# Evaluation of Pharmacist-directed University-based Wellness Clinic

Hrefna Sif Bragadóttir

**Master's Thesis in Pharmacy**
**University of Iceland**
**Faculty of Pharmaceutical Sciences**
**School of Health Sciences**

HÁSKÓLI ÍSLANDS

# Mat á heilsueflingarmiðstöð háskóla sem stjórnuð er af lyfjafræðingi

Hrefna Sif Bragadóttir

Meistararitgerð í lyfjafræði

Umsjónarkennari: Pétur Sigurður Gunnarsson

Lyfjafræðideild

Heilbrigðisvísindasvið Háskóla Íslands

Ágúst 2012

Printing: Háskólaprent
Reykjavík, Iceland 2012

**Author** Hrefna Sif Bragadóttir

**Coordinator** Pétur Sigurður Gunnarsson
Assistant Professor
Faculty of Pharmaceutical Sciences
University of Iceland

**Instructors** Anna Birna Almarsdóttir
Professor
Faculty of Pharmaceutical Sciences
University of Iceland

Angela Pegram
Assistant Professor
Wingate University School of Pharmacy

Sabrina W. Cole
Assistant Professor
Wingate University School of Pharmac

# ABSTRACT

## Evaluation of Pharmacist-directed University-based Wellness Clinic

The pharmacist-directed wellness program at Wingate University has not been evaluated before. The literature supports the need for assessments of clinical, economic, and other health related effectiveness of medication adherence across diseases or drug classes.

The primary objective of this retrospective chart review was to describe medication adherence to prescription therapy for participants in the wellness program who had been diagnosed with certain chronic conditions. Cross-sectional analysis was conducted to evaluate medication adherence between two wellness visits by using prescription refills from an automated database.

The secondary objectives were to assess changes in clinical, economic, and health behavior outcomes between two wellness visits, and relate these to medication adherence. Quasi-experimental design was used to assess these outcomes based on wellness visit charts and other secondary data.

About half (49.5%) of the study population was non-adherent to their prescription therapy. Non-adherent subjects, compared to adherent persons, were more likely to use a higher total number of medications and have abnormal values for body mass index and waist circumference. Subjects were least adherent to anti-diabetic agents, but most compliant to angiotensin II receptor blockers. Of the eight most commonly used medications, subjects were most adherent to simvastatin, but least compliant to niacin. The data suggested that adherent individuals adapted a healthier lifestyle to some extent. The cost analysis indicated higher healthcare costs among non-adherent subjects, but a broader economic evaluation is needed.

The deficient adherence rate for this population suggests implementation of further interventions. This study supports continuing of the wellness program, but more extensive evaluation is needed.

# ÁGRIP

## Mat á heilsueflingarmiðstöð háskóla sem stjórnuð er af lyfjafræðingi

Ekki hefur áður verið lagt mat á heilsueflingarverkefni háskólans í Wingate sem stjórnað er af lyfjafræðingi. Rannsóknir hafa sýnt að þörf er á að meta klínísk, hagfræðileg, og önnur heilsutengd áhrif af meðferðarheldni ýmissa lyfja á meðal sjúklinga með mismunandi sjúkdómsgreiningar.

Meginmarkmið þessarar afturskyggnu sjúkraskrárrýni var að lýsa meðferðarheldni lyfja meðal þátttakenda í heilsueflingunni sem höfðu verið greindir með ákveðna langvinna sjúkdóma. Þversniðsrannsókn var framkvæmd til að meta meðferðarheldni milli tveggja heimsókna í heilsueflingarmiðstöðina út frá lyfjaendurnýjunum fengnum úr lyfjagagnagrunni.

Undirmarkmið rannsóknarinnar voru að meta breytingar í klínískum, hagfræðilegum og hegðunartengdum útkomum milli tveggja heimsókna auk þess að setja þær í samhengi við meðferðarheldni. Íhlutunarsnið án viðmiðunarhóps var notað til að meta þessar útkomur út frá heilsueflingarviðtölum og öðrum skráningargögnum.

Um það bil helmingur (49.5%) þátttakenda í rannsókninni tóku lyfin sín ekki sem skyldi. Ómeðferðarheldnir einstaklingar voru líklegri til að nota fleiri lyf og mælast með óeðlileg gildi á líkamsmassastuðli og mittismáli. Þátttakendur voru minnst meðferðarheldnir við sykursýkislyf en mest við angíótensín II viðtakahindra. Þegar litið er á átta mest notuðu lyfin innan þýðisins var meðferðarheldni við simvastatín hæst en lægst við níasín. Gögnin gáfu til kynna að meðferðarheldnir þátttakendur höfðu heilbrigðari lífstíl að einhverju marki. Kostnaðargreining gaf vísbendingar um hærri heilbrigðiskostnað meðal ómeðferðarheldinna einstaklinga, en þörf er á frekara hagfræðilegu mati.

Ófullnægjandi meðferðarheldni í þessu þýði gefur vísbendingu um þörf á frekari íhlutun. Þessi rannsókn ýtir undir áframhaldandi heilsueflingu, en þó er þörf á viðameira mati.

# ABBREVIATIONS

| | |
|---|---|
| ACE | Angiotensin Converting Enzyme |
| ARB | Angiotensin Receptor Blocker |
| BMI | Body Mass Index |
| CHIP | Coronary Health Improvement Project |
| CVD | Cardiovascular disease |
| DRP | Drug related problem |
| HbA1c | Hemoglobin A1c |
| HDL | High density lipoprotein |
| HMO | Health Maintenance Organization |
| IAWHP | International Association for Worksite Health Promotion |
| ID | Identification |
| LDL | Low density lipoprotein |
| MCO | Managed Care Organization |
| MPR | Medication Possession Ratio |
| MTM | Medication Therapy Management |
| NHIS | National Health Interview Survey |
| OTC | Over-the-Counter |
| PBM | Pharmacy Benefit Manager |
| PDC | Proportion of Days Covered |
| PPO | Preferred Provider Organization |
| U.S. | The United states |
| UK | United Kingdom |
| USA | The United States of America |
| WHO | World Health Organization |

# TABLE OF CONTENTS

# LIST OF TABLES

# LIST OF FIGURES

# 1. INTRODUCTION

Some employers and health plans offer wellness programs to improve health and lower costs (The Kaiser Family Foundation & Health Research & Educational Trust, 2011). Measurement and validation of wellness program effectiveness is one of the primary challenges for employers. Returns on investment in worksite wellness programs can be assessed by various means, e.g. lower rates in prevalence of chronic conditions, reduced direct medical cost, performance measures, and decreased absenteeism (Carnethon et al., 2009).

