

A Comprehensive Approach to Corporate Health Management

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The Northern Telecom Inc. Health, Safety and Environment program is an integrated, cross-functional approach to the management of health and health-related risks. We describe the key structural elements of the program and some preliminary data using survey and insurance claims data to follow changes in health-risk factors and diagnosis-specific costs during 5 years of operation of this comprehensive safety, industrial hygiene, primary care, disease prevention, and health promotion program.

A pilot study demonstrated significant improvements in risk factors, health service use, and health-related costs. On a company-wide basis, there have been similar changes.

We compare these results to published data and discuss possible reasons for the improvements in risks and costs. We conclude that a comprehensive information and skill-building program aimed at management as well as employees and dependents generates synergistic cost-beneficial change.

Since 1984 Northern Telecom Inc, the world's largest supplier of fully digital telecommunications equipment, has taken a comprehensive, integrated approach to the management of health. This strategy includes but goes beyond the management of medical benefits or the care purchased through those programs. It involves all levels of prevention, provision of primary care on site by nurse clinicians and nurse practitioners, education of employees and dependents about self-care and the wise use of medical care, and the active management of medical care. The intent is to affect both the supply side and the demand side of the health care equation.

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Program Rationale

Northern Telecom Inc experienced a 74% increase in medical care costs from 1980 to 1983. A thorough analysis of health-related costs by the Health and Safety and Benefits groups¹⁻³ suggested that more than 62% of the company expenditures for medical care in the previous 4 years were related to lifestyle, including use of the medical care system when self-care would have been more appropriate. In addition, there was significant overuse of health services and avoidable workers' compensation payouts. Therefore, in 1984 and 1985 the company started six related initiatives including (in order of level of prevention) a health promotion program available to all employees, an intensified safety and industrial hygiene program, on-site primary care, incentives to join health maintenance organizations (HMOs), active management of medically related disability, and utilization management of the self-funded indemnity insurance program (see Appendix).

Program Design and Development

Staff worked closely with many departments and functions to share expertise and resources and to ensure that the programs reflected and were supported by Northern Telecom's current or desired culture. For example, media campaigns and materials, as well as communications from officers, were developed jointly with the Corporate Communications department. *Universe*, the corporate newspaper, and Division newsletters regularly featured articles on the programs, safety achievements, participant successes, tips for healthy living, and other areas of interest. The media production facility produced program videos and provided graphics support. Procedures for all areas of health and safety were developed and placed in the Company procedure manual. Overall policies were also adopted by the parent

company, providing a written mandate for the programs.

The work environment was changed to support safe and healthy lifestyles. Healthy food was provided in cafeterias and vending machines. Cigarette machines were removed from work sites; smoking is now prohibited in any company-owned or leased premises or vehicles. Staff taught health, safety, and environment modules in the company-wide management development program. Organizational stress management techniques were presented to management, resulting in work with intact departments, ranging from organizational surveys to participant-directed task realignment, job redesign, safety, and quality improvement.

Prevention and Primary Care

The first initiative, the Health Enhancement Program (health promotion, self-care, primary care, and disability management) used a combination of population-based primary prevention, targeted secondary prevention, and on-site tertiary prevention through screening, case identification, and case management. Information on personal health risks, healthy lifestyles, self-care, appropriate use of the medical care system, and guidelines for personal planning and action in these areas were presented continuously, in "pulsed doses," at the point of need.

Screening, primary care, and chronic disease monitoring also were provided at the work site by specially trained nurses and nurse practitioners. This care enhanced access, continuity, social support, and the ability to identify and counsel persons at risk of lifestyle-related illness or injury. The service delivery component reduced the cost of lost time to use the health care system, provided much more cost-effective service, was a vehicle to discuss the most effective diagnosis and therapy for a given condition, and allowed referral to cost-effective providers.

Health staff manages complex cases and all disability programs, including workers' compensation. Representative reasons for use of the Health Centers, derived from a 1988 survey (see Methods) are shown in Table 1.

Health and Safety works with the Offshore Relations function to provide medical clearance, cross-cultural counseling, surveillance, and support to employees and dependents stationed abroad. The Health staff also man-

ages the emergency evacuation process, should that be necessary.

The Safety and Industrial Hygiene program disseminated information about occupational chemical exposures and physical hazards as well as protection from those hazards. Significant improvements were made in hazard containment and elimination. Intact work groups were used to present information and suggest and make improvements in the work environment. Divisional competition for improvement in safety added motivation, as did management targets for accident frequency, severity, and cost. Hazard communication was integrated into the new employee orientation and skill-building process.

Benefits Changes

In a collaborative process between Treasury, Benefits and Health, and Safety, utilization review was introduced for the self-insured indemnity insurance plan in 1985, with full implementation in 1986. Standards for length of stay have been progressively reduced over 4 years. Case management, particularly in the psychiatric and substance abuse areas, was added in 1987. Data reporting and analysis from claims were significantly upgraded. These changes were widely communicated through media, meetings, and personal counseling by Benefits and Health staff. There have been significant additions of preventive services to the indemnity benefits package, including well-baby care, immunizations, mammography, Pap smears, and preventive dentistry, and changes to promote wise use of health services.

Very low family contribution rates provided incentives for enrollment in staff model HMOs. The proportion of employees enrolled in HMOs increased from 16% in 1985 to more than 50% in 1989. The object was to increase the use of preventive services and to provide a more comprehensive benefits package at the same or lower cost.

