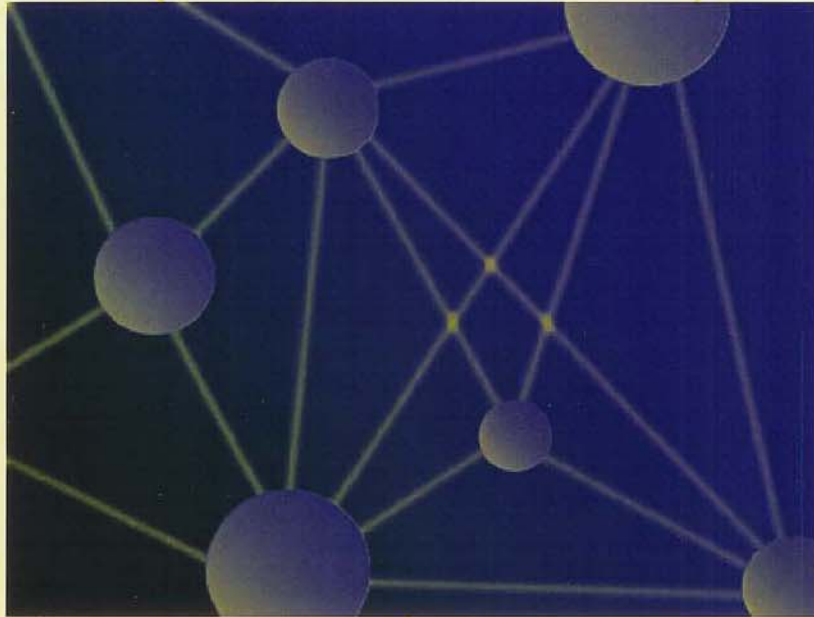


Medicare Health Outcomes Survey



Information Synthesis
April 15, 1999

Health Services Advisory Group & The Health Care Financing Administration



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CHAPTER 1

BACKGROUND & SIGNIFICANCE

Managed Care Organizations (MCOs) are increasingly pressed to implement interventions to keep seniors healthy longer. Seniors are the fastest-growing segment of the U.S. population, and the costs associated with geriatric health care are enormous.

Over the last century, the senior population, defined as those sixty five and over, has grown from 4% of the population in 1900, to 12.4% of the population in 1988 (PHS, 1990). The most rapidly growing segment of this cohort are those over age eighty. Since Medicare's inception, enrollment has almost doubled, from 19.5 million to 36.3 million. During this same time period Medicare expenditures have increased from 4.7 billion to 150.4 billion annually (Feldstein, 1993). This document represents an effort to provide HCFA and MCOs with the most informative and dependable information available to date on health promoting and disease preventing interventions for seniors. The information synthesis process should be regarded as an effort that needs to continue over time in order to incorporate new information as it becomes available, new interventions as they are devised, and new perspectives as they are developed. Some issues that are unclear may be resolved by new studies, and interventions that are questionably effective may be improved.

This report's focus is on interventions that have the greatest relevance for the overall well-being and functional status of seniors. Many clinical interventions are assessed in terms of their effects on basic physiologic parameters or other clinical indicators that are only conjecturally related to how well people actually feel and function in everyday life. For example, in the literature on the treatment and prevention of heart disease, clinical studies often target outcomes such as lowered serum cholesterol, but such research does not typically speak to the question of how much effect a given drop in cholesterol level has on general health status or quality of life. Furthermore, a key outcome variable in much epidemiological and clinical research is mortality, yet older people worry less about death than about living out their days in a state of frailty and dependence (Buchner & Wagner, 1992).

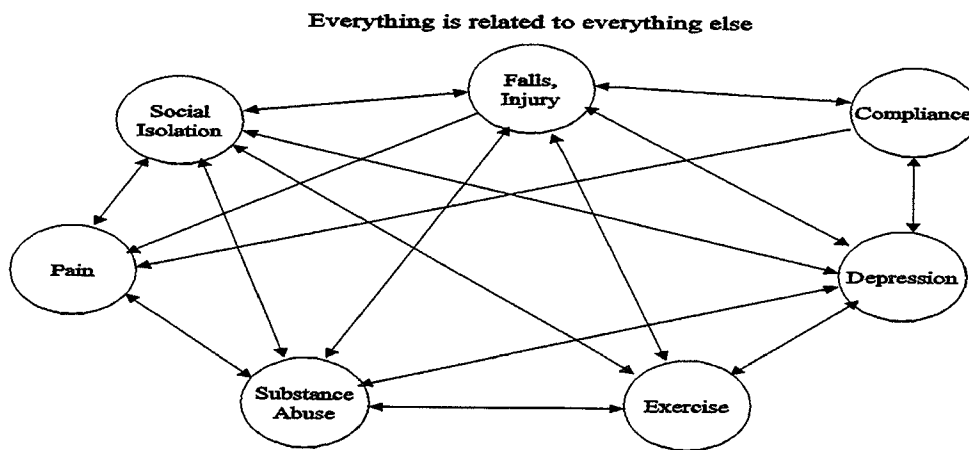
In many ways seniors' health care needs are the most complex and challenging of any age group. At the age of sixty five, people have an average of 16.4 years of life remaining. It is estimated, however, that only twelve of those years will be healthy life years (PHS, 1990). Although people develop chronic diseases such as heart disease and adult onset diabetes over many years, it is often not until late life that the concrete, debilitating consequences of such conditions are manifested. Moreover, seniors very often have comorbid medical problems that exacerbate one

another and require multiple medications that in turn cause troublesome side effects and may counteract or react negatively with each other. As a result of these various problems, close to 40% of people over the age of sixty five have limitations in their reported activities of daily living (National Center for Health Statistics, 1990).

Seniors also face a unique set of psychosocial factors that can seriously compromise their well being; it is in the later years that people are most likely to face the death of a spouse and other loved ones of their age group. Given the relative lack of extended families and community support in modern Western industrialized societies, older people often spend their last years in isolation.

Seniors very often have problems in clusters. In part, this is because the problems they have tend to be highly interrelated. Any viable framework for understanding key issues in the health care of seniors must recognize that the problems are inextricably bound to one another in a complex web of causal relationships. For example, a man in his sixties, faced with the death of his spouse of forty years, may suffer a bout of clinical depression which, if left untreated, may hinder his motivation to follow prescribed dietary and medication regimens for treating his diabetes. Failure to care for his diabetic condition may in turn leave him physically weak and especially vulnerable to falling and sustaining a hip fracture or other major injury that could lead to chronic pain, immobility, and further depression. This case, of course, represents just one example of a myriad of possible pathways by which such variables may be related. The model shown in Figure 1

Figure 1



demonstrates further possible interrelationships between but a few of the key health factors that affect the lives of seniors.

The figure is not to be taken literally; it is an exercise intended to remind us of the interconnectedness of the health and behavioral problems that can afflict seniors. The fact that these health factors are so interrelated can be both troublesome and advantageous with respect to treating any given condition. In one case study, for example, an attempt to deal with an alcohol problem conflicted with the reality that the older gentleman liked to get together with his friends at a tavern every afternoon, that being nearly the totality of his social life. On the other hand, an exercise regimen aimed at treating heart disease may have also have an ameliorative effect on concomitant depressive symptoms as well as a preventative effect on fall related injuries. One may suppose, then, that the most powerful, meaningful, and cost effective interventions will be those that impart multiple, positive effects on these interconnected physical and psychological variables.

To hope that “cure-all” treatments are available and merely waiting to be uncovered is, of course, optimistic, when in fact the state of the geriatric literature is like a patchwork quilt in its early stages, with many pieces yet to be added and properly fit together. There are major problems (e.g., social isolation, “failure to thrive”) at which very little systematic research has been focused. However, new findings emerge every day. For example, a study recently published in *Health Psychology* found that an aquatic exercise program for older patients with chronic obstructive pulmonary disease ameliorated depression (Emery, Hauck, Schein, & MacIntyre, 1998). The process of information synthesis must be ongoing, as new data emerges to shed light on old problems.

As will become evident, this document does not deal with disease specific conditions and interventions. Even a casual inquiry would reveal that heart disease and diabetes are the two most common conditions presenting treatment and management problems for MCOs. For the most part, however, these conditions involve decisions about management of the condition itself rather than about keeping seniors healthy in the first place. A very large portion of the literature on either condition is devoted to a consideration of which drugs or, in the case of heart disease, surgical procedures, are most effective. Decisions about these interventions require detailed knowledge about individual patients and must, ultimately, be made by individual providers.

The problems and interventions toward which this inquiry are directed are broadly behavioral in nature, as suggested by Figure 1. They may generally be thought of as cross cutting issues not necessarily specific to any particular medical diagnosis. Many health and medical problems in the senior population involve pain and social isolation, which affect responses to diseases and other problems. “Depression” in this report does not necessarily refer to the diagnosis of endogenous

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depression but rather a generally negative, depressed mood state, akin to what is sometimes called dysthymia (DSM-IV, 1997). Similarly, "substance abuse" in the senior population includes patterns of excessive drinking likely to interfere with generally good functioning.

The problems selected for inclusion in this document were rather uniformly identified through interviews with MCO representatives; were evident from literature surveys; seemed potentially susceptible to interventions; and were of sufficient importance that their alleviation might well save sufficient money to make interventions cost-effective for MCOs.

CHAPTER 2

METHODOLOGY

Following Goldschmidt's (1986) guide for conducting information synthesis, the overall procedure for conducting this information synthesis included the following: (1) topic specification, i.e. identification of the health issues of highest concern to MCOs and of greatest consequence to seniors' overall health status; (2) a systematic search of the electronic databases representing existing published literature on the health issues identified in stage one; (3) a systematic relevance review procedure for determining whether the located citations were to be included in or excluded from the review; (4) a systematic validation review procedure for determining the degree of confidence the reader can place in the research findings of the reviewed studies; and (5) documentation of the search, relevance review, and validation review processes (see Table 1 in the Appendix, and Chapter 3, Results I - V).

I. Topic Specification

A preliminary survey of the literature on treatment approaches for health promotion and disease prevention in older patients, particularly research pertaining to functional status outcomes in the elderly, indicated that a disease specific analysis might not be optimal. The existence of a report by Ware (1998)¹ on the effects of disease specific treatments on functional health and well being seemed likely, in any case, to deal with those matters.

Ware's report, although not specific to elderly persons, is a comprehensive review of the use of patient based assessments of the treatment of specific diseases over the last decade. Ware reviewed over 750 published studies through 1997 that used the SF-36 survey to assess functional status. The treatment effects database in this review consisted of approximately 39% surgeries, 32% pharmaceutical trials, 17% clinical practice follow ups, 8% behavioral/educational interventions, and 5% physical rehabilitation; with treatments concentrated in the following areas: 43% musculoskeletal, 14% cardiovascular, 11% endocrine, 9% mental illness, 7% viral, 7% respiratory, and 5% other vascular. Results of Ware's analysis indicated that surgeries outperformed other medical interventions in improving vitality scores and social functioning

¹In addition to Ware's (1998) report of the effects of treatments on functional health and well-being, there also exists an annotated bibliography of articles published between 1988-1998 pertaining to the use and validation of the SF-36.

scores on the SF-36, and that the largest average change in any SF-36 scale due to medical interventions was reflected in average improvements in bodily pain scores due to surgeries.

Consideration of the nature and extent of the published literature suggested that rather than risk simply duplicating Ware's review of the (mostly medical) interventions for system specific problems, the better course would be to complement his efforts by reviewing functional status outcomes in relation to more generalized problem and behavioral categories. That idea was strongly supported by responses from MCOs when they were interviewed about their problems in maintaining the health of seniors.

