



Medical Dental Integration Study

March 2013

Executive summary

The study, which was performed by Optum, the nation's leading health services company, on behalf of UnitedHealthcare evaluates the impact of various dental treatments on medical and pharmacy costs for individuals with chronic medical conditions. Results are split by chronic condition as well as by whether or not individuals were compliant managing their chronic condition; removing compliance bias from the study. An additional analysis was performed around chronic conditions that are comorbid with diabetes.

Members were classified based on their chronic condition and compliance with their disease management program as determined through UnitedHealthcare Evidence-Based Medicine (EBM) data. Medical and pharmacy costs for these members were determined using Episode Treatment Groups (ETGs). From a dental perspective, members were grouped based on their dental treatment patterns. We reviewed the total average medical, pharmacy and dental annual costs for all members.

Individuals in this study consisted of 130,546 UnitedHealthcare commercial dental and medical members between the ages of 18 and 65. Compliance and disease categorization, as determined through EBM, was based on claims data for the twelve month period ending 5/31/2011. Calendar year 2010 medical and pharmacy claim data for each member is included. Dental claims incurred between 5/1/2008 and 4/30/2011 was used to assign each member to a dental treatment pattern grouping. Cost has been normalized using age and sex factor and area factor for each ETG.

Overall, net medical costs for members who received dental care (i.e., periodontal treatment or cleanings) was on average \$1,037 lower than medical costs (or \$701 when including drugs) for members who received other or no dental care (i.e., extractions, root canals, restorative treatment, other dental claims or no dental claims) after adjusting for the extra expense of the dental care.

The largest medical savings (\$1,849 for just medical or \$1,706 including Rx) were for members who were not medically compliant with their disease management program and received dental care after adjusting for the extra expense of the dental care. Members who were medically compliant with their disease management program and received dental care achieved an average net savings of \$264.

Non-medically compliant members who received more frequent oral care achieved net savings over non-medically compliant members who received less frequent oral care. Across all chronic conditions, health care costs were \$1,218 lower for members receiving frequent cleanings compared with members receiving non-frequent cleanings and \$1,773 lower for members receiving periodontal treatment with maintenance compared with members receiving non-surgical periodontal treatment without maintenance. This cost saving was observed in all individual chronic disease groups with the exception of Renal Disease. The most common condition observed in this study was diabetes with average medical costs \$1,674 (medical only) lower for non-medically compliant members receiving dental care and \$925 (medical only) lower for medically compliant members receiving dental care. The largest savings achieved was from Renal Disease with an average medical spend \$13,995 lower for non-medically compliant members receiving dental care and \$7,107 lower for medically compliant members receiving dental care.

For diabetics, differences in health care savings were observed based on the type of dental care offered. Those receiving periodontal treatment had the lowest medical cost (\$7,838 medical only or \$10,308 with Rx) of any other dental treatment group compared to medical costs (\$9,588 medical only or \$12,175 with Rx) of members not receiving periodontal care. For members with diabetes, the most prevalent comorbid condition observed was coronary artery disease. While the average medical-only cost for these members was \$22,338, members who received dental care achieved \$3,981 medical-only savings compared to those that did not receive dental care.

Overall, total average health care costs were considerably lower for individuals with chronic medical conditions who received periodontal treatment or cleanings within the timeframe of this study even when considering the costs of additional dental treatments. Savings for individuals receiving preventive dental care were observed across all chronic medical disease categories in this study. Future studies should consider tracking the average costs of members over multiple years, with additional chronic conditions as more data becomes available.

Objective

This study compares the medical and pharmacy costs of individuals with six chronic medical conditions with the dental treatment they receive to determine if there is a difference in total health care costs associated with varying dental treatments. The dental treatments included in this study are periodontal treatment, cleanings and other or no dental treatment (i.e., extractions, root canals, restorative treatment, other dental claims or no dental claims). Chronic medical conditions include diabetes, asthma, congestive heart failure (CHF), coronary artery disease (CAD), chronic obstructive pulmonary disease (COPD), and chronic kidney/renal failure. Results are split by chronic condition as well as by whether or not individuals were compliant with their chronic condition. An additional analysis is included around chronic conditions that are comorbid with diabetes.

Methodology

This study utilizes three years of dental claims experience and two years of UnitedHealthcare Evidence-Based Medicine (EBM) and episode treatment group (ETG) data. Prior industry studies have indicated a compliance bias. By using EBM data to isolate members within the same level of medical adherence, this study focuses specifically on individuals' level of dental care.

Study population

This study is limited to individuals under the age of 65 enrolled in both a UnitedHealthcare commercial dental and medical plan for full calendar year 2010. EBM data was used to identify individuals with one or more of the six chronic conditions included in the study. ETG data was used to determine whether the member had an episode of care for the specific chronic condition. There were 130,546 individuals who met the criteria to be included in the study.

Evidence-based medicine (EBM)

Evidence-based medicine (EBM) data and clinical rules were used to identify members with one of the six specific chronic conditions and determine medical compliance. Many of the EBM rules are based on national measurement standards and were used to determine the demographic component of this analysis.

- ▶ Claims-based rules were used to identify individuals with one of the six chronic conditions.
 - For example, an individual is considered a diabetic if they have more than two office visits coded as a 250.X (ICD-9) more than 14 days apart, an Emergency Room visit or an Admit for diabetes over a 24 month period.
- ▶ Medical compliance was determined based on claims data for the twelve month period ending 5/31/2011. Condition specific claims data was utilized to profile clinical rules. Claims data prior to this period were unavailable.

Data sources

Dental eligibility and claims data was provided by the UnitedHealthcare specialty benefits group. Medical claims data was extracted from UnitedHealthcare's Analytic Platform (UGAP)—a consolidated data mart containing UnitedHealthcare integrated medical and financial data used for quality and affordability analytics

Episode treatment groups (ETGs)

Episode treatment groups (ETGs) are diagnosis-based constructs that create homogeneous claim groupings for characterizing the cost and utilization of similar clinical episodes of care. The ETG software utilizes 24 months (claims incurred September 2009–August 2011) of medical and pharmacy claims data to create episodes. A member can have more than one type of episode at the same time. Episodes can be either complete or incomplete. Only individuals with complete 12-month episodes were included in the study. Age and sex factor and area factor has been applied to normalize cost for each ETG.

Dental treatment groups

Three years of dental claims data (May 2008–April 2011) was utilized to assign each of the 130,546 individuals to one of the following dental treatment groups. The dental treatment groups are mutually exclusive.

Periodontal treatment	<ul style="list-style-type: none">▶ Surgical periodontal treatment with maintenance▶ Surgical periodontal treatment without maintenance▶ Non-surgical periodontal treatment with maintenance▶ Non-surgical periodontal treatment without maintenance
Cleanings (excludes members with periodontal treatment)	<ul style="list-style-type: none">▶ Frequent cleanings—3 or more cleanings in the three year period▶ Infrequent cleanings—less than 3 cleanings in the three year period
Treatments demonstrating a lack of preventive dental care or no dental claims	<ul style="list-style-type: none">▶ Bacteria-removing treatments (extractions, root canals, restorative)▶ Other dental claims not included in treatments above▶ No dental claims

Determination of credibility

We examined variances in medical and pharmacy costs across dental treatment groups for each chronic condition in the study. For each chronic condition, only dental treatment and medical compliance “buckets” with 30 or more chronic care episodes/individuals were deemed to be credible.

