4
Utilization of ICUs

4
Utilization of ICUs

INTRODUCTION

For a number of reasons, there is little systematic information about the characteristics of intensive care unit (ICU) patients, i.e., their age, sex, length of stay, and case mix. Hospitals and physicians vary considerably, for example, in the way they treat patients with the same disease. Furthermore, as was noted earlier, there is no single model of ICU organization—some hospitals have an ICU combined with a coronary care unit (CCU), while others have separate units; some combine medical and surgical ICUs, and others do not; still others have multiple subspecialty ICUs. Community hospitals, which usually do not have full-time salaried physicians, may put less sick patients in ICUs primarily to provide them with concentrated nursing care (67).

There is no national data base which describes ICU utilization in any detail. The American Hospital Association (AHA) survey data provides information only on ICU and CCU beds and days by hospital size and type (see ch. z). A more detailed profile of ICU patients is based on published studies from individual hospitals. A compilation of many, but not all, such studies is presented in table 5. It should be emphasized that these studies are from teaching hospitals and large community hospitals and may not be representative of the ICU care provided in small community hospitals.

Recently, the Health Care Financing Administration (HCFA) has developed a profile of Medicare hospital utilization, including ICU/CCU utilization, based on its short-stay hospital inpatient stay record file for 1979 and 1980 (111,112). This file, called the MEDPAR file[1], is generated by linking information from three HCFA master program files for a 20-percent sample of Medicare beneficiaries. The MEDPAR file is the only data base which provides population-based rather than hospital-based ICU utilization data, and, of course, it only profiles the Medicare population.

[1]The MEDPAR file also contains billed charge data and clinical characteristics, such as principal diagnosis and principal procedure, in addition to utilization data.

UTILIZATION BY TYPE OF ICU

Surgical ICU patients tend to be younger (49, 155,175,227), to have more limited or reversible diseases with reasonably well-defined therapeutic endpoints (50,56,129,175,178), and to be more homogeneous than medical ICU patients (49). Even so, there are substantial differences among surgical ICU patients. The patient profile of surgical trauma patients, for example, differs significantly from that of postcardiac surgery patients. Trauma patients on average are younger and have longer ICU stays than postcardiac surgery patients.

Medical ICU patients tend to be older, have more progressive, chronic diseases (29,174,248, 265) and have more concurrent illnesses (265). These differences must be kept in mind when evaluating reports of utilization and outcome from particular ICUs.

ICU ADMISSION RATES

It is not known what percentage of the population, or even how many hospitalized patients are placed in an ICU for any defined period of time. Relman suggests that 15 to 20 percent of all patients are cared for in an ICU or CCU at some point during their hospital stay (195).

According to the 1979 MEDPAR sample, 18 percent of Medicare patients who were discharged

Table 5.—Summary of Selected ICU Studies

Study author*	Country	Type of ICU	Dates of data collection	Number in study	Mean age	ICU LOS	Percent ICU mortality	Percent hospital mortality for ICU patients
Safar	U.S.	M-S	1959-1961	561	—	—	30.3	—
Bates	Canada	R	1958-1962		48.0	—	43.0	—
Boyd	U.S.	M-S	1963	336	—	5.0	21.0	
Crockett	G.B.	M-S	1963-1965	608	44.3	—	18.0	
Callahan	U.S.	M-C	1964-1966	1,000	—	3.9	10.7	
BMA [a]	G.B.	M-S	1966-1967	5,521	—	4.0	14.7	
Rogers	U.S.	R	1965-1968	200	—	—	18.0	26.0
Carroll	U.S.	M	1968	95	54.0			—
Skidmore	G.B.	M-S	1965-1969	1,162	—	—	29.8	—
Safar and Grenvik (1971)	Us.	M-S	1965-1970	4,918	—	—	18,5	—
Pessi	Finland		1965-1971	1,001	50.0	6.2	20.1	28.9
Spagnolo	U.S.	i	1970-1971	231	56.0	4.8	28.0	47.0
Bell	G.B.	M-S	1966-1972	2,896	45.2	4.4	16.6	
Petty (1974)	U.S.	M-S	1964-1973	1,598		—	25.3	—
Nun	G.B.	M-S	1970-1974	422	—	—	16.4	
Turnbull	U.S.	M-S(ca)	1971-1974	1,035	—	5.2	22.3	38.6
Tagge (1975)	U.S.	M-S	1972-1974	2,878	63.0	—	8.2	—
Tomlin	G.B.	M-S	1973-1976	1,718		3.0	13.5	19.7
McLeave	Australia	M-S	1975-1976	843	53.0	3.4	14,4	
Vanholder	Belgium		1976	380	53.0	—	32.6	42.6
Chassis	U.S.	M,R	1977	489	54.0	5.1		14.0
Byrick	Canada		1978	58	59.1	8.0		—
Fedulo	U.S.		1978	182	65.0		21.0	29.0
Porno	U.S.	M-S	1978	558	54.7	3.6	11.7	17.3
Thibault	U.S.	M-C	1977-1979	2,693	60.0	3.4	6.0	10.0
Legal	France	M-S	1978-1979	228	50.0	—		34.0
Murata	U.S.	M	1979	149	62.7	3.9	16.7	26.8
Hauser	U.S.	M	1978-1980	724	—	—	19.3	—
Franklin	U.S.	M	1979-1980	512	—	—	26.0	—
Knaus, et al. (CCM,1982) [b]	U.S.	M-S	1980-1981	1,408	54.0	4.1		16.9

