Hospital Readmissions as a Measure of Quality of Health Care

Advantages and Limitations

Jochanan Benbassat, MD; Mark Taragin, MD, MPH

We reviewed the recent literature on hospital readmissions and found that most of them are believed to be caused by patient frailty and progression of chronic disease. However, from 9% to 48% of all readmissions have been judged to be preventable because they were associated with indicators of substandard care during the index hospitalization, such as poor resolution of the main problem, unstable therapy at discharge, and inadequate postdischarge care. Furthermore, randomized prospective trials have shown that 12% to 75% of all readmissions can be prevented by patient education, predischarge assessment, and domiciliary aftercare. We conclude that most readmissions seem to be caused by unmodifiable causes, and that, pending an agreed-on method to adjust for confounders, global readmission rates are not a useful indicator of quality of care. However, high readmission rates of patients with defined conditions, such as diabetes and bronchial asthma, may identify quality-of-care problems. A focus on the specific needs of such patients may lead to the creation of more responsive health care systems for the chronically ill.

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Hospitalizations account for about half of all health care expenses, and it has been estimated that 13% of the inpatients in the United States use more than half of all hospital resources through repeated admissions.1 During past decades, hospital readmissions have been the subject of retrospective surveys and prospective trials with a view to their prevention. Our objective is to review these studies and focus on the frequency of readmissions, their causes and validity as a measure of quality of care, and the attempts for their prevention.

Hospital readmissions cluster shortly after discharge and decline thereafter. About one third of them occur within a month of discharge, half of them within 90 days, and 80% within a year.1,2 The term readmission has been defined variously as a repeated hospitalization within 1,4,6 2,7,8 4,9 or 1210 months of discharge. Most preventable readmissions have been reported to occur early, within 1 month of discharge, and it has been suggested to adopt this time interval in comparative studies.9,11 Still, early readmissions may also result from a nonpreventable progression of the disease or from a different diagnosis, whereas even late readmissions of diabetic or asthmatic patients may be preventable by appropriate ambulatory care. Therefore, although readily available from hospitals or health maintenance organizations,1,6,8,12 data on global (all-cause) readmissions have a limited value in the assessment of quality of care. Indeed, after analyzing the data of the entire Medicare population, Gornick et al13 concluded that “the development of the re-hospitalization data was the most complex part of the project . . . [R]e-hospitalizations after medical stays often indicated . . . the progression of disease, rather than discrete outcomes of care. . . . Therefore, [their] analysis . . . would require additional information not available from the Medicare data system.”

The additional information needed to analyze readmissions can be acquired by a prospective follow-up of patients discharged from hospitals3,14,15 or retrospective chart audits of patients admitted to hospitals.7,10,16 Although the yield of such
studies in terms of detected preventable readmissions may be relatively low,\textsuperscript{2} they may identify prototypic errors and suggest ways to better practice. The cornerstone of the continuous quality improvement theory is that system adjustments yield high reward.\textsuperscript{17}

**MATERIALS AND METHODS**

We searched the literature (using “patient readmission” and “quality assurance, health care” as key terms) for articles published from January 1, 1991, through December 31, 1998, and the reference sections of the identified articles were further searched for additional sources on unscheduled readmissions. We excluded articles dealing with readmission to psychiatric and pediatric wards and restricted the survey to internal medicine and surgical departments, with a focus on the frequency of preventable readmissions, efficacy of interventions aiming at their prevention, and directions of future research.

**FREQUENCY AND PREDICTORS OF HOSPITAL READMISSIONS**

The causes of readmissions may be inferred from differences in their rates among various patient populations. Of all discharges from general acute care hospitals, the proportion of readmissions has been reported to be 5% to 14% after 1 month\textsuperscript{2,5,18,19} and 32% to 49% after 1 year.\textsuperscript{2,20} Somewhat higher rates have been reported for geriatric patients, ie, 12% to 16% after 1 month,\textsuperscript{6,16,21-23} 60% to 64% after 6 months,\textsuperscript{24,25} and 34% to 67% after 1 year.\textsuperscript{10,16,23,26} The highest readmission rates have been observed in “high-risk” or severely ill geriatric patients, mostly with heart failure and chronic obstructive pulmonary disease,\textsuperscript{27} ie, 35% after 1 month,\textsuperscript{28} 26% to 44% after 4 to 6 months,\textsuperscript{29,30} and 70% after 1 year (Table 1).