For example, for chronic kidney disease, there were not enough credible cells to isolate surgical and non-surgical periodontal treatment:

- ▶ There were a total of 30 individuals with chronic kidney disease who received surgical periodontal treatment.
- ▶ Twenty-four of these individuals were compliant with their medical condition and six were non-compliant.
- ▶ Since both “buckets” (surgical periodontal/medically compliant and surgical periodontal/medically non-compliant) did not each have 30 members, we did not isolate surgical vs. non-surgical periodontal treatment.

Metrics for comparison

We reviewed the total average annual costs for members in each of the dental treatment groups.

- ▶ Medical and Pharmacy Cost—calendar year 2010 allowed per member per year (PMPY)
- ▶ Dental Cost—allowed PMPY based on claims incurred May 2008–April 2011

As an additional point of comparison, for the diabetes comorbidity analysis, medical and pharmacy cost per episode was calculated based on the most recent 12-month episode from the ETG data. We compared cost per episode for diabetic members that also had CAD and split costs out by diabetes, COD and other medical and pharmacy costs.

Observations: medical vs. dental compliance

We examined the study population to observe the relationship between medical and dental compliance. In other words, are members who are compliant with their medical condition also more likely to be compliant with their dental care?

Dental compliance: Individuals who received periodontal treatment and/or cleanings were categorized as engaged with dental treatment. Individuals with other dental claims (including extractions, root canals, restorative treatment only) or no dental claims were considered to not be engaged in preventive dental care.

Medical compliance: Each individual was assigned a medical compliance indicator for every chronic condition for which he/she had an episode of care. For example, if a member had diabetes and asthma, EBM rules were used to assign a compliance indicator for each condition. The compliance indicator was based on the overall compliance rate for a condition based set of EBM rules. If an individual exceeded a compliance threshold rate for the condition specific EBM rules for which they were eligible, they were considered compliant for that condition. If an individual has two or more chronic conditions, the individual must be compliant with all conditions in order to be classified as “medically compliant”. Medical compliance could not be determined for a small portion (< 0.5%) of individuals in the study. In these instances, it was assumed that these individuals were not medically compliant.

Chart 1: Number of individuals by level of dental engagement and medical compliance

	Compliant with chronic condition(s)	Non-compliant with chronic condition(s)	Total
Dental–engaged	42,472	29,780	72,252
Dental–not engaged	31,573	26,721	58,294
Total	74,045	56,501	130,546

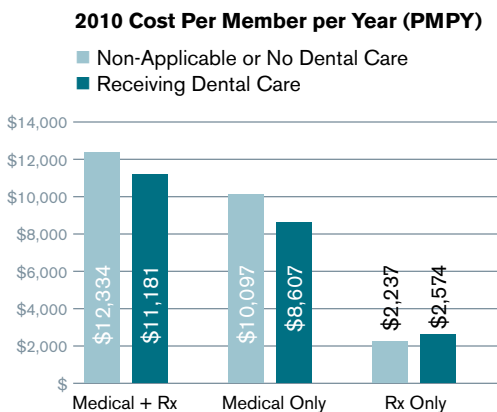
On average, 55.4% (72,252 out of 130,546) members were engaged in dental care. Those compliant with their medical condition showed a slightly higher level of dental engagement (57.4% = 42,472 / 74,045) compared to the group that was not compliant with their medical condition (52.7% = 29,780 / 56,501). This indicates the decision for a member to be compliant with treatments for medical and dental are seemingly independent.

Results

All chronic conditions:

We observed medical and pharmacy per member per year (PMPY) costs for all 130,546 members identified as having a chronic condition. PMPY costs were compared based on level of dental engagement—members who received dental care (i.e., periodontal treatment or cleanings) vs. members with other dental claims or no history (i.e., extractions, root canals, restorative treatment, other dental claims or no dental claims).

Chart 2: PMPY cost for members with chronic conditions



Annual medical costs were \$1,490 lower for the group receiving dental care. The additional cost of dental treatment for this group was \$452, achieving a net savings of \$1,038.

Table 2 (Appendix) shows the annual spend for the dental treatment groups at a more granular level.

Observations

- ▶ Members who received frequent cleanings spent less on health care (\$10,395) than any other dental treatment group.
- ▶ The group receiving surgical periodontal treatment had lower health care cost than the group who received non-surgical periodontal treatment (\$9,391 vs. \$10,539), which is generally a more invasive and costly treatment.
- ▶ Members receiving extractions, root canals, and restorative treatments and other dental treatments had the highest health care spend, demonstrating the correlation between the lack of a preventive, compliant dental pattern and overall medical costs.

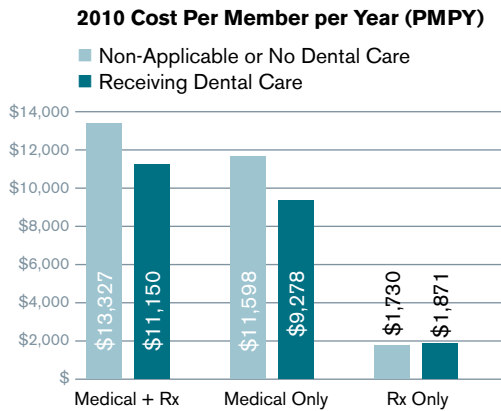
All chronic conditions—removing compliance bias:

In the next two sections, we remove compliance bias by observing variances in medical and pharmacy costs within the different levels of medical compliance.

Members NOT compliant with their chronic condition(s)

Of the 130,546 members identified as having one or more chronic conditions, 56,501 were not medically compliant with one or more of their chronic condition(s).

Chart 3: PMPY cost for all members who were NOT compliant with their chronic condition(s)



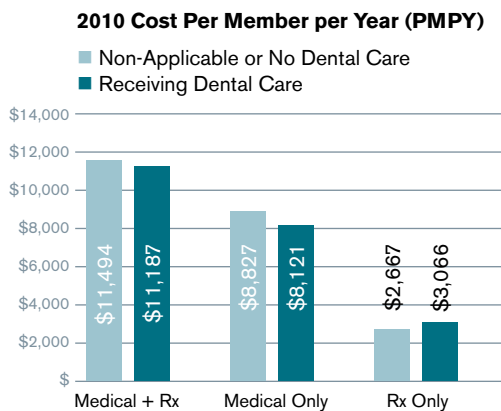
Annual medical costs were \$2,320 lower for the group receiving dental care. The additional cost of dental treatment for this group was only \$471, achieving a net savings of \$1,829 or \$1,706 when including Rx.

Table 3 (Appendix) shows the annual spend for the dental treatment groups at a more granular level.

Members compliant with their chronic condition(s)

Of the 130,546 members identified as having one or more chronic conditions, 74,045 were medically compliant with their chronic condition(s).

Chart 4: PMPY cost for members who were compliant with their chronic condition(s)



Annual medical costs were \$706 lower for the group receiving dental care. The additional cost of dental treatment for this group was \$442, achieving a net savings of \$264.

Table 4 (Appendix) shows the annual spend for the dental treatment groups at a more granular level.

