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Lifestyle Counseling Trends in Ambulatory Care Settings: Results from National Ambulatory Medical Care Survey (NAMCS)

By

Anthony Mufarreh
MPH

Department of Epidemiology

Ambar Kulshreshtha, MD, PhD
Committee Chair

Amit Shah, MD, MSCR
Committee Member

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By

Anthony Mufarreh

Bachelor of Science
University of Michigan
2019

Thesis Committee Chair: Ambar Kulshreshtha, MD, PhD

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Abstract

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By Anthony Mufarreh

Background:

The American College of Cardiology and American Heart Association 2013 (ACC/AHA) guidelines emphasized lifestyle counseling as the foundation for ASCVD prevention. We aim to examine trends in lifestyle counseling among statin users in a nationally representative, ambulatory database.

Methods:

The National Ambulatory Medical Care Survey (NAMCS) provides measures of ambulatory medical care services used in the United States. Sample consisted of patients >40 years, that were seen in ambulatory primary care clinics. We examined trends in lifestyle counseling included weight reduction, diet, exercise, and tobacco cessation in patients receiving statins from 2006-2016. Patient sample weights were applied to enable nationally representative estimates. Univariate and logistic regression analysis performed.

Results:

From 2006-2016, 42,362 total outpatient visits involved statin users in primary care visits in the US. Overall, any type of lifestyle counselling remained low at <25% in primary care settings. Diet counseling declined from 23.5% in 2006 to 20.5% in 2016, similar trends with exercise counseling (19.3% in 2006 to 15.7% in 2016). Among current smokers, 30.5% received tobacco counseling in 2006 and 32.2% in 2016. In regression analysis, no significant change was found for any lifestyle counseling post-2013 compared to years prior after adjusting for sociodemographics, comorbidities, and region. Adults 70 years and older are less likely to receive weight, diet, exercise, and tobacco counseling.

Conclusion:

Despite the ACC/AHA guidelines emphasis on lifestyle for high-risk populations, counseling rates remain low in primary care clinics. More interventions focusing on lifestyle are needed in ambulatory clinic settings for primary and secondary prevention of CVD.

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Introduction:

Atherosclerotic cardiovascular disease (ASCVD) constitutes of coronary artery disease, ischemic stroke, transient ischemic attack, and peripheral artery disease, continues to be highly prevalent and a leading cause of death in the United States[1]. Over 300,000 deaths annually in the US are attributed to coronary heart disease (CHD)[2]. Additionally, ASCVD patients face exceedingly high healthcare utilization costs from suboptimal treatment, along with high burden of disease[3].

Lifestyle counseling and behavior changes represent low-risk and efficacious methods for reduction of cardiovascular disease (CVD) risk-factors, including ideal dietary patterns, increased physical activity, weight loss, and tobacco use cessation[4]. This type of lifestyle medicine, defined as daily practices that impacts both the prevention and treatment of disease, is known to induce short and long-term health benefits[5].

Prior studies have evaluated the protective role of lifestyle changes for reducing ASCVD risk. The US Preventative services Task Force examined diet and exercise counseling effects on cardiovascular disease prevention in adults, finding decreases in cardiovascular events, blood pressure and low-density lipoprotein levels, and adiposity-related outcomes in high-risk individuals[6]. Among those with established cardiovascular disease (CVD), exercise and diet counseling were associated with improved biomarkers for CVD and reduced mortality[7]. One meta-analysis of randomized-control trails, individual smoking cessation counseling resulted in statistically significant smoking abstinence at 6-12 months follow-up among CVD patients[8]. Favorable trends in hypertension and blood low-density lipoprotein (LDL) were seen in cerebrovascular disease patients after tobacco and exercise counseling were implementation[9].

Additionally, reduction in major cardiovascular events among overweight and obese patients were seen post weight loss reduction counseling initiation[10].

The 2013 American College of Cardiology and American Heart Association (ACC/AHA) treatment guidelines for ASCVD reemphasized the use of lifestyle counseling as a fundamental, first-line treatment for high-risk groups at all stages of lipid-lowering treatment. ACC/AHA guidelines emphasizes lifestyle counseling use for both primary and secondary prevention of ASCVD and recommends all individuals receiving cholesterol-lowering statin therapy concurrently receive lifestyle counseling treatments[11].

Primary care practitioners are well-positioned to reduce cardiovascular risk factors due to continuity and comprehensiveness of care and high frequency of chronic disease patients seen in primary care settings[12]. Despite challenges, several intervention strategies for lifestyle counseling have been shown effective[13]. ACC/AHA guidelines are directed towards primary care settings[11].

Little is known regarding trends in lifestyle counseling use among high-risk ASCVD patients, and whether the 2013 ACC/AHA guidelines strong emphasis of lifestyle counseling helped improve counselling rates in primary care setting. Our goal was to describe national estimates of lifestyle counseling (diet, exercise, weight loss, tobacco) among current statin users and other high risk-groups in a primary care setting, using data from the National Ambulatory Medical Care Survey (NAMCS) from 2006-2016.

