

The Effectiveness and Cost of Home Care: An Information Synthesis

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The effect of home care on patient outcomes and costs of care has been controversial. This information synthesis summarizes results from studies of home care using experimental or quasi-experimental designs, explicitly including judgments of methodologic soundness in weighing the results. In 12 studies of programs targeted at chronically ill populations, home care services appear to have no impact on mortality, patient functioning, or nursing home placements. Across studies, these services either have no effect on hospitalization or tend to increase the number of hospital days; ambulatory care utilization may be increased by 40 percent. The cost of care either is not affected or is actually increased by 15 percent. The critical need at present is for better-designed studies to test the effects of different types of home care, targeted at various types of patients, on the outcomes assessed in the existing studies, as well as on other important outcomes such as family finances, quality of life, and quality of care.

The development of an improved system to provide long-term health care to the nation's chronically ill constitutes a major challenge to

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contemporary public policy and the health care system. This system must meet the needs of this population more appropriately, while at the same time making more efficient use of finite resources. Information on the costs and effectiveness of long-term care alternatives is of critical importance to the Veterans Administration, which is facing a projected threefold increase in the number of veterans over age 65 and a sixfold increase in the number of those over age 75 during the next twenty years [1]. In this general context, the following review may be useful to VA and non-VA policymakers, administrators, care providers, and others in making decisions about the effectiveness and future role of one long-term care alternative, home care. In this report, we (1) briefly review the history of home care program evaluations and the approaches and problems of earlier reviews of this literature, (2) present our method of study selection, (3) describe the studies reviewed, (4) list our criteria for assessing the methodologic soundness of the studies reviewed, (5) present the results of our information synthesis for each dependent variable assessed, and (6) discuss the results together with their implications for system managers, program managers, clinicians, and researchers.

Home care, the provision of services to people in their places of residence, has stimulated great interest because of its perceived potential for improving the outcomes of care for the chronically ill, while reducing rapidly rising expenditures for long-term care. A sizable body of literature asserts that home care services can have these effects [2-5]. The development of services that are both better and less expensive for each type of chronically ill patient and the targeting of those services, so that only the most appropriate patients are admitted to the home care program, are such formidable tasks that many observers have concluded that claims should be posited more cautiously and that research to evaluate them is needed [6-9].

Many studies purported to evaluate the effectiveness of these programs, especially the earliest examples of research on this topic, were methodologically unsophisticated. Some presented isolated case studies as proof of efficacy, and others used outcome data based on estimates of treatment effects made by the personnel delivering the services. More rigorously designed studies are now available, many of them completed in recent years. The task of summarizing and understanding the results of these research efforts has been difficult and controversial because of variations among the studies in the types of services evaluated and methodological approaches used, problems encountered in implementation of the studies in the field, and the complexity of results. The present information synthesis was designed to build upon the experi-

ence of earlier reviews of this literature and to avoid some of the methodological problems they encountered. A brief description of some examples of these problems will help to clarify the rationale for the approach taken in the present review.

CRITIQUE OF PREVIOUS REVIEWS OF HOME CARE EFFECTIVENESS

A review by the Urban Institute [10] concluded, in the section on the effects of home care on nursing home utilization, that "all but one [study] found a reduction in the nursing home use" (p. 203). This conclusion was apparently based on erroneous readings of the findings from the studies of Katz et al. [11] and Papsidero et al. [12]. Further, because the interpretation of study results did not consider differences in methodological quality, equal weight was given to observations from studies with better designs and one study in which there was no comparison group of any type and the outcome data were estimates of effects made by the home care providers [3].

Doherty, Segal, and Hicks, in their 1978 review [13], concluded that "evidence for cost-savings is not conclusive" (p. 14). They summarized the results from seven studies with widely divergent levels of methodological sophistication, but made no distinctions based on methodological quality in interpreting the results. The General Accounting Office review [14] did explicitly consider some aspects of methodological quality in formulating the displays of results and conclusions. The tables that were used to present the major results of the studies reviewed did not include the results of less rigorous studies. These studies, those without comparison groups and using estimates of treatment effects, were discussed in a separate narrative section. The tables presenting the results were divided into two sections: studies with control groups (experiments) and studies with nonrandomly assigned comparison groups (quasi experiments).

There are other aspects of the GAO review, however, that could easily lead to misinterpretation of their results. First, while the title of the report, the tables, and much of the narrative refers to "expanded home health care," many of the studies reviewed actually evaluated various community-based services such as day care, or case management programs in which people received home care and additional services, such as day care, various assisted residential care placements, companions, dental care, meals on wheels, etc. Attributing observed effects from this wide variety of services to "home care" alone seems

inappropriate. A second problem in the GAO review is that the tables presenting the results, and some summary conclusion sections, give misleading prominence to nonsignificant differences between groups. A third and very serious problem is that sometimes general interpretations were based on the results of only a small number of the total studies reviewed. For example, because two of nine studies reviewed found significant differences in mortality rates, the report concludes that "individuals who receive home health care services live longer" (p. ii). It should be noted that, in one of the two studies with this finding, the difference was significant only in one of the sets of analyses reported, and that the findings of nonsignificant differences in a tenth study were not included in the table. These kinds of interpretations in a report with such wide circulation and potential impact on policy are especially critical.

Finally, a review of the effects of community-based care on mortality by one of the present authors [15] did attempt to relate differences in findings to differences in study characteristics such as design (experiment or quasi experiment), characteristics and number of people in the sample, length of follow-up period, and type of program studied (home care by registered nurse, home care by home health aide, other—day care, channeling). No attempt was made, however, to explicitly judge the methodological soundness of the studies reviewed and to use these judgments in interpreting the results. We do take the latter approach in the present information synthesis.