Observations

- ▶ Savings are higher for members who received surgical periodontal treatment than non-surgical periodontal treatment. For those members who did not comply with the treatment for their medical condition, but received frequent cleanings spent the least on health care (\$8,520 for medical only or \$10,465 including Rx) compared to any other dental treatment group.
- ▶ Non-medically compliant members receiving more frequent oral care achieved net savings over non-medically compliant members receiving less frequent oral care. Across all chronic conditions, health care costs were \$1,218 lower for members receiving frequent cleanings compared with members receiving non-frequent cleanings and \$1,773 lower for members receiving non-surgical periodontal treatment with maintenance compared with members receiving non-surgical periodontal treatment without maintenance.
- ▶ These cost savings were consistently observed in all individual chronic disease groups for periodontal treatment with maintenance. Cost savings on frequent cleanings were observed in all individual chronic disease groups except Renal Disease, which showed a small increase.

Observations

- ▶ Members receiving surgical periodontal treatment had lower health care spend than members who received non-surgical periodontal treatment. Members who received surgical periodontal treatment spent less on health care (\$9,667) than any other dental treatment group.

Diabetes:

73,144 members in this study were identified as having diabetes. 44,915 members were compliant with their medical condition. 28,229 members were not compliant with their medical condition.

Annual medical costs were \$1,674 (\$1,762 including Rx) lower for the non-compliant group receiving dental care and \$925 (\$595 including Rx) lower for the compliant group receiving dental care.

Chart 5: PMPY cost for diabetic members who were not compliant with their condition(s)

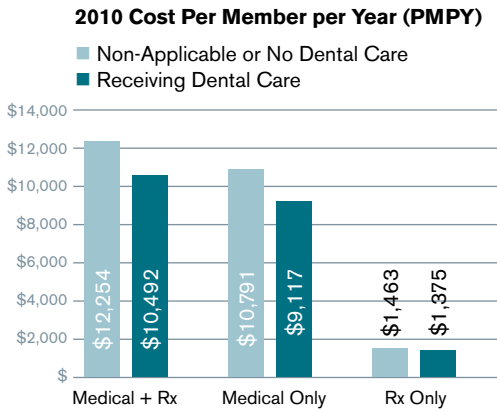
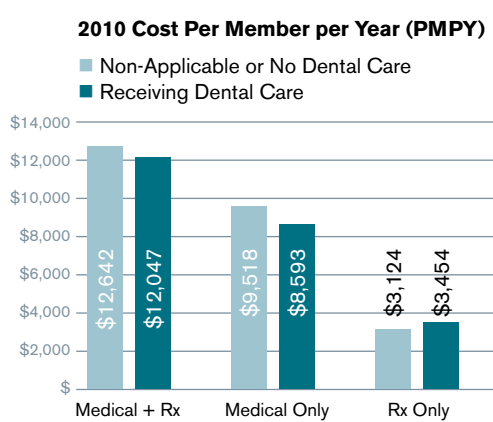


Chart 6: PMPY cost for diabetic members who were compliant with their condition(s)



Annual medical costs were \$7,838 for diabetics receiving periodontal care. Diabetics receiving other or no dental treatments had medical costs of \$9,588, for a medical-only savings of \$1,750.

Table 1: PMPY costs for all medically compliant and non-compliant) diabetic members by type of dental treatment

Members with Diabetic Episode	# Members	2010 PMPY		
		Medical+Rx	Medical	Rx
Periodontal Treatment	7,360	\$10,308	\$7,838	\$2,471
Other or No Dental History	65,784	\$12,175	\$9,588	\$2,587
Cleanings	29,368	\$11,797	\$9,013	\$2,785
Restorative/Extractions Only	5,590	\$12,422	\$9,917	\$2,505
Other Dental Claims	4,288	\$12,948	\$10,536	\$2,412
No Dental History	26,538	\$12,415	\$10,002	\$2,413
Total	73,144	\$11,987	\$9,412	\$2,575

Tables 5 and 6 (Appendix) show the annual spend for the dental treatment groups of non-compliant and compliant diabetics respectively.

Observations

- Members receiving dental care realize a savings on total health care costs. This savings is much greater for those members who are not compliant with their medical treatment regimens.
- Pharmacy costs were higher for diabetics who were compliant with their medical condition. This most likely reflects the additional cost of following treatment regimens.

Observations

- Diabetics receiving periodontal treatment had the lowest medical cost of all dental treatment groups. In particular, those receiving non-surgical periodontal treatment had the lowest medical cost. The additional cost of dental treatment still results in overall health care savings.
- Periodontal treatment yields greater savings for individuals who are non-compliant with their diabetic condition. These members had savings of over \$3,000 per year compared to individuals who received other or no dental treatment. These savings suggests periodontal treatment can lower medical costs for diabetics who do not follow medical treatment regimens.

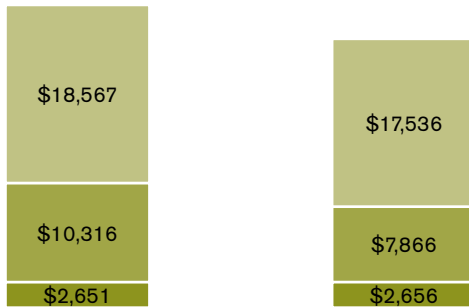
Diabetes and comorbidities:

Coronary Artery Disease (CAD) was the most prevalent comorbidity. 6.8% of members with a diabetic episode also had an episode of CAD.

Chart 7: Individuals with diabetes and CAD

Medical and Pharmacy

■ Diabetes Episode ■ CAD Episode ■ Other Medical/Rx Cost

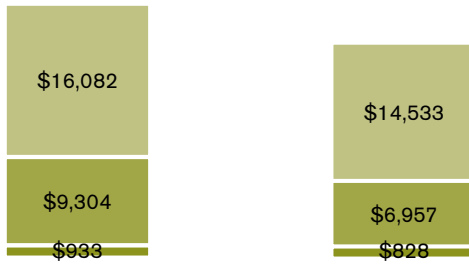


No-applicable or No Dental Care
Total Cost per Member: \$31,534
Members: 2749

Receiving Dental Care (Perio & Cleanings)
Total Cost per Member: \$28,059
Members: 2237

Medical Only

■ Diabetes Episode ■ CAD Episode ■ Other Medical/Rx Cost



No-applicable or No Dental Care
Total Cost per Member: \$26,319
Members: 2749

Receiving Dental Care (Perio & Cleanings)
Total Cost per Member: \$22,338
Members: 2237

Table 8 (Appendix) shows the prevalence of chronic conditions (CAD, Asthma, Renal COD, COPD, CHF) that are comorbid with diabetes.

Observations

- ▶ Members who received other or no dental care spent approximately \$2,000 more on medical and pharmacy costs than individuals who received periodontal treatment and/or cleanings.
- ▶ Diabetics with restorative/extraction-only dental treatments had a higher prevalence of CAD (8.7%) than any other dental treatment group.
- ▶ Costs attributable to diabetes or CAD episodes represent approximately 40% of the total cost for these members.

Asthma

41,451 members in this study were identified as having Asthma. 21,063 members were compliant with their medical condition. 19,993 members were not compliant with their medical condition.