Methods:

The National Ambulatory Medical Care Survey (NAMCS) was formed in 1973 to create national estimates of ambulatory medical care services provided in the United States. Conducted by the National Center for Health Statistics, NAMCS provides nationally representative information on ambulatory office-based visits to non-federally employed physicians engaged in direct patient care. Non-patient care specialties excluded. Offices are sampled by specialty and geographic and randomly assigned a one-week reporting period, recording services offered (lab tests, procedures, examinations, treatments, lifestyle counseling, etc.), demographics, comorbidities, and current medications for each visit. The national survey is conducted and administered annually by the National Center for Health Statistics (NCHS) in the Centers for Disease Control and Prevention (CDC), more detailed methodology for available online[14].

All adults 40 years and older and currently taking statin medication from 2006-2016 were analyzed. Further subsets included current smokers and obesity (BMI ≥30). Study years 2012-2016 created separate datasets for community health center office types and all other office types, therefore 2006-2011 community health centers were excluded to ensure consistent population across the study period.

Lifestyle counseling included weight reduction, nutrition counseling, exercise counseling, and tobacco cessation. Weight reduction refers to information given to patient or referral to other health professional for purpose of weight reduction. Nutrition includes food and/or beverage consumption discussion during visit for general dietary guidelines or disease prevention, or referral to dietitian and nutritionist. Exercise education included any discussion

related to physical condition/fitness and general health promotion or disease prevention or referral to fitness professional (excluding physical therapy). Tobacco education included discussion on health effects of tobacco use, such as cigarettes, cigars, chewing tobacco, and secondhand smoke, and referral for smoking cessation programs.

Since 2006, NAMCS has used the Lexicon Plus® generic component classifications database, a comprehensive database of all prescription drug products in the US drug market[15]. Generic statin medications atorvastatin, fluvastatin, lovastatin, pitavastatin, pravastatin, and rosuvastatin were searched across drug reported lists for each visit. Number of drugs recorded ranged from 8 in 2006 to 10 in 2012 to 30 in 2014.

Atherosclerotic cardiovascular disease (ASCVD) defined by International Classification of Disease Codes, 9th version, Clinical Modifications (ICD-9-CM) from 2006-2015, and comparable 10th version (ICD-10-CM) for 2016 from diagnosis list of sampled visits (**Supplemental Table**).

Patient sample weights derived from NAMCS cluster sampling used to produce nationally representative sample. Univariate frequency was stratified by year and comorbidities. Multivariable logistic regression analysis examined lifestyle counseling use by year, comparing post-2013 to years prior. Odds of lifestyle counseling (weight reduction, diet/nutrition, exercise, tobacco cessation, any counseling) compared prior to and post-2013. All models adjusted for sociodemographic variables (age, sex, race/ethnicity, insurance, specialty, census region, MSA) and comorbidities (ACVD, hypertension, diabetes, hyperlipidemia). In all analysis, 95% confidence intervals were reported, $p<0.05$ was considered statistically significant. Analyses were performed using R version 3.6.2 (R foundation).

Results:

Overall, from 2006-2016, 42,362 outpatient visits involved statin users in the US, representing an average 96,024,037 total visits per year. Average age was 67 (SD, 12) years, with 50% female, 90% non-Hispanic white, and 37% from southern census region. Common comorbidities among statin users included hypertension (65%), hyperlipidemia (61%), and diabetes (32%) (**Table 1**). Demographic breakdown did not significantly change between study years 2006-2016.

For lifestyle counseling, diet counseling held steady from 2006-2011 (range 17.9%-22.5%), however dipped in 2012 to 10.5%, increasing steadily to 20.5% in 2016. Exercise counseling declined from 19.3% in 2006 to 12.3% in 2007, fluctuating slightly through 2016 at 15.7%. Weight reduction varied from 8% in 2006 to 6.3% in 2016. Tobacco education remained low with little variability at 3.7% in 2006 to 3.9% in 2016 (**Figure 1**).

Modest variations by sex were found, with males receiving slightly more exercise and diet counseling from 2007-2011 compared to females but is attenuated after 2012. No sex variation was found in weight and tobacco counseling (**Figure 2).**

Current smokers constituted 4381 (10.3%) outpatient visits from our sample, representing 36,137,448 total visits from 2006-2016. Among smokers, 30.5% received tobacco counseling 2006 and 32.2% in 2016, with little variation across years. Male smokers received more tobacco counseling in a majority of study years (**Figure 3**).

Obese patients constituted 4720 (11.1%) outpatients visits from our sample, representing 28,311,183 total visits from 2006-2016. Among obese patients, 28.2% received weight reduction in 2006 and 25.9% in 2016, with little variation across (**Figure 4**). Males with

obesity received more weight reduction from 2007-2010, however females with obesity received more post 2011. Exercise counseling among obesity was 32.1% in 2006, dipped to 18.6% in 2012, and increasing to 34.1% in 2016 (**Figure 4)**. Diet counseling among obesity was 40.6% in 2006, dipping slightly to 26.6% in 2012, returning to 40.7% in 2016. Females consistently received slightly more diet counseling compared to males.

