

Effect of Multiple Chronic Conditions Among Working-Age Adults

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Objective: To determine the longitudinal effect on healthcare costs of multiple chronic conditions among adults aged 18 to 64 years.

Study Design: Retrospective cohort assessment of working-age employees and their dependents with continuous coverage in a self-funded health plan from January 1, 2004, to December 31, 2007. Data were obtained from health benefit enrollment files and from medical and pharmacy claims.

Methods: Individuals were defined as having chronic conditions based on modification of a published method. The mean annual healthcare costs were estimated for individuals with 0, 1, 2, 3, 4, or 5 or more chronic conditions. The probability of persistence in high-cost categories across years was estimated for individuals in each group.

Results: Overall, 75.3% of working-age adult enrollees had at least 1 chronic condition, 54.3% had multiple chronic conditions, and 16.5% had 5 or more chronic conditions. The cost of healthcare was higher among individuals with more chronic conditions for all ages. The mean medical cost per year for an individual with no chronic conditions was \$2137, while that for an individual with 5 or more chronic conditions was \$21,183. Enrollees with more chronic conditions had higher persistence in high-cost categories between years and persisted at these high costs for more years.

Conclusions: While multiple chronic conditions are common in the population 65 years and older, they are also of great concern for the working-age population. Understanding how to effectively manage individuals with multiple chronic conditions is an important challenge. Effective care management focused on managing the patient as opposed to a condition has the potential to significantly affect healthcare costs.

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For author information and disclosures, see end of text.

Cross-sectional investigations have demonstrated the importance of key chronic conditions on the utilization and cost of healthcare services among older populations.¹ Medicare patients with 3 or more chronic conditions were estimated to account for more than 92% of 2002 Medicare expenditures.² Although Medicare patients have been studied extensively, little is known about the prevalence and longer-term implications of multiple chronic conditions among younger adults. The highest prevalence of chronic conditions is among older persons, while most individuals with chronic conditions are working age and privately insured.³ Healthcare expenditures for the nonelderly are rising.⁴ The rising prevalence of multimorbidity among working-age patients has increased pharmacy needs and the use of healthcare services.^{5,6} The indirect costs of absence, short-term disability, and productivity losses add to healthcare costs.⁷

Understanding the prevalence, persistence, and cost of multiple chronic conditions among working-age adults is essential to improving care and managing healthcare costs. This article examines the prevalence of multiple chronic conditions among a population of employees and their dependents with continuous coverage in a large healthcare delivery system from January 1, 2004, to December 31, 2007, and assesses the effect on persistence of healthcare costs over time.

METHODS

Study Sample

All 33,324 employees and dependents of the Mayo Clinic in Rochester, Minnesota, aged 18 to 64 years with continuous health benefit coverage from January 1, 2004, to December 31, 2007, were included in the study. To avoid potential bias, enrollees who died during the time frame (n = 46) were included. Almost 75% of 45,288 enrollees aged 18 to 64 years in 2007 were included in the analysis.

Data Sources

Continuous healthcare benefit coverage was determined from benefit enrollment records for the 4-year time frame. Data on health-

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care utilization and costs were obtained from medical and pharmacy claims for eligible individuals.

Measures

Chronic Conditions. Our operational definition of chronic conditions is a modification of that used by Hwang et al.¹ Chronic conditions not classified into chronic disease subgroups according to the method by Hwang et al (using Agency for Healthcare Research and Quality Clinical Classifications Software for *International Classification of Diseases, Ninth Revision, Clinical Modification* [<http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp>]) were then assessed for inclusion by a panel among us (JMN, RJS, and DMF). All diagnosis codes included for any hospital encounter or physician visit between January 1, 2004, and December 31, 2007, were included to determine the chronic conditions for each enrollee.

Costs. Costs were analyzed from the payer perspective as modified to be based on total payments made by any insurance or by the patient for deductibles, coinsurance, or copayments. Costs were reported in constant 2007 US dollars, with adjustments over time based on the Consumer Price Index (<http://www.gpoaccess.gov/eop/2007/b60.oxs>). Costs were examined within age groups, in expense categories, and by the number and type of chronic condition.