Chart 8: PMPY costs—members with asthma who were non-compliant with their asthma condition

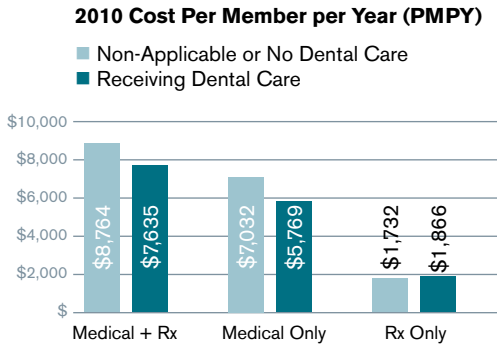
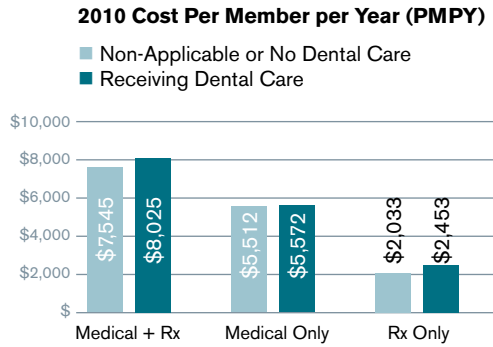


Chart 9: PMPY costs—members with asthma who were compliant with their asthma condition



Annual medical costs were \$1,263 (\$1,129 including Rx) lower for the non-compliant asthmatic group receiving dental care and \$60 (\$480 including Rx) higher for the compliant asthmatic group receiving dental care.

Tables 9 and 10 (Appendix) show the annual spend for the dental treatment groups of non-compliant and compliant Asthmatic members respectively.

Observations

- ▶ Individuals receiving preventive dental treatments (i.e., cleanings) had the lowest annual health spend (\$7,628 for those not compliant with the treatment for their medical condition and \$8,086 for those compliant) than any other dental treatment group. This represents a savings over the group who received other or no dental treatment of \$1,136 for the non-medically compliant group. Conversely, the cost is \$541 higher for the group who received dental treatment for the medically compliant group.
- ▶ Within the non-compliant group, individuals with asthma who received frequent cleanings had the lowest medical cost, which suggests that preventive oral care has a positive impact on medical cost, even for individuals not complying with asthma standards of practice.
- ▶ As with diabetics, asthmatics that were medically compliant had higher prescription drug costs (\$2,316) than the asthmatic group not compliant with their medical condition (\$1,820). This most likely reflects the additional cost of following treatment regimens.

Coronary Artery Disease (CAD)

17,609 members in this study were identified as having CAD. 10,918 members were compliant with their medical condition. 6,691 members were not compliant with their medical condition.

Chart 10: PMPY costs—members with CAD who were not compliant with their condition

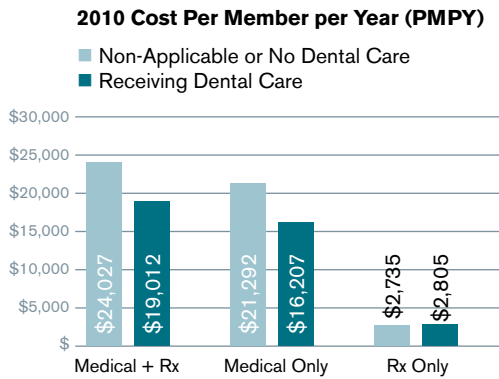
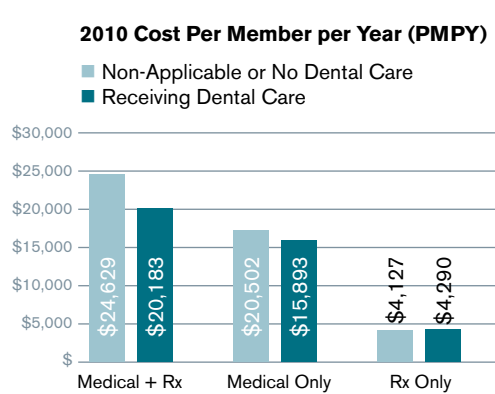


Chart 11: PMPY costs—members with CAD who were compliant with their condition



Annual medical costs were \$5,085 (\$5,015 including Rx) lower for the non-compliant CAD group receiving dental care and \$4,609 (\$4,446 including Rx) lower for the compliant CAD group receiving dental care.

Tables 11 and 12 (Appendix) show the annual spend for the dental treatment groups of non-compliant and compliant CAD members respectively.

Observations

- ▶ Individuals with CAD who visited the dentist for cleanings and/or periodontal treatment had lower medical costs than individuals who received no dental treatment.
- ▶ For those medically compliant with the treatment for their condition, the savings on medical cost was \$3,353 (\$4,150 including Rx) and more than offset the additional cost of surgical periodontal treatment over non-surgical periodontal treatment (\$381 = \$1,156–\$776).
- ▶ For those not compliant with the treatment of their medical condition the additional cost of surgical periodontal treatment (\$484 = \$1,248–\$765) also correlate with lower medical cost (\$15,109 for the surgical periodontal group vs. \$15,578 for the non-surgical periodontal group).
- ▶ Medical cost for individuals receiving restorative and/or extraction-only dental procedures (and no periodontal treatment or cleanings) did not have markedly different medical cost from those receiving no dental care.

Congestive Heart Failure (CHF)

2,253 members in this study were identified as having CHF. 1,318 members were compliant with their medical condition. 935 members were not compliant with their medical condition.

Chart 12: PMPY costs—members with CHF who were not compliant with their condition

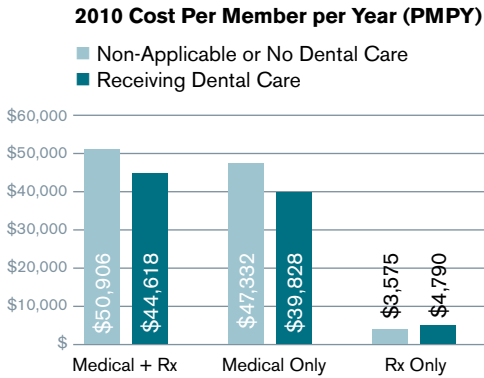
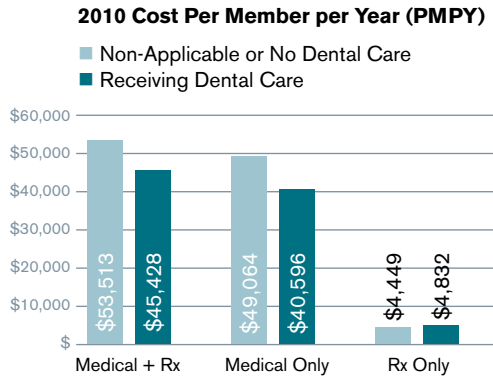


Chart 13: PMPY costs—members with CHF who were compliant with their condition



Annual medical costs were \$7,504 (\$6,288 including Rx) lower for the non-compliant CHF group receiving dental care and \$8,468 (\$8,085 including Rx) lower for the compliant CHF group receiving dental care.

Tables 13 and 14 (Appendix) show the annual spend for the dental treatment groups of non-compliant and compliant CHF members respectively.

Observations

- ▶ Individuals with the same level of medical compliance who received periodontal treatment generally had the lowest medical cost of any other dental treatment group. Exception: individuals compliant with their CHF condition who received frequent cleanings had lower medical/Rx cost (\$39,113) compared to periodontal treatment group (\$41,151).
- ▶ Periodontal treatment is even more important for individuals who are non-compliant with their CHF condition. These members showed a savings of \$12,533 per year when compared to individuals who received no dental treatment. The savings in medical/Rx cost more than outweighed the dollars spent on dental care.
- ▶ Even members receiving frequent cleanings showed much lower costs than individuals who did not receive any dental care.
- ▶ Contrary to other chronic conditions in this study, there were greater savings for medically compliant members than for non-medically compliant members.
- ▶ There was not sufficient data to break the periodontal treatment group up into individuals who received surgical vs. non-surgical treatment.