METHOD

STUDY SELECTION

This information synthesis was intended to serve as a critical, systematic review of experimental or quasi-experimental studies of home care services. For the purpose of this review, experimental studies were defined as randomized controlled trials, i.e., studies in which the investigator randomly assigned people to an experimental group receiving the home care services or to a control group not receiving such services. Quasi-experimental studies were defined as those in which comparisons were made between a group of persons receiving home care services and a group not receiving such services, conducted in a setting in which the investigator could not assign people to groups. In these latter studies, people receiving home care services were compared to a group of people typically receiving some other type of service or living in another geographic area. Home care was defined as health or personal

care services delivered in a person's home. These definitions were designed to be more restrictive than those used in earlier reviews, in an effort to increase the conceptual clarity of the studies' results when considered in aggregate. First, excluding studies without comparison groups was designed to ensure at least a minimum level of research design quality in the studies reviewed. Secondly, excluding studies in which the service intervention consisted of other community-based services, such as day care or case management services, was designed to achieve a minimum level of homogeneity in the services assessed. While people in case management studies often received home care, they also received other services and home care was not the primary focus of such studies.

Study reports were located through a combination of personal contacts with researchers in the field, searches of article files in gerontological and health services libraries, and searches of computerized databases. We began by contacting the investigators of many of the studies cited in the previously discussed reviews or in our own work on related topics [15-18] to ask about other relevant research. This approach was especially crucial in a topic area with a large amount of current research activity, much of which has yet to be published fully. The majority of the studies reviewed had been reported, at least in part, either in unpublished papers or in government documents which were hard to obtain. Computerized searches were conducted on the MEDLARS and Health Planning and Administration databases and located few new citations. The nonbiomedical topic area, multidisciplinary backgrounds of the investigators, and use of a topic defined by research design criteria do not facilitate efficient computerized searches.

A total of 12 studies were found to be randomized experimental studies or quasi-experimental studies of home care and are reviewed in this information synthesis. While the location of 12 appropriate studies may seem like a small number in comparison to the number of citations, this actually represents an unusually large body of well-designed formal evaluation studies of a health care service modality. To take one contrasting example, there have been, to our knowledge, no experimental studies of the effectiveness of cardiac care units for hospitalized patients.

STUDY CHARACTERISTICS

The 12 studies reviewed are presented in Table 1 in alphabetical order by the lead author's name. More than one reference is listed when more

Table 1: Summary of Designs, Samples, Interventions, Quality Criteria Adherence, and Results in Studies of Home Care Services

Reference and Design	Sample	Intervention	Mortality	
			No. of Criteria Met*	Outcome
Bakst and Marra, 1955 [19] Experiment. Record review up to 588 days.	E = 55 C = 35 Cardiac patients discharged from hospital who: 1. Were III-C or below on American Heart Association classification system 2. Were discharged to their own homes 3. Were not under the care of a private physician.	Services in the home by physician, Visiting Nurses Association, and other social and health agencies as required.	4 of 6 (1,2,3,6)	NS‡
Bryant, Candland, and Loewenstein, 1974 [20] Quasi Experiment. Comparison group matched on age, sex, and diagnosis; extreme cases of stroke eliminated. Record review for 9-month follow-up period.	Home care = 25 Physical therapy only = 25 Home care patients were stroke patients admitted to hospital who met following criteria: 1. Physician requested home care and made plan of care 2. Patients medically ready for transfer from hospital to home 3. Patient must require one or more of following health services: -Skilled nursing -Physical therapy -Social service -Occupational therapy -Inhalation therapy -Speech therapy Comparison group patients were stroke patients admitted to hospital who did not receive home care but did receive physical therapy.	Visits by visiting nurse, physical and occupational therapists, home health aides, and social service workers.	3 of 6 (4,5,6)	+
Groth-Junker, Zimmer, McCusker, and Williams, 1983 [21] Experiment. Assessed at study entry, and 3 and 6 months post entry.	E = 82 C = 76 People meeting following criteria: 1. Adults living in county 2. Largely homebound (unable to be transported in private car or taxi) 3. Wishing to receive medical care at home 4. Had at least one family member or friend willing to participate significantly in the care of the patient, preferably living with the patient.	Services provided in home by team consisting of physician, geriatric nurse practitioner, and social worker.	5 of 6 (1,2,3,4,6)	NS

<i>Physical Function</i>		<i>Nursing Home Placement</i>		<i>Hospitalization</i>		<i>Outpatient Visits</i>		<i>Cost</i>	
<i>No. of Criteria Met*</i>	<i>Outcome</i>	<i>No. of Criteria Met*</i>	<i>Outcome</i>	<i>No. of Criteria Met*</i>	<i>Outcome</i>	<i>No. of Criteria Met*</i>	<i>Outcome</i>	<i>No. of Criteria Met*</i>	<i>Outcome</i>
Not available		Not available		Not available		3 of 5 (1,2,3)	E/C = .34	Not available	
Not available		4 of 6 (3,4,5,6)	+	4 of 6 (3,4,5,6)	NS	Not available		1 of 6 (3)	E/C = .4
4 of 5 (1,2,3,4)	NS	3 of 6 (1,2,4)	NS	4 of 6 (1,2,4,6)	NS	3 of 5 (1,2,4)	E/C = .64	4 of 6 (1,2,5,6)	NS E/C = .9

