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A Review and Analysis of the
Health and Cost-Effective
Outcome Studies of
Comprehensive Health
Promotion and Disease
Prevention Programs at the
Worksite: 1991-1993 Update

Kenneth R. Pelletier

Methods, Issues,
and Results
in Evaluation
and Research

A Review and Analysis of the Health and Cost-Effective Outcome Studies of Comprehensive Health Promotion and Disease Prevention Programs at the Worksite: 1991-1993 Update

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Editor Note: This is the second in a series of articles authored by Dr. Kenneth R. Pelletier summarizing the results of studies examining the impact of comprehensive health promotion programs on health and cost. We received over 6,500 reprint requests for the first article, far more than we have received for any other article we have published. Dr. Pelletier updated the summary due to the tremendous response it received and due to the fact that 23 additional studies have been published since the first summary was printed. Our intention is to continue publishing updated summaries of the impact of comprehensive health promotion programs on health and financial outcome measures periodically, and to include all studies published in rigorous peer-reviewed journals. If we have missed a study, please send us a copy to include in the next update.

At the request of Dr. Pelletier, this article is dedicated to the memory of Dr. John (Jack) Erfurt of the University of Michigan for his innovative and pioneering research on worksite health promotion and disease prevention.

Kenneth R. Pelletier, Ph.D., is Director, Corporate Health Program, Stanford Center for Research in Disease Prevention, Stanford University School of Medicine, Palo Alto, California.

Send reprint requests to Dr. Kenneth R. Pelletier, Director, Corporate Health Program, Stanford Center for Research in Disease Prevention, Stanford University School of Medicine, 1000 Welch Road, Stanford, California 94304-1885.

INTRODUCTION

Since the publication of the first article¹ of this series in the *American Journal of Health Promotion* in 1991, there have been over 6,500 requests for reprints as well as a marked increase in the number and quality of health and cost outcome studies. Despite corporate downsizing and increased economic pressures, or perhaps because of these trends, there has been an increasingly focused sophistication in the conduct and analysis of worksite-based programs. According to the January 11, 1993 issue of *Business Week*, medical costs will exceed \$900 billion in 1993 with 51.7% paid by employers, 33.7% from the federal government, and 14.4% from states in medicare and medicaid. No wonder that large to small employers are being forced to face the task of appropriate managed care within a global budget plus an emphasis on patient demand reduction through health promotion and disease prevention programs.

From 1980 to 1991 there were 24 published studies evaluating the health and, in some cases, the cost benefits of comprehensive health promotion and disease prevention programs in the worksite. In those previous studies, all 24 indicated positive health benefits and every study which analyzed for cost effects and/or cost benefit demonstrated a positive effect. As one measure of the growth of interest in worksite programs as an integral, and arguably the single most important influence, in managed care is the fact that there were 24 new studies conducted between 1991 and the early part of 1993. More and better designed studies were conducted in the last two years than for the entire decade of the eighties. What is even more important is that the research design, data analysis, and intervention sophistication is greatly improved in these more recent studies. In reviewing the most recent 24 studies, all but one evidenced positive health outcomes. Again, of the studies which analyzed cost-effectiveness or cost benefits, every one indicated a positive return. When anyone cavalierly dismisses 48 studies with the glib dismissal of

"there is no evidence," they are simply ignorant of more than 13 years of increasingly sophisticated research with documentation of both health and cost outcomes.

Surely, the data supporting the health and cost-effectiveness of comprehensive worksite programs in health promotion and disease prevention are not definitive. However, it is important to bear in mind the fact that many accepted health and medical procedures, particularly surgery, have a much more limited research base in outcomes, often have no basis in cost-effectiveness or cost benefits, and are increasingly found to be deficient in both health or cost outcomes. Managed care or managed competition, with capitated payments, and perhaps a fixed global budget will place greater value on such data for all aspects of health and medical care. With this context and caveat clearly in mind, health promotion and disease prevention research is improving, and more recent studies utilize sophisticated, randomized, controlled trials. One outcome of this improved methodology will be to realize how deficient some earlier studies may have been. For instance, one of the "classic" studies by Blue Cross and Blue Shield of Indiana reported in my 1991 *American Journal of Health Promotion* article¹ has been reanalyzed by a team of most of the original authors.² (See Table 1 for studies cited in *American Journal of Health Promotion* 1991; 5(4):314-315.) Based on this reanalysis, Dr. John Sciacca and his colleagues found that program participation was not associated with reduced-medical care costs as originally reported. These researchers conclude, "It would be prudent to remain guarded about the health cost savings effects of worksite health promotion programs." That point was raised in my original article, has been articulated by such prominent researchers as Dr. Ken Warner of the University of Michigan and Dr. Jonathan E. Fielding of UCLA, and remains an important caveat. One last observation is that virtually all worksite programs to date have been focused on primary prevention. As both interventions and evaluations move into secondary and tertiary prevention areas, to be discussed in the next sections, it will be increasingly possible to prove or disprove both health and cost benefits given the more evident benefits and higher costs associated with higher risk and/or ill populations served by secondary and tertiary prevention programs. These new frontiers within the emerging managed care systems constitute a fertile area for innovative interventions accompanied by increasingly sophisticated health and cost outcomes from randomized, controlled trials.

MANAGED CARE: AN EMERGING CONTEXT FOR WORKSITE HEALTH PROMOTION AND DISEASE PREVENTION

Within managed care, with a renewed emphasis on demand reduction through health promotion, is the opportunity to create a true health care system rather than the current disease management industry. Beyond the specific outcomes in the studies cited in this 1993 update (see Table 2), it is important to consider the new context

of managed care as well as some of the most promising new directions which will constitute the future of health and cost-effective programs in the worksite. What follows is a series of innovations which do not constitute a definitive statement but do illustrate a new context and major new trends that will underlie the future studies to be included in later updates.

More significant and effective innovations in health promotion and disease prevention have taken place in worksites, from small to large, in the last 10 years than since the Industrial Revolution. Work environments are a mainstay in the generation of a true health care system because the workplace provides a site where it is possible to reach the largest number of people and their dependents, for the most years of their adult life, where both the individual and the employer has a vested interest in a person's health and well-being. According to the U.S. Health Care Financing Administration (HCFA), companies are currently spending 48.3% of their after tax profits on the provision of medical care for their employees plus dependents, and that figure is conservatively expected to increase to over 60% by the year 2000. As if that analysis is not alarming enough, Professor Regina Herzlinger, an influential medical economist at the Harvard Business School, has cited an even more startling fact based on her series of articles in the *Harvard Business Review*.³ That point is essentially, if you take the average rate of profitability of all of the Fortune 500 companies and project it into the future and then do the same with the rate of increase in their medical costs, the results are astounding. If current trends continue, in approximately five years these two lines will cross, meaning that all of the medical costs of the Fortune 500 companies will be equal to all of the after tax profits of those same companies. After that point, medical costs will actually begin to exceed their after tax profits.

Paying medical coverage is supposed to be an employee benefit, not the primary role of companies whose real mission is the profitable production of goods, services, and materials in an intensely competitive international market. Corporations, large and small, represent the single largest segment of the United States which has a vested interest in health if for no other reason than to eliminate excess costs in their products and services. Beyond the economic factors, the presence of health promotion programs at the worksite have demonstrated benefits in attracting and retaining key personnel, decreased absenteeism, enhanced productivity, improved public image of the company, and greater allegiance to the company by employees.

To incorporate is derived from the Latin word "incorpore" which means to take on a body. A corporation literally takes on a body which has a life and rights of its own. Within that body are the cells or employees who animate the body and are integral to its health or illness. Increasingly, the fact that healthy people equal a healthy business is being recognized as a fundamental underpinning for the successful company of the twenty-first century. With a grant from the MacArthur Foundation, Dr. Robert H. Rosen has founded Healthy Companies in Washington, D.C., based on his insightful book *The Healthy Company*.⁴

In his book, Rosen observed,

Healthy people make healthy companies. And healthy companies are more likely, more often, and over a longer period of time, to make healthy profits and to have healthy returns on their investments. So healthy people and healthy relationships are at the very core of success in business, but for too long the old fear-based hierarchical paradigms of management and of management-employee relationships have driven the way business is done in America. I might add that those old paradigms also have just about driven business into the ground.

Increasingly, the new model for business is one of healthy individuals within a healthy organization with respect for and contributions to a healthy community and environment. This is not unbridled altruism but a recognition of the inextricable interdependence of a company's health and those people who work in the organization.

STANFORD CORPORATE HEALTH PROGRAM

To address these issues, a program was initiated with a grant from three foundations in 1984 and evolved into the Stanford Corporate Health Program within the Stanford Center for Research in Disease Prevention at the Stanford University School of Medicine. This program is a collaborative, research effort between the university and 22 major corporations, including Amdahl, Apple, ARCO, AT&T, Bank of America, Chevron, Hewlett-Packard, IBM, Johnson & Johnson, Levi-Strauss, Lockheed, Shaklee, Syntex, and Xerox. Medical and personnel directors of these companies meet with university faculty on a regular basis to "develop and evaluate innovative health and medical programs." Over the last eight years we have worked together in very small projects such as one of the first studies of bringing mobile mammography vans to the worksite all the way up to a highly complex study over five years of an innovative managed care plan for over 80,000 employees of a major telecommunications company. Together we have created a knowledge and database for companies to make better decisions on how to allocate their annual medical budgets between treatment and prevention.

Looking into 1993 and beyond, there is an invaluable addition to the collaboration between corporations and universities in this vital area. That innovation is the inclusion of insurance carriers and medical providers in the projects. That may seem obvious, but in reality, too many efforts in health promotion and in managed care have focused too heavily on legal and financial strategies. All too often, hospitals and clinics providing the care are treated as the enemy while the physicians, nurses, therapists, and other clinicians see the managed-care experts running these organizations as interfering with their clinical practices. That is an artificial and time-wasting, adversarial relationship which does not serve any produc-

tive purpose. By contrast, new alliances are being formed to create truly innovative solutions rather than arguing over preserving the status quo or to simply tinker with an obsolete system. One such project was reported in a September 1992 issue of *The New England Journal of Medicine*.⁵ That article cited a new consortium in Minneapolis, long a center of innovation in managed care, of employers and health providers who purposed to work together to resolve their mutual problems. Among the companies are Dayton Hudson and General Mills, working with medical care providers ranging from the Mayo Clinic to local health maintenance organizations or HMOs. These corporations will work with these providers of care to improve the health of their more than 125,000 employees and dependents. Their plan includes a "newly established institute [which] will develop guidelines for practice aimed at reducing variation in practice patterns and eliminating unneeded care." Hopefully the health and cost-effectiveness of health promotion programs will be an integral part of this institute but that remains to be seen. While this consortium is obviously new and untested, it represents a major positive step of employers and providers working together for mutual benefit.

Within the Stanford Corporate Health Program, there is also a major new direction in 1993 toward a working alliance of companies, universities, and providers of medical care. During the first years of the program, all providers of care were explicitly excluded to prevent any marketing or sales activities which would cloud our research objectives. However, it is increasingly clear that the next stages of creating healthy worksites for healthy people will result from collaboration, not competition or antagonism. Toward that end, Blue Shield of California working with a national consortium of Blue Cross/Blue Shield Plans and also Kaiser Permanente have become increasingly active members in working together toward common solutions. That is an exciting and major new direction with new programs being developed in using nurses and computer interventions for advanced heart disease, new programs oriented specifically to women and retirees, and many other innovations. Together these collaborative efforts will enhance the individual efforts of all working people to work in a company to enhance and support the individual practices so both can attain optimal health.

COMMUNITY-BASED HEALTH PROMOTION

Communities will be increasingly seen as health cities. Individual changes are both easier to generate and to sustain in a supportive family, worksite, and community. During the mid-1970s, Dr. John W. Farquhar and his colleagues at the Stanford Center for Research in Disease Prevention of the Stanford University School of Medicine developed the first intervention and evaluation models for working with entire communities to enhance health. That initial project is the classic and much emulated "Three Community Study,"⁶ which focused on an inexpensive, communitywide intervention to reduce cardiovascular risk

in three small cities in California. Such a comprehensive approach uses the medical care system, local regulations such as no-smoking laws, environmental factors, and changes in personal behavior to elicit and sustain healthy lifestyles in an atmosphere of social support.

Building upon the success of this initial study, Dr. Farquhar and his colleagues launched the even more innovative "Five-City Project" reported in a July 1990 issue of the *Journal of the American Medical Association*.⁷ This study was 14 years in duration and compared the effects of the community intervention in two cities of 122,800 people versus two control cities of 197,500. Interventions consisted of media education about heart disease risk; four to five education programs per year focusing on specific risks such as smoking and cholesterol; community classes and contests; as well as one-to-one counseling. There were special programs in Spanish, and school-based programs for grades four, five, seven, and 10. Although a detailed description of the intervention is beyond the scope of this introduction, it is one that can and has been replicated in other communities. Following the first five years of intervention, the researchers reported reductions in cholesterol, blood pressure, pulse, smoking, heart disease risk scores, as well as a 15% reduction in total mortality risk scores. Among the conclusions in this landmark study are that these community approach outcomes "support the effectiveness of community organization and multifactor health education, delivered through multiple channels, in reducing certain chronic disease risk factors at a reasonable cost.... The anti-tobacco effort of the past 25 years in the United States may serve as a prototype for the potential effects of long-term, consistent health education in changing social norms beneficially." Although the decreases in risk were acknowledged as relatively small but significant and the focus was upon heart disease prevention, the Stanford Five-City Project has generated an invaluable model which can be implemented in a community to elicit and sustain individual efforts to achieve optimal health.

Nationally, two other complex and equally well-tested programs have been conducted in the Minnesota Heart Health Project with six cities totaling 356,000 people and the Pawtucket Heart Health Project in two Rhode Island cities with a population of 173,000. Together these three studies include a total of 13 cities and over 890,000 people. Combined results of these studies are indeed significant given the number of people, diversity of geographic location, and demonstrated effectiveness. With such significant numbers of people involved, these community-based programs create an essential base for the low-cost implementation of a true health care system. Given these results, Dr. Farquhar and his colleagues have concluded, "The cost of such national programs is moderate, but the cost of *not* launching such programs is to accept the notion that the energies of communities cannot be harnessed for planned social change for health benefit." Although most programs are in the United States, there is a clear indication that community programs are applicable internationally. Among the best known projects are the

North Karelia Project in Finland, a project in three small rural towns in South Africa, a four-community program in Switzerland, and an Australian study involving three towns.