Worsening of a disease, hospitalization, death, and increased healthcare costs are all consequences of poor adherence to medications (R. Balkrishnan et al., 2003; Butler, Davis, Johnson, & Gardner, 2011; P. Michael Ho et al., 2008; Lars Osterberg, 2005; Pittman, Chen, Bowlin, & Foody, 2011; Sherman, 2011). It is estimated that more than 25% of patients having chronic conditions in the USA are non-adherent with their prescribed medications (Thier et al., 2008). Assessment of medication adherence is important, e.g. to identify patients for intervention and evaluate clinical and economic outcomes related to low adherence (Andrade, Kahler, Frech, & Chan, 2006). Studies focusing on medication adherence for different medical conditions and medication classes have not simultaneously assessed clinical and economic consequences of non-adherence (Briesacher, Andrade, Fouayzi, & Chan, 2008; Yeaw, Benner, Walt, Sian, & Smith, 2009). Studies of interventions to improve medication adherence are limited within the literature (Andrade, et al., 2006), and most adherence studies have focused on a single disease, making comparisons across studies difficult due to the wide variety of methods used to calculate adherence rates (Hess, Raebel, Conner, & Malone, 2006).

The clinical pharmacist should be an important link within the healthcare system to improve medication adherence since one if the objectives of the pharmacist‘s activity is to maximize the clinical effect of a patient‘s medicines, while minimizing the risk of drug related adverse events, and expenditures

related to drug treatments (Beney, 2010; Scroccaro, 2000). It is important that clinical pharmacy participates in research in order to be a part of new knowledge that improves human health and quality of life ("The Definition of Clinical Pharmacy," 2008).

## 1.1 Health and its conservations

### 1.1.1 Major chronic conditions

According to the World Health Organization (WHO), chronic diseases are “diseases of long duration and generally slow progression.” (World Health Organization, e.d.). Chronic conditions are rather common within populations. In the USA they were the reason for 38.7% of all physician ambulatory visits in 2009, an increase of 2.8% from the year before (Centers for Disease Control and Prevention, 2008, 2009). Essential hypertension was the leading primary diagnosis group for office visits, with diabetes mellitus, disorders of lipid metabolism along with ischaemic and other types of heart disease in the top twenty leading primary diagnosis groups (Centers for Disease Control and Prevention, 2009).

Diabetes, cancer, chronic respiratory diseases, heart disease and stroke are the most prevalent chronic conditions causing mortality in the world, or 63% of all deaths (World Health Organization, e.d.). A study that found a decrease in mortality due to coronary heart disease from 1980-2000 suggested that it may be attributable to evidence-based medical therapies and reductions in major risk factors (Ford et al., 2007).

### 1.1.2 Risk factors of chronic conditions

In the middle of the 20$^{th}$ century, cardiovascular diseases were causing many deaths but little was known about their causes (Dawber, 1951). The Framingham Heart Study that started in 1948, has increased knowledge and understanding of many of the major risk factors for cardiovascular diseases, such as cigarette smoking, hypertension, high cholesterol and physical activity (Dawber, 1951; "Framingham Heart Study," e.d.). The fact that most risk factors are involved in more than one specific disease, means that causes of multiple

diseases can be prevented by targeting the risk factors (World Health Organization, 2009).

In 2009, high blood pressure, low physical activity, high blood glucose, tobacco use along with overweight and obesity were the world's leading risks of mortality. All these factors in addition to high cholesterol and alcohol consumption along with low fruit and vegetable intake account for 61% of cardiovascular deaths globally (World Health Organization, 2009).

Many risk factors or causes for chronic diseases are modifiable. Lifestyle factors, such as physical inactivity, excessive energy intake, unhealthy diet and tobacco use are the most important factors (World Health Organization, 2005, 2009). The modifiable risk factors are expressed through intermediate risk factors, such as abnormal blood lipids, raised blood pressure or glucose (World Health Organization, 2005), but it has been projected that measurement of waist circumference is a reliable test to identify individuals at increased risk for type 2 diabetes and cardiovascular diseases (Siren, Eriksson, & Vanhanen, 2012).

It has been demonstrated that it is never too late to switch to a healthy lifestyle, but middle-aged persons can experience a 35% risk reduction of cardiovascular disease events and 40% reduction in all-cause mortality risk in only a four year period, by adapting healthy lifestyles (Dana E. King, Mainous Iii, & Geesey, 2007). On the other hand, a recent study showed that adherence to four healthy lifestyle habits among 40-74 years old people in the USA, decreased from 1988 to 2006 (D. E. King, Mainous, Carnemolla, & Everett, 2009)**.**

### 1.1.3 Preventive care

Interventions can be made to avoid an onset of a disease, identify and modify risk factors, or prevent the progression of diseases by discovering them early (Fletcher & Fletcher, 2005). When interventions are performed in clinical practice it is referred to as preventive care since the activity is supposed to prevent adverse outcomes. Four major types of clinical preventive care exist:

Behavioral counseling, chemoprevention, immunizations, and screening (Fletcher & Fletcher, 2005).

Behavioral counseling is sometimes referred to as lifestyle changes, since clinicians provide such counseling to motivate different types of lifestyle changes. Chemoprevention is a growing type of clinical prevention, where medications are used to prevent diseases early in life and among adults. Risk factors or unrecognized diseases are often identified by screening. That includes, e.g. laboratory tests, physical examination and history taking on certain factors such as smoking. Preventive care should only be performed on conditions threatening health or life. It has been classified in primary, secondary and tertiary prevention due to timing of interventions and the progress of a disease (Fletcher & Fletcher, 2005).

One in four deaths in the United States is due to cancer (Siegel, Naishadham, & Jemal, 2012). According to the newest United States cancer statistics, prostate cancer was the most incident cancer in the USA among males and breast cancer among females, while colon and rectum cancer was in third place (U.S. Cancer Statistics Working Group, 2012). That pattern is estimated to be the same for the year 2012 (Siegel, et al., 2012).

These three cancers can all be diagnosed early through screening (American Cancer Society, 2012b), but data from the 2010 National Health Interview Survey (NHIS), conducted in the USA, showed that 72.4% of respondent women followed recommendations for breast cancer screening, and 58.6% of all participants reported to be up-to-date with colorectal cancer screening (Centers for Disease Control and Prevention, 2012). The Prostate, Lung, Colorectal and Ovarian (PLCO) Cancer Screening Trial found adherence to prostate cancer screenings as high, or more than 89% (Andriole et al., 2005).

A systematic review showed that interventions for increasing breast, cervical, and colorectal cancer screening were e.g. client reminders, provider audit and feedback, small media, and one-on-one education (Brouwers et al., 2011). It has also been indicated that intervention by community health workers, who are individuals trained to serve as liaisons between healthcare providers and members of their communities, can improve rates of breast cancer screening

among certain populations and settings, such as medical and urban settings (Wells et al., 2011).

## 1.2 Healthcare costs in the USA

Healthcare can be paid for in following four ways: Out-of-pocket payment, individual private insurance, employment-based group private insurance, and by government financing (Bodenheimer & Grumbach, 2009). All healthcare systems consist of private and universal coverages, but the structure varies across countries. The healthcare system in the USA has focused more on the private element, while countries in Europe, e.g., Iceland and the UK, are more government financed. This distribution in main payment factors between Iceland, the UK, and the USA in 2010 are listed in table 1 (World Health Organization, 2012).

