841
Rutland HSA	1,312

Although more residents of the Burlington HSA are hospitalized for these conditions, it is not possible to answer the question of whether heart and circulatory diseases are a more significant problem for residents of the Burlington HSA. In order to answer this question, the number of people living in these two HSAs (the denominator for the rate) is needed.[2]

Population Estimates, 2005

Burlington HSA	168,776
Rutland HSA	64,567

[1]Number of discharges by HSA and MDC are found in Monographs 5 & 6

[2]Population numbers are found in Monograph 1.

The Burlington HSA has more than twice the population of the Rutland HSA. Given the greater population in the Burlington HSA, more discharges would be expected, even if all other variables (such as health status and the practice style of area physicians) were equal.

In order to remove the effect of the different population size, the rate is used instead of the count. The crude rates for the Burlington and Rutland HSAs provide a different picture from the counts:[3]

Crude Discharge Rates per 1,000 HSA Residents, 2004
Heart and Circulatory Diseases

Burlington HSA	10.9
Rutland HSA	20.3

Although the Burlington HSA had more Heart and Circulatory discharges, the discharge rate of the Burlington HSA is almost one-half that of Rutland's. That is, a resident of the Rutland HSA is almost twice as likely to be hospitalized for heart disease as a resident of the Burlington HSA.

These crude rates are valuable for comparing rates over limited time periods or among similar populations. However, the utility of crude rates is limited because of the link between health status and age. In general, older people use more hospital resources than do younger people.

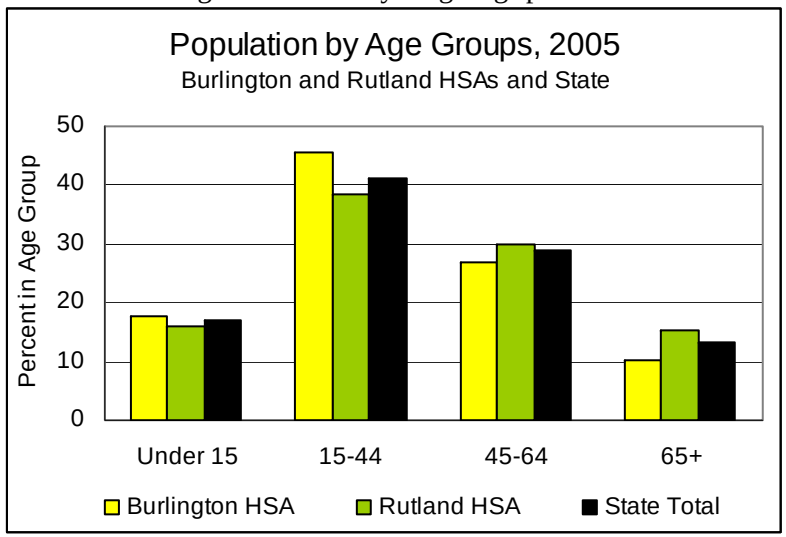
To make comparisons among health care systems, the effect of different age distributions needs to be removed from these comparisons. In the example above, if the average age in Burlington was 30 and the average age in Rutland was 55, the difference in rates would not be surprising. However, if the average ages in the two service areas were the same, other explanations would be considered, such as differences in health status, risk factors and/or provision of care.

[3]Crude rates by HSA and MDC are found in Mongraphs 5 & 6.

The issue can be examined by computing age-adjusted rates. Different standards, such as the projected year 2000 U.S. population, can be used for age-adjusting and different age groups can be used in the age adjustment procedure. This volume uses the overall Vermont age distribution when adjusting HSA rates. See Appendix A for a more complete description of the age-adjustment process used in these Monographs.