Turning to one last innovative model of community health programs is a very unique and significant program in Birmingham, Alabama.^{53,54} This program is somewhat different than the previous studies in that it is worksite focused rather than communitywide, but it does include all of the approximately 4,000 employees of the city of Birmingham. That city as well as every city and employer in the United States has had to face the consequences of unchecked escalation in medical costs by having to pay higher premiums and sacrificing other benefits like salary increases, by cutting back on coverage, or dropping medical insurance altogether. In September of 1985, the city of Birmingham received and matched a \$1.5 million grant from the National Institutes of Health. With that total of \$3 million, the city implemented an integrated system of health promotion programs for active employees and their dependents.

What is most remarkable about the plan is that participation was required in order to be eligible for the medical plan. If an employee declined to participate, he or she did not have access to the medical insurance screening which launched the five-year program. Conducting the actual interventions was R. William Whitmer, President and CEO of "Wellness South" in Birmingham, and his team of psychologists, physicians, and nurses. During the five years of the program there were major reductions in all risk factors, occurrence of illness, and reductions in mortality. Beyond these clinical outcomes are the most impressive indications of the cost-effectiveness. In 1985, the medical costs per employee was \$2,050 per year or \$300 per year above the national average. By the end of the demonstration phase of the program in early 1991, Whitmer and his colleagues reported, "The fact that the city had no increase in the per employee cost of medical benefits over the five-year period is the most important indication of program impact."⁸ Considering the completely uncontrolled escalation of medical costs in the United States during that same time period, this is a major result.

Based on the success of the Birmingham program, there are four important aspects which are unique in the sense that they are not included in other comprehensive health promotion programs. Given the significance of this project, it is increasingly likely that these will be integral aspects of both the community and worksite programs of the future. These four dimensions are:

1. Screening all employees as a prerequisite for medical coverage. Of course, an employee had the option of not participating and seeking his or her own medical care independently. Any mandatory participation is inevitably controversial, but it is certain that future programs will include some form of required participation or individuals will be able to exercise their choice by finding their own coverage or paying a higher premium for coverage.

2. Aggressive physician referral was necessary for 13% of employees found to be at high risk. For the majority of employees, the risk was for heart disease and underscores the importance of community heart disease prevention programs as well as the Stanford Coronary Risk Intervention Program (SCRIP).⁹ (This project is described later.)
3. Assistance in establishing a strong patient and clinician relationship. All too often, it is assumed that people understand their medical plan and have a sound relationship with their physician and other providers. That was not the case in Birmingham where over 40% of the employees did not have an active relationship to their doctors.
4. Regular medical office visits were actually encouraged. This is directly opposite of the unfortunate practice many employers have adopted to discourage utilization.

For the Birmingham project, the philosophy is that "Employees should be educated and encouraged to see the primary-care physician regularly. The correction and monitoring of illnesses or premature death is an important part of cost-effective health promotion."⁸ Perhaps one of the most significant implications of the Birmingham project is that the physicians and providers are not the enemy. All too often, new programs are myopically focused on the supply side by limiting benefits and access to providers rather than the more formidable task of creating a more effective system of appropriate medical care coupled with equally effective and appropriate health promotion to encompass the necessary components of true health care.

REVERSING HEART DISEASE: BEHAVIORAL PLUS PHARMACOLOGICAL INTERVENTION

Behavioral and pharmacological reversal of heart disease is a rapidly evolving alternative to invasive surgeries. Cardiovascular disease is still the leading cause, followed by cancer and injuries, of the loss of life among those who die before the age of 75. According to the 1992 Statistics of the American Heart Association, 1.7 million adults suffer heart attacks each year and over 500,000 die. Angioplasty, thrombolytic therapy, coronary bypass surgery, and heart transplantation, as well as many of the new heart medications, buy time and alleviate symptoms. This is all to the good, but none of these interventions do anything to treat the underlying arterial disease that is the cause of heart attacks. Looking at the current situation, the eminent physician Dr. Alexander Leaf, Chairman of Preventive Medicine at the Harvard Medical School, posed a rhetorical question in a *New England Journal of Medicine* editorial, "Are we developing ingenious, technologically sophisticated, and expensive treatments for established disease and ignoring the fact that the malady is potentially preventable and reversible?...?" It would seem that a health care system that improved the health of the patient and of

the public would be preferred to one that focused only on extending life. This is what preventive measures should accomplish, especially with coronary heart disease."¹⁰ Significant regression of coronary artery blockages has been achieved by a reduction of risk factors, through medications, or a combination of the two. This is very good news, and it generates a new and more optimistic perspective on the prevention of coronary heart disease. To date, seven research studies have demonstrated that pharmacological intervention with advanced heart disease can slow the rate of progression. In addition, three studies have demonstrated a worsening of the heart disease and five studies indicated that heart disease can regress or be reversed. Given the small number of people in the reported studies, the extremely intensive and expensive intervention, the preparation of all of the meals for the participants in one study, and other unique aspects of some programs including intensive psychotherapy, it remains to be demonstrated if such programs are practical for large numbers of people. At the present time, there are further studies and demonstration projects which should successfully resolve these limitations.

One study is of particular significance not only because it demonstrated a 50% slowing in the rate of progression of heart disease, but because it represents a practical, deliverable model today. That project is the Stanford Coronary Risk Intervention Program (SCRIP) led by Dr. William L. Haskell⁹ and his colleagues at the Stanford University School of Medicine. For the vast majority of people, the combination of lifestyle changes plus appropriate use of medications is much easier to maintain than a stringent lifestyle only program. SCRIP is the first study to evaluate this combined impact of comprehensive lifestyle changes in diet, exercise, weight loss, smoking cessation, and counseling plus medications. For this study, 259 men and 41 women were randomly assigned going into the SCRIP program, and 155 going into usual care at another major medical school. After the initial examination, the SCRIP intervention was delivered by trained nurses over the telephone.

At the conclusion of the four years of the study, the people in the SCRIP program showed major improvements beyond the people receiving usual care. Significant reductions occurred in the form of 40% lower cholesterol consumption, a 23% reduction in low-density lipoproteins (LDL), along with a 20% increase in exercise and a 12% rise in high-density lipoproteins. There were three deaths in each group, but there were only 25 hospitalizations in the SCRIP group versus 44 under usual care. Both groups showed some progression or worsening of the disease but the SCRIP patients demonstrated 47% less narrowing of their arteries. Furthermore, a small number of patients in SCRIP evidenced actual regression or reversal of blockages. Beyond the clinical findings, what makes this study so important is a number of unique characteristics because it is the largest, longest study using an inexpensive, nurse-delivered telephone intervention yet still had a major positive impact. Because it required no special facilities and combines easily deliverable lifestyle changes plus

medications, it represents a model that can be used by any hospital, clinic, or individual practice.

Building on that research, Dr. Haskell and his colleagues including Dr. John W. Farquhar and myself are currently developing the "SCRIP 2" clinical research project in conjunction with Blue Shield of California. This is a major policy step because Blue Shield, plus the insurance plans in which Blue Shield and Blue Cross constitute a single plan, constitutes the largest insurance company in the world. For the first time, medical practitioners will be able to be reimbursed for providing a lifestyle plus medication program on an equal footing as invasive surgeries. Insurance companies have long known that for every one coronary bypass surgery that is unnecessary, they can save a minimum of \$30,000 per person, and, for every preventable angioplasty, savings are approximately \$15,000 per procedure. Now some forward-looking insurers are taking the prudent steps necessary to make that dollar and human suffering savings a reality. More and more patients will find that their individual choices ranging from lifestyle interventions only, lifestyle plus medication, to surgery will be supported and reimbursed by at least one major insurance company with others likely to follow the innovative lead of Blue Shield.

ELECTRONIC HOUSECALLS: NEW MODELS OF HEALTH CARE DELIVERY

New technologies and new uses of existing technologies will be invaluable tools in helping individuals attain optimal health. Within medicine itself, the introduction of imaging technologies such as the Magnetic Resonance Imaging (MRI) and Position Emission Tomography (PET), the use of laser and laproscopic surgeries, applications of ultrasound waves for viewing the intrauterine fetus, dissolving stones through lithotripsy, and many other major advances in high technology are clearly evident but at a very high cost. Within a health care system emphasizing health promotion and a pressure to lower medical costs while preserving quality of care, the telephone and computer are achieving much more sophisticated applications.

Actually, the telephone has been linked to medical issues since its inception. In fact, the first transmission over Alexander Graham Bell's "new voice line" was a medical call. On March 10, 1876, Bell's call was to his assistant, Thomas Watson, to help Bell after he had spilled acid on his skin! Now more than a century later, the telephone is assuming a role of increasing importance in health care delivery. Earlier we described the SCRIP programs at the Stanford Center for Research in Disease Prevention to use the telephone in conjunction with computer guidelines by nurses to intervene with advanced coronary heart disease. Similar projects are underway to work with truly addicted smokers as well as for the treatment of arthritis based on the pioneering work of Drs. Kate Lorig, Hal Holman, and James Fries at the Stanford University School of Medicine. Telephone care is an effective means of extending health care beyond the office,

clinic, hospital, or worksite in the form of a telecommunications house call.

Writing in the *Journal of the American Medical Association* in April of 1992, Dr. John Wasson¹¹ and his colleagues at the Dartmouth Medical School worked with 497 men who were 54 years or older using clinician initiated telephone calls to reach out to these patients. Men were randomly assigned to a group who received three telephone contacts per year plus more frequent face-to-face contact while the second group followed the usual care recommended by their doctors. After two years, the men receiving telephone calls to follow up on their care had fewer clinic visits, used less medication, had fewer admissions and shorter stays in the hospital, and less intensive care days, and expenses for these patients were 28% less for the two years. Overall, the researchers concluded that it is effective to substitute telephone care for certain costs.

Using similar approaches, there is a burgeoning of applications of using telephones, computer guidelines, and with nurses and other health care providers using the telephone as an "electronic house call." Among these highly significant innovations are computer-assisted psychotherapy in the form of a Therapeutic Learning Program (TLP) developed by psychiatrist Dr. Roger Gould in Santa Monica, California. Preliminary data from this approach indicates that patients do better more rapidly and are actually more revealing to the computer-interactive system than with face to face therapy. In a September 1992 issue of the *Journal of the American Medical Association*,¹² Dr. Steven E. Locke of the Harvard Medical School published an innovative study using computer-based interviews to screen blood donors for the HIV virus for AIDS. Interviews took only eight minutes and were more effective than standard questionnaires and interviews. Clearly such an application would offer even greater safety for the national blood banks.

Working in San Francisco, Dr. Albert R. Martin and his colleagues at Interpractice Systems have worked together with the Harvard Community Health Plan and H. Ross Perot's former company EDS to develop a computer system to link a patient's home to a central clinic. Based on preliminary studies, these patients required less actual clinic visits, cost the Harvard Community Health Plan less to provide care, and most significantly, the people themselves experienced a greater sense of satisfaction with what they perceived as a higher quality of care. Another innovative application is with patients after a heart attack, or stroke, or coronary bypass surgery to help them return to work. Research by Dr. Robert F. DeBusk, Professor of Medicine and Director of the Cardiac Rehabilitation Program at Stanford University School of Medicine, has focused on contacting patients in the hospital as soon as possible during their recovery and have nurses follow up with the people by telephone after discharge from the hospital. To date, his preliminary research indicates that it is possible for people to return to work sooner, at a higher level of activity, with less subsequent problems, and at a much lower cost.¹³⁻¹⁵ Surely such an intervention is of great benefit to both employers and employees who most often

Table 1

Characteristics of Evaluation of Worksites Health Promotion and Disease Prevention

Study	Purpose of Evaluation	Sample Size	Types of Workers	Comparison Group	Evaluation Period	Outcome Measures	Evaluation Design	Subject Self-selection?	Findings
Canada & North America Life ^a (1982)	Assess health care utilization changes after institution of employee fitness program	Experimental: 392 Control: 142	Employees at Canada Life who attended 3 fitness evaluations (392 out of 1,487)	Yes	1 year	Insurance data on hospital admissions and 4 categories of medical claims (ECG, obstetrics, orthopedics, other)	Pre/post with participants vs. nonparticipants	Analyzed costs of participants vs. nonparticipants at same company	Participants had fewer hospital days and fewer medical claims
Tenneco ^b (1984)	Study relationship between exercise and job performance	3,231 Tenneco employees (81% of eligible)	Management: 561 Professional: 1,265 Clerical: 1,078 Other: 327	No	6 months	Job performance	Compare exercisers to nonexercisers correlating 3 levels of exercise adherence	Self-selected	Exercise and job performance related especially for female, non-exercisers; positive relation between exercise and job performance for "management" and other categories
Prudential ^a (1984)	Examine impact of worksite-based fitness program on fitness levels, medical costs, and disability costs	Disability study: 184 Major Medical Study: 121	Most were "white-collar workers" with "sedentary jobs; only employees enrolled in fitness program	No	Disability: 5 years Medical: 1 year	Disability days; major medical costs	Pre/post longitudinal design	Self-selected	Fewer disability days (43% less); lower major medical costs (46% reduction)
Blue Cross/Blue Shield, Indiana ^a (1985)	Compare health care utilization of participants vs. nonparticipants in worksite health promotion	Participants: 687 Nonparticipants: 692	All headquarter employees of BC/BS of Indiana who completed an HRA	No	5 years	Health care costs determined from claims records	Three month baseline; participants at 7 time periods	Analyzed costs of participants vs. nonparticipants	Participants had lower health care costs (76%); program savings ratio of 2.51 to 1.00
Blue Cross, California ^a (1985)	Evaluate health education program aimed at reducing unnecessary outpatient visits	5,191 employees	Employees from 22 employers	Yes	15 months	Self-reported physician visits	Pre/post "quasi-experimental," "staggered intervention"	Self-selected	Reduced number of visits
Tenneco ^b (1988)	Compare illness and absenteeism rates, and medical care utilization rates for exercisers and nonexercisers	Exercisers: 221 Nonexercisers: 296	A one-fifth random sample of employees at 2 Tenneco divisions in Houston, Texas	No	1 year	Number of sick hours; medical care utilization rate	Pre/post with participants vs. nonparticipants	Analyzed costs of participants vs. nonparticipants	Participants had fewer sick hours and lower non-hospital costs; participants had a higher utilization rate
Johnson & Johnson ^b (1986)	Assess an effort to increase regular exercise as a part of overall "Live for Life" program	Experimental: 2,600 Control: 1,700	All eligible Johnson & Johnson employees at 4 worksites	Yes	2 years	Daily energy expenditure estimates, maximal oxygen consumption; self-report and rating of exercise activity	Experimental group received health screen plus program; control received health screen only	Volunteers plus random sample of nonparticipants at baseline and at two years	Participants had a greater increase in daily energy expenditure in exercise, self-reported ratings
Johnson & Johnson ^b (1988)	Examine relationships between exposure to a comprehensive worksite health promotion program and health care costs and utilization	Experimental: 5,192 & 3,259 Control: 2,955	In experimental groups, 61% and 56% were salaried; in control, 48% (controlled for in analysis)	Yes	5 years	Medical costs and utilization	Experimental group 1; program in place more than 30 months; Experimental group 2: 18-30 months; Control: no exposure	Entire worksite	Experimental groups had lower increases in inpatient costs, hospital days, and admissions
Northern Telecom ^a (1986)	Evaluate "Health Enhancement Program" (HEP) for lifestyle-related costs and impact of HEP on lifestyle behaviors	Not available	All Northern Telecom employees	No	1 year (1984-1985)	Smoking prevalence; observed seat belt use; overall medical costs	Pre/post	Self-selected	Lifestyle contributed significantly to medical costs (CHD at 9.5%); smoking declined from 29% to 18% over 6 months; seat belt use increased from 45% to 79%; medical costs remained constant or declined over 1 year; estimated annual savings of \$3.7 million
AT&T ^b (1986)	Measure effects of program on employee health status, health-related attitudes, and behaviors toward the company and work	Study sites: 1,198 Comparison: 1,673 & 1,425	Randomly selected employees of AT&T in a Kansas City facility and one entire worksite in Bedminster, New Jersey	Yes	1-year appraisal only; 1 with no treatment	Biometric data, risk calculations, health- and job-related attitudes, self-reported; days absent from work	Pre/post with 2 comparison groups	70-82% participation in experimental sites; selected random samples of controls	Lower health risks; changes toward more positive attitudes; gains in positive health behaviors
AT&T ^b (1987)	To determine the reduction of aggregate risks (and associated costs) for cancer and heart attack over the 2-year study period	Experimental: 1,623 Control: 1,673	Wage and salaried	Yes	2 years	Health risk appraisal; smoking rates; exercise levels	Quasi-experimental at 2 worksite locations and 1 control site	Entire worksite	TLC participants reduced health risks; physical exercise increased, smoking decreased; cost benefit of \$312.2 million if TLC reached all 100,000 AT&T employees
Control Data ^a (1987)	Assess impact of the CDC "StayWell" program on risk status, medical costs, utilization, and absenteeism	Demographics on 50,000 employees, participant records on 35,000, HRA on 12,000 claims data, and absenteeism data on 17,000	All CDC employees	No	6 years (1980-1986)	Participation and adherence, risk factors, medical costs, costs and benefits of programs	Link HRA, employee health surveys with claims and personnel records with subsequent use and costs of medical care	Nonrandom samplings and self-selection bias	Reduced claims and absenteeism: smokers evidenced 18% higher medical costs; hypertensives are 68% more likely to have annual claims in excess of \$5,000; non-seabell users spent 54% more days in hospital; savings due to reduced medical claims and absenteeism was \$1.8 million
Tenneco ^b (1987)	Compare turnover before and after opening of Tenneco Fitness Center in 1982	1,788 new hires from 1978-1981; 1,360 new hires from 1982-1985	All Tenneco employees	2 cohorts compared	7-year interval	Job turnover	Compare new hires cohort before and after 1982	No	Exercise had less turnover; relationship between exercise and retention highest for female, non-exempt (clerical) employees; turnover pattern similar before and after 1982