***Table: 1 Healthcare financing in two European countries compared to the USA in the year 2010, as the percentage of the total health expenditure (THE).***

| Type of financing | Iceland | The UK | The USA |
|---|---|---|---|
| Private | 19 | 16 | 47 |
| Government | 81 | 84 | 53 |

Employer sponsored health insurance is very common in the USA (The Kaiser Family Foundation & Health Research & Educational Trust, 2011), but individual private insurance health plans can be less comprehensive and more expensive, where premiums vary by health status and age (The Henry J. Kaiser Family Foundation, 2010). Employers offer group health insurance coverage to employees and their families, and they usually pay most of their employees‘ health insurance premium (Bodenheimer & Grumbach, 2009; The Henry J. Kaiser Family Foundation, 2010). The insurance can be self-funded or fully insured, where the difference is whether the employer or a health plan assumes direct financial responsibility for enrolled employees‘ medical costs. Typically, employers with a self-funded plan contract with a third-party to provide services

for the plan (The Kaiser Family Foundation & Health Research & Educational Trust, 2011).

According to the global health expenditure database, maintained by WHO, total expenditure on health in the USA in the year 2010 ($8,362 per capita) was more than twice the amount spent on health per capita in Iceland ($3722 per capita) and the UK ($3,503 per capita) (World Health Organization, 2012). Healthcare costs have risen at a dramatic rate in the first decade of the 21st century in the USA, with 113% increase in premiums from 2001 to 2011 (Hewitt, 2010; The Kaiser Family Foundation & Health Research & Educational Trust, 2011). In a 10 year period, 2000 to 2010, the total expenditure on health almost doubled (from $4,703 to $8,362 per capita) (World Health Organization, 2012). It is projected that total national expenditures in the USA in 2012 are going to be 2.850 billion dollars and in the year 2019 about 1.6 times higher (U.S. Sensus Bureau, 2011). Total expenditures on prescription medications have also been growing through the years, but about 84% increase was seen between 1990 and 2009 (U.S. Census Bureau, 2011).

### 1.2.1 Managed care

Healthcare costs in the USA have not only been rising in recent years, because increases during the late 1980s and early 1990s, caused employers to move their employees into so-called managed care plans (Fronstin, 2001). There is no globally accepted definition of managed care, but it is a production of healthcare in the USA where organized and planned method is used, with emphasis on preventive care and the objective to deliver good quality of care at the lowest cost (McCarthy, 2007). Managed care organizations provide health services to groups such as employees at companies, and they use providers that offer cost-effective services (McCarthy, 2007). Different types of managed care programs exist. Health maintenance organizations (*HMOs*) and preferred provider organizations (*PPOs*) are prepaid health plans and the most common types of managed care programs. In *HMOs*, the provider usually gets paid for his services per month and per patient. Generally, it does not provide coverage for out-of-network services which is characteristic for this plan (Fronstin, 2001;

McCarthy, 2007). In the other type of plan, *PPO*, the *MCO* makes a contract with healthcare providers to offer healthcare benefits, where physicians bear no risk (Fronstin, 2001; McCarthy, 2007). According to the Kaiser/HRET survey of employer-sponsored health Benefits in 2011, enrollment among covered workers was highest in PPOs, followed by HMOs, but lowest in conventional (fee for service) plans (The Kaiser Family Foundation & Health Research & Educational Trust, 2011).

Managed care covers medicines as well as medical services. Pharmacy Benefit Managers (PBMs) work with third party payers, such as private insurers or self-funded employers, to manage consumers' drug purchases. They decide which drugs are covered and the out-of-pocket amounts paid by the consumer and amounts the pharmacy receives when prescriptions are filled (The Health Strategies Consultancy LLC, 2005). In 2011, prescription drug benefits were part of employer-sponsored plans in 98%, of the covered workforce (The Kaiser Family Foundation & Health Research & Educational Trust, 2011).

### 1.2.2 Ambulatory care

In relation to the purpose of managed care, today's emphasis in patient care in the USA is to offer as much healthcare in the outpatient ambulatory care settings (Parker, 2012) with growing emphasis on disease prevention, health promotion, and control of chronic conditions such as hypertension, asthma and diabetes (Maniscalco-Feichtl & Whalen, 2009). Ambulatory care clinicians, including pharmacists, have diverse responsibilities and activities related to patient care. They provide preventive health information and education, e.g. assist prescribers and patients in choosing appropriate cost-effective medication, ensure correct drug indications, keep an eye on and report adverse drug reactions, along with improving medication adherence and correct use of drugs (Maniscalco-Feichtl & Whalen, 2009; Parker, 2012). Ambulatory care practitioners can practice in a wide range of settings, such as academic medical centers, community pharmacies or clinics, physician's offices, on-site services as a part of disease management, and wellness programs provided by employers (Maniscalco-Feichtl & Whalen, 2009; Parker, 2012).

## 1.3 Employee wellness programs

The International Association for Worksite Health Promotion (IAWHP) defines worksite health promotion as *"a corporate set of strategic and tactical actions that seek to optimize worker health and business performance through the collective efforts of employees, families, employers, communities, and society-at-large"* (Promotion, 2009). Worksite health promotion programs include primary, secondary, and tertiary prevention. Primary prevention focuses on employees who are generally healthy and are a good opportunity for workers who do not adapt healthy lifestyles and are more likely to develop preventable conditions. Health promotion's secondary prevention is directed at persons already at high risk because of abnormal biometric values (e.g. high blood pressure, cholesterol or glucose) or certain lifestyle factors, such as smoking or poor diet (R. Z. Goetzel & Ozminkowski, 2008). Tertiary prevention, or disease management, is sometimes included in health promotion programs, and often promotes better adherence with medications and compliance to evidenced-based clinical practice guidelines for outpatient treatments (R. Z. Goetzel & Ozminkowski, 2008).

### 1.3.1 Implementation of wellness programs in the USA and worldwide

Buck Consultants survey, WORKING WELL: A Global Survey of Health Promotion and Workplace Wellness Strategies, investigates evolving trends in employer-sponsored wellness programs and health promotion. According to the 2010 survey, almost all participating employers offered at least one health program promoting good health of their employees. These strategies are most common in North America, but are growing globally. Only 37% of participants indicated having measured specific outcomes from their programs. Evaluations of these programs are more common for larger employers and most prevalent in the USA, Asia and Latin America (Buck Consultans, 2010). In 2011, 65% of firms offering health benefits and wellness programs in the USA believed that the programs are effective in improving employees' health and 53% thought

they were effective in reducing healthcare cost (The Kaiser Family Foundation & Health Research & Educational Trust, 2011), but 45% of USA employers who had measured the efficacy of their wellness programs, reported healthcare cost reductions (Buck Consultans, 2010).

### 1.3.2 The impact of wellness programs

Few evaluations of employees wellness programs have been reported (Buck Consultans, 2010). At least half of systematic reviews made on the impact of worksite wellness programs on financial and health outcomes, showed beneficial effects (Osilla et al., 2012). Overall, wellness programs have shown the largest improvements among high risk populations (Aldana, Greenlaw, Diehl, Englert, & Jackson, 2002; Colkesen et al., 2011; Loeppke, Edington, & Beg, 2010). Employees at risk for high biometric laboratory values (R. Z. Goetzel et al., 2009) or who have a risk factor for a chronic condition, such as overweight and obesity, cause the largest increase in costs for the employer (R.Z. Goetzel, 2010).