Continued

Table 1: Continued

Reference and Design	Sample	Intervention	Mortality	
			No. of Criteria Met*	Outcome
Hughes, Cordray, and Spiker, 1983 [22] Quasi Experiment. Comparison group of consecutively accepted clients of Home Delivered Meals Program. Assessed at intake and 9 months later.	Home Health Care = 122 Home Delivered meals = 123 Criteria for selection into home health care program: 1. Aged 60 years and older 2. Residing in geographical area served 3. Homebound 4. Medically underserved 5. In need of combination of medical and social services 6. Not in need of 24-hour supervision in the absence of an informal caretaker.	Physician visits, nurse/social worker joint case management, home health aide/homemaker personal care and chore services, telephone reassurance, volunteer friendly visiting.	3 of 6 (4,5,6)	NS
Katz, Vignos, Moskowitz, 1968 [23] Experiment. Followed for 1 year.	E = 20 C = 20 Patients in hospital arthritis clinic who: 1. Were between 16 and 75 years of age 2. Had attended clinic regularly 3. Lived in VNA service area 4. Had had rheumatoid arthritis continuously for at least 1 year, peripheral type only 5. Class 2 or 3 by ARA functional criteria and stage 2,3,4 by ARA anatomic classification.	Home visits by nurses from Visiting Nurse Association.	5 of 6 (1,2,3,4,5)	NS
Katz, Ford, Downs, Adams, and Rusby, 1972 [11] Experiment. Followed for 2 years after intake.	E = 150 C = 150 Patients discharged from chronic disease rehabilitation hospital: 1. To a home setting 2. Who were 50 years old or older 3. Who had a hospital stay of at least a week 4. Who did not leave the hospital against advice.	Home visits by nurses from Visiting Nurse Association.	6 of 6	NS

Physical Function		Nursing Home Placement		Hospitalization		Outpatient Visits		Cost	
No. of Criteria Met*	Outcome	No. of Criteria Met*	Outcome	No. of Criteria Met*	Outcome	No. of Criteria Met*	Outcome	No. of Criteria Met*	Outcome
2 of 5 (4,5)	-	3 of 6 (4,5,6)	+	3 of 6 (4,5,6)	NS	Not available		2 of 6 (5,6)	E/C = 1.2
5 of 5	+	Not available	6 of 6	-	5 of 5	E/C = 1.76	Not available		
4 of 5 (1,2,4,5)	NS	6 of 6	NS	6 of 6	-	Not available		Not available	

Continued

Table 1: Continued

Reference and Design	Sample	Intervention	Mortality	
			No. of Criteria Met*	Outcome
<p>Lutgen, 1979 [24] Quasi Experiment. Comparison group selected from records of hospitalized patients. Retrospective study of utilization and cost data.</p>	<p>Home care = 22 Comparison = 22 Criteria for selection into home care program: 1. Over 60 years old 2. Either patient or care-giver has potential for independent care 3. Needs services from more than one discipline 4. Not under care of non-VA physician or agency 5. Resides in service area. Criteria for selection of comparison group: 1. Over 60 years old 2. Male 3. Had had inpatient stay at VA hospital last year 4. Have at least one of following conditions: CHF, COPD, alcoholism, cancer.</p>	<p>Services provided by nurse, occupational therapist, pharmacist, physical therapist, social worker, dietician, and physician.</p>	<p>Not available</p>	
<p>Mitchell, 1978 [25] Quasi Experiment. Comparison of patients in 3 treatment modalities: home care, community nursing home care, hospital-based nursing home care. Assessed at intake and three months post-intake or when treatment was terminated, whichever came first.</p>	<p>Home Care (HC) = 108 Community Nursing Home (CNH) = 123 Hospital-Based Nursing Home (HNB) = 87 All consecutive patients leaving acute care status in one of four hospitals for one of three treatment programs over a three-month period.</p>	<p>Home care: services provided by physician, nurse, dietician, and social worker and, as required, by others including physical therapist and home health aide.</p>	<p>4 of 6 (3,4,5,6)</p>	<p>NS</p>

<i>Physical Function</i>		<i>Nursing Home Placement</i>		<i>Hospitalization</i>		<i>Outpatient Visits</i>		<i>Cost</i>	
<i>No. of Criteria Met*</i>	<i>Outcome</i>	<i>No. of Criteria Met*</i>	<i>Outcome</i>	<i>No. of Criteria Met*</i>	<i>Outcome</i>	<i>No. of Criteria Met*</i>	<i>Outcome</i>	<i>No. of Criteria Met*</i>	<i>Outcome</i>
Not available		Not available		Not available		Not available		2 of 6 (5,6)	NS E/C = 1

3 of 5 (3,4,5)	+	Not available	4 of 6 (3,4,5,6)	+	Not available	Not available	Not available
	HC > CNH > HNH			HC < CNH			
				NS			
				HC = HNH			

Continued

Table 1: Continued

Reference and Design	Sample	Intervention	Mortality	
			No. of Criteria Met*	Outcome
Nielsen, Blenkner, Bloom, Downs, and Beggs, 1972 [26] Experiment. Assessed at intake, 2 weeks after discharge and 6 and 12 months after intake.	E = 50 C = 50 Patients discharged from chronic disease rehabilitation hospital who: 1. Were over 60 years of age 2. Did not require intensive skilled nursing or custodial care 3. Had a noninstitutional place of abode 4. Were not already receiving home aide, homemaker, or housekeeper services from a community agency.	Home aide services under supervision of paraprofessionals under supervision of social worker and nurse.	4 of 6 (1,3,4,5)	NS
Papsidero, Katz, Kroger, and Akpom, 1979 [12]; Hedrick, 1982 [27] Experiment. Assessed at intake and at 6-month intervals thereafter until end of study (6 to 24 months depending on time of study entry) except for one control group at one site assessed at intake, 6 months, and end of study period.	E = 438 C = 436 Patients who were about to be discharged from selected hospitals or patients in selected ambulatory care facilities who met following criteria: 1. 45 years of age or older 2. Discharged to or living in noninstitutional setting within geographic access to home care services 3. In need of assistance for at least three months with respect to either the activities of daily living, cardiopulmonary condition, or arthritis 4. Not in need of skilled nursing service, 24-hour a day supervision or on kidney dialysis.	Services delivered by team of physician, nurses or social worker, and 2 health assistants.	5 of 6 (1,2,3,5,6)	NS