Likelihood of any lifestyle counseling among statin users did not significantly change post-2013 (**Table 2**). On multivariable analysis, adjusted for sociodemographic variables and comorbidities, odds of receiving any lifestyle counseling were not statistically different post-2013 compared to pre-2013. For each individual counseling, again no significant change was seen post-2013. By age, the odds of receiving counseling decreased with older age. For visits involving those aged ≥70 years compared to 40-49 years, odds of receiving counseling post-2013 was weight: 0.35 (95% CI: 0.25, 0.48), diet: 0.73 (95% CI: 0.58, 0.91), exercise: 0.71 (95% CI: 0.56, 0.9), tobacco: 0.33 (95% CI: 0.21, 0.52). Increases in all lifestyle counseling were seen among comorbidities ASCVD, hypertension, diabetes, and hyperlipidemia with few exceptions.

Compared to family practice, other specialty practices less likely to use weight (OR: 0.7, 95% CI: 0.52, 0.95), diet/nutrition (OR: 0.64, 95% CI: 0.5, 0.83), exercise (OR: 0.71, 95% CI: 0.53, 0.95), tobacco (OR: 0.66, 95% CI: 0.51, 0.85), and any counseling (OR: 0.69, 95% CI: 0.56, 0.85) post-2013 (**Table 2**).

Inconsistent differences found by insurance and MSA.

Discussion:

In this exploratory analysis of ambulatory care visits from 2006-2016 using NAMCS, high-risk ASCVD patients were less likely to receive lifestyle counseling for lipid management, irrespective of reemphasis from 2013 ACC/AHA guidelines. Diet, exercise, and weight reduction counseling actually decreased over the study period. Tobacco counseling among smokers, as well as weight reduction among obese patients, was suboptimal. Overall, lifestyle counseling showed no significant changes in use post-2013. Counseling use decreased with increasing age and showed no significant relationship with insurance type or census region. The ACC/AHA[11], Centers for Disease Prevention and Control (CDC)[16,17] and US Preventive Services Task Force[18] all recommend lifestyle counseling to reduce cardiovascular risk. Unfortunately, we show that this has not translated into clinical practice.

Similar trends in lifestyle counseling among high-risk ASCVD patients have been previously reported. In patients with peripheral artery disease (PAD), only 22% received exercise or diet counseling, comparable to our results for exercise and diet (20.5% and 15.7%, respectively))[19]. Only 35.8% of current smokers with PAD received tobacco counseling, again similar to tobacco counseling trends presented (32.2% in 2016. In a population of hyperlipidemia office-based visits from 2013-2014, again decreases in nutrition (39.7%-22.4%), exercise (32.1%-16%), and tobacco counseling can be seen[20]. Among pre-diabetes patients who would benefit from diet, exercise, and weight reduction counseling, prevalence of counseling was less than 25%[21].

We report the 2013 ACC/AHA guidelines showed no significant improvement in lifestyle counseling utilization in primary care office-based visits. Noteworthy, dissemination and

implementation of clinical guidelines may be delayed[22], particularly among cardiovascular patients[23]. Despite this, the Adult Treatment Panel III, published in 2001, also emphasized important of lifestyle counseling among high-risk groups for both secondary and primary prevention[24]. Therefore, it is unlikely that results presented here are a consequence of lack of dissemination of lifestyle counseling importance.

A potential solution to increasing lifestyle counseling utilization by primary care physicians is use of electronic medical record auto generated clinical reminders among statin users. However, these have been shown to be suboptimal at improving counseling use among obese patients for weight reduction[25].

Medical education is a significant barrier to implementation of lifestyle counseling in primary care. Many providers lack the confidence and ability to perform lifestyle counseling, therefore leading to low utilization[26]. It is possible, however, to improve competency of primary care providers, either through active practice during medical training or supplemental experience in continuing medical education[27]. Use of mobile applications and smart band technologies to supplement office-visit counseling has also been shown to improve adherence and outcomes of lifestyle changes[28]. Widespread implementation of these strategies may expand counseling use in primary care settings.

The current study has several strengths. The NAMCS dataset provides annual, nationally representative estimates from very large sample of nonfederal office-based ambulatory care visits, utilizing a clustered sample design. Consistent, annual measurements of variety of items makes NAMCS a powerful tool for healthcare utilization research in outpatient settings and policy research. NAMCS captures number of concurrent medications and prescribing behavior

at the primary care level, moreover it provides more complete information on primary care utilization at the physician level compared to other national databases.

The current study has some noteworthy limitations. NAMCS data is a cross-sectional study, therefore we cannot infer any causal association, however various studies have used NAMCS for temporal trends in ambulatory care for high-risk cardiovascular patients[21, 29, 30, 31, 32]. Moreover, NAMCS is not linked to individual patients, rather based on physician reports from office-based visits and may actually overestimate rates of counseling. Participation in NAMCS is voluntary, therefore differences compared to nonparticipants are difficult to assess and may not represent general population. However, cluster sample design of survey may mitigate this when nationally estimates produced. There are limited data on racial and ethnic variation in NAMCS with less than 10% Black patients across survey years[33]. More work in racially and ethnically diverse populations are needed to accurately evaluate disparities in counseling use.

Although lifestyle counseling was offered at ambulatory visits, we were not able to capture adherence. It has been reported that among recently prescribed statin users who received diet or exercise counseling, half achieved significant changes in their behaviors as a result[34]. Insufficient adherence among cardiovascular patients may be associated with a variety of factors downstream of primary care, such as financial limitations, medical comorbidities, access to resources, and misinformation[35].