Chronic Obstructive Pulmonary Disease (COPD)

5,428 members in this study were identified as having COPD. 3,706 members were compliant with their medical condition. 1,722 members were not compliant with their medical condition.

Chart 14: PMPY costs—members with COPD who were not compliant with their condition

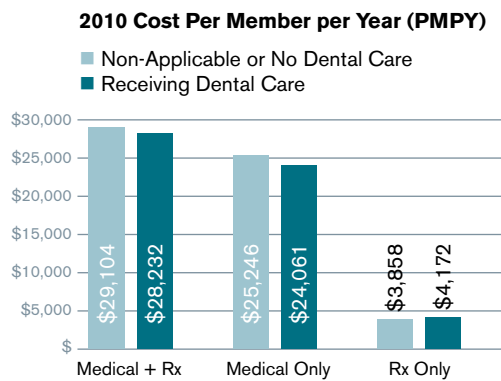
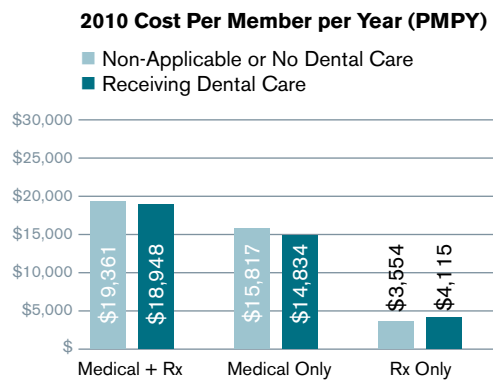


Chart 15: PMPY costs—members with COPD who were compliant with their condition



Annual medical costs were \$1,185 (\$872 including Rx) lower for the non-compliant COPD group receiving dental care and \$983 (\$413 including Rx) lower for the compliant COPD group receiving dental care.

Tables 15 and 16 (Appendix) show the annual spend for the dental treatment groups of non-compliant and compliant COPD individuals respectively.

Chronic Kidney/Renal Disease

3,816 members in this study were identified as having Renal Disease. 2,822 members were compliant with their medical condition. 994 members were not compliant with their medical condition.

Chart 16: PMPY costs—members with Renal Disease who were not compliant with their condition

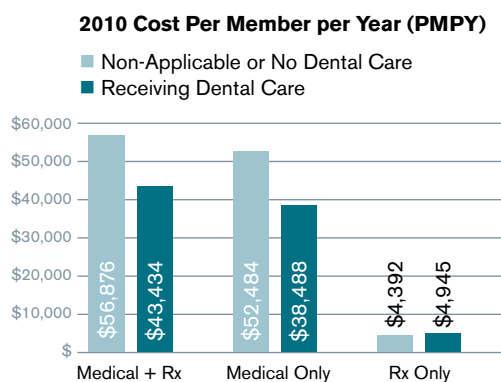
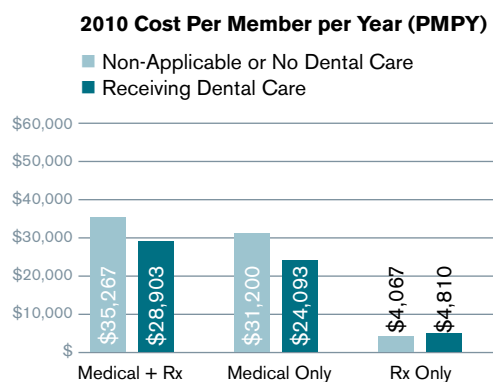


Chart 17: PMPY costs—members with Renal Disease who were compliant with their condition



Annual medical costs were \$13,996 (\$13,442 including Rx) lower for the non-compliant Renal Disease group receiving dental care and \$7,107 (\$6,364 including Rx) lower for the compliant Renal Disease group receiving dental care.

Tables 17 and 18 (Appendix) show the annual spend for the dental treatment groups of non-compliant and compliant Renal Disease individuals respectively.

Observations

- ▶ The dental treatment group receiving cleanings had similar costs to the group not receiving any dental treatment.
- ▶ Members who received periodontal treatment had the lowest cost.
- ▶ There was not sufficient data to break the periodontal treatment group up into individuals who received surgical vs. non-surgical treatment.

Observations

- ▶ Any level of dental care had a positive impact on the medical cost. The differences (i.e., savings) were much larger for individuals who were non-compliant with their renal condition. Although a small population, this suggests a savings opportunity for members with kidney disease.
- ▶ Over 25% of members with chronic kidney disease were non-compliant with medical treatment, and their medical costs were 59% higher than those who were medically compliant.
- ▶ Members non-compliant with their medical condition who received periodontal treatment or cleanings spent approximately \$14,000 less per year on medical.
- ▶ There was not sufficient data to break the periodontal treatment group up into individuals who received surgical vs. non-surgical treatment.

Conclusion and next steps

Overall, total medical costs were considerably lower for individuals with chronic medical conditions who received periodontal treatment or cleanings within the timeframe of this study even when considering the costs of additional dental treatments. Net savings were realized, irrespective of medical compliance. However, savings were substantially greater (\$1,849) for non-medically compliant individuals than they were for individuals who were compliant with their medical condition (\$264). Savings for individuals receiving preventive dental care were observed across all chronic medical disease categories in this study. Conversely, members receiving extractions, root canals, restorative treatments and no preventive or periodontal treatment had the highest health care spend, demonstrating a potential link between the lack of a preventive dental pattern and overall medical costs.

In this study, savings from preventive treatment for many of the chronic conditions were primarily driven by cleanings. An exception was observed for diabetics, where periodontal treatment, specifically non-surgical periodontal, had the lowest medical cost of any other dental treatment group.

Future studies should consider tracking a homogenous group of members with similar chronic conditions, costs and severities who have received different dental treatments, to follow their average costs over a multi-year time period. Additionally, as more data becomes available to review, additional portions of this study will turn credible, specifically various cancer conditions.