<i>Physical Function</i>		<i>Nursing Home Placement</i>		<i>Hospitalization</i>		<i>Outpatient Visits</i>		<i>Cost</i>	
<i>No. of Criteria Met*</i>	<i>Outcome</i>	<i>No. of Criteria Met*</i>	<i>Outcome</i>	<i>No. of Criteria Met*</i>	<i>Outcome</i>	<i>No. of Criteria Met*</i>	<i>Outcome</i>	<i>No. of Criteria Met*</i>	<i>Outcome</i>
Not available		5 of 6 (1,3,4,5,6)	+	4 of 6 (1,3,4,5)	NS	Not available		Not available	
3 of 5 (1,2,5)	NS	3 of 6 (1,2,5)	NS	4 of 6 (1,2,5,6)	NS	4 of 5 (1,2,3,5)	E/C = 1.6	4 of 6 (1,2,4,6)	NS E/C = 1

Continued

Table 1: Continued

Reference and Design	Sample	Intervention	Mortality	
			No. of Criteria Met*	Outcome
<p>Selmanoff, Mitchell, Widlak, and Mossholder, 1979 [28]</p> <p>Experiment.</p> <p>Assessment at intake; 2, 4, and 6 months after service began; and 3 months after termination of care for patients under care at end of study.</p>	<p>E = 64 E = 60</p> <p>Persons who:</p> <ol style="list-style-type: none"> 1. Were 60 years old or older 2. Could be maintained at home with periodic health care at the nonskilled level 3. Have chronic or disabling conditions 4. Wish to remain in own home and would benefit from services of Health Maintenance Team 5. Can themselves or have responsible person who is capable and willing to provide care during nights, weekends, and holidays 6. Have a telephone available for use 7. Can obtain food, shelter, clothing, medicines, and equipment. 	<p>Nonskilled nursing care in home including personal and environmental care provided by aide, LPN, and RN. Maximum of 12 hours of service a week by health assistants, visits by RN and LPN as needed, and telephone supervision at a skilled level on a 24-hour basis.</p>	<p>5 of 6 (1,3,4,5,6)</p>	<p>+</p>
<p>Weissert, Wan, and Livieratos, 1979 [29], 1980 [30]</p> <p>Experiment.</p> <p>Assessed at intake and at 3, 6, 9, and 12 months.</p>	<p>E = 424 C = 354</p> <p>Patients who were:</p> <ol style="list-style-type: none"> 1. Medicare eligible 2. Hospitalized for at least three days during two weeks prior to study period 3. Judged to need health care services to restore or maintain functional ability, nor merely custodial care 4. Judged as not requiring 24-hour a day supervision 	<p>Following services provided in person's home:</p> <p>home management — cooking, cleaning, laundry; personal care services — assistance in bathing, dressing, walking, skin care.</p> <p>supportive activities outside home such as shopping.</p> <p>health care management services — accompanying patient to health care services.</p>	<p>4 of 6 (1,3,4,6)</p>	<p>NS</p>

<i>Physical Function</i>		<i>Nursing Home Placement</i>		<i>Hospitalization</i>		<i>Outpatient Visits</i>		<i>Cost</i>	
<i>No. of Criteria Met*</i>	<i>Outcome</i>	<i>No. of Criteria Met*</i>	<i>Outcome</i>	<i>No. of Criteria Met*</i>	<i>Outcome</i>	<i>No. of Criteria Met*</i>	<i>Outcome</i>	<i>No. of Criteria Met*</i>	<i>Outcome</i>
3 of 5 (1,3,5)	NS	4 of 6 (1,4,5,6)	-	4 of 6 (1,4,5,6)	NS	Not available		Not available	
2 of 5 (1,4)	NS	4 of 6 (1,3,4,6)	NS	4 of 6 (1,3,4,6)	NS	Not available		5 of 6 (1,3,4,5,6)	- E/C = 1.4

*The study quality criteria for the outcome concerned: (1) randomized design, (2) randomization procedures, (3) group similarity at enrollment, (4) level of completeness of follow-up, (5) equivalence of follow-up procedures and completeness level, and (6) frequent occurrence of outcome.

†The study quality criteria for cost concerned: (1) randomized design, (2) randomization procedures, (3) group similarity at enrollment, (4) comprehensiveness of cost measures, and (5) completeness of follow-up.

‡NS = no significant difference between groups. + = significant difference favoring home care group. - = significant difference favoring home control group. E/C = ratio of experimental group to control group outcome.

than one report contains study results. A summary of selected aspects of the design, sample, and intervention used in these studies is presented in the first three columns. Eight of the studies were randomized experiments and four were quasi experiments. In ten of the studies, the majority of information on patient outcomes was collected through assessment interviews conducted at various times after study intake, with the last assessment conducted at times ranging from three weeks for one study to up to two years for others. Two studies were conducted solely through record reviews. The total number of persons included in the study samples ranged from 40 to 874. Patients were admitted to the study from hospitals, ambulatory care facilities, or community settings after meeting a number of different admission criteria typically concerning age, geographic location of residence, availability of a caregiver in the home, needed services, and health status.

