# Maui Bed Needs Study, 2005—2025

Final Report

August 25, 2004

Presented to:

Kaiser Permanente

Malulani Health Systems, Incorporated

Maui County Mayor's Office

Maui Memorial Medical Center

State Health Planning and Development Agency

By Hawaii Health Information Corporation

# Table of Contents

# Executive Summary

After the island of Lanai, the island of Maui has the fastest growing population in the state. In addition, the visitor (non-resident) population increases the population by roughly one third. The supply of both acute care and long-term care beds on the island is insufficient to meet current and anticipated future needs of the resident and visitor populations. Little capacity exists to accommodate seasonal fluctuations, disasters, or the needs of an aging population. The question addressed in this report is "How many acute care beds are needed on Maui to meet anticipated needs and to add flexibility?"

To answer this question, the State Health Planning and Development Agency (SHPDA) collaborated with Maui Memorial Medical Center (MMMC), Malulani Health Systems, Inc., Kaiser Permanente, and the Maui Mayor's office to study the acute care bed needs on the island. These collaborators, or stakeholders, have committed to the goal of improving the healthcare provided to the people of Maui and improving the stability of the entire system.

The stakeholders hired Hawaii Health Information Corporation (HHIC) to produce "evidence-based" bed need projections. The bed need study builds upon an understanding of patterns of hospitalization on Maui, in the State as a whole, and across the country; the characteristics of Maui's population, driving forces in healthcare, and multiple projection methodologies.

## Findings

- Without wait list patients, MMMC's existing supply of licensed beds (i.e. 196 beds) is adequate for the short-term, through 2005. To meet the bed needs of wait listed patients an additional 41 beds (a 21 percent increase) need to be added to MMMC's capacity to meet current demand.
- Bed capacity expansion is needed beyond 2005 to meet the acute care needs of the growing and aging population. High estimates indicate that approximately 30 more beds needed every five years beginning in 2015[1]. With wait listed patients included, increases need to be 30-40 bed increases every five years beginning in 2005.
- To meet the needs of the population 99 percent of the time, 21-31 beds needed to be added every five years beginning in 2015 if the need is only for acute care, and beginning in 2005 if the high volume of wait listed patients is to continue.

Number of beds per 1,000 population

- Currently, Maui's acute care bed supply is 1.4 beds per 1,000 population.
- Both the current use and trend analysis models yield bed need projections substantially below 2 beds per 1,000 population. In 2002, Maui's [SHPDA-recognized] licensed bed supply was 1.5 beds per 1,000 population. Projections which include wait list patients start a 1.5 beds per 1,000 and reach 1.8 beds by 2025. Projections which exclude wait list patients range from 1.3 beds per 1,000 in 2005 to 1.5 beds per 1,000 in 2025.

[1] High estimates are the current use projection plus 5%.

- Under the high estimates the ratio of beds to population would stay at 1.4 beds per 1,000 population until 2020 when it would reach 1.6 beds per 1,000 population.

A simplified version of the number of beds to be added is included in Table 1 below:

***Table 1: Beds to be Added on Maui Island, 2005-2025***

| **Needs if 12% of Maui Residents Continue to be Hospitalized on Oahu** | **2005** | **2010** | **2015** | **2020** | **2025** |
|---|---|---|---|---|---|
| High Estimate to Meet Acute Care Needs Only | 189 | 214 | 242 | 272 | 305 |
| High Estimate to Meet Wait List Needs Only | 48 | 55 | 65 | 73 | 85 |
| **Total Beds Needed to Match High Estimates** | **237** | **269** | **307** | **345** | **390** |
| **Beds to be Added Beyond Current 196 at MMMC** | | | | | |
| To Meet High Estimate Acute Care Needs | -7 | 18 | 46 | 76 | 109 |
| To Meet High Estimate Wait List Needs | 48 | 55 | 65 | 73 | 85 |
| **Total Beds to be Added to Meet High Estimates** | **41** | **73** | **111** | **149** | **194** |
| **OR** | | | | | |
| **Revised Needs if Maui Residents No Longer Go to Oahu for Hospitalization** | | | | | |
| Additional Beds Required | 25 | 29 | 33 | 37 | 42 |
| **Revised Total Beds Needed** | **262** | **298** | **340** | **382** | **432** |
| **Revised Total Additional Beds Needed** | **66** | **102** | **144** | **186** | **236** |

**Note:** The High Estimate is the Current Use Model estimate assuming an occupancy rate of 75% plus 5%. Refer to Table 14 on page 55 for details.

## Assumptions and Policy Issues

The following assumptions impact the bed need projections substantially:

- An underlying assumption with all methods was that 12 percent of Maui island residents would continue to be hospitalized on Oahu. That is equivalent to 20 to 23 beds per day currently.
- Two different assumptions were presented related to critical care utilization on Maui. One assumption was that the ratio of critical care beds to medical surgical beds would remain at 2002 levels, or 8.2%. The second assumption was that the ratio would approximate the state average between 1998 and 2002, or 9.5%.
- Assumptions related to Maui patients treated on Oahu and the ratio of critical care beds involve basic policy questions which need to be answered and are beyond the scope of this study:
    - Will tertiary care services remain centralized on Oahu or will there be planned dissemination of these services and resources (workforce, technology, infrastructure) to neighbor islands?
    - Will Big Island patients travel to Maui for tertiary care rather than traveling to Oahu?
- Two sets of calculations were performed for each bed projection model. The first set assumed that there would be no wait list patients in acute care beds. The second set assumed

that the problem of wait list patients in acute care beds would not be resolved and that this patient population would continue to grow.

- The policy question to be addressed related to wait list patients is:
    - How will Hawaii address the needs of its elderly population for long-term care services? The planned solution needs to alleviate the current default whereby the burden of their [long-term] care becomes a problem of acute care facilities.

## Issues

Several issues were raised during this study which impact bed need requirements and reflect problems in the greater community. All of the following issues, if not resolved, increase the number of beds required to meet the needs of Maui's population:

- Wait list patients filling acute care beds impact MMMC quite negatively, filling 32 beds per day, on average. Without wait list patients, MMMC's existing supply of 196 acute care beds is sufficient for short-term needs.
- Antibiotic resistant staph infections (MRSA) make it difficult to transfer infected wait list patients to long-term care. The impact of MRSA on average length of stay for all patients at MMMC is significant. While patients with MRSA represent just one-half percent of all discharges, their hospital length of stay is, on average, more than six times longer than that for patients without MRSA and represents three percent of total patient days. While only three percent of the wait listed patients are MRSA patients, they represent over 10 percent of the total patient days for wait listed patients in 2002. The number of patients treated for MRSA increased 140 percent between 2001 and 2003.
- Potentially preventable hospitalizations are those for which timely and effective ambulatory care can help reduce the risks of hospitalization for common problems. High rates of preventable hospitalizations may be an indicator of a lack of or failure of prevention efforts, a primary care resource shortage, poor performance of primary health care delivery systems, or other factors that create barriers to obtaining timely and effective care. At MMMC, approximately 29 beds are filled each day with patients with these conditions. Addressing the adequacy of the primary care delivery system, including increasing the number of primary care physicians on Maui, may reduce the demand on the hospital for some of these patients.

## Conclusion

Clearly, the island of Maui needs more acute care and long-term care beds to meet the needs of its residents and visitors. Decisions regarding the timing and extent of expansion are difficult because of the complexity of the overlapping issues:

- Insufficient primary care resources create greater demands on the acute care hospital.
- Lack of supply of long-term care beds creates greater demands on the acute care hospital.
- Antibiotic resistant infections place greater demands on the acute care hospital.

Adding acute care beds will solve problems related to insufficient acute care capacity, but will not address the problems elsewhere in Maui's health care delivery system. There is no one right answer. Expansion of acute care capacity alone would be a disservice to Maui's population.

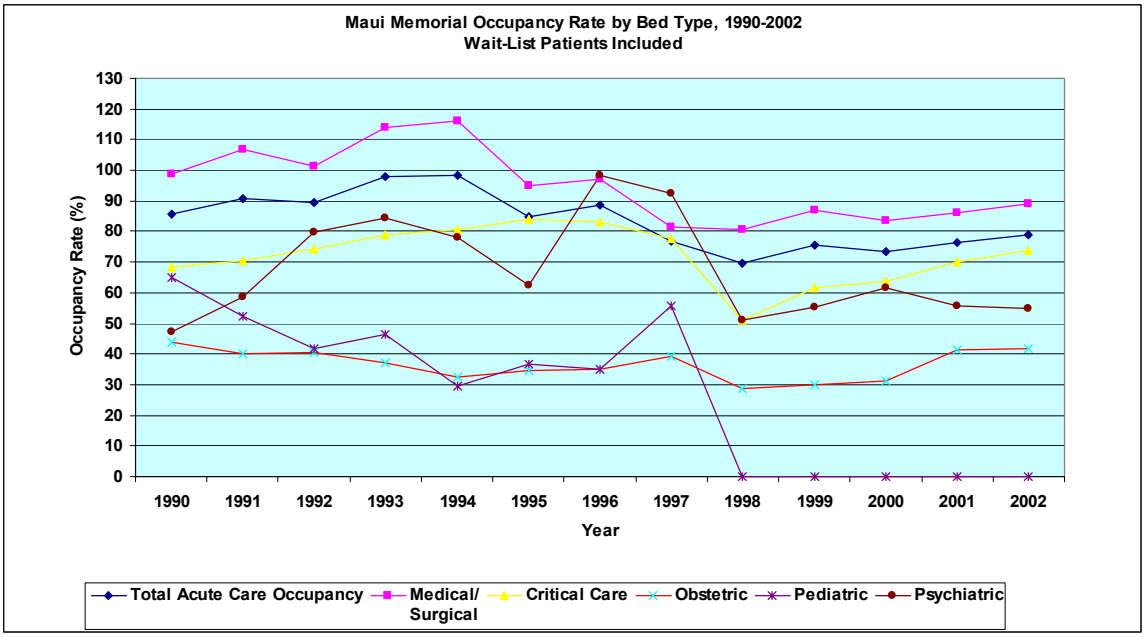
HHIC recommends an iterative process of review and action on current plans for expansion that encompass the short-term (e.g., five to seven years). During that time, plans need to be established and implemented to address other segments of the health care delivery system. Bed need projections should be reevaluated every five years, given the rapid changes taking place in health care.

## Background

After the island of Lanai, the island of Maui has the fastest growing population in the state.[2] In addition, the visitor (non-resident) population increases the population by roughly one third.[3] Facilities to serve the health care needs of the residents and visitors are presented below:

- Maui Memorial Medical Center (MMMC), with 196 beds, is Maui's only acute care hospital[4]. In recent years, occupancy rates for medical/surgical beds at MMMC have averaged 85-90 percent (see Figure 1).

***Figure 1: Occupancy Rates by Bed Type***




Source: SHPDA Health Care Utilization Reports, 1990-2002.
Note: Pediatric beds eliminated in 1998.

- Hale Makua (Wailuku and Kahului) and Kula Hospital provide facility-based long-term care, with a total of 124 Intermediate Care (ICF) beds, and 344 Skilled Nursing/Intermediate Care (SNF/ICF) beds. In 2002, occupancy rates for Intermediate Care beds was 97 percent and SNF/ICF beds 96 percent.[5]

Maui's insufficient supply of facility-based services to meet current and anticipated future needs is a major problem. Little capacity exists to accommodate seasonal fluctuations, disasters, or the needs of an aging population. There is no flexibility in the system. The question being addressed in this study is: "How many acute care beds are needed on Maui to meet anticipated needs and to add flexibility?

[2] U.S. Census, Population Division, 2004.
[3] Department of Business and Economic Development, 2002 Data Book, Table 1.08.
[4] Maui Memorial has 99% of the medical/surgical licensed bed capacity on the island of Maui. Kula Hospital has 1% with 2 acute care beds.
[5] Source: SHPDA Health Care Utilization Report, 2002 (the latest available report).

## *The Goals*

1. Establish overall commitment of the stakeholder group: improve healthcare provided to the people of Maui and improve the stability of the entire system.
2. Produce "evidence-based" bed need projections for the island of Maui using multiple methods, accommodating different scenarios, and addressing the needs of the de facto population (i.e., residents and visitors).
3. Document the process for replication on other islands.

While the collaborative approach involved and the evidence collected and presented may raise many questions and important issues about healthcare on the island of Maui, the scope of this engagement is limited to the goals stated above, with the key deliverable being the production of "evidence-based" bed need projections. Other questions will need to be addressed in the future.

## *The Process*

Discussions between SHPDA and HHIC regarding bed needs began in 2002. SHPDA recognized the need to update projections to replace acute care projections published in April 1991. HHIC, building upon its work supporting hospitals in both health planning and quality improvement, recognized the need for Hawaii's hospitals to have projections reflecting the impact of changes in demography, technology, and models of care.

The initial approach adopted included literature reviews and surveys to identify existing methodologies (Appendix A), their strengths and weaknesses; application of multiple methods to develop forecasts; and, perhaps most important of all, inclusion of key experts in the process to identify the "drivers" of change in utilization and to generate scenarios based on structural changes in healthcare.

In early 2004, SHPDA contacted HHIC to build upon the earlier work and focus on the island of Maui. Multiple stakeholders agreed to work with the State Health Planning and Development Agency to project the future bed needs for the island. Stakeholders are identified in Appendix B and represent the following groups:

- MMMC/Hawaii Health Systems Corporation
- Office of the Mayor, County of Maui
- Kaiser Permanente
- Malulani Health Systems, Inc.
- State Health Planning and Development Agency

***Table 2: Maui Island Bed Needs Study Process***

| ***Step #*** | ***Step*** | ***Timing*** | ***Related Deliverable*** |
|---|---|---|---|
| 1 | Adopt Evidence-based Methods: Conduct literature reviews and surveys to identify existing methodologies, their strengths and weaknesses | 2003 | Appendix A Literature review |
| 2 | Apply Multiple Methods to Develop Forecasts | 2003<br>June 23, 2004 | Same as above.<br>Included in this report |
| 3 | Convene local hospital planners/experts to identify "drivers" of change in utilization and generate scenarios based on anticipated structural changes in healthcare. | 2003 | |
| 4 | Meet with Stakeholders to initiate the Maui Bed Needs study to develop working relationships, common goals and discuss expectations and priorities. | Jan. 28, 2004 | |
| 5 | Gain Agreement on the Process:<br>Review proposal with stakeholders and obtain agreement on process. | Feb. 13, 2004 | Appendix C Determining Hospital Bed Needs on Maui, Proposal Discussion Draft dated Feb. 9, 2004 |
| 6 | Gain Agreement on Population Projections:<br>Present preliminary data to stakeholders for discussion. | April 2, 2004 | PowerPoint Presentation, MMMC Bed Need Projections: Initial Findings |
| 7 | Produce Project Plan to reflect changes generated April 2, 2004. | May 7, 2004 | Appendix C Maui Bed Needs Study Project Plan, May 7, 2004 |

***Table 2: Maui Island Bed Needs Study Process (continued)***

| *Step #* | *Step* | *Timing* | *Related Deliverable* |
|---|---|---|---|
| 8 | Modify Results Based on New Data and New Requirements: availability of corrected population and wait listed data; expand deliverables based on stakeholder feedback.<br>• Revised population data for Maui County received: April 26, 2004<br>• Monthly ADC data received May 6, 2004<br>• Complete Wait list Data received May 21, 2004<br>• Corrections and Verifications of Wait list data received June 4, 2004 | April - June, 2004 | |
| 9 | Gather Evidence on Stakeholder Issues Related to the Project: bio-terrorism, integrated medicine, Medicare projection methodologies | April 30, 2004 | Appendix D |
| 10 | Synthesize "driving forces" and various scenarios from national healthcare forecasts | May 28, 2004 | Appendix E Document, "Factors Driving the Future of Healthcare on Maui" |
| 11 | Discuss "driving forces" and scenarios with Maui experts, representing medicine, SHPDA, and the Mayer's office. Distill comments and incorporate assumptions into bed need forecast. | May 28, 2004 | Appendix E |
| 14 | Present results of analysis to stakeholder group, gather feedback, and generate final report. | June 23, 2024 | PowerPoint presentation, draft final report |

This bed need study builds upon an understanding of patterns of hospitalization on Maui, in the State as a whole, and across the country; the characteristics of Maui's population; driving forces in healthcare; and multiple projection methodologies.

## Driving Forces and Scenarios for Maui's Healthcare Future

Bed need projections relate directly to the CON need and accessibility criteria. To enhance the process for determining bed needs, key issues driving change in healthcare were synthesized from a series of forecasts developed nationally. Table 3 summarizes these driving forces in relationship to CON criteria.

Some of these driving forces are factored into the projection models, specifically aging of the population, population growth, utilization, and disease trends. Other driving forces become issues for consideration in review of specific proposals, although these issues do not directly influence the number of acute care beds needed on the island of Maui. Examples include access to capital, development of specialty facilities, and workforce shortages.

During the course of the bed needs study, one teleconference was held with physicians and public officials on Maui (Appendix E), to discuss these driving forces. Numerous concerns were raised about the growing population, the uninsured, workforce shortages and the potential for the elderly being underinsured. Success was seen as patients being treated in the right setting at the right time, with no mal-distribution of resources. Consensus was that sufficient hospital beds should be available on Maui to handle 99 percent of the demand.

Participants also discussed a variety of scenarios for Maui's healthcare in the future:

- ***Stormy Weather***
- ***The Long and Winding Road***
- ***The Sunny Side of the Street***

These scenarios could impact bed need projections in the following ways:

- Increase or decrease likelihood of hospitalization (use-rates)
- Increase or decrease length of stay (patient days)
- Shift in the percentage of Maui patients treated on Oahu

The consensus was that the Stormy Weather scenario best fit Maui's foreseeable healthcare future. However, one member challenged the group to step back and consider:

> "What would it take for us to achieve the Sunny Side of the Street scenario?"

This question remains an unanswered challenge for addressing Maui's future. The question also impacts the determination of bed needs beyond the next five to seven years. A potential approach to move away from "Stormy Weather" towards the more desirable "Sunny Side of the Street" is to adopt the bed need projections, review and act upon current projects for increasing bed need, and periodically review bed needs (e.g., every 5-7 years). In the interim, continue to engage the residents, employers, and providers of Maui regarding their vision for Maui's healthcare future. Design that future.