Appendix

Table 2: Medical, Rx and dental PMPY costs for all members with chronic condition

	# Members	2010 Cost Per Member per Year (PMPY)			
		Medical + Rx	Medical	Rx	Dental
Periodontal Treatment	10,954	\$10,469	\$8,195	\$2,273	\$696
Surgical Perio	674	\$9,391	\$7,117	\$2,274	\$940
-With Maintenance	591	\$9,442	\$7,202	\$2,240	\$953
-Without Maintenance	83	\$9,026	\$6,514	\$2,512	\$845
Non-Surgical Perio	10,280	\$10,539	\$8,266	\$2,273	\$680
-With Maintenance	7,476	\$10,013	\$7,695	\$2,318	\$713
-Without Maintenance	2,804	\$11,943	\$9,790	\$2,154	\$594
Cleanings	61,298	\$11,308	\$8,681	\$2,627	\$529
-Frequent	20,933	\$10,395	\$7,707	\$2,688	\$573
-Infrequent	40,365	\$11,782	\$9,186	\$2,596	\$506
Receiving Dental Care (Periodontal + Cleanings)	72,252	\$11,181	\$8,607	\$2,574	\$554
Non-applicable or No Dental History	58,294	\$12,334	\$10,097	\$2,237	\$102
-Restorative/Extractions Only	8,647	\$12,760	\$10,363	\$2,397	\$504
-Other	6,816	\$12,772	\$10,497	\$2,276	\$230
-No Dental History	42,831	\$12,179	\$9,980	\$2,199	-
Total	130,546	\$11,696	\$9,272	\$2,424	\$352

Table 3: Medical, Rx and dental PMPY costs for members NOT compliant with their chronic condition(s)

Medical Compliance = N	# Members	2010 Cost Per Member per Year (PMPY)			
		Medical + Rx	Medical	Rx	Dental
Periodontal Treatment	4,385	\$10,297	\$8,659	\$1,639	\$722
Surgical Perio	244	\$8,904	\$7,255	\$1,650	\$969
-With Maintenance	208	\$9,065	\$7,495	\$1,570	\$995
-Without Maintenance	36	\$7,977	\$5,870	\$2,107	\$820
Non-Surgical Perio	4,141	\$10,461	\$8,824	\$1,637	\$693
-With Maintenance	2,882	\$9,922	\$8,260	\$1,663	\$730
-Without Maintenance	1,259	\$11,695	\$10,116	\$1,580	\$607
Cleanings	25,395	\$11,297	\$9,385	\$1,912	\$547
-Frequent	8,048	\$10,465	\$8,520	\$1,945	\$611
-Infrequent	17,347	\$11,683	\$9,787	\$1,896	\$518
Receiving Dental Care (Periodontal + Cleanings)	29,780	\$11,150	\$9,278	\$1,871	\$573
Non-applicable or No Dental History	26,721	\$13,327	\$11,598	\$1,730	\$102
-Restorative/Extractions Only	3,970	\$13,692	\$11,797	\$1,895	\$515
-Other	2,991	\$14,245	\$12,472	\$1,773	\$226
-No Dental History	19,760	\$13,115	\$11,425	\$1,690	-
Total	56,501	\$12,180	\$10,375	\$1,804	\$350

Table 4: Medical, Rx and dental PMPY costs for members compliant with their chronic condition(s)

Medical Compliance = Y	# Members	2010 Cost Per Member per Year (PMPY)			
		Medical + Rx	Medical	Rx	Dental
Periodontal Treatment	6,569	\$10,478	\$7,785	\$2,693	\$703
Surgical Perio	430	\$9,667	\$7,039	\$2,628	\$923
-With Maintenance	383	\$9,647	\$7,043	\$2,604	\$930
-Without Maintenance	47	\$9,829	\$7,007	\$2,822	\$863
Non-Surgical Perio	6,139	\$10,592	\$7,890	\$2,702	\$672
-With Maintenance	4,594	\$10,070	\$7,340	\$2,729	\$702
-Without Maintenance	1,545	\$12,146	\$9,524	\$2,621	\$582
Cleanings	35,903	\$11,316	\$8,182	\$3,134	\$515
-Frequent	12,885	\$10,351	\$7,200	\$3,152	\$548
-Infrequent	23,018	\$11,856	\$8,732	\$3,124	\$497
Receiving Dental Care (Periodontal + Cleanings)	42,472	\$11,187	\$8,121	\$3,066	\$544
Non-applicable or No Dental History	31,573	\$11,494	\$8,827	\$2,667	\$102
-Restorative/Extractions Only	4,677	\$11,968	\$9,145	\$2,823	\$495
-Other	3,825	\$11,621	\$8,952	\$2,669	\$233
-No Dental History	23,071	\$11,377	\$8,741	\$2,635	-
Total	74,045	\$11,318	\$8,422	\$2,896	\$356

Table 5: PMPY costs for members with diabetes who were non-compliant with diabetes care

Medical Compliance = N	# Members	2010 Cost Per Member per Year (PMPY)			
		Medical + Rx	Medical	Rx	Dental
Periodontal Treatment	2,696	\$8,897	\$7,552	\$1,346	\$780
Surgical Perio	166	\$8,851	\$7,437	\$1,413	\$1,082
Non-Surgical Perio	2,530	\$8,900	\$7,559	\$1,341	\$761
-With Maintenance	1,712	\$8,539	\$7,200	\$1,339	\$795
-Without Maintenance	818	\$9,657	\$8,311	\$1,346	\$689
Cleanings	10,249	\$10,912	\$9,529	\$1,383	\$496
-Frequent	2,862	\$9,375	\$8,055	\$1,320	\$530
-Infrequent	7,387	\$11,507	\$10,100	\$1,408	\$483
Receiving Dental Care (Periodontal + Cleanings)	12,945	\$10,492	\$9,117	\$1,375	\$555
Non-applicable or No Dental History	15,284	\$12,254	\$10,791	\$1,463	\$106
-Restorative/Extractions Only	2,345	\$11,786	\$10,395	\$1,481	\$526
-Other	1,719	\$13,219	\$11,905	\$1,314	\$229
-No Dental History	11,220	\$12,185	\$10,703	\$1,482	-
Total	28,229	\$11,446	\$10,023	\$1,423	\$312

Table 6: PMPY costs for members with diabetes who were compliant with their diabetes care

Medical Compliance = Y	# Members	2010 Cost Per Member per Year (PMPY)			
		Medical + Rx	Medical	Rx	Dental
Periodontal Treatment	4,664	\$11,124	\$8,003	\$3,121	\$740
Surgical Perio	295	\$10,659	\$7,616	\$3,043	\$992
Non-Surgical Perio	4,369	\$11,156	\$8,029	\$3,126	\$723
-With Maintenance	3,217	\$10,489	\$7,343	\$3,146	\$757
-Without Maintenance	1,152	\$13,017	\$9,945	\$3,073	\$627
Cleanings	19,119	\$12,272	\$8,736	\$3,536	\$505
-Frequent	6,718	\$11,446	\$7,797	\$3,649	\$533
-Infrequent	12,401	\$12,720	\$9,245	\$3,474	\$490
Receiving Dental Care (Periodontal + Cleanings)	23,783	\$12,047	\$8,593	\$3,454	\$551
Non-applicable or No Dental History	21,132	\$12,642	\$9,518	\$3,124	\$109
-Restorative/Extractions Only	3,245	\$12,817	\$9,572	\$3,245	\$523
-Other	2,569	\$12,766	\$9,620	\$3,146	\$237
-No Dental History	15,318	\$12,584	\$9,489	\$3,095	-
Total	44,915	\$12,327	\$9,028	\$3,299	\$343