The study sample was rank ordered by both annual and 4-year total expenses and then categorized into the following 4 percentile groups: (1) the top 5%, (2) the next 6% to 20%, (3) the next 21% to 50%, and (4) the bottom 50%. A transition probability matrix was developed to characterize individual changes in healthcare spending from year to year over 4 years.

RESULTS

Prevalence and Cost of Chronic Conditions

The number and percentage of adults identified with specific chronic conditions, as well as the mean annual cost for all enrollees with that chronic condition, are given in **eAppendix A** (available at www.ajmc.com). The most frequent chronic conditions included hyperlipidemia (29.4%), hypertension (18.9%), depression (16.6%), allergic rhinitis (14.9%), and osteoarthritis (12.7%). Most of these chronic conditions increased with age, some substantially. When considering both prevalence and total costs per patient for all services, the patients with the following chronic conditions had the largest total expenditures: hyperlipidemia, hypertension, depression,

Take-Away Points

This study looked at the longitudinal effect on healthcare costs of multiple chronic conditions among working-age adults.

- Results showed that 75.3% of working-age adult healthcare system enrollees had at least 1 chronic condition and that 16.5% had 5 or more chronic conditions.
- The cost of healthcare was higher for individuals with more chronic conditions.
- Enrollees with more chronic conditions had increased persistence in high-cost categories and persisted at these high costs for more years.
- The best care management for working-age adults may be a stratified approach. Effective care management focused on managing the patient as opposed to a condition has the potential to significantly affect healthcare costs.

osteoarthritis, conduction disorders, allergic rhinitis, back problems, obesity, malignant neoplasms, and ovarian, uterine, and reproductive problems.

Prevalence and Cost of Multiple Chronic Conditions Across Age Groups

Overall, 75.3% of working-age adult enrollees had at least 1 chronic condition, 54.3% had multiple chronic conditions, and 16.5% had 5 or more chronic conditions. The percentage of individuals with any chronic condition and the percentage with multiple chronic conditions increase with age among working-age adults (**Table**). A larger proportion of total health expenditures is consumed by a smaller proportion of beneficiaries as the number of chronic conditions increases. The mean annual cost per person increases from \$1700 to \$2000 per additional chronic condition for enrollees with 0 to 4 chronic conditions across inpatient, pharmacy, and physician services. Compared with those having 4 chronic conditions, enrollees with 5 or more chronic conditions have a mean annual cost per person that is about \$10,000 higher than that of enrollees with 4 chronic conditions. Annual costs are highest among young adults for each number of chronic conditions. For the other age groups, total costs for individuals with 5 or more chronic conditions increase with age. As expected, most service types increase among persons with more chronic conditions.

Persistence of Costs Over Time

Large proportions of individuals in the highest and lowest cost categories for any year remain in the same cost categories for the next year. The **Figure** shows the probabilities that individuals remain in the top 5% from year to year by the number of chronic conditions. **eAppendix B** (available at www.ajmc.com) gives the transition probabilities of remaining in or changing between each percentile category from year to year overall and by the number of chronic conditions. The 5% of enrollees with the highest costs in 2004 accounted for 33.3% of total costs in 2004, while the 50% of enrollees with the lowest costs in 2004 accounted for 10.5% of total costs in 2004. Overall, 26.4% of those in the top 5% in the base year are in

■ **Table.** Prevalence and Mean Annual Cost of Multiple Chronic Conditions Across Age Groups

