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The Relationship Between Chronic and Non-Chronic Trends

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Abstract

Cost trend plays a crucial role in evaluating the outcome of disease management (DM) programs, which typically attempt to manage members who have any of 5 major chronic conditions (the chronic population) through targeted intervention. A widely adopted methodology for evaluating DM outcomes is commonly referred to as the "pre-post" method, also known as the adjusted historical control method. One drawback of the pre-post approach is the need for a valid trend adjustment so that program year and baseline year costs can be compared to determine the impact of the DM program. The trend adjustment plays a crucial role in the pre-post methodology because the estimated cost savings is very sensitive to the variation in the trend estimate.

DMAA: The Care Continuum Alliance recommends that the concurrent trend for members who do not have any of the 5 chronic conditions (the non-chronic population) be used to estimate the chronic trend. One major assumption in using this method is that there is a relatively stable relationship between the chronic trend and the non-chronic trend for the same population in the absence of the DM program. In this analysis, the relationship between the two trends is studied based on empirical data. Some key factors that may impact the relationship between the chronic and non-chronic trends are also examined.

Medical and pharmacy claims from a large commercial client over a 4-year period were collected for the analysis. This client did not have any robust DM program in place during the 4-year period. The major findings from this study include: (1) The method used to identify the chronic population for calculating the trend has a significant impact on the relationship between the chronic and non-chronic trends. With the Annual Qualification method, in which the chronic members are identified using the claims in a specific time period regardless of whether they have been identified previously or thereafter, the relationship between the non-chronic and chronic trends appears stable over time. With the Prospective method, the non-chronic trend does not serve as a good estimate of the chronic trend. (2) It is important to use risk adjustment when calculating trends to account for risk changes within the population from year to year. The chronic and non-chronic trends converge further when risk adjustment is applied.

Based on the empirical evidence from the data used in this study, the concurrent non-chronic trend could be used to help estimate the chronic trend if the proper member selection method (Annual Qualification) is used to select the chronic population and proper steps are taken to adjust the different risk levels from year to year. One should not conclude, however, that such a stable relationship between chronic and non-chronic trend has been universally validated based on this single study. This study highlights the importance of carefully validating trend relationships from a particular population before assuming a stable trend relationship in DM program outcome evaluation. (*Population Health Management* 2009;12:31–38)

Introduction

As disease management (DM) programs become more widely used as tools to manage rising health care costs, there are increasing demands to better measure the cost savings achieved by these programs. Typical DM programs manage 5 major chronic conditions: diabetes, asthma, coronary artery disease (CAD), congestive heart failure (CHF), and chronic obstructive pulmonary disease (COPD). Population members who are identified as having 1 or more of these 5 chronic conditions comprise the chronic population. Members who are not identified as having any of these 5 chronic conditions are considered the non-chronic population.

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The cost saving evaluation methods used by the DM industry are still evolving, with heated debates on the pros and cons of different evaluation methods.[1,2] The *pre-post* method, also known as the adjusted historical control method, has been widely adopted by most DM vendors and other industry practitioners to evaluate the outcomes of DM programs.[3] Using this method, the medical and pharmacy claims costs incurred in the measurement period (or a particular *program year*) are compared to those of a previous period (or *baseline year*) for the chronic population. It is preferable that the baseline year be prior to the implementation of the DM program.

One drawback of the pre-post approach is the need for a valid trend adjustment so that program year and baseline year costs can be compared to determine the impact of the DM program. Comparing the medical and pharmacy claims costs in 2 different time periods may not lead to a completely valid comparison because health care costs tend to increase over time, due to many factors other than the impact of the DM program. A control mechanism is necessary to correct for this. One way to establish a reasonable control is to take the claims cost from the baseline year and adjust it by multiplying by a trend factor that accounts for the exogenous cost increase from the baseline year to the program year. This results in an adjusted historical control that is a proxy for what the medical and pharmacy claims costs for the chronic population would have been had there been no DM program. The difference between the observed claims costs in the program year and the adjusted baseline is then used to measure the cost savings that can be attributed to the DM program.

The trend factor plays a crucial role in the pre-post methodology because the estimated cost savings is very sensitive to the variation in the trend estimate. It is not uncommon for a change in trend of just a few percentage points to transform an assessment of program cost savings from positive to negative. Consequently, measuring trend as appropriately and precisely as possible is critical to the validity of outcomes derived using the pre-post methodology.