Primary and secondary prevention interventions at worksites are common to improve employees health and reduce the risk and burden of diseases, mainly cardiovascular conditions (Aldana, et al., 2002; Colkesen, et al., 2011; Loeppke, et al., 2010). The American Heart Association's, Heart at Work, program, used by 13,000 companies in the USA, and the Coronary Health Improvement Project (CHIP) are good examples. They are worksite wellness programs with the goal of reducing cardiovascular diseases (CVD), by focusing on risk factors and lifestyle. Video education on health risks and surveys collecting info on CVD-related knowledge, self-efficacy, behavior, job satisfaction, and absenteeism were performed among employees within a few companies (Aldana, et al., 2002; Pegus, Bazzarre, Brown, & Menzin, 2002). The primary prevention program, Heart at work, improved significantly knowledge of blood pressure management, heart attack risk factors, and nutrition and diet. Respondents at the intervention site were also more likely to begin blood pressure treatment with medications compared to those at the control site (Pegus, et al., 2002). The CHIP program evaluated biometric values (body

mass index, blood pressure, glucose, total-cholesterol, triglycerides, along with HDL and LDL cholesterol) in addition to a questionnaire on healthy lifestyles. Participating employees showed significant and clinically meaningful reductions in all health risks measured, except for total-cholesterol-HDL ratio and HDL cholesterol (Aldana, et al., 2002).

Health risk assessments (HRAs) have been widely used as an initial intervention of worksite health promotion programs (Baicker, Cutler, & Song, 2010) to obtain self-reported information on employees‘ health and lifestyle along with biometric measurements. Individually tailored health recommendations from these factors are then given as a feedback to the participant in the program, hoping for some improvements in health behaviors or burden of a disease (Colkesen, et al., 2011; Loeppke, et al., 2010). Such programs have shown improvements in employees’ awareness of risk factors and initiation of health behavior related changes (Colkesen, et al., 2011; Loeppke, et al., 2010). As an example, an evaluation of a health plan, referred to as The Prevention Plan™, on employees‘ health risks after one year of primary and secondary prevention interventions showed significant reduction in ten of fifteen health risks measured.

## 1.4 Clinical pharmacy and pharmaceutical care

The term „clinical“ is defined as something that is associated with or based on direct attention to the patient, according to the American College of Clinical Pharmacy ("The Definition of Clinical Pharmacy," 2008). Clinical pharmacy is a health specialty which describes the services and activities of the clinical pharmacist to provide patient care that optimizes medication therapy and promotes disease prevention, health and wellness along with appropriate and rational use of medicinal products and devices (Beney, 2010; "The Definition of Clinical Pharmacy," 2008; Scroccaro, 2000). Clinical pharmacy comprises all the services carried out by pharmacists in community pharmacies, hospitals, nursing homes, clinics, home-based care services and other settings where medicines are used and prescribed (Beney, 2010; Scroccaro, 2000). Clinical pharmacists practice both independently and as a part of a healthcare team, where they are in collaboration or consultation with other healthcare

professionals ("The Definition of Clinical Pharmacy," 2008). They can promote correct use of medicines at three different levels; before written prescription, during it or after it is released (Beney, 2010; Scroccaro, 2000).

The terms clinical pharmacy and pharmaceutical care are related in many ways. Hepler and Strand came up with the popular definition of pharmaceutical care that has been adopted worldwide. It states that: *"Pharmaceutical care is the responsible provision of drug therapy for the purpose of achieving definite outcomes that improve a patient´s quality of life."* The outcomes mentioned in the definition refer to cure of a disease, elimination or reduction of the patients' symptoms, prevention of a disease or symptoms, or arresting or slowing of a disease process (Hepler & Strand, 1990). The extent of Pharmaceutical care implementation, training and marketing varies between countries (Kheir, Foppe van Mil, Shaw, & Sheridan, 2004). A recent study indicated that pharmacists across Europe, i.e. Iceland, have much to accomplish in order for the provision of pharmaceutical care to be considered as routine practice (Hughes et al., 2010). The term medicines management is similar in nature to the definition of pharmaceutical care, but the National Prescribing and Primary Care Research and Developement Centres in England, define it as a system of behaviors and processes that decides how patients and the healthcare system use medications. Effective medicines management will put the patient in the first place, resulting in more targeted care and informed individuals. (National Prescribing Centre & National Primary Care Research and Development Centre, 2002). The meaning of management in this case is not only to improve patient health, care and satisfaction. Increasingly, the focus is on decreasing cost, drug wastes along with effective clinical governance, better use of professional skills and maximization of the effective use of available resources. (Barber, 2001; National Prescribing Centre & National Primary Care Research and Development Centre, 2002).

## 1.5 Drug related problems

Medications are commonly used all around the world. In the years 2007 to 2008, about half (48%) of the U.S. population used one or more prescription drugs. Treatment increased with age, where about 88% of people 60 years or

older used prescription drugs (Gu, Dillon, & Burt, 2010). Despite the high potential benefit of medications, they can also cause severe problems for the users. The definition of a drug-related problem (DRP) in 1990, by Strand et al., and the modern definition by The Pharmaceutical Care Network Europe Foundation, are similar in nature. They indicate that a DRP is an undesirable circumstance or event involving a drug, which potentially or actually interferes with desired patient outcomes (Pharmaceutical Care Network Europe Foundation, 2010; Strand, 1990). DRPs include both problems which have already clinical outcomes or therapy failure, and problems which are not manifest but if left unresolved they can lead to harm to the patient (Viktil & Blix, 2008).

Medication-related visits to emergency departments have been studied. An observation conducted in Canada of adults coming to an emergency department over a twelve week period, showed that 122 (12%) of 1017 visits were identified as drug-related (Zed et al., 2008) showing similar results for the elderly in North-India, or 83 (14.4%) of 578 emergency admissions studied (S. Malhotra, R. S. Karan, P. Pandhi, & S. Jain, 2001). The literature shows that about 70% of drug-related emergency visits are preventable. The most common reasons for these admissions are adverse drug reactions and non-adherence to medications (P. Patel & Zed, 2002; Zed, et al., 2008). In Canada, adverse drug reactions in adults accounted for 39% of drug-related visits but 28% were due to non-adherence (Zed, et al., 2008). The prevalence of non-adherence appeared slightly higher percentage for the elderly population in North-India (S Malhotra, R S Karan, P Pandhi, & S Jain, 2001). The drug classes often implicated in these visits are e.g. anti-diabetic and cardiovascular drugs (P. Patel & Zed, 2002), but it was found that more than half (51%) of preventable drug-related hospital admissions involve either diuretics, anti-platelets, NSAIDs, or anticoagulants (Howard et al., 2007).

### 1.5.1 Medication adherence

Adherence, or compliance, to medications focuses on to what extent patients take their drugs as prescribed (Lars Osterberg, 2005). Adherence rates are

commonly higher for those with acute diseases compared to chronic conditions, but there is no golden standard for a good adherence (Lars Osterberg, 2005). Most studies assessing medication adherence in individuals with chronic conditions, assume persons adherent if they take their medications as prescribed 80% of the time or more (P. Michael Ho, et al., 2008; Pittman, et al., 2011; Wiegand, McCombs, & Wang, 2012; Wong, Jiang, & Griffiths, 2011; Zhang, Zhao, Davies, Radican, & Seck, 2011).