We report underutilization of lifestyle counseling among ASCVD patients. Despite national guidelines and evidence supporting lifestyle counseling to reduce cardiovascular risk factors, they remain underutilized in primary care settings. Behavioral change and adherence to lifestyle counseling are key quality improvement metrics for cardiovascular disease risk

reduction and is linked to improved patient outcomes. It is critical to disseminate and incorporate national guidelines into primary care as this can greatly improve outcomes in high-risk patients.

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Figures

Table 1: Demographic characteristics of statin user, 2006-2016

	Frequency, %										
Characteristics	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
N (1,000s)	68,882	81,042	89,743	114,494	109,821	100,420	92,138	114,816	128,071	138,039	108,491
Age											
40-49	8.7%	9.0%	7.1%	8.1%	8.8%	6.7%	7.3%	7.0%	6.5%	5.6%	6.2%
50-59	19%	20%	21%	20%	18%	18%	20%	19%	19%	20%	20%
60-69	27%	27%	27%	28%	31%	27%	29%	30%	30%	30%	32%
≥70	45%	43%	46%	44%	42%	48%	44%	44%	45%	45%	42%
Sex (male)	51%	49%	51%	51%	51%	50%	50%	51%	49%	47%	46%
Race/Ethnicity											
NH[1] White	93%	92%	89%	90%	88%	91%	91%	89%	92%	86%	91%
NH[1] Black	7.5%	7.6%	11%	9.8%	12%	9.1%	9.1%	11%	8.1%	14%	9.1%
Insurance type											
Private	41%	40%	41%	43%	41%	37%	39%	37%	36%	35%	36%
Medicare	49%	50%	52%	52%	53%	58%	54%	55%	57%	56%	56%
Medicaid/CHIP	7.0%	5.5%	2.6%	2.6%	2.8%	3.5%	3.3%	4.8%	4.4%	6.7%	6.0%
Other	3.2%	3.9%	4.6%	3.1%	2.9%	2.1%	3.4%	3.4%	2.6%	2.2%	2.2%
MSA[2]											
MSA	87%	88%	90%	86%	89%	85%	87%	91%	91%	93%	91%
Not MSA	13%	12%	9.7%	14%	11%	15%	13%	8.6%	9.3%	6.6%	8.8%
Census Region											
Midwest	21%	21%	21%	16%	19%	18%	19%	21%	21%	19%	20%
Northeast	18%	19%	22%	31%	23%	21%	17%	22%	23%	23%	30%
South	38%	40%	39%	36%	38%	34%	41%	36%	36%	35%	33%
West	23%	19%	19%	17%	19%	27%	23%	21%	21%	23%	17%
Obesity	13%	9.4%	10%	14%	12%	12%	10%	11%	15%	12%	13%
Hypertension	61%	58%	63%	67%	63%	68%	62%	65%	69%	67%	68%
Diabetes	29%	28%	28%	32%	31%	34%	31%	33%	34%	36%	36%
Hyperlipidemia	62%	53%	59%	67%	60%	64%	58%	60%	65%	63%	60%
Cerebrovascular	5.0%	4.7%	4.0%	5.7%	4.0%	6.1%	6.0%	5.6%	5.7%	5.0%	6.4%
Tobacco	11%	11%	8.4%	10%	8.8%	10%	12%	11%	11%	11%	10%
Renal failure	4.5%	3.3%	5.3%	5.3%	4.1%	9.1%	4.2%	4.9%	7.6%	11%	6.2%
Nm. Conditions[3]	2.66 (1.51)	2.38 (1.45)	2.48 (1.49)	2.77 (1.49)	2.50 (1.51)	2.82 (1.48)	2.48 (1.45)	2.57 (1.46)	3.00 (1.63)	3.00 (1.75)	3.02 (1.73)
Specialty											
Family	27%	26%	25%	25%	24%	29%	29%	30%	28%	27%	36%
Internal	33%	28%	28%	32%	29%	27%	28%	24%	23%	22%	18%
Other[4]	40%	47%	47%	42%	47%	45%	44%	46%	49%	52%	47%
Counseling											
Weight	8.0%	6.5%	7.3%	9.0%	7.0%	7.1%	3.8%	5.5%	4.7%	5.4%	6.3%
Nutrition	24%	19%	18%	21%	18%	18%	11%	14%	16%	18%	21%
Exercise	19%	12%	13%	16%	13%	12%	7.9%	10%	11%	13%	16%
Tobacco	3.7%	2.5%	2.0%	3.7%	3.4%	3.1%	2.4%	3.0%	3.8%	3.7%	3.9%

[1] = Non-Hispanic

[2] = Metropolitan status area

[3] = Average number of chronic conditions, mean (SD)

[4] = Pediatrics, general surgery, OB/GYN, Orthopedic surgery, Cardiovascular diseases, Dermatology, Urology, Psychiatry, Neurology, Ophthalmology, Otolaryngology, All other