The nature of the home care services evaluated differed substantially across these studies. The majority of studies assessed services delivered by teams of providers including various combinations of physicians, nurses, social workers, therapists (physical, occupational, speech, inhalation), dietitians, licensed practical nurses, home health aides, and homemakers. Other studies evaluated the services delivered primarily by one of these providers: registered nurses in the studies by Katz et al. [23,11] and homemakers in the work by Weissert et al. [29,30].

The 12 studies were reviewed by both authors to determine which dependent variables, or measures of home care program impact, were included. Of the many possible dependent variables, only six were used by sufficient numbers of studies to permit systematic review and information synthesis: mortality, physical function, nursing home placement, acute hospital utilization, outpatient visits, and costs of care. Eleven studies assessed impact on patient mortality; eight, on impact on physical function; eight, on nursing home placement; ten, on hospitalization; four, on outpatient visits; and six, on costs of care. The prevalence of these variables in the available studies probably reflects the perceived importance of these outcomes, as well as the judgments of researchers regarding those outcomes most likely to be affected by the provision of home care services. Other variables included in at least one study were psychosocial function (e.g., mental orientation, depression, contentment, social role functioning), adherence to medical regimens, economic dependence, use of other community services, satisfaction with care, and unmet need for other services.

The studies did not use identical measures of these variables. As major global measures of physical function, the studies by Katz et al.

[23,11], Papsidero et al. [12], Selmanoff et al. [28], and Weissert et al. [29] used the Katz Index of Independence in the Activities of Daily Living [31]. Hughes et al. [22] used the OARS methodology [32]; Groth-Juncker et al. [21], the Sickness Impact Profile [33]; and Mitchell [25], a Functional Status Index developed for that study. Nursing home placements were measured by the number of nursing home admissions, except in the case of Weissert et al. [29], where this information was not available and length of stay was used.

STUDY REVIEW CRITERIA

The next task of the information synthesis was to develop explicit review criteria which could be applied to the 12 studies to distinguish those with fewer methodologic problems from studies with more potential weaknesses. The development of these criteria was guided by an examination of generically similar work by other researchers [34-38]. The final set of review criteria was newly developed to serve the purposes of the present task.

Review criteria were developed and applied separately for each of the six outcomes assessed in this study. Although there were differences in application across study outcomes, the six basic criteria can be outlined as follows:

1. A randomized controlled design was used.
2. Randomization procedures were described and judged appropriate.
3. The groups must have been compared and found not to be significantly different on descriptive characteristics at study enrollment, including physical function and prognosis for studies of physical function and locus of care prior to enrollment for studies of nursing home placement.
4. The patient's outcome status at follow-up was known for a stated percentage of subjects. (For studies of mortality, the percentage was 90 percent; for studies of other outcomes, 80 percent.)
5. Procedures for patient follow-up were equivalent for experimental and comparison groups, and there were no significant differences in the percentage of subjects for whom outcomes were known.
6. For studies of mortality and nursing home placement, the outcome occurred for at least 10 percent of subjects.

For studies of physical function and outpatient visits, only the first

five criteria were used. For studies of cost, the first three criteria were basically the same, while criterion 4 stated that all direct costs of care should have been assessed including the patient's out-of-pocket costs, and criterion 5 stated that cost data should be available for at least 80 percent of the subjects enrolled in the study.

The authors independently reviewed all studies, applying each criteria set to a given study according to that study's outcomes. Judgments of each study's adherence to criteria were then compared, and differences between the reviewers were resolved by discussion, further study of the research report, or both. As a matter of standard procedure, studies were classified either as adhering to a particular criterion or as not presenting written evidence of such compliance in the research reports available to us. For example, a study report which alluded to "randomization" of subjects but did not actually describe the procedure used to randomize would have been listed as noncompliant with criterion 2. This approach may seem arbitrary and unduly demanding, but it follows the methods of others undertaking such tasks [36,37].

When a study that included a particular dependent variable had been judged on all criteria, the number of criteria met was summed. The next step was the determination of whether a study reported a significant difference between the comparison groups on the dependent variables of interest, and if so, the direction and, in some cases, the magnitude of the difference.

RESULTS

The results of this information synthesis are presented in Table 1 separately for each outcome variable assessed. The first column under each outcome presents the number of criteria that the study met for that outcome and lists the criteria in parentheses. When a study did not report comparable findings on a particular outcome, "not available" is entered in the columns. The study results for the comparison of experimental and control group outcomes are presented in the second column under each outcome. Since none of the studies reporting comparisons of outpatient visits and only two of those reporting cost differences reported significance levels, these results are summarized by ratios of the experimental group visits or costs to those of the control group.

The study results for each outcome will now be summarized across studies. Reference to the studies' criteria adherence will be made as

appropriate to allow for interpretation of study results in relation to methodological quality.

MORTALITY

Two of the eleven studies [20,28] reported statistically significant differences between the group receiving home care services and the control or comparison group, both in the direction of a lower mortality rate in the home care group. Of these two studies, the Selmanoff study [28] was an experiment with a moderate level of criteria adherence and the Bryant study [20] was a quasi experiment with the lowest level of criteria adherence. The studies that found nonsignificant differences in mortality include the one study with the highest possible criteria score, Katz [11], and the five other experimental studies.