Readmission rates have also varied according to demographic, social, and disease-related characteristics.\textsuperscript{32} A meta-analysis of 44 studies published before 1990 revealed that age, length of stay during the index hospitalization, and previous use of hospital resources were among the main independent predictors of readmissions.\textsuperscript{31} Other authors have identified as predictors of readmissions male sex,\textsuperscript{8,34} white race,\textsuperscript{8} supplemental Medicaid coverage,\textsuperscript{8} low socioeconomic status,\textsuperscript{35-37} single marital status,\textsuperscript{38} psychiatric comorbidity,\textsuperscript{39} behavioral problems,\textsuperscript{35} diagnosis\textsuperscript{34,40-44} (Table 2), the severity of the illness,\textsuperscript{45} nutritional status,\textsuperscript{29,46,47} comorbidity,\textsuperscript{34} and length of stay during the index hospitalization.\textsuperscript{8,34,48}

These findings indicate that patient-specific factors predict readmissions. Patient-specific factors could be independent and nonmodi-

| Table 1. Hospital Readmission Rates Reported Since 1990 by Patient Population |

<table>
<thead>
<tr>
<th>Source, y</th>
<th>Setting and Study Population</th>
<th>Design</th>
<th>No. of Patients</th>
<th>Interval Between Index Discharge and Readmission, mo</th>
<th>Readmission Rates, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unselected Inpatients</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrigan and Kazandijan,\textsuperscript{2} 1991</td>
<td>Medical and surgical patients</td>
<td>Retrospective</td>
<td>7242</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24</td>
<td>39</td>
</tr>
<tr>
<td>Fitzgerald et al,\textsuperscript{20} 1994</td>
<td>Medical patients</td>
<td>Prospective</td>
<td>335</td>
<td>3</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12</td>
<td>49</td>
</tr>
<tr>
<td>Cardiff et al,\textsuperscript{5} 1995</td>
<td>Medical patients</td>
<td>Retrospective</td>
<td>1800</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Bean and Waldron,\textsuperscript{18} 1995</td>
<td>Community hospital</td>
<td>Prospective</td>
<td>503</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Einstadler et al,\textsuperscript{16} 1996</td>
<td>Medical patients</td>
<td>Prospective</td>
<td>229</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>Geriatric Patients</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gautam et al,\textsuperscript{21} 1996</td>
<td>Geriatric patients</td>
<td>Prospective</td>
<td>713</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12</td>
<td>32</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>24</td>
<td>39</td>
</tr>
<tr>
<td>Wei et al,\textsuperscript{5} 1995</td>
<td>&gt;65 years of age</td>
<td>Retrospective</td>
<td>27 618</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Hansen et al,\textsuperscript{18} 1995</td>
<td>Geriatric patients</td>
<td>Prospective</td>
<td>97</td>
<td>6</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td>60</td>
</tr>
<tr>
<td>Thomas et al,\textsuperscript{5} 1993</td>
<td>Geriatric patients</td>
<td>Prospective</td>
<td>58</td>
<td>6</td>
<td>60</td>
</tr>
<tr>
<td>Kelly et al,\textsuperscript{22} 1992</td>
<td>Geriatric unit</td>
<td>Retrospective</td>
<td>622</td>
<td>12</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12</td>
<td>66</td>
</tr>
<tr>
<td>Lokk and Arnetz,\textsuperscript{24} 1994</td>
<td>Geriatric day care</td>
<td>Prospective</td>
<td>32</td>
<td>12</td>
<td>66</td>
</tr>
<tr>
<td>Townsend et al,\textsuperscript{16} 1992</td>
<td>&gt;75 years of age</td>
<td>Prospective</td>
<td>903</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12</td>
<td>48</td>
</tr>
<tr>
<td>Haines-Wood et al,\textsuperscript{22} 1996</td>
<td>Elderly patients</td>
<td>Prospective</td>
<td>97</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>24</td>
</tr>
<tr>
<td>Hennen et al,\textsuperscript{23} 1995</td>
<td>Medicare inpatients</td>
<td>Retrospective</td>
<td>184 490</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td>60</td>
</tr>
<tr>
<td>High-Risk Patients</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weinberger et al,\textsuperscript{20} 1996</td>
<td>Severely ill patients*</td>
<td>Prospective</td>
<td>1396</td>
<td>6</td>
<td>44</td>
</tr>
<tr>
<td>Martin et al,\textsuperscript{16} 1994</td>
<td>At-risk geriatric patients</td>
<td>Prospective</td>
<td>54</td>
<td>12</td>
<td>70</td>
</tr>
<tr>
<td>Evans and Hendricks,\textsuperscript{28} 1993</td>
<td>High-risk patients for hospital use</td>
<td>Prospective</td>
<td>418</td>
<td>1</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9</td>
<td>61</td>
</tr>
<tr>
<td>Friedmann et al,\textsuperscript{29} 1997</td>
<td>Nutritionally compromised patients</td>
<td>Prospective</td>
<td>92</td>
<td>4</td>
<td>26</td>
</tr>
</tbody>
</table>