There are many different ways to estimate the trend for the chronic population. The possible methods range from using a published national trend to using the estimated trend for the total population of the particular client based on historical experience. In DMAA's *Outcomes Guidelines Report, Volume II*,[4] it is recommended that the concurrent trend for the members who do not have chronic conditions (the non-chronic population) be used to estimate what the trend might have been for the members who have chronic conditions (the chronic population). One major assumption for this approach is that there is a relatively stable relationship between the chronic trend and the non-chronic trend for the same population in the absence of the DM program. This is asserted in the *Outcomes Guidelines*: "In many cases, the relationship between historical chronic trend and non-chronic trend may be quite stable, allowing the use of the difference between these trends for adjustment of non-chronic trend."[4] However, few published studies validate the assumption of the steady relationship between the chronic trends and the non-chronic trends.

The objective of this study is to use empirical data to validate the assumption that the relationship between chronic and non-chronic trends is relatively stable, such that the non-chronic trend can be used to estimate the chronic trend. Some key factors that may impact the relationship between the chronic and non-chronic trends, such as the definition of the chronic population, risk adjustment, and ways to process outliers, are also examined.

Population and Methods

Population

Members from a large commercial health plan were used in this study. The study period for this analysis was from January 1, 2004 to December 31, 2007. The average total number of eligible members for this client was 393,441 during the 4-year period.

There was no rigorous DM program for this population during the study period. A "light touch" care management program was in effect for this client during the study period. However, it did not target chronic members specifically and impacted very few members. It is expected that this program had minimal differential impact on the trends in the chronic population vs. the non-chronic population.

Membership information, medical claims data, and pharmacy claims data for this client during the study period were used in the analysis. There was no minimum membership eligibility requirement for individual members to be included.

Identifying chronic members

In each of the 4 years of the study period, eligible members are classified into either the chronic population or the non-chronic population based on their medical and pharmacy claims incurred during the 12 months in the calendar year. The identification rules are as follows:

- At least 1 inpatient admission or 1 emergency room visit with a primary diagnosis of 1 of the 5 chronic conditions, or
- At least 2 medical or pharmacy claims, on separate dates for 1 of the 5 chronic conditions.

The *International Classification of Diseases*, Ninth Revision, Clinical Modification (ICD-9-CM), Current Procedural Terminology codes (CPT), and National Drug Codes (NDC) used to identify the 5 conditions with medical and pharmacy claims data are proprietary. However, they are generally consistent with those commonly used by most industry practitioners.[4,5]

Various methods can be used to select the chronic population in the baseline and program years to evaluate the cost savings achieved for the chronic population. Different methods could potentially lead to different outcomes and different levels of validity. DMAA's *Outcomes Guidelines Report, Volume I*, [6] offered 2 potential alternative member selection methods:

- The Prospective method, also known as "once chronic always chronic." Using this method, members identified as chronic in the first period will automatically be carried over to subsequent periods as chronic members, even if these members cannot be identified as a chronic based on claims in the subsequent periods.

- The Annual Qualification method, also referred to as the Requalification method. In this method, the chronic members in each time period must be identified based on the claims for that period. A member identified as chronic in the first period may or may not be selected for the chronic population in subsequent periods, depending on whether the member can be identified as chronic using the claims in the subsequent period.

Volume II of DMAA's *Outcomes Guidelines Report*,[7] clearly recommends that the Annual Qualification method be adopted for outcomes evaluation "due to its closer correlation to the principle of equivalence." In this study, these 2 different selection methods will be used to examine the relationship between chronic and non-chronic trends.

Other methods could be used to select the chronic population for evaluation purposes. The Cohort method, which was used to evaluate outcomes in the early years of DM, is rarely used now because of the well-recognized problem of regression to the mean. The Retrospective method, which was studied in detail by Bachler et al,[8] has never been adopted as a serious alternative because it is "difficult to justify on clinical grounds."

Calculating the cost trend

The cost trend calculation is based on the per-member-per-month (PMPM) cost, which is obtained by dividing the total annual claims costs by total member months for all eligible members in that year. The PMPM costs in this analysis are based on the allowed costs for each client.