MCO Interviews: The health issues of greatest concern to MCOs were identified through telephone interviews. Fourteen telephone interviews were conducted with MCOs who participated in Cohort I. Each interview averaged twenty minutes in length. The general outline of questions asked of MCO representatives appears in Table 2 below. As the telephone interviews proceeded, a constant comparative analysis was used to progressively focus the interviews. An example best illustrates this technique. The first interview identified "pain" as a major problem in the Medicare population enrolled in this MCO. Subsequent interviews asked MCO representatives if pain was also a problem in their Medicare population. The information gathered from the interviews was used to augment the literature search strategy.

Table 2. MCO Interview Questions

1. Identify broad problems in your Medicare population, not restricted to disease processes, but also discuss most the most prevalent problems with Activities of Daily Living (ADLs) and functional status.
2. Identify the most prevalent comorbidities in your Medicare population.
3. Discuss symptom clusters that are most prevalent in your Medicare population.
4. Identify problems with side effects of treatment in your Medicare population.
5. What wellness, health promotion and disease prevention strategies have you implemented in your Medicare population?

MCO representatives identified the three most prevalent disease processes in the Medicare population as diabetes, congestive heart failure (CHF), and respiratory diseases (chronic obstructive pulmonary disease, asthma). The majority of them also identified depression as a major problem. The most frequently cited comorbidity was pneumonia, occurring along with a chronic disease. MCOs were in agreement that patients with chronic diseases, such as diabetes or CHF, were the most difficult to manage as the sequelae to those diseases manifested themselves.

Falls and their resultant injuries were cited as the most prevalent problem impacting functional status and ability to engage in ADLs. Other frequently mentioned problems impacting ADLs included difficulty ambulating (decreased energy), poor motor functioning, social isolation and urinary problems (incontinence). With respect to symptom clusters, the most frequently cited problem was pain. The Medicare population presents with pain from a variety of disease processes such as arthritis and other chronic diseases.

All MCOs that were interviewed cited polypharmacy as a problem in the Medicare population. The definition of polypharmacy varied across MCOs, with criteria ranging from six or more medications a day to ten or more medications a day. Only half of the interviewed MCOs stated that substance abuse was a problem among their older patients. However, those MCOs that did not have data to confirm substance abuse in their Medicare population agreed that it might be an undetected problem.

Based on the information gathered from the MCO interviews, which was quite consistent with ideas stemming from the preliminary survey of the literature, five topics emerged that were likely to have the most relevance to the overall health status of seniors and to be represented in the literature in reasonable size and quality. The five topics were: 1) exercise; 2) depression; 3) falls and injury prevention; 4) chronic pain; and 5) immunization.²

Cross-cutting Issues: Initial examination of the literature and some early interview responses identified other overriding issues, such as poor adherence to treatment regimens and the need for ongoing physician education regarding specific health care interventions for seniors. Further examination of the literature and a more indepth review suggests that, although these may be widespread issues, they are selective across health problems, populations, and settings. Some seniors may be non adherent to medical treatments but not necessarily non adherent to other interventions. Recommended procedures to increase adherence would probably be quite different depending on the type of behavior demonstrated. Similarly, physician education would need to reflect that the specific issues to be addressed and the nature of the educational interventions could differ widely from one problem to another. Even though at the present time there is no

²We initially identified nutrition as a sixth topic, but found that although large amounts of federal dollars have been appropriated for nutrition related programs such as Meals on Wheels and senior centers, there has been very little evaluation of these programs (see Elderly American: Nutrition Information is Limited and Guidelines are Lacking; statement by Robert York, Director of Program Evaluation and Methodology Division, before the Select Committee on Aging, House of Representatives, Washington, DC 1992). We were therefore unable to assess the efficacy of these interventions in improving nutritional status and related functional outcomes in the elderly.

clear consensus regarding these issues, physician education must be considered a priority, as indicated in the literature. For example, one recent study (Ramsey, et al, 1998) shows that primary care physicians very often miss important patient information during initial visits. This could be reflective of critical factors, such as physician interview skills, MCO patient intake systems, and management pressures to shorten the time of visits in order to increase productivity. Further information is necessary in order to more effectively address these factors.

II. Search Strategy

Five databases were identified as likely to include a large proportion of all potentially available published evidence: MEDLINE, HealthSTAR, Cumulative Index to Nursing and Allied Health Literature (CINAHL), International Pharmaceutical Abstracts, and PsychINFO. Some unpublished studies were reviewed and this might be a desirable resource in the future. The identifying terms used to perform the searches included multiple combinations of the following terms: elderly, geriatric, gerontology, treatment, intervention, community, prevention, health promotion, functional status, exercise, physical activity, pain, chronic pain, pain management, falls, injury, hip fracture, immunization, and vaccination. Bibliographies of articles that were retrieved, including especially those of review and synthesis articles, were examined to identify items not located in the database search. See Table 1 (Appendix) for a complete list of search combinations and final search results.

III. Relevance Review

Articles became part of the database for the present study if they were published in English after 1960, and if the research appeared to have included subjects over the age of sixty five in relation to any of the five identified topic areas. Letters to the editor and expressions of expert opinion were excluded. Review articles were included so that their bibliographies could be scanned for relevant articles not identified through the data base searches. Also see Table 1 (Appendix) for summaries of the numbers of relevant articles selected for final review.

IV. Validation Review

The studies available for review varied widely in the adequacy of their methodologies. All things being equal, one would want to give more weight to studies with stronger methodologies. Were this report in the form of a formal meta-analysis, that sort of weighting would be appropriate. This synthesis, however, concentrates more on the consistency of research findings and their

relevance to intervention strategies that might be enacted in the context of managed care. Of at least as much importance as methodological rigor, for example, is the clarity with which the intervention is described and the use of an outcome measure that could reasonably be translated into an assumption about favorable effects on functional status or quality of life. Even a finely controlled randomized experiment would not be of great usefulness if one could not tell exactly what the intervention was or if the outcome measure used was a physiological index of uncertain meaning in terms of functioning.

In fact, a set of methodological criteria of any usual stringency would have eliminated a very large proportion of the studies available for review. None of the studies of exercise, for example, followed a double-blind methodology, considered a virtually absolute requirement for clinical trials of other kinds. Double blind studies of exercise would be difficult, if not impossible. Even the best studies were usually weaker than they might have been since few of them kept the persons performing the outcome assessments blind to conditions of the experiment. Exercise studies are also particularly plagued by attrition of subjects from the experiment. Many people simply do not like to exercise, and they drop out of studies.

Thus, the internal validity of exercise studies is often impaired, or apparently so, and external validity is seemingly limited. Internal validity may not always be seriously jeopardized by attrition, however, for the jeopardy stems from the assumption that those remaining in the experimental exercise group would have improved without the intervention, perhaps exercising on their own. That is often unlikely, and if subjects in an exercise group improve their functioning by any substantial amount, that is almost certainly attributable to the intervention. Limits on external validity from attrition simply define the population for which the intervention is appropriate. One wants to know that persons who exercise will improve in functional status. If many people will not exercise, they represent a challenge to either find ways of motivating them to exercise, or to discover other ways of keeping them functioning that will compensate for lack of exercise.

A critical methodological shortcoming of many studies is the absence of a useful comparison data series. The shortcoming may not, however, be as serious for studies of exercise in the elderly as for many other kinds of interventions. The kind of comparison data needed depends on the conclusion to be drawn. It is well established that the physical capabilities of people decline with age. Therefore, if a group of seniors engaged in exercise improve in functioning over a reasonable period of time during which they might otherwise have been expected to decline, attributing the improvement to exercise does not strain credibility. This would not be any more than saying the failure of malnourished children to grow in stature over a period of time would, with reason, be attributed to poor nourishment.

More of a threat to the causal attribution is failure to assure good conditions of measurement. If those advocating and implementing the exercise program also do the measurements used to detect change over time, the opportunities for bias are obvious. These opportunities for bias are greater for some measures than for others, e.g., measurements of "flexibility" almost certainly reflect more potential bias than measurements of VO_2 or arm circumference. Even for the latter, however, bias could be a factor if those performing the measurements give greater encouragement at the post-exercise time, or in subtle ways move a tape around so as to maximize the value obtained. Few effects of exercise programs are so large that they could not be manifestations of bias, or at least not be so much influenced as to make an important difference in conclusions about statistical significance.

Many studies of health promotion interventions with seniors are conducted on populations restricted by dimensions other than age. Studies that are racially or ethnically representative of the larger population are rare; in fact, studies involving minority subjects at all are relatively infrequent. Studies are very often carried out on either all male or all female samples. Such limited samples may be a serious methodological issue for most health promotion and disease prevention interventions. However, curtailment of "generalizability" is reasonable only if there are expectations that the responses of different populations to interventions would be quite different. The possibility that exercise might benefit senior males in ways that would not benefit females, e.g., in improving balance or ameliorating depression, seems small. The possibility that members of a minority group might not be helped by pain clinics, or that they might respond adversely to reminders to get vaccinations, seems similarly small. It is important to keep in mind that a difference between groups in the magnitude of an effect would not necessarily invalidate the intervention for the less responsive group. Interactions that would reverse the directions of interventions, or even reduce them to zero in some groups, are quite unlikely.

An important limitation on the potential value of many of the research findings concerning health promotion and disease prevention interventions, has to do with the effect sizes and whether they are of any practical consequence. It is reasonably straightforward for an MCO to judge whether an increase in the expected proportion of vaccinated members is likely to be of sufficient importance to justify the cost. On the other hand, it is difficult to know whether an exercise intervention that results in a reduced resting heart rate of two beats per minute is of any value, even if the difference is statistically significant. One review of exercise programs noted that some of the most impressive results were obtained in an intervention carried out with frail elderly persons whose baseline muscle strength was so low that even a 100 percent increase was of dubious importance (Wagner, LaCroix, Buchner, & Larson, 1992). Very few measures in social science are calibrated in a way that makes their practical importance evident (Sechrest, McKnight, & McKnight, 1996). Changes in "flexibility" scores, depression indices, or balance measures

often defy interpretation. Much more work needs to be done if such measures are to be meaningful in any health care setting.

Quality of Evidence: Ultimately, the question of the quality of evidence came down to a complex informed judgment process rather than application of a formal rating system. Quality of evidence was judged according to whether, in light of the overall conduct of a study, the results seemed sufficiently persuasive to stand on their own, to be readily aggregated with results from other studies, or to be supportive of other, better studies if they are available. Using overall judgments of studies meant that relative weaknesses some might have in one or more respects could be compensated for by strengths in other areas. Thus, for example, a study with only a reasonably good comparison group might be regarded as strong if it had exceptionally good measurement procedures. Final methodological rating categories are described later in this section.

It should be understood, however, that the defined methodological ratings are of limited value in this particular review. The principal reasons are that there were very few interventions for which there were substantial numbers of studies, as well as many interventions with conflicting results which raised questions about the methodological adequacy.

The methodological rating categories used in this report were as follows:

High:

- I Results of the study are clear and interpretable and by themselves can be taken as indicative, if not definitively so, of the effectiveness or lack of effectiveness of the intervention
- II Randomized design with relatively little attrition that would jeopardize interpretation
- III Study with good comparison group or data set even if not a randomized design
- IV Study with good baseline data
- V Good measurement procedures although not necessarily blind
- VI Relatively little likelihood of bias sufficient to account for results
- VII Appropriate statistical analyses with sufficiently large sample size to justify conclusion of no difference if that was required

Medium:

- I Results of the study believable but persuasive only with existence of other studies of at least similar quality
- II Attrition higher than should be true in randomized experiment
- III Comparison group or other data useful but not entirely satisfactory
- IV Baseline data series too brief or imprecise

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- V Measurement procedures involving less than good measures or permitting bias in some circumstances
- VI Conclusions potentially challengeable on statistical grounds or for lack of sufficient statistical power

Low:

- I Results are of interest only insofar as they may generally support or extend the findings from more adequate studies
- II Designs lacking appropriate comparison groups or suffering from excessive attrition
- III Simple pre-post designs without comparison groups or with inadequate baseline data
- IV Weak measures readily susceptible to bias
- V Inappropriate or potentially misleading statistical analyses

A fourth, implicit category of research reports was Not useful, consisting of reports of research so poorly done or reported as to be uninterpretable.