Most often single doses help improving adherence and maximizing it (Lars Osterberg, 2005). A large review of 76 trials made by Claxton and colleagues found that adherence is inversely proportional to the frequency of dosing (Claxton, Cramer, & Pierce, 2001) and it has been detected for the population of patients with cardiovascular diseases in the United States as well (Bae et al., 2012). The impact of poly-pharmacy on medication adherence among randomly selected patients with type 2 diabetes was not observed (Grant, Devita, Singer, & Meigs, 2003), but it has been detected in an elderly population (Gellad, Grenard, & Marcum, 2011).

Common barriers to good adherence are under the patient‘s control. According to results from a questionnaire, typical reasons for patients’ poor adherence included forgetfulness, a decision to omit doses, other priorities, emotional factors, or lack of information(Lars Osterberg, 2005). Physicians and the healthcare system can also lead to poor adherence with their action. Physicians often prescribe complex regimens along with no explanations on possible adverse events, benefit of the drug therapy and the cost of medications, while healthcare systems limit access to healthcare and switch to a different formulary (Lars Osterberg, 2005). A recent study evaluating the effect of a physician-variation on medication adherence among diabetic patients found out that the impact of clinicans on patients‘ adherence to chronic medications are of great importance (Sherman, 2011).

Adherence can be measured both directly or by means of indirect ways but none of the methods should be considered as a golden standard (Fairman & Motheral, 2000; Lars Osterberg, 2005). It depends on the type of intervention being assessed, available data sources along with ethical and legal

considerations related to the patient, although indirect methods are most commonly used (Fairman & Motheral, 2000). Measurement of blood or urine concentration of a drug is an example of direct observation of adherence, while questionnaires, pill counting, or rates of prescription refills are indirect measures (Lars Osterberg, 2005).

#### 1.5.1.1 Measuring adherence using prescription refills

Automated pharmacy databases are relatively accessible and an inexpensive choice to evaluate medication adherence. All assessment of medication adherence using pharmacy dispensing data rely on identifying prescription refills and are therefore, especially suitable for evaluation on treatment for chronic conditions and long-term therapy (Andrade, et al., 2006; Fairman & Motheral, 2000). Medication adherence can be evaluated from prescription claims data by different methods, e.g. length of therapy, persistence, days of coverage, gaps and medication possession ratio (MPR) (Fairman & Motheral, 2000), but a large proportion of studies in the literature reported a measure of medication availability by using days of supply obtained during specific time or refill intervals period (Andrade, et al., 2006). Recent studies conducted in different countries, evaluating medication adherence to treatments for different chronic conditions, have used pharmacy claims data. Two methods, proportion of days covered (PDC) and MPR, were most commonly used in these studies (R. Balkrishnan, et al., 2003; Rajesh Balkrishnan et al., 2003; Briesacher, et al., 2008; Corrao et al., 2011; P. Michael Ho, et al., 2008; Pittman, et al., 2011; Wiegand, et al., 2012; Wong, et al., 2011; Zhang, et al., 2011).

The commonly used method, MPR, is calculated for each medication (active ingredient) seperately. It is a standard method to measure adherence to chronic medications (National Quality Forum, 2010). The MPR is defined as the ratio of total days supplied for any medication in a drug class, excluding the days‘ supply for the last prescription refill, to total days in a period of time (Halpern et al., 2006; National Quality Forum, 2010). The following two definitions have been mainly described within studies using automated databases (Andrade, et al., 2006):

$$MPR = \frac{number\ of\ days\ supplied\ obtained\ during\ observation\ period}{number\ of\ days\ in\ observation\ period} \cdot 100$$

$$MPR = \frac{number\ of\ days\ supplied\ obtained\ (excluding\ last\ refill)}{number\ of\ days\ between\ first\ and\ last\ refill\ date} \cdot 100$$

Evaluation of MPR requires patients to receive at least two prescriptions of a medication in a given period to have a time frame during therapy (Halpern, et al., 2006). An MPR of 1.0 (100%) indicates full adherence with therapy, but if number of days supplied are greater than number of days in the period (MPR > 1.0), the MPR should be truncated to 1.0, because it is unlikely that patients use medications for chronic conditions to greater extent than prescribed (Halpern, et al., 2006; National Quality Forum, 2010).

The main limitation to MPR calculations is the assumption that patients take their medications as prescribed even though they fill the prescriptions at regular intervals (Halpern, et al., 2006). It has been shown that adherence which is assessed by using prescription refills is more reflective of the number of doses consumed than whether patients are taking doses at the right time (Choo et al., 1999). One of the limitations of the MPR measurement is that patients may obtain medications from sources not included in the available data. Nevertheless, MPR is the accepted standard for the evaluation of medication adherence, using retrospective data (Halpern, et al., 2006).

#### 1.5.1.2 The link between non-adherence, chronic conditions, and drug classes

Retrospective database studies evaluating adherence and persistence focus mostly on cardiovascular diseases and diabetes (Andrade, et al., 2006). A comparison of medication adherence was performed among about 700,000 privately insured adult patients within 45 large employers and public organizations in the USA with type 2 diabetes, hyperlipidemia, and hypertension and an incident use of medication therapy for their conditions. It showed that 27.7% of hypertensive patients had adherence rates of less than 80% during the first year of drug therapy, compared to 34.6% of diabetes patients, and

45.7% of patients with hyperlipidemia (Briesacher, et al., 2008). Another study also detected low adherence rates among lipid lowering agents (65% of patients with a PDC less than 80%) dispensed in the first year following the index date (Wiegand, et al., 2012).

Overall, it seems that patients with these chronic conditions are rather non-adherent to their medications (Briesacher, et al., 2008; P. M. Ho et al., 2006; Pittman, et al., 2011; Wiegand, et al., 2012; Yeaw, et al., 2009; Zhang, et al., 2011). Recent researches have shown that these patients tends to be more non-adherent to lipid-lowering drugs, especially statins (Briesacher, et al., 2008; Pittman, et al., 2011; Wiegand, et al., 2012; Yeaw, et al., 2009; Zhang, et al., 2011), compared to anti-diabetic (Briesacher, et al., 2008; Yeaw, et al., 2009; Zhang, et al., 2011) and antihypertensive agents (Briesacher, et al., 2008; P. Michael Ho, et al., 2008; Vegter et al., 2011). Another study, assessing adherence and persistence among six commonly used chronic medication classes, in a large heterogenous population of members enrolled in different health plans in the USA, showed the same pattern in non-adherence among statins (39% [n =94,700]), and oral anti-diabetic drugs (28% [n = 22,031]), but not for angiotensin receptor blockers, or ARBs (34% [n = 29,876]) (Yeaw, et al., 2009).

These studies have also shown improvement in compliance with age (Briesacher, et al., 2008; P. M. Ho, et al., 2006; Pittman, et al., 2011; Vegter, et al., 2011; Wiegand, et al., 2012; Yeaw, et al., 2009) and males seem to be more adherent than females (Pittman, et al., 2011; Wiegand, et al., 2012). A positive relationship of medication adherence and number of comorbid conditions has also been indicated in many of these studies (Briesacher, et al., 2008; P. M. Ho, et al., 2006; Vegter, et al., 2011), although the opposite has also been detected (Wiegand, et al., 2012). Add on drug therapies or a history of trying other drugs for chronic conditions increased adherence among subjects with hypertension, and type 2 diabetes, but not hyperlipidemia (Briesacher, et al., 2008).