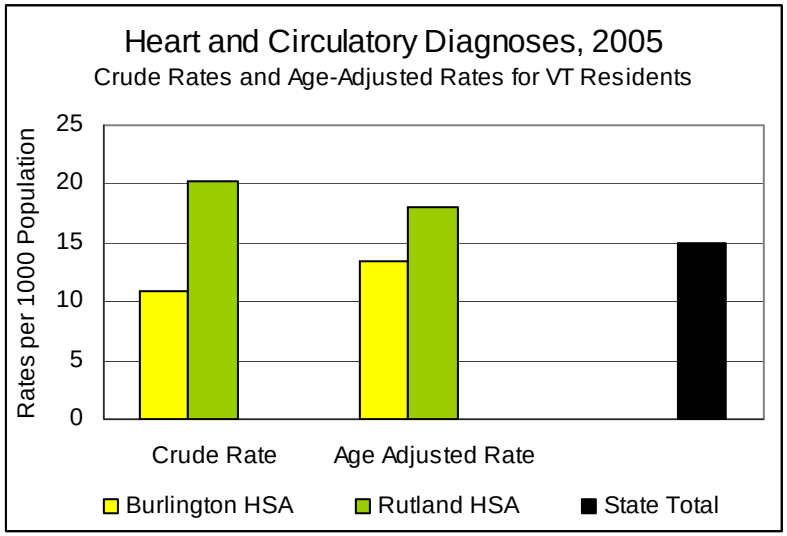
To illustrate the rationale for age adjusting, consider the 2005 population distribution of the Burlington and Rutland HSAs and the state as a whole shown below.

The Burlington HSA has a younger age profile than the Rutland



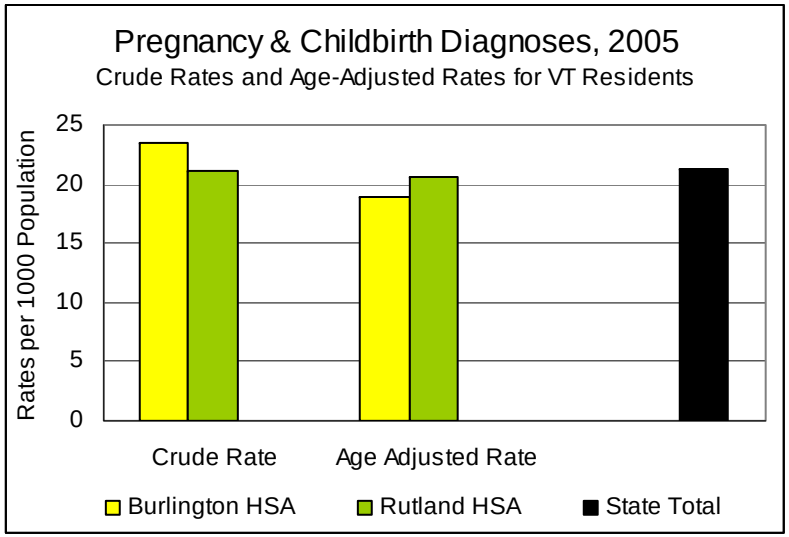
HSA, with a larger proportion of its population in the 15-44 age category, and a smaller proportion aged 45 and above. Age adjusting eliminates the effect of these differing age distributions on the discharge rates.

When the age-adjusted heart and circulatory discharge rates of the two HSAs are compared, the differences seen in the crude rates become smaller. Burlington HSA's low rate of heart and circulatory discharges was due, in part, to its younger population. Rutland HSA's higher rate was due, in part, to its older population.[4] Remaining differences may be attributable to differences in underlying health status, risk factors and/or practice patterns.



While heart and circulatory disorders are most common among older populations, delivery and abortion occur almost entirely among women aged 15-44. For this diagnostic category, therefore, the Burlington HSA would be expected to have a higher crude rate than the Rutland HSA due to its younger population. The chart below shows that this is the case. When we take the age structure of the population into account by age-adjusting, we find that in fact the Burlington HSA rate is lower than the Rutland rate.

[4]Age-adjusted rates are found in Monograph 5.