Further exploration of these studies was conducted because of concerns over the lack of statistical power in the many reports of nonsignificant differences in evaluations of social programs [39] and medical therapies [40]. Mortality was the only outcome variable in these studies for which appropriate data were present (in eight of the nine studies) to perform these calculations. Power calculations were performed for the eight studies to determine the probability of detecting (i.e., finding to be significant at the $p < .05$ level, two-tailed) a 10 percent difference in mortality rates, if it existed, given the study sample size. For the Katz et al. [23] and Nielson et al. [26] studies, there was a less than 10 percent mortality rate for either group, so the test was of the probability of detecting a result where mortality was reduced to zero, rather than a 10 percent difference.

Three of the eight studies were judged to have sufficient power in this analysis. The probabilities of these studies detecting a mortality difference of the specified size were: Papsidero et al. [27], .97; Hughes et al. [22], .93; and Weissert et al. [29,30], .86. Stated in other terms, the Papsidero study, for example, had a 97 percent chance of detecting a 10 percent difference in mortality rates, if it existed, at the conventional level of statistical significance. For these studies, at least, one can have a high degree of confidence that the sample sizes were sufficient to detect any actual differences of this magnitude in mortality rates. The other studies do not support such a degree of confidence. The studies and their statistical power, in descending order, are: Katz et al. [11], .56; Nielson et al. [26], .53; Groth-Juncker et al. [21], .29; Bakst et al. [19], .20; and Katz et al. [23], .03. These findings, in combination with the overall level of adherence to study quality criteria, indicate

that while several of the studies probably did provide definitive tests of the effects of home care on mortality, others did not.

A final methodological point should be made regarding studies of mortality. All but one of the studies above reported only comparisons of the total number of deaths at the end of the study period. An alternative and preferable approach is that taken by Weissert et al. [29], a comparison of mortality rates at intervals over the entire follow-up study period, adjusting for the number of persons remaining at risk (survival analysis using a life table approach).

PHYSICAL FUNCTION

Five of the eight studies including measures of physical function found no significant differences between the home care and comparison groups at the end of the study [21,11,12,28,29]. Two of the studies [23,25] found a positive result, with the home care group having a significantly higher level of function, and one [22] found the opposite, with the home care group having a lower functional level at study end. The studies with significant positive results are the highest rated experimental and quasi-experimental studies. The study with significant negative results is a lower rated quasi experiment. The six studies with nonsignificant results were the other experimental studies with various levels of methodological quality ratings.

NURSING HOME PLACEMENT

Four of the eight studies including nursing home placement as an outcome found significant differences in the number of nursing home admissions or days between the home care and comparison groups. Three of these differences were in a positive direction [20,22,26], with the home care groups having fewer placements, and one was negative [28], with the home care group having more placements. The studies with positive differences were an experimental study [26] with the next to highest rating and the two quasi-experimental studies [20,22]. The study with the difference in the opposite direction was an experimental study that met three of the five criteria [28]. The studies with nonsignificant differences were four experimental studies, including those with the lowest and highest ratings [21,11,12,29].

HOSPITALIZATION

Ten studies included hospitalization as a study outcome. The two highest rated experimental studies, those by Katz et al. [23,11], found that the home care groups had a greater number of hospital admissions or

days than the control groups. In a third study, a higher rated quasi experiment by Mitchell [25], a positive result was found for one of the two study comparisons. In this study, the home care group had fewer hospital readmissions than a comparison group in community nursing homes, but the number of readmissions were not significantly different from a comparison group in VA nursing homes. The majority of the studies, seven out of ten, found no significant differences in the number of hospital admissions or hospital days between the home care and comparison groups. These studies were the two quasi experiments [20,22] and the five experimental studies with lower numbers of criteria met [21,26,12,28,29].

OUTPATIENT VISITS

Only four studies, all of which were experiments, included results on the number of outpatient visits made by patients during the study period. The results for these studies are presented as the ratio of the number of visits made by the home care group to the number of visits made by the control group. The interpretation of these findings is limited by the fact that the available data did not allow for determination of the statistical significance of those differences, as well as the variability in the measures of visits used in the studies. Incomplete as they are, the results may at least be useful in the context of the other utilization and cost data in these studies.

The experimental study with the highest possible rating on the quality criteria [23] and one of the two with the next-highest rating [12] found that the experimental group used more outpatient visits than the control group, with ratios of 1.76 and 1.60, respectively. The other two studies found that the experimental patients used fewer visits, with ratios of .64 [21] and .34 [19]. The average ratio for the four studies, weighted by the number of subjects in the study, is 1.4. It should be noted that, of the four studies, the study with the largest study population [12] counted visits by home care providers themselves as outpatient visits, thus biasing the results in comparison with the other studies in the direction of a greater number of visits for the experimental patients.

COST

Six of the studies reviewed here included measures of cost. The difficulties involved in obtaining standard and valid measures of service costs are indicated by the relatively low number of quality criteria met. Only two of the seven studies [12,29] met cost criterion 4 by including

measures of all direct costs (including the patients' and families' out-of-pocket expenditures). Study results are represented in Table 1 as ratios of the cost of health care services for the home care group to the cost of services for the comparison group. Tests of the significance of differences between the groups were available for three studies. Two of the seven studies found that the home care group had higher costs than the comparison group, with ratios of 1.4 ($p < .01$) [29] and 1.2 (significance level unknown) [22]. These studies were the experimental study with the highest ratings [29] and the quasi-experimental study with the highest rating [22]. For an additional three studies, there were no differences in costs of care between the home care and comparison groups. These studies were two of the three experimental studies [11,12] with the moderate and lowest rating on the quality criteria, and one of the quasi-experimental studies with the higher quality criteria rating [24]. Only one study, the quasi-experimental study with the lowest rating [20], found that the home care group had lower costs, with a ratio of .4 (significance level unknown).

