Technical Report

Comparison of the Management Costs for Headache Among Different Provider Types: Doctors of Chiropractic, Medical Doctors, and Physical Therapists

The North Carolina State Health Plan for Teachers and State Employees, 2000-2009

Eric L. Hurwitz, DC, PhD

Professor of Epidemiology
Office of Public Health Studies
Department of Public Health Sciences
John A. Burns School of Medicine
University of Hawaii, Mānoa
Honolulu, HI 96822

September 18, 2013

Introduction and Methods

This technical report of North Carolina medical claims data analysis focuses on patients with headache diagnoses reported during years 2000-2009. Each reporting year represents a benefit year starting in July and ending in June. This was done to use the same benefits in a fiscal year. The initial data extraction for this study included the claims for 664,000 covered lives comprising 62% female and 37% male patients. For headache, 910,778 claims met the inclusion criteria. Medicare and non-North Carolina residents were excluded.

This report is the third installment in an analysis of some of the most common musculoskeletal conditions seen by health care providers. These conditions include complicated and uncomplicated low back pain (covered in the first report), complicated and uncomplicated neck pain (covered in the second report), and headache (covered in this report). Following this report, each technical report will then be revised for a series of peer-reviewed article publications.

Contained within these reports are analyses of patients' "risk scores" among providers for the years 2006-2009. Risk scores reflect the measure of risk of expected health care cost and utilization relative to that of the overall population. For example, a score of 1.00 indicates risk comparable to that of the population used in developing the risk groups, whereas a score of 2.00 indicates 100% greater risk than the average for the population. Risk also reflects the potential difficulty of managing a particular case. For headache, the mean risk score over the 4-year period was 1.76 for MD only care and 1.75 for DC only care (the more stable medians were 1.19 and 1.25, respectively), indicating essentially equivalent risks.

Following the analysis of the risk scores, risk-adjusted average (mean) charges were calculated to take into account patient-specific factors that may affect utilization and charges (i.e., increase the risk of higher health-care use and greater charges). These factors were age, sex, primary diagnosis, comorbidities and use of prescription drugs. We calculated risk-adjusted average charges for patients in the middle quintile of risk (patients with risk scores between the 40^{th} and 60^{th} percentiles). This range is significant because it reflects patients at "average" risk in the population and yields an "apples to apples" comparison of provider's allowable charges. The risk-adjusted average allowable charge findings for headache are significantly different than the charge findings that did not take into account these factors.

Background

Chiropractic doctors have been long associated with treatment of back and neck complaints, but what is less well-known is that a substantial number of individuals seek out chiropractors for care of headaches, due to the significant influence that cervical spine conditions have upon these presentations.

Diagnoses

Patients with headache have primary diagnoses falling in the following ICD-9 categories: Tension headache (307.81), Cluster headache syndrome unspecified (339.00), Episodic cluster headache (339.01), Chronic cluster headache (339.02), Episodic paroxysmal hemicrania (339.03), Chronic paroxysmal hemicrania (339.04), Tension type headache, unspecified (339.10), Episodic tension type headache (339.11), Chronic tension type headache (339.12), Post-traumatic headache, unspecified (339.20), Acute post-traumatic headache (339.21), Chronic post-traumatic headache (339.22), Drug induced headache, not elsewhere classified (339.3), New daily