* Includes patients with chronic obstructive pulmonary disease, diabetes mellitus, and congestive heart failure.
fiable risk indicators of readmissions; on the other hand, they could be markers of other, modifiable factors. For example, readmissions could be related to advancing age because of noncompliance with medication regimen or inappropriate home care. In other words, an apparently patient-specific factor may reflect a failure to provide adequate health care.

The existence of modifiable factors of readmissions is suggested by their geographic variability. Regardless of the initial cause of the admission and its severity, Medicare beneficiaries had consistently higher rates of readmission in Boston, Mass, than did Medicare beneficiaries in New Haven, Conn, possibly because of variability in practice habits due to hospital-bed availability. Modifiable factors of readmissions are suggested also by their variability according to discharge destination. A study of a national sample of patients with chronic obstructive pulmonary disease or dementia revealed that after adjusting for severity and clinical and demographic characteristics, patients discharged to nursing homes were less likely to be readmitted within 30 days after discharge than those discharged to personal homes. Finally, some studies have found an association between readmission rates and inappropriate care during the index hospitalization. A case-control study revealed that 5 criteria of inpatient care (resolution of main problem, adequacy of the postdischarge destination, stability of doses of therapy, and appropriate timing of the first follow-up visit) predicted readmissions within 30 days. Another case-control study found that a set of disease-specific, explicit criteria of appropriateness of care predicted readmissions. It has been suggested that 1 of 7 readmissions in patients with diabetes, 1 of 5 readmissions in patients with heart failure, and 1 of 12 readmissions in patients with obstructive lung disease were attributable to substandard care. Absence of documentation of discharge planning, increased temperature, intravenous fluids on the day of discharge, or undressed abnormal test results at discharge were related to an increased subsequent mortality. A meta-analysis of 29 studies published from 1975 through 1993 confirmed that low-quality inpatient care during the index hospitalization increased the risk of subsequent readmissions. At least some readmissions, therefore, are associated with modifiable factors.

FREQUENCY OF POTENTIALLY PREVENTABLE READMISSIONS

Of all readmissions, the proportion of those judged on retrospective chart audits to be preventable has varied from 9% to 50% (Table 3), and the meta-analysis by Ashton et al revealed that as many as 55% of the readmissions could be due to poor-quality and theoretically modifiable care during the index hospitalization. In contrast, the percentage of preventable hospital admissions in general (whether first or recurrent) has been estimated to be 9%, 20%, 21%, 23%, or 23%. The variability in estimated proportions of preventable readmissions could be caused by the limited reliability of the identification of a readmission as preventable. A study of 713 discharges revealed 109 (15.3%) unscheduled readmissions within 28 days. A review by 2 evaluators identified 34 (31%) of these readmissions as preventable. A second audit by another team of physicians identified only 16 (15%) of the same readmissions as preventable.