Study	Intervention	Control	Follow-up	Outcomes	Notes
BlueCross/Blue Shield TM (1988)	Impact of health promotion on employee risk factors, absenteeism, and insurance utilization per site	6 state BC/BS programs ranging from 746 to 1,559 participants	No	From 1 year to 5 years	Health risk appraisal; smoking; weight; absenteeism
Johnson & Johnson SM (1988)	Assess results of the smoking cessation program of the overall Johnson & Johnson "Live for Life" health promotion program	Experimental: 1,389 continuously employed individuals; Control: 748 continuously employed individuals	Yes	2 years	Smoking status (self-report); thiocyanate (SCN) used with self-report but not used to validate
Tenneco SM (1988)	Determine relationship between exercise and injury prevalence	6,104 employees	No	2 years	Injury prevalence
Coors Company SM (1989)	Evaluate health and cost-effectiveness of a cardiac rehabilitation program	180 post-coronary employees	No	6 years	Wage savings; cardiac rehabilitation savings; exercise treadmill savings
General Mills SM (1989)	To compare health risk, medical costs, and absenteeism of employees before and after the "TriHealthalon" health promotion program	1,200 invited Experimental: 685 Control: 341 Unassigned: 174	Yes	2 years	Health risk appraisal; medical costs; absenteeism
DuPont SM (1990)	Effect of a comprehensive health promotion program on absences among full-time employees in a large, multi-location company	Experimental: 4 sites with 29,315 employees Control: 19 sites with 14,573 employees	Yes, 19 control sites	2 years	Disability days
General Motors SM (1990)	Determine effect of programs to reduce CHD risk through weight and smoking classes; 4 levels of intervention intensity	Total of 7,804 employees in all 4 sites	Yes, 1 control site	3 years	Smoking cessation enrollment; weight reduction enrollment; reduction in overall CHP risk
Southwestern Bell Corporation SM (1990)	Determine effect of introducing a health care PPO triple option "Customcare" on overall medical utilization; determine proportion of claims experience that is attributable to lifestyle habits and risks	Total of 87,000 workers and approximately 70,000 dependents and early retirees; 43,000+ employees "in network"; 30,000+ employees "out of network"	Yes	5 years	Claims costs 1985 through 1990; change in utilization patterns; PPO-HMO migration; Johnson & Johnson "Lifestyle Claims Analysis" (LCA) by multiple regression
Johnson & Johnson SM (1990)	Effect of comprehensive health promotion program on work related attitudes of employees	Experimental: 1,019 Control: 586 Measured at baseline and at 1 and 2 years	Yes	2 years	Six employee attitude scales: organizational commitment, job involvement, growth opportunity, supervision, working conditions, and job competence; 4 single item measures: respect from family, coworker relations, pay/benefits, job security
Johnson & Johnson SM (1990)	Study of the absenteeism experience of 2 groups of Johnson & Johnson employees	Experimental: 1,406 Control: 487	Yes	3 years	Adjusted mean levels of absenteeism annually and over 3 years
Travelers Insurance SM (1990)	Employee absenteeism after 1 and 2 years membership in a worksite fitness center	2,232 insurance company employees	No	2 years	Mean number of absences due to illness at 1 and 2 years

Fewer claims and lower costs; assumed increase in life expectancy and retirement benefits created negative cost benefits; participants exhibited reduced blood pressure; decreased serum cholesterol; weight reduced; increased smoking cessation; lower average medical payments

More smokers quit in intervention sites (25%) than controls (17%); not statistically significant; high risk CHD smokers quit at intervention sites (32%) vs. 13% at control sites

Exercisers had lower annual medical costs; exercisers did not experience any more injuries; for employees over 50, medical costs decreased as level of exercise increased

Wage savings: \$1,078,588
 Rehabilitation: \$ 226,198
 Treadmill: \$ 85,905
 Total: \$1,390,661
 Savings over 6 years

After 1 year: medical costs up 20% for participants and 24% for nonparticipants (not significant); participants smoking declined from 21% to 13% in 9 months; participants exercising up from 48% to 80%; participants had 19% reduction in absenteeism vs. 69% increase in nonparticipants; after 2 years, above trends continued TriHealthalon paybacks of \$3.10 in year 1 and \$3.90 in year 2 for each program dollar; seat belt use increased from 44% to 81%; percent of people with high diastolic blood pressure decreased 15% to 10%

Blue-collar employees at intervention sites had 14% decline in disability days vs. 5.6% decline for controls; total of 11,726 fewer net disability days; return of \$2.05 for every program dollar by end of the second year

In the 2 "counseling" sites employee participation was 46% in smoking cessation and 54% in weight reduction; without counseling, engaged only approximately 10% of employees in weight and smoking reduction

Preliminary data to date confirm effectiveness of managed care program in savings; lifestyle claims analysis (LCA) identified specific areas of lifestyle diseases to be addressed through the SEC comprehensive health promotion program ("Good Life"); medical costs for Customcare employees rose 7% in 1989 and less than 10% in 1990 vs. corporate national average of 20.4% in 1989 and 21.6% in 1990

Employee attitude changes at intervention sites greater and more favorable; significant positive changes on: organizational commitment, supervision, working conditions, job competence/ security, pay/benefits

Adjusted mean levels of absenteeism declined and were lower (P<.01) in final year for wage earners; no significant difference for salaried personnel

Both men and women's absenteeism decreased by 1.2 days; women's decreased more; greater decrease in year 2 than year 1; decrease related to level of participation

Table 2

Characteristics of Evaluation of Worksite Health Promotion and Disease Prevention Programs

Study	Purpose of Evaluation	Sample Size	Types of Workers	Comparison Group	Evaluation Period	Outcome Measures	Evaluation Design	Subject Self-selection?	Findings
Blue Shield of California ^a (1985)	Evaluate a workplace health education program to reduce unnecessary outpatient visits; program of Blue Shield titled "It's Your Choice" to help employees make better decisions regarding medical care	Total of 5,200 workers from 22 Northern California worksites; all employees attended a lecture, received self-help books, and completed a self-administered questionnaire	All levels of employees ranging from blue-collar to white-collar in nongovernment employment	No comparison group	15 months	Medical visits per household for the 15 months of the intervention	Quasi-experimental, staggered intervention design involving 8 different cohorts with before and after (pre and post) comparisons; statistical adjustments for seasonality and other identified intervening variables	Yes	Visit rates for insured households were reduced by 17% (p=0.001) or 2 visits per household per year, reductions at all ages, education, and most reduction in households with first dollar fee for service coverage; copays had less reduction and no change with HMOs; minimal, self-care program can reduce outpatient medical visits
Travelers Insurance ^a (1990)	Conduct an analysis of comprehensive health promotion program for all eligible employees of a major insurance carrier in the "Taking Care" program	36,000 employees and retirees nationwide; also, employees (10,000) with access to the Taking Care Center (TCC) fitness center in Hartford, Connecticut	Predominantly white-collar with gray- and pink-collar workers included	No; all employees had access to at least the mass communication program	1988-1990 (4 years) with benefit-to-cost ratios projected to the year 2000	Program costs for personnel, capital expenses, materials, rent, and pension liability were determined; these were compared to program impact of medical costs including cost savings, increased productivity, decreased absenteeism, decreased life insurance claims, and program generated income	Longitudinal tracking and multiple year comparisons of costs and benefits of the comprehensive program over 4 years	Yes	After adjusting future monies to net present value, a benefit-to-cost ratio was estimated to be 3.4 for the "Taking Care" program; "hidden" cost of health promotion for pension liabilities was included in this ratio; TCC membership had 1.2 fewer days absent; reductions in projected death rate were .17 deaths per 1,000 or 6 employee lives per year for each of the next 10 years; membership fees generated \$662,000 in 1990 or \$179/employee; in total, a net cumulative benefit of over \$146 million is accrued on an overall investment of \$57 million over 15 years; return on investment of \$3.4 for every dollar spent on program
DuPont ^a (1990)	Needs assessment, design, implementation, and preliminary evaluation of comprehensive workplace health promotion program	110,000 U.S. employees	White-, gray-, pink-, and blue-collar employees in more than 100 U.S. locations	No	6 years	Employee absenteeism, morbidity, and mortality	Pilot study in one location; not a research study per se but overview of program planning and implementation with examples from pilot project outcomes	Yes	A 47.5% decline in hourly employee absenteeism over 6 years vs. a 12.5% decline in total DuPont hourly work force; good overview of program planning and client future areas: spouses, sales personnel, shift workers, small sites, integrating health promotion with medical, safety, EAP, and benefits; continue evaluation and documentation
DuPont ^a (1990)	Evaluate the relative efficacy and cost-effectiveness of a stop smoking clinic and self-help kit and characteristics of those who benefited most from each; program is the American Lung Association program	1,400 eligible employees in a large office complex; 110 attended orientation, 75 signed up for the program, 70 completed the program	White-collar office and clerical workers	No	18 months	Quit rates and cost per participant	Pre and post assessment with subjects serving as their own controls over 18 months	Yes	Combined quit rate for the two groups was 17% at 18 months; cost was twice as high for the clinic (\$32 vs. \$16), but cost per quitter (Appx. \$150) was same for both
First National Bank of Chicago ^a (1991)	Determine health and cost-effectiveness of an onsite prenatal education and gynecological program at a major bank; programs included the March of Dimes "Babies and You"	Over 100 women in the prenatal classes in 1989; over 400 onsite gynecological exams from 1985 to 1990	All eligible female employees	No	5 years (1985-1990)	All but two of the most common surgical procedures of First Chicago are directly related to women: Caesarean section, normal deliveries, laparoscopy, and dilation/curettage (DC)	Longitudinal trend analysis	Yes	Caesarean section rate was 25% in 1987, 35% in 1988, and dropped to 19.5% in 1989 after implementation of the program with second opinion; concluded that the programs provided "cost-effective" health care
First National Bank of Chicago ^a (1991)	Test the efficacy of a medical claims data system; included occupational, inpatient, outpatient, and HRA data for employees, dependents, and retirees	15,000 employees of the bank	All eligible employees, dependents and retirees	No	4 years (1986-1990)	Data access and processing of the Occupational Medical Nursing Information System (OMNIS)	Longitudinal trend analysis	Not applicable	Immediate access by authorized users is provided for more than 30,000 current and former employees; data base can be constantly updated and grows with updates, new information, and daily recording of new services
First National Bank of Chicago ^a (1991)	Assess the impact of an onsite employee assistance program (EAP) with four components: 1) EAP/wellness program, 2) psychiatric hospital utilization review, 3) consulting psychiatrists, and 4) benefit plan design changes. EAP established in 1979 and expanded in 1989	All employees; approximately 12,400 in the medical plan	White-collar	No	4 years (1984-1988)	Mental health costs; percent of total medical costs, dollars per employee; inpatient mental health; total dollars, dollars per 1,000 employees, number of admissions, average length of stay, and inpatient days; psychiatric short-term disability; number of events, days absent, and days/event	Longitudinal trend analysis	Yes	Overall result of the 4-year evaluation indicates: reduction in inpatient psychiatric hospitalization costs, reduction in average length of short-term disability episodes, and better "overall management of mental health care costs"
General Motors ^{a,c} (1990) and (1991)	Evaluate the medical and cost benefits of a worksite blood pressure control program consisting of worksite monitoring and counseling	Three sites (N=183 to 367 employees/sites)	All eligible employees	Yes; control site of 168 matched employees who had received no post-screening follow-up or monitoring	4 years	Blood pressure, medical care claims, costs of program expressed as cost-benefit ratio	Longitudinal study with matched controls and subjects serving as pre- and posttest	Yes; hyper-tensive at voluntary screening	Cost of medical claims for hypertensives was lower in the 3 intervention sites compared to the control; no significant differences across sites in claims for normotensives; after adjusting for 1982 dollars, the data showed a reduction of \$1.89 to \$2.72 for every dollar spent on the program