Several potentially important and interesting topics were excluded from the current review. The basis for excluding topics was the absence of a body of pertinent literature related to them. In this context, "pertinent" refers to studies implementing and assessing interventions aimed at alleviating the problems. For example, fatigue and "failure to thrive" are often mentioned as health maintenance problems in seniors, but there are very few, if any, intervention studies. Nutrition is often mentioned as a health maintenance problem for older persons, but a very large proportion of nutrition studies are focused on dietary supplements with no behavioral outcomes. Substance abuse is also an obvious problem, but there are very few interventions tested on seniors, and the best one can do is simply to recommend that those interventions shown to be effective in the general population be tried with the seniors.

CHAPTER 3

RESULTS/DISCUSSION

I. Exercise

Sedentary lifestyle is often cited as a source of health problems for older persons, and exercise is widely recommended for seniors. In fact, exercise, or lack of it, may well be related to a wide range of health problems, and if getting more exercise is not a panacea, it is at least of highly probable benefit. Of no small importance is the fact that exercise appears to have virtually no undesirable consequences, at least if it is carried out at a reasonable level. Certainly people can be injured while exercising, and individuals with compromised cardiovascular systems could suffer untoward events related to exercise, but no article encountered in this review documented any such outcomes. Nevertheless, if people are going to be urged to exercise on the grounds that it will be beneficial for them, and especially if exercise programs are to be paid for from funds that might be used for other worthwhile purposes, then the positive outcomes of exercise should be empirically demonstrated. Scientifically sound studies showing substantial benefits for seniors are not as frequent as one would think, and the benefits, when shown, are difficult to translate into any practical terms. Results of exercise interventions are typically expressed in metrics that do not have immediate meaning.

Exercise interventions for seniors can be classified into the following categories: 1) endurance training, 2) strength training, 3) flexibility and range of motion training (e.g., Yoga), 4) balance training, 5) Tai Chi, and 6) those interventions that employ some combination of these types of exercise (e.g., endurance training combined with strength and flexibility exercise). The bulk of this review will focus on endurance training interventions, as these are the most common. (Section III on falls and injury prevention deals more extensively with Tai Chi and balance training.)

Research pertaining to exercise and seniors focuses primarily on the physiological status of the respiratory, cardiovascular, neurological, sensorimotor, and musculoskeletal systems. Outcome measures that reflect cardiorespiratory status include VO_2 max, aerobic capacity, and anaerobic threshold. Cardiovascular outcomes include blood pressure and triglyceride and cholesterol levels. Neurological outcomes include reaction time, cerebral perfusion, and memory; while sensorimotor outcomes, which are in part a function of neurological variables, include balance, postural stability, motor control, and speed of movement. Musculoskeletal outcomes include muscle strength and endurance, muscle mass, total body mass, flexibility, bone mineral density, and bone fracture incidents.

The psychological status of seniors participating in exercise programs has generally been measured to a lesser degree than has physical status. Of those psychological status variables that have been measured, psychological well being, anxiety, depression, and mood have been the most frequent outcomes measured.

Health status measures have been infrequently used in the study of exercise, but since the mid-nineties, the use of such measures has increased. Nineteen exercise interventions with health status outcome measures were identified for this review.

Endurance Training Interventions

Endurance training, or aerobic conditioning, has been by far the most common type of exercise intervention published in the geriatric literature. The types and intensity of aerobic exercise carried out in these interventions have varied, but some rough generalizations about frequency and amount can be made based on a review of approximately forty studies published since the early 1960s. In most studies, older subjects engaged in some form of aerobic exercise (typically walking or using a treadmill or stationary bicycle) three times a week for thirty to forty-five minutes. Depending on the aims of a given study, subjects exercised to 30-40% of their maximum heart rate (considered low intensity) or to 60-70% of their maximum heart rate (considered moderate intensity). The overall duration of these exercise interventions varied widely, from two hours to two years, with three months being the most common duration. It can be generally stated, then, that *three months of low-to-moderate intensity aerobic exercise at least three times a week is sufficient to impart many of the benefits obtained in these interventions*. Such benefits are not likely to be retained without continuing to exercise regularly beyond this initial three month period.

Cardiorespiratory Outcomes in Endurance Training Interventions: It has been well established that endurance training brings about statistically significant improvements in cardiorespiratory outcome variables such as VO₂max, aerobic capacity, and anaerobic threshold in older subjects, including healthy subjects as well as those diagnosed with cardiovascular disease, diabetes, and/or arthritis (Adams & deVries, 1973--**Medium**; Ades, Waldmann & Gillespie, 1995--**High**; Ades et al, 1993--**Low**; Ades & Grunwald, 1990--**Medium**; Ades, Hanson, Gunther, & Tonino, 1987--**Medium**; Agre, Pierce, Raab, McAdams, & Smith, 1988--**Medium**; Babcock, Paterson, & Cunningham, 1994--**Medium**; Badenhop, Cleary, Schaal, Fox, & Bartels, 1983--**Medium**, Barry et al, 1966a--**Medium**; Bergman & Boyungs, 1991--**Low**; Blumenthal et al, 1991--**High**; Bowman, Clayton, Murray, Reed, Subhan, & Ford, 1997--**High**; Bravo, Gauthier, Roy, Payette, & Gaulin, 1997--**Low**; Buccola & Stone, 1975--**Low**; Buchner et al, 1997--**Medium**; Clark, Wade, Massey, & Van Dyke, 1975--**Medium**; Cononie, Graves, Pollock, Phillips, Sumners, &

Hagberg, 1991--**High**; deVries, 1970--**Medium**; DiPietro, Seeman, Stachenfeld, Katz & Nadel, 1998--**High**; Emery, Schein, Hauck, & MacIntyre, 1998--**High**; Emery & Blumenthal, 1990--**High**; Fabre, Masse-Biron, Ahmaidi, Adam, & Prefaut, 1997--**Medium**; Fonong, Toth, Ades, Katzel, Calles-Escandon, & Poehlman, 1996--**Low**; Foster, Hume, Byrnes, Dickinson, & Chatfield, 1989--**Medium**; Hughes, Fiatarone, Ferrara, McNamara, Charnley, & Evans, 1994--**Medium**; Green & Crouse, 1995--**High**; Karper & Boschen, 1993--**Low**; Katzel, Bleecker, Colman, Rogus & Sorkin, Goldbery, 1995--**Medium**; Kavanagh, Myers, Baigrie, Mertens, Sawyer, & Shephard, 1996--**Medium**; Kirwan, Kohrt, Wojta, Bourney, & Holloszy, 1993--**Low**; Levy, Cerqueira, Abrass, Schwartz, & Stratton, 1993--**Medium**; Ligtenberg, Hoekstra, Bol, Zonderland, & Erkelens, 1997--**Medium**; Madden, Blumenthal, Allen, & Emery, 1989--**High**; Morey et al, 1991--**Low**; Morey et al, 1989--**Low**; Nieman, Warren, O'Donnell, Dotson, Butterworth, & Henson, 1993--**High**; Pollock et al, 1991--**High**; Sauvage et al, 1992--**Medium**; Seals, Hagberg, Hurley, Ehsani, & Holloszy, 1984--**Medium**; Sial, Coggan, Hickner, & Klein, 1998--**Low**; Spina, Bourney, Ogawa, & Ehsani, 1994--**Low**; Spina, Ogawa, Miller, Kohrt, & Ehsani, 1993--**Low**; Taunton et al, 1996--**Medium**; Vitiello et al, 1997--**High**; Williams, Maresh, Esterbrooks, Harbrecht, & Sketch, 1985--**Low**). Some studies report that seniors can achieve cardiorespiratory improvements comparable to younger people participating in similar exercise regimens (Ades, Hanson, Gunther, & Tonino, 1987--**Medium**; Babcock, Paterson, & Cunningham, 1994--**Medium**). Although it is difficult to know how such gains translate into functional status, some researchers do at least partially address this issue. For example, Ades et al (1993--**Low**) state that improvements in cardiorespiratory efficiency imply increased functional independence, since all activities are subsequently performed at a lower percentage of maximal capacity; thus, less effort should be required to perform the activities of daily living. The degree of improvement in cardiorespiratory outcomes, however, varies considerably across these studies, and it is unclear how many percentage points of improvement are necessary to impart tangible functional gains.

Cardiovascular Outcomes in Endurance Training Interventions: The available evidence suggests that endurance training imparts statistically significant improvements in seniors' blood pressure (Ades, Hanson, Gunther, & Tonino, 1987--**Medium**; Barry et al, 1966--**Medium**; Buccola & Stone, 1975--**Low**; Cononie, Graves, Pollock, Phillips, Sumners, & Hagberg, 1991--**High**; Cox, Puddey, Burke, Beilin, Morton, & Bettridge, 1996--**High**; deVries, 1970--**Medium**; Hagberg, Montain, Martin, & Ehsani, 1989--**Medium**; Katzel, Bleecker, Colman, Rogus, Sorkin, & Goldberg, 1995--**Medium**; McMurdo & Burnett, 1992--**High**; Motoyama et al, 1998--**High**; Seals, Hagberg, Hurley, Ehsani, & Holloszy, 1984--**Medium**), but the evidence is much less consistent with respect to other cardiovascular outcome variables such as cholesterol and triglyceride levels. For example, of nine studies that tested the effects of endurance training on seniors' cholesterol levels, including total cholesterol and HDL/LDL levels; several produced

statistically significant improvements in total cholesterol and LDL levels, but not HDL levels (Binder, Birge, & Kohrt, 1996--**Medium**; Blumenthal et al, 1989--**High**; Katznel, Bleecker, Colman, Rogus, Sorkin, & Goldberg, 1995--**Medium**). One endurance training study reported a significant improvement in HDL cholesterol levels (Lavie, Milani, & Littman, 1993--**Low**), but another, two-year randomized controlled study of walking among older women reported no effect on HDL cholesterol levels (Cauley, Kriska, LaPorte, Sandler, & Pambianco, 1987--**Medium**). A study that measured only total cholesterol levels found a statistically significant reduction in this variable (Kohrt, Obert, & Holloszy, 1992--**Medium**); but four studies found no effect on any measure of cholesterol levels (Fonong, Toth, Ades, Katznel, Calles-Escandon, & Poehlman, 1996--**Low**; Hughes, Fiatarone, Ferrara, McNamara, Charnley, & Evans, 1994--**Medium**; King, Haskell, Taylor, Kraemer, & DeBusk, 1991--**Low**; Thompson, Crist, Marsh, & Rosenthal, 1988--**Medium**).

Among studies that have addressed the effects of aerobic exercise on seniors' triglyceride levels, only two (Katznel, Bleecker, Colman, Rogus, Sorkin, & Goldberg, 1995--**Medium**; Kohrt, Obert, & Holloszy, 1992--**Medium**) reported statistically significant improvement, while six found no such improvement (Binder, Birge, & Kohrt, 1996--**Medium**; Hughes, Fiatarone, Ferrara, McNamara, Charnley, & Evans, 1994--**Medium**; King, Haskell, Taylor, Kraemer, & DeBusk, 1991--**Low**; Lavie, Milani, & Littman, 1993--**Low**; Raz, Hauser, & Bursztyn, 1994--**Medium**; Thompson, Crist, Marsh, & Rosenthal, 1988--**Medium**).

In contrast with most cardiovascular outcome studies that assess specific physiological variables within a short-term measurement framework, one randomized controlled study measured newly diagnosed cardiovascular problems (e.g., angina, myocardial infarction, atrial fibrillation) two years after 184 healthy subjects had exercised three times a week for four months. The result showed that 13% of the non-exercisers had cardiovascular problems two years following the intervention, as compared with only 2% of those who had exercised three times a week for four months (Posner et al, 1990--**Medium**).