persistent headache (339.42), Primary thunderclap headache (339.43), Other complicated headache syndrome (339.44), Primary exertional headache (339.84), Primary stabbing headache (339.85), Other headache syndromes (339.89), Migraine with aura, without mention of intractable migraine w/o mention of status migrainosus (346.00), Migraine with aura, with intractable migraine, so stated, without mention of status migrainosus (346.01), Migraine with aura, without mention of intractable migraine with status migrainosus (346.02), Migraine with aura, with intractable migraine, so stated, with status migrainosus (346.03), Migraine without aura, without mention of intractable migraine w/o mention of status migrainosus (346.10), Migraine without aura, with intractable migraine, so stated, without mention of status migrainosus (346.11), Migraine without aura, without mention of intractable migraine with status migrainosus (346.12), Migraine without aura, with intractable migraine, so stated, with status migrainosus (346.13), Variants of migraine, nec (not elsewhere classified), w/o mention of intractable migraine w/o mention of status migrainosus (346.20), Variants of migraine, nec, with intractable migraine, so stated, w/o mention of status migrainosus (346.21), Variants of migraine, nec, without mention of intractable migraine with status migrainosus (346.22), Variants of migraine, nec, with intractable migraine, so stated, with status migrainosus (346.23), Hemiplegic migraine, without mention of intractable migraine w/o mention of status migrainosus (346.30), Hemiplegic migraine, with intractable migraine, so stated, without mention of status migrainosus (346.31), Hemiplegic migraine, without mention of intractable migraine with status migrainosus (346.32), Hemiplegic migraine, with intractable migraine, so stated, with status migrainosus (346.33), Chronic migraine w/o aura, w/o mention of intractable migraine w/o mention of status migrainosus (346.70), Chronic migraine w/o aura, with intractable migraine, so stated, w/o mention of status migrainosus (346.71), Chronic migraine without aura, without mention of intractable migraine with status migrainosus (346.72), Chronic migraine without aura, with intractable migraine, so stated, with status migrainosus (346.73), Other forms of migraine, w/o mention of intractable migraine w/o mention of status migrainosus (346.80), Other forms of migraine, with intractable migraine, so stated, w/o mention of status migrainosus (346.81), Other forms of migraine, without mention of intractable migraine with status migrainosus (346.82), Other forms of migraine, with intractable migraine, so stated, with status migrainosus (346.83), Migraine, unspecified, without mention of intractable migraine w/o mention of status migrainosus (346.90), Migraine, unspecified, with intractable migraine, so stated, without mention of status migrainosus (346.91), Migraine, unspecified, without mention of intractable migraine with status migrainosus (346.92), Migraine, unspecified, with intractable migraine, so stated, with status migrainosus (346.93), Nonallopathic lesions, head region (739.0), and Headache (784.0).

Health-care providers

The provider type for headache can be classified into four types: DC, MD, PT, and referral (RE or ref), with each of them defined as DC=Chiropractic; MD=Medical Doctors and Doctors of Osteopathy in General Practice, Internal Medicine, Neurology, Neurosurgery, Obstetrics, Obstetrics-Gynecology, Orthopedic Surgery, Osteopathy, Pediatrics, Physical Medicine Rehab, General Surgery, Family Practice, or Geriatric Medicine; Nurse Practitioner; Podiatry; Public Health; University/College Infirmary; Urgent Care; VA/Military Hospital-Professional Staff; PT=Physical Therapy; and referral=hospitalization, surgery, emergency medicine, diagnostic radiology, durable medical equipment, laboratory, pharmacy, and other specialty referral services and providers.

Claim types

For each fiscal year, drug claim data are combined with the medical claim data based on each patient's unique ID. There are five major claim types based on the service provided to each patient: "Office Visit", "MRI_CT", "DX_RAD", "Physical Therapy", and "Surgical". The five major claim types are defined as follows:

Office Visit: the place of service provided is in office (place of service [POS] code 11).

MRI_CT: If the service type is associated with advanced imaging that was ordered for the patient, such as a CT scan, magnetic resonance imaging (MRI), computerized axial tomography or similar services, then the claim type is MRI_CT.

DX_RAD: If the service type is associated with testing that was ordered for the patient such as diagnostic x-ray imaging or similar services, then the claim type is DX_RAD.

Physical Therapy: the provider specialty is physical therapist or the service code is consistent with physical therapy (e.g., codes 0420-0429). Physical therapy procedures such as electrical stimulation [97014] and ultrasound [97035] that may be used by PTs, DCs, or MDs are not ascribed to this claim category if performed by a DC or MD.

Surgical: surgical services and ancillary services provided by a neurosurgeon, orthopedic surgeon, or general surgeon for patients diagnosed with one or more of the headache diagnoses listed above.