***Table 3: Key Issues Driving Change in Healthcare[6] in Relationship to CON Criteria***

| | |
|---|---|
| ***Criteria 1: Relation to the State Plan:***<br>(1) The relationship of the proposal to the state health services and facilities plan (aka H2P2). | |
| ***Criteria 2: Need and Accessibility:***<br>(2) The need that the population served or to be served has for the services proposed to be offered or expanded, and the extent to which all residents of the area, and in particular low income persons, racial and ethnic minorities, women, people with disabilities, and other underserved groups, and the elderly, are likely to have access to those services. | |
| ***Aging & Longevity*** | The impact of aging is more complicated than it has been in the past, for several reasons. Solucient forecasts a 46 percent increase in demand for acute care beds by 2027 if today's use patterns are applied to population projections. Factors: Baby Boomers are beginning to experience acute symptoms of emerging chronic illnesses. 75+ will use 3-4times the number of days as younger adults, 2 times the physician visits. Higher education makes Baby Boomers and seniors more health conscious. Baby Boomers have high contact with the healthcare system because of their aging parents. Chronic diseases, more prevalent among seniors than younger groups, including heart disease, cancers, and respiratory disorders. |
| ***Population Growth*** | Demographic growth is accelerating the expansion of healthcare facilities in some communities. The full impact of the aging population will not be felt until well after 2010, when Baby Boomers reach retirement age. While population for Hawaii as a whole grew by 12 percent between 1990 and 2002, most of that growth occurred outside CC of Honolulu. Maui County experienced the biggest growth in population, with a 34 percent increase. Current DBEDT projections indicate that the neighbor islands will grow faster than Honolulu over the next 25 years. (Coile, p.3; Presken, p. 1; HHIC, p. 17, Institute for the Future, p.18) |
| ***Income*** | Household income is increasing, but the gap between extremes is widening. Hospital use decreases with increasing per capita income. Research has shown that when income disparity among the population widens, the overall health status of the population worsens.(Institute for the Future, p. 21, Forrest, et al, p. 11) |

[6] **Sources**:

- Coile, Russell C. Jr., Futurescan 2003: A forecast of Healthcare Trends 2003-2007, Health Administration Press.
- Institute for the Future, Health and Healthcare 2010: The Forecast, The Challenge, Second Edition, supported by the Robert Wood Johnson Foundation, January 2003.
- Gartner Group, Healthcare State of the Union 2002: Uncertain Times. Hard Choices. Practical Solutions.
- Foundation for Accountability, Innovators and Visionaries: Strategies for Creating a Person-centered Health System, September 2003.
- Forrest, Sharon, et al, Forces Influencing Inpatient Costs in the United States, prepared for BCBS, October 2002.
- HHIC, *Health Trends in Hawaii, 6th Edition*, funded by HMSA Foundation, December 2003.
  Presken, P. "National and Local Impact of Long-term Demographic Change on Inpatient Care." Solucient, 2002.
- Siegrist, Richard B. Jr., Understanding the Inpatient Cost of Caring for the Uninsured, prepared for BCBS, June 2003.

***Table 3: Key Issues Driving Change in Healthcare in Relationship to CON Criteria (continued)***

| | |
|---|---|
| ***Coverage*** | The major categories of Medicare, Medicaid, uninsured, and private health insurance will remain the core sources of coverage (or lack of coverage). The number of uninsured is increasing about 750,000 nationally per year. The surge of ER patients is driven by the rapidly expanding numbers of uninsured. Rising levels of uncompensated care could have serious financial effects on hospital profitability in the next five years.<br><br>Uninsured individuals who require inpatient hospital care are quite different from the general uninsured population and from those covered under private insurance. They are much older than the general uninsured population. They are hospitalized much more frequently than privately insured individuals for conditions that could be treated outside the hospital if good preventive and ambulatory care services were more accessible. Inpatient care for diabetes, asthma and mental health services is much more common for the uninsured. (Coile, pp. 13-14; Institute for the Future, p. 42, Siegrist, p. 3) |
| ***Consumerism*** | Need to incorporate consumers into health care decision making. Consumers are paying more of their health plan and medical bill costs as employers and plans shift more costs to enrollees. The concept of a consumer-led market could accelerate if major employers switch from "defined benefit" to "defined contribution", encouraging consumers to become prudent purchasers of health insurance and medical services. Hawaii must address the Prepaid Healthcare Act for this switch to take place. Raising the share of health costs that consumers pay is an increasingly popular solution to the rising costs of health coverage, medical services, and pharmaceuticals. Up to a point, cost sharing is good public policy, as well as a way to offset employers' rising health costs. But limits to cost sharing could be reached in the next two to five years, after which some consumers will just stop using health services or buying drugs until their health problems become too acute to ignore. (Coile, pp. 5-8) |
| ***Demand*** | Managed care has loosened its hold on prior authorizations, allowing more patients to obtain diagnostic and treatment procedures in hospitals. After years of declining utilization rates, the demand for acute inpatient care is climbing. (Coile, pp. 2-4). |
| ***Disease*** | By 2020, it is expected that half of the US population will suffer from chronic disease and that management of these conditions will represent 80 percent of health care spending. In terms of its negative effects on chronic medical conditions and health-related quality of life, obesity is worse than both drinking and smoking combined. The effect of obesity on emergence of chronic disease and quality of life is similar to that observed with 20 years of aging. Obesity is linked to substantial healthcare resource utilization and cost. (Forrest, et al, pp. 13-24) |

***Table 3: Key Issues Driving Change in Healthcare in Relationship to CON Criteria (continued)***

| | |
|---|---|
| ***Relationship to the Existing Health Care System Criterion:***<br>***(1) The relationship of the proposal to the existing health care system of the area.*** | |
| ***Change in Business Direction: e.g., mergers, consolidation, etc.*** | Consolidation should improve the financial situation of troubled systems and hospitals. Few facilities are likely to be closed, but money-losing services could be discontinued. Cash flow and financial management of consolidated institutions will be improved. For-profit companies are taking advantage of the opportunity to provide capital and management services to hospitals in distress; these companies are likely to expand in the next two-to-five years. One caution: continued consolidation among healthcare providers could raise red flags for antitrust authorities. (Coile, p. 10-11) |
| ***Disaster/ Bioterrorism*** | Healthcare facilities are the first line of defense in the event of an attack of weapons of mass destruction. Hospitals in major urban centers feel more likely to be involved. (Coile, p. 27) |
| ***Cost and Financial Criteria:***<br>***(1) The probable impact of the proposal on the overall costs of the health services to the community;***<br>***(2) The probable impact of the proposal on the costs and charges for providing the health services by the applicant;***<br>***(3) The immediate and long-term financial feasibility of the proposal;***<br>***(4) The availability of less costly or more effective alternative methods of providing service.*** | |
| ***Financial Stability*** | After a decade of low inflation in the 1990's, healthcare expenditures are rising again. Managed care's moderating effect on medical care inflation is over. Higher demand is propelling higher costs for hospital care, diagnostic and surgical procedures, and emergency room use. Health insurance premiums are soaring at inflation rates of 12-15 percent, and frustrated employers are searching for alternatives. Rising Medicare and Medicaid costs are a growing concern to government. Although service volumes and revenues are growing, many hospitals fear their fast-rising costs for wages and pharmaceuticals will wipe out any profits. Hospitals caught in the spiral of rising costs and uncompensated care are turning to revenue-cycle enhancement to boost their finances. (Coile, pp. 10-11) |
| ***Access to Capital*** | Hospitals are now catching up on 10 years of delayed capital investment in inpatient facilities. Top priorities for expansion will be operating rooms, critical care units, and emergency departments. From a capital standpoint, "haves and have-nots" will exist among US hospitals. In an expanding market, organizations with capital can make the facility investments needed to grow. But facilities with limited capital access or those that are "capped-out" in terms of additional borrowings must become innovative in terms of capital partnerships, joint ventures, and other financial arrangements. (Coile, pp. 12, 18-21) |
| ***Alternatives: Ambulatory Surgery Centers, Specialty Facilities*** | Some community hospitals say niche providers "cherry pick" the few lucrative service lines left in healthcare and leave hospitals with responsibility for the financially draining services such as trauma centers, burn units and emergency departments. Hospitals are very dependent on a few profitable service lines like heart care and surgery, which could be competed away by specialized hospitals and ambulatory care facilities. In contrast to the 1990's, demand is now growing for both inpatient and outpatient care. As hospitals switch their attention back to their inpatient facilities, entrepreneurs--and the hospital's own doctors--see an opportunity to respond to consumer preference for ambulatory care centers. Hospitals could be outspent and outmaneuvered in the ambulatory care market by more agile competitors with shorter business planning cycle times. (Coile, pp. 10-11; Forrest, et al, p. 39) |

***Table 3: Key Issues Driving Change in Healthcare in Relationship to CON Criteria (continued)***

| | |
|---|---|
| ***Disease: Last year of life and death*** | Researchers led by Stephen Crystal, Ph.D., of Rutgers University, analyzed the 1992-1996 Medicare Current Beneficiary Survey, which contains yearly health care use and cost data for about 10,000 elderly men and women. The mean annual medical expenditures (1996 dollars) for the elderly from 1992 to 1996 were $37,581 during the last year of life versus $7,365 for other years. The estimated 1992-1996 mean Medicare expenses during the last year of life were $22,967. However, the portion of Medicare expenses spent on the last year of life in 1992-1996 was 26 percent, similar to that spent on the last year of life between 1976 and 1988. In addition, last-year-of-life expenses constituted 22 percent of all medical, 26 percent of Medicare, 25 percent of Medicaid, and 18 percent of all non-Medicare expenditures. Additional non-Medicare expenditures near the end of life are directed toward facility-based management of chronic conditions preceding death rather than to acute terminal conditions per se. As the elderly population ages, average total end-of-life medical expenses (adjusted for inflation) will probably change little, but the portion paid by non-Medicare sources supporting chronic and custodial care will likely rise, conclude the researchers. (Forrest, et al, p. 26) |
| | ***Quality Criteria:***<br>***(1) The applicant's compliance with federal and state licensure requirements;***<br>***(2) The quality of the health care services proposed;***<br>***(3) In the case of existing health services or facilities, the quality of care provided by those facilities in the past.*** |
| ***Liability*** | Premiums are rising fast for professional liability insurance for both doctors and hospitals. Malpractice premiums for physicians, schools and hospitals have increased between 20 percent and 199 percent. Legal costs are swelling uncontrollably. This situation creates some difficulties for hospitals to purchase coverage and contributes to rising costs. Liability issues have also led to the practice of "defensive medicine" where a physician prescribes unnecessary treatments and tests to avoid litigation. Expect that the malpractice situation will affect the choice of residency training by medical students, which could very quickly slash the pipeline of trainees for high-risk specialties such as neurosurgery, obstetrics/gynecology and anesthesiology. (Coile, p. 14; Forrest, et al, pp. 38-39) |
| | ***Availability of Resources Criterion:***<br>***(1) The availability of resources (including health personnel, management personnel, and funds for capital and operating needs) for the provision of services proposed to be provided and the need for alternative uses of these resources as identified by the state health services and facilities plan (a.k.a. H2P2) or the annual implementation plan.*** |
| ***Workforce Shortages*** | Competition for nurses and other health workers will persist, and could get worse in the short-term, with little expansion of supply likely in the next 2-5 years. Labor shortages continue to plague hospitals across America despite higher wages and increased work flexibility. New estimates place the nursing turnover rate at 21 percent per year. Hospitals are experimenting with staffing mixes and team approaches. Many other categories of health workers, including pharmacists and technicians, are also in short supply. There is a specter of a coming physician shortage.<br><br>Workforce shortages are costly; high demand has led to salary increases up to 10 percent for full time nurses. Complying with recent California legislation requiring one nurse to five patients in medical/surgical units is projected to cost $217,210 per hospital, or 1.7 percent of the typical hospital budget. However, the cost of hiring additional nurses [if they exist] may be offset if patients have fewer adverse events and complications and leave the hospital sooner. (Coile, pp. 28-30, Forrest, et al, pp. 44-47) |

***Table 3: Key Issues Driving Change in Healthcare in Relationship to CON Criteria (continued)***

| | |
|---|---|
| ***Technology*** | The growth of capital spending for high technology may stimulate criticism of a "medical arms race" among competing hospitals and ambulatory facilities. Concern about excess competition and spending could lead to demands by employer coalitions or health plans to revive capital expenditures review by state regulatory agencies or even to establish review at the national level.<br>• By 2010, there should be a cascade of new diagnostics, drugs, and gene therapies being released as a result of current genomics research.<br>• Expansion of self-referred imaging may lead to greater utilization of healthcare services to confirm the benign nature of incidentally found lesions.<br>• The arrival of drug-coated stents may be more of a boon to community hospitals than teaching hospitals, with the push of tertiary services away from traditional referral centers.<br>• Also, there will be accelerated competition between cardiac surgeons vs. cardiologists vs. interventional radiologists (e.g., "tribal warfare")<br>• Biomedical devises may dramatically change the health status of patients such as congestive heart failure patients.<br>• More minimally invasive surgeries will be conducted.<br>• Major breakthroughs expected by 2010 in the area of improved diagnostics and treatment for cancer.<br>• The digital transformation of America's 5,000 hospitals is gaining momentum.<br>(Coile, pp. 15-18, 22-25; Forrest, Sharon, et al, pp. 39-43, Institute for the Future, pp. 111-132, comments from Ron Kwon) |

## Hospitalization: Understanding the Issues

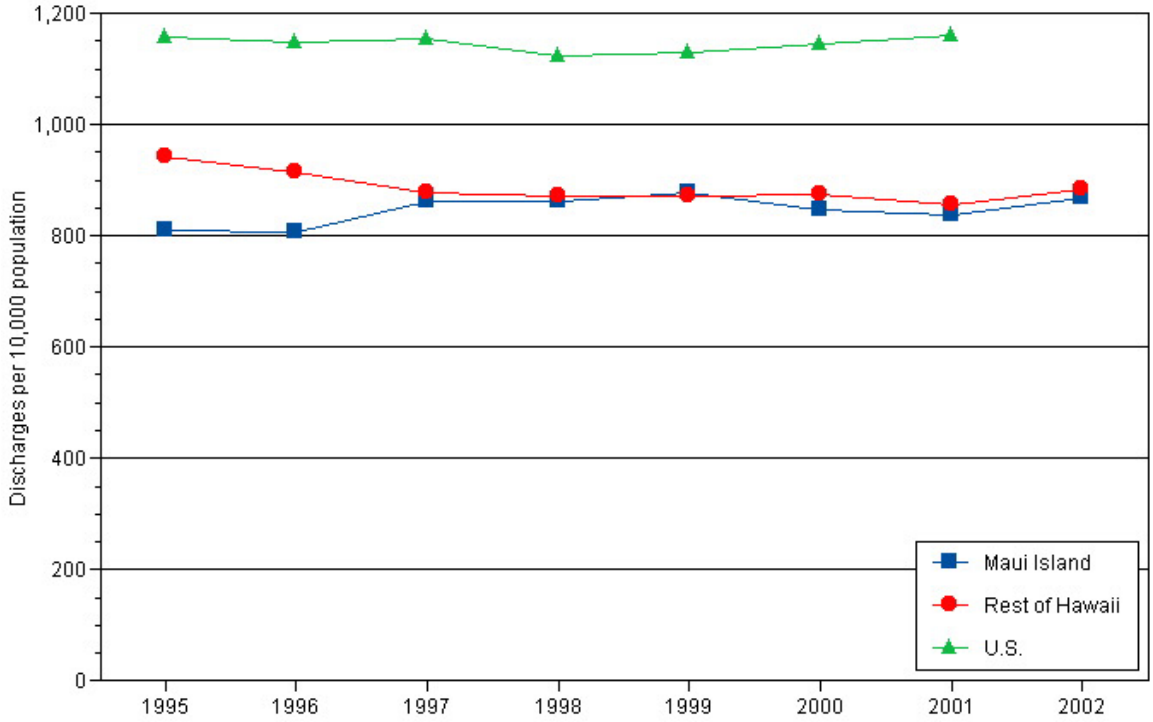
In order to establish the need for updated acute care bed projections, the current acute care hospital bed situation on Maui needs to be understood. The situation is described in terms of comparative hospitalization use rates by location and age group, changes in hospitalization over time, emergency department use, potentially preventable hospitalizations, occupancy rates over time and "target" rates, daily census trends, wait listed patients, and Maui resident hospitalization on Oahu.

The purpose in examining many perspectives of hospital use is that the issues surrounding demand for acute care reflect the functioning of the entire healthcare delivery system including primary care, emergency care, acute care and long-term care. Changes in primary care and long-term care will impact both emergency care and acute care utilization, and subsequently, bed needs.

## *Maui use rates versus Other Island use rates, US rates*

Maui island residents (and Hawaii state residents, generally) are hospitalized less frequently than residents of other states. This pattern has been consistent over time.

***Figure 2: Maui Resident Use Rates Compared to Other Islands, US, 1995-2002***

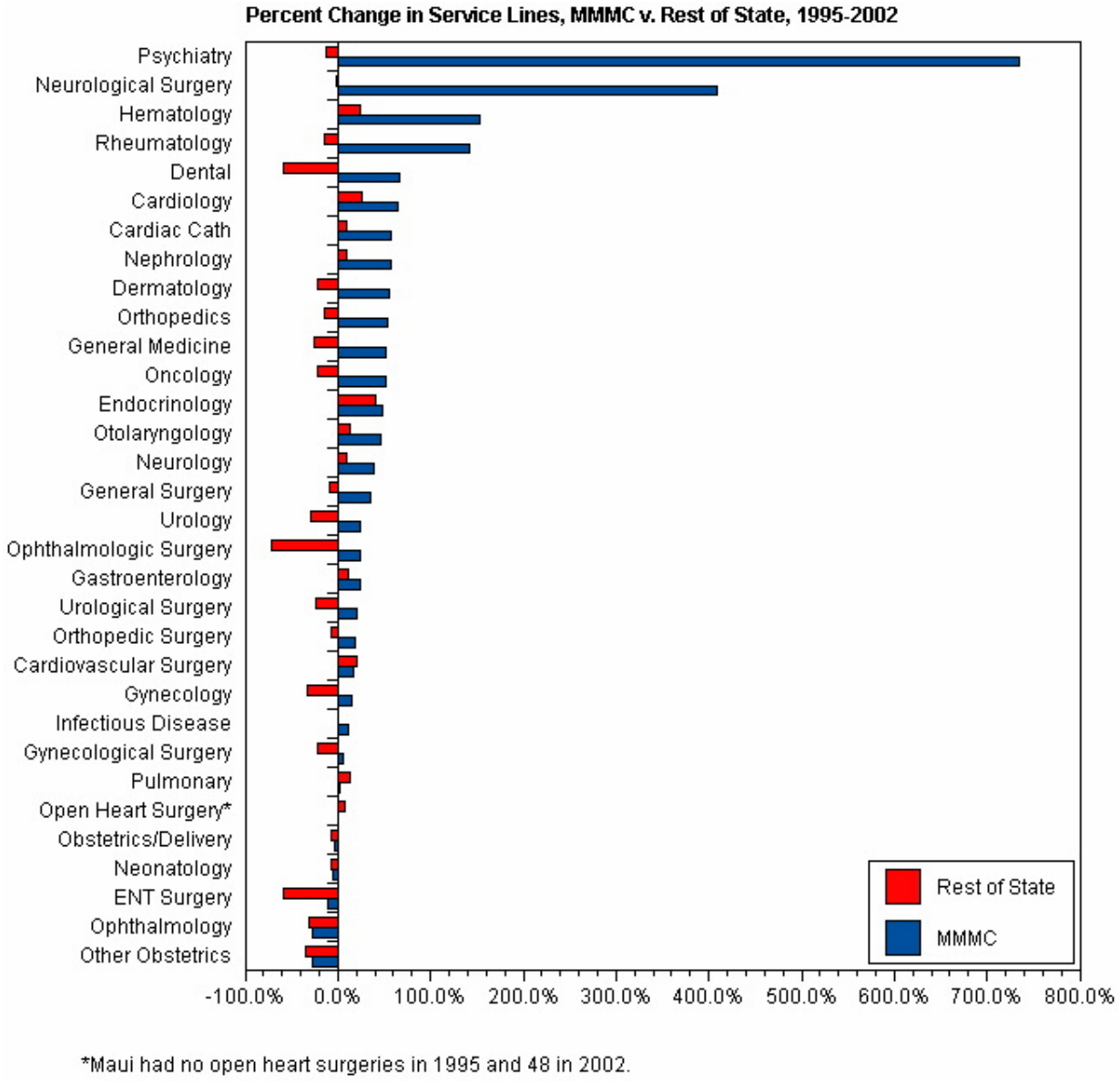



Source: Hawaii: Hawaii Health Information Corporation, Inpatient Database, 1995-2002; U.S.: HCUPnet, Healthcare Cost and Utilization Project. Agency for Healthcare Research and Quality, Rockville, MD. http://www.ahrq.gov/HCUPnet/. Excludes newborns. Includes Maui residents hospitalized in Hawaii on islands other than Maui.