Musculoskeletal Outcomes in Endurance Training Studies: Several endurance training studies have produced improvements in muscular variables including flexibility (Bravo, Gauthier, Roy, Payette, & Gaulin, 1997--**Low**; Buccola & Stone, 1975--**Low**; Hickey, Wolf, Robins, Wagner, & Harik, 1995--**Low**; Hopkins, Murrell, Hoeger, & Rhodes, 1990--**Medium**; Raab, Agre, McAdams, & Smith, 1988--**Low**) and muscle strength/endurance (Agre, Pierce, Raab, McAdams, & Smith, 1988--**Medium**; Barry, Steinmetz, Page, & Rodahl, 1966b--**Low**; Bravo, Gauthier, Roy, Payette, & Gaulin, 1997--**Low**; Ettinger et al, 1997--**High**; Hopkins, Murrell, Hoeger, & Rhodes, 1990--**Medium**; Lord, Lloyd, Nirui, Raymond, Williams, & Stewart, 1996a--**High**; Lord, Ward, & Williams, 1996b--**High**; Sforzo, McManis, Black, Luniewski, & Scriber, 1995--

Medium; Williams & Lord, 1997--**Medium**). These outcome variables seem logically related to functional status in that stronger, more flexible bodies are likely to be more mobile and less susceptible to injury. However, there is no way to infer from these studies how much strength and flexibility (or in what muscles) are needed to produce noticeable functional improvement for seniors.

Studies with outcomes pertaining to the integrity of the skeletal structure, most of which have been limited to female subjects, have been less consistent. In a recent two year randomized placebo controlled trial of brisk walking aimed at preventing osteoporosis in postmenopausal women (Ebrahim, Thompson, Baskaran, & Evans, 1997--**Medium**), bone mineral density at the femoral neck had fallen to a lesser (statistically significant) extent in the brisk walking group as compared with the placebo group, but there were no differences between the two groups in lumbar spine bone mineral density. The cumulative risk of falls was greater in the walking group. In another study of a water aerobics intervention for senior women, there was no change in femoral neck bone mineral density, and spinal bone mineral density actually *decreased* to a statistically significant extent following the intervention (Bravo, Gauthier, Roy, Payette, & Gauline, 1997--**Low**). In contrast, an eleven month endurance training intervention for older women produced statistically significant improvements in whole body, lumbar spine, femoral neck and proximal femur bone mineral density (Kohrt, Ehsani, & Birge, 1997--**Medium**). Another twelve month study of aerobic dancing reported that bone mineral density showed a statistically significant increase among exercising women with signs of osteoporosis (Kudlacek, Pietschmann, Bernecker, Resch, & Willvonseder, 1997--**Medium**). In a sixteen week endurance training study that included both male and female seniors, bone mineral density improved in men but not women (Blumenthal et al, 1991--**High**). Overall, it is difficult to draw any solid conclusions about the effects of aerobic exercise on skeletal outcomes in seniors.

It is worth noting here that while researchers' interest in musculoskeletal outcomes often stems from the relationship between these variables and the risk of fall related fractures in older people, it is not possible, on the basis of these studies, to draw definitive conclusions about falls and injury risk unless falls and injuries are themselves directly measured. This is because falls have multiple causes including musculoskeletal, sensorimotor, neurological, and psychological variables, and a gain or loss in one of these areas alone may not be sufficient to affect the risk of falling and sustaining a bone fracture or other injury (See Section III on Falls and Injury Prevention for a more thorough discussion of interventions pertaining to fall risks.)

Neurological Outcomes in Endurance Training Interventions: Research addressing the effects of endurance training on neurological outcomes in seniors indicates that aerobic exercise may have positive effects on such variables as reaction time, memory, and cognitive functioning, although

the results within and between such studies are not very consistent. Several studies report statistically significant improvements in reaction time (Hassmen & Koivula, 1997--**Medium**; Lord & Castell, 1994--**Medium**; Lord, Ward, & Williams, 1996b--**High**; Rooks, Kiel, Parsons, & Hayes, 1997--**High**; Williams & Lord, 1997--**Medium**), while a few report improvement in memory (Hassmen & Koivula, 1997--**Medium**; Molloy, Beerschoten, Borrie, Crilly, & Cape, 1988--**Medium**; Powell, 1974--**Medium**; Williams & Lord, 1997--**Medium**) and general cognitive functioning as measured, for example, by the Mini Mental State Examination (Molloy, Beerschoten, Borrie, Crilly, & Cape, 1988--**Medium**). Often, however, the results are not consistent across different measures of cognitive function or across time within the same study (Emery & Blumenthal, 1990--**High**; Molloy, Beerschoten, Borrie, Crilly, & Cape, 1988--**Medium**; Williams & Lord, 1997--**Medium**), and a number of studies have failed to find any effect of aerobic exercise on cognitive function (Barry, Steinmetz, Page, & Rodahl, 1966b--**Low**; Buccola, & Stone, 1975--**Low**; Emery & Gatz, 1990--**Medium**; Madden, Blumenthal, Allen, & Emery, 1989--**High**; Panton, Graves, Pollock, Hagberg, & Chen, 1990--**High**).

Psychological Outcomes in Endurance Training Interventions: Results of studies addressing the effects of aerobic exercise on psychological variables have been inconsistent, and in fact this body of research as a whole points to effects that are at best weak, especially over the long term. Several studies report statistically significant gains in seniors' "psychological well being" or "mental outlook" (Bravo, Gauthier, Roy, Payette, & Gaulin, 1997--**Low**; Cowper et al, 1991--**Low**; Hickey, Wolf, Robins, Wagner, & Harik, 1995--**Low**; Morey et al, 1994--**Low**; Sharpe et al, 1997--**High**), though one study failed to find such an effect (Emery & Gatz, 1990--**Medium**). A couple of studies report statistically significant reductions in anxiety or "psychological distress" (McAuley, Shaffer, & Rudolph, 1995--**Low**; Minor, Hewett, Webel, Anderson, & Kay, 1989--**Medium**), though others found no such reductions (Karper & Boschen, 1993--**Low**; Williams & Lord, 1997--**Medium**). Two studies found that aerobic exercise had no effect on depression in senior subjects (MacRae, Asplund, Schnelle, Ouslander, Abrahamse, & Morris, 1996--**Medium**; Williams & Lord, 1997--**Medium**). Similarly, two studies measured seniors' self-esteem and found no effect of aerobic exercise on this variable (Blumenthal et al, 1989--**High**; Blumenthal, Schocken, Needels, & Hindle, 1982--**Low**). Most studies that have measured mood likewise report no positive effect (Blumenthal et al, 1989--**High**; Blumenthal, Schocken, Needels, & Hindle, 1982--**Low**; Hassmen & Koivula, 1997--**Medium**), though one study did find a positive effect of endurance training on mood (Williams & Lord, 1995--**Low**). One study found a positive, statistically significant effect of aerobic exercise on mood, self confidence, and loneliness at sixteen weeks, but these effects did not hold at thirty two weeks (Emery & Blumenthal, 1990--**High**).

Metabolic Outcomes in Endurance Training Studies: Several studies have addressed the effects of aerobic exercise on various diabetes-related metabolic variables (e.g., glucose tolerance, fructosamine, insulin values, HbA_{1c}) among senior subjects. The majority of these studies report statistically significant improvements in such variables following endurance training (Cononie, Goldberg, Rogus, & Hagberg, 1994--**Low**; Katzel, Bleecker, Colman, Rogus, Sorkin, & Goldberg, 1995--**Medium**; Kirwan, Kohrt, Wojta, Bourney, & Holloszy, 1998--**Low**; Kohrt, Obert, & Holloszy, 1992--**Medium**; Raz, Hauser, & Bursztyn, 1994--**Medium**; Sial, Coggan, Hickner, & Klein, 1998--**Low**), though three studies failed to achieve such improvements (Ligtenberg, Hoekstra, Bol, Zonderland, & Erkelens, 1997--**Medium**; Morey et al, 1991--**Low**; Skarfors, Wegener, Lithell, & Selinus, 1987--**Medium**). One study reported improvements in glucose response to an oral glucose tolerance test only among those with impaired glucose tolerance at baseline (DiPietro, Seeman, Stachenfeld, Katz, & Nadel, 1998--**High**). All of these studies should be considered in light of a much larger body of research with younger subjects, indicating that regular exercise is efficacious in the treatment and prevention of diabetes (Graham, 1991).

Health Status Outcomes in Endurance Training Studies: A total of nineteen studies addressing the effects of various types of exercise on functional status of seniors was identified. Of these, only seven studies were primarily endurance training interventions; the remaining twelve studies consisted of non aerobic exercise interventions such as strength and/or balance training, or programs that combined several forms of exercise. A variety of health status measurement instruments were used in these studies, including the SF-36, the Sickness Impact Profile, the Multidimensional Health Locus of Control Inventory, the Jette Functional Status Test, the Arthritis Impact Measurement Scale, the Quality of Well-Being Scale, the Human Activity Profile, the General Health Survey, and various assessments of activities of daily living.

Of the seven studies that assessed the effect of endurance training on health status, four reported statistically significant improvements. In the eighteen month Fitness Arthritis and Seniors Trial (FAST), arthritic seniors who participated in aerobic exercise three times a week had 10% better scores than a health education control group on a self report disability scale which included basic and complex activities of daily living subscales. The exercisers also reported significantly less knee pain than the controls (Ettinger et al, 1997--**High**).

In a six week randomized trial of walking exercise for seniors with chronic pain, walkers reported statistically significant improvements in pain and performance based measures of functional status (Ferrell, Josephson, Pollan, Loy, & Ferrell, 1997--**Medium**). Another study found that subjects who had participated in aerobic exercise for sixteen weeks had higher scores than a control group on a variety of self perceived outcomes including overall health status, energy level, sleep

patterns, and life satisfaction, although these gains did not hold at thirty two weeks (Emery & Blumenthal, 1990--**High**).

A nursing intervention in which seniors exercised three times a week for nine months addressed various outcomes related to functional status, including health outlook, rejection of sick role, and sleep quality. This study found statistically significant improvements in all of these variables for both low and moderate intensity exercise groups (Stevenson, & Topp, 1990--**Low**). In addition, a recent randomized controlled study reported that sixteen weeks of moderate intensity endurance training significantly improved seniors' sleep quality (King, Oman, Brassington, Bliwise, & Haskell, 1997--**High**).

Three other studies of endurance training in seniors failed to produce changes in exercisers' health status from pre-intervention to post-intervention (Blumenthal, Schocken, Needels, & Hindle, 1982--**Low**) or compared to a control group (Coleman, Buchner, Cress, Chan, & de Lateur, 1996--**High**; Emery, Schein, Hauck, & MacIntyre, 1998--**High**).

A few other interventions with health status outcomes included aerobic exercise, but it is difficult to isolate its effects in these studies because it is combined with other modes of exercise such as strength or balance training (see the section on Multimodal Exercise Interventions later in this report for a more thorough discussion of these interventions). However, it is worth noting here that most of the non-aerobic interventions failed to positively affect health status (Fisher, Kame, Rouse, & Pendergast, 1994--**Low**; Karl 1982--**Medium**; Kutner, Barnhart, Wolf, McNeely, & Xu, 1997--**High**; Molloy, Beershtoten, Borrie, Crilly, & Cape, 1988--**Medium**; Skelton, Young, Greig, & Malbut, 1995--**Medium**); while four out of six multimodal interventions that included aerobic exercise *did* produce statistically significant improvements in health status (Kovar, Allegrante, MacKenzie, Peterson, Gutin, & Charlson, 1992--**High**; McMurdo & Burnett, 1992--**High**; Minor, Hewett, Webel, Anderson, & Kay, 1989--**Medium**; Sharpe, et al, 1997--**High**). This suggests that the aerobic element may be the most important mode of exercise in improving seniors' health status.