Patterns of care

Based on the utilization of providers, patients were classified into 15 care patterns:

1.	MD_only:	Patients who only use MD service
2.	DC_only:	Patients who only use Chiropractic service
3.	PT_only:	Patients who only use Physical Therapy
4.	RE_only:	Patients who only use referred provider or service
5.	MD_DC:	Patients who use both MD and Chiropractic service
6.	MD_PT:	Patients who use both MD and Physical Therapy (PT) care
7.	MD_RE:	Patients who use both MD and referred provider or service
8.	PT_DC:	Patients who use both PT and Chiropractic (DC) care
9.	DC_RE:	Patients who use both DC and referred provider or service
10.	PT_RE:	Patients who use both PT and referred provider or service
11.	MD_DC_PT:	Patients who use MD, DC, and PT care
12.	MD_DC_RE:	Patients who use MD, DC, and referred provider or service
13.	RE_DC_PT:	Patients who use DC, PT, and referred provider or service
14.	MD_PT_RE:	Patients who use MD, PT, and referred provider or service
15.	MD_DC_PT_RE:	Patients who use all four provider types

Among these 15 care patterns, the PT only care pattern was not included in tables due to small sample size. Any negative medical or pharmaceutical charges (allowed amount, member liability, and paid amount) were excluded from the analysis. Note: Episodes of care were not used. Episodes of care would have required arbitrary definitions of (a) episode length, (b) time lapse between visits, and (c) time to recurrence (e.g., reoccur in 1 week, 1 month or 1 year) that have not been validated.

Statistical analysis

SAS 9.3 (Cary, NC) was used for data management and statistical analyses. The demographic variables analyzed are age and gender. Age is calculated from the patient's birth date as of January 1st of the reporting year. The summary statistics for age were calculated for each care pattern using the *proc means* procedure in SAS. The frequency distributions of gender and age group (>=18 years old or < 18 years old) were calculated by the *proc freq* procedure in SAS. *Proc means* and *proc freq* are the primary procedures in SAS for computing descriptive statistics.

The number of claims for each care pattern was identified by the *proc freq* procedure. The number of claims in each provider group for each care pattern was found by the cross tabulation of care pattern and provider type. Within each of those five claim types, the care pattern and provider type were cross-tabulated to identify the number of claims in each provider group for each care pattern by the *proc freq* procedure.

The total and per claim medical, pharmaceutical, and combined expenses were summarized for each patient using the *proc means* procedure. The patient-based and claim-based mean and median of medical, pharmaceutical, and combined medical and pharmaceutical expenses were then summarized for each care pattern by the *proc means* procedure. Pharmaceutical data included only categories for skeletal muscle relaxants, analgesics, antipyretics and anti-inflammatory agents. Pharmacy data were included only on patients that met the diagnostic inclusion criteria.

Scores reflecting risk of expected health care cost and utilization relative to that of the overall population were available in years 2006-2009. General linear models were used to fit log10 transformed total allowed charges per patient with risk scores within 40-60 percentiles to examine pairwise differences across eight patterns of care after adjusting for between-pattern differences in risk scores within the 40-60 percentile patient group. Linear orthogonal contrasts (ratios) were used to compare differences in charges between DC-related care patterns (DC only, MD-DC care, DC plus referral care, and MD-DC plus referral care) and MD-PT-related care patterns (MD only, MD-PT care, MD plus referral care, and MD-PT plus referral care). Log10 transformation of total allowed charges per patient were used due to the highly positive skew of these costs. Residual diagnostics were conducted and the normality assumptions of residuals were satisfied.

Results

Utilization and charges by pattern of care for each year are reported in diagnosis and year-specific Tables 1 through 4. Table 5 for each year shows age and gender distributions (by care pattern) of patients with at least one claim in that year. Approximately eighty percent of patients are female. Patients are about 40 years old, on average. Although patterns of care vary somewhat by age and gender, there are no consistent or significant differences by provider type.