The cost trend is the percentage increase in the PMPM cost from one year to another. If only 2 consecutive years are available for calculating the trend, the definition of the trend from year t to year $t+1$ is defined as:

$$\text{Trend} = (\text{PMPM}_{t+1}/\ \text{PMPM}_t) - 1$$

When more than 2 years of claims data are available, in addition to calculating the year-to-year trend for each 2 consecutive years, we also can calculate the annualized trend over a multiyear period. For example, if the claims cost data over N years are available, it can be assumed that the claims cost increases by a constant annualized trend each year over the N-year period. The advantage of using the annualized trend is that it provides a more stable estimate of the rate of claims cost increase and smooths out the variation of the year-to-year trend. The assumed constant annualized trend can be calculated using the following equation:

$$\text{PMPM}_{t+n-1} = \text{PMPM}_t*(1 + \text{Trend})^{(n-1)}$$

Risk adjustment

When calculating the cost trend from one period to another, it is important to ensure that the populations for the 2 time periods have comparable risk profiles. It is not uncommon for a client's population risk to shift significantly over 2 periods. Difference in age, sex, and the prevalence of various conditions all could lead to different costs for the 2 periods. The difference in risk across time must be corrected to mitigate its impact on the cost trend.

In this study, the Impact Pro™ Total Cost Risk Score,[9] a widely adopted predictive risk tool, is used for risk adjustment. Like many other commercially available or proprietary predictive risk models, the Impact Pro risk model is developed using demographic information and the medical and pharmacy claims information from the 12 months prior to the time of scoring. The Total Cost Risk Score predicts the total claims costs for a member in the 12-month period following the time of scoring. This risk score provides a convenient tool for risk adjustment because it incorporates the impact of many exogenous risk factors that could affect medical and pharmacy claims costs.

The average risk scores at the beginning of the year$_t$ and the following year$_{t+1}$, noted as RS_t and RS_{t+1} accordingly, are used for risk adjustment when calculating the risk-adjusted year-to-year trend. Figure 1 shows the relationship time line for risk scoring and risk adjustment.

$$\text{Risk Adjusted Trend} = ((\text{PMPM}_{t+1}/\ \text{RS}_{t+1})/\ (\text{PMPM}_t/\text{RS}_t)) - 1$$

Similarly, the annualized trend can also be adjusted by using the average risk scores at the beginning of the first year and the last year. The risk-adjusted annualized trend can be calculated using the following equation:

$$(\text{PMPM}_{t+n-1}/\text{RS}_{t+n-1}) = (\text{PMPM}_t/\text{RS}_t)*(1 + \text{Risk Adjusted Trend})^{(n-1)}$$

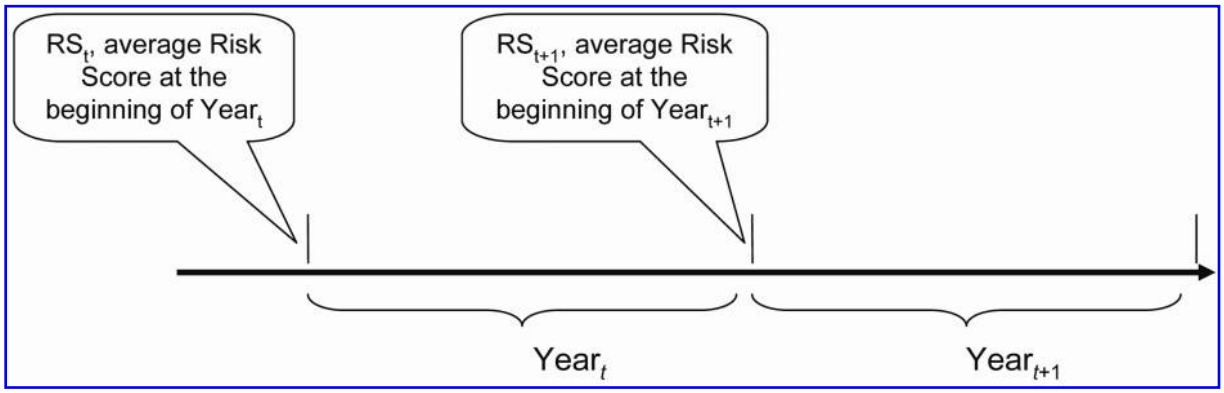

FIG. 1. Risk adjustment for trend.