## *Changes in Hospitalization at Maui Memorial Medical Center, 1995-2002*

Between 1995 and 2002, the pattern of change in hospital discharges at MMMC was quite different from that seen in other hospitals across the state (Figure 3). MMMC experienced increased utilization in nearly all service lines.

***Figure 3: Changes in Hospitalization at Maui Memorial, 1995-2002***

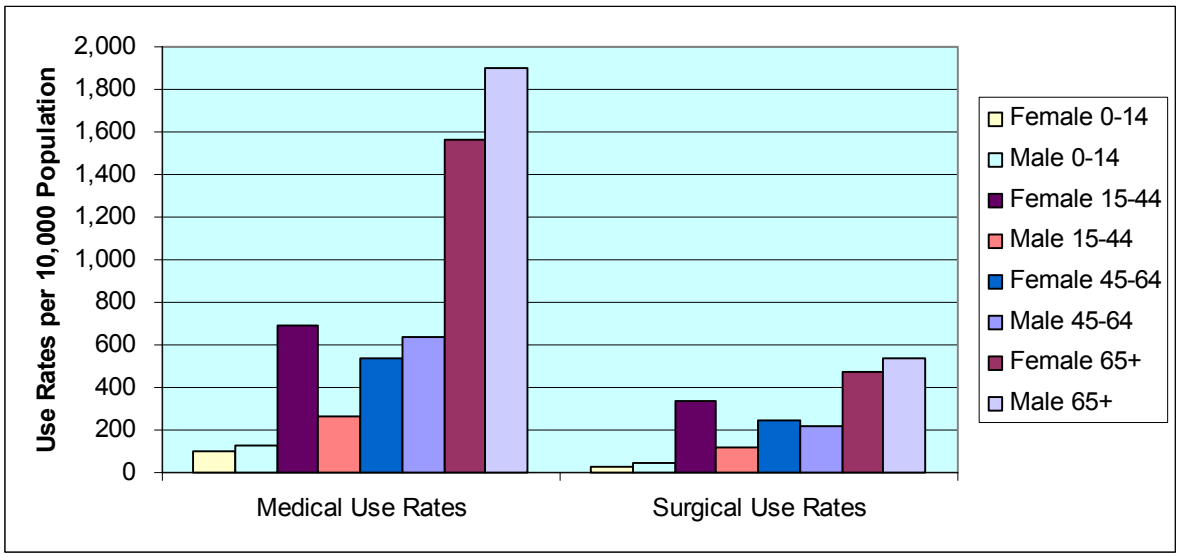



Source: Hawaii Health Information Corporation inpatient database.

## *High versus Low Utilizers*

The elderly are much more likely to be hospitalized than the young, with the exception of women of childbearing age. Figure 4 summarizes hospitalization "use rates" per 10,000 population based on age/sex cohorts.

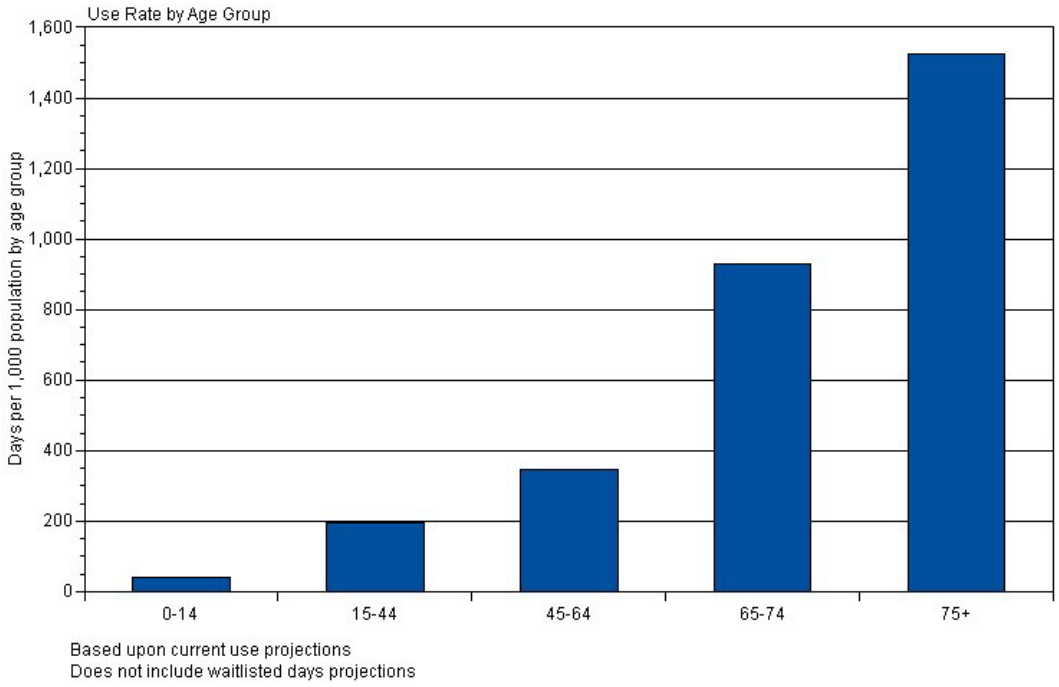
***Figure 4: Maui Resident Hospitalizations per 10,000 by Age/Sex Cohorts, 2002***




Source: Hawaii Health Information Corporation inpatient database.

Figure 4a summarizes patient days by age cohort. Note that patients age 75 years and older are likely to spend much more time in the hospital than all other age groups, including those 65-74 years.

***Figure 4a: Maui Resident Days per 1,000 Population by Age, 2002***



## *Emergency Department Utilization*

Nationally, about 12 percent of patients visiting the emergency department (ED) for care are hospitalized.[7] For the state of Hawaii, 16 percent of ED patients are hospitalized. At MMMC, 23 percent are hospitalized.[8] Further, 54 percent of MMMC's hospitalized patients are admitted through the ED, compared to the state average of 47 percent and national average of 40 percent.[9]

Why is the pattern different on Maui?

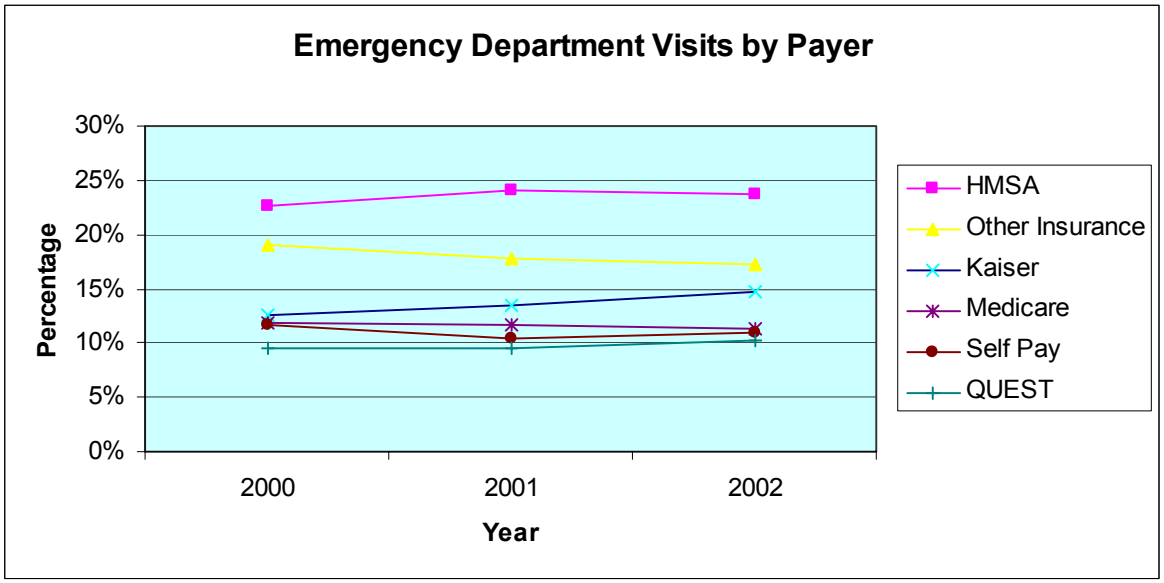
Maui's supply of health and social services workers, as a percent of the total workforce, is the lowest in the State. Similarly, its supply of physicians is the lowest in the State, as measured by the proportion of primary care physicians to total physicians and the number of physicians per 10,000 population.[10] Growth in Maui's physician population is not keeping up with the growth in the de facto population.

Potential explanations for Maui's pattern of hospitalizations from the ED include:

a) Patients don't have a primary care physician so they delay care until their condition is urgent/emergent (physician shortage).
b) Patients are uninsured and as a consequence, do not have a regular source of primary care. Care is delayed until there is an emergency (uninsured).
c) Patients live too far from a physician's office. They wait until their care requires emergency attention (mal-distribution of resources).

[7] National Hospital Ambulatory Medical Care Survey: 2002 Emergency Department Summary, www.cdc.gov/nchs/fastats/ervisits.htm.
[8] Hawaii Health Information Corporation Emergency Department Database.
[9] HCUPnet, Healthcare Cost and Utilization Project. Agency for Healthcare Research and Quality, Rockville, MD. http://www.ahrq.gov/HCUPnet/
[10] HMSA Foundation, Health Trends in Hawaii, Sixth Edition, pp. 76-77

***Figure 5: Emergency Department Visits by Payer, Maui Memorial Medical Center, 2000-2002***




Source: Hawaii Health Information Corporation Emergency Department Database

Maui Island's emergency department visit rates are substantially below those of the Big Island and Kauai. Part of the difference may be explained by the availability of Kaiser's urgent care clinic, open from 5:00 a.m. – 9:00 p.m. weekdays and 8:00 a.m. – 5:00 p.m. on weekends and holidays. Evidence to support this assumption is that, while 35-40 percent of Maui Island's population is Kaiser Health Plan members,[11] only 13-15 percent of MMMC's Emergency Department visits are comprised of Kaiser members (Figure 5).

[11] Source: Kaiser Permanente Medical Group, Vice President for Neighbor Island Services. Note: 25 percent of Maui's inpatients are Kaiser members.

## *Potentially Preventable Hospitalization Trends, 1995-2002*

From the standpoint of developing bed need projections, understanding preventable hospitalizations become a means of identifying potential opportunities to improve the overall healthcare system by further developing the primary care environment. The better the primary care system works, the fewer hospitalizations (and acute care beds) are required for these conditions.

Potentially preventable hospitalizations are those for which timely and effective ambulatory care can help reduce the risks of hospitalization for common problems such as asthma, diabetes, or dehydration. High rates of preventable hospitalizations in a community may be an indicator of a lack of or failure of prevention efforts, a primary care resource shortage, poor performance of primary health care delivery systems, or other factors that create barriers to obtaining timely and effective care.

***Table 4: Maui Memorial Medical Center Potentially Preventable Hospitalizations, Discharges, Days, ALOS and ADC*, 1995-2002***

| Year | Discharges | Total Days | ALOS* | ADC** |
|---|---|---|---|---|
| 1995 | 1,250 | 11,057 | 8.8 | 30.3 |
| 1996 | 1,230 | 11,984 | 9.7 | 32.8 |
| 1997 | 1,336 | 9,927 | 7.4 | 27.2 |
| 1998 | 1,480 | 10,395 | 7.0 | 28.5 |
| 1999 | 1,392 | 9,520 | 6.8 | 26.1 |
| 2000 | 1,425 | 10,717 | 7.5 | 29.4 |
| 2001 | 1,419 | 10,360 | 7.3 | 28.4 |
| 2002 | 1,481 | 10,698 | 7.2 | 29.3 |

Source: Hawaii Health Information Corporation Inpatient Database.
* ALOS: Average length of stay
** ADC: Average daily census

There are 16 ambulatory care sensitive conditions (ACSC), or potentially preventable hospitalizations, tracked in Hawaii.[12] In 2002, these conditions account for 13 percent of all discharges at MMMC, utilizing approximately 29 beds daily. Of the 16 ACSCs, three conditions are prominent each year: congestive heart failure, bacterial pneumonia, and cellulitis. These three conditions alone utilize 17 beds daily. In addition, the diabetes-related hospitalizations represent about nine percent of preventable hospitalizations each year, adding three beds to the daily bed census (Table 5).

[12] Definitions of these indicators are available from the Agency for Healthcare Research and Quality (AHRQ), http://www.qualityindicators.ahrq.gov/data/hcup/prevqi.htm.

***Table 5: Potentially Preventable Hospitalizations by Condition, Maui Memorial Medical Center, 1995-2002***

| Potentially Preventable Hospitalization | Discharges | % of Total "Preventable" Discharges | Total Days | % of Total Days | ALOS | ADC |
|---|---|---|---|---|---|---|
| Congestive Heart Failure | 2,193 | 20% | 16,141 | 19% | 7.4 | 44.2 |
| Bacterial Pneumonia | 2,082 | 19% | 17,736 | 21% | 8.5 | 48.6 |
| Cellulitis | 1,384 | 13% | 14,228 | 17% | 10.3 | 39.0 |
| Asthma | 1,104 | 10% | 4,486 | 5% | 4.1 | 12.3 |
| Urinary Tract Infection | 763 | 7% | 4,999 | 6% | 6.6 | 13.7 |
| Chronic Obstructive Pulmonary Disease | 741 | 7% | 5,742 | 7% | 7.7 | 15.7 |
| Dehydration | 619 | 6% | 4,461 | 5% | 7.2 | 12.2 |
| Diabetes Long-term Complications | 533 | 5% | 6,411 | 8% | 12.0 | 17.6 |
| Low Birth Weight | 336 | 3% | 796 | 1% | 2.4 | 2.2 |
| Angina Without Procedure | 327 | 3% | 1,189 | 1% | 3.6 | 3.3 |
| Diabetes with Lower-extremity Amputation | 202 | 2% | 4,976 | 6% | 24.6 | 13.6 |
| Perforated Appendix | 196 | 2% | 1,456 | 2% | 7.4 | 4.0 |
| Hypertension | 168 | 2% | 614 | 1% | 3.7 | 1.7 |
| Pediatric Gastroenteritis | 151 | 1% | 265 | 0% | 1.8 | 0.7 |
| Diabetes Short-term Complications | 144 | 1% | 657 | 1% | 4.6 | 1.8 |
| Uncontrolled Diabetes | 70 | 1% | 501 | 1% | 7.2 | 1.4 |
| **Total Potentially Preventable Hospitalizations** | **11,013** | **100%** | **84,658** | **100%** | | |

Source: Hawaii Health Information Corporation Inpatient Database.
High volume preventable hospitalizations
Diabetes-related hospitalizations

Recently published research indicates that HMOs tend to have fewer preventable hospitalizations. [13] Changes in the primary care delivery system over time (e.g., more physicians, health workers, increased insurance coverage, better transportation and other access) may result in reducing the number of preventable hospitalizations.

[13] Zhan, Chunliu, Marlene R. Miller, Herbert Wong, and Gregg S. Meyer, "The Effects of HMO Penetration on Preventable Hospitalizations", Health Services Research, 39:2, April 2004, pp. 345-361.

## *Occupancy Rates*

Occupancy rates are an indicator of the level of service a hospital can provide.

Typical occupancy rates used for hospital planning are summarized in Table 6. These are based on federal targets established about 25 years ago and rely on readily available data, e.g., number of licensed beds, total admissions or discharges, and length of stay.

***Table 6: Typical Target Hospital Occupancy Rates Used for Hospital Planning***

| ***Type of Bed*** | ***Typical Occupancy Guidelines***[14] |
|---|---|
| Obstetric | 75 percent |
| Pediatric | 75 percent |
| Psychiatric | 75 percent |
| Critical Care | 75 percent |
| Medical/Surgical | 80-85 percent |

Source: RM Towill, Maui Public Facilities Study

Not all policy analysts agree with this guideline, given the other factors that impact the availability of a hospital bed for a patient in need. Linda Green's article, "How Many Hospital Beds?" clearly explains some of the limitations of the guidelines in Table 5:[15]

> "Though current occupancy numbers are generally low, leading to the widespread perception of excess beds, they must be regarded with suspicion for several reasons.
>
> First, hospital occupancy is defined as the ratio of occupied beds to the total number of beds. However, both the numerator and denominator of this ratio have associated measurement problems. First, what is a "bed"? Published occupancy levels usually are based on the total number of certified or licensed beds. However, internal data used by hospitals typically include both certified beds and beds "in service", where the latter is generally less than the former…..
>
> Similarly, what is "occupied"? Reported occupancy levels generally are based on the average "midnight census." This refers to the time when hospitals count patients for

[14] Various sources cite these typical guidelines, including: RM Towill Maui County Facilities Study, p. 8-12; Green, Linda "How many hospital beds?" (400-412); Billings,John., Kaplan, S., and Mihanovitch, T. "Projecting Hospital Utilization and Bed Need in New York City for the Year 2000." HRP Reports, New York University, 1996; Brecher, C. and Speizio, S. "Privatization and Public Hospitals", New York: Twentieth Century Fund Press, 1995.

[15] Green, Linda, "How many hospital beds?" (400-412). See also Appendix G for copy of the article.

> billing purposes. However, the midnight census usually measures the lowest occupancy level of the day….
>
> Finally, the use of hospital facilities is far from uniform across the week or across the year. Specifically, very few procedures are scheduled for weekends, so elective patients are usually not admitted on weekends when the average daily census is considerably lower. Summer and holiday periods are also slower and other seasonal effects have been observed in specific hospitals and/or specific units. Reported occupancy levels are yearly averages, and hence do not reflect significantly higher levels that may exist for extensive periods of time."

Currently available data do not take into account the following factors:

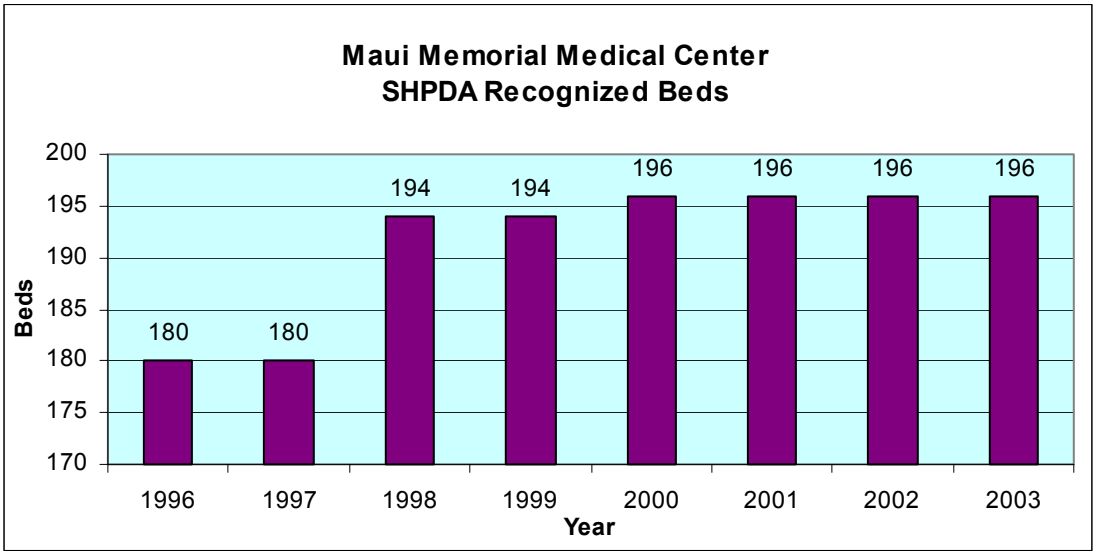
- Delays in placing a patient in the appropriate bed.
- Backup of patients in the emergency department.
- Unavailability of beds because of staffing shortages.
- Unavailability of an appropriate bed because other patient types are taking up the beds due to overflow or unavailability of beds in other areas of the hospital.
- Early discharge of patients due to bed constraints.
- Holding patients in "upstream" areas such as surgical areas, where long delays may backup the surgery schedule and result in surgery postponement or cancellation.