Year-specific table contents

Table 1: Utilization and charges, by patient (n=) and claim (n=).

Table 2: Overall (medical + pharmaceutical) mean and median charges ($) according to pattern of care, by patient and claim.

Table 3: Charges ($) per patient and claim, by care pattern and claim type.

Table 4: Overall medical and pharmaceutical charges ($) per patient and claim, by care pattern and claim type.

Table 5: Age and gender distributions for patients (n=).

Headache results

Results summary: Mean numbers of claims, charges per claim, and mean overall allowed charges per patient were used to analyze costs. The majority of patients and claims fell in the MD only or MD plus referral patterns, representing 70% of patients and 65% of claims in 2009. Chiropractic patterns represented less than 10% of patients and total allowed charges (but a larger proportion of claims in any given year due to the larger number of DC claims per patient). Specialty referral services and providers, including emergency care and hospitalization, accounted for about 20% of all headache patients and total allowed charges. Pharmaceutical charges accounted for more than a third of total allowed charges for all care patterns combined.

Average numbers of claims per patient are generally higher for care patterns that included chiropractic compared with patterns involving medical care; however, charges per medical claim were much greater on average than charges per chiropractic claim. For all years, care patterns involving referral services in combination with medical or chiropractic care resulted in appreciably greater average charges per patient than care patterns without referrals. In general, care patterns with MDs and referrals resulted in greater average charges per patient than care patterns with non-referral provider types such as DC and PT providers. When looking at average overall allowed charges (which differs from individual claim charges) for care patterns with at least 50 patients, MD-only care, DC-only care, and MD-DC care are consistently the three least expensive patterns of care for headache (mean [median] total allowed charges in 2009 of $1232 [$180], $1737 [$284], and $1522 [$166], respectively). In all years 2000-2009, patterns of care *without calculation of risk adjusted averages* that included MDs alone incurred fewer charges than care patterns that included DCs alone.

Medical care with physical therapy is generally more expensive than medical care with chiropractic when care does not involve referral providers. Without referral providers or services, medical care with physical therapy was on average $30 more expensive than medical care with chiropractic in 2009. Although mean total allowed charges were greater for MD-DC care in four of the 10 years, median charges were equal to or less than those for MD-PT care in all 10 years. With referral providers, medical care with physical therapy was generally less expensive than medical care with chiropractic throughout the decade.

Mean difference in total allowed charges for medical care with physical therapy vs. medical care with chiropractic care for headache, by referral status and year.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
No ref	+$316	+$960	+$44	-$26	+$257	+$1886	-$74	-$471	-$360	+$30
W/ref	-$195	-$2028	+$16	+$802	-$248	+$258	-$1210	-$1035	-$95	-$1097

The total allowed charges of medical care with referrals are substantially larger on average than the total allowed charges of chiropractic care with referrals, i.e., MD referrals to other providers and services are much more costly than DC referrals to other providers and services. For example in 2009, compared with DC care with referrals, MD care with referrals resulted in an average of $1737 greater total charges (MD referrals added

$1876 to total charges, on average, vs. $139 for DC referrals). However, medical care with DC care plus referrals was on average $1127 more expensive than medical care with PT care plus referrals in 2009 (MD-PT referrals added $1606 to total charges, on average, vs. $2733 for MD-DC referrals). MD-DC referrals were less costly than MD-PT referrals in only two of the 10 years (2003 and 2008).