Hospital-Based Analyses

Some questions require a comparison of hospitals rather than HSAs. Hospital-based analysis is useful for understanding overall hospital utilization. Hospital-based analyses include all people served by the hospital, whether they are Vermont residents or not. Monographs II, III, IV, and VII provide various statistics by hospital.

Monograph II, for example, gives a comprehensive summary of utilization by hospital. The first page of the Monograph provides a one-page snapshot of all Vermont hospitals plus Dartmouth Hitchcock Medical Center, including total discharges, total patient days, and average length of stay. The remaining pages of Monograph II present additional detail by hospital for these measures by Major Diagnostic Category (MDC).

The example below uses data from Monograph II to compare hospitalizations for Heart and Circulatory diagnoses (MDC 5) at Fletcher Allen Health Care and at Rutland Regional Medical Center.

Number of Patient Days, 2005
Heart and Circulatory Diseases

Fletcher Allen Health Care	19,155
Rutland Regional Medical Center	3,311

For heart and circulatory diagnoses, Fletcher Allen Health Care provided nearly six times as many days of hospitalization as Rutland Regional Medical Center. This difference can be a result of seeing more patients, keeping patients in the hospital longer, or a combination of the two.

In order to determine the contribution of these two factors, the number of Heart and Circulatory patient days can be divided by the number of Heart and Circulatory discharges to produce the average length of stay for Heart and Circulatory hospitalizations.

Average Length of Stay (Days), 2005
Heart and Circulatory Diseases

Fletcher Allen Health Care	4.3
Rutland Regional Medical Center	3.8

At Fletcher Allen Health Care, heart and circulatory patients stay an average of 4.3 days, slightly longer than patients at Rutland Regional Medical Center who stay an average of 3.8 days. If the difference were larger, one could reasonably ask whether the patients at Fletcher Allen Health Care are sicker or if the care is less efficient. Researchers have used a variety of tools, such as measures of severity of illness, to answer such questions. This volume does not attempt to answer questions about hospital performance or health of populations. Its purpose is to provide the data that illuminate patterns and evoke questions for further study.

Hospital-Based Analysis Compared with Hospital Service Area Analysis

Certain of the Monographs report both hospital-based and HSA data. Monograph II provides, in addition to the hospital utilization data described above, comparisons of data for hospitals and their HSAs. For example, average length of stay for each hospital is listed next to the average length of stay statistic for its HSA.

Discharge and patient day rates per 1,000 population are provided for each hospital's HSA along with the percent of those discharges and patient days provided by that hospital. In 2005, Fletcher Allen Health Care provided the highest percentage of care to residents of its HSA, accounting for 92.8 percent of the discharges for residents in its HSA and 92.9 percent of the patient days. Rutland Regional Medical Center was second highest, as the provider of 74.5 percent of the discharges and 71.5 percent of the patient days for people who live in its service area.

Data on the extent to which hospitals provide care primarily to residents of their service area are also provided in Monograph II. Among HSAs with a single hospital, the 2005 data show that North Country Hospital was highest on this measure, with 94.7 percent of their discharges being people who reside in their HSA. Fletcher Allen Health Care had the lowest percent on this measure, with only 53.5 percent of their discharges being people residing in their local service area. Thus, 46.5 percent of Fletcher Allen's discharges were people from other parts of Vermont or out of state.

Population

Population data used in the inpatient Monographs are from several sources:

- 2000 data are from the 2000 U.S. Census,
- 2001-2002 estimates were prepared for VDH by Claritas, Inc., and
- 2003-2005 estimates were created by VDH using adjustments to the National Center for Health Statistics population estimates.

Population data are presented in Monograph I by HSA. These population statistics are used as the basis for all rates presented in the remaining Monographs.

Population estimates for 2001 were produced prior to release of the detailed 2000 Census data. There is more fluctuation than usual in the 2001 estimates, especially in the younger age groups.