General Motors ^a (1991)	General Motors ^b (1991)	Blue Shield of California and Blue Cross/Blue Shield ^c (1992)	Coors ^d (1992)	Bank of America ^e (1992)	Bank of America ^f (1992)	Georgia-Pacific Corporations ^g (1992)	Postal Employees ^h (1992)
Compare 4 different interventions aimed at controlling high blood pressure, obesity, and smoking	Compare health care costs for treated hypertensive employees, vs. controls, vs. normotensives	Determine impact of 2 low-cost, minimal intervention, mail-based health promotion programs for adults and senior adults	Implement a voluntary program focused on multiple risk factor reduction for cardiovascular disease (CHD) at the worksite	Evaluate relationship between health risks and medical care costs with a group of retirees	Evaluate by randomized trial a health promotion program using risk assessment and mailed materials to a geographically dispersed group of retirees	To determine both the health and cost-effectiveness of different models of delivering a total cholesterol reduction program	Conduct a health and cost outcome study of a pre-employment drug screen program for government employees
2,300 employees at 4 sites	1,235 employees at 4 sites (3 experimental sites; N=163 to 367 employees and one control site; N=163)	103,837 subjects enrolled in "Healthrac" and "Senior Healthrac" from Jan. 1, 1986 through Jan. 1, 1991	692 employees (52% of eligible) in "Lifecheck"; voluntary, 8-week program to reduce CHD risk; at worksite to all eligible employees with classes, one-on-one counseling, and fitness facilities	1,558 Bank of America retirees; tracked between January 1988 and April 1989	5,686 Bank of America retirees	3,202 employees of Georgia Pacific Corporation focus on cholesterol reduction ranging from 1 to 3 months	Three studies: 1) a prospective study of 160 hospital workers with weak results; 2) prospective study of 2,537 postal employees in Boston; and, 3) prospective, multi-site, blind study of 4,396 United States Postal Service employees
White-collar, clerical, and manufacturing	White-collar, clerical, and manufacturing	Cross-section of adult U.S. population	All eligible employees at Coors	All eligible retirees from all employment levels of Bank of America	All eligible retirees from all employment levels of Bank of America	All eligible employees	All eligible U.S. Postal Service Employees for pre-employment screening
Yes	Yes	No	No	No	No	Yes: 4 intervention groups with interventions of 1 to 3 months and 1 control site	No
3 years	Follow-up at 4 years after program	5 years	1 year	1 year	1 year	1 to 3 months	1 year
Percent change (reduction in high blood pressure, obesity, and smoking)	Medical claims for hypertensives vs. normotensives	Improved health risk scores over 18 months, of 14.7% over 65, of 18.4% under 65; at 30 months, improvements were increased to 18.6% and 25.7%, respectively; improvement in all targeted risks: smoking, dietary fat, salt, fiber, stress, alcohol, cholesterol, and exercise but not pounds over ideal weight (all p<.001)	Decreases in systolic blood pressure, total cholesterol, weight, physical activity, and risk of ischemia within 8 years as measured by the Framingham score (p<.05)	Decrease in smoking, excessive drinking, excessive body mass, and increased seat belt use; were related to major decreases in medical care costs; (range of significant p values in two-tailed tests)	Full program produced positive outcomes in 31 of 32 comparisons with 19 at p<.05 and 13 at p<.01; health risk scores fell 4.3% in full program and rose 7.2% in questionnaire only control group; 12 month retention was very high at 84%	Reduced total cholesterol; costs of each of 5 groups of employees for program delivery and control	First study (hospital) had weak association between drug screen and adverse employment outcomes; second study (Boston) indicated that marijuana positive had relative risk of 1.55 turnover, 1.85 of injury, and 1.55 of disciplinary action; mean absence rate was 7.1% for users vs. 4.4% for nonusers; third study (U.S. Postal) found drug use positives associated with 6.63% absenteeism vs. 4.16% with nonusers
Quasi-experimental design with 4 plant sites randomly assigned to treatment and control	Quasi-experimental design with 3 treatment sites and 1 control site	Prospective, longitudinal observational study with subjects serving as their own controls (followed for minimum of 6 months up to 30 months); no randomized control group	Participants as their own control in pre-post test design; no control group; total of 499 employees (72% of eligible) completed the follow-up screening	Self-selected sample who completed baseline and 12-month follow-up on "Senior Healthrac"; 1,558 comparable to 2,000 who elected not to participate; pre- and posttest with no control group	Randomized controlled trial	Case control design with 5 groups: Group 1 control; Group 2 had 1-month educational program; Group 3 same program, plus incentives; Group 4 had 3-month educational program; and Group 5 had same as 4th group, plus incentives	Pre and post design with subjects serving as their own control.
Risk-based screening for eligibility	Hypertensive men and women	No	Yes	Yes	No	No	No: Mandatory pre-employment drug screening
Short-term interventions through screenings only (Site 1) or education only (Site 2) were less effective than adding follow-up counseling (Site 3) plus social organization (Site 4)	Medical care claims cost for hypertensive workers at treatment sites were lower than costs at control sites; costs for matched normotensive workers did not differ across sites; 4 years after program termination, the cost benefit ranged from \$1.89 to \$2.72 for each \$1 invested in programs	Low-cost, low-impact programs can be practically applied to large populations; positive trends increase over time; changes in senior people as great as younger ones; effects equal in all socioeconomic classes	All services free to employees except A12 for lipid panel and glucose. Excluding the evaluation budget, the program cost \$22,163 or \$32 per participant; evaluation cost \$42,678; targeting employees with multiple risk factors for long-term intensive risk modification programs may decrease future medical costs	Savings were calculated with range of \$372 to \$598 direct cost savings; total savings of approximately \$4,296 per person per year; first longitudinal data relating health habits to medical costs in a senior population	Total direct and indirect costs decreased by 11% in the experimental group and increased by 6.3% in the controls; claims data confirmed these trends: a low-cost, health promotion program can reach highly distributed group of retirees resulting in health improvement and has potential to decrease medical utilization	Groups 3 and 4 had the highest percentages (28% and 33% of borderline high-risk and high-risk employees who reduced cholesterol 10% or more; initial and second screens cost \$5.14 and \$8.49 per employee; intervention costs ranged from \$6.33 per employee (Group 2) to \$31.71 (Group 5); Groups 3 and 4 were most cost-effective means of lowering cholesterol; Group 5 was the least cost-effective	In all three studies, the associations between positive drug tests and turnover, injuries, absenteeism, or accidents was weak; cost-benefit analysis of the U.S. Postal Service study was flawed; cost-benefit analysis in the Boston study indicated drug testing would save approximately \$163 per new hire employee; cautions noted regarding laboratory quality and drug use prevalence in affecting the range of false positives

Table 2 (continued)

Study	Purpose of Evaluation	Sample Size	Types of Workers	Comparison Group	Evaluation Period	Outcome Measures	Evaluation Design	Subject Self-selection?	Findings
Treatwell ¹⁷ (1992)	Evaluate a worksite-based nutrition intervention program to create low-fat, high-fiber diets	16 worksites in Massachusetts and Rhode Island	All eligible workers at the 16 selected worksites	Yes	1 year	Dietary patterns by means of a semiquantitative food frequency questionnaire	Randomized, control study; cohort of workers at intervention sites were randomly surveyed pre- and post-intervention	No	Decrease in mean dietary fat intake was 1.1% of total calories in intervention sites vs. controls (p<.005); no differences in mean fiber intake; concluded that worksite, nutrition program can effectively influence the dietary habits of workers
City of Birmingham, Alabama ¹⁸ (1992)	Implement and evaluate a comprehensive, worksite based health promotion program under a National Institutes of Health (NIH) grant	Approximately 4,000 employees; Predominantly blue-collar	All eligible workers in the city government of Birmingham, Alabama	Yes	5 years from 1986 to 1991	Complete medical physical, computerized health risk appraisal (HRA); all employees received confidential copies of their own medical screens and HRAs	Randomized, control group design	No; participation was mandatory by the city for enrolling in its medical benefit plan	Among "street and sanitation" workers, there was decreased smoking from 53% in 1986 to 31.8% in 1990; decreased number of participants with cholesterol of over 200 mg/dl from 55.8% in 1986 to 44.3% in 1990; in 1986, 11.4% had blood pressure over 150/90 and decreased to 9.6% in 1990; comparable results for "parks and recreation" and "fire and reserve" workers; while the total number of employees increased from 3,586 in 1985 to 4,000 in 1990, the average medical benefit cost role total of \$28 per employee; costs per employee were \$2,097 in 1985 and \$2,075 in 1990; a mandatory, comprehensive health promotion program for predominantly blue-collar, city employees is both health and cost-effective
Treatwell ¹⁶ (1993)	Worksite-based nutrition intervention program to impact nutrients implicated in carcinogenesis (vitamins, trace metals, and fatty acids)	16 worksites with N=1,762 employees	Not indicated	Yes; 8 control sites and 5 intervention sites	15 months	Mineral intake, water soluble vitamins, oil soluble vitamins, fiber, alcohol, caloric sources, and fatty acids (omega-3)	Pre and post measures comparing control to intervention groups	No	Broader impact than on fat and fiber only; increased intake of carotene, vitamin A and B6, small decrease in calories from both saturated and monosaturated fats, and smaller increase in percentage of calories from polyunsaturated fatty acids
Minneapolis/St. Paul Metropolitan Area ¹⁹ (1993)	Determine impact of a worksite intervention for weight control and smoking cessation	Of 10,000 total workers, 2,041 in weight control and 270 in smoking cessation	Wide range of blue- and white-collar and clerical in government, finance, education, and manufacturing	Yes	2 years	Weight loss and smoking cessation	Thirty-two randomized worksites: 16 control and 16 intervention sites	No	Weight loss of an average of 4.8 lbs. and 43% quit rate on smoking. Net 2-year reductions in smoking prevalence in treatment vs. control were 4% and 2.1% in cross-sectional and cohort surveys, respectively; no significant treatment effect for smoking; cost of smoking program was \$1,500 for the two years and with 24 people who quit, program was determined to be cost-effective
California Public Employees Retirement System (PERS) and HealthTrac (Blue Shield of California) ²⁰ (1993, in press)	Determine impact of a low-cost, mail-delivered health promotion program conducted with active and retired California public employees	PERS intervention group: 54,902 compared to control group of 2,366	Active: 21,170; pre-Medicare retirees: 8,316; and seniors with Medicare supplement: 25,416	Yes; participants divided into "types of workers" then further subdivided into active with assessment and print materials at 6- to 12-month intervals vs. and compared to claims experience of control group	12 months	Health risk scores, change in risk behaviors, medical utilization, and claims costs	Randomized control with pre and post measures; approximately 800 individuals from each "type of worker" category was randomly assigned as a control population	No	Reductions in risk scores, risk behaviors, self-reported medical utilization, and medical claims; claim costs for participants were approximately \$8 million less to PERS or \$2.4 less with adjustment for outlier; self-reported data indicated decrease in doctor visits, hospital days, sick days, and home confinement
Bank of America ²¹ (1993)	To perform a 2-year randomized trial of a low-cost mail-delivered health promotion program to evaluate effects upon health risks and health care costs	5,686 Bank of America retirees	All eligible retirees from all employment levels of Bank of America	Yes	2 years	Health risk scores, self-reported cost savings, claims data cost savings	Randomized, questionnaire only and unobtrusive claims data only vs. full program	No	Overall risk scores improved by 12% at 12 months and 23% at 24 months compared with control; all age groups (55-65, 65-75, 75+) improved; cost reductions were 20% by self-reported (p<.01) and 10% by claims experience (p<.02); return on investment approximately 6:1
Arthritis Self-Management Program (General Population in 5 California Counties) ²² (1993)	To determine both the health and cost benefits of the Arthritis Self-Management Program, 4 years after participation	Volunteers (284) from the general population of 5 mid-California counties	General population (most but not all employed)	Yes; wait list control	4 years after completion of 6 weekly, 2-hour sessions in groups of 10-15 people on arthritis self-management with lay leaders	Pain, physical disability, costs, and valid self-administered instruments used to measure health status, psychological status, and medical care utilization	In 1984, subjects were randomized into ASPM vs. wait list control for 4 months; 1 year after ASPM, the 343 participants were randomized into another 6-week program, a bimonthly newsletter, or no reinforcement, 4 years after this second stage, 284 participants were evaluated again	Yes; arthritis patients only	Pain declined 20%; physician visits declined 40%; while actual physical disability increased 5%, no changes in costs; estimated 4-year savings were \$648 per rheumatoid patient and \$189 per osteoarthritis patient; health education in arthritis improves health and cost outcomes up to 4 years after participation
County of California ²³ (1993)	Implement and evaluate a back injury prevention program in 6 divisions of a northern California county; determine both health and cost effects	158 state employees	White- and blue-collar workers in parks and recreation, public works, and two county hospitals	Yes; a matched control county in another geographic area of California	1 year	Changes in CDC HRA, reduction in back injury and/or pain, reduction in risky behavior, and improved employee job satisfaction	Pre and post analysis before and after the 1-year program	Yes; back pain with 77% of the 205 eligible employees participating	"Modest" decline in back pain prevalence rates, significant improvement in job satisfaction and reduction of risky behavior, cost benefit analysis found net benefit of \$161,108 or a 179% return on investment

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A Review and Analysis of the
Health and Cost-Effective
Outcome Studies of
Comprehensive Health
Promotion and Disease
Prevention Programs at the
Worksite: 1991–1993 Update

Kenneth R. Pelletier

Methods, Issues,
and Results
in Evaluation
and Research

A Review and Analysis of the Health and Cost-Effective Outcome Studies of Comprehensive Health Promotion and Disease Prevention Programs at the Worksite: 1991-1993 Update

Kenneth R. Pelletier

Editor Note: This is the second in a series of articles authored by Dr. Kenneth R. Pelletier summarizing the results of studies examining the impact of comprehensive health promotion programs on health and cost. We received over 6,500 reprint requests for the first article, far more than we have received for any other article we have published. Dr. Pelletier updated the summary due to the tremendous response it received and due to the fact that 23 additional studies have been published since the first summary was printed. Our intention is to continue publishing updated summaries of the impact of comprehensive health promotion programs on health and financial outcome measures periodically, and to include all studies published in rigorous peer-reviewed journals. If we have missed a study, please send us a copy to include in the next update.

At the request of Dr. Pelletier, this article is dedicated to the memory of Dr. John (Jack) Erfurt of the University of Michigan for his innovative and pioneering research on worksite health promotion and disease prevention.