The average cost ratio for these six studies, weighted by the number of subjects in the study, is 1.15, suggesting that the average cost of services to persons in the home care group is 15 percent higher than costs of care for comparison group members. In light of the quality criteria adherence information, it could be concluded that the costs of service utilized by home care patients are at least equal to those of comparison group persons and could be somewhat higher.

Although the home care service programs studied in this review were more homogeneous than in previous reviews, it is clear that there are substantial differences among them. The descriptions of interventions in Table 1 permit inspection of relationships between interventions and results. An analysis of this information was performed to explore these potential relationships. First, programs with physicians on the core staff [19,21,22,24,25,12] were compared with those without physicians [20,23,11,26,28,29]. This comparison was also made excluding programs providing only personal care and homemaking services [26,29]. Second, programs providing services beyond personal care and homemaking with a multidisciplinary team structure (visiting nurses *with* occupational therapists, physical therapists, and/or social workers) [20-22,24,25,12] were compared with Visiting Nurse Association (VNA)-model programs (visiting nurse without core services from any of the aforementioned clinical disciplines) [19,23,11,28].

Combining all outcome comparisons made, the type of program did not appear to influence outcomes. Outcomes favoring home care compared to controls were no more frequent in physician-staffed pro-

grams than in others (aggregate analysis of 12 trials with a total of 50 outcome assessments, $\chi^2 = 0.95$, $p = 0.62$). Excluding personal care and/or homemaker services from consideration, the result was similar (10 programs with 42 outcomes assessed, $\chi^2 = 2.14$, $p = 0.35$). Similarly, the aggregate outcomes favoring home care compared to controls were no more frequent for multidisciplinary team programs than for VNA-model programs (10 trials with a total of 42 outcomes assessed, $\chi^2 = 2.16$, $p = 0.35$).

Within particular outcomes, we can comment only on trends favoring one program type versus another, recognizing that sample sizes in these comparisons are so small that they preclude statistical significance and that the multiple-test problem looms large in any such subgroup analysis. Anecdotally, lower mortality rates for home care were found only in the instance of programs *without* physician core staff. Greater rates of hospitalization compared to controls were also found only in the instance of evaluations of home care programs without physician core staff. Finally, in contrasts of team-model versus VNA-model program evaluations, hospitalization and nursing home placement rates were higher compared to controls only for VNA-model care programs, while the converse was true of team-model home care programs (lower rates compared to controls of nursing home placement and hospitalization).

DISCUSSION

STUDY PURPOSE AND LIMITATIONS

A summary critical review of a particular topic may be particularly important to undertake when a question or questions remain controversial even after considerable effort has been expended to address these questions through research. Under these conditions, it may be helpful to summarize the results of research in a manner which places greatest emphasis on the conclusions of methodologically superior work. While studies across a methodologic spectrum of rigor may arrive at conflicting inferences, if an inference of one type predominates among studies of apparently greater validity, it may be reasonable to conclude that the weight of evidence favors this conclusion.

Even this approach to an information synthesis may fail to provide definitive answers to controversial questions when (1) insufficient total numbers of studies exist, (2) the studies that do exist differ substantially from one another in subjects and methods, (3) insufficient information is presented in study publications to reconstruct comparable analyses

for the purposes of meta-analysis, and (4) review of the studies' methodological quality reveals substantial problems in design and execution. The preceding analysis of home care program effectiveness studies permits few, if any, conclusions which are apt to be totally uncontested. First, in spite of an exhaustive attempt to identify rigorous home care effectiveness experiments and quasi experiments in the public domain, only 12 such studies could be located. A simple, but important, observation is that an insufficient number of studies have been conducted, for some outcomes in particular, to permit an information synthesis with substantial power. Further, the nature of home care services provided by the individual programs studied differed substantially. Although in our analyses, program type was not related to differences in results overall, there were trends, based on small numbers of studies, in such relationships for particular outcomes. Similarly, another assumption is made in information syntheses that one population of patients may be compared directly to another. This assumption is obviously unwarranted, but comparable information available in these research reports was insufficient to attempt any direct stratification for patient types.

Our assessment of the methodological soundness of these studies revealed substantial problems in all areas including subject selection, attrition, and assessment, and in the reporting of methods, analyses, and results. A special problem concerned statistical power. No study reported statistical power calculations and appropriate data were available for only one outcome (mortality), which would allow us to calculate them. The seriousness of this problem is indicated by our finding that only three of the eight studies with "no difference" findings, for which power calculations could be made, had sufficient power to detect a clinically significant difference if it existed. In the face of the preponderance of "no difference" findings, our inability to determine the power of the studies assessing the other outcomes reviewed has similarly constrained our ability to interpret these results. Judging from the power of the mortality studies, it seems likely that insufficient sample sizes have limited the extent to which this body of literature can be seen as comprising truly definitive tests of the impact of home care on the outcomes studied.

SUMMARY OF STUDY RESULTS

Even given these caveats, the results of this summary analysis by outcome do permit some systematic observations across studies. Twelve experimental or quasi-experimental studies is a substantial number to

have available for the assessment of one type of clinical service program, and several of the studies were quite exemplary in design and execution, meeting all of our criteria for certain outcomes.¹ We can contend that home care programs do not appear to affect mortality rates for individuals to whom these services are rendered. Nine of the eleven studies reviewed support this contention, including those with the highest criteria scores. The results of two experimental studies and one quasi-experimental study support this inference, *and* the studies have sufficient sample size to assert the null hypothesis with reasonable power. The majority of studies reviewed support the contention that home care has no impact on physical function, although the experimental study with the highest methodologic rating showed a positive impact.