Figure 1: Overall lifestyle counseling among statin users 40 years or older

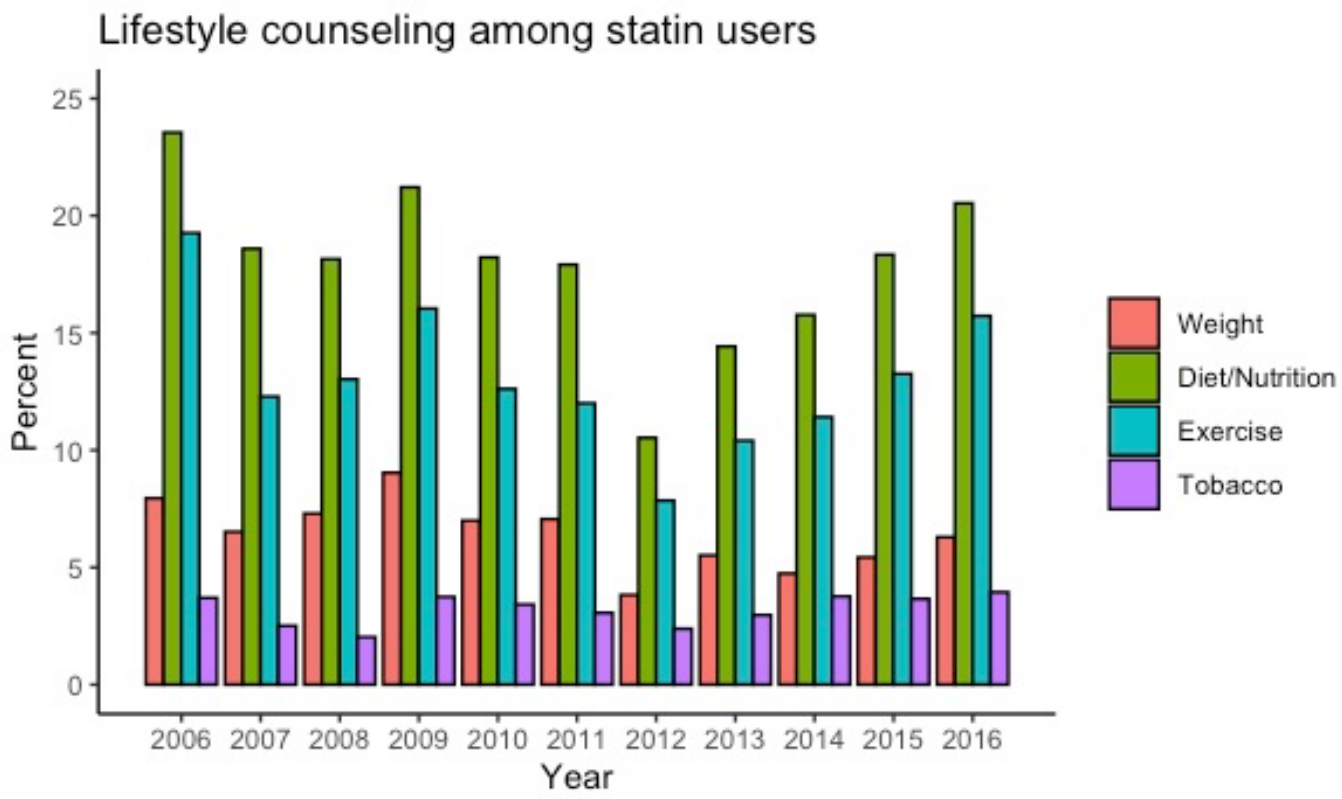

Figure 2: Point prevalence of lifestyle counseling stratified by sex

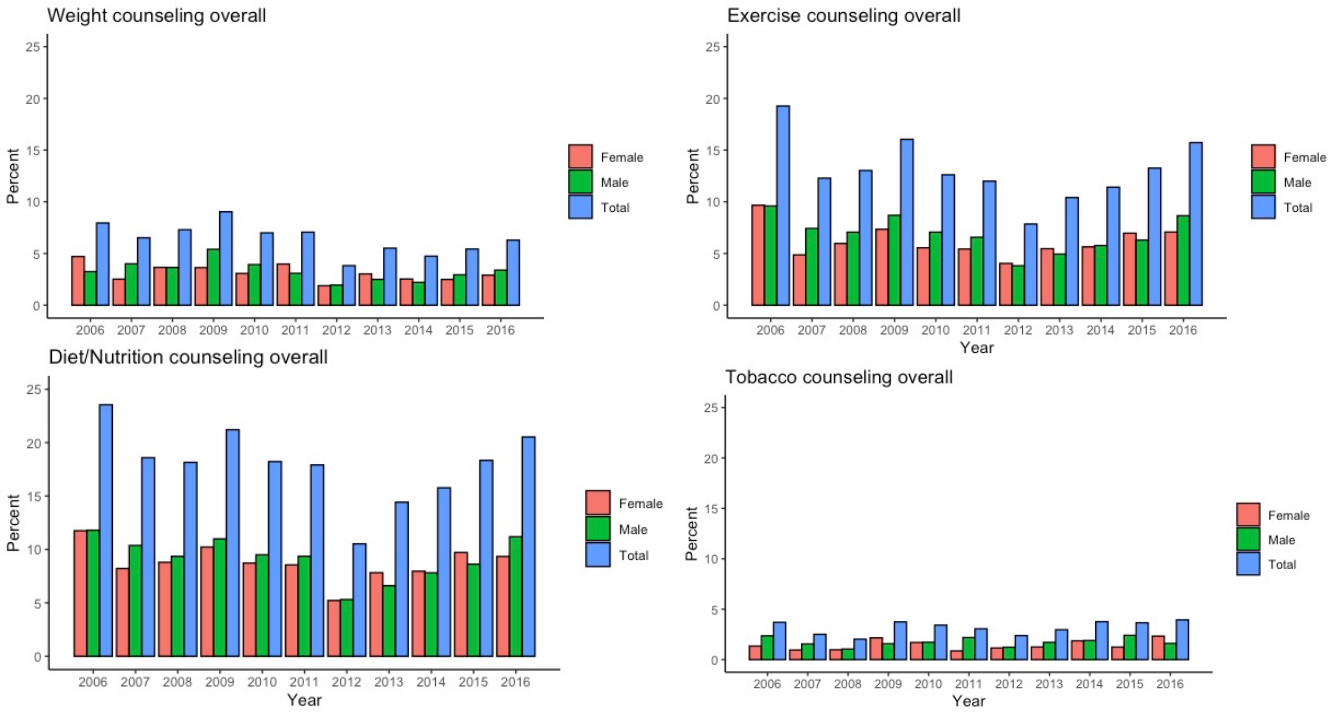

Figure 3: Frequency of tobacco cessation counseling among current smokes by sex

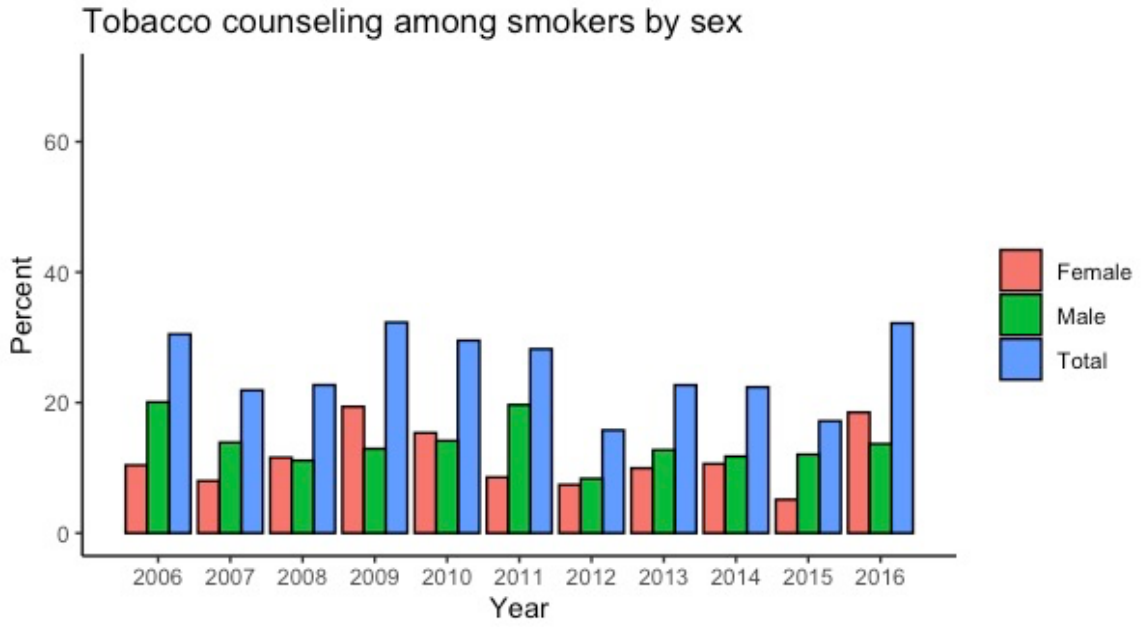

Figure 4: Frequency of lifestyle counseling among obesity by sex

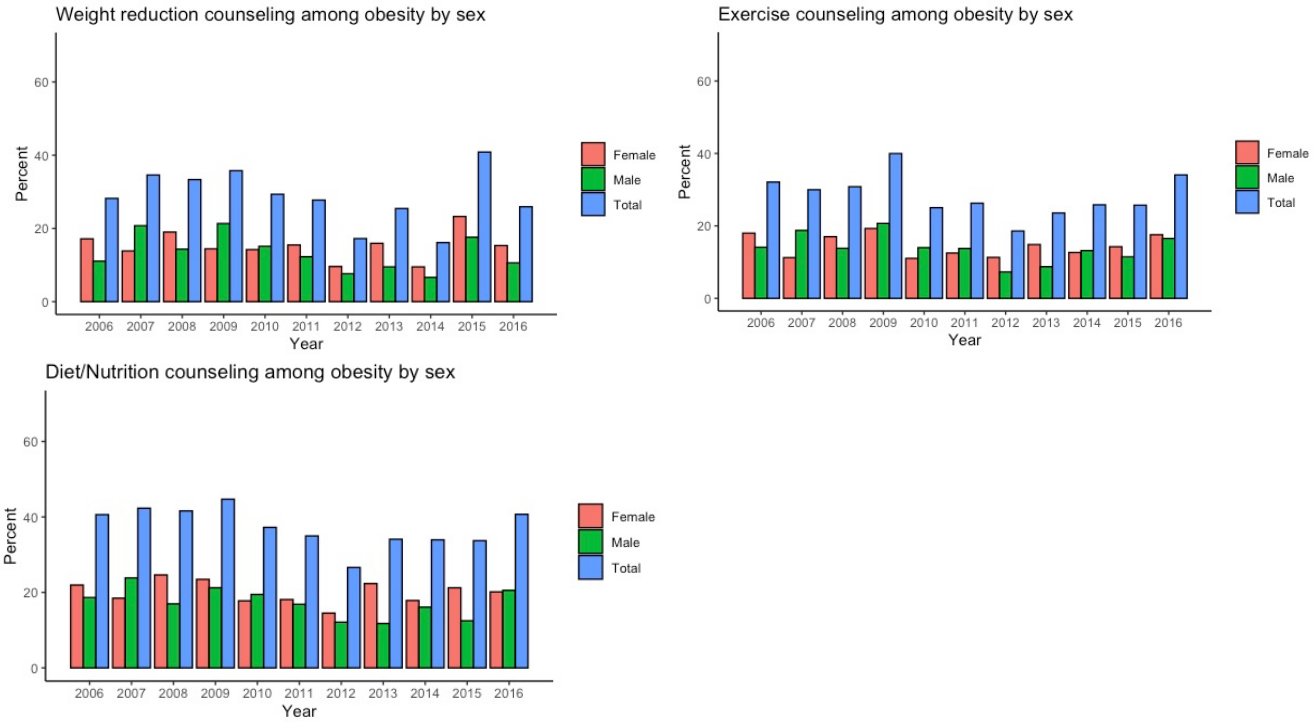

Table 2: Multivariable Logistic Regression models, lifestyle counseling among statin users 2006-2013 vs. 2014-2016

	Weight Reduction		Diet/Nutrition		Exercise		Tobacco cessation		Any counseling	
Variables	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Post 2013	1.16	(0.91, 1.49)	0.84	(0.67, 1.05)	0.81	(0.63, 1.05)	0.94	(0.66, 1.36)	0.88	(0.72, 1.07)
Age										
40-49 (ref)	-	-	-	-	-	-	-	-	-	-
50-59	0.81	(0.61, 1.08)	0.96	(0.78, 1.17)	0.99	(0.8, 1.22)	1.07	(0.75, 1.54)	0.9	(0.75, 1.07)