As a whole, the current literature on the effects of exercise interventions on health status among seniors confirms an earlier review of such interventions, which concluded that "the evidence that exercise improves functional status is promising, but inconclusive" (Buchner, Beresford, Larson, LaCroix, & Wagner, 1992). Future research should investigate how type and duration of exercise impacts the various components of functional status, including overall health and quality of life, mental health, social functioning, and ability to carry out activities of daily living.

Low vs. Moderate Aerobic Exercise for Seniors: Several studies have addressed the question of whether seniors can obtain benefits from lower intensity endurance training (30-40% of maximum heart rate), similar to those obtained through higher intensity exercise (60-70% of maximum heart rate). Results of these studies indicate that lower intensity training is just as efficacious in terms of affecting cardiovascular variables (Badenhop, Cleary, Schaal, Fox, & Bartels, 1983--**Medium**; Foster et al, 1989--**Medium**; King et al, 1991--**Low**), cardiorespiratory variables (Badenhop et al, 1983--**Medium**), and functional outcomes including sleep quality and health outlook (Stevenson & Topp, 1990--**Low**). These findings have implications for the implementation of future exercise programs, since seniors may be more willing to adapt to a lower intensity (i.e., less strenuous) exercise routine, such as walking.

Strength Training: Strength training interventions for seniors typically employ free or machine based weights in strengthening various muscle groups. Usually specific muscle groups (e.g. upper or lower body) are targeted in any given study. The primary outcome variable in such studies is muscle strength, and most studies have produced statistically significant improvements in strength, no matter what muscles are targeted (Charette et al, 1991--**Medium**; Cononie, Graves, Pollock, Phillips, Sumners, and Hagberg, 1991--**High**; Ettinger et al, 1997--**High**; Fiatarone et al, 1994--**High**; Fiatarone, Marks, Ryan, Meredith, Lipsitz, & Evans, 1990--**Low**; Fisher, Pendergast, Gresham, & Calkins, 1991--**Low**; Frontera, Meredith, O'Reilly, Knuttgen, & Evans, 1988--**Low**; Jette et al, 1996--**High**; Judge, Whipple, & Wolfson, 1994--**High**; Judge, Underwood, & Gennosa, 1993--**High**; McCartney, Hicks, Martin, & Webber, 1996--**High**; McCartney, Hicks, Martin, & Webber, 1995--**High**; McMurdo & Rennie, 1994--**High**; Nichols, Omizo, Peterson, & Nelson, 1993--**Medium**; Parker et al, 1996--**Low**; Perkins & Kaiser, 1961--**Medium**; Pollock et al, 1991--**High**; Phillips & Hazeldene, 1996--**Medium**; Pykar, Lindenberger, Charette, & Marcus, 1994--**Medium**; Rooks, Kiel, Parson, & Hayes, 1997--**High**; Sharpe et al, 1997--**High**; Skelton, Young, Greig, & Malbut, 1995--**Medium**; Taaffe, Pruitt, Reim, Butterfield, & Marcus, 1995--**Medium**; Vitti, Bayles, Carender, Prendergast, & D'Amico, 1993--**Low**; Wolfson et al, 1996--**High**). One study noted "clinically" significant effects on muscle strength and stair climbing power among frail older subjects (Fiatarone et al, 1994--**Medium**). It is, however, generally difficult to ascertain, on the basis of these studies, what statistically significant gains in muscle strength really mean in terms of day to day functional abilities.

Balance Training and Tai Chi: A number of studies have incorporated balance training in an attempt to affect such outcomes as stability and susceptibility to falls and injury. Tai Chi, a gentle martial art that incorporates poses aimed at enhancing balance and coordination, has also been used as a form of exercise intervention for seniors. For a review of studies of balance and Tai Chi training, see the Falls & Injury Prevention (Section III) later in this chapter.

Multimodal Exercise Interventions: A substantial number of the exercise interventions identified for this review incorporate several modes of exercise for a given treatment group, making it difficult to isolate the effects, for example, of aerobic exercise versus weight lifting versus balance training. Nevertheless, these studies are worth noting as examples of general exercise interventions.

Most noteworthy are a number of studies that have combined strength and endurance training; these have generally been efficacious in increasing muscle strength (Coleman, Buchner, Cress, Chan, & deLateur, 1996--**High**; Lord & Castell, 1994--**Medium**; Morey et al, 1996--**Low**; Morey et al, 1989--**Low**; Sauvage et al, 1992--**Medium**; Schnelle, et al, 1996--**Medium**; Sipila, Multanen, Kallinen, Era, & Suominen, 1996--**High**; Williams & Lord, 1995--**Low**) and flexibility (McMurdo & Burnett, 1992--**High**; Morey et al, 1996--**Low**; Morey et al, 1994--**Low**; Morey et al, 1989--**Low**; Raab, Agre, McAdam, & Smith, 1988--**Low**). Two studies with sensorimotor outcome measures (e.g., balance, postural sway) failed to produce an effect of combined strength and aerobic training on such outcomes (Sauvage et al, 1992--**Medium**; Thompson, Crist, Marsh, & Rosenthal, 1988--**Medium**). One study of community dwelling Japanese seniors over age 75 reported that combined strength and endurance training produced a statistically significant improvement in one measure of balance (the "Functional Reach" test) and one physical performance measure of functional ability (the "Up & Go" test); although the intervention failed to affect several other measures of cognitive function (Okumiya, Matsubayashi, Wada, Kimura, Doi, & Ozawa, 1996--**High**).

One study stands out as a particularly outstanding example of a well designed, multimodal exercise program: a twelve month, randomized controlled intervention that encompassed aerobic training, weight lifting, and flexibility exercises with outcome measures that assessed various components of "functional fitness," including flexibility, coordination, agility, strength, and endurance. Other outcome measures included back pain, health status, psychological well being, and bone mineral density of the spine and femur. The exercise group achieved statistically significant gains in four out of five measures of functional fitness, psychological well being, and self perceived health, as well as a decrease in back pain (Bravo et al, 1996--**High**).

Summary of Exercise Interventions

Substantial evidence supports the conclusion that regular, moderate aerobic exercise has positive effects on cardiorespiratory, cardiovascular, and musculoskeletal variables. To a lesser but notable extent, there is evidence for positive effects on diabetes related variables, neurological outcomes including cognitive function, and health status outcomes. With respect to psychological outcomes, the evidence is too inconsistent to draw meaningful conclusions. The evidence is

undoubtedly sufficient to suggest that exercise programs for seniors should be pursued and further researched in relation to functional outcomes, particularly since exercise (especially endurance training) has the power to affect several bodily systems at once.

II. Depression

Epidemiological research indicates that about fifteen percent of community dwelling seniors have clinically important depressive symptoms (Blazer, 1994). Depressive reactions are particularly insidious in older persons because neither the patient nor the health care provider may recognize their symptoms in the context of multiple physical problems that frequently occur in this population (Birrer, 1998) (Friedhoff, 1994). Failure to identify depression may lead to increased medical expenses due to unnecessary specialist consultations, laboratory examinations and inappropriate medications or other treatments (DasGupta, 1998). The consequences of untreated depression in seniors are often dire, ranging from diminished motivation to engage in life, to a shift from home living to a nursing facility, to suicide. In fact, older Americans have a higher suicide rate than any other group (Mercer, 1992). Moreover, the actual rate of suicide may be higher because reported rates do not include self neglect, failure to adhere to prescribed medication regimens, or "accidents" that were not accidents at all (Butler & Lewis, 1995; Glass & Reed, 1993). These "passive suicide behaviors" can increase the risk of life endangering conditions, such as pneumonia or cardiac arrest (Glass & Reed, 1993).

Treatment of Late Life Depression

Fortunately, the prospects for treatment of late life depression are fairly good, despite common misconceptions that depression is more chronic and difficult to treat in older patients (Blazer, 1997). The biggest problem with intervening in geriatric depression may not be a lack of viable treatment options, but insufficient recognition and diagnosis of the problem by primary care providers (PCPs). For example, a recent study compared clinical opinions of general practitioners (GPs) with assessments of the mental state of 510 senior patients using a validated interview schedule, and found that GPs were aware of depression in only 51% of depressed patients (Crawford, Prince, Menzeles, & Mann, 1998).

Physician Education Interventions: Two studies have addressed the need for improved recognition and diagnosis of late life depression by primary care physicians. A large, rigorous, controlled study used intensive screening, patient specific treatment recommendations, and educational materials in an attempt to improve diagnosis and treatment outcomes (Callahan et al., 1994--**High**). These interventions were effective in increasing recognition and treatment of late life depression by general practitioners, but did not produce significant improvement in

patients' depression or severity of disability. The authors concluded that "efforts to improve the functional status of these patients may require more integrated interventions and more aggressive attempts to target psychosocial stressors traditionally outside the purview of primary care" (Callahan et al., 1994).

Another randomized controlled intervention by Health Services Advisory Group (1996-1998--**High**) included the formation of a continuous quality improvement team to develop guidelines and management systems for the identification and treatment of late life depression in an MCO. The intervention produced a transient improvement in physicians' recognition of depression that dissipated at the second round of measurement. The authors attribute these results in part to the increased demands for physician productivity, which may preclude spending the amount of time necessary to recognize this insidious illness in senior patients.

Obviously, neither of the above studies is cause for optimism concerning the prospects for increasing diagnostic sensitivity of primary care physicians with respect to signs and symptoms of depression. Neither of the studies specifically addressed the diagnosis of depression among seniors, but there is no reason to think that physicians would be any more sensitive to depression in older populations than in the general population. It may very well be true, also, that current pressures for productivity among primary care physicians have an adverse effect on their sensitivity to depression, in the context of other diagnostic possibilities. On the other hand, there are simple screeners for depression that can be easily taught and understood (Rost, Burnam, & Smith, 1993). Efforts thus far to influence MCO management and to educate physicians may not have been optimal.

Psychosocial Treatments: Two meta analyses of psychosocial interventions for geriatric depression between 1979 and 1993 yielded consistent results: treatment was more effective than placebo or no treatment, with moderately high mean effect sizes in both studies. Treatment effects were characterized as durable, meaning that gains were maintained well at follow-up. (Engels & Vermey, 1997--**High**; Scogin & McElreath, 1994--**High**). Both analyses reviewed a variety of interventions, including behavioral therapy, cognitive therapy, combination cognitive behavior therapy, reminiscence therapy, anger expression, and psychodynamic therapy. (There was about 50% overlap in the studies reviewed in these two reports). Behavioral therapy and cognitive therapy produced larger effect sizes than other interventions, and individual therapy was more effective than group therapy. Although a relatively small number of studies was used to compute average effect sizes in these studies (less than twenty per meta analysis), the consistent effects associated with the various treatments minimize the possibility that these results are the product of chance.

Outcome measures in these studies were either clinician rated depression measures such as the Hamilton Rating Scale for Depression, or self report scales such as the Beck Depression Inventory. In general, it is difficult to translate these outcome measures to an understanding of functional status as it relates to geriatric depression. Nevertheless, a few inroads have been made toward relating depression rating scales to health status measures. For example, a recent longitudinal study examined the usefulness of the SF-36 in measuring health outcomes in the depressed elderly (Beusterien, Steinwald, & Ware, 1996). It was found that the SF-36 Mental Health Scale and Mental Component Summary Score exhibited the strongest associations with severity of depression, as measured by the Hamilton Depression Rating Scale, the Clinician's Global Impression of Severity and Improvement, and the Geriatric Depression Scale. The authors concluded that the SF-36 is useful for estimating the burden of depression and monitoring changes in functional health and well being over time among depressed seniors.