Treasury modified both the Health Benefits and Workers' Compensation assessment systems so that Divisions now pay according to their actual illness and injury experience, with a "tail" modification factor. This provides an incentive for program implementation to improve health and safety.

After several years' experience with a hybrid managed indemnity/HMO system, it became apparent that benefits could be more efficiently managed through a single, dual-option system. Starting in 1991, employees may stay inside a managed care network at full reimbursement or may use any provider with a substantial copayment and deductible. Health staff developed parts of the network in areas where the third-party administrator was unable to penetrate the medical community.

Educational Outreach

Through the Northern Telecom University Interaction Program, independent preceptorships, and the INROADS program for minority students, the Health Enhancement Program has hosted over 50 undergraduate

TABLE 1

Reasons for Use of Health Centers in Percents*

Primary care	42
Occupational injury	37
Physical†	23
Medical benefits information	22
Fitness	20
Lifestyle counseling	17
Physician referral	10
Immunization	5

* May total more than 100% due to multiple choices.

† Protocol calls for recheck every 3 years, so eligibles are 1/3 of population.

Source: Employee Awareness and Perceptions of Medical Benefits Programs, NCG Research, 1988.

and graduate students in health promotion, nursing, physical fitness, safety, ergonomics, occupational health, and nutrition.

Data Analysis and Reporting

Health and Safety personnel analyzed workers' compensation, benefits claims, and utilization management data as well as risk assessment data to determine patterns of illness and health service use in the employee and dependent population.¹⁻³ A *Cost Effective Health Care* report was submitted to senior management and distributed to all Cabinet members and Human Resource executives as the basis for annual presentations at the corporate, group, and division levels. The report included sections on the total costs of ill health, including lost time, medical care costs, wage replacement costs, manpower replacement costs, and down time. It also projected savings from the substitution of in-house services for purchased medical and health promotion services.

Evaluation Methods

A formal evaluation scheme was not designed into the various elements of the health management program. Cost, risk, and diagnostic data were collected in the Health Centers, through various surveys, and from insurance claims data to monitor progress and expenditures. This information formed the basis for a business analysis of the programs. As is typical in such management reporting, we were mainly concerned with expense trends and the reasons for them. We did not structure in control groups or stage the interventions, as the object was to introduce change as quickly and as inclusively as possible. Participation in work site wellness programs is considered a benefit by our employees. Controlled dissemination of these innovations would have created employee relations problems, as there was company-wide demand for health promotion and safety programs, and management demand for utilization controls.

Staff conducted pilot and population-wide surveys of health risks and internal service use. (Because companies are primarily concerned with the human and financial costs to the organization, we believed the employed group as a whole was the appropriate unit of analysis.^{4,5}) The 1984 HealthCheck[®] screening at Headquarters was repeated in 1986 to determine whether the Health Enhancement Program had resulted in risk-factor and self-reported cost reduction and to determine perceived reasons for any change.¹ Baseline personal risk factor prevalence was determined from merged data from mass HealthCheck[®] screenings held in late 1984 and early 1985 to establish baseline health records for most employees. Self-reported (1988) data were derived from a company-wide 10% stratified random sample survey. Measured blood pressure control data were collected during the annual blood pressure screening and stored in a custom database.

Indemnity insurance claims data were analyzed, by diagnostic category, adjusted for HMO migration, age, and benefits inflation. Individual paid indemnity medical claims were coded by International Classification of Diseases-9-CM diagnosis and CPT-4 procedural code. Averages then were provided by major diagnostic category to track claimant (case) rates, cost per case, inpatient, outpatient and total cost per 1000 employees and dependents, and hospitalization rates. The data were reformatted using custom-designed spreadsheets to compute rates adjusted for HMO migration, population mean age, and benefits inflation.

Cost data were adjusted to constant dollars, with base year 1984, using the benefits trend factor for major companies tabulated by several consulting firms.⁶ Interpretation of cost trend data is critically dependent on the inflation adjustment factor used. (Although the benefits trend index appears to be more accurate for private sector medical care outlays by employers, it is not a weighted market basket, nor is it collected in a rigorous sampling frame.) Inasmuch as it is logical that cost inflation should be relatively equivalent for any broad diagnostic category (because the general inputs, such as hospital facilities and nursing care are similar), this may not be true due to changes in specific input costs, such as drugs, and changes in technology, such as the introduction of effective anti-ulcer drugs in place of surgery.

The mean age for the population insured by the indemnity plan increased from 34 to 36 years from 1985 to 1988. In the age range discussed here, hospitalization rates, office visits per 1000, and prescriptions per 1000 increase 2.5% per year of mean age in this mean age bracket.⁷⁻⁹ The effects of these adjustments are particularly pronounced for mental disorders, which provides a good illustration of the importance of adjustments (Fig. 1).