Table 8: Prevalence of chronic conditions comorbid with diabetes

Members with Diabetic Episode	# Members	% of Members with Comorbid Episode				
		CAD	Asthma	Renal	COPD	CHF
Periodontal Treatment	7,360	6.4%	2.6%	1.8%	1.0%	0.9%
Surgical Perio	461	7.8%	0.9%	2.4%	1.1%	0.4%
Non-Surgical Perio	6,899	6.3%	2.7%	1.8%	1.0%	0.9%
-With Maintenance	4,929	6.5%	2.5%	1.9%	0.9%	1.0%
-Without Maintenance	1,970	5.8%	3.1%	1.6%	1.1%	0.8%
Cleanings	29,368	6.0%	3.2%	1.8%	0.8%	0.7%
-Frequent	9,580	6.3%	3.2%	1.9%	0.7%	0.6%
-Infrequent	19,788	5.9%	3.2%	1.7%	0.8%	0.8%
Receiving Dental Care (Periodontal + Cleanings)	36,728	6.1%	3.1%	1.8%	0.8%	0.8%
Non-applicable or No Dental History	36,416	7.5%	2.9%	2.3%	1.6%	1.6%
-Restorative/Extractions Only	5,590	8.7%	3.1%	2.3%	1.9%	1.7%
-Other	4,288	7.9%	2.6%	2.0%	1.9%	1.6%
-No Dental History	26,538	7.3%	2.9%	2.3%	1.6%	1.6%
Total	73,144	6.8%	3.0%	2.0%	1.2%	1.2%

Table 9: PMPY costs—members with asthma who were non-compliant with their asthma condition

Medical Compliance = N	# Members	2010 Cost Per Member per Year (PMPY)			
		Medical + Rx	Medical	Rx	Dental
Periodontal Treatment	925	\$7,717	\$6,069	\$1,648	\$583
Surgical Perio	31	\$4,906	\$2,882	\$2,024	\$749
Non-Surgical Perio	894	\$7,814	\$6,179	\$1,635	\$577
-With Maintenance	652	\$7,488	\$5,870	\$1,618	\$621
-Without Maintenance	242	\$8,692	\$7,013	\$1,679	\$459
Cleanings	12,224	\$7,628	\$5,746	\$1,882	\$520
-Frequent	4,203	\$7,067	\$5,205	\$1,862	\$588
-Infrequent	8,021	\$7,922	\$6,029	\$1,893	\$484
Receiving Dental Care (Periodontal + Cleanings)	13,149	\$7,635	\$5,769	\$1,866	\$525
Non-applicable or No Dental History	6,844	\$8,764	\$7,032	\$1,732	\$85
-Restorative/Extractions Only	855	\$10,793	\$8,731	\$2,062	\$484
-Other	683	\$9,115	\$7,422	\$1,693	\$244
-No Dental History	5,306	\$8,392	\$6,708	\$1,684	-
Total	19,993	\$8,021	\$6,201	\$1,820	\$374

Table 10: PMPY costs—members with asthma who were compliant with their asthma condition

Medical Compliance = Y	# Members	2010 Cost Per Member per Year (PMPY)			
		Medical + Rx	Medical	Rx	Dental
Periodontal Treatment	1,034	\$7,253	\$5,398	\$1,855	\$577
Surgical Perio	47	\$7,374	\$5,378	\$1,996	\$790
Non-Surgical Perio	987	\$7,247	\$5,398	\$1,848	\$567
-With Maintenance	747	\$6,961	\$5,008	\$1,953	\$593
-Without Maintenance	240	\$8,137	\$6,615	\$1,522	\$487
Cleanings	13,187	\$8,086	\$5,586	\$2,500	\$497
-Frequent	4,639	\$7,739	\$5,346	\$2,393	\$550
-Infrequent	8,548	\$8,274	\$5,716	\$2,558	\$468
Receiving Dental Care (Periodontal + Cleanings)	14,221	\$8,025	\$5,572	\$2,453	\$503
Non-applicable or No Dental History	6,842	\$7,545	\$5,512	\$2,033	\$81
-Restorative/Extractions Only	849	\$9,075	\$6,797	\$2,277	\$462
-Other	760	\$7,873	\$5,736	\$2,137	\$217
-No Dental History	5,233	\$7,249	\$5,271	\$1,978	–
Total	21,063	\$7,869	\$5,553	\$2,316	\$366

Table 11: PMPY costs—members with CAD who were non-compliant with their condition

Medical Compliance = N	# Members	2010 Cost Per Member per Year (PMPY)			
		Medical + Rx	Medical	Rx	Dental
Periodontal Treatment	620	\$18,221	\$15,549	\$2,673	\$794
Surgical Perio	38	\$17,905	\$15,109	\$2,796	\$1,248
Non-Surgical Perio	582	\$18,242	\$15,578	\$2,664	\$765
-With Maintenance	417	\$17,480	\$14,642	\$2,838	\$804
-Without Maintenance	165	\$20,167	\$17,942	\$2,225	\$665
Cleanings	2,411	\$19,215	\$16,376	\$2,840	\$557
-Frequent	795	\$15,856	\$13,317	\$2,539	\$608
-Infrequent	1,616	\$20,868	\$17,881	\$2,987	\$531
Receiving Dental Care (Periodontal + Cleanings)	3,031	\$19,012	\$16,207	\$2,805	\$605
Non-applicable or No Dental History	3,660	\$24,027	\$21,292	\$2,735	\$131
-Restorative/Extractions Only	619	\$23,702	\$20,600	\$3,102	\$602
-Other	451	\$25,428	\$22,160	\$3,268	\$235
-No Dental History	2,590	\$23,860	\$21,306	\$2,555	–
Total	6,691	\$21,755	\$18,988	\$2,767	\$346

Table 12: PMPY costs—members with CAD who were compliant with their condition

Medical Compliance = Y	# Members	2010 Cost Per Member per Year (PMPY)			
		Medical + Rx	Medical	Rx	Dental
Periodontal Treatment	1,102	\$20,573	\$16,271	\$4,302	\$810
Surgical Perio	99	\$16,796	\$13,219	\$3,577	\$1,156
Non-Surgical Perio	1,003	\$20,946	\$16,572	\$4,374	\$776
-With Maintenance	791	\$20,861	\$16,499	\$4,362	\$805
-Without Maintenance	212	\$21,262	\$16,843	\$4,419	\$666
Cleanings	4,811	\$20,094	\$15,806	\$4,288	\$553
-Frequent	1,911	\$17,751	\$13,533	\$4,219	\$579
-Infrequent	2,900	\$21,638	\$17,305	\$4,333	\$537
Receiving Dental Care (Periodontal + Cleanings)	5,913	\$20,183	\$15,893	\$4,290	\$601
Non-applicable or No Dental History	5,005	\$24,629	\$20,502	\$4,127	\$132
-Restorative/Extractions Only	838	\$24,923	\$20,454	\$4,469	\$576
-Other	699	\$25,440	\$21,430	\$4,010	\$257
-No Dental History	3,468	\$24,395	\$20,327	\$4,068	–
Total	10,918	\$22,221	\$18,006	\$4,216	\$386

Table 13: PMPY costs—members with CHF who were not compliant with their condition

Medical Compliance = N	# Members	2010 Cost Per Member per Year (PMPY)			
		Medical + Rx	Medical	Rx	Dental
Periodontal Treatment	74	\$38,373	\$35,669	\$2,704	\$612
Surgical Perio	1	\$13,501	\$10,121	\$3,380	\$1,024
Non-Surgical Perio	73	\$38,714	\$36,019	\$2,695	\$607
-With Maintenance	53	\$38,536	\$35,635	\$2,902	\$590
-Without Maintenance	20	\$39,185	\$37,039	\$2,146	\$651
Cleanings	259	\$46,402	\$41,016	\$5,386	\$520
-Frequent	75	\$43,344	\$37,758	\$5,586	\$635
-Infrequent	184	\$47,648	\$42,344	\$5,304	\$474
Receiving Dental Care (Periodontal + Cleanings)	333	\$44,618	\$39,828	\$4,790	\$541
Non-applicable or No Dental History	602	\$50,906	\$47,332	\$3,575	\$103
-Restorative/Extractions Only	91	\$44,819	\$40,486	\$4,333	\$547
-Other	71	\$58,915	\$54,019	\$4,896	\$171
-No Dental History	440	\$50,873	\$47,669	\$3,204	-
Total	935	\$48,667	\$44,659	\$4,007	\$259