While data regarding the above factors are not readily available, the issues are taken into account by relaxing occupancy rate "targets" to provide an estimated range of beds needed and by calculating the number of beds required to meet patient demand 99 percent of the time. The peaks in daily census, which epitomize the need for flexibility in bed need projections, are presented in the next section.

## *Daily Census Trends*

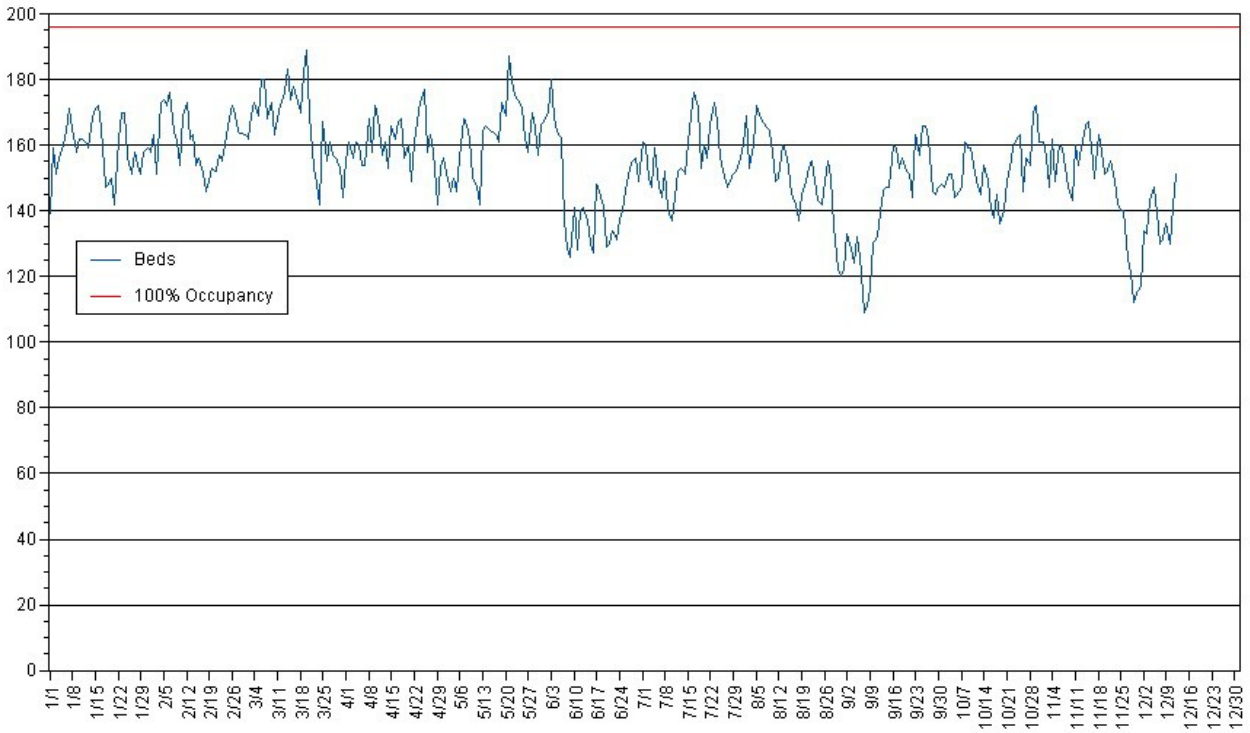
In 2002, occupancy rates based on licensed bed capacity at MMMC exceeded 85 percent 67 times or almost six days every month. At no point during 2002 did overall occupancy exceed 100%. During this time, MMMC periodically increased its licensed bed supply to respond to community need (Figures 7-8).

***Figure 7: Changes in Maui Memorial Medical Center's Acute Care Bed Supply, 1990-2003***




Source: SHPDA Health Care Utilization Reports, 1990-2002.

***Figure 8: 2002 Average Daily Variation in Occupancy (includes Wait Listed Patients)***




Source: Hawaii Health Information Corporation Inpatient Database and MMMC wait listed patient population, 2002.

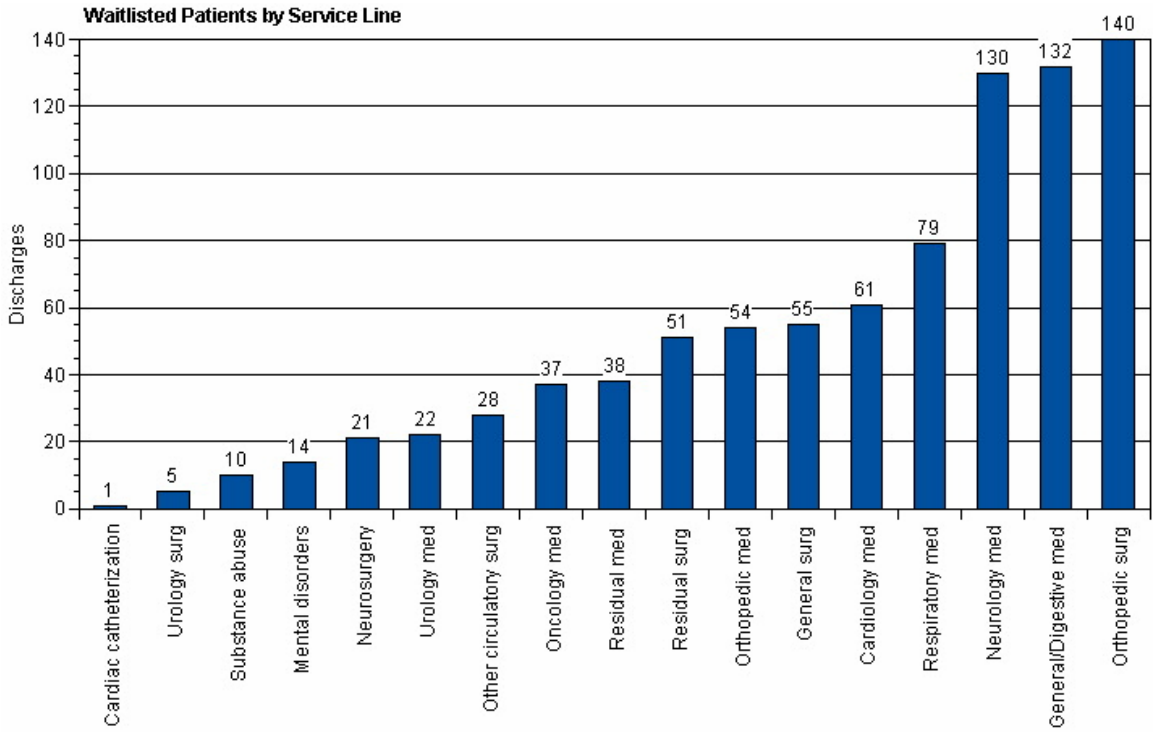
## *Wait Listed Patients*

On Maui, wait listed stays are a particular problem. Wait listed patients are defined as hospital inpatients no longer requiring acute care and ready to be discharged to a lower level of care, usually an SNF or ICF, but for whom no capacity exists to enable transfer, or the patient is not acceptable to the available provider of care.

In 2002, the only year for which detailed wait listed data were available, 883 patients were wait listed for a total of 11,691 days, the equivalent of 32 hospital beds filled every day, or 16 percent of MMMC's SPHDA-recognized bed capacity.

Wait listed patients tend to be older (71 years) and spend an average of 23 days in the hospital, with only 10 days required for their acute care. Eight percent of these patients are not Maui residents. The specific diagnostic categories for which wait listed patients were hospitalized are summarized in Figure 9.

***Figure 9: Maui Wait Listed Patients by Service Line, 2002***




Source: Hawaii Health Information Corporation Inpatient Database and MMMC wait listed patient population, 2002.

Nearly half (46 percent) of all wait listed patients are orthopedic surgery, general medicine, or neurology patients. Most orthopedic wait listed patients are hip and joint replacement or hip fracture patients. General medicine wait listed patients have cellulitis, other bacterial infections, or hypovolemia and other electrolyte disorders. Neurology wait listed patients tend to be stroke patients.

Discussions with the stakeholder group revealed that methicillin-resistant staphylococcus aureus[16] (MRSA) is a particular problem in the community. For MMMC, the presence of MRSA makes it difficult to transfer infected wait listed patients to other settings.

MRSA is a "staph" infection that has become resistant to various antibiotics. MRSA occurs more commonly among persons in hospitals and healthcare facilities. MRSA infection usually develops in hospitalized patients who are elderly or very sick or who have an open wound (such as a bedsore) or a tube going into their body (such as a urinary catheter or intravenous [IV] catheter). MRSA infections acquired in hospitals and healthcare settings can be severe. In addition, certain factors can put some patients at higher risk for MRSA including prolonged hospital stay, receiving broad-spectrum antibiotics, being hospitalized in an intensive care or burn unit, spending time close to other patients with MRSA, having recent surgery, or carrying MRSA in the nose without developing illness.

[16] An MRSA fact sheet is available at www.cdc.gov/ncidod/hip/Aresist/mrsafaq.htm.

MRSA causes illness in persons outside of hospitals and healthcare facilities as well. Cases of MRSA diseases in the community have been associated with recent antibiotic use, sharing contaminated items, having active skin diseases, and living in crowded settings. Some Maui physicians noted:[17]

> "With the recession, we're seeing bad infections. We need to catch these infections before the patients end up in the hospital. Open urgent care. Do that instead of building more beds."

The impact of MRSA on average length of stay at MMMC is significant, as illustrated in Table 7. While patients with MRSA represent just one-half percent of all discharges, their hospital length of stay is, on average, more than six times longer than that for patients without MRSA and represents three percent of total patient days. While only three percent of the wait listed patients are MRSA patients, they represent over 10 percent of the total patient days for wait listed patients in 2002. The number of patients treated for MRSA increased 140 percent between 2001 and 2003.[18]

***Table 7: Comparison of Total Discharges and Length of Stay with MRSA Patient Discharges and Length of Stay, Maui Memorial Medical Center, 2002***

| Age Group | Total Discharges | Total Days | ALOS for Total DC's | MRSA Discharges | MRSA Days | ALOS for MRSA DC's |
|---|---|---|---|---|---|---|
| 0 - 14 | 2027 | 4383 | 2.2 | 2 | 13 | 6.5 |
| 15 - 44 | 3916 | 12427 | 3.2 | 11 | 241 | 21.9 |
| 45 - 54 | 1468 | 7295 | 5.0 | 15 | 540 | 36.0 |
| 55 - 64 | 1411 | 8280 | 5.9 | 5 | 256 | 51.2 |
| 65 - 74 | 1397 | 10834 | 7.8 | 10 | 125 | 12.5 |
| 75 - 84 | 1361 | 11660 | 8.6 | 9 | 411 | 45.7 |
| 85+ | 633 | 5612 | 8.9 | 6 | 205 | 34.2 |
| **Totals:** | **12213** | **60491** | **5.0** | **58** | **1791** | **30.9** |

Source: Hawaii Health Information Corporation Inpatient Database, 2002.

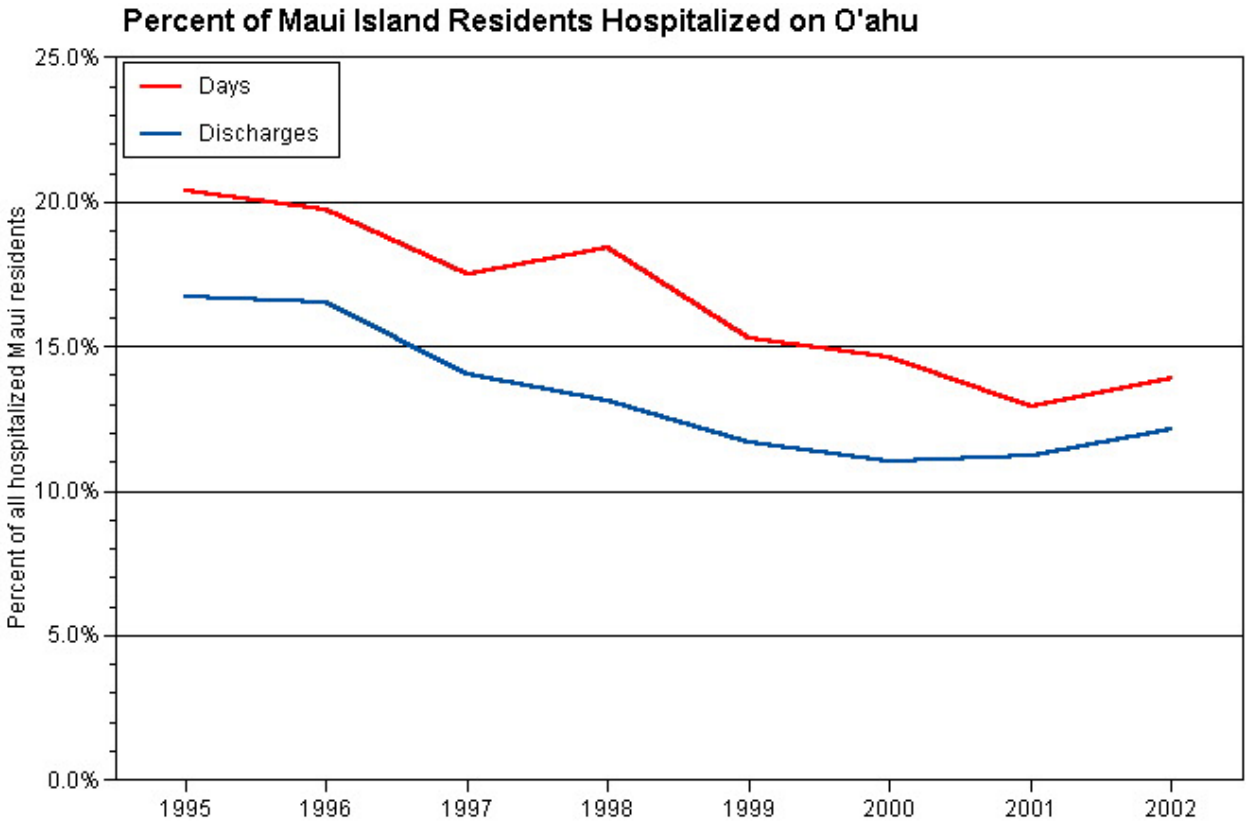
[17] Conference call to discuss driving forces in healthcare, their impact on Maui and various scenarios. A summary of this call is included in Appendix E.

[18] Hawaii Health Information Corporation Inpatient Database.

## *Trends in Maui Resident Hospitalization on Oahu*

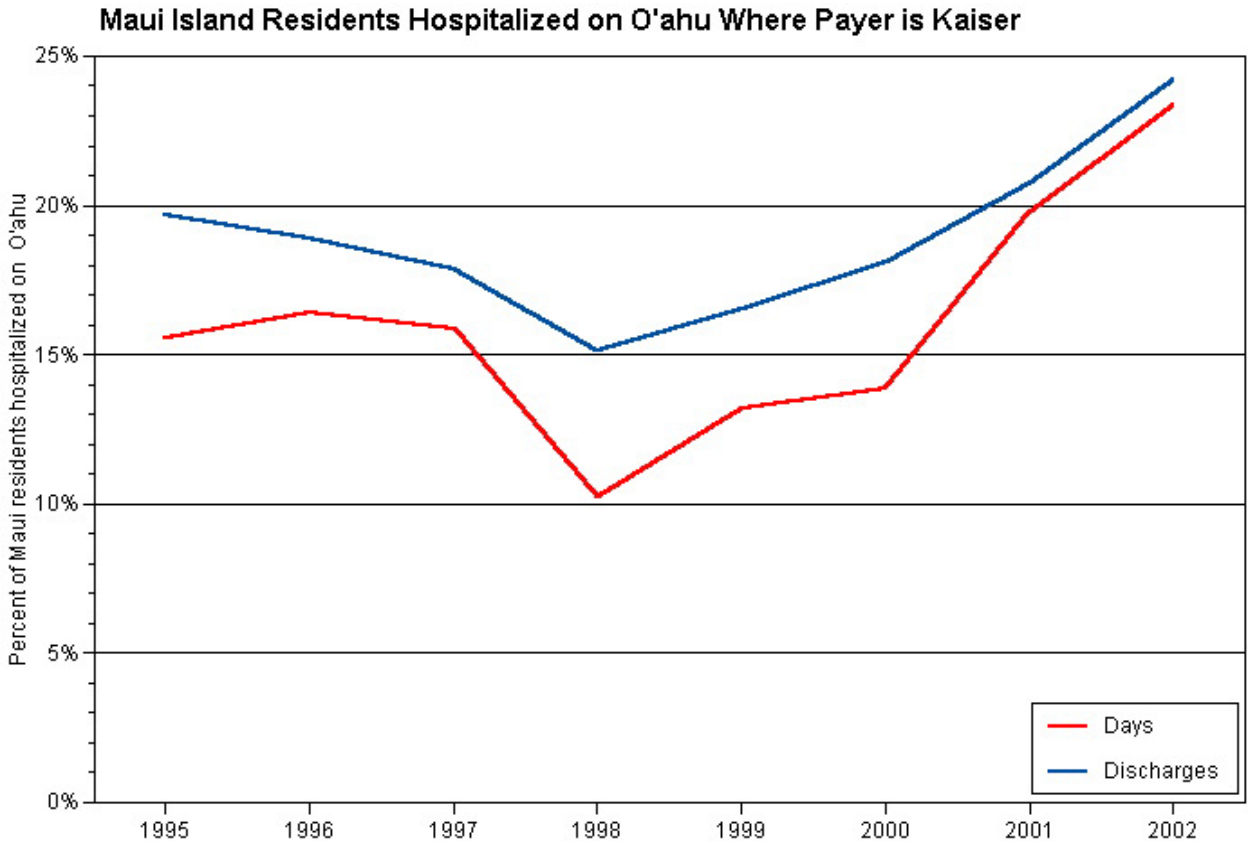
Maui residents are periodically hospitalized on Oahu. Trends from 1995-2002 are presented in Figure 10, ranging from a high of nearly 17 percent in 1995 to a low of 12 percent in 2000-2001. Maui residents fill approximately 20 to 23 beds per day on Oahu.

***Figure 10: Maui Residents Hospitalized on Oahu, 1995-2002***




Source: Hawaii Health Information Corporation Inpatient Database.

***Figure 11: Maui Island Residents Treated on Oahu Where Kaiser is the Primary Payer, 1995-2002***




Source: Hawaii Health Information Corporation Inpatient Database.

Approximately one third of the 2002 Maui cases treated on Oahu were related to cardiovascular conditions. Maui residents who were Kaiser members were transferred to Kaiser's Moanalua Medical Center primarily for cardiovascular conditions.

Maui residents travel to Oahu for the following types of surgery:

- "Other" circulatory surgery, includes percutaneous cardiovascular procedures with and without acute myocardial infarction, other vascular procedures, extracranial vascular procedures, etc.
- Orthopedic surgery, includes primarily hip and knee replacements, hip and femur procedures for trauma, and knee and lower leg procedures, etc.
- Neurosurgery, includes craniotomy except for trauma, intervertebral disc excision and decompression; cervical and spinal fusion and other back/neck procedures except disc excision/decompression; dorsal and lumbar fusion procedures except for curvature of the back, etc.
- General surgery, includes major pancreas, liver and shunt procedures, major small and large bowel procedures, major stomach, esophageal and duodenal procedures and procedures for obesity, etc.