60-69	0.57*	(0.43, 0.75)	0.82	(0.67, 1.01)	0.83	(0.67, 1.03)	0.64*	(0.43, 0.94)	0.78*	(0.65, 0.93)
≥70	0.35*	(0.25, 0.48)	0.73*	(0.58, 0.91)	0.71*	(0.56, 0.9)	0.33*	(0.21, 0.52)	0.62*	(0.51, 0.76)
Sex (male=ref)	1.03	(0.89, 1.21	0.98	(0.87, 1.1)	0.88	(0.78, 1.0)	0.88	(0.71, 1.1)	0.97	(0.87, 1.07)
Race/Ethnicity										
NH[1] White (ref)	-	-	-	-	-	-	-	-	-	-
NH[1] Black	1.01	(0.73, 1.38)	1.29	(1.0, 1.66)	1.26	(0.94, 1.67)	0.99	(0.67, 1.46)	1.17	(0.94, 1.46)
ASCVD	1.68*	(1.04, 2.71)	1.15	(0.78, 1.68)	1.56*	(1.1, 2.21)	2.17*	(1.2, 3.9)	1.32	(0.96, 1.82)
HTN	1.39*	(1.14, 1.69)	1.29*	(1.13, 1.46)	1.37*	(1.18, 1.58)	1.2	(0.88, 1.64)	1.27*	(1.14, 1.42)
Diabetes	1.81*	(1.53, 2.15)	1.7*	(1.48, 1.94)	1.38*	(1.17, 1.63)	0.95	(0.68, 1.31)	1.5*	(1.33, 1.7)
Hyperlipidemia	2.03*	(1.62, 2.54)	2.08*	(1.75, 2.47)	2.02*	(1.65, 2.46)	1.65*	(1.31, 2.07)	1.96*	(1.71, 2.25)
Insurance										