Stepwise multiple regressions of length of stay (LOS) and admission rates were performed against bed days per 1000 by major diagnostic category to determine the cumulative savings in inpatient care due to reduced LOS, which were presumed to be due to the utilization management (UM) program implemented at the same time as the Health Enhancement Program, and to other factors. The UM program affected LOS only.^{10,11}

Standard illness and injury frequency and severity rates were tabulated from the 200 Log required by the Occupational Safety and Health Administration. Costs for self-funded workers compensation pay outs were obtained from the third-party administrator and adjusted to real dollars using the compensation trend index calculated by the National Council on Compensation Insurance.¹²

Results

Cost Improvement Awards

Most Division Health Centers have received Cost Improvement awards for cost avoidance totaling several million dollars a year for a variety of Health Promotion

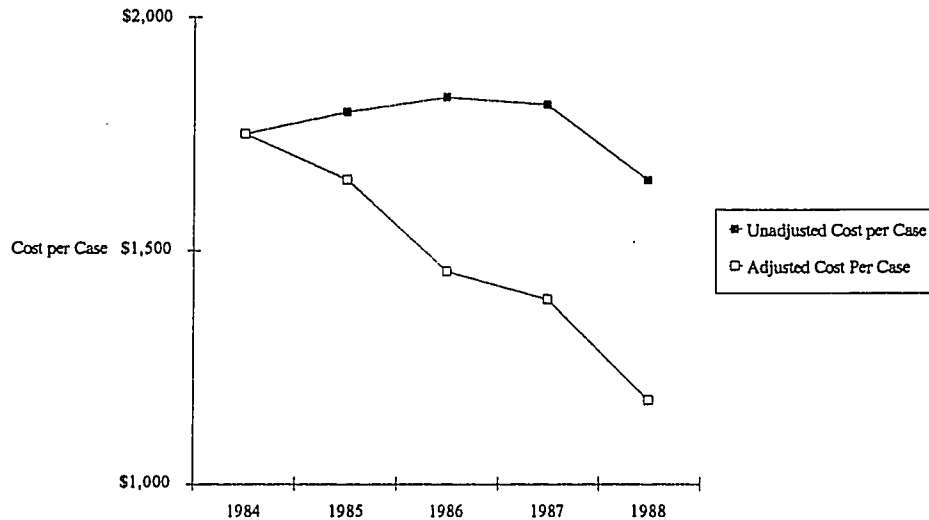


Fig. 1. Unadjusted and adjusted cost per case for mental disorders.

programs. These awards are screened by the Finance function and approved by senior management. Programs also have received awards for health promotion and safety from the Governors of North Carolina and Tennessee, the US Secretary of the Department of Health and Human Services, Liberty Mutual Insurance, Kelly Communications, and several professional organizations.

Pilot Evaluation

The nonrandom pilot evaluation of HealthCheck participants at Headquarters from 1984 to 1986 ($n = 153$ in 1984 and 78 in 1986) revealed significant improvements in some self-reported health behaviors, assessments, and health service use. These included improvements in seat belt use (most or all of the time: 67% to 95%, $P < .001$), heavy drinking (mean decrease of one risk stratum, $P < .05$), days absent (mean decrease of 2 days per year, $P < .01$), physician visits (decrease of 1 per year, $P < .001$), hospital admissions (decrease of 0.5, $P < .05$), out of pocket health related expenses (decrease of \$297/year, $P < .001$) and perceived health status (good to very good, $P < .001$). There were also improvements in measured physiologic variables. VO_2 max increased by 5 ml/min ($P < .005$); body fat decreased by an average of 3 percentage points ($P < .005$); and systolic blood pressure dropped an average of 6 mm Hg ($P < .05$). Participants did not report a subjective improvement in fitness.

Company-wide Health Risks

This led us to consolidate health risk data collected in each division in 1984 as part of the program needs assessment and to compare it to self-reported risks collected from a 10% random stratified sample of employees conducted in 1988 in conjunction with a benefits survey. On a company-wide basis, there were significant

improvements in heavy drinking, seatbelt use, smoking rates, and stress levels (Table 2). Some risks factor prevalence varied significantly by job class as of 1988, with implications for programming. There was significantly more smoking ($P < .001$) among nonexempt and hourly employees. There were more abstinent persons among the hourly employees and more heavy drinking among technicians ($P < .0001$). Significantly more stress was reported among exempt employees ($P < .001$).

Blood pressures were measured annually in a department competition. With a sample size of about 6000, including several entire divisions, the prevalence of uncontrolled hypertension dropped from 15% in 1985 to 4% in 1988.

Analysis of Insurance Claims Data

One element of management analysis and reporting was designed to use available medical insurance claims information. It was a business analysis rather than a research project, in keeping with the parsimonious approach of the entire program. The data analyzed and reported, therefore, reflect actual cost and risk experience, but caution must be used in interpretation and in ascribing causal associations.

Our initial intent was to examine associations between severity and frequency of illness trends and health promotion interventions, and between resource use and utilization management interventions. The main data source available to us was billed and paid medical service data from the indemnity insurance program. This was a reasonable pool of information to analyze from at least one standpoint, since company officials were interested in the effects of our programs on the escalating outlays for medical benefits. However, HMOs were unable or unwilling to provide utilization data by diagnostic group. In some cases, they did not provide data at all. Therefore we tracked population cost and the num-

TABLE 2

Reported Changes in Health Behavior Prevalence NTI Employees Companywide 1984 v 1988 ($n \approx 600$)

Risk Factor	1984	1988	P Value
	%	%	
Alcohol use more than 1 drink/day	23	12	.05
Elevated blood pressure*	15	18	NS
Uncontrolled hypertension	15	4	.0001
Elevated cholesterol†	NA‡	25	NA‡
Overweight§	22	39	.004
Seat belt use	20	81	.001
Smoking	33	25	.05¶
Sedentary lifestyle	65	59	NS
Great work stress	40	33	.05
Great home stress	8	8	NS

* Greater than 140/90. These figures include all those known to be hypertensive, whether controlled or uncontrolled. We believe the apparent increase reflects better case finding.