Drug Therapy: A number of randomized (mostly double blind) medical studies have addressed the efficacy of antidepressant drugs in the medical treatment of geriatric depression. Nortriptyline (a tricyclic) has been the most frequently studied antidepressant in seniors. Results generally indicated that this drug is moderately effective with few serious side effects except in patients over eighty (Brodie, McGhie, & O'Hara, 1975--**High**; Georgotas, McCue, & Cooper, 1989a--**High**; Georgotas, McCue, & Cooper, 1989b--**High**; Katz, Simpson, & Curlik, 1990--**High**; Meyers & Mei-Tal, 1985--**Low**; Reynolds, Perel, & E.Frank, 1989--**Low**; Reynolds, Perel, & Kupfer, 1987--**Low**; Schneider, Frederickson, & Severson, 1986--**Medium**; Sorenson, Kragh-Sorenson, & Larsen, 1978--**Low**). Studies of imipramine (Cohn, Varga, & Lyford, 1984--**High**; Eklund, Dunbar, & Pinder, 1985--**High**; Gerner, Estabrook, & Steuer, 1980--**High**; Jarvik, Mintz, & Steuer, 1982--**Medium**; Merideth, Feighner, & Hendrickson, 1984--**High**; Meyers & Mei-Tal, 1985--**Low**; Middleton, 1975--**High**; Zung, Gianturco, & Pfeiffer, 1974--**Medium**) and amitriptyline (Altamura, Mauri, & Colacurcio, 1988--**High**; Altamura, Mauri, & Rudas, 1989a--**High**; Altamura, Percudani, & Guercetti, 1989b--**High**; Ather, Ankier, & Middleton, 1985--**High**; Blacker, Shanks, & Chapman, 1988--**High**; Branconnier, Cole, & Ghazvinian, 1982--**High**; Burch, Ahmed, & Hullin, 1988--**High**; Koncevoj, Kolibas, & Psatnickij, 1989--**Medium**; Schneider et al., 1986--**Medium**; Waite, Grundy, & Arie, 1986--**High**), both tricyclics, showed low to moderate success in relieving depression, but serious side effects and residual depressive symptoms were common. Most clinicians avoid these two drugs when treating geriatric depression because they cause significant orthostatic hypotension, which can result in falls and fractures (Friedhoff, 1994).

Several studies of monoamine oxidase inhibitors (MAOIs) have found them to have moderate effects on late life depression, but little information about side effects was provided (Ashford &

Ford, 1979--**Low**; Georgotas, Friedman, & McCarthy, 1983a--**Medium**; Georgotas, McCue, & Cooper, 1987a--**Medium**; Georgotas, McCue, & Friedman, 1987b--**High**; Georgotas, McCue, & Hapworth, 1986--**Medium**; Georgotas, Reisberg, & Ferris, 1983b--**Medium**; Lazarus, Groves, & Gierl, 1986--**Medium**; Reynolds et al., 1987--**Low**).

Outcome studies of the selective serotonin reuptake inhibitor (SSRI) fluoxetine have found it to be an effective antidepressant for seniors, with fewer side effects than comparative tricyclics (Altamura et al., 1989b--**High**; Falk, Rosenbaum, & Otto, 1989--**High**; Feighner & Cohn, 1985--**High**; Weilburg, Rosenbaum, & Biederman, 1989--**Low**). Trazodone, also an SSRI, has also been shown effective in the treatment of geriatric depression (Altamura et al., 1988--**High**; Altamura et al., 1989a--**High**; Altamura et al., 1989b--**High**; Blacker et al., 1988--**High**; Gerner et al., 1980--**High**), although one study (Falk et al., 1989--**High**) suggested that trazodone is not as effective as fluoxetine. Two recent reviews also confirm that fluoxetine and other SSRIs have better side effect profiles than tricyclics in seniors (Menting et al., 1996; Newhouse, 1996). One study found that depressed seniors with chronic physical illness respond to fluoxetine as well as those who are not chronically ill (Small, Birkett, Meyers, Koran, Bystritsky, & Nemeroff, 1996--**High**). Of particular interest with respect to the impact of antidepressants on functional status is a study (not specific to seniors), whose findings suggest that fluoxetine treatment may be associated with higher levels of social functioning and health perception than treatment with tricyclics (Souetre, Martin, Lozet, & Monteban, 1996--**Medium**).

In general, most antidepressants are viewed as equally (moderately) effective for treating depression in seniors, with some (i.e., SSRIs) having better side effect profiles than others (Bierrer, 1998; Friedhoff, 1994). Almost none of the cited pharmacological studies asked patients about their quality of life or functional status; instead, "therapeutic response" was measured in terms of percentage decline of baseline rating scale scores. It is not clear how much of a change in these rating scale scores is needed to produce a noticeable improvement in functional status. As mentioned previously, there is some indication that certain subscales of the SF-36 are comparable to standard depression scales such as the Hamilton Depression Rating Scale, which suggests that it may be possible to convert from depression rating scores to measures of functional status and well being.

Community Interventions: Very little exists in the way of published community interventions for depressed seniors. However, a recent social work service intervention, "Link Plus" in St. Louis, was moderately effective in increasing social contact and reducing depressive symptoms in seniors at increased risk of suicide (Morrow-Howell, Becker-Kemppainen, & Judy, 1998--**High**). This was a well designed, randomized controlled intervention involving multiple phone contacts (with a median of eight months of weekly contacts), with at risk seniors to assess functional

status and service use and to provide supportive counseling. In addition, the social workers contacted patients' physicians, family members, and other community service agencies to arrange needed services for treatment subjects.

Summary of Depression Review

A variety of moderately effective treatments are available for depressed older patients. However, there are no "magic bullets," and unfortunately little of the research in this area helps us understand how these clinical effects translate into functional outcomes for seniors. An important limitation on drug studies is that they almost invariably involve extensive exclusionary criteria related to comorbid conditions, which may mean that the benefits of treatment are limited in the kinds of populations found in MCOs; and in particular it probably means that extra caution needs to be taken in monitoring patients for drug side effects and drug interactions. Nevertheless, if even a moderate degree of the suffering caused by depression can be ameliorated with these interventions, they may be worth pursuing, for depression is a very common and potentially debilitating condition among older people.

III. Falls & Injury Prevention

Falls, and the injuries that result from them, are very serious problems among older persons. Seniors have a higher rate of falls than all other age groups except children under the age of fifteen. Thirty percent of community dwelling seniors between the ages of sixty five and eighty five, and 50% of those over eighty five, will fall at least once in any given year. Falls are the sixth leading cause of death in people over the age of sixty five, and the leading cause of injury related death in this group. Non fatal falls are associated with functional decline and admission to long term care facilities. Typical results of a fall can include hip fracture, other fracture, soft tissue damage, and increased fear of falling, which often leads to more rapid functional decline than would otherwise be expected (Baker & Harvey, 1985; Burt, 1995; Englander, Hodson, & Terregrossa, 1996 Sept; Hindmarch & Estes, 1989; Morris, Rubin, Morris, & Mandel, 1987; Stalenhoef, Crebolder, Knottnerus, & Van Der Horst, 1997; Tinetti & Williams, 1997). Seniors are more likely than other age groups to suffer fractures and require hospitalization as a result of injuries sustained from falls. They are less likely to be discharged home after hospitalization, and they require more long term care than younger age groups (Hall & Owings, 1994). As a result, cost of treatment per injury is significantly higher for older patients than for younger age groups (more than seven times higher according to Kopjar's 1997 study). Indeed, costs associated with fall episodes and their sequelae have a significant impact on overall health care costs for seniors.

Most falls appear to involve multiple risk factors. Risk factors for falls have been classified as environmental or host factors (Connell, 1996 Nov; Tibbitts, 1996 Sept; Tinetti, Doucette, & Claus, 1995). Environmental risk factors include poor lighting, cluttered floors, unstable furniture, stairs with poor railings, throw rugs, and low beds and toilets (Archea, 1985; Connell, 1996 Nov; Tibbitts, 1996 Sept). Although research has indicated that elements of older people's environments can affect the likelihood of falling, few intervention studies have examined effects of home safety education, inspections, and plans for home safety improvements. The few published interventions have shown only small effects on fall related outcomes (Hornbrook et al., 1994 Feb; Reinsch, MacRae, & Lachenbruch, 1992). Further research in this area is needed.

Host factors that affect falls include chronic and acute illnesses, living alone, and medication use, as well as problems with balance, proprioception, visual acuity, reaction time, strength, and flexibility. Chronic medical conditions that have been linked to risk for falls include dementia, musculoskeletal disorders such as osteoporosis and arthritis, postural hypotension, neurological conditions such as Parkinson's disease, and history of stroke or anemia (Herndon et al., 1997; Tinetti & Speechley, 1989).

Several studies have established connections between the use of psychoactive medications, particularly antidepressants, and increased risk of falls and increased risk of hip fractures (Ray, Griffin, Schaffner, Baugh, & Melton, 1987). Ray's (1987) study indicated an 80% increase in risk of hip fractures among users of hypnotics or anxiolytics with a long half life relative to non users; as well as a 200% increase in risk of hip fractures among users of tricyclic antidepressants or antipsychotic drugs relative to non users. Regular use of more than four medications has also been strongly linked to an increase in risk of falls (Cole, 1992; Liu, Topper, Reeves, Gryfe, & Maki, 1995; Macdonald, 1985; Ray et al., 1987; Sheahan et al., 1995). Given the evidence that specific medications are associated with an increased risk of falls, evaluation of the drug regimens of older persons would seem to be a priority. The goal of such evaluation should be to identify and eliminate unnecessary medications, reduce dosages to the least amount that is still effective, and implement non drug interventions whenever possible (Sheahan et al., 1995). Although such a program has not actually been tested, it makes sense conceptually and may prove to be more cost effective as well.

Exercise Interventions to Prevent Falls & Injuries: A growing number of studies indicate a preventive effect of exercise on the risk of falls in seniors (Buchner et al., 1997--**High**; Buchner, Nicola, Martin, & Patrick, 1997--**High**; Lord, Ward, Williams, & Strudwick, 1995--**High**; Wolf et al., 1996--**High**; Wolfson et al., 1996--**High**). Many of these studies show improvements in strength and balance measures as well as a reduction in the risk of falls. One group of studies of particular interest is the Multicenter Trials of Frailty and Injuries: Cooperative Studies of Intervention Techniques (FICSIT), funded by the National Institute on Aging and the National

Institute for Nursing Research. These were a series of multicenter studies that investigated various interventions to prevent or reduce frailty and injuries in seniors (Kutner et al., 1992--**High**). All but one of the eight study sites conducted randomized controlled clinical trials involving exercise and/or balance training.

A pre planned meta analysis of the seven FICSIT sites revealed significant effects of general exercise in reducing the risk of falls in seniors (Province et al., 1995--**High**). It is clear from these studies and a few others (Hornbrook et al., 1994--**High**; Lord et al., 1995--**High**; Wagner et al., 1994--**Medium**), that older people who exercise can reduce their risk of falling and maintain functional capacity compared to those who remain sedentary. In the FICSIT studies, overall exercise was associated with a 10% reduction in the risk of falls; balance training was associated with a 17% risk reduction; and Tai Chi was associated with a 37% risk reduction (Province et al, 1995--**High**). It remains somewhat unclear as to which specific types of exercise, and in what amounts, are particularly effective. One exception is balance training techniques, which were particularly efficacious in reducing fall risk in the FICSIT studies (Province et al, 1995--**High**).

Methods used in balance training in these studies have incorporated platform training, Tai Chi exercises, and various standing and sitting exercises (Wolf, Barnhart, Ellison, & Coogler, 1997--**High**; Wolf et al., 1996--**High**; Wolf, Kutner, Green, & McNeely, 1993--**High**; Wolfson et al., 1996--**High**). The balance platform training involved individualized exercises using a computerized system, which required subjects to move a cursor on a screen by leaning their bodies without moving their feet. The aim is to incrementally increase sway in order to reach the limits of postural stability.