*Full citations found in References section.
[a]weighted average from 14 ICUs.
[b]Weighted average from 6 ICUs.
KEY: M-S Medical-Surgical ICU; M Medical ICU; M-C Medical-Cardiac ICU; R Respiratory ICU; S Surgical ICU.

SOURCE: Office of Technology Assessment.

from the hospital used intensive or coronary care. Fifteen percent used both general ward and ICU/CCU beds, while 3 percent used only ICU/CCU beds. As table 6 indicates, use of ICU/CCU beds by Medicare patients does not vary significantly by hospital size, except for hospitals under 100 beds. Table 6 also shows that there is little variation in ICU use by Medicare patients by size of hospital when ICU/CCU use is considered as a percentage of the patients' total charges. Interestingly, there was also little variation in ICU/CCU charges as a percent of total charges by type of hospital sponsorship (not shown); 7 percent of all charges for Medicare patients in voluntary,

Table 6.—Use and Percentage of Hospital Charges incurred in ICUs and CCUs for Medicare Beneficiaries Discharged From Short-Stay Hospitals, 1979

Hospital bed size	Percent using ICU/CCU	Percent total charges incurred in ICU/CCU
1-99 beds	12	5
100-199 beds	18	7
200-299 beds	20	8
300-499 beds	19	8
>500 beds	20	7
All hospitals	m	7

SOURCE: C. Helbing, "Medicare: Use of and Charges for Accommodation and Ancillary Services in Short-Stay Hospitals, 1979," Office of Research, Health Care Financing Administration, U.S. Department of Health and Human Services, undated.

proprietary, and public, non-Federal hospitals were room and board charges for ICU/CCUs.

Given the significant regional variations in the concentration of ICU/CCU beds (see ch. 2), it is not surprising that utilization of ICU/CCU beds by Medicare patients also varied somewhat according to region (see table 7). Perhaps part of the explanation for the higher per diem costs and shorter lengths of stay in ICUs on the west coast is a result of the greater use of relatively costly ICU/CCUs in that region **(255).**

There are also variations by State in the use of ICU/CCUs by Medicare patients; with a range from 12 percent of Medicare hospital discharges in Louisiana, Kansas, and South Dakota, to **27** percent in Connecticut.

Table 7.—Use and Percentage of Hospital Charges Incurred in ICUs and CCUs for Medicare Beneficiaries Discharged From Short-Stay Hospitals, by Geographic Region, 1979

Region	Percent using Icwccu	Percent total charges incurred in ICU/CCU
New England	20	*7*
Middle Atlantic	19	*7*
South Atlantic.	18	*7*
East North Central ., ., .	17	*7*
East South Central	15	*6*
West North Central	15	*7*
West South Central	15	*6*
Mountain	18	*7*
Pacific ... , ...	23	10

SOURCE: C. Helbing, "Medicare: Use of and Charges for Accommodation and Ancillary Services in Short-Stay Hospitals, 1979," Office of Research, Health Care Financing Administration, U.S. Department of Health and Human Services, undated.

SEX AND AGE DISTRIBUTION OF ICU USE

Studies of ICU patients demonstrate a remarkably consistent male to female ratio of about 3:2 (16,47,56,67,146,175,178,248). Only Chassin reports a slight female predominance (40). In general, the ratio represents the prevalence of serious cardiovascular diseases among males and females under the age of 70. Above that age, female representation in ICUs increases (248).