Table 1. Member Distribution by Age and Sex

Year	*2004*	*2005*	*2006*	*2007*
% Male	53.3%	53.3%	53.2%	53.0%
Average age	32.9	33.1	33.2	33.2
Age distribution				
0 to 5	6.5%	6.3%	6.2%	6.2%
6 to 11	9.0%	8.9%	8.6%	8.4%
12 to 18	11.1%	11.1%	11.0%	10.7%
19 to 34	20.5%	21.3%	22.3%	24.0%
35 to 44	20.4%	19.4%	18.6%	17.8%
45 to 54	21.0%	20.6%	20.2%	19.4%
55 and older	11.4%	12.3%	13.1%	13.5%

Results

Demographic information

Table 1 shows the percentage of male members, the average age of all members, and the age distribution. About 53% of the members are male in each of the 4 years in the study period. The average age stays fairly constant at about 33 throughout the study period. The age distribution does not change much either, although the percentage of members age 55 and older has increased slightly over the years.

The impact of member selection methods

The method used to select the chronic population for calculating the chronic trends has a significant impact on the relationship between chronic and non-chronic trends. With the Prospective method, the non-chronic trend does not appear to be a good estimate of the chronic trend. With the Annual Qualification method, however, the relationship between the chronic and non-chronic trends becomes relatively stable, even though fluctuation still exists in year-to-year trends.

The medical and pharmacy costs and trends using the Prospective selection method are shown in Table 2. Two types of trends are listed. The first type is the year-to-year trend, from 2004 to 2005, 2005 to 2006, and 2006 to 2007. The year-to-year trends allow us to observe the relationship between chronic and non-chronic trends over a certain period. The second type is the annualized trend over the 4 years in our study period. This trend helps smooth out the variations of the trend relationship in the year-to-year trends and provides a more stable view of the trend relationship.

In general, the non-chronic trends are higher than the chronic trends. The annualized trend is 7.7% for the non-chronic population compared to 4.5% for the chronic population. Whereas both the chronic trend and the non-chronic trend have increased over the study period, the relationship between the two does not appear to be stable over time. Figure 2 illustrates the relationship of the year-to-year chronic and non-chronic trends over time. The chronic trend started as negative but increased at a much faster pace than the steadily increasing non-chronic trend. The non-chronic trend does not serve as a good estimate of the chronic trend using the Prospective selection method.

The medical and pharmacy costs and trends using the Annual Qualification selection method are shown in Table 3. The non-chronic trends are generally lower than the chronic trends with the Annual Qualification selection method, in contrast to the relationship observed with the Prospective selection method. The annualized trend is 8.9% for the non-chronic population compared to 11.7% for the chronic population.

Furthermore, the difference between the chronic and non-chronic trends remains relatively stable over the years. Figure 3 illustrates the relationship between the year-to-year chronic and non-chronic trends. While the difference between the 2 trends still fluctuates from year to year, the relationship is relatively more stable than that observed using the Prospective selection method. It appears that the non-chronic trend could be used to estimate the chronic trend with the Annual Qualification selection method.

The impact of risk adjustment

Another factor that affects the trend relationship is the shift of the risk profile from year to year. Figure 4 illustrates the changes in average risk scores for the non-chronic and chronic populations. The risk score for a year is the Impact Pro Total Cost Risk Score predicting the total costs in that year. This score is retrospectively created as of the beginning of the year, using the membership and claims data from the 12 months prior to that time. Because data are not available before 2004, the risk score predicting the total costs for 2004 cannot be produced. As a result, the risk-adjusted year-to-year trend can only be produced for 2005 to 2006 and 2006 to 2007. Similarly the risk-adjusted annualized trend is calculated over the 3-year period from 2005 to 2007.

The average risk score for the non-chronic population has remained reasonably flat for the 3 years, while the average risk score for the chronic population has increased steadily during the same period. The difference in risk profile changes in the 2 populations certainly impacts the trend relationship. For example, the average risk score for the chronic population increased from 2.24 in 2005 to 2.35 in 2006. Some of the cost increase from 2005 to 2006 in the chronic population should be attributed to this worsening risk profile. On the other hand, the average non-chronic risk score increased only slightly from 0.83 in 2005 to 0.84

Table 2. The Medical and Pharmacy Costs and Trends: Prospective Method

Year	*PMPM cost*	*Year-to-year trend*	*Annualized trend*
Non-chronic members			
2004	$153		
2005	$161	5.6%	
2006	$174	7.8%	
2007	$191	9.7%	7.7%
Chronic members			
2004	$633		
2005	$616	−2.7%	
2006	$652	5.8%	
2007	$723	10.8%	4.5%

PMPM, per member per month.