Private (ref)	-	-	-	-	-	-	-	-	-	-
Medicare	0.93	(0.76, 1.13)	0.88	(0.76, 1.01)	0.87	(0.74, 1.01)	1.73*	(1.22, 2.46)	0.94	(0.82, 1.07)
Medicaid/CHIP	1.05	(0.62, 1.77)	0.77	(0.57, 1.03)	0.64*	(0.44, 0.93)	2.3*	(1.33, 4.01)	0.95	(0.74, 1.22)
Specialty										
Family (ref)	-	-	-	-	-	-	-	-	-	-
Internal	1.31	(0.99, 1.74)	1.35*	(1.03, 1.77)	1.25	(0.92, 1.69)	1.19	(0.78, 1.8)	1.4*	(1.11, 1.78)
Other[2]	0.70*	(0.52, 0.95)	0.64*	(0.5, 0.83)	0.71*	(0.53, 0.95)	0.66*	(0.51, 0.85)	0.69*	(0.56, 0.85)
Census Region										
Northeast (ref)	-	-	-	-	-	-	-	-	-	-
Midwest	0.76	(0.53, 1.09)	0.75	(0.56, 1.0)	0.76	(0.53, 1.1)	0.74	(0.42, 1.29)	0.72*	(0.55, 0.93)
South	0.68*	(0.49, 0.94)	0.81	(0.61, 1.08)	0.85	(0.6, 1.2)	0.74	(0.42, 1.28)	0.78	(0.6, 1.0)
West	0.57*	(0.4, 0.82)	0.7*	(0.48, 0.93)	0.75	(0.51, 1.1)	0.66	(0.36, 1.22)	0.66*	(0.5, 0.88)
MSA (urban=ref)	0.79	(0.57, 1.11)	0.73*	(0.56, 0.95)	0.79	(0.59, 1.06)	1.15	(0.75, 1.76)	0.85	(0.7, 1.03)