A major issue with respect to Medicare is the representation of elderly people in ICUs. With aging comes an increase in the incidence of critical illness. Thus, elderly people might be expected to require more intensive care than their proportion of the general population (34) and, possibly, more than their proportion of the hospitalized population (76,175). On the other hand, to the extent that ICU beds are in short supply (248,265) or that poor patient prognosis is considered (34,54,56,76), elderly patients might receive less intensive care than younger patients.

In the United States, the representation of elderly patients in ICUs seems to be the same or only slightly more than as it is in the hospital as a whole (76,139,175). Data from ICUs do not address the effect of screening on the basis of age that may take place prior to ICU entry. Speculation on the extent of such screening differs (33,76,137). The recent HCFA MEDPAR data is somewhat helpful on this issue. As table **8** shows, use of ICU/CCUs by elderly people does not vary from that of the general population until age 85. Even for people 85 and older, however, the decrease in ICU/CCU use is slight.

Once in the ICU, elderly patients generally *re*ceive more interventions than younger patients (34). However, when an attempt is made to control for acute severity of illness, the age of ICU patients does not appear to be a factor in the amount of resources expended in the ICU (137, 140). Rather, health status, independent of age,

Table 8.-Use and Percentage of Hospital Charges Incurred in ICUs and CCUs for Medicare Beneficiaries Discharged From Short-Stay Hospitals, by Age, 1980

Beneficiary age group	Percent using ICU/CCU	Percent total charges incurred in ICU/CCU
<65	18	7
65-69	18	8
70-74	18	7
75-79	18	7
80-84	17	7
>85	15	6
Total all ages . . .	18	7

SOURCE: C Helbing, Supervisory Statistician, Office of Research, Division of Beneficiary Studies, Health Care Financing Administration, U.S. Department of Health and Human Services, personal communication, June 6, 1983. Data derived from the MEDPAR file.

seems to be the key factor influencing the use of ICU resources once the patient is in the ICU (33,137).

Age does appear to be an important determinant of ICU admission in other countries. While the populations are not strictly comparable, table 5 clearly demonstrates a younger mean age of ICU patients in foreign countries. Knaus compared the ICUs in five U.S. teaching hospitals and seven French teaching hospitals and found that 45.5 percent of U.S. emergency ICU admissions were **60** years or older compared to only 31 percent of the French patients **(142).** Vanholder in Belgium acknowledged that when there is a lack of space in the ICU, older patients are less apt to be admitted (265). With many fewer ICU beds per capita available in Britain, age appears to be a primary factor for limiting access to the scarce ICU beds (1).

When they were first developed, use of renal dialysis machines were rationed partly on the basis of age, and it has been suggested that age was similarly a factor in the United States in rationing scarce beds in the early days of ICUs (248). In fact, as can be seen in table 5, in the last 15 years or so, there has been no dramatic trend toward older ICU patients even though the mean age of the population has increased. Unfortunately, data on the age of ICU patients in the late 1950s and early 1960s, when ICUs were first opened, are not available. In addition, there appears to be no consistent age difference in ICU use based on size or type of hospital. Finally, it should be pointed out that mean ages reported in ICU studies are a few years lower than the median ages (248).

ICU CASE MIX

Diagnoses

One characteristic of the ICU, particularly in comparison to other special care units (i.e., coronary, burn, and neonatal units), is the wide variety of underlying diseases that are present. As Chassin emphasized, medical ICUs treat a wide spectrum of illnesses; any specific disease represents a very small proportion of the total number of diseases that are present **(40,238,265).** Similar findings have been described for mixed ICUs and nonsubspecialty surgical ICUs **(49,54,129, 139).** Even respiratory ICUs treat a variety of primary diseases (10,29).

In surgical ICUs in major regional centers, trauma patients may represent **40 to 50** percent of the ICU population **(129,178).** In other surgical ICUs and mixed ICUs, trauma victims represent a much smaller percent of the overall ICU population (139), but are still a large proportion of the most critically ill patients (54). Trauma patients are much younger than the overall ICU profile **(54,129).**

There is no accepted classification scheme that describes the clinical characteristics of ICU patients. Perhaps the major problem with identifying ICU case mix is the fact that many critically ill patients have multiple underlying medical problems which interact to produce severe physiologic complications. Vanholder found, for example, that, excluding coronary care patients, each patient in his ICU had an average of **4.39** significant, distinct diagnoses (265). Questionable diagnoses, disorders not likely to have vital consequences, and previous diseases that had been cured at the time of admission to the ICU were not included in his calculation. The sicker the patient, the more likely it is that the ICU is treating failure of major organ systems, in addition to the underlying disease or the disease that precipitated the failure.