† Greater than 220 mg/dL.

‡ NA, not available.

§ Since this was a self-reported item, it is believed the apparent increase is due to an increased level of awareness.

|| All or almost all of the time.

¶ If the 17% rate achieved after the company became smoke free in 1988-1989 is used, the significance rate becomes .001.

ber of different claimants (a proxy for disease prevalence data) for the segment of employees and dependents insured by the indemnity program and adjusted the data as described above.

These data are analyzed in the aggregate rather than on a case-by-case basis and then reagggregated, for several reasons. The primary ones were constrained data processing resources on our part, and limited analytic resources at the fiscal intermediary, which had the tapes and mainframe. We were not able to adjust cases for severity or to create "episodes" of care in which all services for a given episode of illness are linked. The former would have required the use of special software such as APACHE or MEDISGRPS. The latter continues to be a perplexing analytic problem because starting and stopping dates are not always clear, and because there may be more than one illness occurring at the same time.

There is another inherent risk in this type of analysis. With turnover in the 7% range, for example, a quarter of the work force would change in 3 years. One makes the assumption, therefore, that the demographics and health status of those entering the work force are similar to those leaving; however, there are no data to support this. Further, new workers will have had less exposure to the health promotion program, weakening any causal association between that intervention and changes in risks, health status, or costs.

One can compare the points at which utilization management or health promotion interventions were introduced and inflection points in cost trends or regress one data series on another to determine correlation. This analysis is limited by the length of the time series, which in this case is relatively short.

As mentioned above, data were adjusted by reintroducing a weighted average utilization for employees and dependents who had moved to HMOs, based on their indemnity claims experience in the year before selecting the HMO. The increase in enrollment in HMOs caused

apparent adverse selection against the indemnity plan in all areas, including admission and hospital utilization rates, as low users left the indemnity plan and likely stayed with the HMO.¹³ For example, the rate of claimants/1000 employees and dependents was on average 1.5 times higher for those who stayed in the indemnity plan. The cost per case was on average 1.4 times higher. Psychotherapy,¹⁴ prescription drugs, and chiropractic treatment in particular were more expensive. The admission rate was on average 1.6% higher, and the average length of stay was 1.4 times higher. In total, bed days were 1.7 times higher. These data are consistent with several previous studies¹⁵⁻¹⁸ but not others.¹⁹ Adverse selection seems to be related to the relative out-of-pocket cost of the two alternative benefits plans as well as to the model of HMO presented. These were all staff models. In cases where individual practice associations are offered, there may be adverse selection against the HMO as ill people with established physician relationships switch to the more comprehensive, but community-rated HMO.^{20,21}

As was the case with almost all insurers, properly coded and formatted data were not available prior to 1984. With all these caveats in mind, let us examine the available data.

Health Service Use

Adjusted hospitalization (admission) rates declined for a number of major diagnostic categories (MDCs) from 1984 to 1988 (Table 3). There were continuous drops for endocrine and immune disorders (despite the inclusion of AIDS in this category), asthma and bronchitis, gastritis and colitis, female genital complaints, bone and connective tissue disorders, and ill-defined complaints. There were declines from a peak level in 1985 for infectious diseases, congenital anomalies, and injuries. Rates for most other MDCs remained relatively

TABLE 3
Hospitalization Rate Decreases for Key Diagnostic Categories and Procedures (per 1000)

Diagnostic Category	1984	1985	1986	1987	1988
Infectious disease	1.0	1.4	1.2	1.2	0.9
Endocrine/immune	1.6	1.3	1.1	1.0	1.0
Asthma/bronchitis	1.4	1.2	1.0	0.9	0.7
Gastritis, colitis	1.7	1.4	1.3	1.3	0.8
Genitourinary	13.0	8.4	7.0	5.9	5.3
Female genital*	18.2	12.1	10.7	8.9	8.2
Bone/CT	5.7	4.7	4.1	3.1	3.1
Congenital anomaly	1.3	1.6	0.9	0.9	0.7
Injuries	4.4	5.5	5.1	4.1	3.5
Ill defined complaints	16.7	12.0	4.7	3.8	4.0
Total	95.9	93.3	88.0	80.6	73.0

* Denominator is females over 18 only.

stable, with increases noted for nonmalignant neoplasms and perinatal disorders only. In total, the adjusted admission rate dropped from 95.9 per 1000 in 1984 to 73 per 1000 in 1988.

This may be due in part to a secular trend. Advance data from the National Center for Health Statistics' National Hospital Discharge Survey showed approximately a 21% drop in the discharge rate during that period for the population aged 0-64. There should therefore not have been a direct effect of DRGs, which applied only to Medicare beneficiaries. Utilization management has reduced the admission rate directly by only 1% to 2%.¹⁹ This decline might therefore reflect either a change in practice patterns or a change in population health status. The trends began before the introduction of the health promotion program and the utilization management program, and did not change slope appreciably at their points of introduction in 1984-1985 and 1985-1986 respectively.