Kenneth R. Pelletier, Ph.D., is Director, Corporate Health Program, Stanford Center for Research in Disease Prevention, Stanford University School of Medicine, Palo Alto, California.

Send reprint requests to Dr. Kenneth R. Pelletier, Director, Corporate Health Program, Stanford Center for Research in Disease Prevention, Stanford University School of Medicine, 1000 Welch Road, Stanford, California 94304-1885.

INTRODUCTION

Since the publication of the first article¹ of this series in the *American Journal of Health Promotion* in 1991, there have been over 6,500 requests for reprints as well as a marked increase in the number and quality of health and cost outcome studies. Despite corporate downsizing and increased economic pressures, or perhaps because of these trends, there has been an increasingly focused sophistication in the conduct and analysis of worksite-based programs. According to the January 11, 1993 issue of *Business Week*, medical costs will exceed \$900 billion in 1993 with 51.7% paid by employers, 33.7% from the federal government, and 14.4% from states in medicare and medicaid. No wonder that large to small employers are being forced to face the task of appropriate managed care within a global budget plus an emphasis on patient demand reduction through health promotion and disease prevention programs.

From 1980 to 1991 there were 24 published studies evaluating the health and, in some cases, the cost benefits of comprehensive health promotion and disease prevention programs in the worksite. In those previous studies, all 24 indicated positive health benefits and every study which analyzed for cost effects and/or cost benefit demonstrated a positive effect. As one measure of the growth of interest in worksite programs as an integral, and arguably the single most important influence, in managed care is the fact that there were 24 new studies conducted between 1991 and the early part of 1993. More and better designed studies were conducted in the last two years than for the entire decade of the eighties. What is even more important is that the research design, data analysis, and intervention sophistication is greatly improved in these more recent studies. In reviewing the most recent 24 studies, all but one evidenced positive health outcomes. Again, of the studies which analyzed cost-effectiveness or cost benefits, every one indicated a positive return. When anyone cavalierly dismisses 48 studies with the glib dismissal of

"there is no evidence," they are simply ignorant of more than 13 years of increasingly sophisticated research with documentation of both health and cost outcomes.

Surely, the data supporting the health and cost-effectiveness of comprehensive worksite programs in health promotion and disease prevention are not definitive. However, it is important to bear in mind the fact that many accepted health and medical procedures, particularly surgery, have a much more limited research base in outcomes, often have no basis in cost-effectiveness or cost benefits, and are increasingly found to be deficient in both health or cost outcomes. Managed care or managed competition, with capitated payments, and perhaps a fixed global budget will place greater value on such data for all aspects of health and medical care. With this context and caveat clearly in mind, health promotion and disease prevention research is improving, and more recent studies utilize sophisticated, randomized, controlled trials. One outcome of this improved methodology will be to realize how deficient some earlier studies may have been. For instance, one of the "classic" studies by Blue Cross and Blue Shield of Indiana reported in my 1991 *American Journal of Health Promotion* article¹ has been reanalyzed by a team of most of the original authors.² (See Table 1 for studies cited in *American Journal of Health Promotion* 1991; 5(4):314-315.) Based on this reanalysis, Dr. John Sciacca and his colleagues found that program participation was not associated with reduced-medical care costs as originally reported. These researchers conclude, "It would be prudent to remain guarded about the health cost savings effects of worksite health promotion programs." That point was raised in my original article, has been articulated by such prominent researchers as Dr. Ken Warner of the University of Michigan and Dr. Jonathan E. Fielding of UCLA, and remains an important caveat. One last observation is that virtually all worksite programs to date have been focused on primary prevention. As both interventions and evaluations move into secondary and tertiary prevention areas, to be discussed in the next sections, it will be increasingly possible to prove or disprove both health and cost benefits given the more evident benefits and higher costs associated with higher risk and/or ill populations served by secondary and tertiary prevention programs. These new frontiers within the emerging managed care systems constitute a fertile area for innovative interventions accompanied by increasingly sophisticated health and cost outcomes from randomized, controlled trials.

MANAGED CARE: AN EMERGING CONTEXT FOR WORKSITE HEALTH PROMOTION AND DISEASE PREVENTION

Within managed care, with a renewed emphasis on demand reduction through health promotion, is the opportunity to create a true health care system rather than the current disease management industry. Beyond the specific outcomes in the studies cited in this 1993 update (see Table 2), it is important to consider the new context

of managed care as well as some of the most promising new directions which will constitute the future of health and cost-effective programs in the worksite. What follows is a series of innovations which do not constitute a definitive statement but do illustrate a new context and major new trends that will underlie the future studies to be included in later updates.

More significant and effective innovations in health promotion and disease prevention have taken place in worksites, from small to large, in the last 10 years than since the Industrial Revolution. Work environments are a mainstay in the generation of a true health care system because the workplace provides a site where it is possible to reach the largest number of people and their dependents, for the most years of their adult life, where both the individual and the employer has a vested interest in a person's health and well-being. According to the U.S. Health Care Financing Administration (HCFA), companies are currently spending 48.3% of their after tax profits on the provision of medical care for their employees plus dependents, and that figure is conservatively expected to increase to over 60% by the year 2000. As if that analysis is not alarming enough, Professor Regina Herzlinger, an influential medical economist at the Harvard Business School, has cited an even more startling fact based on her series of articles in the *Harvard Business Review*.³ That point is essentially, if you take the average rate of profitability of all of the Fortune 500 companies and project it into the future and then do the same with the rate of increase in their medical costs, the results are astounding. If current trends continue, in approximately five years these two lines will cross, meaning that all of the medical costs of the Fortune 500 companies will be equal to all of the after tax profits of those same companies. After that point, medical costs will actually begin to exceed their after tax profits.

Paying medical coverage is supposed to be an employee benefit, not the primary role of companies whose real mission is the profitable production of goods, services, and materials in an intensely competitive international market. Corporations, large and small, represent the single largest segment of the United States which has a vested interest in health if for no other reason than to eliminate excess costs in their products and services. Beyond the economic factors, the presence of health promotion programs at the worksite have demonstrated benefits in attracting and retaining key personnel, decreased absenteeism, enhanced productivity, improved public image of the company, and greater allegiance to the company by employees.

To incorporate is derived from the Latin word "incorpore" which means to take on a body. A corporation literally takes on a body which has a life and rights of its own. Within that body are the cells or employees who animate the body and are integral to its health or illness. Increasingly, the fact that healthy people equal a healthy business is being recognized as a fundamental underpinning for the successful company of the twenty-first century. With a grant from the MacArthur Foundation, Dr. Robert H. Rosen has founded Healthy Companies in Washington, D.C., based on his insightful book *The Healthy Company*.⁴

In his book, Rosen observed,

Healthy people make healthy companies. And healthy companies are more likely, more often, and over a longer period of time, to make healthy profits and to have healthy returns on their investments. So healthy people and healthy relationships are at the very core of success in business, but for too long the old fear-based hierarchical paradigms of management and of management-employee relationships have driven the way business is done in America. I might add that those old paradigms also have just about driven business into the ground.

Increasingly, the new model for business is one of healthy individuals within a healthy organization with respect for and contributions to a healthy community and environment. This is not unbridled altruism but a recognition of the inextricable interdependence of a company's health and those people who work in the organization.

STANFORD CORPORATE HEALTH PROGRAM

To address these issues, a program was initiated with a grant from three foundations in 1984 and evolved into the Stanford Corporate Health Program within the Stanford Center for Research in Disease Prevention at the Stanford University School of Medicine. This program is a collaborative, research effort between the university and 22 major corporations, including Amdahl, Apple, ARCO, AT&T, Bank of America, Chevron, Hewlett-Packard, IBM, Johnson & Johnson, Levi-Strauss, Lockheed, Shaklee, Syntex, and Xerox. Medical and personnel directors of these companies meet with university faculty on a regular basis to "develop and evaluate innovative health and medical programs." Over the last eight years we have worked together in very small projects such as one of the first studies of bringing mobile mammography vans to the worksite all the way up to a highly complex study over five years of an innovative managed care plan for over 80,000 employees of a major telecommunications company. Together we have created a knowledge and database for companies to make better decisions on how to allocate their annual medical budgets between treatment and prevention.

Looking into 1993 and beyond, there is an invaluable addition to the collaboration between corporations and universities in this vital area. That innovation is the inclusion of insurance carriers and medical providers in the projects. That may seem obvious, but in reality, too many efforts in health promotion and in managed care have focused too heavily on legal and financial strategies. All too often, hospitals and clinics providing the care are treated as the enemy while the physicians, nurses, therapists, and other clinicians see the managed-care experts running these organizations as interfering with their clinical practices. That is an artificial and time-wasting, adversarial relationship which does not serve any produc-

tive purpose. By contrast, new alliances are being formed to create truly innovative solutions rather than arguing over preserving the status quo or to simply tinker with an obsolete system. One such project was reported in a September 1992 issue of *The New England Journal of Medicine*.⁵ That article cited a new consortium in Minneapolis, long a center of innovation in managed care, of employers and health providers who purposed to work together to resolve their mutual problems. Among the companies are Dayton Hudson and General Mills, working with medical care providers ranging from the Mayo Clinic to local health maintenance organizations or HMOs. These corporations will work with these providers of care to improve the health of their more than 125,000 employees and dependents. Their plan includes a "newly established institute [which] will develop guidelines for practice aimed at reducing variation in practice patterns and eliminating unneeded care." Hopefully the health and cost-effectiveness of health promotion programs will be an integral part of this institute but that remains to be seen. While this consortium is obviously new and untested, it represents a major positive step of employers and providers working together for mutual benefit.

Within the Stanford Corporate Health Program, there is also a major new direction in 1993 toward a working alliance of companies, universities, and providers of medical care. During the first years of the program, all providers of care were explicitly excluded to prevent any marketing or sales activities which would cloud our research objectives. However, it is increasingly clear that the next stages of creating healthy worksites for healthy people will result from collaboration, not competition or antagonism. Toward that end, Blue Shield of California working with a national consortium of Blue Cross/Blue Shield Plans and also Kaiser Permanente have become increasingly active members in working together toward common solutions. That is an exciting and major new direction with new programs being developed in using nurses and computer interventions for advanced heart disease, new programs oriented specifically to women and retirees, and many other innovations. Together these collaborative efforts will enhance the individual efforts of all working people to work in a company to enhance and support the individual practices so both can attain optimal health.

COMMUNITY-BASED HEALTH PROMOTION

Communities will be increasingly seen as health cities. Individual changes are both easier to generate and to sustain in a supportive family, worksite, and community. During the mid-1970s, Dr. John W. Farquhar and his colleagues at the Stanford Center for Research in Disease Prevention of the Stanford University School of Medicine developed the first intervention and evaluation models for working with entire communities to enhance health. That initial project is the classic and much emulated "Three Community Study,"⁶ which focused on an inexpensive, communitywide intervention to reduce cardiovascular risk

in three small cities in California. Such a comprehensive approach uses the medical care system, local regulations such as no-smoking laws, environmental factors, and changes in personal behavior to elicit and sustain healthy lifestyles in an atmosphere of social support.

Building upon the success of this initial study, Dr. Farquhar and his colleagues launched the even more innovative "Five-City Project" reported in a July 1990 issue of the *Journal of the American Medical Association*.⁷ This study was 14 years in duration and compared the effects of the community intervention in two cities of 122,800 people versus two control cities of 197,500. Interventions consisted of media education about heart disease risk; four to five education programs per year focusing on specific risks such as smoking and cholesterol; community classes and contests; as well as one-to-one counseling. There were special programs in Spanish, and school-based programs for grades four, five, seven, and 10. Although a detailed description of the intervention is beyond the scope of this introduction, it is one that can and has been replicated in other communities. Following the first five years of intervention, the researchers reported reductions in cholesterol, blood pressure, pulse, smoking, heart disease risk scores, as well as a 15% reduction in total mortality risk scores. Among the conclusions in this landmark study are that these community approach outcomes "support the effectiveness of community organization and multifactor health education, delivered through multiple channels, in reducing certain chronic disease risk factors at a reasonable cost.... The anti-tobacco effort of the past 25 years in the United States may serve as a prototype for the potential effects of long-term, consistent health education in changing social norms beneficially." Although the decreases in risk were acknowledged as relatively small but significant and the focus was upon heart disease prevention, the Stanford Five-City Project has generated an invaluable model which can be implemented in a community to elicit and sustain individual efforts to achieve optimal health.

Nationally, two other complex and equally well-tested programs have been conducted in the Minnesota Heart Health Project with six cities totaling 356,000 people and the Pawtucket Heart Health Project in two Rhode Island cities with a population of 173,000. Together these three studies include a total of 13 cities and over 890,000 people. Combined results of these studies are indeed significant given the number of people, diversity of geographic location, and demonstrated effectiveness. With such significant numbers of people involved, these community-based programs create an essential base for the low-cost implementation of a true health care system. Given these results, Dr. Farquhar and his colleagues have concluded, "The cost of such national programs is moderate, but the cost of *not* launching such programs is to accept the notion that the energies of communities cannot be harnessed for planned social change for health benefit." Although most programs are in the United States, there is a clear indication that community programs are applicable internationally. Among the best known projects are the

North Karelia Project in Finland, a project in three small rural towns in South Africa, a four-community program in Switzerland, and an Australian study involving three towns.

Turning to one last innovative model of community health programs is a very unique and significant program in Birmingham, Alabama.^{53,54} This program is somewhat different than the previous studies in that it is worksite focused rather than communitywide, but it does include all of the approximately 4,000 employees of the city of Birmingham. That city as well as every city and employer in the United States has had to face the consequences of unchecked escalation in medical costs by having to pay higher premiums and sacrificing other benefits like salary increases, by cutting back on coverage, or dropping medical insurance altogether. In September of 1985, the city of Birmingham received and matched a \$1.5 million grant from the National Institutes of Health. With that total of \$3 million, the city implemented an integrated system of health promotion programs for active employees and their dependents.

What is most remarkable about the plan is that participation was required in order to be eligible for the medical plan. If an employee declined to participate, he or she did not have access to the medical insurance screening which launched the five-year program. Conducting the actual interventions was R. William Whitmer, President and CEO of "Wellness South" in Birmingham, and his team of psychologists, physicians, and nurses. During the five years of the program there were major reductions in all risk factors, occurrence of illness, and reductions in mortality. Beyond these clinical outcomes are the most impressive indications of the cost-effectiveness. In 1985, the medical costs per employee was \$2,050 per year or \$300 per year above the national average. By the end of the demonstration phase of the program in early 1991, Whitmer and his colleagues reported, "The fact that the city had no increase in the per employee cost of medical benefits over the five-year period is the most important indication of program impact."⁸ Considering the completely uncontrolled escalation of medical costs in the United States during that same time period, this is a major result.

