A major employer as a health care services laboratory

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Abstract

Health care management within the USA operations of the Ford Motor Company is a substantial and critical enterprise. The company provides health care coverage for a population of 636,000 active employees, retirees and their dependents at a cost of US$1.5 billion annually. The company realizes that effective management of health care resources requires continuous improvement in the services for which the company contracts and in the manner in which these services are provided to employees. In this context, the company's health care management department views the Ford employee population as a living health care sciences laboratory for the design, evaluation and improvement of health care services. The population, available data sources, and their advantages and disadvantages for use in the evaluation of disease and health utilization patterns are discussed in this paper from an epidemiological perspective. Two examples of preliminary evaluations are presented to illustrate use of data from this large employee population for improving care provided to persons with elevated risk of cardiovascular disease.

Keywords: employee populations, epidemiology, Ford Motor Company, health services research, health care utilization, the MEDSTAT Group

By any measure the health care management department at the Ford Motor Company is a substantial and critical enterprise. The company spends $1.5 billion each year to provide health care services to its USA employees, retirees, and their dependents. Aside from the costs incurred, it is even more important to realize that the services purchased with these dollars determine whether the employees are healthy and whether they are satisfied with their most important employee benefit.

To manage this health care enterprise properly, the company is incorporating a process of continuous improvement as an integral part of the health care services it provides. Data must be translated into information useful to the design of health care benefit packages. We must be able to identify employee groups with special health and medical needs in order to deliver specialized services for such needs. We must evaluate these special programs, as well as the general health benefit programs, before and after they are implemented. These evaluations will then become the basis for the next series of improvements. In this context, we view the company’s health care enterprise as a living laboratory for the design, evaluation and improvement of health care services.

The purpose of this paper is to describe the potential for using large employers as the analytical basis for studying health care delivery, quality, and outcomes. We will present an epidemiological perspective of the strengths and weaknesses of our living health care services laboratory along with two examples of studies that we have completed during this past year.

The Ford population

The population available for study in our health care laboratory is defined by employment status. The primary or core component of this population is the active employees who run the company’s 60 manufacturing facilities and the engineering and administrative centers in the USA. The second component consists of retirees and their dependents, and the dependents of the active employees.

Active employees

In 1996 active employees numbered 151,500 persons. Approximately 70% (105,500) were classified as hourly employees and the remaining 30% (46,000) were classified as salaried employees. Demographic information regarding this population is given in Table 1.

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The active employee population of the Ford Motor Company, USA, 1996

<table>
<thead>
<tr>
<th>Work activities</th>
<th>Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managerial/administrative/clerical</td>
<td>46 000 (30.4%)</td>
</tr>
<tr>
<td>Large object manufacturing (vehicle assembly and stamping)</td>
<td>57 500 (38.0%)</td>
</tr>
<tr>
<td>Small object manufacturing (engines/transmissions/components)</td>
<td>44 000 (29.0%)</td>
</tr>
<tr>
<td>Warehousing/shipping</td>
<td>4000 (2.6%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ethnic group (%)</th>
<th>Paid hourly</th>
<th>Salaried</th>
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</thead>
<tbody>
<tr>
<td>White</td>
<td>75</td>
<td>85</td>
</tr>
<tr>
<td>Black</td>
<td>22</td>
<td>9</td>
</tr>
<tr>
<td>Hispanic</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td>&lt;1</td>
<td>4</td>
</tr>
<tr>
<td>Female (%)</td>
<td>15</td>
<td>25</td>
</tr>
</tbody>
</table>

Despite the size of this employee population, one could be skeptical that the occupational health issues of automobile workers would be applicable to the workforces in other industries. This, however, is not the case.

The Ford workforce can be divided into four major groups according to their general work activities, as presented in Table 2. The overwhelming majority of salaried employees are engaged in managerial, engineering or clerical functions in locations not physically attached to manufacturing facilities. Their occupational health issues would be equivalent to those seen in most salaried workforces.

The largest group of employees at Ford are directly involved in final assembly of cars and trucks. It might be more useful, however, to think of them as being involved in large object manufacturing. This means that the items that they assemble are larger than the employees. During the assembly process they typically must adapt their physical position to the vehicle or even climb inside the partially assembled vehicle. The occupational health issues associated with large object manufacturing are applicable to certain other industries, but to a lesser extent than the company’s other operations.

The work activity category described as small object manufacturing involves the manufacturing of automobile components, such as engines, transmissions, alternators and fuel pumps. The consistent feature of these activities is that the part is small enough that the employee can position the part to his or her most comfortable working position. The health issues and risks associated with these manufacturing processes are translatable to companies who make small home appliances, molded plastic lawn furniture, lawnmowers, or even personal computers.