The ability of MMMC or any other hospital developed on Maui to manage the surgical and cardiac cases currently being sent to Oahu will depend in large part on the specialty physician supply on Maui and the corresponding development of the facilities and services. A better understanding of specific physician requirements, facilities and services is needed to support any further reduction in reliance on Oahu hospitals. For future projections of bed need, we assumed that 12 percent of Maui residents requiring hospitalization would continue to travel to Oahu for care.

## *Summary of Hospitalization Issues*

Hospitalization reflects inter-relationships among consumer access and transportation issues, population health status, availability of primary and specialty care resources, emergency care, acute care, and long-term care. On Maui, competing needs (e.g., development of more long term care beds **versus** or **and** acute care beds) and complicating problems such as MRSA make the determination of bed needs both critical and difficult.

### Key findings:

- A full understanding of occupancy issues at MMMC is limited by lack of data such as unavailability of beds due to staffing shortages, early discharge of patients due to bed constraints, and "backup" of patients in such areas as the emergency department or surgical areas.
- Maui island residents (and Hawaii state residents, generally) are hospitalized less frequently than residents of other states. This pattern has been consistent over time. Parameters for bed supply in other markets may overestimate bed needs in Hawaii.
- The elderly are much more likely to be hospitalized than the young, with the exception of women of childbearing age. Bed need projections must take into account the needs of the aging population.
- On Maui, wait listed stays are a particular problem. In 2002, the equivalent of 32 hospital beds, or 16 percent of MMMC's SPHDA-recognized bed capacity, was filled with wait listed patients. This category of patient is creating the bed crisis on Maui.
- Discussions with the stakeholder group revealed that methicillin-resistant staphylococcus aureus (MRSA) is a particular problem in the community. For MMMC, the presence of MRSA makes it difficult to transfer infected wait listed patients to other settings. MRSA is both a hospital problem and a community health issue.
- Potentially preventable hospitalizations account for 13 percent of all discharges at MMMC and occupy approximately 29 beds each day. Expanded primary care and improved insurance coverage may be strategies to reduce these hospitalizations.
- In 2002, occupancy rates based on licensed bed capacity at MMMC exceeded 85 percent 67 times, or approximately 6 days out of every month. At no time during the year did occupancy exceed 100% of the licensed bed capacity.
- Periodically, Maui island residents are treated on Oahu. Approximately one third of the 2002 Maui cases treated on Oahu were related to cardiovascular conditions.
- The ability of MMMC or any other hospital developed on Maui to manage the surgical and cardiac cases currently being sent to Oahu will depend in large part on the specialty physician supply on Maui and the corresponding development of the facilities and services.

## Maui's Population: Framing the Needs

The population structure drives bed needs.

While population for the state as a whole grew by 12 percent between 1990 and 2002, most of that growth occurred outside the City and County of Honolulu. Maui County experienced the biggest growth in population with a 34 percent increase. Current projections by DBEDT indicate that the neighbor islands will grow faster than Honolulu over the next 25 years.

### *Debate over Population Projections*

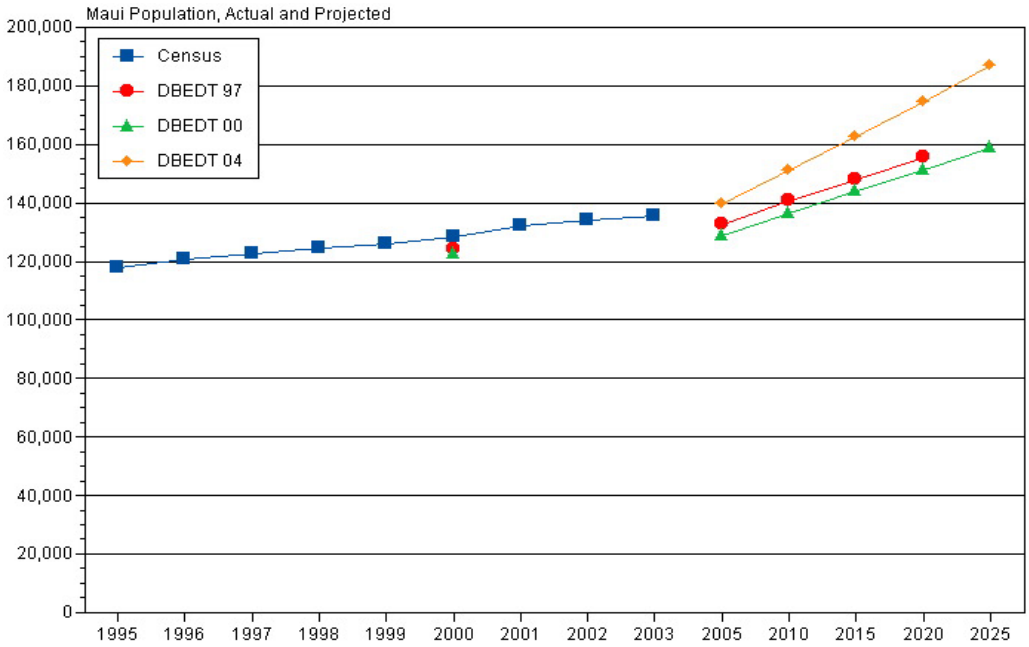
Multiple series of population projections produced by the Department of Business, Economic Development and Tourism (DBEDT) and short term projections developed by private demographic firms (e.g., MapInfo, Claritas) have been discussed and debated by the stakeholder group. DBEDT projections are considered the official projections used by the State of Hawaii and the Counties. Their limitation is they are usually available at the County, not island level. U.S. Census data collected every ten years with intercensal estimates between census years provide some detail at the island level, but are not always available in a timely manner. Proprietary data make it possible to estimate the population at the sub-region level, such as island or zip code. Population projections extend out only five years.

Each source adds some value to our collective understanding of the Maui Island and Maui County populations, and is used in this study. Projections are based on the DBEDT 2004 series for Maui County.

A concern among stakeholders is the perception that DBEDT "always" underestimates Maui island population growth. Data that back up this concern are presented in Figure 12. DBEDT projection for Year 2000, conducted in 1997 and again in 2000, were three to four percent below the actual census.[19] Projections released in late April 2004 portray more growth for Maui County than predicted in earlier series.

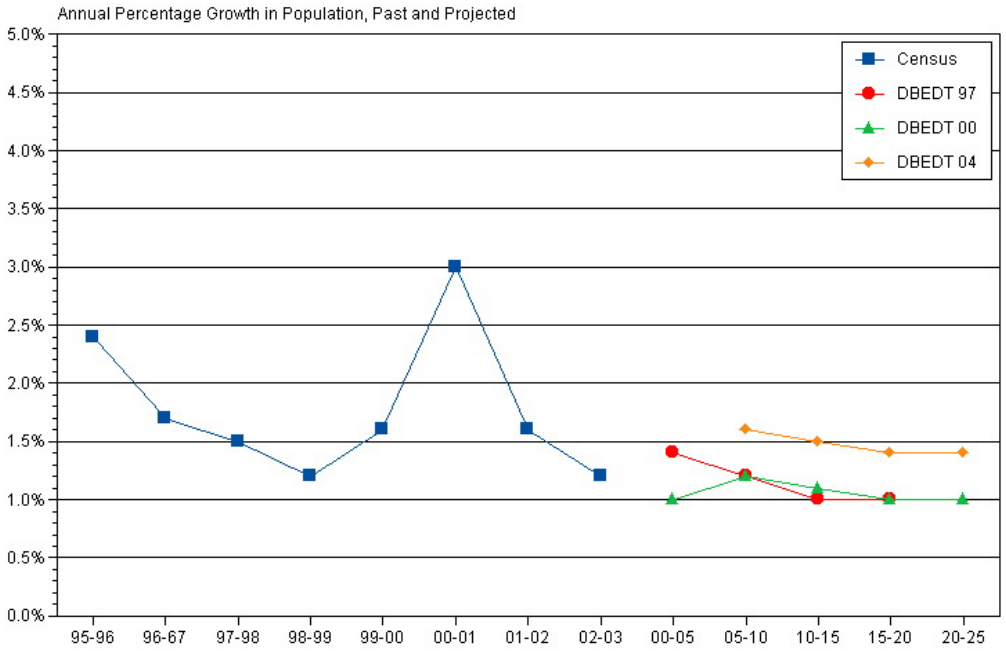
[19] The 2000 census demonstrated estimates during the 1990's to be low for the nation as a whole.

***Figure 12: DBEDT Projections of Maui County Population, 2005-2025, U.S. Census Estimates, 1995-2003***




Source: U.S. Census Bureau, 1995-2003 estimates. DBEDT 1997, 2000 and 2004 projections

***Figure 13: DBEDT Projections of Annual Growth for Maui County, 2000-2025, U.S. Census Estimates, 1995-2003***

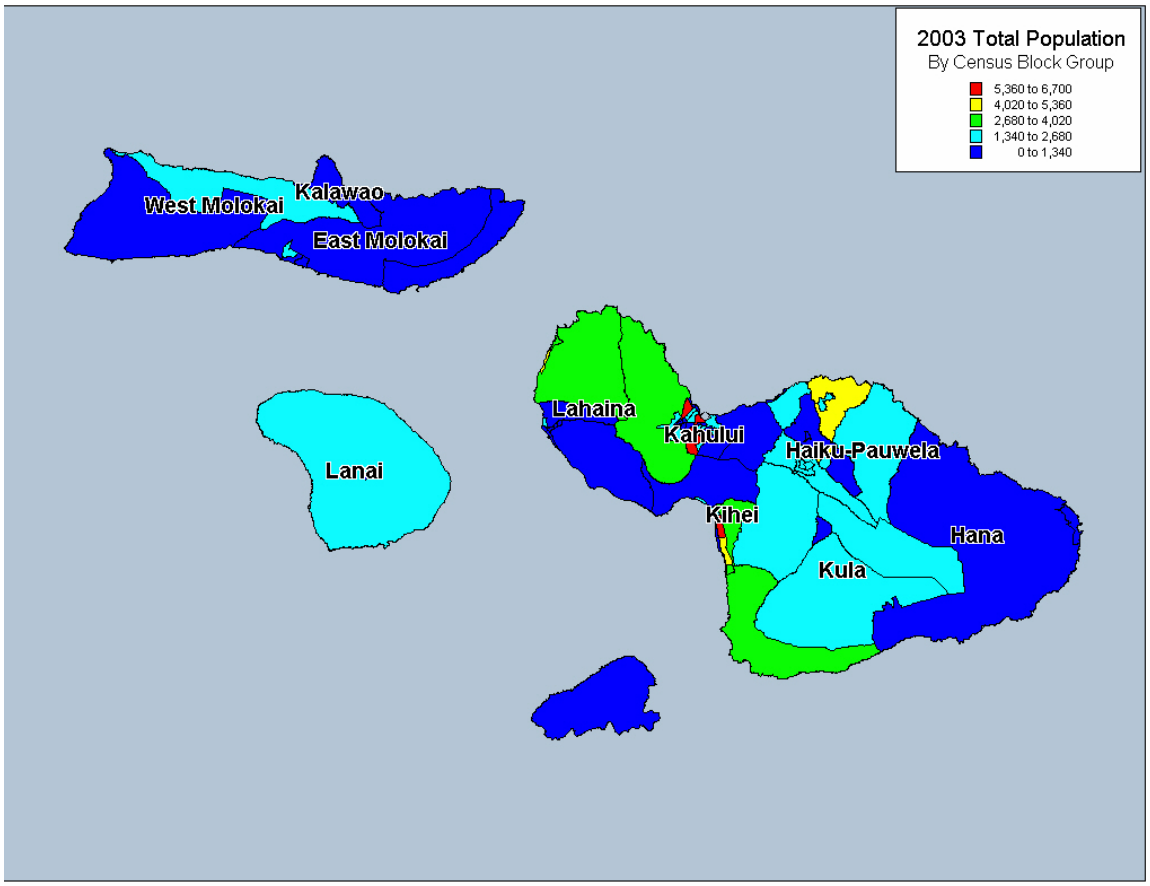



Source: U.S. Census Bureau, 1995-2003 estimates. DBEDT 1997, 2000 and 2004 projections

DBEDT population projections are periodically modified to reflect observed changes in the population. In the case of Maui, the extent of growth in recent years was not anticipated by DBEDT in its 1997 and 2000 projections. DBEDT's recently released projections for Maui County reflect much more aggressive growth than earlier projections. The most recent DBEDT projections are used in this report.

## *Maui County Population Density and Growth*

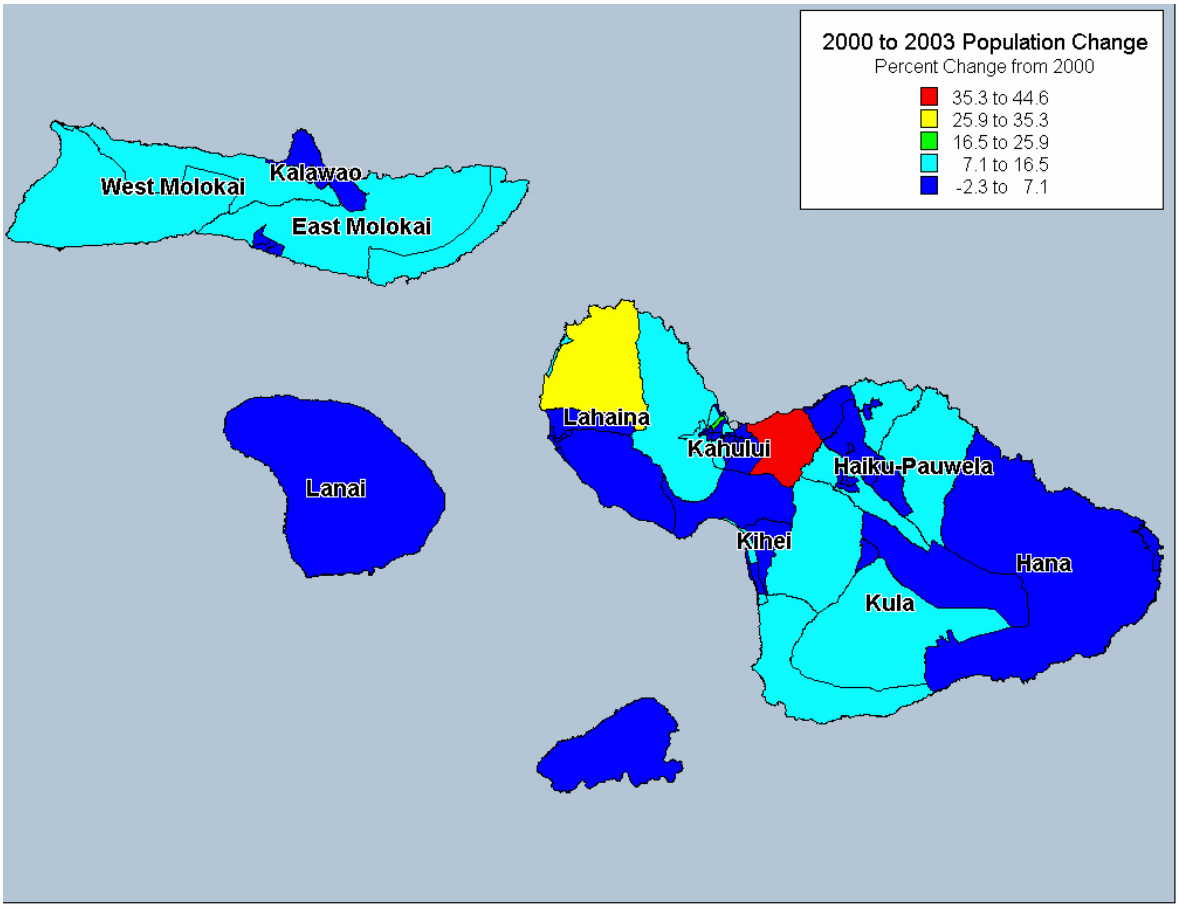
***Map 1: Maui County Population Density, 2003***




Source: MapInfo Corporation, 2004.

The greatest concentration of population is in the Kahului/Wailuku area, and the most rapidly growing area is just east of Kahului.

***Map 2: Maui County Population Growth, 2000-2003***




Source: MapInfo Corporation, 2004.

## *Population Structure*

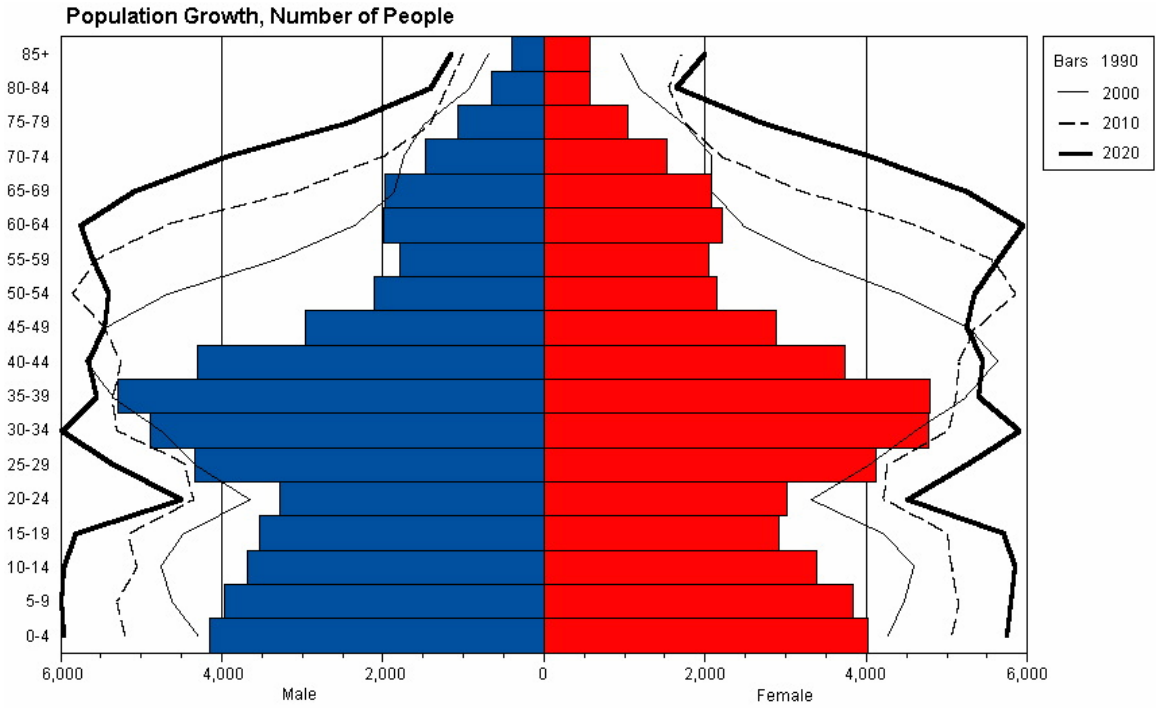
Population structure strongly influences bed needs. Hospital bed requirements are often tied to a particular gender or age called a "population cohort". Certain types of care, such as critical care and acute care, are needed by residents and visitors alike and are used by adults of all ages and both genders. Others, such as children or the elderly, are in an age-specific cohort.

The basic demographic structure of a population can be visually summarized by a population pyramid that graphically shows the distribution of people by age and gender. The sum of all age and gender groups equals 100 percent of the population.

A classic "pyramid" shape describes a young population with many infants and few elderly. A "pillar" shape corresponds to a more mature population with more even distributions of individuals across age groups. Events such as wars, baby booms, or periods of high in/out migration can affect the age/gender structure significantly.