#### 1.5.1.3 Non-adherence leads to poor outcomes

Retrospective studies have shown an association between non-adherence and higher biometric values among diabetic patients (P. M. Ho, et al., 2006) and others receiving lipid-lowering therapy (Wiegand, et al., 2012). Non-adherence to beta-blockers, ACE inhibitors, and statins was significantly associated with increased all-cause mortality risk and higher risk of cardiovascular mortality in patients with coronary artery disease (P. Michael Ho, et al., 2008). A prospective cohort study of more than 200,000 adult patients in Italy, who were newly treated for hypertension but were without a history of a cardiovascular disease showed during an average follow-up of 6 years that 5% of subjects experienced a hospitalization for coronary or cerebrovascular disease. Persistent patients had a 37% reduction in risk compared with discontinuers, and those with intermediate and high adherence level had reduction of 20% and 25% of the risk, compared to patients with a very low adherence level. This study shows that in clinical practice initial antihypertensive drug treatment is frequently abandoned, but adequate adherence to these medications is effective in the primary prevention of cardiovascular outcomes (Corrao, et al., 2011).

#### 1.5.1.4 Non-adherence and healthcare costs

It has been estimated in the UK that about 100 million pounds sterling each year is wasted on medications which are returned to pharmacies, and that is apart from the prescribed medicines not consumed (Cushing, 2007). Suboptimal adherence in the USA is associated with additional direct and indirect cost of as much as $290 billion ever year (Sherman, 2011).

A retrospective cohort observation of 137,277 adult patients enrolled in employer sponsored plans showed that high levels of medication adherence were associated with lower disease-related medical costs for diabetes and hyperlipidemia. For both of these conditions, total healthcare costs tended to decrease at high level of medication adherence, despite of increased prescription costs. Medical costs for hypertension tended to be lowest at adherence more than 80% (Sokol, McGuigan, Verbrugge, & Epstein, 2005). Another study, also showed that an adjusted all-cause medical and total

healthcare costs were lowest for adherent (MPR = 80-100%) subjects using statin medications, even though prescription costs increased with improved adherence (Pittman, et al., 2011).

## 1.6 Pharmacist's impact on various outcomes

Medication adherence programs have been implemented for patients using medications indicated for chronic conditions and the core of many disease management programs are behavioral and educational strategies to enhance medication adherence (Fairman & Motheral, 2000).

A systematic review included studies of interventions designed to improve adherence with antihypertensive or lipid-lowering medications, from 1972 to 2002. Sixty two studies describing 79 interventions showed that 56% of interventions improved patient adherence. The most effective interventions were personalized, patient-focused programs that involved frequent contact with health professionals but a combination of interventions were the most effective at improving adherence. Examples of interventions detected, were fixed-dose combination drugs, once-daily or once-weekly dosing schedules, case management by pharmacists, treatment in pharmacist- or nurse-operated disease management clinics or self-monitoring (Petrilla, Benner, Battleman, Tierce, & Hazard, 2005). A systematic review of 37 trials studying interventions to enhance medication adherence in chronic medical conditions, showed that adherence increased most consistently with behavioral interventions that reduced dosing demands and interventions involving monitoring and feedback (Kripalani, Yao, & Haynes, 2007).

Studies, such as the Diabetes Ten City Challenge, have been conducted to evaluate clinical, economic and/or humanistic outcomes for the first year following an initiation of a multisite pharmaceutical care services program for patients with diabetes, indicating improvement in all outcomes observed (B. M. Bluml, Ellis, & Fera, 2009; Garrett & Bluml, 2005). The impact of clinical pharmacists in the ambulatory care setting has been well documented, with the Asheville Project. It is a pharmacist-directed and a medication therapy management (MTM) program with the objective to provide personal oversight

and education for employees with chronic conditions such as diabetes, hypertension and hyperlipidemia. The programs for these conditions detected clinically meaningful progress in clinical outcomes, such as HbA1c concentrations, blood pressure, mean LDL, total cholesterol, and serum triglycerides. Diabetes patients at higher risk were most likely to experience improvements in clinical factors following a pharmaceutical care service. Adherence was estimated by asking participants questions regarding their diabetes care before and after the program, resulting in increased adherence rates. Economic outcomes improved with overall decrease in direct medical costs for third party payers for all the chronic conditions. Although the medication use increased nearly threefold, it did not have any impact on the decrease in total healthcare cost (Bunting & Cranor, 2006; Bunting, Cranor, & Christensen, 2003; Bunting, Smith, & Sutherland, 2008).

A study showed that the extent of pharmacist based programs does not necessarily matter. It found that patients who started a statin therapy demonstrated greater adherence and persistence rates than a comparison group after a brief face-to-face counseling with a community pharmacist (Taitel, Jiang, Rudkin, Ewing, & Duncan, 2012). Pharmacists‘ positive impact on medication adherence has been detected among heart failure patients (Bouvy et al., 2003) and those receiving antihypertensive agents as well. A randomized controlled trial of evaluation of pharmaceutical care program in secondary care hypertension/dyslipidemia outpatient clinic in Portugal, on antihypertensive medication adherence and blood pressure control showed that a pharmacist’s intervention can improve medication adherence and modify factors affecting it in addition to improving blood pressure levels in patients receiving antihypertensive agents for their condition (Morgado, Rolo, & Castelo-Branco, 2011).

A study showed that a small portion of physicians communicated regularly with community pharmacists about adherence problems even though they believed it would improve medication adherence (Laubscher, Evans, Blackburn, Taylor, & McKay, 2009). It is important to discuss this with physicians because the collaboration of pharmacists and other healthcare professionals has

appeared to be beneficial (Rothman et al., 2005). One study of a program in the USA, referred to as Project ImPACT, found that patients with hyperlipidemia receiving pharmaceutical care from a pharmacist in cooperation with physicians can make significant short-term improvements in compliance, persistence, and lipid levels (B. M. Bluml, Cziraky, & McKenney, 2000). Another study detected the benefit of physician and pharmacist cooperation on benefits of cholesterol risk management in patients of high risk for cardiovascular events (Tsuyuki et al., 2002). Their collaboration has also shown an improvement in blood pressure control by changes in medication therapy and improving adherence (Carter et al., 2008). Despite the large benefit of the cooperation of physicians and pharmacists on many patients with chronic conditions and at high risk for them, the TEAM study performed in Canada, showed that an ambulatory primary care management program does not necessary have any impact on dyslipidemia patients at low-risk (Villeneuve et al., 2010). Patients receiving lipid-lowering therapy in the U.S. who visited physicians more often had a significantly decreased risk of non-adherence (Wiegand, et al., 2012).