The smallest work activity category consists of approximately 4000 employees who work in the company’s 11 parts shipping centers or parts depots. Their function is to receive parts inventory from the company’s manufacturing facilities and then to repackage them as parts shipments to the service departments at Ford dealerships. In addition to the employees in the parts depots, there are employees working in material handling at all of Ford’s 60 manufacturing facilities in the USA. This means that the number of employees routinely involved in material handling is approximately 15 000. Material handling at Ford and its occupational health
issues are no different from those existing in other material handling operations or in the overnight package industry.

**Occupational risks**

Despite the different work activities of the hourly workforce, they share a common set of occupational exposures or risks, among themselves and with other industries. The two most prevalent risks are cumulative trauma disorders and acute injuries. With the exception of skilled trade job assignments and certain maintenance and cleaning tasks, nearly all the jobs in a manufacturing facility involve a high degree of repetition. Despite this, acute injuries such as lacerations, abrasions and contusions account for nearly two-thirds of all first time occupational visits to the plant medical departments. They account for nearly one-half of the injuries and illnesses that are considered sufficiently severe to be recorded on documents that are readily available for government health inspectors from the Occupational Safety and Health Administration.

Although Ford is not a producer of chemicals, the potential for significant exposure is present because the manufacturing processes consume large volumes of chemicals and plastics. Millions of gallons of metal working fluids are used each year in the machining of engine and transmission components. Auto body sealers, adhesives and caulk are applied to vehicle bodies by workers or robots operating near them. Smokes and fumes are generated by welding operations in which door and body assemblies are built-up from smaller stamped metal parts. With few exceptions the exposures are considerably lower than the applicable regulatory standards, but the risk of higher exposures is always present.

Less tangible occupational health risks are those associated with shift work, special work schedules and the ever increasing pressures of competition. Approximately 40% of the hourly workforce work an afternoon–evening shift. A limited number of the assembly plants have special work crew scheduling so that the plant is operated 24 hours a day during the week and 10 hours a day on weekend shifts. Salaried operations and engineering staff are constantly striving to reduce the time required to bring new vehicles or components from design to actual production. All of these factors are increasing the concerns about stress-related issues involving the workforce.

**The larger Ford population**

If the population of active employees at Ford is large enough to support the study of occupational health issues, consider the larger Ford population for the study of health care issues. This larger population includes the active employees, retirees, surviving spouses and each group’s respective dependents. In all, this extended Ford population consists of 636 500 people who in some way receive their health benefits through the company. A distribution of the extended Ford population is presented by hourly and salaried employee designations in Table 3.

The company provides its employees and retirees, and their dependents with health care benefits using three major plan types: health maintenance organizations (HMOs); preferred provider organizations (PPOs); and traditional indemnity plans. HMOs and PPOs both charge a fixed amount for each employee enrolled and provide for all the health care needs of each enrollee whether the costs are trivial or enormously expensive. In either plan, the enrolled employee bears very little or no additional cost for services after the initial enrollment fees are paid by the employer. HMOs assign a physician to each employee to direct the provision of health care services and to arrange for any referrals to specialists that may be needed. PPOs limit their involvement in managing each employee’s use of health care services to requiring that the employee uses health care providers who are affiliated with the particular PPO. After an enrollment fee is paid by the employer, traditional indemnity plans allow an enrolled employee to seek treatment from any legitimate health care provider he or she may choose. Unlike the other two plans, the employee is typically required to pay a percentage of the cost of services received up to a defined cost limit. Moderate to small employers tend to purchase health care insurance from a health care insurance company which reduces the employer’s exposure to significant financial loss if a number of their employees have catastrophic illnesses in a given year. Large employers, like Ford, contract with health insurance companies only to process health care claims, and the large employers still assume the risk of covering all health care costs. This is typically more cost efficient than purchasing health care insurance for large companies.

Among 150 000 active employees, approximately 60% are enrolled in HMOs or PPOs. The remaining 40% are in traditional indemnity plans. When the substantial population of retirees and their dependents is included, the enrollment pattern shifts; 52% (334 300) are in indemnity plans; 32% (202 000) are in HMOs, and 16% (100 200) are in PPOs. This diversity of health care plans that still exists at Ford will present many opportunities to evaluate different approaches to improving health care quality by modifying several different types of health care plan.