No. of Chronic Conditions	Age 18-34 y		Age 35-49 y		Age 50-64 y		Total	
	Cost, \$	No.	Cost, \$	No.	Cost, \$	No.	Cost, \$	No.
0	2560.32	3674	1826.52	3680	1675.38	887	2137.39	8241
1	4332.41	2309	3772.05	3396	3731.91	1133	3954.62	6838
2	6634.38	1402	5482.12	2714	5319.13	1489	5727.04	5605
3	8611.44	835	7696.64	1816	7238.24	1581	7705.89	4232
4	10,571.48	471	10,318.08	1181	9247.87	1255	9897.11	2907
≥5	23,806.99	479	20,743.98	1820	21,039.68	3202	21,182.81	5501

the highest-cost category in the next year, 20.9% are in the highest-cost category in the third year, and 19.9% remain in the highest-cost category in the fourth year. However, enrollees with more chronic conditions have higher persistence in high-cost categories than those with fewer chronic conditions and persist at these high costs for more years (Figure). Among individuals with 5 chronic conditions, more than 35% of those in the highest category in the base year remained among the costliest patients in the next year, and approximately 30% were among the costliest patients in years 3 and 4. Meanwhile, among those with 1 chronic condition who started in the costliest category, only 7.6% remained in the costliest category in the next year, while 3.9% and 2.7% were in the most costly category in years 3 and 4, respectively.

addition of each chronic condition from 0 to 4, with greater cost increases for 5 or more chronic conditions. The number of chronic conditions increases the probability of persisting in high-cost categories.

Patients with multiple chronic conditions pose a complex set of problems. Among these are disruptions in continuity of care when patients transfer between primary care and specialty providers.⁸⁻¹³ Adherence to clinical care guidelines across multiple chronic conditions is also problematic, as most guidelines do not apply to multiple chronic conditions.¹⁴⁻¹⁷ Disorganized or uncoordinated care of complex patients is costly. Duplication of tests and services,¹⁸ breakdown of communication in the referral process,^{11,19} readmissions that could have been prevented with coordinated care,²⁰ and medical errors or forgoing of medical care are costly and potentially fatal.

DISCUSSION

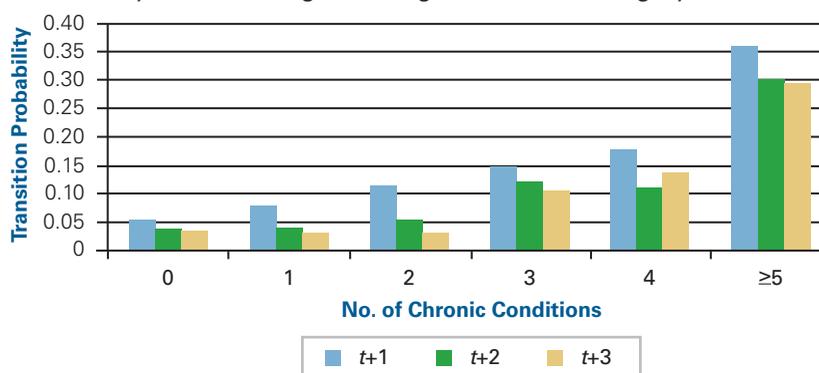
Study Findings

As has been reported for older populations, the presence of chronic conditions increases the costs of healthcare for working-age adults, not just for a single year but over longer time frames. Patients with many selected chronic conditions have high mean costs, and those with high costs often have multiple problems. The mean costs increase steadily with the

Comparison With Other Studies

Anderson²¹ reported that up to 88% of the population 65 years and older had 1 or more medical chronic conditions, with up to 78% of total healthcare expenses going toward treating individuals with chronic conditions in 2004, and Wolff et al²² found that 82% of Medicare-eligible patients had chronic conditions and 65% had multiple chronic conditions in 1999. This is comparable to our finding that 75.3% of adults aged 18

■ **Figure.** Transition Probability for Remaining in the Highest 5% Cost Category



t+1 indicates next year; t+2 third year; and t+3, fourth year.

to 64 years have a chronic condition and that these individuals consume 93.1% of total healthcare expenses. Multiple chronic conditions were seen among 54.3% of our cohort. The differences could be due to age but also may reflect better health among employed individuals with insurance coverage. A steady increase in healthcare costs among individuals with additional chronic conditions was also reported by Wolff et al.²²

Herein, the highest-cost patients with multiple chronic conditions consistently were in high-cost categories across the 4-year time line. This is in agreement with a 3-year study²³ among Medicaid patients that found similar persistence of beneficiaries in high-cost categories.