*= $p<0.05$

[1] = Non-Hispanic

[2] = Pediatrics, general surgery, OB/GYN, Orthopedic surgery, Cardiovascular diseases, Dermatology, Urology, Psychiatry, Neurology, Ophthalmology, Otolaryngology, All other

Model = post2013 + Age + Sex + Race/Ethnicity + ASCVD + HTN + Diabetes + Hyperlipidemia + Insurance + Specialty + Census Regions + Metropolitan

Supplemental Table 1

	Code	
Name	**ICD-10 (10/01/2015)**	**ICD-9**
Atherosclerosis	I70	440
Atherosclerosis of aorta	I70.1	440.1
Atherosclerosis of native arteries of the extremities	I70.2	440.2(0,1,2, 3,4,9)
Atherosclerosis of unspecified type of bypass graft(s) of the extremities	I70.3	440.3
Atherosclerosis of autologous vein bypass graft(s) of the extremities	I70.4	440.31
Atherosclerosis of Nonautologous biological bypass graft(s) of the extremities	I70.5	440.32
Atherosclerosis of nonbiological bypass graft(s) of the extremities	I70.6	
Atherosclerosis of other type of bypass graft(s) of the extremities	I70.7	
Atherosclerosis of other arteries	I70.8	440.8
Other and unspecified atherosclerosis	I70.9	440.9
Angina pectoris	I20	413
Unstable angina	I20.0	411.1
Angina pectoris with documented spasm	I20.1	413.1
Other forms of angina pectoris	I20.8	413.0
Angina pectoris, unspecified	I20.9	413.9
Acute myocardial infarction	I21	
ST elevation (STEMI) myocardial infarction of anterior wall	I21.0	410.(0,1,2) 410.1(0,1,2)
ST elevation (STEMI) myocardial infarction of inferior wall	I21.1	410.2(0,1,2) 410.3(0,1,2) 410.4(0,1,2)
ST elevation (STEMI) myocardial infarction of other sites	I21.2	410.5(0,1,2) 410.6(0,1,2) 410.8(0,1,2)
ST elevation (STEMI) myocardial infarction of unspecified site	I21.3	
Non-ST elevation (NSTEMI) myocardial infarction	I21.4	410.7(0,1,2)
Acute myocardial infarction, unspecified	I21.9	410.9(1,2,3)
Other type of myocardial infarction	I21.A	
Other acute ischemic heart disease	I24	
Other forms of acute ischemic heart disease	I24.8	411.89

Acute ischemic heart disease, unspecified	I24.9	
Family history of ischemic heart disease and other diseases of the circulatory system	Z82.4	V17.3
Transient cerebral ischemic attacks and related syndromes	G45	
Vertebro-basilar artery syndrome	G45.0	435 435.(0,1,2,3,8,9)
Carotid artery syndrome (hemispheric)	G45.1	
Multiple and bilateral precerebral artery syndromes	G45.2	
Amaurosis fugax	G45.3	
Transient global amnesia	G45.4	
Other transient cerebral ischemic attacks and related syndromes	G45.8	
Transient cerebral ischemic attack, unspecified	G45.9	
Family history of stroke	Z82.3	V17.1
Nontraumatic subarachnoid hemorrhage (0)	I60 I60.(0,1,2,3,4,5,6,7,8,9)	430
Nontraumatic intracerebral hemorrhage (0)	I61.(0,1,2,3,4,5,6,7,8,9)	431
Other and unspecified nontraumatic intracranial hemorrhage	I62 I62.(0,1,9)	432.(0,1,9)
Cerebral infarction	I63 I63.(0,1,2,3,4,5,6,8,9)	
Occlusion and stenosis of precerebral arteries, not resulting of cerebral infarction	I65 I65.(0,1,2,8,9)	433 433.0(0,1) 433.1(0,1) 433.2(0,1) 433.3(0,1) 433.8(0,1) 433.9(0,1)
Occlusion and stenosis of cerebral arteries, not resulting in cerebral infarction	I66 I66.(0,1,2,3,8,9)	434 434.0(0.1) 434.1(0,1) 434.9(0,1)
Cerebral atherosclerosis	I67.2	
Other peripheral vascular diseases	I73 I73.(0,1,8,9)	443 443.0 443.1

		443.2(1,2,3,4,9) 443.8(1,2,9) 443.9