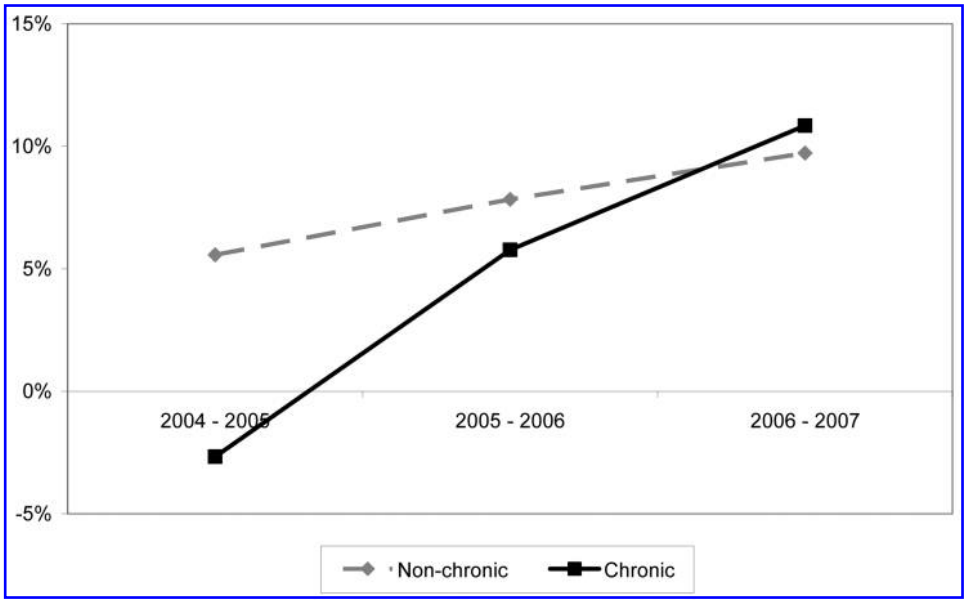

FIG. 2. The relationship between the chronic and the non-chronic trends: Prospective method.

in 2006 and, consequently, the medical cost increase from 2005 to 2006 for the non-chronic population should experience very little impact from the risk profile. Without adjusting for changes in risk the chronic trend from 2005 to 2006 is overstated relative to the corresponding non-chronic trend.

When the different risk profiles are adjusted using the average risk scores as described in the Methods section, the non-chronic trend and the chronic trend converge even more. Table 4 shows the risk adjusted chronic and non-chronic trends using the Annual Qualification selection method. The risk-adjusted annualized non-chronic trend over 3 years is 8.3%, which is very close to the risk-adjusted annualized chronic trend of 8.5%. The year-to-year non-chronic and chronic trends also are much closer with risk adjustment. This result suggests that when using the non-chronic trend to estimate the chronic trend, it is important to adjust for shifts in population risk.

Other factors

Many other factors that could impact the trend relationship were examined as part of this study. None of these factors was found to have a significant impact on the trend relationship that would change the outcome of the study.

The distribution of member cost data is skewed, with a few members who have extremely high costs exerting a big impact on average PMPM cost. It is common practice in evaluating DM outcomes that these outliers are treated to correct for potential bias. The trend relationship was examined both with and without capping the outliers using the percentile distribution method, as recommended in DMAA's *Outcomes Guidelines Report, Volume II*, [4] that caps the PMPM cost at the 99.5 percentile. The results vary slightly using this method, but the variance is not significant. All the results shown are calculated without capping.

The claims costs in the study are calculated using allowed costs, which reflect network discounts and other factors. Bachler et al[8] used billed cost in their study. The rationale behind their choice may be that their data were pooled from multiple health plans, and different health plans may have negotiated different network discounts. The current study uses members from a single client, so the same negotiated discounts apply to the chronic and non-chronic populations.

Finally, the impact of minimum member eligibility requirements was considered. When measuring DM program outcomes, a common practice is to include only those members who meet certain minimum eligibility requirements. In the results presented here, no minimum eligibility requirements were applied simply to enable comparison of our findings with previous studies. To test the sensitivity of our findings to eligibility, the analysis was rerun with a 6-month minimum member eligibility requirement and no significant

TABLE 3. THE MEDICAL AND PHARMACY COSTS AND TRENDS: ANNUAL QUALIFICATION

Year	*PMPM cost*	*Year-to-year trend*	*Annualized trend*
Non-chronic members			
2004	$153		
2005	$164	7.3%	
2006	$178	8.9%	
2007	$197	10.6%	8.9%
Chronic members			
2004	$633		
2005	$687	8.5%	
2006	$773	12.6%	
2007	$882	14.0%	11.7%

PMPM, per member per month.