Limitations and Strengths of the Study

The generalizability of our results may be limited by the fact that we studied employees and dependents of a single healthcare system in the Midwest. Furthermore, our results are based on a population with continuous insurance coverage for multiple years. The rich employer-based medical, disability, and retirement benefits may have led to higher retention among individuals with multiple chronic conditions covered by our health plan compared with working-age adults covered by similar plans. We found that 75.3% of health plan enrollees who were continuously eligible for 4 years had at least 1 chronic condition, while 37.9% had 3 or more chronic conditions. Paez and colleagues²⁴ found that 45.3% of respondents aged 18 to 64 years had at least 1 chronic disease, while 12.0% had 3 or more chronic conditions in the 2005 Medical Expenditure Panel Survey data. Although our study and their study were based on the classification of chronic conditions by Hwang et al,¹ there are important differences between the 2 studies in how chronic conditions are identified (claims data vs self-report) and in what the time frame of interest was (4-year longitudinal vs cross-sectional). These observations are balanced by the fact that our study was based on 4 years of longitudinal assessment of a non-Medicare population. We were able to study a large cohort among a stable employee with uniform insurance coverage, primarily served by an integrated provider group with shared medical records and a common database. We do not believe that characteristics of the healthcare system would bias the concentration or persistence over time of higher costs among individuals with more chronic conditions.

Although we used a standard classification of chronic conditions, another study limitation was that our identification source of chronic conditions was based on claims data rather than on medical records. This may have undercounted the prevalence of chronic conditions.

Implications for Practice, Policy, and Patients

The best care management approach for the working-

age adult population may be a stratified approach. For most healthy (or presymptomatic) individuals, the primary focus is to keep them healthy. For individuals with 1 or 2 chronic conditions, the main focus is to maintain function and to prevent chronic conditions from progressing. Increasing the availability of nonvisit care and incorporating aspects of a medical home should foster this goal.²⁵⁻²⁷ For the small group of individuals with multiple chronic conditions, more active and individualized management is necessary.

Focusing on chronic conditions commonly addressed by disease management programs, Charlson et al²⁸ found small cost differences among patients with only 1 chronic condition, but costs increased rapidly as the number of comorbidities increased. They concluded that a patient-centered approach rather than a condition-centered approach is needed to address the highest-cost patients with multiple comorbidities. With increasing prevalence of this type of patient, refocusing guidelines to meet patient-specific needs in managing multiple diseases may be required.^{15,29}

Future Research

A traditional primary care model does not readily support a stratified approach to care delivery. Usual care delivery through in-office physician visits provides limited flexibility to address varying levels of need. A multidisciplinary team-based approach extending beyond the confines of the office could support the stratification of care to meet the varying needs of a population. For healthy patients, much care and management could be delivered in nonoffice settings by nonphysicians or via computer or phone.³⁰⁻³² Patients with 1 or 2 chronic conditions can receive evidence-based planned care delivered by nurses, pharmacists, nurse practitioners or physician assistants, and physicians.^{6,33-38}

For patients with multiple chronic conditions, a more useful strategy will focus on a patient's unique care coordination needs rather than on specific chronic conditions. In a primary care setting, patients with multiple chronic conditions pose a challenge.^{5,29,39,40} Again, guidelines for management of multiple diseases may need to be changed to meet specific needs of the increasingly prevalent complex patient with multiple chronic conditions.^{15,29}

CONCLUSIONS

While it is well documented that multiple chronic conditions are common in the population 65 years and older, our research shows that comorbid illness is also prevalent among the working-age population aged 18 to 64 years and drives high costs that persist over time. Effective healthcare delivery requires an understanding of how to best manage patients with multiple chronic conditions. It is imperative that we integrate

the necessary building blocks to manage the complex patient in an effective system of care, identify additional elements needed to improve patient quality of life, and reduce costs and utilization of inpatient care and emergency services.

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