Reductions in inpatient surgery rates did contribute to the reduction in hospital use. Excision of breast tumors, bone marrow operations, rhinoplasties, lens extractions, dilation and curettage, tubal ligations, and meniscectomies disappeared from inpatient claims records. These presumably were shifted to the outpatient setting. Adjusted inpatient rates declined for hemorrhoidectomies (-50.0%), tonsillectomies (-70.0%), appendectomies (-55.5%), cholecystectomies (-55.5%), cystoscopies (-85.7%), and hysterectomies (-51.5%).

The average length of stay (ALOS) (adjusted for HMO transfers) for mental disorders, myocardial infarctions, gastritis and colitis, female genital complaints, and skin disorders declined substantially (Table 4). In particular, length of stay (LOS) declined for selected surgical procedures. LOS for hemorrhoidectomy fell 73.7%, tonsillectomy by 31.2%, herniorrhaphy by 63.3%, cholecystectomy by 40%, appendectomy by 20.9%, hysterectomy by 19.7%, c-section by 15%, hip replacement by 66.9%, laminectomy by 41.2%, and myelography (and presumably back pain) by 70.3% days on average. ALOS for infectious disease, pneumonia, colectomy, cystoscopy, and overdose rose somewhat. In total, ALOS peaked in 1986, and subsequently has dropped by 6.7%. Total hospital resource use, as measured by bed days per 1000 and adjusted for HMO transfers and age, fell by 22.1% from 1984 to 1988 (Fig

2—the data are shown as an index, being company confidential).

The proportion of reduction in bed days per 1000 employees accounted for by the LOS, by the admission rate, and by MDC is shown in Table 5. Multiple regression revealed that most of the reduction (83.8%) was due to the drop in the admission rate, but that 15% could be ascribed, at least statistically, to reduction in LOS. This figure is compatible with the results of Feldstein et al.^{22,23} The utilization management system appears to have had some effect.

The issue of secular trends again must be discussed. The same National Center for Health Statistics data referred to above demonstrated an 11% increase in ALOS for the 0- to 15-year-old age group, but a 4.1% drop for those 15 to 44, and a 5.6% decline for those aged 45 to 64. Days per 1000, employees as affected by these two parameters, fell 12.2% for the youngest age group, 24.4% for those 15 to 44, and 27.2% for those 45 to 64 years old. We were not able to do a direct comparison, because the Human Resource Information System does not track the ages of dependents.

In the aggregate, adjusted cost per claimant (a proxy

TABLE 4
Changes in ALOS* and Admission Rates for Selected Diagnostic Categories

Diagnostic Category	ALOS*	Admissions/1000
	%	%
Infections	+27.5	-35.7
Malignancy	+12.7	+5.0
Endocrine/immune	-2.1	-23.1
Diabetes	+7.7	-20.0
Mental disorders	-24.7	-13.0
Alcohol abuse	-3.2	+12.5
Drug abuse	+1.7	0
Nervous system	+25.6	-53.9
Circulatory disease	-8.5	-7.0
MI	-36.2	-25.0
Bronchitis/asthma	-4.8	-41.7
Gastritis/colitis	-24.3	-42.9
Ulcer	-36.7	-33.3
Female genital	-14.0	98.44
Births	-8.5	-54.8
Skin	-44.3	-15.4
Injury	-9.9	-36.3
Ill defined	-5.3	-67.7
Total	-6.7	-21.5
Total without births	-7.0	-5.0

* ALOS, average length of stay.

for cases, we believe), as expressed as a ratio of annual cost over a base year (1984) fell 18% (Table 6) (actual cost data are company confidential). Smooth declines were seen for a variety of MDCs. Others stayed relatively stable, the ratio rose only for ulcer disease. The claimant (case prevalence) rate did increase for infectious disease, malignancy, endocrine and immune disorders, diabetes, mental disorders, alcoholism substance abuse, ulcer, bone and connective tissue disease, and congenital anomalies. It remained stable for other MDCs. These MDCs accounted for the 13% increase in one year case prevalence from 574/1000 employees to 651/1000 employees from 1984 to 1988. Whether these changes are due to better case finding is unknown, but one might suspect that was the case inasmuch as the total costs for these MDCs did not increase. An inter-

esting finding was noted for acute myocardial infarction: when the case rates for employees and dependents were separated, a decline could be seen for employees, who were exposed to the Health Enhancement Program, and dependents, who were not (Fig. 3).

We did not link individual risk assessments (including physical examination and laboratory data) and claims data. Further, risk assessments were done on individuals every 2 to 3 years, reducing the number of data points. Therefore, we examined and adjusted population claims data to determine any association between trends in risk levels and trends in expenditures.