Based on the success of the Birmingham program, there are four important aspects which are unique in the sense that they are not included in other comprehensive health promotion programs. Given the significance of this project, it is increasingly likely that these will be integral aspects of both the community and worksite programs of the future. These four dimensions are:

1. Screening all employees as a prerequisite for medical coverage. Of course, an employee had the option of not participating and seeking his or her own medical care independently. Any mandatory participation is inevitably controversial, but it is certain that future programs will include some form of required participation or individuals will be able to exercise their choice by finding their own coverage or paying a higher premium for coverage.

2. Aggressive physician referral was necessary for 13% of employees found to be at high risk. For the majority of employees, the risk was for heart disease and underscores the importance of community heart disease prevention programs as well as the Stanford Coronary Risk Intervention Program (SCRIP).⁹ (This project is described later.)
3. Assistance in establishing a strong patient and clinician relationship. All too often, it is assumed that people understand their medical plan and have a sound relationship with their physician and other providers. That was not the case in Birmingham where over 40% of the employees did not have an active relationship to their doctors.
4. Regular medical office visits were actually encouraged. This is directly opposite of the unfortunate practice many employers have adopted to discourage utilization.

For the Birmingham project, the philosophy is that "Employees should be educated and encouraged to see the primary-care physician regularly. The correction and monitoring of illnesses or premature death is an important part of cost-effective health promotion."⁸ Perhaps one of the most significant implications of the Birmingham project is that the physicians and providers are not the enemy. All too often, new programs are myopically focused on the supply side by limiting benefits and access to providers rather than the more formidable task of creating a more effective system of appropriate medical care coupled with equally effective and appropriate health promotion to encompass the necessary components of true health care.

REVERSING HEART DISEASE: BEHAVIORAL PLUS PHARMACOLOGICAL INTERVENTION

Behavioral and pharmacological reversal of heart disease is a rapidly evolving alternative to invasive surgeries. Cardiovascular disease is still the leading cause, followed by cancer and injuries, of the loss of life among those who die before the age of 75. According to the 1992 Statistics of the American Heart Association, 1.7 million adults suffer heart attacks each year and over 500,000 die. Angioplasty, thrombolytic therapy, coronary bypass surgery, and heart transplantation, as well as many of the new heart medications, buy time and alleviate symptoms. This is all to the good, but none of these interventions do anything to treat the underlying arterial disease that is the cause of heart attacks. Looking at the current situation, the eminent physician Dr. Alexander Leaf, Chairman of Preventive Medicine at the Harvard Medical School, posed a rhetorical question in a *New England Journal of Medicine* editorial, "Are we developing ingenious, technologically sophisticated, and expensive treatments for established disease and ignoring the fact that the malady is potentially preventable and reversible?...?" It would seem that a health care system that improved the health of the patient and of

the public would be preferred to one that focused only on extending life. This is what preventive measures should accomplish, especially with coronary heart disease."¹⁰ Significant regression of coronary artery blockages has been achieved by a reduction of risk factors, through medications, or a combination of the two. This is very good news, and it generates a new and more optimistic perspective on the prevention of coronary heart disease. To date, seven research studies have demonstrated that pharmacological intervention with advanced heart disease can slow the rate of progression. In addition, three studies have demonstrated a worsening of the heart disease and five studies indicated that heart disease can regress or be reversed. Given the small number of people in the reported studies, the extremely intensive and expensive intervention, the preparation of all of the meals for the participants in one study, and other unique aspects of some programs including intensive psychotherapy, it remains to be demonstrated if such programs are practical for large numbers of people. At the present time, there are further studies and demonstration projects which should successfully resolve these limitations.

One study is of particular significance not only because it demonstrated a 50% slowing in the rate of progression of heart disease, but because it represents a practical, deliverable model today. That project is the Stanford Coronary Risk Intervention Program (SCRIP) led by Dr. William L. Haskell⁹ and his colleagues at the Stanford University School of Medicine. For the vast majority of people, the combination of lifestyle changes plus appropriate use of medications is much easier to maintain than a stringent lifestyle only program. SCRIP is the first study to evaluate this combined impact of comprehensive lifestyle changes in diet, exercise, weight loss, smoking cessation, and counseling plus medications. For this study, 259 men and 41 women were randomly assigned going into the SCRIP program, and 155 going into usual care at another major medical school. After the initial examination, the SCRIP intervention was delivered by trained nurses over the telephone.

At the conclusion of the four years of the study, the people in the SCRIP program showed major improvements beyond the people receiving usual care. Significant reductions occurred in the form of 40% lower cholesterol consumption, a 23% reduction in low-density lipoproteins (LDL), along with a 20% increase in exercise and a 12% rise in high-density lipoproteins. There were three deaths in each group, but there were only 25 hospitalizations in the SCRIP group versus 44 under usual care. Both groups showed some progression or worsening of the disease but the SCRIP patients demonstrated 47% less narrowing of their arteries. Furthermore, a small number of patients in SCRIP evidenced actual regression or reversal of blockages. Beyond the clinical findings, what makes this study so important is a number of unique characteristics because it is the largest, longest study using an inexpensive, nurse-delivered telephone intervention yet still had a major positive impact. Because it required no special facilities and combines easily deliverable lifestyle changes plus

medications, it represents a model that can be used by any hospital, clinic, or individual practice.

Building on that research, Dr. Haskell and his colleagues including Dr. John W. Farquhar and myself are currently developing the "SCRIP 2" clinical research project in conjunction with Blue Shield of California. This is a major policy step because Blue Shield, plus the insurance plans in which Blue Shield and Blue Cross constitute a single plan, constitutes the largest insurance company in the world. For the first time, medical practitioners will be able to be reimbursed for providing a lifestyle plus medication program on an equal footing as invasive surgeries. Insurance companies have long known that for every one coronary bypass surgery that is unnecessary, they can save a minimum of \$30,000 per person, and, for every preventable angioplasty, savings are approximately \$15,000 per procedure. Now some forward-looking insurers are taking the prudent steps necessary to make that dollar and human suffering savings a reality. More and more patients will find that their individual choices ranging from lifestyle interventions only, lifestyle plus medication, to surgery will be supported and reimbursed by at least one major insurance company with others likely to follow the innovative lead of Blue Shield.

ELECTRONIC HOUSECALLS: NEW MODELS OF HEALTH CARE DELIVERY

New technologies and new uses of existing technologies will be invaluable tools in helping individuals attain optimal health. Within medicine itself, the introduction of imaging technologies such as the Magnetic Resonance Imaging (MRI) and Position Emission Tomography (PET), the use of laser and laproscopic surgeries, applications of ultrasound waves for viewing the intrauterine fetus, dissolving stones through lithotripsy, and many other major advances in high technology are clearly evident but at a very high cost. Within a health care system emphasizing health promotion and a pressure to lower medical costs while preserving quality of care, the telephone and computer are achieving much more sophisticated applications.

Actually, the telephone has been linked to medical issues since its inception. In fact, the first transmission over Alexander Graham Bell's "new voice line" was a medical call. On March 10, 1876, Bell's call was to his assistant, Thomas Watson, to help Bell after he had spilled acid on his skin! Now more than a century later, the telephone is assuming a role of increasing importance in health care delivery. Earlier we described the SCRIP programs at the Stanford Center for Research in Disease Prevention to use the telephone in conjunction with computer guidelines by nurses to intervene with advanced coronary heart disease. Similar projects are underway to work with truly addicted smokers as well as for the treatment of arthritis based on the pioneering work of Drs. Kate Lorig, Hal Holman, and James Fries at the Stanford University School of Medicine. Telephone care is an effective means of extending health care beyond the office,

clinic, hospital, or worksite in the form of a telecommunication house call.

Writing in the *Journal of the American Medical Association* in April of 1992, Dr. John Wasson¹¹ and his colleagues at the Dartmouth Medical School worked with 497 men who were 54 years or older using clinician initiated telephone calls to reach out to these patients. Men were randomly assigned to a group who received three telephone contacts per year plus more frequent face-to-face contact while the second group followed the usual care recommended by their doctors. After two years, the men receiving telephone calls to follow up on their care had fewer clinic visits, used less medication, had fewer admissions and shorter stays in the hospital, and less intensive care days, and expenses for these patients were 28% less for the two years. Overall, the researchers concluded that it is effective to substitute telephone care for certain costs.

Using similar approaches, there is a burgeoning of applications of using telephones, computer guidelines, and with nurses and other health care providers using the telephone as an "electronic house call." Among these highly significant innovations are computer-assisted psychotherapy in the form of a Therapeutic Learning Program (TLP) developed by psychiatrist Dr. Roger Gould in Santa Monica, California. Preliminary data from this approach indicates that patients do better more rapidly and are actually more revealing to the computer-interactive system than with face to face therapy. In a September 1992 issue of the *Journal of the American Medical Association*,¹² Dr. Steven E. Locke of the Harvard Medical School published an innovative study using computer-based interviews to screen blood donors for the HIV virus for AIDS. Interviews took only eight minutes and were more effective than standard questionnaires and interviews. Clearly such an application would offer even greater safety for the national blood banks.

Working in San Francisco, Dr. Albert R. Martin and his colleagues at Interpractice Systems have worked together with the Harvard Community Health Plan and H. Ross Perot's former company EDS to develop a computer system to link a patient's home to a central clinic. Based on preliminary studies, these patients required less actual clinic visits, cost the Harvard Community Health Plan less to provide care, and most significantly, the people themselves experienced a greater sense of satisfaction with what they perceived as a higher quality of care. Another innovative application is with patients after a heart attack, or stroke, or coronary bypass surgery to help them return to work. Research by Dr. Robert F. DeBusk, Professor of Medicine and Director of the Cardiac Rehabilitation Program at Stanford University School of Medicine, has focused on contacting patients in the hospital as soon as possible during their recovery and have nurses follow up with the people by telephone after discharge from the hospital. To date, his preliminary research indicates that it is possible for people to return to work sooner, at a higher level of activity, with less subsequent problems, and at a much lower cost.¹³⁻¹⁵ Surely such an intervention is of great benefit to both employers and employees who most often

Table 1

Characteristics of Evaluation of Worksite Health Promotion and Disease Prevention

Study	Purpose of Evaluation	Sample Size	Types of Workers	Comparison Group	Evaluation Period	Outcome Measures	Evaluation Design	Subject Self-selection?	Findings
Canada & North America Life ⁴ (1982)	Assess health care utilization changes after institution of employee fitness program	Experimental: 392 Control: 142	Employees at Canada Life who attended 3 fitness evaluations (392 out of 1,487)	Yes	1 year	Insurance data on hospital admissions and 4 categories of medical claims (ECG, obstetrics, orthopedics, other)	Pre/post with participants vs. nonparticipants	Analyzed costs of participants vs. nonparticipants at same company	Participants had fewer hospital days and fewer medical claims
Tenneco ¹⁷ (1984)	Study relationship between exercise and job performance	3,231 Tenneco employees (81% of eligible)	Management: 561 Professional: 1,265 Clerical: 1,078 Other: 327	No	6 months	Job performance	Compare exercisers to nonexercisers correlating 3 levels of exercise adherence	Self-selected	Exercise and job performance related especially for female, non-exempt; positive relation between exercise and job performance for "management" and other categories
Prudential ¹⁸ (1984)	Examine impact of worksite-based fitness program on fitness levels, medical costs, and disability costs	Disability study: 184 Major Medical Study: 121	Most were "white-collar workers" with "sedentary" jobs; only employees enrolled in fitness program	No	Disability: 5 years Medical: 1 year	Disability days; major medical costs	Pre/post longitudinal design	Self-selected	Fewer disability days (43% less); lower major medical costs (46% reduction)
Blue Cross/Blue Shield, Indiana ¹⁹ (1985)	Compare health care utilization of participants vs. nonparticipants in worksite health promotion	Participants: 667 Nonparticipants: 892	All headquarter employees of BC/BS of Indiana who completed an HRA	No	5 years	Health care costs determined from claims records	Three month baseline; participants vs. nonparticipants at 7 time periods	Analyzed costs of participants vs. nonparticipants	Participants had lower health care costs (76%); program savings ratio of 2.51 to 1.00
Blue Cross, California ²⁰ (1985)	Evaluate health education program aimed at reducing unnecessary outpatient visits	5,191 employees	Employees from 22 employers	Yes	15 months	Self-reported physician visits	Pre/post "quasi-experimental," "staggered intervention"	Self-selected	Reduced number of visits
Tenneco ¹⁷ (1986)	Compare illness and absenteeism rates, and medical care utilization rates for exercisers and nonexercisers	Exercisers: 221 Nonexercisers: 296	A one-fifth random sample of employees at 2 Tenneco divisions in Houston, Texas	No	1 year	Number of sick hours; medical care utilization rate	Pre/post with participants vs. nonparticipants	Analyzed costs of participants vs. nonparticipants	Participants had fewer sick hours and lower non-hospital costs; participants had a higher utilization rate
Johnson & Johnson ²¹ (1986)	Assess an effort to increase regular exercise as a part of overall "Live for Life" program	Experimental: 2,600 Control: 1,700	All eligible Johnson & Johnson employees at 4 worksites	Yes	2 years	Daily energy expenditure estimates; maximal oxygen consumption; self-report and rating of exercise activity	Experimental group received health screen plus program; control received health screen only	Volunteers plus random sample of nonparticipants at baseline and at two years	Participants had a greater increase in daily energy expenditure in exercise, self-reported ratings
Johnson & Johnson ²¹ (1986)	Examine relationships between exposure to a comprehensive worksite health promotion program and health care costs and utilization	Experimental: 5,192 & 3,259 Control: 2,955	In experimental groups, 61% and 58% were salaried; in control, 48% (controlled for in analysis)	Yes	5 years	Medical costs and utilization	Experimental group 1: program in place more than 30 months; Experimental group 2: 18-30 months; Control: no exposure	Entire worksite	Experimental groups had lower increases in inpatient costs, hospital days, and admissions
Northern Telecom ²² (1986)	Evaluate "Health Enhancement Program" (HEP) for lifestyle-related costs and impact of HEP on lifestyle behaviors	Not available	All Northern Telecom employees	No	1 year (1984-1985)	Smoking prevalence; observed seat belt use; overall medical costs	Pre/post	Self-selected	Lifestyle contributed significantly to medical costs (CHD at 5.5%); smoking declined from 29% to 18% over 6 months; seat belt use increased from 45% to 79%; medical costs remained constant or declined over 1 year; estimated annual savings of \$3.7 million
AT&T ²³ (1986)	Measure effects of program on employee health status, health-related attitudes, and behaviors toward the company and work	Study sites: 1,198 Comparison: 1,673 & 1,425	Randomly selected employees of AT&T in a Kansas City facility and one entire worksite in Bedminster, New Jersey	Yes	1-year appraisal only; 1 with no treatment	Biometric data, risk calculations, health- and job-related attitudes, self-reported; days absent from work	Pre/post with 2 comparison groups	70-82% participation in experimental sites; selected random samples of controls	Lower health risks; changes toward more positive attitudes; gains in positive health behaviors
AT&T ²³ (1987)	To determine the reduction of aggregate risks (and associated costs) for cancer and heart attack over the 2-year study period	Experimental: 1,623 Control: 1,673	Wage and salaried employees	Yes	2 years	Health risk appraisal; smoking rates; exercise levels	Quasi-experimental at 2 worksite locations and 1 control site	Entire worksite	TLC participants reduced health risks; physical exercise increased; smoking decreased; cost benefit of \$312.2 million if TLC reached all 100,000 AT&T employees
Control Data ²⁷ (1987)	Assess impact of the CDC "StayWell" program on risk status, medical costs, utilization, and absenteeism	Demographics on 50,000 employees; participant records on 35,000; HRA on 12,000 claims data, and absenteeism data on 17,000	All CDC employees	No	6 years (1980-1986)	Participation and adherence, risk factors, medical costs, costs and benefits of programs	Link HRA, employee health surveys with claims and personnel records with subsequent use and costs of medical care	Nonrandom samplings and self-selection bias	Reduced claims and absenteeism; smokers evidenced 16% higher medical costs; hyperfensives are 68% more likely to have annual claims in excess of \$5,000; non-seatbelt users spent 54% more days in hospital; savings due to reduced medical claims and absenteeism was \$1.6 million
Tenneco ¹⁷ (1987)	Compare turnover before and after opening of Tenneco Fitness Center in 1982	1,788 new hires from 1978-1981; 1,360 new hires from 1982-1985	All Tenneco employees	2 cohorts compared	7-year interval	Job turnover	Compare new hires cohort before and after 1982	No	Exercise had less turnover; relationship between exercise and retention highest for female, nonexempt (clerical) employees; turnover pattern similar before and after 1982