Table 14: PMPY costs—members with CHF who were compliant with their condition

Medical Compliance = Y	# Members	2010 Cost Per Member per Year (PMPY)			
		Medical + Rx	Medical	Rx	Dental
Periodontal Treatment	103	\$41,151	\$36,172	\$4,979	\$723
Surgical Perio	2	\$43,733	\$37,834	\$5,899	\$937
Non-Surgical Perio	101	\$41,100	\$36,139	\$4,960	\$719
-With Maintenance	75	\$43,908	\$38,052	\$5,856	\$733
-Without Maintenance	26	\$33,000	\$30,623	\$2,377	\$678
Cleanings	410	\$46,502	\$41,707	\$4,795	\$495
-Frequent	128	\$39,113	\$34,097	\$5,016	\$508
-Infrequent	282	\$49,856	\$45,161	\$4,695	\$489
Receiving Dental Care (Periodontal + Cleanings)	513	\$45,428	\$40,596	\$4,832	\$541
Non-applicable or No Dental History	805	\$53,513	\$49,064	\$4,449	\$99
-Restorative/Extractions Only	126	\$49,758	\$44,498	\$5,260	\$518
-Other	83	\$68,604	\$63,613	\$4,991	\$174
-No Dental History	596	\$52,205	\$48,003	\$4,202	-
Total	1,318	\$50,366	\$45,768	\$4,598	\$271

Table 15: PMPY costs—members with COPD who were not compliant with their condition

Medical Compliance = N	# Members	2010 Cost Per Member per Year (PMPY)			
		Medical + Rx	Medical	Rx	Dental
Periodontal Treatment	124	\$27,547	\$23,075	\$4,471	\$760
Surgical Perio	9	\$18,762	\$16,451	\$2,311	\$1,056
Non-Surgical Perio	115	\$28,234	\$23,594	\$4,640	\$737
-With Maintenance	75	\$24,024	\$19,257	\$4,767	\$788
-Without Maintenance	40	\$36,127	\$31,724	\$4,403	\$640
Cleanings	457	\$28,419	\$24,328	\$4,091	\$622
-Frequent	148	\$27,680	\$23,495	\$4,185	\$606
-Infrequent	309	\$28,772	\$24,727	\$4,045	\$629
Receiving Dental Care (Periodontal + Cleanings)	581	\$28,232	\$24,061	\$4,172	\$651
Non-applicable or No Dental History	1,141	\$29,104	\$25,246	\$3,858	\$146
-Restorative/Extractions Only	205	\$30,869	\$26,387	\$4,483	\$623
-Other	158	\$32,534	\$27,099	\$5,435	\$249
-No Dental History	778	\$27,942	\$24,570	\$3,373	-
Total	1,722	\$28,810	\$24,846	\$3,964	\$317

Table 16: PMPY costs—members with COPD who were compliant with their condition

Medical Compliance = Y	# Members	2010 Cost Per Member per Year (PMPY)			
		Medical + Rx	Medical	Rx	Dental
Periodontal Treatment	323	\$16,671	\$12,938	\$3,733	\$834
Surgical Perio	22	\$14,767	\$11,249	\$3,518	\$991
Non-Surgical Perio	301	\$16,811	\$13,061	\$3,749	\$822
-With Maintenance	224	\$16,811	\$12,676	\$4,135	\$879
-Without Maintenance	77	\$16,810	\$14,183	\$2,627	\$657
Cleanings	1,130	\$19,599	\$15,375	\$4,224	\$549
-Frequent	401	\$17,202	\$12,880	\$4,321	\$584
-Infrequent	729	\$20,918	\$16,748	\$4,170	\$531
Receiving Dental Care (Periodontal + Cleanings)	1,453	\$18,948	\$14,834	\$4,115	\$613
Non-applicable or No Dental History	2,253	\$19,361	\$15,817	\$3,544	\$132
-Restorative/Extractions Only	390	\$22,488	\$18,286	\$4,202	\$537
-Other	301	\$24,458	\$20,423	\$4,036	\$291
-No Dental History	1,562	\$17,598	\$14,313	\$3,285	–
Total	3,706	\$19,199	\$15,431	\$3,768	\$320

Table 17: PMPY costs—members with Renal Disease who were not compliant with their condition

Medical Compliance = N	# Members	2010 Cost Per Member per Year (PMPY)			
		Medical + Rx	Medical	Rx	Dental
Periodontal Treatment	95	\$43,658	\$38,450	\$5,208	\$847
Surgical Perio	6	\$25,026	\$20,090	\$4,937	\$985
Non-Surgical Perio	89	\$44,914	\$39,688	\$5,227	\$837
-With Maintenance	65	\$27,821	\$22,216	\$5,605	\$888
-Without Maintenance	24	\$91,209	\$87,008	\$4,201	\$699
Cleanings	356	\$43,374	\$38,499	\$4,875	\$514
-Frequent	118	\$43,618	\$38,237	\$5,381	\$561
-Infrequent	238	\$43,252	\$38,628	\$4,624	\$491
Receiving Dental Care (Periodontal + Cleanings)	451	\$43,434	\$38,488	\$4,945	\$584
Non-applicable or No Dental History	543	\$56,876	\$52,484	\$4,392	\$122
-Restorative/Extractions Only	85	\$46,080	\$41,422	\$4,658	\$596
-Other	70	\$51,598	\$46,752	\$4,845	\$222
-No Dental History	388	\$60,193	\$55,941	\$4,252	–
Total	994	\$50,777	\$46,134	\$4,643	\$332

Table 18: PMPY costs—members with Renal Disease who were compliant with their condition

Medical Compliance = Y	# Members	2010 Cost Per Member per Year (PMPY)			
		Medical + Rx	Medical	Rx	Dental
Periodontal Treatment	309	\$27,712	\$23,105	\$4,607	\$787
Surgical Perio	24	\$17,954	\$14,756	\$3,198	\$1,007
Non-Surgical Perio	285	\$28,534	\$23,808	\$4,726	\$768
-With Maintenance	220	\$23,073	\$18,282	\$4,791	\$780
-Without Maintenance	65	\$47,019	\$42,511	\$4,508	\$730
Cleanings	1,187	\$29,213	\$24,350	\$4,863	\$487
-Frequent	451	\$20,629	\$15,709	\$4,920	\$531
-Infrequent	736	\$34,473	\$29,645	\$4,828	\$461
Receiving Dental Care (Periodontal + Cleanings)	1,496	\$28,903	\$24,093	\$4,810	\$549
Non-applicable or No Dental History	1,326	\$35,267	\$31,200	\$4,067	\$110
-Restorative/Extractions Only	200	\$32,658	\$28,542	\$4,115	\$513
-Other	144	\$29,650	\$25,813	\$3,837	\$298
-No Dental History	982	\$36,622	\$32,531	\$4,091	–
Total	2,822	\$31,893	\$27,432	\$4,461	\$343



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