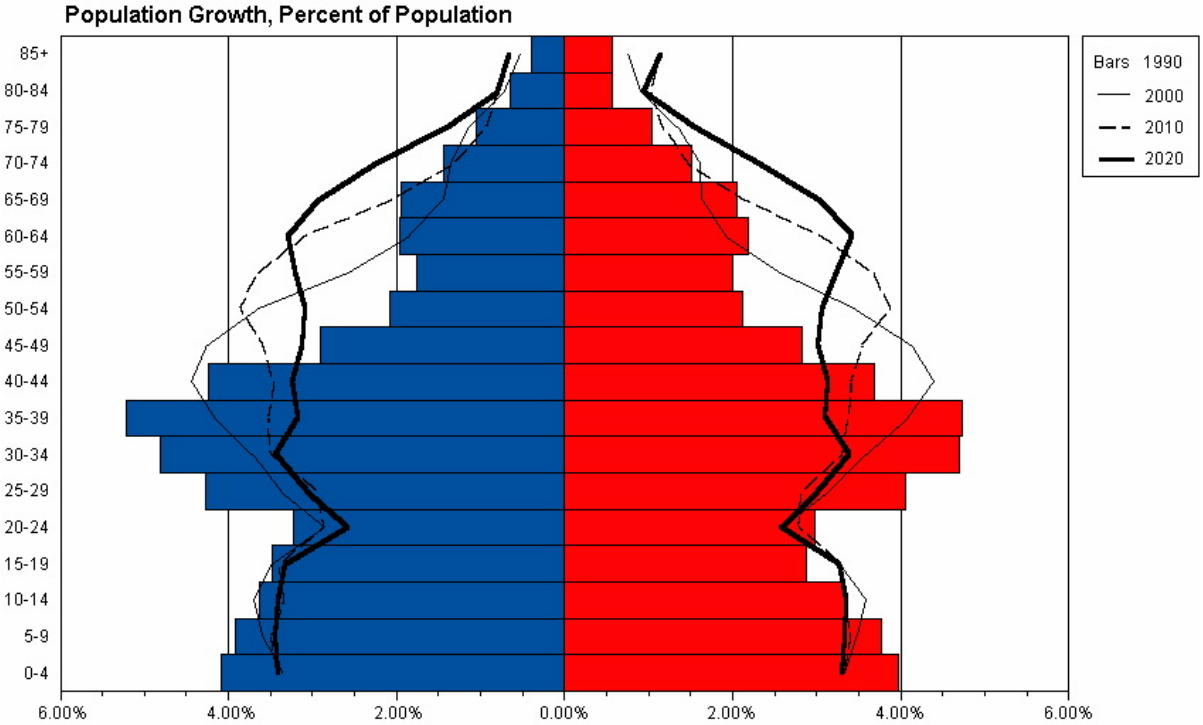
The population structure of the county of Maui, and the island of Maui, in particular, reflects a growing aging population. In the years ahead, as the "baby boomers" age and fewer infants are born, the elderly proportion will increase (see Figures 14, 15).

***Figure 14: Maui County Resident Population Distribution, 1990, 2000, 2010, 2020***




Source: U.S. Census, 2004 (1990, 2000) and DBEDT, 2004 (2010, 20220)

***Figure 15: Percent Distribution Maui County Resident Population, 1990, 2000, 2010, 2020***




Source: U.S. Census, 2004 (1990, 2000) and DBEDT, 2004 (2010, 20220)

## *In- versus Out-Migration*

One of the areas of interest for stakeholders was immigration to and emigration from Maui County. Population movement provides greater insight into the emerging healthcare needs for the island. The advantage of this type of analysis is that it provides some indication of changes that may need to be made in the future if policy efforts are made to retain populations that traditionally leave.

In order to produce relevant information for the stakeholders, county resident population was divided into 5 year age groups by sex for the years 1990, 1995, 2000, 2005, 2010, 2015, 2020, 2025 using Census counts and estimates for 1990-2000 and the latest DBEDT projections for 2005-2025.

Changes from immigration/emigration were calculated by subtracting the differences due to aging in the population from differences between years.

In Table 8, patterns of immigration and out-migration are summarized. More detailed information, segmented for age-sex cohorts, is presented in Appendix H.

***Table 8: Maui County In and Out-Migration by age, 1990-2025****

| Age group | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2025 |
|---|---|---|---|---|---|---|---|
| 0-4 | 1,939 | (1,206) | 1,121 | 550 | 750 | 700 | 800 |
| 5-9 | (42) | 929 | (500) | 350 | (200) | (50) | (100) |
| 10-14 | 817 | 498 | (260) | (500) | 350 | (150) | 0 |
| 15-19 | 656 | 775 | 681 | (50) | (50) | 800 | 300 |
| 20-24 | 239 | 1,463 | 1,686 | 2,850 | 1,600 | 1,600 | 2,500 |
| 25-29 | (2,120) | (1,174) | (1,400) | (1,750) | (150) | (1,450) | (1,600) |
| 30-34 | (1,186) | (2,429) | (988) | (950) | (1,600) | 50 | (1,300) |
| 35-39 | (473) | (1,496) | (1,229) | (500) | (150) | (750) | 950 |
| 40-44 | 1,981 | 1,331 | (731) | (450) | 50 | 400 | (150) |
| 45-49 | 2,194 | 1,621 | 579 | (800) | (400) | 50 | 400 |
| 50-54 | 1,566 | 2,169 | 1,628 | 550 | (900) | (500) | (50) |
| 55-59 | 418 | 1,722 | 2,495 | 1,600 | 600 | (850) | (500) |
| 60-64 | (412) | 162 | 1,793 | 2,700 | 1,800 | 900 | (450) |
| 65-69 | 156 | 38 | 895 | 2,100 | 3,000 | 2,200 | 1,350 |
| 70-74 | 1,035 | 467 | 110 | 1,000 | 2,100 | 3,000 | 2,350 |
| 75-79 | 913 | 1,010 | 624 | 150 | 1,050 | 2,000 | 2,850 |
| 80-84 | 871 | 1,070 | 1,108 | 800 | 400 | 1,150 | 2,100 |
| 85+ | 236 | 318 | 446 | 500 | 50 | (550) | (100) |

Source: U.S. Census
* Data in red and in parenthesis represent out-migration population estimates.

## Key Issues

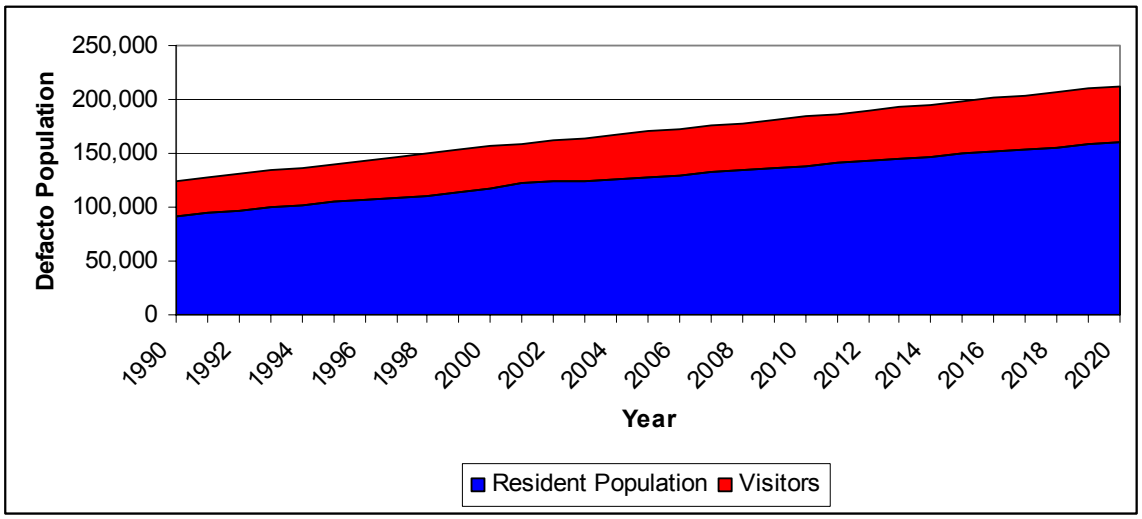
- An increase in the 20-24 age category suggests that Maui draws a young crowd, fresh out of college. This, however, is offset by the emigration that occurs in the immediate three age groups that follow, suggesting that there may not be jobs or career paths that keep them there.
- Consistently over the period 1995 through 2025, there is more out-migration than immigration for both males and females between the ages of 25 and 39 years, key years for establishing both families and careers.
- In 2005, males and females ages 40-44 years old are more likely to leave rather than come to Maui. In subsequent 5 year periods, individuals 45-49, then 50-54, 55-59, and 60-64 are more likely to leave Maui.
- Immigration is most common among both males and females ages 65+. People are moving to Maui for retirement.

## *The Impact of Tourism: The De Facto Population*

Maui's role as a tourist destination has a major impact on healthcare. Tourists often require healthcare services including hospitalization. In 2002, eight percent of total hospitalizations at MMMC were out of state and/or out of country residents.[20]

Between 1990 and 2000, Maui island's visitor population added between 33 percent (2000) to 39 percent (in 1990) to the resident population (Figure 3). For purposes of bed need projections, it is assumed that the visitor population will continue to expand the resident population by 33 percent.

***Figure 16: Maui Island De facto Population, 1990-2020***




Source: Resident population 1990-2020 and de facto population for 1990, 1995, 2000, Department of Business, Economic Development and Tourism. De facto population for the Island of Maui for 2005, 2010, 2015 and 2020 from SMS Research & Marketing Services, Inc., May 29, 2002 as reported in RM Towill's study of Maui County Facilities. Visitor population calculated as the difference between de facto and resident populations. Note that the Maui Island estimated de facto population data was not used as the basis of projecting bed needs because it is not official data and it does not include the detail needed for age/sex cohorts.

[20] Hawaii Health Information Corporation.

# Methods

## Population Estimates

*Resident versus De Facto Population.* Incorporating the impact of the visitor population on acute bed utilization presented a particular challenge. Demographic data (age and gender) on the projected visitor population for Maui was not available at the level needed to compute bed use projections. To address this data constraint, the 2002 statewide visitor demographic profile (applied to Maui's visitor count) was used to estimate the impact on Maui's acute care bed needs.[21] While population estimates from the U.S. Census were used for the resident population estimates and serves as the basis for projecting bed needs on Maui, these computations were adjusted to account for Maui's visitor population. Assumptions:

- The visitor population will augment the resident population by 33 percent for each of the projected years.
- The demographic profile for visitors will age similarly to Maui County.

*Maui County versus Maui Island Population.* For Hawaii, estimates of the population by age and sex are provided by the U.S Census on a county-by-county basis. Island level estimates are not provided. As a result, Maui County's resident population is the basis for projecting bed needs in this report. Maui island's population represents 92 percent of the County's population.

## Utilization Projection Methodologies

Projecting illness or hospital usage for a population over time involves applying a multiplier for the usage to an appropriate set of population estimates. For Hawaii, population estimates for each of the eight years 1995–2002 were obtained from the US Bureau of the Census. The projected population to 2025 was provided by the Hawai'i State Department of Business, Economic Development, and Tourism (DBEDT—2004 projection series).[22] Estimates of the population by age and sex are provided from these sources on a county-by-county basis. No additional characteristics of the population are projected in this manner.[23]

Two critical characteristics of hospital usage are the length of stay on the average, and the number of discharges. When these have been collected over a period of time, it is possible to compute a regression equation linking the usage to the makeup of the population. Specifically, for each age and sex combination[24] fit the regression equations:

(1) Sum of discharges = a (sex * age * population)

(2) Average LOS = b (sex* age* population)

[21] The state level visitor demographic for 2002 was similar to Maui's resident population for age. The visitor population included a higher percent of females than the resident population.

[22] Projected population takes into account factors such as immigration and emigration, birth and death rates and interstate migrations.

[23] Specifically, items that might allow prediction of illnesses or conditions resulting from poverty, dangerous working conditions, and the like, are not generally a part of the demographic model of the state's population.

[24] For Maui estimates, nine age groups and the standard two gender groups were used.

The resulting coefficient (a) estimates the number of discharges per person in the age/sex group (essentially a probability of discharge). Multiplying this fractional value times the population in the cell provides an estimated count of discharges for that cell. The multiplication procedure is repeated for each age/sex cell and for each year for which the population is projected. The coefficient (b), similarly, estimates the average number of days an individual in the age/sex cell might be hospitalized.

This model describes the simplest form of estimation.

For Maui usage, however, additional factors must be considered. The analysis routine chosen computed all 18 (9 age groups x 2 gender groups) simultaneously. Two additional critical variables were added to the original utilization data: type of hospitalization (medical or surgical), and residence location (Maui or elsewhere). Each of these variables is associated with a discrete body of usage numbers. Specifically, there are length of stay and discharge count values for Maui residents, and for non-residents. Thus the computation above was repeated for the following separate groups:[25,26]

**Medical care:**
Females: ages 0-14, 15-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-84 & 85+
Males: ages 0-14, 15-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-84 & 85+

**Surgical care:**
Females: ages 0-14, 15-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-84 & 85+
Males: ages 0-14, 15-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-84 & 85+

In general, the applications of the model explained between 34 percent and 97 percent of the variation in length of stay and number of discharges. The prediction of discharges was uniformly better than that of length of stay. There are, however, no additional variables in the medical record sources which are also found in public population projections that might have made the fit of the length of stay equations more precise. The constraining issue is that health and social conditions that might predict population hospital usage are not part of the demographic model which predicts Hawaii's population.

Applying the (4 x 18) coefficients to the population future estimates produces a set of very detailed usage estimates. For presentation and discussion purposes, the estimates are summarized into a set of tables with fewer entries, for example combining all surgical discharges, regardless of residency of the patient, and so forth.

*Wait listed patients.* The estimated usage obtained with the procedures above is not adjusted for any wait list characteristics. The wait list is recorded by age/sex category and the type of service, medical or surgical. The most consistent source of information about the likely size of a wait list is the information available on average length of stay and count of discharges. The data

[25] Newborns were excluded from calculations.
[26] Age and gender grouping based on analysis of utilization data described by Stewart et al.,"Projecting Hospital Bed Needs for 2020" Manitoba Centre for Health Policy, June 2002.

at hand allows estimation of the likely wait list, given the recorded length of stay and discharge count.

The following equations give a wait list estimate:

(1) Wait list days = constant + a (length of stay) + b (number of discharges)

(2) Wait list discharges = constant + c (length of stay) + d (number of discharges)

These models fit very well, with R-squared values of .90 or greater (explaining 90 percent of the variation in wait list value with the two predictor variables).

Predicting wait list days and discharges proceeds much as above: The models are fitted to the observed wait list day and discharge data, separately for medical and surgical patients. Age and gender are not included in the model, since they have been used to estimate the underlying usage pattern, and add nothing to the understanding of wait list frequencies.

The coefficients (a) and (b) are applied to the estimated length of stay and discharge count values to obtain predicted wait list days, for each age/sex cell, for each projected year. The coefficients (c) and (d) are applied to the same two variables to obtain the estimated wait list discharge counts. These counts are then used to adjust the estimated usage values (and are also tabulated separately).

### Current Use (CU) Projection Model

Two different models were used to project bed needs for MMMC. The first model, called Current Use Projection Model, projects future use on the basis of current patterns of use. Hospital data from the year 2002 was used to define the current use of acute care beds (by age and sex). The data were projected forward to 2025 based on DBEDT population projections. Detailed steps to generate current use projections are included in Table 9.

***Table 9: Current Use Projection Model Analytic Steps and Data Sources***

| # | *Step* | *Analysis* | *Data Source* |
|---|---|---|---|
| 1 | Collect discharge information for MMMC patients, 2002 | Given | HHIC Inpatient Database, 2004 |
| 2 | Breakout discharge information by age group, sex, residence, and stay classification (medical-surgical) | Given | HHIC Inpatient Database, 2004 |
| 3 | Obtain actual and forecast population by age group and sex for Maui County | Given | Actual population for 1995-2002: U.S. Census Bureau, Population Division, 2004. Projected population 2005-2025: Hawaii Department of Business, Economic Development, and Tourism, 2004 |
| 4 | Obtain wait list information for MMMC for 2002 (only year available) in same breakout format as discharge information | Given | MMMC, 2004 |
| 5 | Match HHIC data with MMMC wait list data to identify wait list and acute care days | Data were matched comparing medical record number[27], date of admission, and date of discharge | Derived |
| 6 | Calculate population-based use rates by age group, sex, residence, and stay classification for total, acute, and wait listed days for 2002 | Days stay per resident = total days stay divided by resident population for each age group, sex, residence, and classification category. Data were adjusted to account for visitor population. | Derived |

[27] Note: HHIC is a business associate of all acute care hospitals in Hawaii. As such, HHIC and each hospital have entered into a business associate agreement documenting how HHIC will handle identifiable data such as medical record number, according to HIPAA privacy regulations.

***Table 9: Current Use Projection Model Analytic Steps and Data Sources (continued)***

| # | *Step* | *Analysis* | *Data Source* |
|---|---|---|---|
| 7 | Calculate days stay for total, acute, and wait listed days for future periods by applying current use rates to future population projections | Total future days = the sum of days stay per resident multiplied by projected population for each age group, sex, residence, and classification category. | Derived |
| 8 | Calculate the Average Daily Census (ADC) for 2005-2025 | ADC = Total future days divided by 365 | Derived |
| 9 | Stratify bed type by Major Diagnostic Category (MDC) grouping | Stays for pregnancy, childbirth, and puerperium = obstetric stays; stays for mental diseases and disorders = psychiatric stays; remaining stays looked at the historical ratio between medical/surgical beds and critical care beds and maintained the ratio for acute care days, establishing the number of critical care days. Remaining days were classified as medical/surgical days | Hawaii State Health Planning and Development Agency, Inpatient Facilities Utilization Report, 1990-2002 Data, 1991-2003. Hawaii Health Information Corporation, Inpatient Database, 2004. Derived |
| 10 | Calculate ADC by bed type for 2005-2025 | ADC by bed type = days by bed type divided by 365 | Derived |
| 11 | Calculate number of beds by type for 2005-2025 | # of beds = ADC by bed type divided by occupancy rate by type | Derived |

### Merits

The current use model is easy to use and apply. If one has good projections concerning the future population, one can easily apply the model to the population to arrive at a projection of use for that future date. As long as use rates stay stable with little variation from year to year, this model provides an accurate indication of use at a future point. The model recognizes that age, gender, and type of stay have different impacts upon total use and takes those impacts into account.

### Limitations

While this model is relatively easy to use in projecting hospital use, it does have drawbacks. This model assumes that future hospital use will be similar to use patterns for 2002. It fails to recognize trends in healthcare that would decrease demand on inpatient beds, such as technologies that reduce length of stay, improvements in surgical methods that move more procedures to the outpatient setting, or even lifestyle shifts in the population. Use of this type of

model in the past has generally over-estimated future needs. In previous SHPDA projections of non-federal bed needs for the state of Hawai‘i, this model overestimated hospital days by 11.7 percent for 2000 (even though it did not account for usage by age and sex).

## Trend Analysis Model

In developing the second model, the Trend Analysis Model, eight years (1995–2002) of data on hospital use were used.[28] Table 10 reflects the steps followed under this model. Differences from the current use projection model are highlighted in **red**.