## 1.7 Evaluation of the pharmacist-directed wellness clinic at Wingate University

Wingate University is a private comprehensive university in North Carolina, USA. It offers its employees and their spouses participation in a self-insured medical plan. In response to escalating healthcare costs in the first decade of the 21$^{st}$ century in the USA, Wingate established a university-based wellness clinic in the year 2005 as a means of controlling overall healthcare costs associated with the self-insured program. The wellness clinic has provided many benefits from other pharmacists' interventions to certain groups of patients. Each participant in the health plan was offered a voluntary annual screening that included a lipoprotein analysis (i.e. total cholesterol, HDL cholesterol, LDL cholesterol and triglyceride), blood glucose concentration, blood pressure, height, weight, waist circumference, in addition to a general health assessment (Pegram & Cole, 2011).

During the first four years of the program, enrollment ranged from 30% to 35%. Low participation rates, limited clinic hours, high turnover rate for clinic

personnel, and small incentive for participation, which was a 10-dollar discount in healthcare premiums per month, were believed to be the reasons for low participation rates. These reasons are in line with a study, which found out that the top three barriers to participation in a worksite wellness program were lack of incentives, location, and time (Person, 2010). Financial incentives are offered by firms to encourage participation in a wellness program (The Kaiser Family Foundation & Health Research & Educational Trust, 2011), because if health management programs are going to succeed in improving people's risks for various risk factors, the participation rate from employees must be high (Loeppke, et al., 2010). That was one of Wingate's solution to the problem, since in the year 2009, the Committee on Health Benefits for the University strongly encouraged screening for all employees and spouses who were covered under the health insurance benefit. While still voluntary, a significant discount (70% paid by Wingate) in monthly healthcare premiums was offered as an incentive to increase participation. Failure to attend a wellness screening would result in a reversal of the percentages paid by Wingate and participants. While saving employees and their spouses in premium healthcare costs annually, it is not known if the overall healthcare expenditures are decreased as a result of the program (Pegram & Cole, 2011).

Employees and spouses covered under the self-insured medical plan that had at least their blood glucose and lipid panel measured at a physician's office in the six months prior to their wellness visit appointment had the opportunity to skip their wellness visit. If patient's opt for documentation from a physician's visit to fulfill the requirement, no intervention and consultation can be made from the pharmacist performing wellness screenings (Pegram & Cole, 2011) .

Angela Pegram, the director of wellness clinic and assistant professor of Pharmacy at Wingate University, was in charge of all wellness screenings studied in this project. She is a pharmacist and a certified diabetes educator, but the clinic actually started as a diabetes self-management program for the Union County and City of Monroe employees. The Wellness clinic was added a few months later when the University wanted to explore a Wellness option for employees, and it was decided that the existing diabetes clinic should take on

the wellness program of the University. From August 2009 to October 2010 she completed screenings and necessary follow up for abnormal results for all participants in the health plan. The same applied for the 2011 wellness visit, the second year of the required screening program (Pegram & Cole, 2011).

The wellness program at Wingate University have never been evaluated before, but an interest was present within this academic institution to get a glimpse of the need of continued wellness program, possible beneficial effects, and if an extensive evaluation should be convened. Limited evaluation on worksite wellness programs, has given stakeholders at Wingate University limited idea of health and financial related benefit of preventive and wellness programs. All the studies and facts which have been discussed above, along with limited evaluations of pharmacist's directed wellness programs, especially within the university area, encouraged the need and the necessity to evaluate clinical and economic impacts of Wingate's program. The literature also supports the need for evaluations of medication adherence in relation to other factors which are a part of the program, e.g. economics, clinical outcomes, lifestyle, and compliance to recommended cancer screenings. Analyzes of the relation between medication adherence and these factors is not commonly seen within the literature but would be beneficial addition to present adherence studies.

# 2. OBJECTIVES

A retrospective chart review and a quality assurance project were conducted to evaluate pharmacist-directed wellness clinic located at Wingate University's campus.

Primary objective:

- Describe medication adherence to prescription therapy for participants in the wellness program associated with Wingate University's self-insured health plan, who had been diagnosed with diabetes, heart disease, hyperlipidemia, and/or hypertension.

Secondary objectives:

- Assess changes between two wellness visits in the following clinical indicators: Blood glucose concentrations, blood pressure, body mass index, lipoprotein analysis components, and waist circumference; and relate these to medication adherence.
- Assess the association between medication adherence and general wellness and lifestyle seeking behavior, between the two wellness visits.
- Assess changes between the two wellness visits in the following economic outcomes: Medical costs, prescription costs and total health care costs; and relate these to medication adherence.

## 2.1 Research questions

Primary research questions:

1. How adherent are participants in the wellness program to prescription therapies which are indicated for the four target disease groups?
2. Are age, gender, race and number of these target medications associated with medication adherence to prescription therapy?
3. Which types of target medications are participants using and is there variation in adherence to different medications?

4. Is there a difference in medication adherence between the target disease groups or by the number of diagnoses?

Secondary research questions:

1. Do participants show some improvement in clinical indicators *(Blood glucose concentrations, blood pressure, body mass index, lipoprotein analysis components, and waist circumferenc*e) between the two wellness visits and is there a relation between abnormal values and medication adherence?
2. Is there an association between general wellness seeking behavior *(attendance to physician visits and three cancer screenings)* and medication adherence; and do participants show some improvements between wellness visits?
3. Is there an association between self-reported lifestyle behavior and medication adherence and do participants adapt changes in lifestyle between wellness visits?
4. Do economic outcomes change between the two wellness visits and by medication adherence?
   a) How much are the direct medical healthcare *costs (medical costs, prescription costs and total health care costs)*?
   b) Is there an association between non-adherence and higher costs?
   c) Is the number of target diagnoses associated with total health care costs?

# 3. METHODS

The study was performed over three months period, from January 9th to April 5th 2012, at Wingate University, School of Pharmacy, and the Wellness Clinic located on its campus. Overview of the study process is showed in figure 1.