In one study (Wolf, Barnhart, Ellison & Coogler, 1997--**High**) this computerized balance training (CBT) was compared with training in ten poses of Tai Chi. Both groups practiced approximately two hours a week for fifteen weeks. Subjects in the Tai Chi group showed a substantial decrease in the rate of falls, while subjects in the CBT group showed no reduction. Subjects in the Tai Chi group also had a decreased fear of falling after completing training, and an increased confidence in daily activities relative to both the CBT group and the control group. Furthermore, almost half of the Tai Chi subjects chose to continue meeting informally to practice Tai Chi after the study concluded. This study is important because it points to the potential overall effectiveness of a simple and inexpensive technique in reducing fall risk in seniors. Tai Chi is a technique that requires no specialized equipment or location for instruction. This study also showed that it is appealing to many elderly persons, and that noncompliance was not a problem with this program.

The FICSIT Tai Chi programs utilized a modified version of the traditional Chinese Tai Chi, which consists of 108 forms or moving poses that flow into one another. The modified program consists of ten composite forms selected because they emphasize movements that affect postural stability and are easily learned (Wolf, Coogler, & Xu, 1997 Aug). Two studies conducted by researchers in Taiwan indicate that maximum health benefits may result only from practicing the traditional, longer form of Tai Chi. These studies show increased flexibility and aerobic capacity and decreased body fat in people who practice the traditional form of Tai Chi regularly for one year or more (Lai, Lan, Wong, & Teng, 1995 Nov; Lan, Lai, Chen, & Wong, 1998 Mar). These researchers also indicate that Tai Chi cannot be learned properly from videotape or book instruction because the teacher's interaction with the students is necessary to ensure correct posture during the exercise. Whether the short or long form is implemented, the above studies indicate that a minimum of one, one hour session per week should be conducted with an experienced instructor. Students may then be encouraged to practice on their own or in small groups, perhaps with videotaped instruction for reinforcement. A video recommended in one study is Tai Chi for Health, produced by Heron Communications, Inc. (1990; Ross & Presswalla, 1998 Feb). Qualified instructors can typically be found through university physical education departments or martial arts studios (Ross & Presswalla, 1998 Feb).

Summary of Falls/Injuries Review

Exercise programs, especially those that incorporate balance training, show promise in the prevention of falls and injuries among older people. Tai Chi training appears to be a particularly promising option for preserving and possibly improving functional status as it relates to seniors' mobility and the likelihood of falling (Kessenich, 1998). More programs are needed, however, that persuade seniors to adopt an ongoing regimen of exercise and balance training. If such programs were developed (perhaps by implementing group Tai Chi classes in community centers, nursing homes, church groups, etc.), it is possible that benefits beyond falls and injury prevention, such as increased social interaction, might accrue. This remains a promising avenue of health promotion research.

IV. Chronic Pain

There is a common belief among medical professionals that sensitivity to pain decreases with age (Harkins, 1996; Harkins, Kwentus, & Price, 1990); and epidemiological studies in American (Sternbach, 1986; Vonkorff, Dworkin, LeResche, & Kruger, 1988), Swedish (Brattberg, Thorslund, & Wikman, 1989), and Danish (Anderson & Worm-Pederson, 1987) samples have indeed suggested that complaints of chronic pain peak in middle age and decline thereafter, with the exception of arthritis related joint pain, which increases markedly with age (Sternbach, 1986).

Clinical evidence, however, including the previously reported results of the interviews with MCOs, paints a bleaker picture, suggesting that many seniors experience persistent, often disabling pain associated not only with arthritis, but also with diabetes, cardiovascular disease, falls, and injuries (Harkins, 1996; Harkins et al., 1990; Melding, 1991). In fact, given that disease processes in seniors are characterized by multiplicity and chronicity, it is surprising that studies of pain patterns in seniors are so limited. Each year over 4000 articles (Medline data) are published on pain, but less than 1% of these focus on geriatric pain (Melding, 1991).

The intermittent, aching pain of arthritis is by far the most commonly experienced non malignant pain in seniors (Demlow, Liang, & Eaton, 1986); but other pain categories warrant attention, as well. For example, 25% of persons with seriously disabling low back pain are over age sixty five (Wood & Badley, 1980); and approximately one out of twelve people over age seventy report severe headaches (Lipton, Pfeffer, Newman, & Solomon, 1993). Pain may be under diagnosed and under treated in older patients, as there is a tendency for patients to under report pain, in order to not displease their doctor. As older patients are more likely to have multiple health problems making pain low on their list of priorities, they often believe that they should bear pain as "a part of life," and fear voicing pain complaints because of past taboos (Forman & Stratton, 1991).

There is little published research that has directly investigated the impact of pain on seniors' functional status or quality of life; although impaired mobility, disrupted sleep, depression, and decreased social activity have all been associated with persistent pain in older persons (Ferrell, Ferrell, & Osterweil, 1990; Parmelee, Katz, & Lawton, 1991; Roy, 1986). Pain often leads to functional limitations, as in the case of arthritis; whereby walking, use of the hands, or other movements can be painful enough to limit engagement in valued activities. Chronic pain may also play a vital mediating role in the cascade from chronic illness to physical impairment, social disability, and psychological distress; as data from the second wave of an eight-year longitudinal study by Kahana and associates (Kahana, Kahana, Namazi, Kercher, & Stange, 1997) suggests.

Treatment of Chronic Pain in the Elderly

Drug Therapy: Analgesics, particularly aspirin, acetaminophen, and non steroidal anti inflammatory agents (NSAIDs), are the most frequently prescribed medications for chronic, non malignant pain in seniors (Gagliese & Melzack, 1997). Very little evidence exists regarding the efficacy of these treatments in the management of geriatric pain, although it is well documented that the elderly are more likely than younger people to react adversely to analgesics (Portenoy & Farkash, 1988). For example, diminished renal function, which is common in older persons, can cause a toxic build up of salicylate, the active ingredient in aspirin. Salicylate intoxication can cause dizziness, confusion, and drowsiness, all of which may predispose older persons to falls

and injuries (Forman & Stratton, 1991). Adverse NSAID side effects include dyspepsia, gastrointestinal hemorrhage, fluid retention, and hypertension (Roth, 1989). These drugs can also have significant, problematic interactions with concurrent antihypertensive and anticoagulant drugs (Harkins et al, 1990). In general, pharmacological management of pain in older persons requires particular vigilance with respect to potential drug toxicity and interactions (Helme, M. Bradbeer, Katz, & Gibson, 1997).

A small, growing body of literature is available on nonpharmacological interventions for the management of chronic, non malignant pain in older persons. These interventions can be divided into three categories: 1) "cognitive" programs that teach pain coping skills; 2) biofeedback and relaxation training; and 3) chronic pain rehabilitation programs (CPRPs) that offer structured combinations of psychological and physical rehabilitation therapies. (Some overlap exists between these categories, as cognitive interventions typically include an element of relaxation training, and CPRPs incorporate relaxation and biofeedback training.) Most studies in these areas have been of low to moderate methodological quality. Nevertheless, for the most part, the results of these studies are uniform in suggesting that nonpharmacological interventions can impart meaningful alleviation of pain and/or ability for seniors to cope with pain.

Cognitive Interventions: Four studies have implemented pain coping skill training programs for senior subjects with chronic (mostly osteoarthritic) pain (Cook, 1998; Fry & Wong, 1991; Keefe et al, 1990; Puder, 1988). Skills taught in these programs included guided imagery and relaxation, activity rest cycling scheduling, attention diversion, and cognitive restructuring to help patients recognize and modify irrational cognition related to pain. Treatments consisted of an average of 16 hours of group based training in these skills. All four studies found statistically significant reductions in self reported pain severity. One study (Puder, 1988--**Medium**) showed significant decreases in the degree to which pain interfered with activity. Another controlled study found that subjects in the pain coping skills treatment group had significantly less psychological disability as measured by the Arthritis Impact Measurement Scales (Keefe et al, 1990--**Medium**).

Biofeedback & Progressive Muscle Relaxation Training: Three studies addressed progressive muscle relaxation in older patients with chronic tension and/or migraine headaches (Arena et al, 1988--**Low**; Blanchard et al,--**Medium**, 1985; Kabela et al, 1989--**Medium**). One of these, a small retrospective study, found that only 20% of patients met the criterion for clinically significant reduction in headache pain (Blanchard et al., 1985--**Medium**); while the other two studies reported that 60% (Kabela et al, 1989--**Medium**) and 70% (Arena et al, 1988--**Low**) of subjects achieved clinically meaningful pain reduction. The average treatment consisted of eight, one hour relaxation training sessions.

Only one study has specifically addressed the efficacy of biofeedback training in senior pain patients (Arena, Hannah, Bruno, & Meador, 1991--**Medium**); although others have included biofeedback as one component of a multi modal treatment program (see the review of CPRPs below). Patients in this study underwent twelve, fifty minute sessions of frontal EMG feedback for the treatment of chronic headache pain, with half of the patients achieving clinically significant pain reduction.

Chronic Pain Rehabilitation Programs: Two studies have examined the effects of multidisciplinary clinic treatment of various types of chronic pain in seniors (Cutler et al, 1994--**Low**; Middaugh et al, 1988--**Low**). Components of these programs included physical therapy, occupational therapy, biofeedback and relaxation training, pain coping skill training, stress management, and medication management. Both studies reported that geriatric patients had significantly less pain following treatment, and the larger of the two studies (153 geriatric patients), reported significant gains in functional status and quality of life. Although the methodological quality of both of these studies was rated "low," the results should be considered in light of a larger, more scientifically rigorous body of research on CPRP's within the general population. This meta analysis of sixty five studies evaluated the efficacy of CPRPs for chronic back pain; and found that CPRPs were superior to no treatment, waiting list, and single discipline treatments such as drug therapy; and physical therapy; and that effects were stable over time (Flor, Fydrich, & Turk, 1992--**High**). Beneficial effects of multidisciplinary treatment included reductions in pain, improvements in mood, less interference with activities of daily living, and decreased use of the health care system. Therefore, in the context of the overall literature, the two senior specific studies suggest that such pain clinics hold considerable promise for older persons with chronic pain.

Summary of Pain Review

The evidence for the efficacy of nonpharmacological treatment of chronic pain in seniors is based on a small body of literature that is somewhat lacking in scientific rigor. However, the results are generally consistent in that most of the interventions show a moderate ameliorative effect on pain in older patients. Such treatments certainly warrant further attention and should be researched with greater rigor, especially given that drug treatments for pain can lead to a whole extra dimension of problems (side effects, drug interactions) to which seniors are especially susceptible, and that might be avoided with the implementation of nonpharmacological treatments.

V. Immunization

Immunization remains among the most effective tools for the primary prevention of infectious diseases. Pneumococcal and influenza vaccinations are especially important to the health of seniors, as pneumonia and influenza are among the top five leading causes of death in older people (USPSTF, 1996). Ninety percent of all influenza and pneumococcal associated deaths in the United States occur in people aged sixty five and older (CDC, 1995b). Certain subgroups of seniors are at particularly high risk; for example, rural-based elders appear to carry more risk due to lack of accessibility to health care services (Krout, 1994); and inner city seniors experience a higher infectious disease related death rate than the aggregate elderly sum (CDC, 1989).

Influenza vaccination can produce a 37% reduction in illness, a 72% reduction in hospitalization, and an 87% reduction in flu related mortality rates among seniors during flu season (Le & Chang, 1988; Shann, 1990). With cost estimates of \$3-\$12 billion during outbreaks, the cost effectiveness of immunization is substantial (CDC, 1989; Le & Chang, 1988). Effectiveness of the pneumococcal vaccine has ranged from 65% to 81% in clinical studies (CDC, 1997). This vaccine is considered underused, with 70% or more of targeted persons as yet unimmunized (CDC, 1995a). The U.S. Public Health Service has established a 60% immunization rate for seniors as a national health objective for the year 2000 (PHS, 1991).