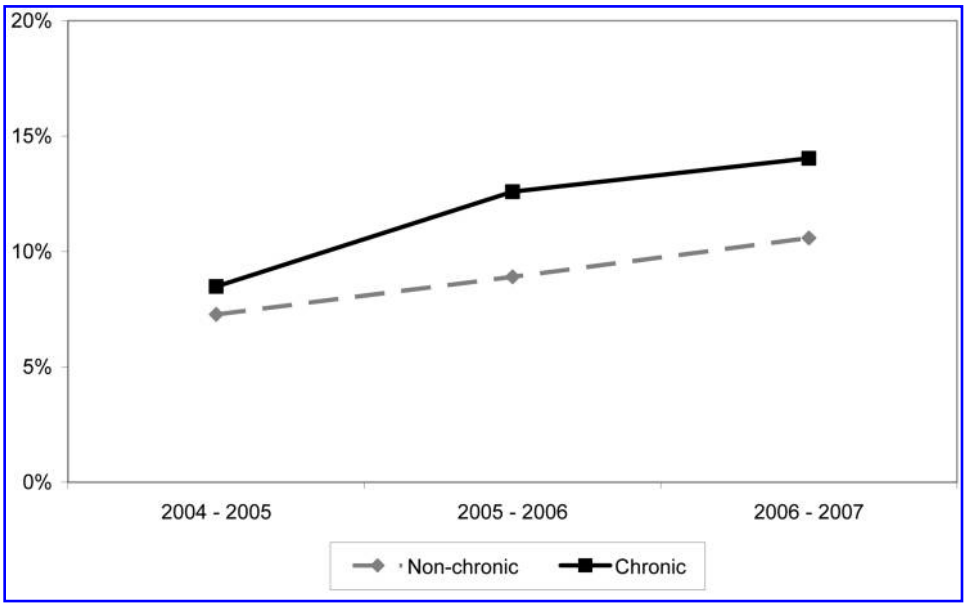

FIG. 3. The relationship between the chronic and the non-chronic trends: Annual Qualification method.

difference was found in the results as compared to those obtained with no minimum eligibility requirement.

Discussion

Two other in-depth studies have been published on the relationship between chronic and non-chronic trends. Bachler et al[8] examined the trend relationship on a commercial population from 1999 to 2002. Fitch et al.[10] studied the trend relationship on a Medicare population.

Bachler et al[8] reached some conclusions that are very similar to the findings in the current study. First, they found that the non-chronic trend is a poor proxy for the chronic trend using the Prospective method. Second, they also found that chronic and non-chronic trends get closer when risk adjustment is applied or when the Annual Qualification method is used. However, they did not take the additional step of combining the Annual Qualification method and risk adjustment as we did in this study.