Mean difference in total allowed charges for (a) medical care with referrals vs. chiropractic care with referrals and (b) medical care with PT plus referrals vs. medical care with DC plus referrals for headache, by year.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
(a)	+$1203	+$2032	+$1691	+$2260	+$2340	+$1936	+$1746	+$1761	+$1851	+$1737
(b)	-$511	-$2988	-$28	+$828	-$505	-$1628	-$1136	-$564	+$265	-$1127

Trends: The number of patients with at least one claim for headache as a primary diagnosis increased from 9587 in 2000 to 22,780 in 2009 (138% increase). Total claims increased from 50,781 in 2000 to 118,992 in 2009 (134% increase). Total allowed charges for the year tripled from $15,187,791 in 2000 to $46,446,882 in 2009 (206% increase). Total charges almost tripled from 2000 through 2005, and then declined in 2006 and 2007 before rising again in 2008 and 2009. Of historical note: on October 1, 2006, a legislative mandate was implemented for the State of North Carolina Employees Health Plan. The mandate required that insurance copays for primary care and chiropractic care be equal. Up until that point, chiropractic copays were equal to higher specialist levels. This mandate was reversed effective October 1, 2007 and chiropractic copays were returned to the higher specialist levels.

Average total charges for all care patterns combined increased from $1612 in 2000 to $2527 in 2005 (57% increase), and declined thereafter, to $2370 in 2006 and $2062 in 2009. Over the decade, average total allowed charges for headache increased by 28%.

Sum and mean of total allowed charges for all care patterns combined for headache, by year.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Sum	$15.2M	$27.0M	$30.7M	$33.0M	$37.6M	$44.5M	$41.9M	$40.7M	$43.6M	$46.4M
Mean	$1612	$2014	$1942	$2102	$2290	$2527	$2370	$2084	$2074	$2062

Numbers of patients and claims in most care patterns increased over the 10-year period; however, gains were greatest among care patterns involving MDs, PTs, and referral providers or services. Numbers of patients in DC-care patterns increased the least amount. Numbers of patients in care patterns with MDs (with or without referral to PT or other providers but without DC care) increased from 6116 in 2000 to 16,006 in 2009, a gain of 9890 patients (162% increase), whereas numbers of patients in care patterns with DCs (with or without MDs or referral care but without PT care) increased from 1092 in 2000 to 1393 in 2009, a gain of 301 patients (28% increase). Concomitant medical claims increased from 30,481 in 2000 to 80,562 in 2009, a gain of 50,081 claims (164% increase), whereas concomitant chiropractic claims increased from 11,163 in 2000 to 16,068, a gain of 4905 claims (44% increase).

Numbers of patients in care patterns with PTs increased from 219 in 2000 to 673 in 2009, a gain of 454 patients (207% increase); numbers of claims in patterns of care with PTs increased from 2507 in 2000 to 5284 in 2009 (2777 gain; 111% increase).

In office allowed and other charges per patient generally increased for most care patterns through 2005, then declined or leveled off between 2006 and 2009. Total allowed charges per patient generally increased through 2005 and decreased thereafter (though specific care patterns showed gains in 2008 and/or 2009, e.g., (a) MD only and (b) MD-DC and MD-PT with and without referrals). Comparing total allowed charges for headache in 2000 and 2009, care patterns with at least 50 patients showing significant increases in means are DC only [from $1213 to $1737], MD-DC plus referral care [from $2734 to $$4255], MD-PT plus referral care [from $2539 to $3158], MD plus referral care [from $2606 to $3108], MD only care [from $850 to $1232], and referral only care [from $1561 to $2031]. From 2000 to 2009, mean total allowed charges for MD-DC care increased slightly from $1408 to $1522, whereas mean total allowed charges for MD-PT care decreased slightly [from $1724 in 2000 to $1522 in 2009].

Discussion and Conclusions

Mean and median per-patient and per-claim charges associated with headache varied significantly by pattern of care during the 2000-2009 decade. In general, patterns of care involving multiple providers and referral care incurred the largest charges, while patterns of care involving single or non-referral providers incurred the least charges. Mean charges per patient and per claim are substantially higher than median charges for all care patterns, indicating the presence of extremely high-cost cases among the care patterns. Numbers of claims per patient are much higher when chiropractic care is involved; however, mean and median charges per chiropractic claim are appreciably less than mean and median charges per medical claim. Mean charges per physical therapy claim are higher than mean charges per chiropractic claim; however, numbers of physical therapy claims per patient are on average fewer than numbers of chiropractic claims per patient.