There are downward trends in adjusted total cost per 1000 population (Table 7) for a number of diagnostic categories or diagnoses logically associated with lifestyle risks (or conversely, their reduction). These in-

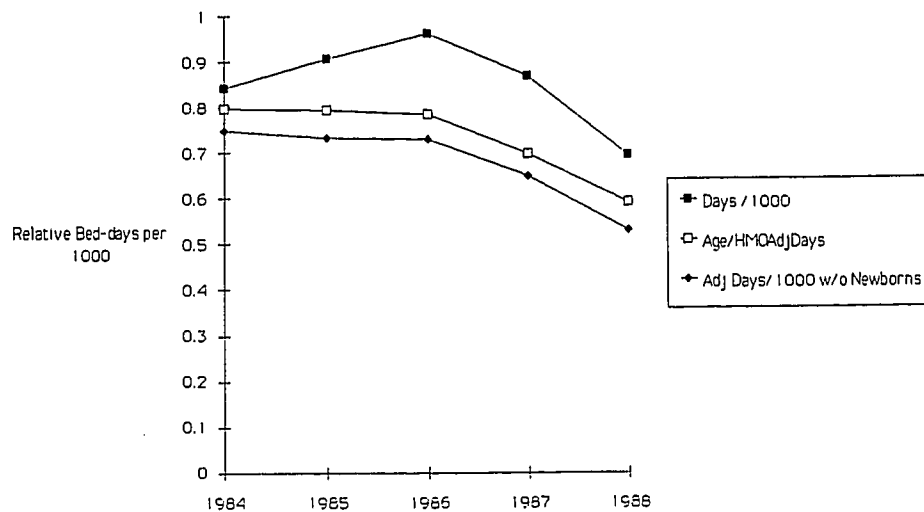


Fig. 2. Relative changes in unadjusted and adjusted bed days per 1000 employees and dependents.

TABLE 5
Proportion of Variation in Bed Days Accounted for by Changes in ALOS* and Admission Rates for Selected Diagnostic Categories

Diagnostic Category	ALOS*	Admissions/1000	P Value (Model)
	%	%	
Infections	39.67	59.98	.005
Malignancy	95.14	4.42	.01
Endocrine/immune	95.30	NS	.003
Diabetes	63.90	NS	.05
Mental disorders	70.64	28.19	.017
Alcohol abuse	5.29	88.51	.017
Drug abuse	NS	97.80	.011
Nervous system	37.38	59.62	.007
Circulatory disease	42.97	50.73	.032
MI	NS	67.39	.067
Bronchitis/asthma	3.76	94.71	.015
Gastritis/colitis	5.00	92.78	.024
Ulcer	4.30	95.2	.005
Female genital	1.55	98.44	.000
Hysterectomy	NS	99.27	.004
Births	NS	70.7	.05
Skin	84.20	15.63	.002
Injury	14.43	85.20	.007
Ill defined	NS	99.64	.001
Total	83.8	15.2	.01
Total without births	51.98	42.13	.01

* ALOS, average length of stay.

TABLE 6
Cost/Case Ratio Decreases for Key Diagnostic Categories and Procedures (per 1000)

Diagnostic Category	1984	1985	1986	1987	1988
Infectious disease	1.00	0.84	0.85	0.84	0.80
Malignancy	1.00	0.67	0.77	0.72	0.60
Mental disorders	1.00	0.92	0.80	0.73	0.61
Substance Abuse	1.00	0.92	0.80	0.73	0.61
Circulatory disease	1.00	0.94	1.07	0.45	0.50
Asthma/bronchitis	1.00	0.87	0.77	0.66	0.73
Gastritis, colitis	1.00	0.79	0.86	0.70	0.56
Genitourinary	1.00	0.86	0.79	0.75	0.64
Female genital*	1.00	0.93	0.85	0.80	0.73
Birth related	1.00	0.94	0.95	0.92	0.87
Skin disorders	1.00	0.94	0.79	0.75	0.73
Bone/CT	1.00	0.94	0.81	0.74	0.73
Congenital anomaly	1.00	0.45	0.42	0.38	0.44
Total	1.00	0.91	0.88	0.88	0.82
Total without births	1.00	0.88	0.83	0.84	0.78

* Denominator is females over 18 only.

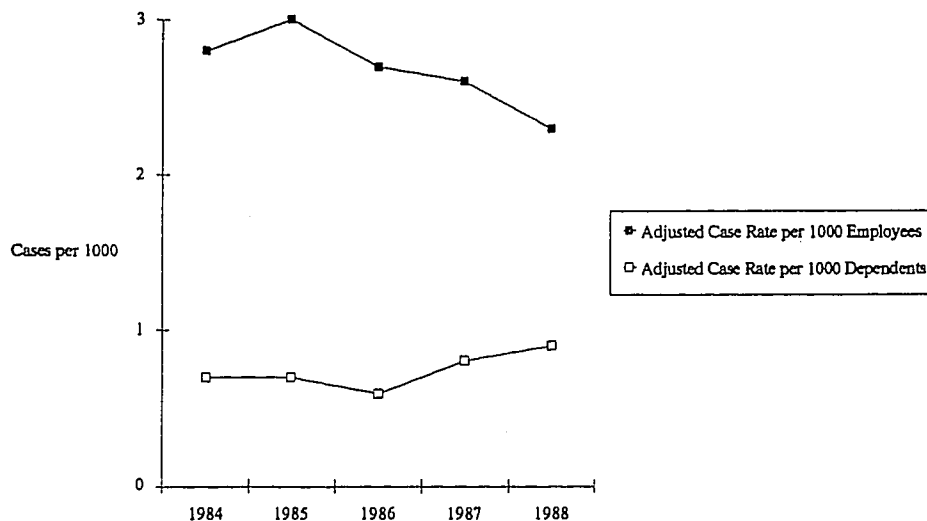


Fig. 3. Adjusted case rates per 1000 employees and dependents for heart attack.

clude mental disorders and substance abuse (EAP and substance abuse education); circulatory disease and acute myocardial infarction (fitness, stress management, smoking cessation, and smoke-free workplace, weight reduction, diabetes control, hypertension control); asthma and bronchitis (smoking cessation and smoke-free workplace); ulcer disease, gastritis, and colitis (stress management); female genital disorders (self-care and primary care); birth related (self-care and primary care); injuries (safety and self-care); and ill-defined complaints (wise use and self-care education). Further analysis suggests there may be an association in some categories and not in others.