Contrary to our findings, Fitch et al[10] found that the

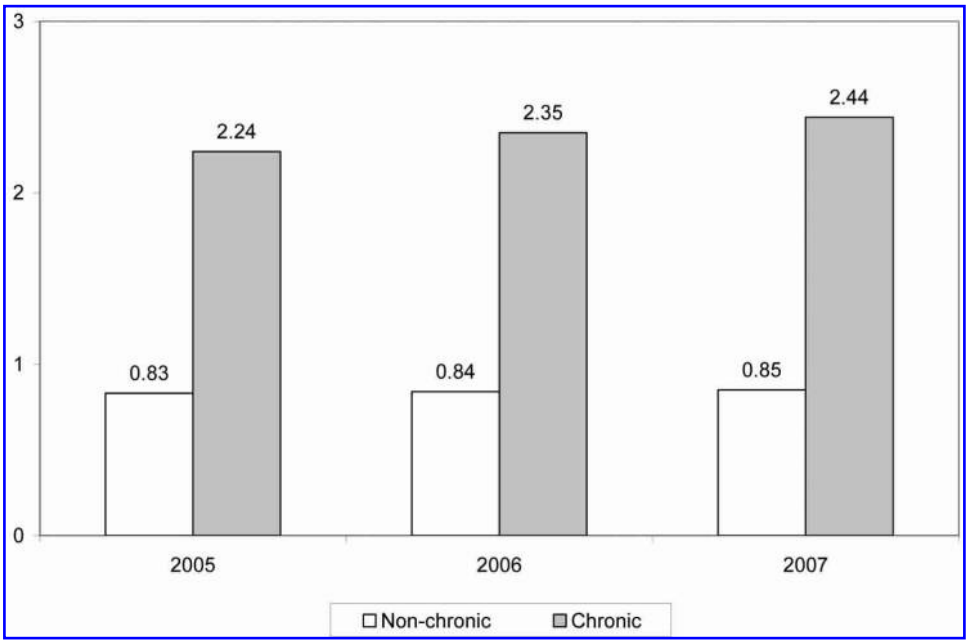

FIG. 4. The average risk scores.

Table 4. Risk-Adjusted Trends

Year	Year-to-year trend	Annualized trend
Non-chronic members		
2005–2006	7.9%	
2006–2007	8.8%	8.3%
Chronic members		
2005–2006	7.4%	
2006–2007	9.6%	8.5%

chronic trend is always lower than the non-chronic trend, even using the Annual Qualification method. The explanation they offered is that the chronic population has proportionally higher inpatient costs (50% of the total medical cost) than the non-chronic population (25% of the total medical cost), and the inpatient costs grow at a slower pace than general medical costs. This observation may be unique to the Medicare population included in their study. Bachler et al[8] also examined the service setting costs and trends but did not find similar results. In the commercial population used in Bachler's study, inpatient costs for the chronic population are only 36% of the PMPM cost compared to 30% for the non-chronic population. Furthermore, Bachler et al. found that chronic inpatient costs grew at a faster pace than general chronic claims costs.

One obvious potential explanation for the very different findings of Fitch et al[10] is that the trend relationship for a Medicare population may be different from that of a commercial population. Another potential driver is that Fitch et al. used only medical claims costs because pharmacy claims were not available, whereas both medical and pharmacy costs were used by Bachler et al and in our study.

Certain limitations in our study may have affected our conclusions. As mentioned in the Methods section, a "light touch" care management program was in effect during the study period. The program was not designed to manage chronic members specifically and it engaged very few members; only 121 of almost 400,000 members were managed for chronic conditions. Therefore, it is unlikely that the program created any differential impact on the chronic and the non-chronic populations studied. Another potential limitation is that a proprietary identification algorithm is used to identify chronic members. While it is generally consistent with the identification criteria recommended by DMAA or similar criteria adopted by other vendors or organizations, certain discrepancies still exist. For example, using the proprietary identification criteria, children younger than age 18 are allowed to be identified for diabetes and asthma, while the latest proposal by DMAA specifies a minimum age limit of 18 years for all conditions. These minor differences in the identification criteria could have a small impact on the trend relationship.

The fact that the trend relationship observed for one population may not be completely replicated for another demonstrates the complex nature of trend relationships. It is important for practitioners to closely study and validate trend relationships for their own populations.

Conclusions

Based on our analysis of data from a large client, the concurrent non-chronic trend could be used to help estimate what the chronic trend would have been had there been no DM program if the Annual Qualification method is used to define the chronic population. The relationship between the non-chronic and the chronic trends is relatively stable when the Annual Qualification method is used. However, the non-chronic trend does not serve as a good estimate of the chronic trend when the Prospective method is used. It is also important that proper steps are taken to adjust for the different risk profile changes from year to year. Appropriate risk adjustment causes the non-chronic trend and the chronic trend to converge.

One should not conclude from this study that a stable relationship between the chronic and the non-chronic trend has been universally validated. The similar findings of this study and that of Bachler et al.[8] suggest that a stable relationship between chronic and non-chronic trends may apply to typical commercial populations. However, the findings by Fitch et al.[10] suggest that there may be different dynamics with a Medicare population. This further highlights the importance of carefully studying and validating the trend relationships for a particular population before using the non-chronic trend as a proxy for the chronic trend in outcome evaluations.

Disclosure Statement

All authors of this paper are current employees of Health Management Corporation (HMC), a wholly owned subsidiary of WellPoint, Inc., that provides a wide spectrum of care management programs, including disease management programs, to health plans and employers. Claims cost trend analysis, such as that discussed in this study, is used by HMC to evaluate care management programs provided to its clients.

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