Utilization increased for all care patterns over the decade; however, utilization increased most dramatically for care involving MDs, PTs, and referral providers or services. DC care showed the least gains in patients and claims over the decade. Charges increased considerably on average from 2000 to mid-decade and decreased in each subsequent year. Policy changes that took place between 2005 and 2007 may have affected utilization and charges.

As mentioned earlier in this report, for several years (2006-2009) risk scores were available for analysis. The scores reflect measure of risk of expected health care cost and utilization relative to that of the overall population and when utilized, allow for a more accurate comparison of provider cost of care. For example, a score of 1.00 indicates risk comparable to that of the population used in developing the risk groups, whereas a score of 2.00 indicates 100% greater risk than the average for the population. The risk score tables are included in the table section of this report (see Appendix pages 269-270).

The risk score data reveal patterns of care with MDs generally have similar risk scores as patterns of care with DCs. For example, for headache, the mean risk score over the 4-year period was 1.76 for MD only care and 1.75 for DC only care (the more stable medians were 1.19 and 1.25, respectively), indicating essentially equivalent risks. Comparing MDs with referral care and DCs with referral care, the 4-year mean difference is about 5% (2.21 for MDs and 2.11 for DCs). The more stable median risks are actually greater for DC care (1.46 for MD care, 1.56 for DC care [7% greater risk in the DC group]).

Headache cases involving both medical and chiropractic care had fairly similar risk scores as cases with medical and physical therapy care over the 2006-2009 period (without additional referrals: means 2.22 vs. 2.10; medians 1.74 vs. 1.62; with additional referrals: means 2.58 vs. 2.99; medians 2.02 vs. 2.06).

Risk-adjusted mean charges are significantly greater for MD only vs. DC only care and MD-PT vs. MD-DC care in all years (2006-2009) except for MD-PT vs. MD-DC care in 2007 (p=0.3694) and 2009 (p=0.7325). Ratios range from 0.21 to 0.90 (i.e., among headache patients with risk scores between the 40th and 60th percentiles, total allowed charges are on average 10-79% less for DC patients). Risk-adjusted mean charges for DC plus referral care and MD plus referral care are statistically similar except in 2009 (ratio 1.93, p=0.0104). Risk-adjusted mean charges for MD-DC plus referral care and MD-PT plus referral care are also statistically similar except in 2007 (ratio 0.34, p=0.0276).

Risk-adjusted mean total allowed charges by pattern of care and year among patients with headache as a primary diagnosis and with risk scores between the 40th and 60th percentiles.

	2006 (n=1815)	2007 (n=2490)	2008 (n=2906)	2009 (n=3252)
DC only	$191.22	$263.03	$586.57	$594.15
MD only	$454.22	$1246.20	$1791.73	$2097.38
MD+DC	$249.27	$454.99	$615.08	$1807.57
MD+PT	$903.14	$705.09	$1700.07	$2013.43
DC+referral	$633.58	$1299.20	$1505.95	$3770.40
MD+referral	$550.54	$987.08	$1692.51	$1956.04
MD+DC+referral	$440.20	$516.59	$861.91	$1860.49
MD+PT+referral	$411.38	$1541.59	$1361.03	$1592.62

Overall, for headache in 2009, care patterns with MDs (with or without referral to PT or other providers but without DC care) incurred average total per patient charges of $2026; and care patterns with DCs (with or without MDs or referral care but without PT care) incurred average total per patient charges of $2383. Therefore, MD care for headache in 2009 was on average $357 (or 15%) less expensive than DC care. However, *overall* total per patient charges do not reflect the risk-adjusted averages that yield an "apples to apples" comparison of provider's allowable charges, and are significantly different than the risk-adjusted averages.