BlueCross/Blue Shield ²⁴ (1988)	Impact of health promotion on employee risk factors, absenteeism, and insurance utilization per site	6 state BC/BS programs ranging from 746 to 1,589 participants	Different employees in different sites: 1) those free of heart disease, cancer, or stroke; 2) only employees in experimental units; 3) only employees with selected risk factors	No	From 1 year to 5 years	Health risk appraisal; smoking; weight; absenteeism	Quasi-experimental with voluntary participation by worksites	No	Fewer claims and lower costs; assumed increase in life expectancy and retirement benefits created negative cost benefits; participants exhibited reduced blood pressure; decreased serum cholesterol; weight reduced; increased smoking cessation; lower average medical payments
Johnson & Johnson ²⁶ (1988)	Assess results of the smoking cessation program of the overall Johnson & Johnson "Live for Life" health promotion program	Experimental: 1,399 continuously employed individuals; Control: 748 continuously employed individuals	All Johnson & Johnson employees at eligible worksites	Yes	2 years	Smoking status (self-report); thiocyanate (SCN) used with self-report but not used to validate	Pre/post test design with 4 intervention sites and 3 sites receiving only annual health screen interviews; compare participants to nonparticipants	Yes: select random sample of 53% of nonvolunteers for interviews; compare participants to nonparticipants	More smokers quit in intervention sites (23%) than controls (17%); not statistically significant; high risk CHD smokers quit at intervention sites (32%) vs. 13% at control sites
Tenneco ³¹ (1988)	Determine relationship between exercise and injury prevalence	6,104 employees	In 1984: 3,230; In 1985: 2,874	No	2 years	Injury prevalence	Correlate medical and injury claims for 1984 and 1985 (selected injuries) with 4 levels of exercise	No	Exercisers had lower annual medical costs; exercisers did not experience any more injuries; for employees over 50, medical costs decreased as level of exercise increased
Coors Company ³² (1989)	Evaluate health and cost-effectiveness of a cardiac rehabilitation program	180 post-coronary employees	Wage and salaried	No	6 years	Wage savings; cardiac rehabilitation savings; exercise treadmill savings	Individual as own control pre and post MI, CAB, or angioplasty	All MI, CAB, or angioplasty	Wage savings: \$1,078,588 Rehabilitation: \$ 226,198 Total: \$ 852,005 Savings over 6 years
General Mills ³³ (1989)	To compare health risk, medical costs, and absenteeism of employees before and after the "TriHealthalon" health promotion program	1,200 invited Experimental: 685 Control: 341 Unassigned: 174	National sales division — white-collar	Yes	2 years	Health risk appraisal; medical costs; absenteeism	Pre/post with participants compared to nonparticipants	No; authors note that "control group chose not to be in the TriHealthalon"	After 1 year: medical costs up 20% for participants and 24% for nonparticipants (not significant); participants smoking declined from 21% to 13% in 9 months; participants exercising up from 48% to 80%; participants had 19% reduction in absenteeism vs. 69% increase in nonparticipants; after 2 years, above trends continued TriHealthalon paychecks of \$3.10 in year 1 and \$3.90 in year 2 for each program dollar; seat belt use increased from 44% to 81%; percent of people with high diastolic blood pressure decreased 15% to 10%
DuPont ³⁴ (1990)	Effect of a comprehensive health promotion program on absences among full-time employees in a large, multi-location company	Experimental: 4 sites with 29,315 employees Control: 19 sites with 14,573 employees	White-collar and blue-collar	Yes, 19 control sites	2 years	Disability days	Pre/post test control group design with no randomization	No	Blue-collar employees at intervention sites had 14% decline in disability days vs. 5.8% decline for controls; total of 11,726 fewer net disability days; return of \$2.05 for every program dollar by end of the second year
General Motors ³⁵ (1990)	Determine effect of programs to reduce CHD risk through weight and smoking classes; 4 levels of intervention intensity	Total of 7,804 employees in all 4 sites	Wage and salaried	Yes, 1 control site	3 years	Smoking cessation enrollment; weight reduction enrollment; reduction in overall CHD risk	Quasi-experimental in 4 randomized worksites; 2 worksites with individual counseling	Worksites randomized but not individuals	In the 2 "counseling" sites employee participation was 46% in smoking cessation and 54% in weight reduction; without counseling, engaged only approximately 10% of employees in weight and smoking reduction
Southwestern Bell Corporation ³⁶ (1990)	Determine effect of introducing a health care PPO triple option "Customcare" on overall medical utilization; determine proportion of claims experience that is attributable to lifestyle habits and risks	Total of 87,000 workers and approximately 70,000 dependents and early retirees; 43,000+ employees "in network"; 30,000+ employees "out of network"	Two groups tracked: 1) all active employees, dependents, and retirees; 2) a cohort of 44,000 active employees over 5 years	Yes	5 years	Claims costs 1985 through 1990; change in utilization patterns; PPO-HMO migration; Johnson & Johnson "Lifestyle Claims Analysis" (LCA) by multiple regression	Time series longitudinal analysis	Employees in target 65% in network, 35% with comparable demographics; out of network	Preliminary data to date confirm effectiveness of managed care program in savings; lifestyle claims analysis (LCA) identified specific areas of lifestyle diseases to be addressed through the SBC comprehensive health promotion program ("Good Life"); medical costs for Customcare employees rose 7% in 1989 and less than 10% in 1990 vs. corporate national average of 20.4% in 1989 and 21.6% in 1990
Johnson & Johnson ³⁷ (1990)	Effect of comprehensive health promotion program on "work related attitudes" of employees	Experimental: 1,019 Control: 586 Measured at baseline and at 1 and 2 years	All workers at 7 manufacturing sites within 50 mile radius in central New Jersey and northeastern Pennsylvania	Yes	2 years	Six employee attitude scales: organizational commitment, job involvement, growth opportunity, supervision, working conditions, and job competence; 4 single item measures: respect from family, coworker relations, pay/benefits, job security	Pre/post test with 4 companies receiving "Live for Life" and 3 companies receiving annual health screens only	Yes: a random sample of all nonvolunteers selected for interview; compare volunteers to nonvolunteers	Employee attitude changes at intervention sites greater and more favorable; significant positive changes on: organizational commitment, supervision, working conditions, job competence/security, pay/benefits
Johnson & Johnson ³⁸ (1990)	Study of the absenteeism experience of 2 groups of Johnson & Johnson employees	Experimental: 1,406 Control: 487	Wage and salaried	Yes	3 years	Adjusted mean levels of absenteeism annually and over 3 years	Experimental group received comprehensive "Live for Life" program; controls received no program	Yes	Adjusted mean levels of absenteeism declined and were lower (P<.01) in final year for wage earners; no significant difference for salaried personnel
Travelers Insurance ³⁹ (1990)	Employee absenteeism after 1 and 2 years membership in a worksite fitness center	2,232 insurance company employees	White-collar and clerical	No	2 years	Mean number of absences due to illness at 1 and 2 years	Voluntary enrollment compared to nonmember employees controlling for known pre-existing differences between these 2 groups	No	Both men and women's absenteeism decreased by 1.2 days; women's decreased more; greater decrease in year 2 than year 1; decrease related to level of participation

Table 2

Characteristics of Evaluation of Worksite Health Promotion and Disease Prevention Programs

Study	Purpose of Evaluation	Sample Size	Types of Workers	Comparison Group	Evaluation Period	Outcome Measures	Evaluation Design	Subject Self-selection?	Findings
Blue Shield of California ¹ (1985)	Evaluate a workplace health education program to reduce unnecessary outpatient visits; program of Blue Shield titled "It's Your Choice" to help employees make better decisions regarding medical care	Total of 5,200 workers from 22 Northern California worksites; all employees attended a lecture, received self-help books, and completed a self-administered questionnaire	All levels of employees ranging from blue-collar to white-collar in nongovernment employment	No comparison group	15 months	Medical visits per household for the 15 months of the intervention	Quasi-experimental, staggered intervention design involving 8 different cohorts with before and after (pre and post) comparisons; statistical adjustments for seasonality and other identified intervening variables	Yes	Visit rates for insured households were reduced by 17% (p<0.001) or 2 visits per household per year; reductions at all ages, education, and most reduction in households with first dollar fee for service coverage; copays had less reduction and no change with HMOs; minimal, self-care program can reduce outpatient medical visits
Travelers Insurance ¹ (1990)	Conduct an analysis of comprehensive health promotion program for all eligible employees of a major insurance carrier in the "Taking Care" program	36,000 employees and retirees nationwide; also, employees (10,000) with access to the Taking Care Center (TCC) fitness center in Hartford, Connecticut	Predominantly white-collar with gray- and pink-collar workers included	No; all employees had access to at least the mass communication program	1986-1990 (4 years) with benefit-to-cost ratio projected to the year 2000	Program costs for personnel, capital expenses, materials, rent, and pension liability were determined; These were compared to program impact of medical costs including savings, increased productivity, decreased absenteeism, decreased life insurance claims, and program generated income	Longitudinal tracking and multiple year comparisons of costs and benefits of the comprehensive program over 4 years	Yes	After adjusting future monies to net present value, a benefit-to-cost ratio was estimated to be 3.4 for the "Taking Care" program; "hidden" cost of health promotion for pension liabilities was included in this ratio; TCC membership had 1.2 fewer days absent; reductions in projected death rate were .17 deaths per 1,000 or 6 employee lives per year for each of the next 10 years; membership fees generated \$662,000 in 1990 or \$179/employee; in total, a net cumulative benefit of over \$146 million is accrued on an overall investment of \$57 million over 15 years; return on investment of \$3.4 for every dollar spent on program
DuPont ² (1990)	Needs assessment, design, implementation, and preliminary evaluation of comprehensive workplace health promotion program	110,000 U.S. employees	White-, gray-, pink-, and blue-collar employees in more than 100 U.S. locations	No	6 years	Employee absenteeism, morbidity, and mortality	Pilot study in one location; not a research study per se but overview of program planning and implementation with examples from pilot project outcomes	Yes	A 47.5% decline in hourly employee absenteeism over 6 years vs. a 12.5% decline in total DuPont hourly work force; good overview of program planning and sites future areas: spouses, sales personnel, shift workers, small sites; integrating health promotion with medical, safety, EAP, and benefits; continue evaluation and documentation
DuPont ³ (1990)	Evaluate the relative efficacy and cost-effectiveness of a stop smoking clinic and self-help kit and characteristics of those who benefited most from each; program is the American Lung Association program	1,400 eligible employees in a large office complex; 110 attended orientation, 75 signed up for the program, 70 completed the program	White-collar office and clerical workers	No	18 months	Quit rates and cost per participant	Pre and post assessment with subjects serving as their own controls over 18 months	Yes	Combined quit rate for the two groups was 17% at 18 months; cost was twice as high for the clinic (\$32 vs. \$16), but cost per quitter (Appx. \$150) was same for both
First National Bank of Chicago ⁴ (1991)	Determine health and cost-effectiveness of an onsite prenatal education and gynecological program at a major bank; programs included the March of Dimes "Babies and You"	Over 100 women in the prenatal classes in 1989; over 400 onsite gynecological exams from 1985 to 1990	All eligible female employees	No	5 years (1985-1990)	All but two of the most common surgical procedures of First Chicago are directly related to women: Caesarean section, normal deliveries, laparoscopy, and dilatation/curettage (D&C)	Longitudinal trend analysis	Yes	Caesarean section rate was 25% in 1987, 35% in 1988, and dropped to 19.5% in 1989 after implementation of the program with second opinion; concluded that the programs provided "cost-effective" health care
First National Bank of Chicago ⁵ (1991)	Test the efficacy of a medical claims data system; included outpatient, inpatient, employee, dependents, and retirees	15,000 employees of the bank	All eligible employees, dependents and retirees	No	4 years (1986-1990)	Data access and processing of the Occupational Medical Nursing Information System (OMNIS)	Longitudinal trend analysis	Not applicable	Immediate access by authorized users is provided for more than 30,000 current and former employees; data base can be constantly updated and grows with updates, new information, and daily recording of new services
First National Bank of Chicago ⁶ (1991)	Assess the impact of an onsite employee assistance program (EAP) with four components: 1) EAP/wellness program; 2) psychiatric hospital utilization review; 3) consulting psychiatrists; and 4) benefit plan design changes. EAP established in 1979 and expanded in 1989	All employees; approximately 12,400 in the medical plan	White-collar	No	4 years (1984-1988)	Mental health costs: percent of total medical costs, dollars per employee; inpatient mental health; total dollars, dollars per 1,000 employees, number of admissions, average length of stay, and inpatient days; psychiatric short-term disability; number of events, days absent, and days/event	Longitudinal trend analysis	Yes	Overall result of the 4-year evaluation indicates: reduction in inpatient psychiatric hospitalization costs, reduction in average length of short-term disability episodes, and better "overall management of mental health care costs"
General Motors ^{7,8} (1990) and (1991)	Evaluate the medical and cost benefits of a worksite blood pressure control program consisting of worksite monitoring and counseling	Three sites (N=163 to 367 employees/sites)	All eligible employees	Yes; control site of 169 matched employees who had received no post-screening follow-up or monitoring	4 years	Blood pressure, medical care claims, costs of program expressed as cost-benefit ratio	Longitudinal study with matched controls and subjects serving as pre- and posttest	Yes; hypertensive at voluntary screening	Cost of medical claims for hypertensives was lower in the 3 intervention sites compared to the control; no significant differences across sites in claims for normotensives; after adjusting for 1982 dollars, the data showed a reduction of \$1.89 to \$2.72 as a ROI for every dollar spent on the program