The most common barrier to successful vaccine delivery has been the perceived fear of vaccination side effects (Duclos & Jatcher, 1993; Nichol, Mac Donald, & Hauge, 1997; Rodriguez & Baraff, 1993); although a recent study (Nichol et al, 1997) found that pneumococcal vaccination was not associated with a significant increase in systemic side effects in vaccinated subjects as compared to a control group. The CDC (1998) has suggested implementing influenza and pneumococcal vaccination interventions where seniors can be found: outpatient clinics, physician offices, acute care facilities, nursing homes and other LTC facilities, hospitals, in-home programs (e.g. Meals-on-Wheels), retirement communities, and senior recreation facilities.

Community Based Interventions: A number of community intervention strategies have brought about significant increases in the number of rural based seniors immunized for both influenza and pneumonia. For example, a mobile health unit in two rural counties of the mid Atlantic coast (Alexy & Elnitsky, 1998--**High**) visited senior citizen areas and community sites (e.g. malls, post-offices) three days per week and made home visits two days per week between September and February to provide free immunizations. Senior vaccination rates for pneumonia and influenza showed significant increases compared to the year prior to implementation of the mobile unit. The rate of vaccination increased from 50% of the targeted elderly population in the year prior to the intervention, to 78% following implementation of the mobile unit.

The San Diego Medicare Preventive Health Services Demonstration, a six year randomized health promotion study, provided annual influenza shots and a one time pneumococcal vaccination at community sites. The experimental group was at least twice as likely to receive vaccinations for influenza in the first three years, and 70% more likely in the fourth year, compared with the control group. The study demonstrates that even a modest intervention that increases awareness and improves access can improve vaccination rates among seniors. (William et al, 1997--**High**).

The state of Hawaii recently conducted a pneumococcal vaccination campaign as one of four health promotion initiatives. Hawaii, with 106,000 seniors, had a 15% pneumococcal vaccination rate prior to the study, with the objective of vaccinating 30,000 older people. Through this program, 115 community based free pneumococcal vaccination sites were set up from September through February. During the campaign, 15,909 persons with a mean age of 70.1 were vaccinated at clinic sites. Although the campaign reached only 53% of its target, pneumococcal vaccinations by private physicians also increased during the campaign. The Hawaii initiative was able to vaccinate 25% of the state's seniors at an average cost of \$10.06 per dose, a cost running \$5-\$9 lower than most national vaccination campaigns. (Campbell, Donahue, Nevin-Woods et al, 1993--**Medium**; Campbell et al, 1989--**Medium**).

Provider Based Strategies: Provider based strategies that have been proven effective in increasing senior vaccination rates include practice based tracking systems and physician reminder systems. Physicians using such tracking systems have administered 30% more influenza vaccines than those not using the system (Buffington, Bell, LaForce et al, 1991--**Medium**). Physician reminder systems are used to remind doctors to review the need for pneumococcal and influenza vaccines for individual patients and to administer vaccines when needed. Typically, primary care staff tag the medical records of those patients who should receive the vaccine. The use of preventive health checklists increased pneumococcal vaccination rates fourfold in one study (Cheney & Ramsdell, 1987--**Medium**), and by 5% to 42% in another (Cohen, Littenberg, Wetzel, & Neuhauser, 1982--**Medium**). In one hospital, implementation of a computer reminder system which prompted physicians to review pneumococcal vaccination status before discharge, increased associated vaccination rates from 4% to 45% (Clancy, Gelfman, & Poses, 1992--**Medium**).

Facilities providing episodic or acute care (i.e., emergency room and walk in clinics) provide an opportunity for high risk groups to receive immunizations through a very simple inquiry method. In a study to determine the feasibility of immunizing unvaccinated seniors with influenza and pneumococcal shots in an emergency department setting, it was determined that many older patients will accept immunization as part of the emergency department visit and that these

vaccines can be delivered effectively (Rodriguez & Baraff, 1993--**Medium**). Of the older patients seen at the clinic during the course of the study, 82% had not received the pneumococcal vaccine, with 58% subsequently immunized in the ER. Of these same patients 63% had not received flu shots, with 50% immunized in the ER. The main reasons for refusing vaccination include the desire to first discuss vaccination with their primary care physician, a belief that vaccines do not work, and fear of vaccine reactions.

Nursing homes and long term care facilities may dramatically increase rates of immunization while possibly lowering costs by implementing some simple procedures. One program achieved a 90% immunization rate by having a pre authorized immunization consent form on file (Siewert, Drinka, & Langer, 1988). This compared with a 57% immunization rate of those facilities who require written consent for each immunization (Setia, Serventi, & Lorenz, 1985). Assignment of one particular nurse to implement immunization strategies has also proved efficacious in increasing vaccination rates (Siewert et al, 1988).

In a large randomized cohort at a public urban teaching hospital, three approaches for improving seniors' compliance with influenza and pneumococcal vaccinations were compared during the flu season of 1990. While all three provider groups in the study received intensive education in immunization standards, the control group received no further intervention; the second group offered education to patients during hospital visits; and the third group (the "prevention team") used a flowsheet, offered education to patients, and redefined tasks to facilitate compliance (e.g., nurses could vaccinate independent of MD initiative). During the intervention, influenza vaccinations were offered more frequently to prevention team patients (68.3%), than to patients in either the patient education (50.4%) or control group (47.6%). Similarly, pneumococcal vaccinations were offered more frequently to previously unvaccinated prevention team patients (28.3%) than to patient education (6.5%) or control (5.4%) patients. Compliance rates did not differ significantly between patient education and control subjects for either vaccine. Pre intervention surveys documented significantly higher perceived compliance than actual compliance for both vaccines, indicating that physicians believe they screen more often than they actually do. The results of this trial suggest that organizational changes, including the involvement of non physician personnel, are effective in enhancing vaccination rates among seniors (Herman, Speroff, & Cebul, 1994--**High**).

Summary of Vaccination Review

Immunization programs can be tagged onto almost any existing intervention or health awareness program, whether they be mobile health units (McNeal, 1996; Reuben et al, 1996; William, Elder, Seidman, & Mayer, 1997), health care screening programs in shopping malls, in home or congregate meal sites (Reuben et al, 1996; Sadoway et al, 1994), acute care, nursing homes

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(Sadoway et al, 1994), or elderly support groups. Perhaps of most interest to MCOs, however, are tracking and flagging systems to identify patients in need of vaccination as they visit their primary care providers. While these systems might not reach all seniors in need of vaccination, they can substantially reduce the costs, suffering, and mortality attributable to influenza and pneumonia in this population.

CHAPTER 4

OVERALL DISCUSSION

The key finding that emerges from this information synthesis is that the state of the research on health promotion for seniors requires continued and sustained development. Therefore, the identification of interventions that are cost-effective and have a meaningful effect on the functional status of seniors are in the early stages of implementation. The intent of this review is to provide direction in developing new interventions that are relevant to the specific needs of Medicare patients.

Effective health promotion interventions that address the health care of seniors will need to be developed by health care organizations and their provider groups. The existing literature does not provide "off the shelf" interventions that can simply be installed as elements in a health care plan. For example, provider interventions to increase vaccination rates should not be difficult to implement in most health care settings. Exercise interventions, in contrast, would require more explicit specification, and would almost certainly need extended testing and adaptation in any setting.

Limited evidence exists on the effects of any health promotion and disease prevention efforts on functional status and quality of life of patients. Such positive effects as have been found for various interventions have been limited for the most part to clinical or other indicators that, however important, are at least one step removed from the everyday lives of patients. Since depression is measured largely in terms of self reported unhappiness or misery, one may suppose that the implications for ameliorating depression are obvious for quality of life. Also, the alleviation of pain and prevention of falls and injuries would seem inherently desirable.

The studies available to date do not usually report outcomes in terms of effects that are directly interpretable. For example, with only a few exceptions, one cannot be certain that whatever improvements were reported in outcome variables were sufficiently large to be clinically or personally important to patients. At least some of the deficiencies in measuring outcomes may be laid at the doorstep of the social sciences, but, if health care organizations and programs are going to engage in activities aimed at improving functional status and quality of life, measures of those characteristics will need to be included in the developmental efforts.

The literature currently available in the areas covered in this synthesis, as well as in related areas, is not impressive with respect to its scientific quality. That, however, is not the principal difficulty. The fundamental shortcoming of the literature on health promotion and disease

prevention is its diffuseness. Interventions tend not to be well defined in the first place, and very little attention is paid to their initial strength (Sechrest, West, Phillips, Redner, and Yeaton, 1979). One may doubt that many of the interventions were sufficiently strong as to instill much confidence at all in their potential effects. Interventions are also changed in various ways from one implementation to another, so that it is difficult to be sure that what is being tested and what may account for any observed differences in effects varies from one site to another. Still another, and even more serious problem, is the fact that very few interventions are ever tested more than once or twice; and they almost never undergo the kind of systematic, iterative testing that would be required for their long term development into dependable mechanisms for producing change. Science is meant to be cumulative, and that is how it advances understanding and control over the phenomena addressed by its theories and research. The research on health promotion and disease interventions is not impressively cumulative. Studies do not appear to build on their predecessors; they are not systematic in their attacks on problems; and they do not produce a body of evidence that can readily be synthesized into any firm set of conclusions.

Health care organizations and programs will probably need to develop their own internal research programs if they are to develop interventions that will be effective in keeping their senior subscribers well and happy. Many of them have the capability of making important contributions to health care, including initial discoveries. An example of this is a recently published paper that used available records to determine that nonsteroidal anti inflammatory drugs, when taken in combination with muscle relaxants, may be effective in reducing back pain (Cherkin, Wheeler, Barlow, and Deyo, 1998). An interesting conclusion of that study was that the results might justify the conduct of a randomized clinical trial. Thus, the flow of scientific information between health care facilities and basic research settings needs to be a two way process. It will be a challenge for MCOs to develop their research capabilities and produce information that can be made part of the public data base about the effectiveness of health care.

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APPENDIX

TABLE 1

Terms Used in Search	Medline	HealthStar	CINAHL	PsychINFO	Int'l Pharm. Abs
exercise + intervention + elderly	88 (16)	78 (21)	19 (4)	27 (13)	
exercise + treatment + elderly	237 (34)	186 (28)	22 (9)	47 (16)	
physical activity + treatment + elderly	47 (7)	42 (12)	2 (1)	12 (2)	
health promotion + exercise + elderly	40 (15)	41 (18)	17 (9)	22 (9)	
exercise + treatment + geriatric	23 (2)	22 (6)	4 (1)	25 (12)	
exercise + treatment + gerontology	0 (0)	0 (0)	0 (0)	4 (2)	
depression + intervention + elderly	95 (35)	92 (21)	34 (12)	180 (35)	4 (1)
depression + treatment + elderly	864 (59)	653 (36)	48 (23)	1179 (76)	64 (17)
depression + health promotion + elderly	12 (4)	13 (4)	6 (2)	8 (2)	0 (0)
chronic pain + elderly + intervention	4 (3)	4 (2)	4 (1)	10 (3)	0 (0)
chronic pain + elderly + treatment	26 (14)	22 (10)	2 (1)	40 (9)	5 (2)
pain management + elderly	72 (48)	65 (25)	37 (15)	51 (10)	9 (3)
chronic pain + geriatric + treatment	10 (8)	8 (3)	3 (1)	16 (3)	0 (0)
pain + elderly + treatment	616 (38)	448 (32)	26 (14)	115 (21)	37 (14)
injury prevention, aged 65 - 80+	99 (10)	98 (4)	12 (9)		
falls, aged 65 - 80+	188 (15)	40 (10)	177 (20)		
immunization, aged 65 - 80+	109 (16)	131 (10)	45 (6)	9 (5)	
vaccination, aged 65 - 80+	68 (14)	72 (13)	32 (4)	5 (2)	