The reduction in mental disorder costs appears to be due in large part to a shift to the outpatient setting. The reduction in substance abuse costs is seen in both inpatient and outpatient settings, however.

Outpatient circulatory disease costs dropped dramatically, but inpatient costs did not. The reduction in asthma and bronchitis costs was due to a drop in outpatient costs.

There were 60% to 75% reductions in inpatient costs for ulcer disease and gastritis/colitis, and a sharp in-

crease in outpatient expenditures for ulcers and stable costs for gastritis/colitis. There seems to be an effect of technology with the introduction of new pharmacotherapy in this period.

Female genital disorder treatment costs fell in both inpatient and outpatient settings. The reduction in birth-related costs was exclusively on the inpatient side, as were injury costs. The costs for ill-defined complaints declined proportionately in both settings. In total, there seemed to be a slightly greater effect on the inpatient side.

We believe these data suggest an association between interventions and reductions in rates and costs, but they are by no means conclusive, given all the methodologic difficulties associated with an attempt at post hoc reconstruction using business rather than experimental data.

Safety and Workers Compensation Data

We tracked accident frequency and severity on an annual basis, noting substantial downturns in both parameters.

TABLE 7
Ratios of Cost per 1000 to Base Year

Diagnostic Category	1985	1986	1987	1988
Mental disorders	1.00	0.94	0.87	0.76
Substance abuse	1.00	0.95	0.91	0.72
Asthma and bronchitis	1.00	0.83	0.81	0.81
Ulcer	1.00	0.67	0.63	0.60
Gastritis, colitis	1.00	1.08	0.92	0.68
Female genital disorders	1.00	0.80	0.80	0.73
Birth related	1.00	1.04	0.96	0.89
Injuries				
Inpatient	1.00	0.81	0.58	0.61
Outpatient	1.00	1.07	0.98	0.93
Total	1.00	0.96	0.80	0.79
Ill defined	1.00	0.84	0.79	0.64
Total				
Inpatient	1.00	0.98	0.90	0.78
Outpatient	1.00	1.06	0.91	0.95
Total	1.00	1.02	0.91	0.87
Total without birth related				
Inpatient	1.00	0.95	0.87	0.77
Outpatient	1.00	1.06	0.91	0.94
Total	1.00	1.01	0.90	0.87

Frequency dropped 40%, and total lost work days declined 43% as of 1988 (the actual figures are company confidential.) This was accompanied by a 50% improvement in internal safety audit scores.²⁴ We believe that frequency was reduced by the safety and industrial hygiene programs, including engineering controls, personal protective equipment, and extensive worker involvement and education. The reduction in severity, which is related to promptness of treatment and management of lost time, in addition to actual severity of illness or injury, was caused in part by immediately available on-site care and by intensive disability management. We also tracked incurred costs, noting the decline in adjusted cost per worker shown in Fig. 4.

Disability Management

It has become apparent that time and productivity lost due to unmanaged medically related absence are major issues. We are therefore devoting more attention to developing standards and adhering to them, in a manner similar to utilization management of the medical care itself. This service is provided through health centers rather than an outside vendor, as utilization management is.

On-site Care Cost Effectiveness Analysis

On an annual basis, we compared the cost of providing on-site primary care by diagnosis and test to the cost of similar services provided by physicians in the community. On average, community services would have cost nine times the actual cost of on-site care for occupational complaints. Additionally, there was one seventh as much lost time (and therefore lost productivity) when care was provided on site. This was an annual net benefit of over \$1.2 million. For nonoccupational complaints, the

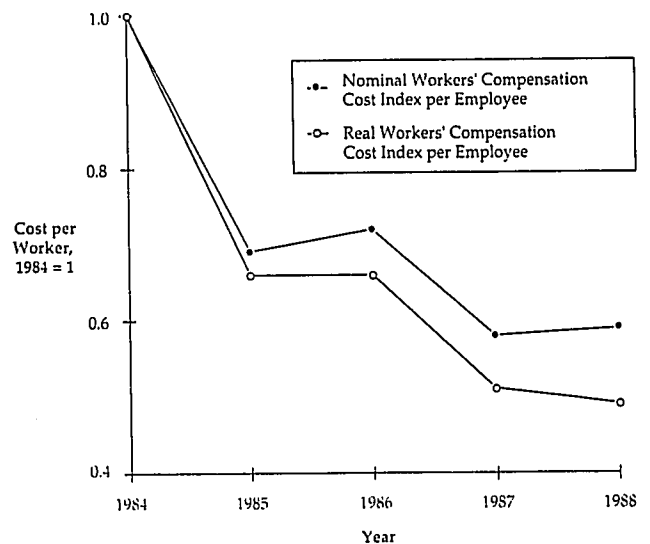


Fig. 4. Unadjusted and adjusted workers' compensation cost per worker, index, base 1984.

direct benefit was 7:1, and indirect benefits were 16:1, for an additional \$1.2 million saved.