***Table 10: Trend Analysis Projection Model Analytic Steps and Data Sources***

| # | *Step* | *Analysis* | *Data Source* |
|---|---|---|---|
| 1 | Collect discharge information for MMMC patients, 1995-2002 | Given | HHIC Inpatient Database, 2004 |
| 2 | Breakout discharge information by age group, sex, residence, and stay classification (medical-surgical) | Given | HHIC Inpatient Database, 2004 |
| 3 | Obtain actual and forecast population by age group and sex for Maui County | Given | Actual population for 1995-2002: U.S. Census Bureau, Population Division, 2004. Projected population 2005-2025: Hawaii Department of Business, Economic Development, and Tourism, 2004 |
| 4 | Obtain wait list information for MMMC for 2002 (only year available) in same breakout format as discharge information | Given | MMMC, 2004 |
| 5 | Match HHIC data with MMMC wait list data to identify wait list and acute care days | Data were matched comparing medical record number[29], date of admission, and date of discharge | Derived |

[28] This model was heavily influenced by a study conducted in Manitoba. See Stewart, David K., Robert Tate, et al, “Projecting Hospital Bed Needs for 2020”

[29] Note: HHIC is a business associate of all acute care hospitals in Hawaii. As such, HHIC and each hospital have entered into a business associate agreement documenting how HHIC will handle identifiable data such as medical record number, according to HIPAA privacy regulations.

***Table 10: Trend Analysis Projection Model Analytic Steps and Data Sources (continued)***

| | | | |
|---|---|---|---|
| 6 | Calculate regression formula for each age group, sex, residence, and stay classification for the years 1995-2002 | Linear regression formula derived from each grouping | Derived |
| 7. | Adjust regression formula to account for assumptions | Adjustments to regression formula allowed for an increase in number of patients that would be treated on Maui instead of Oahu and maintained overall ALOS despite an aging population. Note: proportion of Maui patients treated on Maui held constant at 12%. | Derived |
| 8 | Calculate days stay for total, acute, and wait listed days for future periods by applying regression formula to future population projections | Linear regression formula applied to future populations | Derived |
| 9 | Calculate the Average Daily Census (ADC) for 2005-2025 | ADC = Total future days divided by 365 | Derived |
| 10 | Break days down into days by bed type using ratios from current use projection of stay types. | Stays for pregnancy, childbirth, and puerperium = obstetric stays; stays for mental diseases and disorders = psychiatric stays; remaining stays looked at the historical ratio between medical/surgical beds and critical care beds and maintained the ratio for acute care days, establishing the number of critical care days. Remaining days were classified as medical/surgical days | Hawaii State Health Planning and Development Agency, Inpatient Facilities Utilization Report, 1990-2002 Data, 1991-2003. Hawaii Health Information Corporation, Inpatient Database, 2004. Derived |
| 11 | Calculate ADC by bed type for 2005-2025 | ADC by bed type = days by bed type divided by 365 | Derived |
| 12 | Calculate number of beds by type for 2005-2025 | # of beds = ADC by bed type divided by occupancy rate by type | Derived |

Note: Comments in **red** signify differences from the current use model.

### Merits

The trend model assumes that in addition to the impacts of age, gender, and type of stay, that there are other forces that need to be taken into consideration. The trend model looks at data over time and examines the data for trends in use. Trends are then mapped out over the projected population using regression formulas to determine use for a future date. The trend model is more likely to reflect changes in technology and social behavior that may have effects on use beyond demographic pressure. Specific types of changes statewide in the 1995-2002 period include changes in inpatient surgery rates, reduced length of stay, and changes in likelihood of hospitalization for certain conditions. By examining trends, these factors are incorporated in the analysis. In addition, this model makes it possible to insert additional assumptions which, in this iteration, included assuming that the proportion of Maui residents receiving care on Oahu would remain constant at 12 percent and that overall length of stay would not increase beyond current levels.

### Limitations

While the trend model takes additional factors into consideration, it also assumes that these trends will continue at steady rates into the future. It is unable to predict sudden changes in the health system or social patterns that could significantly change patterns of utilization. Likewise, because there is the assumption of a consistent trend, changes that cause big one time changes in utilization during the trend period would be carried into the future at a steady, incremental rate.

## Comparison of Models in Terms of Driving Forces

***Table 11: Comparison of Models in Terms of Driving Forces***

| *Driving Force* | *Current Use Model* | *Trend Analysis Model* | *Potential Impact of Driving Force* |
|---|---|---|---|
| **Population Growth and Aging** | **X** | **X** | Growth and aging both increase hospitalization. |
| **Income Disparities and Healthcare Coverage** | **Somewhat – Related to current hospitalization rate** | **Somewhat— Related to hospitalization rates over time** | Increasing poverty and increasing numbers of uninsured individuals impact emergency department use and hospitalization rates. |
| **Transparency and Consumerism** | | | While the models do not reflect these driving forces, the evidence-based approach taken in preparing this study is based on transparency and consumerism. |
| **Demand** | | **X** | Changes in hospitalization rates over eight years reflect changes in managed care patterns. |
| **Disease** | | **X** | Changes in hospitalization rates over eight years reflect aging of the population and changes in disease patterns. |
| **End of Life Care** | **X** | **X** | The impact of end of life care is included in both methods as an age-specific probability of hospitalization. |
| **Technology** | | **Somewhat** | Changes in technology are most likely to reduce length of stay and may change the mix of inpatient to outpatient to home care. |
| **Access to Capital** | | | Impacts the ability to build, but not the population's bed needs |
| **Financial Stability** | | | Impacts the ability to continue to operate, but not the population's bed needs |
| **Workforce Shortages** | | | Workforce shortages impact the availability of staffed beds, a critical factor for success for Maui acute care bed expansion. |
| **Liability** | | | Impacts the availability of physicians and the availability of services, but not the population's bed needs |
| **Alternative Care Settings** | **Somewhat— Related to wait list** | **Somewhat— Related to wait list** | Solution to long-term care capacity issues will have major impact on Maui. Potential for niche hospitals might alter the mix of patients at MMMC, impacting profitability and ability to provide some services. |
| **Change in Business Direction** | | | Hopefully business direction is consistent with population need. However, population bed needs are independent of business direction. |
| **Disaster/Bioterrorism** | **Somewhat— Related to sensitivity (e.g., +/- 5%)** | **Somewhat— Related to sensitivity (e.g., +/- 5%)** | Uncertainty associated with disasters/bioterrorism may lead to consideration of building more flexibility into the healthcare system. |

## *Allocating Bed Days by Bed Type Adjusted for Ideal Occupancy Rates*

The projection methodologies yield the number of bed days required in the future. To fully understand these projections, however, bed days must be converted to bed types, taking into account target occupancy rates cited earlier. In addition, we assume that, in order to provide the greatest flexibility of use, single rooms instead of semi-private rooms are available.

Bed types were determined by obtaining the Major Diagnostic Category (MDC) for each discharge. Of particular interest were discharges for Pregnancy, Childbirth, and the Puerperium (MDC 14) and discharges for Mental Diseases and Disorders (MDC 19). These diagnoses provide indication of the need for obstetric and psychiatric beds respectively. Since Maui does not have pediatric beds, the remaining discharges were either medical/surgical beds or critical care beds. To determine which of these belonged where, the proportion of critical care days to medical/surgical days was examined, both for MMMC and for those hospitals with critical care beds as a whole.[30,31]

Overall, MMMC has a lower percentage of critical care days, compared to the rest of the State. However, in the last five years the percentage of critical care days to medical/surgical days has grown from 5.6 percent to 8.2 percent. While the percentage remains below the rest of the State (9.5 percent), Maui's trend is moving toward the state average.

For this report, both percentages are used:

- Assumption 1: MMMC had finished its growth spurt and the proportion of critical care days would remain at 8.2 percent; and
- Assumption 2: MMMC would continue to increase its critical care capacity to the current state average for hospitals with critical care beds. For this assumption, critical care days would be 9.5 percent of all medical/surgical days.

*Process:* Using projected bed days based on the Current Use model, obstetric related days [defined by Medical Diagnostic Category (MDC) 14] and psychiatric data (defined by MDC 19) were subtracted from the total number of days. To compute critical care days using Assumption 1, 8.2 percent of these remaining days were assigned as critical care, the remainder assigned to medical/surgical. For Assumption 2, 9.5 percent of the remaining days were assigned to critical care with the rest assigned to medical/surgical. The same formula was applied to the Trend Analysis Model to get the days for each bed type.

Days were translated into an average daily census (ADC) by dividing the days for each bed type by 365. The projected number of beds was computed by taking the ADC for each bed type and dividing it by the ideal occupancy rate. Except for medical/surgical beds, each bed type had an ideal occupancy rate of 75 percent. The ideal occupancy rate for medical/surgical beds ranged between 75 percent and 85 percent; occupancy rates of both 75 percent and 85 percent are used in preparation of the bed need projections in this report.

[30] Data concerning the number days stay per bed type come from Hawaii State Health Planning & Development Agency, Inpatient Facilities and Home Health Services Utilization Report, 1989-2002 Data, 1990-2003.

[31] Critical care usage at Kapiolani Medical Center for Women and Children differed significantly from the other hospitals in the State: critical care days exceeded 72 percent of medical/surgical and critical care days and provided over 15 percent of the critical care days for the entire state. For this reason, Kapiolani days and discharges were removed from the state analysis.

# Findings

## *Current Use (CU) Model*

Using the CU model, we project a 20 percent increase in the total number of acute care days in 2010 and a 72 percent increase in 2025 over 2002. Discharges increase by 18 percent between 2002 and 2010 and by 60 percent between 2002 and 2025.

***Table 12: Current Use Projection Model Discharges and Days by Patient Type***

| | Female Surgical | | Male Surgical | | Medical | | Total | |
|---|---|---|---|---|---|---|---|---|
| Year | Discharges | Days | Discharges | Days | Discharges | Days | Discharges | Days |
| 2002 | 1,767 | 11,231 | 1,164 | 11,315 | 7,671 | 34,922 | 10,602 | 57,468 |
| 2005 | 1,859 | 11,978 | 1,230 | 12,089 | 8,137 | 37,300 | 11,226 | 61,367 |
| 2010 | 2,022 | 13,601 | 1,379 | 13,819 | 9,093 | 42,193 | 12,493 | 69,613 |
| 2015 | 2,208 | 15,628 | 1,548 | 15,999 | 10,157 | 47,753 | 13,913 | 79,380 |
| 2020 | 2,418 | 17,845 | 1,721 | 18,278 | 11,263 | 53,545 | 15,402 | 89,668 |
| 2025 | 2,629 | 20,028 | 1,905 | 20,728 | 12,454 | 60,549 | 16,988 | 101,305 |

Excludes newborns
Source: Hawaii Health Information Corporation, 2004

Between 2002 and 2025, average daily census for acute care patients increases by 91 patients, and, if no alternatives are developed for long-term care, wait listed patient daily census could increase by 30 patients.

***Table 13: Current Use Projection Model Discharges, Days, and Average Daily Census for Acute and Wait listed Patients***

| | Total | | Wait listed | Acute | ADC | | |
|---|---|---|---|---|---|---|---|
| Year | Discharges | Days | Days | Days | Total | Acute | WL |
| 2002 | 10,602 | 57,468 | 11,691 | 45,777 | 157.4 | 125.4 | 32.0 |
| 2005 | 11,226 | 61,367 | 12,569 | 48,798 | 168.1 | 133.7 | 34.4 |
| 2010 | 12,493 | 69,613 | 14,491 | 55,122 | 190.7 | 151.0 | 39.7 |
| 2015 | 13,913 | 79,380 | 16,881 | 62,498 | 217.5 | 171.2 | 46.3 |
| 2020 | 15,402 | 89,668 | 19,416 | 70,253 | 245.7 | 192.5 | 53.2 |
| 2025 | 16,988 | 101,305 | 22,478 | 78,827 | 277.5 | 216.0 | 61.6 |

Excludes newborns
Source: Hawaii Health Information Corporation, 2004

***Table 14: Current Use Model Projections for Acute Care Bed Needs***

| Bed Type (Occupancy Target) | SHPDA Beds 2002 | Acute Care Only | | | | | If Long Term Care Bed Availability Not Resolved (e.g., Wait List Patients Remain in Acute Care Beds) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Assumption 1**[32] | | **2005** | **2010** | **2015** | **2020** | **2025** | **2005** | **2010** | **2015** | **2020** | **2025** |
| Obstetric (75%)[33] | 23 | 14 | 15 | 15 | 17 | 18 | 14 | 15 | 15 | 17 | 18 |
| Psychiatric (75%) | 18 | 12 | 13 | 14 | 15 | 16 | 13 | 14 | 16 | 16 | 17 |
| Med/Surg (75-85%) | 140 | 141-125 | 161-142 | 184-162 | 208-184 | 235-208 | 186-164 | 212-187 | 244-215 | 277-245 | 315-278 |
| Critical Care (75%) | 15 | 13 | 15 | 17 | 19 | 21 | 13 | 15 | 17 | 19 | 21 |
| Total Acute Beds Projection | 196 | 164-180 | 185-204 | 208-230 | 235-259 | 263-290 | 204-226 | 231-256 | 263-292 | 297-329 | 334-371 |
| Acute Beds + 5% CI[34] | | 189 | 214 | 242 | 272 | 305 | 237 | 269 | 307 | 345 | 390 |
| Meet Demand 99% of Time | | 166 | 183 | 203 | 224 | 248 | 200 | 223 | 249 | 278 | 309 |
| **Assumption 2**[35] | | 2005 | 2010 | 2015 | 2020 | 2025 | 2005 | 2010 | 2015 | 2020 | 2025 |
| Obstetric (75%) | 23 | 14 | 15 | 15 | 17 | 18 | 14 | 15 | 15 | 17 | 18 |
| Psychiatric (75%) | 18 | 12 | 13 | 14 | 15 | 16 | 13 | 14 | 16 | 16 | 17 |
| Med/Surg (75-85%) | 140 | 139-123 | 159-140 | 181-160 | 205-181 | 232-205 | 184-162 | 210-185 | 241-213 | 274-242 | 312-275 |
| Critical Care (75%) | 15 | 15 | 17 | 19 | 22 | 25 | 15 | 17 | 19 | 22 | 25 |
| Total Acute Beds Projection | 196 | 164-180 | 185-204 | 208-229 | 235-259 | 264-291 | 204-226 | 231-256 | 263-291 | 297-329 | 335-372 |
| Acute Beds + 5% CI | | 189 | 214 | 240 | 272 | 306 | 237 | 269 | 306 | 345 | 391 |
| Meet Demand 99% of Time | | 166 | 183 | 203 | 224 | 248 | 200 | 223 | 249 | 278 | 309 |

Source: Hawaii Health Information Corporation, Maui Memorial Medical Center

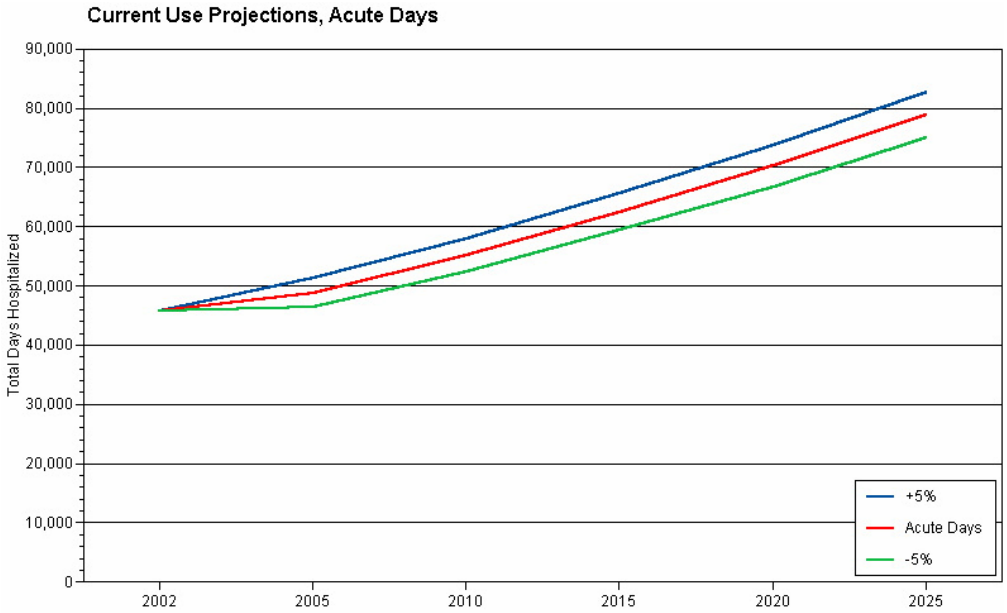
[32] Assumption 1: ratio of critical care days to medical surgical days will remain at 2002 levels, i.e., 8.2%.

[33] Numbers in parentheses indicate the assumed occupancy for the type of bed.

[34] CI: Confidence interval defined as +/- five percent of CU projection.

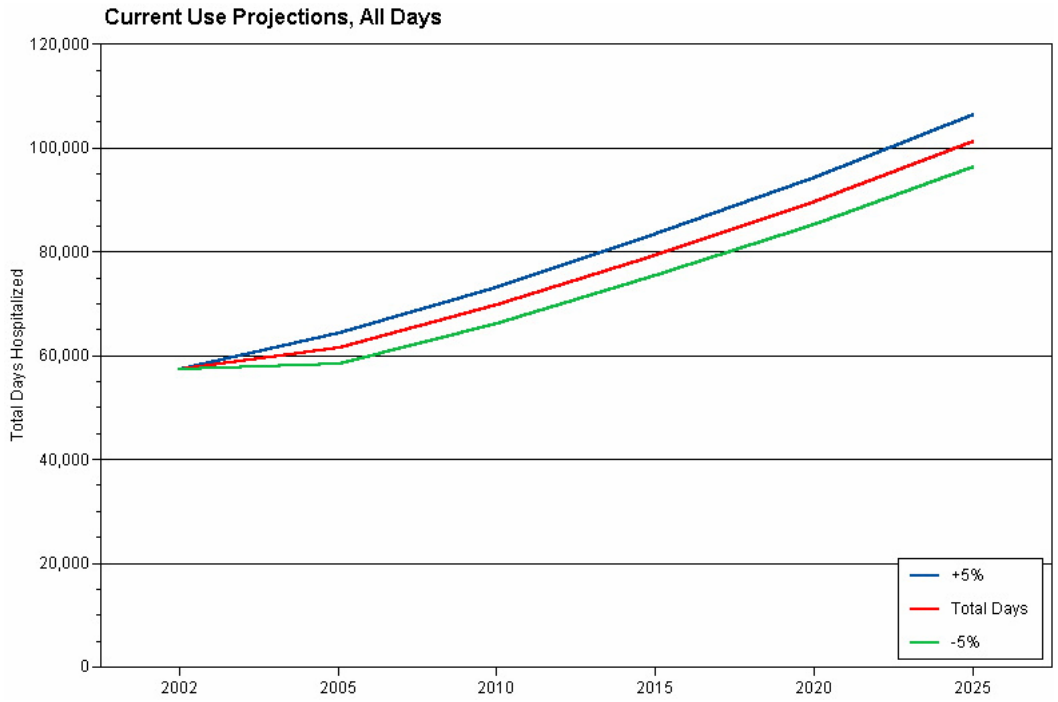
[35] Assumption 2: ratio of critical care days to medical surgical days will approximate the state average between 1998 and 2002, i.e., 9.5%.

***Figure 17: CU Projections of Total Acute Care Days ± 5 percent, 2002-2025***




Source: Hawaii Health Information Corporation, 2004

***Figure 18: CU Projections of Total Days (including Wait List) ±5 percent, 2002-20025***




Source: Hawaii Health Information Corporation, 2004

## *Trend Analysis (TA) Model*

Using the TA model, we project a 15 percent increase in the total number of acute care days in 2010 and a 63 percent increase in 2025 over 2002. Discharges increase 16 percent in 2010 and 57 percent between 2002 and 2025.