Other Case Mix Parameters

Recognizing that the complexity and severity of illness of ICU patients are generally not reflected by the primary diagnosis, other descriptions of ICU case mix have been used. Patients can be grouped according to those referred directly from emergency rooms, those transferred from the regular hospital floors, and those transferred from other hospitals (31). Interhospital ICU transfer of patients is relatively infrequent

in the United States, but common in some other countries (81,142,146).

ICU admissions can be characterized as emergency or elective, the latter usually referring to postoperative admissions. Medical ICU admissions are usually emergencies, whereas the majority of surgical admissions are elective (49, **52,227),** unless the hospital is a major trauma center. Elective, postoperative patients may, nevertheless, be critically ill, or at least need close monitoring and observation (54).

ICU patients can be characterized as those requiring close observation and monitoring and those requiring intensive therapy. As was pointed out earlier, there is no general agreement on how to classify patients into these groups. Some have employed subjective medical assessments of severity of illness and treatment needs (42,163,179). Others have employed objective measures of therapeutic resource use developed by Cullen and colleagues at Massachusetts General Hospital in Boston to separate patients into discrete groups requiring different personnel and treatment requirements (51,129,144). Recent work has attempted to ascribe a severity-of-illness score to each patient and has found a good correlation between scores of severity and treatment requirements (144,270).

Because authors use varying approaches to describe the intensity of ICU therapy, it is difficult to summarize the data. Nevertheless, it would appear from the literature—most of which is from teaching or major community hospitals—that **patients receiving the most concentrated intensive treatment, involving fairly continuously direct physician involvement and various forms of life support, represent less than half and sometimes as little as** 10 **to 20 percent of the ICU patient population** (54,129,144). At the other end of the spectrum, **patients who receive technical monitoring and nursing care but only routine physician care probably represent about 20 to** 30 **percent of patients in general ICUs** (136,137,178,246,269). The remaining 30 to 70 percent of ICU patients are those that receive actual therapeutic intervention to maintain and stabilize one or more physiologic functions, but do not require constant physician involvement in their care or nurse-to-patient ratios of greater than 1:1. The percentage of "monitor patients" is much higher in ICUs that also serve a CCU function (31,249).

Because most research has come from teaching hospitals, the pattern of case mix in community hospitals may be different, although anecdotal reports do not indicate a consistent difference between teaching and community hospitals (67, 163,175).

Readmission

Recently, attention has focused on the fact that high-cost users of hospital care are often patients with chronic illnesses who have repeated hospital admissions (161,218). This pattern is being increasingly recognized for intensive care as well (231,248). As might be expected, readmission to the same unit are less frequent for surgical ICU patients (178). In a 5-year period, almost 19 percent of all patients seen in a major teaching hospital medical/cardiac ICU were readmissions, and 6 percent were patients readmitted to the ICU during the same hospital stay (so-called "bounce backs") (248).

Length of Stay

The mean length of stay (LOS) in an ICU for all Medicare ICU/CCU patients in 1980 was **4.2** days (112). The LOS in ICUs is about 0.5 days longer than in CCUs (49). The LOS is reportedly longer in non-U.S. ICUs (29,88,142,178), probably because there are fewer monitor patients in these ICUs. The average LOS in U.S. hospitals has been notably stable over the past 15 years (see table 5).

As expected, mean LOS is significantly longer than median LOS (42). The mean does not reflect the great variation in LOS of ICU patients. In a study of 1,001 consecutive patients in a surgica] ICU, Pessi **(178)** found that 27 percent stayed less than 2 days, while 15 percent stayed longer than 10 days. In one medical ICU, Chassin (40) found that 10 percent stayed longer than 10 days. ICU stays of more than a month are not uncommon (49).

While the mean hospital LOS before the recent changes in Medicare reimbursement in U.S. hos-

pitals was 7.6 days (4) and 10.4 days for Medicare patients (113), ICU patients have significantly longer total hospital stays. From the few reports that present both ICU and total hospital LOS, there is significant variation in hospital LOS, presumably because of case mix differences (40,49, 175). Part of the variation in published studies may also represent the general pattern of shorter hospital lengths of stay on the west coast (256).