Summary

Northern Telecom has pursued a six-pronged, evolutionary strategy to manage health for the last 6 years. This was a cross-functional effort involving the Finance, Benefits, Employee Relations, Legal, Internal Communications, Facilities, Operations, Management Development, and Health, Safety, and Environment functions. Utilization management has progressively reduced inpatient resource use and costs. However, because outpatient costs and the introduction of new technology are not under control in the indemnity plan and there is an imbalance in the risk pools between the two benefits options, all employees will be enrolled in a point-of-

service, dual-option, managed care plan starting in 1991.

There have been significant changes in self-reported and measured health risks. Primary care provided through the Health Enhancement Program has been substantially less expensive than community-based care. Significant reductions in all safety statistics have been achieved through intensified safety, ergonomics, and industrial hygiene efforts. All programs rely on employee involvement at most stages. This integrated approach has been cost effective. A planned research design as well as an improved information system will assist in defining causal relationships in the future.

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APPENDIX

Health Enhancement Program Components

Primary Prevention	Secondary Prevention
Health check	Chronic disease monitoring
AIDS education	CPR/first aid
Back injury prevention	Emergency response
Blood pressure control	Employee assistance
Cholesterol control	Primary care
Cancer awareness	Self-care discharge
Breast, testicular, skin,	Instructions
Colon, cervical	Self-care
Ergonomics	Wise use of health services
Fitness	
Health fairs	Tertiary Prevention
Incentive programs	Disability management
Nutrition	Return to work/modified duty
Prenatal care and	
education	
Safety	
Seatbelts/child safety	
restraints	
Smoking control	
Social support	
Stress management	
Substance abuse	
education	
Travel wellness	
Weight management	

References

- Harris JS. Northern Telecom: A million dollar medically based program in a rapidly changing high tech environment. *Am J Health Promo.* 1986;1:50-59, 84.
- Harris JS. *Cost Effective Health Care*, Nashville, Tenn: Northern Telecom Inc., 1984, 1985, 1986.
- Harris JS. *Health Care Management Report*. Nashville, Tenn: Northern Telecom Inc., 1987, 1988.
- Glasgow RE, Terborg JR. Occupational Health Promotion Programs to Reduce Cardiovascular Risk. *J Consult Clin Psychol.* 1988;56:365-373.
- Katz PP, Showstack JA. Is it worth it? Evaluating the economic impact of Worksite Health Promotion. *State Art Rev Occup Med.* 1990;5:837-850.
- Brenneman DL et al. *Medical Benefits Cost Trends and Cost Containment Strategies*. East Orange, NJ: Noble Lowndes, 1989. See also annual publications by TPF&C and the Employee Benefits Research Institute.
- Fisher CR. Differences by age groups in health care spending. *Health Care Finan Rev.* 1980; Spring: 65-90.
- Arnett RH, McKusick DR, Sonnefeld ST, Cowell CS. Projections of health care spending to 1990. *Health Care Finan Rev.* 1986;7:1-36.
- Jones SP. The costs of membership aging in a Blue Cross and Blue Shield plan. *Inquiry.* 1985;22:201-205.
- Harris JS, Dalton BA, Naron NH. Utilization Management by Third Parties: Comments from the Corporate Health Management Perspective. Submitted to the National Institute of Medicine Study on Utilization Management by Third Parties, June, 1988.
- Gray BH, Field MJ, eds. *Controlling Costs and Changing Patient Care? The Role of Utilization Management*. Washington DC: National Academy Press, 1989.
- Furey EB, ed. *Issues Report, 1989*. New York: National Council on Compensation Insurance; 1989.
- Neipp J, Zeckenhauser R. Persistence in the choice of health plans. *Adv Health Economics Health Serv Res.* 1985;6:47-72.
- Diehr P, Williams SJ, Martin DP, Price K. Ambulatory mental health services utilization in three provider plans. *Med Care.* 1984;22:1-13.
- Lairson DR, Herd JA. The role of health practices, health status, and prior health care claims in HMO selection bias. *Inquiry.* 1987;24:276-284.
- Merrill J, Jackson C, Reuter J. Factors that affect the HMO enrollment decision: A tale of two cities. *Inquiry.* 1985;22:388-395.
- Wilensky GR, Rossiter LF. Patient self selection in HMOs. *Health Aff.* 1986;5:66-80.
- Dunn JP, Mitchell J. Health care experience among employees prior to and after enrollment in a prepaid health insurance plan (HMO). *J Occup Med.* 1984;26:86-90.
- Buchanan JL, Cretin S. Risk selection of families electing HMO membership. *Med Care.* 1986;24:39-51.
- Luft HS. *Health Maintenance Organizations: Dimensions of Performance*. New York: John Wiley and Sons, 1981.
- Berki SE, Ashcraft M. HMO enrollment: Who joins what and why: A review of the literature. *Milbank Q.* 1980;58:588-600.
- Feldstein PJ, Wickizer TM, Wheeler JRC. Private cost containment: The effects of utilization review programs on health care use and expenditures. *N Engl J Med.* 1988;318:1310-1314.
- Wickizer TM, Wheeler JRC, Feldstein PJ. Does utilization review reduce unnecessary hospital care and contain costs? *Med Care.* 1989;27:632-647.
- Harris JS. Controlling work-related illnesses, injuries, and costs: one company's experience. *Occup Environ Med Rep.* 1990;4:28-32.