### Table 2. Hospital Readmission Rates Reported Since 1990 by Diagnosis

<table>
<thead>
<tr>
<th>Source, y</th>
<th>Diagnosis</th>
<th>Study Design</th>
<th>No. of Patients</th>
<th>Interval Between Discharge and Readmission, mo</th>
<th>Readmission Rates, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schneider et al, 1993</td>
<td>Heart failure</td>
<td>Prospective</td>
<td>28</td>
<td>1</td>
<td>29</td>
</tr>
<tr>
<td>Naylor et al, 1994</td>
<td>Cardiac patients</td>
<td>Prospective</td>
<td>276</td>
<td>0.5</td>
<td>9</td>
</tr>
<tr>
<td>Rich et al, 1995</td>
<td>Heart failure</td>
<td>Prospective</td>
<td>282</td>
<td>6</td>
<td>42</td>
</tr>
<tr>
<td>Thomas, 1996</td>
<td>Angina</td>
<td>Retrospective</td>
<td>14,590</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Coronary bypass surgery</td>
<td></td>
<td>4,261</td>
<td>3</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Heart failure</td>
<td></td>
<td>14,405</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>Cholecystitis</td>
<td></td>
<td>4,567</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>COPD</td>
<td></td>
<td>3,571</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>Pneumonia</td>
<td></td>
<td>10,549</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Krumholz et al, 1997</td>
<td>Heart failure</td>
<td>Retrospective</td>
<td>17,448</td>
<td>6</td>
<td>44</td>
</tr>
<tr>
<td>Camberg et al, 1997</td>
<td>COPD</td>
<td>Retrospective</td>
<td>6,761</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Stroke</td>
<td>Retrospective</td>
<td>2,261</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Dementia</td>
<td>Retrospective</td>
<td>2,652</td>
<td>1</td>
<td>18</td>
</tr>
</tbody>
</table>

*COPD indicates chronic obstructive pulmonary disease.*
other study similarly found that the agreement between evaluators of readmissions was moderate ($\kappa = 0.43$). A second possible explanation of the variability in the proportion of readmissions judged to be preventable is differences in the quality of care provided in various hospitals. Thus, an audit of 811 readmissions judged 277 (34%) of them to be preventable. Hospital system factors accounted for 37%; clinician factors, 38%; and patient factors, 21%. Nine hospitals differed markedly in their profile of reasons for preventable readmissions, published from 1980 through 1990. All but 4 of them found lower readmission rates in the intervention group.30 Soeken et al33 reviewed 12 controlled studies of the efficacy of planned interventions in reducing readmissions, published from 1980 through 1990. All but 4 of them found lower readmission rates in the intervention group. Table 4 and Table 5 summarize 19 studies published since 1991,8 all but 3 of them randomized. A 12% to 75% reduction in readmissions or in emergency visits was found in 14 of these 19 studies. Another study compared 2 control and 2 intervention hospitals to evaluate a utilization management program. The results indicated that both intervention hospitals and 1 control hospital had lower 30-day readmission rates after the intervention than before.5 The remaining 4 studies detected either no differences in readmissions between control and intervention patients19,20,64 or even higher readmission rates in the intervention group.30

The effect on mortality of interventions aiming to reduce readmission rates was reported in 7 studies.16,20,24,25,42,69,68 Three of them found that the intervention was associated with a 25%,42 70%,25 and 80%,68 decline in mortality. Costs and length of hospital stay were reported to have been reduced in 5 of a total of 7 studies. None, however, studied cost-effectiveness. Most intervention studies reviewed by Eggert and Friedman70 were not cost-effective. Safran and Phillips71 used decision analysis to examine the cost-effectiveness of interventions aiming to prevent readmissions. The authors considered the following 3 strategies: no intervention, intervention for all patients, and intervention for patients at high risk for readmission. They found that an intervention that costs $250 per patient would reduce overall costs for high-risk patients if its success rate exceeded 9% and for all patients if its success rate exceeded 17%. Pre-discharge reviews and improved postdischarge care, therefore, may prevent readmissions, although their cost-effectiveness is uncertain.

HOSPITAL READMISSIONS AS AN INDICATOR OF QUALITY OF CARE

The findings concerning the effect of interventions indicate that improved hospital and postdischarge care are associated with fewer readmissions. Still, there is evidence that global readmission rates have a limited value as indicators of quality of care. For example, about half of the studies reviewed by Ashton et al6 failed to uncover any relationship between quality of care and readmissions. In all clinical conditions studied by Thomas,43 readmission rates of patients who received poor-quality care were similar to those of patients whose care was judged acceptable. Similarly, Roe et al72 assessed risk-adjusted outcomes after renal failure, gastrointestinal tract hemorrhage, stroke, myocardial infarction, and heart failure and con-
hospital quality: mortality, readmissions, and complications. They ranked 300 hospitals on each index, and found no relationship between a hospital's ranking on any one of these indices and its ranking on the other two. Finally, a Monte Carlo simulation indicated that readmission rates were a poor measure of quality.75

As with all diagnostic tests, measures of quality of health care may identify incorrectly some medical interventions as inappropriate when they are actually appropriate, and vice versa.76 Therefore, it appears that this is true also for readmissions, and punitive measures based on high readmission rates may penalize hospitals without ample reason.77 However, the uncertain validity of global readmission rates as an indicator of quality of care does not preclude efforts for their reduction. Hospital readmissions raise concern among health care providers, and therefore efforts for their reduction are likely to be endorsed by clinicians and administrators.