<table>
<thead>
<tr>
<th>Enrollment category</th>
<th>Hourly</th>
<th>Salary</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actives</td>
<td>103 000</td>
<td>42 800</td>
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</tr>
<tr>
<td>Retirees</td>
<td>67 300</td>
<td>31 000</td>
<td></td>
</tr>
<tr>
<td>Surviving spouses</td>
<td>33 100</td>
<td>10 400</td>
<td></td>
</tr>
<tr>
<td>Dependents</td>
<td>250 000</td>
<td>98 900</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plan type</th>
<th>Hourly</th>
<th>Salary</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indemnity</td>
<td>334 300(52%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPO</td>
<td>100 200(16%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HMO</td>
<td>202 000(32%)</td>
<td></td>
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</tr>
</tbody>
</table>
Health risks

Regardless of plan type, the Ford population is at risk for health issues that impact the rest of the USA general population. These include developing a chronic disease and the issues associated with its diagnosis and management. As a population, the company’s employees are susceptible to life style factors associated with diminished health status. These include substance abuse, which includes nicotine addiction; lack of physical activity or conditioning; and inappropriate diet. With steady employment come opportunities for a wide variety of recreational activities and their associated injury risks. The employees are at risk, as everyone is, of the health consequences of negative social interactions. Examples would include being involved in an abusive domestic situation, or simply being in the wrong place at the wrong time during a robbery. Finally, even though our employees design and make automobiles, they and their families are not granted exemptions from the laws of physics if they are involved in motor vehicle crashes.

Health-related information structures

In addition to a large, stable population, the company has four existing data systems which support the evaluation and study of health issues among its employees, retirees and their dependents.

Work history and mortality data base

This data base contains detailed work history information for former and current employees. It also contains detailed death information for deceased employees. Currently, this database contains detailed work histories for nearly 900,000 current and former employees back to January 1973. It contains death information (date of death, underlying cause and associated conditions) for over 80,000 former employees.

Worker compensation data base

In the USA each state operates a program which provides financial compensation to workers for disabling occupational injuries or illness. These programs are funded by mandated employer contributions. The primary purpose of this data system is the tracking and payment of workers compensation claims by the company. It is the primary source for claims payment information which is routinely incorporated in detailed occupational health investigations. The findings of these investigations and the costs of associated injury or illness are used to justify plant and process improvements to reduce the risk of injuries and cumulative trauma disorders or acute injuries.

Occupational injury/illness data system

The company has a unique data system to capture and analyze information generated by unscheduled visits to company medical departments. The foundation of the system is an electronic medical record. Information generated during the medical visit is entered directly into the data system by the medical practitioners. This consists of a brief narrative regarding how the injury occurred or what occupational factors were associated with the illness. A clinical narrative regarding presentation of symptoms, diagnosis and treatment is also captured. Codes for diagnosis, body-part affected and treatment are also collected. Internal program logic determines whether the case is of sufficient severity to have the employee’s supervisor complete an electronic incident investigation, which when completed is incorporated in the data base. This assembled medical and safety investigation information is uploaded each week to the Health Data Analysis (HDA) module of the overall Occupational Health and Safety data system. Access to the HDA module is provided to plant-level operations staff and union representatives who are involved in health and safety activities, as well as division- and corporate-level health and safety staff. Currently, there are over 500,000 occupational cases contained in the HDA module from June 1993 to date.

Health care data base

The company maintains a centralized health care data base for the evaluation of care utilization, disease prevalence, and treatment patterns among the Ford population of employees, retirees and dependents. This data base is maintained offsite by a third-party vendor, the MEDSTAT Group. Historically, its function had been limited to the collection of claims data for persons covered by Ford’s indemnity health care plans. In the past 18 months, cost and utilization data from PPOs and HMOs have been added to the data base for all but the capitated plans with very small numbers of Ford enrollees. Currently, it contains health care information for 85% of all of the Ford population for the last 36 months. This portion of the data base includes inpatient, outpatient and pharmacy information.

It should be noted that access to health-related information contained in any of the aforementioned data bases is granted according to a specific set of guidelines for determining who has access and for what purpose. In general, access to occupational injury or illness data is much broader than that permitted for non-occupational health issues. Access to occupational health information is on a need-to-know basis, which is usually defined by activities that need to be conducted for incident investigations and to comply with government regulations. The access to non-occupational health information is much more limited. Analysis of this type of data is conducted through a third-party data management group. They assemble and link claims information provided by health care providers using a scrambled employee identifier. This eliminates the ability of any of the company analysts to identify a specific individual whose health information is included in a particular analysis. To improve the current guidelines and practices, the company is establishing an Institutional Review Board comprised of outside experts in confidentiality and study design issues to evaluate future health care research proposals.
Advantages and disadvantages of using Ford as a health care services laboratory

Using Ford, or any large employer, as a living laboratory for studying health care patterns and costs has advantages and disadvantages.