Four of the eight studies reviewed, comprising the majority of the experimental studies, suggest that the provision of home care services has no effect on nursing home placements. Our analysis would suggest that home care programs either have no effect on inpatient hospitalization (seven of ten studies), or actually tend to increase the use of hospital bed-days (two of ten studies, both experiments with the highest possible criteria scores). Similarly, the provision of home care services may actually increase ambulatory care service utilization by approximately 40 percent. Consistent with these observations on ambulatory care and hospitalization, summary analyses of the relative costs of home care suggest that the provision of home care services either has no effect on the direct costs of medical care (three studies), or actually increases costs (the two highest rated experiments) with a suggestion that costs could be increased by approximately 15 percent.

Within the limitations of this analysis, there are several implications for system managers, program managers, and clinicians. First, no one should assume that the provision of home care program services will result in diminished utilization of nursing homes, hospitals, or outpatient clinics. Furthermore, we are unable to substantiate the contention that home care program services reduce expenditures for medical care.

SUGGESTIONS FOR FUTURE RESEARCH

Surely the safest conclusion from this summary analysis would be to contend that, while the preponderance of evidence does not support the expectation that home care programs of the types studied have a positive impact on the outcomes assessed here, the existence of some contradictory findings and methodological problems in these studies sup-

ports the need for additional methodologically rigorous research to assess the effectiveness of home care. Based upon our experience in this review and drawing upon the contentions of others, we wish to draw the attention of potential investigators to design issues which will require thoughtful problem solving if the quality of research is to improve. First, the choice and description of subjects and setting requires greater attention. Home care program objectives, services rendered, the nature of clinical objectives for patients, and the clinical status and prognosis of patients are all pertinent to the feasibility of any experiment which is designed to measure home care program effectiveness, as well as to the choice and timing of measures. At the very least, we are obliged to describe such characteristics of the subject and the setting more completely.

The targeting of service programs and their evaluations should be improved. Studies assessing the effect of home care services designed to substitute for nursing home placements, for example, should enroll subjects clearly at high risk for nursing home placements. This has proven to be a difficult task in past studies, although new work on identifying characteristics associated with such placements may be of help [41].

Next, sample sizes and the expected power of observations will require careful attention. Given the preponderance of null effect conclusions and insufficient sample sizes in the literature to date, new studies should be designed to enroll and retain sufficient numbers of subjects to be able to detect differences at the 90 percent level of probability. Studies coming to a null conclusion should be required to estimate the power of this assertion. True experiments are to be preferred to quasi-experimental designs, and randomization will be important to avoid intrusion of bias in the allocation of subjects. Katz and colleagues [11,12] have provided us with the sole example in the studies reviewed of efforts to obtain blinded assessments of outcomes through separating interviewers geographically and administratively from care providers and not allowing them access to information about the participants' study group assignments. This design feature is methodologically desirable, and should be implemented where feasible, even though it may impose additional experimental costs.

Greater attention needs to be drawn to the problems of subject attrition in home care experiments before and after randomization. Prerandomization attrition (the withdrawal of eligible subjects) and the reasons for it can be measured and should be clearly reported, since this information provides important data about the generalizability of study observations. Postrandomization attrition is also important to

minimize, measure, and report at all stages of the study, particularly in light of the potential for differential withdrawal from experimental and control groups. Where subject withdrawal is a major phenomenon, or where duration of follow-up is variable, appropriate statistical techniques for "censored data" should be employed. For one-time outcomes like mortality, formal survival analyses should be performed using life table techniques.

Another area in need of methodological attention is the frequent finding that subjects have not remained in the experimental categories to which they were assigned—with experimental patients not receiving any services and control patients receiving services under different auspices [42]. The incidence of such crossover should be assessed and reported for every study. The primary data analysis should take the standard approach of analyzing all subjects in the original groups to which they were assigned, whether or not they were "contaminated." Supplementary "sensitivity analyses," where comparison groups are formed excluding contaminated subjects and the results are compared with the standard approach, can add to our understanding of the effects of treatment.

Analyses of dependent variables should take into account intake patient characteristics which have been shown to differentially influence treatment effectiveness, such as age, living arrangements (alone or with others), recent hospital or nursing home stays, clinical status, prognosis, and treatment objectives. Home care programs in the Veterans Administration, for example, enroll substantial numbers of patients for terminal (hospice) care, as well as other individuals for true rehabilitation or maintenance care aimed at achieving an acceptable and functional state. Mixing together such individuals is inappropriate when assessing the impact of home care service on functional status.

Finally, we and others would recommend strict, complete standards for reporting research results [35,36]. Reporting the results of major outcomes as unadjusted summary statistics (percents, means, variances) before reporting the results of multivariate analyses not only would facilitate greater understanding of the results and their clinical significance, but also would permit more systematic reanalysis for the purposes of summary reviews. Data describing patients' utilization of health care services would, for instance, be most useful if the total number of patients using the service were given and, as appropriate, the mean and variance of the number of visits or admissions per person, and the mean and variance of length of stay.

Among the many topics for research pertinent to home care program effectiveness, we recommend additional work in all areas because

of the limited numbers of controlled studies now available. Experimental work should include outcomes of care that have been measured less frequently and by noncomparable measures. These outcomes include the technical and interpersonal quality of home care, patient satisfaction with home versus other modalities of extended care, and the impact of home care on other measures of physical health status, psychosocial status (mental status, contentment, life satisfaction, behavior problems, social role), adherence to medical regimens, unmet need for services, family function, and family finances.

NOTE

1. In addition, recent randomized controlled trials of home care by Bergner et al. [43] and Wade et al. [44] support the overall conclusions of this study.

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