**DIRECTIONS FOR FUTURE RESEARCH AND PRACTICE**

The survey of controlled studies of the efficacy of planned interven-

<table>
<thead>
<tr>
<th>Source, y</th>
<th>Setting and Study Population</th>
<th>Randomization</th>
<th>Intervention</th>
<th>Follow-up, mo</th>
<th>Relevant Outcomes</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Townsend et al,18 1992</td>
<td>Patients aged &gt;75 y</td>
<td>Yes</td>
<td>Domiciliary aftercare: 12 h/wk for 2 wk after discharge</td>
<td>18</td>
<td>Readmissions</td>
<td>−12</td>
</tr>
<tr>
<td>Evans and Hendricks,28 1993</td>
<td>Patients at “high risk” for frequent health care resource use</td>
<td>Yes</td>
<td>Discharge planning from day 3 in hospital; assistance provided: home care, financial, housing, and referrals</td>
<td>1</td>
<td>Readmissions</td>
<td>−31</td>
</tr>
<tr>
<td>Thomas et al,26 1993</td>
<td>Patients aged &gt;70 y</td>
<td>Yes</td>
<td>Team assessment with recommendations to attending physicians</td>
<td>6</td>
<td>Readmissions</td>
<td>−50</td>
</tr>
<tr>
<td>Lokk and Arnetz,24 1994</td>
<td>Geriatric daycare</td>
<td>No</td>
<td>Program designed to counteract passivity and enhance active patient involvement</td>
<td>12</td>
<td>Readmissions</td>
<td>−40</td>
</tr>
<tr>
<td>Martin et al,31 1994</td>
<td>Patients at “high risk” of failing to resettle</td>
<td>Yes</td>
<td>Home treatment team for 6 wk after discharge</td>
<td>3</td>
<td>Readmissions</td>
<td>−36</td>
</tr>
<tr>
<td>Fitzgerald et al,25 1994</td>
<td>Medical patients aged &gt;45 y</td>
<td>Yes</td>
<td>Case managers; educational material mailed to discharged patients followed by telephone call to resolve unmet needs, warning signs, barriers to keeping appointments</td>
<td>12</td>
<td>Office or emergency department visits</td>
<td>Increase</td>
</tr>
<tr>
<td>Cardiff et al,4 1995</td>
<td>Medical patients</td>
<td>No</td>
<td>Assessment of the appropriateness of care</td>
<td>1</td>
<td>Readmissions</td>
<td>−14</td>
</tr>
<tr>
<td>Hansen et al,24 1995</td>
<td>Geriatric patients</td>
<td>Yes</td>
<td>Follow-up home visits by a geriatric team (physician, nurse, physiotherapist)</td>
<td>6</td>
<td>Readmissions</td>
<td>−31</td>
</tr>
<tr>
<td>Einstadter et al,19 1996</td>
<td>Medical patients aged 18-95 y</td>
<td>No</td>
<td>Case manager; discharge planning and postdischarge follow-up</td>
<td>1</td>
<td>Readmissions</td>
<td>No effect</td>
</tr>
<tr>
<td>Weinberger et al,30 1996</td>
<td>Severely ill patients*</td>
<td>Yes</td>
<td>Follow-up by a nurse and a primary care physician, before discharge and for the next 6 mo</td>
<td>6</td>
<td>Readmissions</td>
<td>Increase</td>
</tr>
<tr>
<td>Siu et al,64 1996</td>
<td>Patients with functional limitations and unstable medical problems, aged &gt;65 y</td>
<td>Yes</td>
<td>Comprehensive geriatric assessment before and after discharge</td>
<td>2</td>
<td>Readmissions</td>
<td>No effect</td>
</tr>
</tbody>
</table>

* Includes patients with chronic obstructive pulmonary disease, diabetes mellitus, and congestive heart failure.
tions in reducing readmissions demonstrated a significant improvement in outcome of care in all 6 studies, which focused on patients with defined disorders (Table 5), but only in 6 of 10 studies of patients with various chronic disorders (Table 4). This finding suggests that a focus on patients with defined disorders may yield a higher reward in terms of improved patient care than attempts to reduce readmissions in the general inpatient population.