Advantages

A large, well-defined, stable population
The population of the 636,000 persons covered by Ford health benefits is a very stable population, especially after the first year of employment. While Ford employees and retirees may change health plans, they still retain some type of health coverage through Ford. This makes multi-year longitudinal studies possible.

Health care plans of different types and from different vendors
The Ford population has significant representation in all of the major plan types: indemnity, HMO and PPO. This affords the opportunity to study case management hybrids or alternatives in a market that is not totally dominated by HMOs.

Health care information is automated
The basic core information necessary for health care studies is automated and online for ready access by authorized users. Inpatient, outpatient and pharmacy information is available for all three major plan types (indemnity, PPO, and HMO) for the last 36 months. The inpatient and outpatient information for indemnity plans is available for the past 7 years.

Historical work history and mortality information
This data base is one of the largest work history and mortality data sets that exists. It supports the conduct of cohort mortality studies and nested case control studies. The cohort mortality studies compare the death rates among Ford employees with those of the USA general population. The nested case control studies compare the occupational histories of employees who died from a particular disease to those of co-workers who did not die of the same disease. These comparisons establish associations between certain exposures and the disease, which in turn guide prevention activities.

Substantial middle-income black population
The number of black employees at Ford in 1996 was approximately 25,000. With the inclusion of their dependents and retirees, the number of black individuals receiving health care benefits through Ford is approximately 120,000. This entire population is solidly middle-income or better. The lowest paying entry-level job at Ford pays over $18 an hour, which translates to an annual income of almost $40,000, and has extensive health care benefits. This offers a unique opportunity to study the health issues of this understudied population group.

Disadvantages

Study population is primarily a Midwestern population
By not having representation of West coast populations, evaluations or demonstration projects can not incorporate the attitudes and behaviors of populations living in areas of the country where HMOs dominate the health care landscape.

Middle- or upper-income population only
The income levels of the Ford population precludes the evaluation of health issues or utilization patterns associated with poverty. This feature also may cause a certain lack of comparability between the Ford health care studies or measures and the corresponding national-level studies or measures.

Health care plans of different types
Just as having a variety of health plans to study can be advantageous, it can also create difficulties. The most obvious is the variation in the data variables which are available and the quality of the data supplied by each plan. For example, a staff-based HMO will link costs to patient services differently than will a practice-based HMO. These types of differences limit investigators’ ability to make comparison of costs between these types of plans.

Insufficient number of Hispanics in the population
Ford’s operations are based primarily in the Midwest and south-central USA. For this reason, the number of Hispanic individuals in the population is not sufficient for meaningful analysis of health care information among this ethnic group.

Health care data systems do not include information about functional capacity of patients or clinical values from laboratory and diagnostic tests
Ford’s health care data systems contain claims information and a limited amount of patient satisfaction survey information. The diagnoses and pharmacy information associated with the claim information is the current mechanism used to identify patients with specific diseases. While this

Good working relationship with the United Automobile, Aeronautical and Agricultural Implement Workers Union (UAW)
The relationship between Ford and the UAW is one of the most productive in all of American industry. The spirit of cooperation is most evident in the jointly funded health programs which were first established in 1985.

Qualified professional staff direct the health care research program
Ford health care management staff have expertise in epidemiology, ergonomics, health care management, industrial hygiene, occupational medicine, systems and toxicology. While their technical competencies are broad and strong, Ford must still engage outside technical vendors to manage Ford’s health care enterprise properly. When this is done, Ford builds in strong collaborative links between its technical staff and the outside vendors.
supports many types of applied research, several assumptions and extra data processing steps are needed to assemble case series for study. As Ford’s health care management activities become more sophisticated analytically, this will become a major shortcoming of the data systems.

A sampling of studies

We offer the following examples of health studies and evaluations as evidence of how a large employee population can serve as a health care laboratory.

Targeting case management for patients following coronary bypass surgery

Ford provides coverage for over 83,000 active employees and early retirees (younger than 65 years of age) through traditional indemnity plans. Nearly 300 members of this coverage population receive coronary artery bypass grafts (CABGs) each year. The question of how best to assess the case management needs of these patients precipitated an evaluation of CABG claims data. Using these data as a surrogate for clinical outcomes data, the evaluation was designed to determine if there was an obvious targeting strategy for identifying types of cases which should be the subject of intense case management after their CABGs.