General Motors ^a (1991)	General Motors ^b (1991)	Blue Shield of California and Blue Cross/Blue Shield ^c (1992)	Coors ^d (1992)	Bank of America ^e (1992)	Bank of America ^f (1992)	Georgia-Pacific Corporations ^g (1992)	Postal Employees ^h (1992)
Compare 4 different interventions aimed at controlling high blood pressure, obesity, and smoking	Compare health care costs for treated hypertensive employees, vs. controls, vs. normotensives	Determine impact of 2 low-cost, minimal intervention, mail-based health promotion programs for adults and senior adults	Implement a voluntary program focused on multiple risk factor reduction for cardiovascular disease (CHD) at the worksite	Evaluate relationship between health risks and medical care costs with a group of retirees	Evaluate by randomized trial a health promotion program using risk assessment and mailed materials to a geographically disbursed group of retirees	To determine both the health and cost-effectiveness of different models of delivering a total cholesterol reduction program	Conduct a health and cost outcome study of a pre-employment drug screen program for government employees
2,300 employees at 4 sites	1,235 employees at 4 sites (3 experimental sites; N=183 to 367 employees and one control site; N=169)	103,837 subjects enrolled in "Healthtrac" and "Senior Healthtrac" from Jan. 1, 1986 through Jan. 1, 1991	692 employees (52% of eligible) in "Lifecheck", voluntary, 8-week program to reduce CHD risk; at worksite to all eligible employees with classes, one-on-one counseling, and fitness facilities	1,558 Bank of America retirees; tracked between January 1988 and April 1989	5,686 Bank of America retirees	3,202 employees of Georgia Pacific Corporation focus on cholesterol reduction ranging from 1 to 3 months	Three studies: 1) a prospective study of 160 hospital workers with weak results; 2) prospective study of 2,537 postal employees in Boston; and, 3) prospective, multi-site, blind study of 4,306 United States Postal Service employees
White-collar, clerical, and manufacturing	White-collar, clerical, and manufacturing	Cross-section of adult U.S. population	All eligible employees at Coors	All eligible retirees from all employment levels of Bank of America	All eligible retirees from all employment levels of Bank of America	All eligible employees	All eligible U.S. Postal Service employees for pre-employment screening
Yes	Yes	No	No	No	Yes; retirees randomized into full SeniorHealthtrac program's control group of questionnaire only and control of insurance claims only; full health appraisal every 6 months, individualized reports each 6 months, personal letters, self-care materials by mail, and a self-care book	Yes; 4 intervention groups with interventions of 1 to 3 months and 1 control site	No
3 years	Follow-up at 4 years after program	5 years	1 year	1 year	1 year	1 to 3 months	1 year
Percent change (reduction in high blood pressure, obesity, and smoking)	Medical claims for hypertensives vs. normotensives	Improved health risk scores over 18 months, of 14.7% over 65, of 18.4% under 65; at 30 months, improvements were increased to 18.8% and 25.7%, respectively; improvement in all targeted risks: smoking, dietary fat, salt, fiber, stress, alcohol, cholesterol, and exercise but not pounds over ideal weight (all p<.001)	Decreases in systolic blood pressure, total cholesterol, weight, physical activity, and risk of ischemia within 8 years as measured by the Framingham score (p<.05)	Decrease in smoking, excessive drinking, excessive body mass, and increased seat belt use; were related to major decreases in medical care costs; (range of significant p values in two-tailed tests)	Full program produced positive outcomes in 31 of 32 comparisons with 19 at p<.05 and 13 at p<.01; health risk scores fell 4.3% in full program and rose 7.2% in questionnaire only control group; 12 month retention was very high at 84%	Reduced total cholesterol; costs of each of 5 groups of employees for program delivery and control	First study (hospital) had weak association between drug screen and adverse employment outcomes; second study (Boston) indicated that marijuana positive had relative risk of 1.56 turnover, 1.85 of injury, and 1.55 of disciplinary action; mean absence rate was 7.1% for users vs. 4.4% for nonusers; third study (U.S. Postal) found drug use positives associated with 6.63% absenteeism vs. 4.16% with nonusers
Quasi-experimental design with 4 plant sites randomly assigned to treatment and control	Quasi-experimental design with 3 treatment sites and 1 control site	Prospective, longitudinal observational study with subjects serving as their own controls (followed for minimum of 6 months up to 30 months); no randomized control group	Participants as their own control in pre-post test design; no control group; total of 439 employees (72% of eligible) completed the follow-up screening	Self-selected sample who completed baseline and 12-month follow-up on "Senior Healthtrac"; 1,558 comparable to 2,000 who elected not to participate; pre- and posttest with no control group	Randomized controlled trial	Case control design with 5 groups: Group 1 control; Group 2 had 1-month educational program; Group 3 same program, plus incentives; Group 4 had 3-month educational program; and Group 5 had same as 4th group, plus incentives	Pre and post design with subjects serving as their own control.
Risk-based screening for eligibility	Hypertensive men and women	No	Yes	Yes	No	No	No; Mandatory pre-employment drug screening
Short-term interventions through screenings only (Site 1) or education only (Site 2) were less effective than adding follow-up counseling (Site 3) plus social organization (Site 4)	Medical care claims cost for hypertensive workers at treatment sites were lower than costs at control sites; costs for matched normotensive workers did not differ across sites; 4 years after program termination, the cost benefit ranged from \$1.89 to \$2.72 for each \$1 invested in programs	Low-cost, low-impact programs can be practically applied to large populations; positive trends increase over time; changes in senior people as great as younger ones; effects equal in all socioeconomic classes	All services free to employees except A12 for lipid panel and glucose. Excluding the evaluation budget, the program cost \$22,163 or \$32 per participant; evaluation cost \$42,678; targeting employees with multiple risk factors for long-term intensive risk modification programs may decrease future medical costs	Savings were calculated with range of \$372 to \$598 direct cost savings; total savings of approximately \$4,299 per person per year; first longitudinal data relating health habits to medical costs in a senior population	Total direct and indirect costs decreased by 11% in the experimental group and increased by 6.3% in the control; claims data confirmed these trends; a low-cost, health promotion program can reach highly distributed group of retirees resulting in health improvement and has potential to decrease medical utilization	Groups 3 and 4 had the highest percentages (28% and 33%) of borderline high-risk and high-risk employees who reduced cholesterol 10% or more; initial and second screens cost \$5.14 and \$8.49 per employee; intervention costs ranged from \$6.33 per employee (Group 2) to \$31.71 (Group 5); Groups 3 and 4 were most cost-effective means of lowering cholesterol; Group 5 was the least cost-effective	In all three studies, the associations between positive drug tests and turnover, injuries, absenteeism, or accidents was weak; cost-benefit analysis of the U.S. Postal Service study was flawed; cost-benefit analysis in the Boston study indicated drug testing would save approximately \$163 per new hire employee; cautions noted regarding laboratory quality and drug use prevalence in affecting the range of false positives

Table 2 (continued)

Study	Purpose of Evaluation	Sample Size	Types of Workers	Comparison Group	Evaluation Period	Outcome Measures	Evaluation Design	Subject Self-selection?	Findings
Treatwell ¹⁷ (1992)	Evaluate a worksite-based nutrition intervention program to create low-fat, high-fiber diets	16 worksites in Massachusetts and Rhode Island	All eligible workers at the 16 selected worksites	Yes	1 year	Dietary patterns by means of a semiquantitative food frequency questionnaire	Randomized, control study; cohort of workers at intervention sites were randomly surveyed pre- and post-intervention	No	Decrease in mean dietary fat intake was 1.1% of total calories in intervention sites vs. controls (p<.005); no differences in mean fiber intake; concluded that worksite, nutrition program can effectively influence the dietary habits of workers
City of Birmingham, Alabama ^{18,19} (1992)	Implement and evaluate a comprehensive, worksite-based health promotion program under a National Institutes of Health (NIH) grant	Approximately 4,000 employees; Predominantly blue-collar	All eligible workers in the city government of Birmingham, Alabama	Yes	5 years from 1986 to 1991	Complete medical physical, computerized health risk appraisal (HRA); all employees received confidential copies of their own medical screens and HRAs	Randomized, control group design	No; participation was mandatory by the city for enrolling in its medical benefit plan	Among "street and sanitation" workers, there was decreased smoking from 53% in 1986 to 31.8% in 1990; decreased number of participants with cholesterol of over 200 mg/dl from 55.6% in 1986 to 44.5% in 1990; in 1986, 11.4% had blood pressure over 150/90 and decreased to 9.6% in 1990; comparable results for "parks and recreation" and "fire and reserve" workers; while the total number of employees increased from 3,596 in 1985 to 4,000 in 1990, the average medical benefit cost rose total of \$28 per employee, costs per employee were \$2,097 in 1985 and \$2,075 in 1990; a mandatory, comprehensive health promotion program for predominantly blue-collar, city employees is both health and cost-effective
Treatwell ¹⁶ (1993)	Worksite-based nutrition intervention program to impact nutrients implicated in carcinogenesis (vitamins, trace metals, and fatty acids)	16 worksites with N=1,762 employees	Not indicated	Yes; 8 control sites and 5 intervention sites	15 months	Mineral intake, water soluble vitamins, oil soluble vitamins, fiber, alcohol, caloric sources, and fatty acids (omega-3)	Pre and post measures comparing control to intervention groups	No	Broader impact than on fat and fiber only; increased intake of carotene, vitamin A and B6, small decrease in calories from both saturated and monosaturated fats, and smaller increase in percentage of calories from polyunsaturated fatty acids
Minneapolis/St. Paul Metropolitan Area ¹ (1993)	Determine impact of a worksite intervention for weight control and smoking cessation	Of 10,000 total workers, 2,041 in weight control and 270 in smoking cessation	Wide range of blue- and white-collar and clerical in government, finance, education, and manufacturing	Yes	2 years	Weight loss and smoking cessation	Thirty-two randomized worksites: 16 control and 16 intervention sites	No	Weight loss of an average of 4.8 lbs. and 43% quit rate on smoking. Net 2-year reductions in smoking prevalence in treatment vs. control were 4% and 2.1% in cross-sectional and cohort surveys, respectively; no significant treatment effect for smoking; cost of smoking program was \$1,500 for the two years and with 24 people who quit, program was determined to be cost-effective
California Public Employees Retirement System (PERS) and HealthTrac (Blue Shield of California) ²⁰ (1993, in press)	Determine impact of a low-cost, mail-delivered health promotion program conducted with active and retired California public employees	PERS intervention group: 54,902 compared to control group of 2,366	Active: 21,170; Medicare retirees: 8,316; and seniors with Medicare supplement: 25,416	Yes; participants divided into "types of workers" then further subdivided into active with assessment and print materials at 6- to 12-month intervals vs. and compared to print materials only and compared to claims experience of control group	12 months	Health risk scores, change in risk behaviors, medical utilization, and claims costs	Randomized control with pre and post measures; approximately 800 individuals from each "type of worker" category was randomly assigned as a control population	No	Reductions in risk scores, risk behaviors, self-reported medical utilization, and medical claims; claim costs for participants were approximately \$8 million less to PERS or \$2.4 less with adjustment for outlier; self-reported data indicated decrease in doctor visits, hospital days, sick days, and home confinement
Bank of America ² (1993)	To perform a 2-year randomized trial of a low-cost mail-delivered health promotion program to evaluate effects upon health risks and health care costs	5,686 Bank of America retirees	All eligible retirees from all employment levels of Bank of America	Yes	2 years	Health risk scores, self-reported cost savings, claims data cost savings	Randomized, questionnaire only and unobtrusive claims data only vs. full program	No	Overall risk scores improved by 12% at 12 months and 23% at 24 months compared with control; all age groups (55-65, 65-75, 75+) improved; cost reductions were 20% by self-reported (p<.01) and 10% by claims experience (p<.02); return on investment approximately 6:1
Arthritis Self-Management Program (General Population in 5 California Counties) ³ (1993)	To determine both the health and cost benefits at the Arthritis Self-Management Program, 4 years after participation	Volunteers (284) from the general population of 5 mid-California counties	General population (most but not all employed)	Yes; wait list control	4 years after completion of 6 weekly, 2-hour sessions in groups of 10-15 people on arthritis self-management with courses taught by lay leaders	Pain, physical disability costs, and valid self-administered instruments used to measure health status, psychological status, and medical care utilization	In 1984, subjects were randomized into ASMP vs. wait list control for 4 months; 1 year after ASMP, the 343 participants were randomized into another 6-week program, a bimonthly newsletter, or no reinforcement; 4 years after this second stage, 284 participants were evaluated again	Yes; arthritis patients only	Pain declined 20%, physician visits declined 40%, while actual physical disability increased 5%, no changes in controls; estimated 4-year savings were \$648 per rheumatoid patient and \$180 per osteoarthritis patient; health education in arthritis improves health and cost outcomes up to 4 years after participation
County in California ⁴ (1993)	Implement and evaluate a back injury prevention program in 6 divisions of a northern California county; determine both health and cost effects	158 state employees	White- and blue-collar workers in parts and recreation, public works, and two county hospitals	Yes; a matched control county in another geographic area of California	1 year	Changes in CDC HRA, reduction in back injury and/or pain, reduction in risky behavior, and improved employee job satisfaction	Pre and post analysis before and after the 1-year program	Yes; back pain with 77% of the 205 eligible employees participating	"Modest" decline in back pain prevalence rates, significant improvement in job satisfaction and reduction of risky behavior, cost benefit analysis found net benefit of \$161,108 or a 179% return on investment

do want to return to their careers and occupations.

Surely these new trends will be reflected in a true health care system built upon managed competition within a global budget. Under such conditions there is the necessity of regulating unrealistic or inappropriate demand for care. A mainstay is the continued development and evaluation of comprehensive health promotion and disease prevention programs.

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