We believe that future research will focus on readmissions of inpatients with specific conditions, such as labor and child birth,78 coronary artery bypass grafting,79 uncontrolled pain,80 traumatic spinal cord injury,81 or acute coronary disease.82 A scrutiny of the causes of these readmissions may lead to an identification of unmet clinical, educational, and psychosocial needs. Once defined, research will focus on possible ways to meet these needs. There is already evidence of the benefit of interventions combining clinical expertise with coordinated care of patients with specific chronic disorders, such as bronchial asthma,65,67 heart failure,40-42,68 and diabetes,69 for which there are processes of care known to affect outcomes. The specific features of these interventions are patient education, close follow-up, home monitoring, medication adjustment, and regular communication with clinical experts.83 Approaches that ensure closer adherence to evidence-based guidelines and meet patient self-management needs may improve clinical outcomes and reduce health care expenditures.

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Table 5. Planned Interventions to Reduce Readmission Rates in Patients With Specific Disorders in Prospective Controlled Studies Since 1991

<table>
<thead>
<tr>
<th>Source, y</th>
<th>Setting and Study Population*</th>
<th>Randomization</th>
<th>Intervention</th>
<th>Follow-up, mo</th>
<th>Effect of the Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mayo et al,65 1990</td>
<td>Asthmatics requiring multiple admissions</td>
<td>Yes</td>
<td>Vigorous outpatient treatment and education in a special clinic</td>
<td>8</td>
<td>Readmissions −70</td>
</tr>
<tr>
<td>Schneider et al,66 1993</td>
<td>Patients aged 43-94 y with CHF</td>
<td>No</td>
<td>Medication discharge planning program</td>
<td>1</td>
<td>Readmissions −72</td>
</tr>
<tr>
<td>Naylor et al,40 1994</td>
<td>Medical and surgical cardiac patients aged &gt;70 y</td>
<td>Yes</td>
<td>Discharge planning by a gerontological nurse specialist</td>
<td>3</td>
<td>Readmissions −75 Days in hospital −71 Costs −71</td>
</tr>
<tr>
<td>Hassell et al,66 1994</td>
<td>Subjects who had enteral nutrition support for ≥24 h</td>
<td>No</td>
<td>Enteral nutrition managed by an enteral nutrition team</td>
<td>7</td>
<td>Readmissions −43 Days in hospital −12 Mortality −23</td>
</tr>
<tr>
<td>Rich et al,42 1995</td>
<td>Patients aged &gt;70 y with CHF and &gt;4 admissions during past 5 y</td>
<td>Yes</td>
<td>Education on diet, social service, and medications; planning of discharge and follow-up</td>
<td>3</td>
<td>Readmissions −31 Cost −35 Mortality −25</td>
</tr>
<tr>
<td>Madge et al,67 1997</td>
<td>Children with bronchial asthma</td>
<td>Yes</td>
<td>Discussions, written information, follow-up and telephone advice; parents provided with guidance when to start oral steroid therapy</td>
<td>2-4</td>
<td>Readmissions −88 Emergency department visits No effect</td>
</tr>
<tr>
<td>Stewart et al,49 1998</td>
<td>“High risk” patients with CHF</td>
<td>Yes</td>
<td>Single home visit to optimize medication management, identify clinical deterioration, and intensify medical follow-up as appropriate</td>
<td>6</td>
<td>Readmissions −43 Mortality −80</td>
</tr>
<tr>
<td>Aubert et al,68 1998</td>
<td>Diabetic outpatients</td>
<td>Yes</td>
<td>Nurse case manager; written management algorithms under the direction of a family physician and an endocrinologist</td>
<td>12</td>
<td>Hemoglobin A1c −12 Improved Patient-perceived health status Emergency department visits −67 Hospital admissions No effect</td>
</tr>
</tbody>
</table>

*CHF indicates congestive heart failure.
emergency readmissions be used as health ser-
vice indicators and in medical audit? Health Serv
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