Two series of CABG cases were identified using the Ford claims data warehouse that is maintained by the MEDSTAT Group. One case series consisted of patients who received their CABGs in 1993. The other series was identified among 1994 CABG cases. The medical claims for each case were assembled for a time frame which began 12 months prior to their admission for the CABG and extended for at least 36 months following discharge from the hospital. Claims were examined for three major time intervals: pre-admission; the hospital stay; and post-discharge. The initial assumption was that inpatient costs would be predictive of the cost levels after discharge; as shown in Figure 2, they were not. The CABG cases were then reaggregated in terms of their respective medical costs for the 2-month post-discharge period.

As a group, the cases whose medical costs exceeded $5000 during the 2-month interval had an average cost per case that was more than three times that of the other cases. For cases with more than $5000 of cost for the 2-month interval, the cost per case for the 3–12 month interval was $15,073 per case as illustrated in Figure 3. The other cases had an average cost of $4,362 for the same period. This cost difference diminished during the second year following discharge and virtually disappeared during the third year. This indicated that a targeting strategy based on costs incurred soon after discharge could have application for CABG patients.

Targeting prevention efforts for cardiovascular disease (CVD)

In an effort to move further forward in the prevention cycle, utilization of health care services was evaluated to determine which employees had received recommended clinical screening and evaluation. The population included in this evaluation consisted of 72,000 active hourly and salaried employees enrolled in the company’s traditional indemnity health plan. Their claims data for 1995 were reviewed electronically to determine which employees’ medical claims histories showed a diagnosis of ischemic heart disease and those that did not.

Of the 72,000 employees, 8,000 had records which carried a diagnosis of ischemic heart disease (Figure 4). By looking
at the previous 4 years of their claims data along with the 1995 data, it was possible to determine that 800 (10%) had undergone a procedure for CABG or percutaneous transluminal coronary angioplasty (PTCA). The other 7200 (90%) had diagnoses for ischemic heart disease but did not have any surgical intervention from 1991 through 1995. This group could have had CABGs or PTCA prior to 1991 or they could be high risk patients who could benefit from risk reduction efforts or referral for PTCA or CABG. Note: the number of patient's surgical procedures is less than the 300 per year cited in the previous example; this was because review of procedures from 1991 through 1994 did not include employees who were enrolled in the indemnity plans prior to 1995, but had changed coverage or retired prior to 1995.

The more interesting findings involved those employees who had no diagnosis of heart disease. These 64 000 active employees were categorized into three groups on the basis of the health care utilization patterns revealed by their claims data. The claims experience of the employees was reviewed electronically from 1991 through 1995. It was determined that 17 000 had records of a visit to a physician's office during the time period and had a record of a blood test, which presumably included a characterization of lipid levels. No diagnoses of hypertension, diabetes or elevated lipids were associated with their respective claims data. In Figure 4, this group was considered to have adequate medical visits without elevated risk of CVD. A second group, which consisted of employees over 35 years of age in 1991, also had claims for medical visits. None of this group, however, had any claim for a blood test. Therefore, this group of 29 000 employees had been to see a physician, but the minimum recommended screening for elevated lipid levels during the 5-year period had not been conducted. This group was considered to have marginal medical visits and could be a candidate population for targeted efforts to promote recommended screening. The remaining 18 000 employees were considered to be at elevated risk of developing CVD given their existing conditions of diabetes, hypertension or elevated lipids. Members of this CVD Risk group could be candidates for specialized disease management efforts. Refinement and pilot testing of this approach to identify CVD Risk groups could be used to target late stage prevention efforts instead of relying on generalized health education messages which are ignored by most healthy and at-risk individuals.

**A randomized clinical trial**

To demonstrate that Ford is pushing the envelope in health care studies, we would like to give a brief overview of a randomized clinical trial that is being conducted by the Centers for Disease Control and Prevention with the assistance of Ford. The study is designed to determine the efficacy of influenza vaccine among a young to middle-aged, apparently healthy employee population. Its basic design is a double-blind randomized clinical trial with placebo. The study group consists of 1200 Ford salaried employees; 600 received vaccine and 600 received a placebo. Each subject was sent health status surveys every 2 weeks through the company's internal E-mail system. The response rate for the observation period during the influenza season was 97%. Its findings will be incorporated into the Centers for Disease Control and Prevention recommendations regarding vaccination of apparently healthy, young to middle-aged adults.

**Conclusions**

The need to base health care program decisions on appropriate data is critical to the proper management of these large enterprises. The health care services research community should consider large employers as living laboratories for applied research. What can be learned in terms of analytic methods and actual health care findings could be of significant benefit to the employer functions involved in protecting the health of the company's employees and their dependents. After all, healthier employees will certainly translate into a healthier company.

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