***Table 15: Trend Analysis Model Discharges and Days by Patient Type***

| | Female Surgical | | Male Surgical | | Medical | | Total | |
|---|---|---|---|---|---|---|---|---|
| Year | Discharges | Days | Discharges | Days | Discharges | Days | Discharges | Days |
| 2002 | 1,767 | 11,231 | 1,164 | 11,315 | 7,671 | 34,922 | 10,602 | 57,468 |
| 2005 | 1,843 | 11,564 | 1,119 | 10,103 | 8,105 | 37,048 | 11,067 | 58,715 |
| 2010 | 1,994 | 13,021 | 1,251 | 11,418 | 9,031 | 41,833 | 12,276 | 66,272 |
| 2015 | 2,165 | 14,697 | 1,401 | 13,090 | 10,057 | 47,271 | 13,623 | 75,059 |
| 2020 | 2,362 | 16,505 | 1,556 | 14,921 | 11,145 | 52,997 | 15,063 | 84,422 |
| 2025 | 2,559 | 18,379 | 1,719 | 17,006 | 12,330 | 59,810 | 16,608 | 95,195 |

Excludes newborns
Source: Hawaii Health Information Corporation, 2004

Between 2002 and 2025, average daily census for acute care patients increases by 78 patients and, if no alternatives are developed for long-term care, wait listed patient daily census could increase by 25 patients.

***Table 16: Trend Analysis Model Discharges, Days, and Average Daily Census for Acute and Wait listed Patients***

| | Total | | Wait listed | Acute | ADC | | |
|---|---|---|---|---|---|---|---|
| Year | Discharges | Days | Days | Days | Total | Acute | WL |
| 2002 | 10,602 | 57,468 | 11,691 | 45,777 | 157.4 | 125.4 | 32.0 |
| 2005 | 11,067 | 58,715 | 11,955 | 46,760 | 160.9 | 128.1 | 32.8 |
| 2010 | 12,276 | 66,272 | 13,720 | 52,552 | 181.6 | 144.0 | 37.6 |
| 2015 | 13,623 | 75,059 | 15,837 | 59,221 | 205.6 | 162.2 | 43.4 |
| 2020 | 15,063 | 84,422 | 18,095 | 66,328 | 231.3 | 181.7 | 49.6 |
| 2025 | 16,608 | 95,195 | 20,805 | 74,390 | 260.8 | 203.8 | 57.0 |

Excludes newborns
Source: Hawaii Health Information Corporation, 2004

***Table 17: Trend Analysis Model Projections for Acute Care Bed Needs***

| Bed Type (Occupancy Target) | SHPDA Beds | Acute Care Only | | | | | If Long Term Care Bed Availability Not Resolved (e.g., Wait List Patients Remain in Acute Care Beds) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Assumption 1**[36] | **2002** | **2005** | **2010** | **2015** | **2020** | **2025** | **2005** | **2010** | **2015** | **2020** | **2025** |
| Obstetric (75%)[37] | 23 | 13 | 14 | 15 | 16 | 17 | 13 | 14 | 15 | 16 | 17 |
| Psychiatric (75%) | 18 | 11 | 12 | 13 | 14 | 15 | 13 | 14 | 15 | 16 | 16 |
| Med/Surg (75-85%) | 140 | 135-120 | 153-135 | 174-154 | 196-173 | 222-196 | 175-157 | 202-178 | 231-204 | 261-230 | 296-262 |
| Critical Care (75%) | 15 | 13 | 14 | 16 | 18 | 20 | 13 | 14 | 16 | 18 | 20 |
| Total Acute Beds Projection | 196 | 157-172 | 175-193 | 198-218 | 221-244 | 248-274 | 196-214 | 220-244 | 250-277 | 280-311 | 315-349 |
| Acute Beds + 5% CI[38] | | 181 | 203 | 229 | 256 | 288 | 225 | 256 | 291 | 327 | 366 |
| **Assumption 2**[39] | | 2005 | 2010 | 2015 | 2020 | 2025 | 2005 | 2010 | 2015 | 2020 | 2025 |
| Obstetric (75%) | 23 | 13 | 14 | 15 | 16 | 17 | 13 | 14 | 15 | 16 | 17 |
| Psychiatric (75%) | 18 | 11 | 12 | 13 | 14 | 15 | 13 | 14 | 15 | 16 | 16 |
| Med/Surg (75-85%) | 140 | 133-118 | 151-134 | 172-152 | 194-171 | 219-193 | 176-155 | 200-176 | 228-201 | 258-228 | 293-259 |
| Critical Care (75%) | 15 | 14 | 16 | 18 | 21 | 23 | 14 | 16 | 18 | 21 | 23 |
| Total Acute Beds Projection | 196 | 156-171 | 176-193 | 198-218 | 222-245 | 248-274 | 195-216 | 220-244 | 249-276 | 281-311 | 315-349 |
| Acute Beds + 5% CI | | 180 | 203 | 229 | 257 | 288 | 227 | 256 | 290 | 327 | 366 |

Source: Hawaii Health Information Corporation, Maui Memorial Medical Center

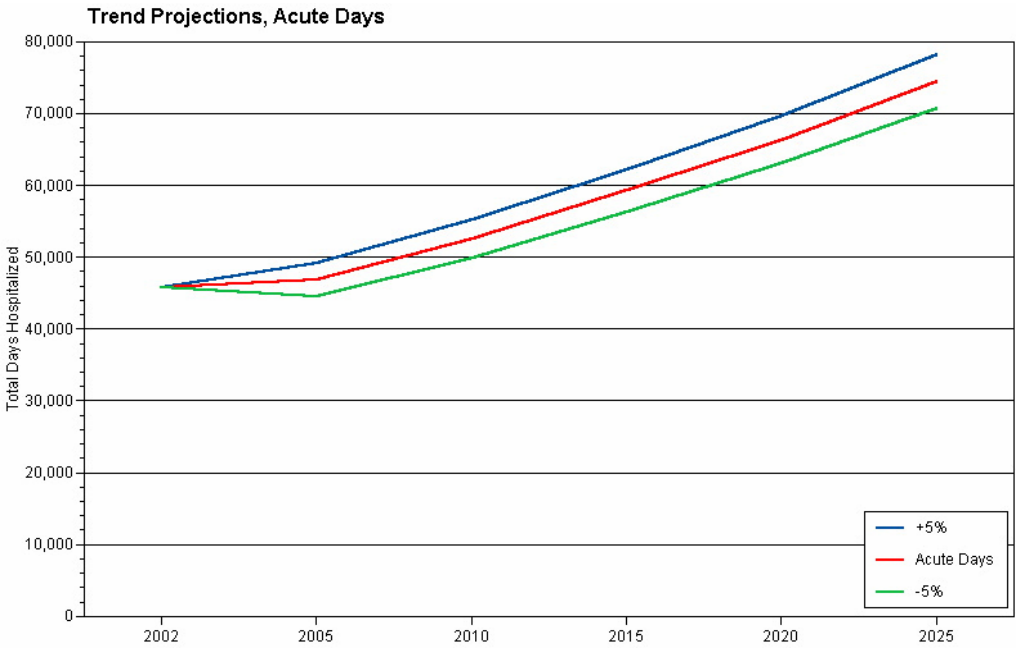
[36] Assumption 1: ratio of critical care days to medical surgical days will remain at 2002 levels, i.e., 8.2%.

[37] Numbers in parentheses indicate the assumed occupancy for the type of bed.

[38] CI: Confidence interval defined as +/- five percent of projection.

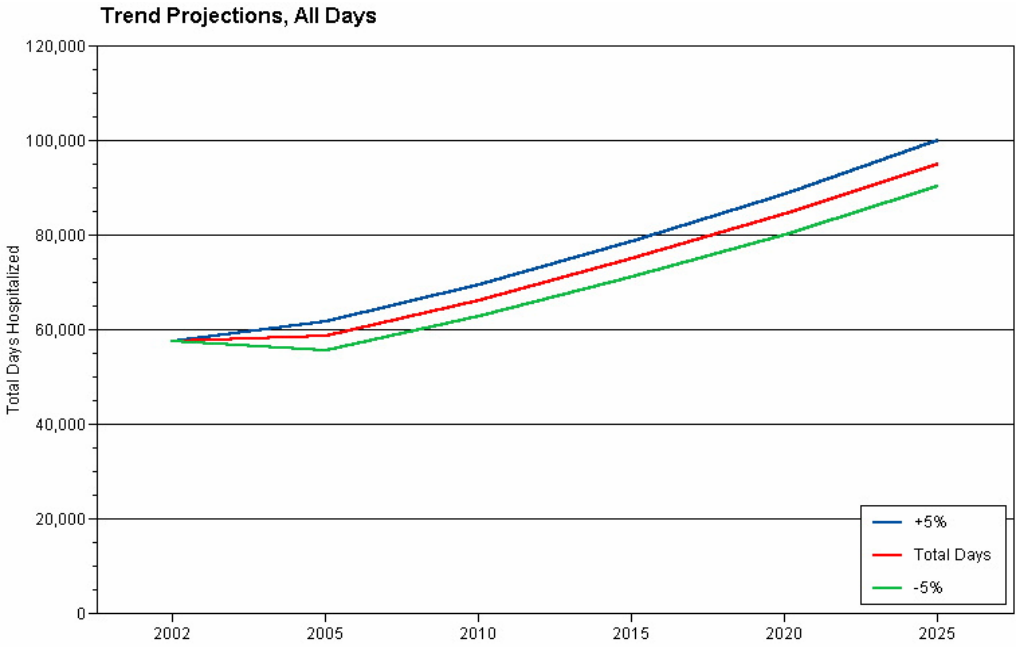
[39] Assumption 2: ratio of critical care days to medical surgical days will approximate the state average between 1998 and 2002, i.e., 9.5%.

***Figure 19: Trend Analysis Model Total Acute Care Days ± 5 percent, 2002-2025***




Source: Hawaii Health Information Corporation, 2004

***Figure 20: Trend Analysis Model Total Days (includes Wait list) ±5 percent, 2002-2025***




Source: Hawaii Health Information Corporation, 2004

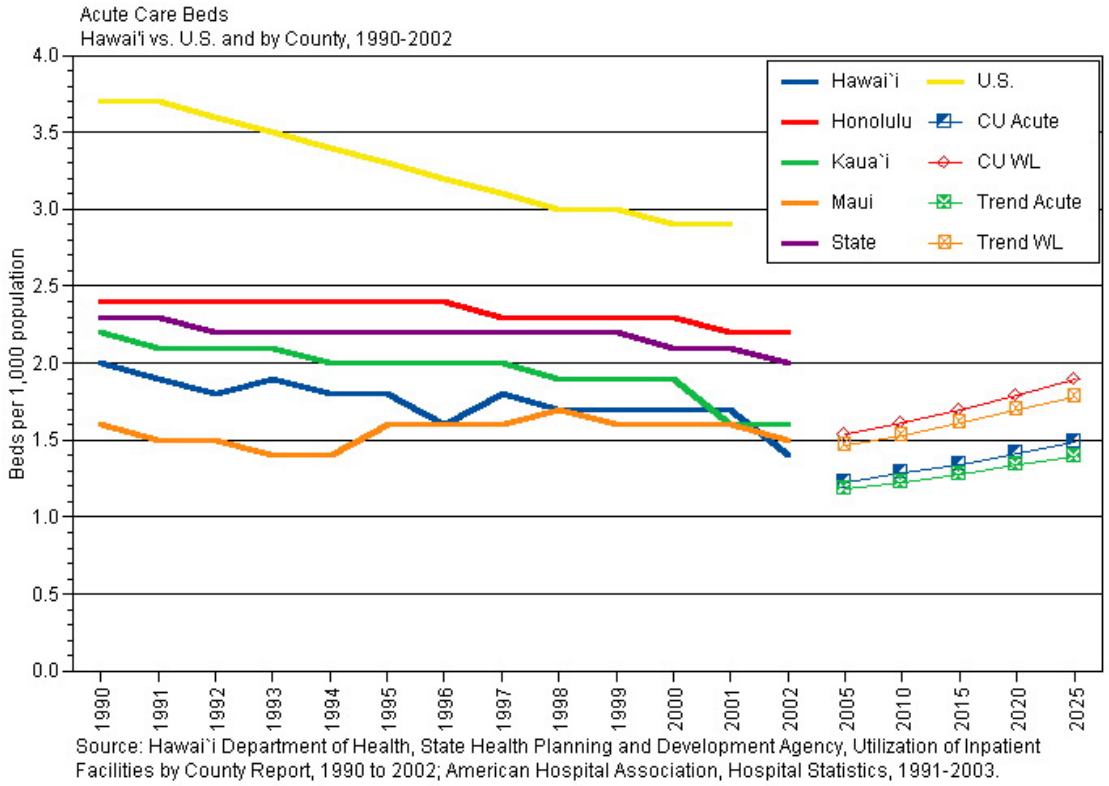
## *Another Perspective: Beds per 1,000 Population*

A common way of reporting bed supply is in terms of beds per 1,000 population. Traditionally, Hawaii's supply of acute care beds has been below that of the rest of the country. Hawaii's policy makers and hospital executives alike have viewed this difference as an indication the state was not burdened with over-capacity. The alternate view is that Hawaii as a state does not have much flexibility for increases in utilization associated with an aging population.

Following the experience in the state of California under managed care, health care futurist Russell Coile predicted in 1998 that future bed supply parameters should be 1 bed per 1,000 population.[40] This is probably the lower limit. After years of declines in utilization, Hawaii as a state is beginning to experience increases.

In addition to the current use model and the trend analysis model, beds per 1,000 population provides a third perspective for evaluating bed needs. Projections from both the current use model and the trend analysis model are translated in Figure 21 into beds per 1,000 population.

***Figure 21: Beds per 1,000 Population, Hawaii, All Hawaii Counties & U.S.***




[40] Coile, Russell C. Jr., "Hospital Bed Demand: Calculating Need for Facilities in the Millennium." Health Trends Vol. 10, No. 10 (1998): 2-4.

Both the current use and trend analysis models yield bed need projections substantially below 2 beds per 1,000 population. In 2002, Maui's [SHPDA-recognized] licensed bed supply was 1.5 beds per 1,000 population. Projections which include wait list patients start a 1.5 beds per 1,000 and reach 1.8 beds by 2025. Projections which exclude wait list patients range from 1.3 beds per 1,000 in 2005 to 1.5 beds per 1,000 in 2025.

## *Projection Summary*

Using the CU model, we project a 20 percent increase in the total number of acute care days in 2010 and a 72 percent increase in 2025 over 2002. Discharges increase by 18 percent between 2002 and 2010 and by 60 percent between 2002 and 2025. Between 2002 and 2025, average daily census for acute care patients increases by 91 patients, and, if no alternatives are developed for long-term care, wait listed patient daily census could increase by 30 patients.

Using the TA model, we project a 15 percent increase in the total number of acute care days in 2010 and a 63 percent increase in 2025 over 2002. Discharges increase by 16 percent by 2010 and by 57 percent between 2002 and 2025.

Between 2002 and 2025, average daily census for acute care patients increases by 78 patients and, if no alternatives are developed for long-term care, wait listed patient daily census could increase by 25 patients.

Table 18 contains a consolidated summary of both current use and trend analysis models, incorporating flexibility of +5 percent and calculating bed requirements to meet demand 99 percent of days. In addition, this table presents the number of beds needed to meet 1.4 to 2.0 beds per 1,000 population.

Meeting the needs of wait list patients requires 24-28 percent additional beds beyond either the current use or trend analysis projections +5 percent. Without wait list patients, MMMC's existing supply of licensed beds (e.g. 196 beds) is sufficient for the short-term, according to these models.

Bed supply based on beds per 1,000 may overestimate requirements at the 1.8 or 2.0 beds per 1,000 level, based on actual use rates of Maui residents and average length of stay. At 2.0 beds per 1,000, the bed requirements are 48 percent higher than the current use model plus 5 percent.

Table 19 contains a simplified summary, assuming that the current use model is applied, focusing on meeting 99% of the demand, and stating the impact of having 100% of Maui's patients receive their hospital care on Maui rather than Oahu[41].

[41] The option of having 100% of Maui's patients receive care on Maui is provided for illustrative purposes only. The calculation was based on 2003 Maui Memorial data and applying the same percentage increase in days as shown in table 11. Days were divided by 365 to calculate bed needs.

***Table 18: Bed Needs Summary***[42]

| | Acute Care Only | | | | | If Long Term Care Bed Availability Not Resolved (e.g., Wait List Patients Remain in Acute Care Beds) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **2005** | **2010** | **2015** | **2020** | **2025** | **2005** | **2010** | **2015** | **2020** | **2025** |
| **Current Use (CU) Projection** | 164-180 | 185-204 | 208-230 | 235-259 | 264-291 | 204-226 | 231-256 | 263-292 | 297-329 | 335-372 |
| **Current Use (CU) Projection +5%** | 189 | 214 | 242 | 272 | 306 | 237 | 269 | 307 | 345 | 391 |
| Meet Demand 99% of Time | 166 | 183 | 203 | 224 | 248 | 200 | 223 | 249 | 278 | 309 |
| | | | | | | | | | | |
| **Trend Analysis (TA) Projection** | 157-172 | 175-193 | 198-218 | 222-245 | 248-274 | 195-216 | 220-244 | 250-277 | 280-311 | 315-349 |
| **Trend Analysis (TA) Projection +5%** | 181 | 203 | 229 | 257 | 288 | 227 | 256 | 291 | 327 | 366 |
| **Beds per 1,000 Population: 2.0 Beds** | **280** | **303** | **325** | **349** | **374** | | | | | |
| **1.8 Beds** | **252** | **272** | **293** | **314** | **336** | | | | | |
| **1.6 Beds** | **224** | **242** | **260** | **279** | **299** | | | | | |
| **1.4 Beds** | **196** | **212** | **228** | **244** | **261** | | | | | |

Source: Hawaii Health Information Corporation, 2004

[42] Note: highest numbers for each model/assumption are highlighted in **bold**.

***Table 19: Beds to be Added, 2005-2025***

| **Needs if 12% of Maui Residents Continue to be Hospitalized on Oahu** | **2005** | **2010** | **2015** | **2020** | **2025** |
|---|---|---|---|---|---|
| High Estimate to Meet Acute Care Needs Only | 189 | 214 | 242 | 272 | 305 |
| High Estimate to Meet Wait List Needs Only | 48 | 55 | 65 | 73 | 85 |
| **Total Beds Needed to Match High Estimates** | **237** | **269** | **307** | **345** | **390** |
| **Beds to be Added Beyond Current 196 at MMMC** | | | | | |
| To Meet High Estimate Acute Care Needs | -7 | 18 | 46 | 76 | 109 |
| To Meet High Estimate Wait List Needs | 48 | 55 | 65 | 73 | 85 |
| **Total Beds to be Added to Meet High Estimates** | **41** | **73** | **111** | **149** | **194** |
| **OR** | | | | | |
| **Revised Needs if Maui Residents No Longer Go to Oahu for Hospitalization** | | | | | |
| Additional Beds Required | 25 | 29 | 33 | 37 | 42 |
| **Revised Total Beds Needed** | **262** | **298** | **340** | **382** | **432** |
| **Revised Total Additional Beds Needed** | **66** | **102** | **144** | **186** | **236** |

**Note:** The High Estimate is the Current Use Model estimate assuming an occupancy rate of 75% plus 5%. Refer to Table 14 on page 55 for details.

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## Appendices

A) Review of Methodologies
B) Stakeholders
C) Maui Bed Need Study Proposal and Project Plan
D) Scenarios and Driving Forces
E) Maui's Health Status Summary from "Toward a Healthy Hawaii 2010: Checking the Health of Maui County in 2000"
F) Evidence Regarding Stakeholder Issues
G) Selected Articles
H) Population Data