Although charges per claim were less, on average, for DC-associated claims, patients in DC care patterns had many more claims, on average, than patients in MD care patterns. Not surprisingly, pharmaceutical charges account for a greater proportion of total charges associated with medical care. On average over the decade, the combination of medical and chiropractic care (without additional referral care) incurred $256 fewer total charges per patient than the combination of medical care with physical therapy (without additional referral care); however, with additional referral care, the combination of medical and chiropractic care incurred $483 greater total charges per patient than the combination of medical and physical therapy care. Referrals associated with medical care over the decade were much more expensive than referrals associated with chiropractic care (MD vs. DC referrals: $1856 greater total charges for patient), but referrals associated with MD-DC care were more expensive, on average, than referrals associated with MD-PT care ($739 greater total charges per patient).

Acknowledgements

This study was made possible with the assistance of the North Carolina General Assembly, by grants from NCMIC Research Foundation and Health Networks Solutions, Inc., and with the technical assistance of Ms. Patricia Rowe, Clinical Health Care Analyst, North Carolina State Employees Health Plan, Blue Cross/Blue Shield North Carolina, and Dr. Dongmei Li, Assistant Professor of Biostatistics, University of Hawaii, Mānoa.

Appendix

Table of Contents

Addendum

This study is an analysis of 664,000 covered lives generating 910,778 claims meeting the inclusion criteria over a 10-year period. Mean numbers of claims, mean charges per claim, and mean overall allowed charges per patient were used to analyze costs. The patients were tracked over 15 different care patterns with 49 potential primary diagnoses for headache. This was done to determine the cost of: office visits, advanced imaging, diagnostic x-ray, pharmaceutical prescription, physical therapy, in and out-patient facilities and surgical interventions. These patterns included doctors of chiropractic, physical therapists and medical doctors. The medical doctor category included 15 different specialties.

These methods are reviewed here because the complex design required to track multiple data points through multiple provider patterns, specialties and interventions may confuse the reader. Although stratification and analysis of all data points was needed to describe the totality of utilization and charges, limiting the analysis to patients at similar risk reduces "statistical static" (between-pattern heterogeneity) that can complicate data interpretation. Risk is the potential for higher health-care use and greater charges based upon age, sex, primary diagnosis, comorbidities and use of prescription drugs. Since the average risk score was 1.76 for MD only care and 1.75 for DC only care (the more stable medians were 1.19 and 1.25, respectively), the risks were found to be essentially equivalent for the years that risk scores were available (2006-2009).

With that point established, the risk-adjusted mean charges are significantly greater for medical management with or without physical therapy or specialist referral than chiropractic care (see table in Discussion and Conclusions section). With risk scores that fell between the 40th and 60th percentiles and represented an "apples to apples" comparison, the total allowed charges are on average 10-79% less for DC only patients.

The 2000-2009, data base included an important finding on trends as well. On October 1, 2006, a legislative mandate was implemented for the State of North Carolina Employees Health Plan. The mandate required that insurance copays for primary medical care and chiropractic care be equal. Up until that point, chiropractic copays were equal to higher specialist levels. This mandate was repealed on October 1, 2007, and chiropractic copays were returned to the higher specialist levels. This event created a year-long opportunity to study charges when access to chiropractic care increased due to significantly lower copays.

Before reviewing the impact of the period of the legislative mandate, it should be noted that total allowed charges had tripled from $15.2 million in 2000 to $46.4 million in 2009 (206% increase). With reference to the effect of the legislative mandate: total allowed charges almost tripled from 2000 ($15.2 million) through 2005, (44.5 million) and then declined in 2006 (41.9 million) and 2007 (40.7 million) before rising again in 2008 (43.6 million and 2009 (46.4 million). The decreased total allowed charges which occurred during the North Carolina legislative mandate of October 1, 2006 through October 1, 2007, were reflected in the preceding low back pain and neck pain analysis of the State of North Carolina Employees Health Plan as well.

Over the 4 years during which risk scores are available and risk-adjusted mean charges could be calculated (2006-2009), chiropractic charges range from a low of 10% to a high of 79% less than charges for medical care or medical care with physical therapy for headache patients in the middle quintile of risk. Additionally, increased access to chiropractic care via removal of higher copay barriers was accompanied by lower total allowed charges in a magnitude of millions of dollars.