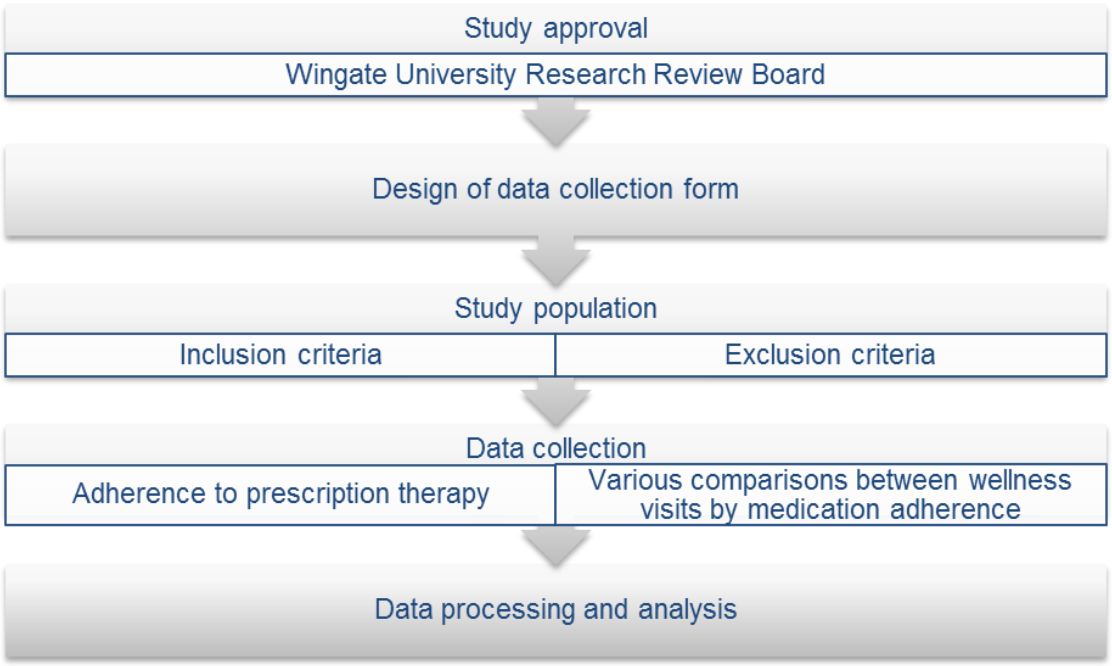


***Figure: 1*** *Study process*.

## 3.1 Study approval

An application for the study was sent to Wingate University's Research Review Board, for ethical approval. The application was exempted from review by the board because it is a retrospective chart review with minimal risk to study's subjects and no indication of their names in results. The approved form of the application, an e-mail response explaining the board's decision of its exemption for review, along with restrictions made for this study can be seen in appendix A.

## 3.2 Study design

This retrospective chart review and quality assurance project was divided into two parts, medication adherence evaluation (part I) and a comparison of various factors related to medication adherence between a baseline wellness visit in the academic year 2009 to 2010, and a follow-up visit in the calendar year 2011 (part II). The time between these two wellness visits will be referred to as a study period. It was rounded to the next whole number of months below or above, with 14 days as a reference.

Available data called for two descriptive study designs, one for each part of the study. Cross-sectional analysis was conducted to evaluate medication adherence to prescription therapy between the two wellness visits. A quasi-experimental design, One-Group Pretest-Posttest design without controls, was used to assess a difference between the two wellness visits in relation to medication adherence for biometric test results, general wellness and lifestyle seeking behavior, and economic outcomes.

## 3.3 Study population

The study sample was drawn from all participants in the wellness program associated with Wingate University's self-insured health plan based on criteria listed in table 2.

***Table: 2 The inclusion and exclusion criteria in the study.***

| Inclusion criteria | Exclusion criteria |
|---|---|
| Active participants in Wingate's self-insured program during the study period | Not active in the self-insured program some time during the study period |
| A wellness visit in the academic year 2009-2010, or all requirements fulfilled (baseline visit) | Only one wellness visit during the study period |
| A wellness visit in the calendar year 2011, or all requirements fulfilled (follow-up visit) | Participants having wellness visits prior to the year 2009 |
| Diagnosis of diabetes, heart disease, hyperlipidemia and/or hypertension (target disease groups) at either or both wellness visits | Participants starting the wellness program in the years 2011 and 2012. |
| At least one medication with at least two prescription refills indicated for one or more of the target disease groups at baseline (target drugs) | No diagnosis of a target disease group at either visit. |
| | No target medication at baseline visit |
| | Target medications with only one refill during the study period |
| | Target medications with frequent dose changes |
| | Prescriptions on other than medications (e.g. needles and lancets) |

A list of all participants who had a wellness visit or met the program's requirements during the calendar year 2011 (follow-up visit), was the sample frame of the study. Subjects' medical charts, located in the wellness clinic, were assessed to see if patients had a baseline visit in the academic year 2009-2010.

Inclusion criteria covered subjects having one or more of the following four disease groups: Diabetes, heart disease, high cholesterol, and hypertension, at both or either visits. They will be referred to as target diseases, diagnoses, or disease groups in this study. This criterion was set due to their high prevalence in the USA and worldwide, the potential of preventing further complications or regression of these chronic conditions, along with the importance of medication adherence for these patients. The diagnoses were assigned according to subjects' self-report at wellness visits and when available, diagnoses reported by physicians to the insurance company.

Medications requiring frequent dose changes were excluded from evaluation of medication adherence, since they might bias the overall results for the study population.

## 3.4 Data collection

Data collection was performed over a four week period, from March 2nd to March 29th.

A data collection form was designed to elicit all necessary data in the chart review. A series of changes were made to the form to clarify content, organization, and wording. It was tested with three subjects before finalizing the form. Minor edits were made at the beginning of the data collection period, which did not compromise the integrity of the process.

The data collection form was in paper format and consisted of eight sections, which described subjects' demographics and study periods, lifestyle, self-reported number of medications and food supplements, general wellness seeking behavior, screening results of definite clinical indicators, target and other diseases, medication adherence from prescription refills, and economic data. On the back of the form was a space for comments. The final version of the data collection form can be seen in appendix B.

### 3.4.1 Data sources

Data was only collected electronically in the first part of this study, but paper forms were also used in part II. The sources were various and different in nature, but are described below and listed in table 3, along with variables collected from each source of data.

The managed care database, Healthgram, is an automated database used by insurance companies, managed care organizations, directors of preventive programs, and/or patients to remotely coordinate care and support on-site medical clinics (Primary PhysicianCare, 2010). All existing data in the database comes from the Wellness Clinic or other services subjects use through their self-insurance. Data was not always available for all factors, since information had not been entered appropriately or was missing.

The database was used in both parts of the study. Medication list of prescription refills paid through patients' health insurance coverage, including drug name, quantity, days of supply and filling date, was used as the source in evaluation of medication adherence. Healthgram was used to validate self-reported or other secondary data on following factors, when available:

- Laboratory results
- Vaccines and screenings (annual physical and cancer screenings)
- Vitals (weight, height, body mass index, blood pressure and waist circumference)
- Diagnoses for five disease groups (i.e. asthma, diabetes, heart disease, hyperlipidemia and hypertension)
- Medical Claims

Economic data was obtained from Healthgram as well, but the insurance company and the managed care organization serving Wingate University for its health plan were the only two that had access to it. Therefore, the insurance company sent summarized information on medical, prescription, and total healthcare costs for every participant in the wellness program.

Health Risk Assessment (HRA) is a single-page paper form, which the insurance company, serving Wingate University with its self-insured plan, requires to be filled out for participants in the health plan during the annual wellness visit. It consists primarily of demographics, past and current personal medical history, certain key screenings, lifestyle and overall health factors, health effects on patient's work, and screening results of biometric tests from the clinic. The HRA form is a part of the program so the managed care organization serving the insurance company can keep track of the population's health status and make health-risk assessments for the wellness program. Most of this information is transferred to Healthgram. A sample of the HRA form can be seen in appendix C.

The wellness screening form is the pharmacist's registration tool during the wellness visit. It contains information on basic demographics, screening results for clinical indicators measured, lifestyle (diet, exercise, sleep and smoking), family and personal medical history, allergies, current medications (prescription drugs, OTC drugs) and food supplements (herbal and vitamins), along with certain key screenings (physician's visits, dentistry, eye exam, vaccines, and cancer screenings).

The construct and arrangement of the 2009 to 2010 wellness screening form varied slightly from the 2011 form. Eight ordinal variables with five response choices each were used as an assessment of diet in the academic year 2009-2010, but the latter form included a question about well-rounded meals with a dichotomous response choice. Another difference between years was the time frame for physician visits. The 2009-2010 wellness screening form asked if people had visited physician in the past year, while the 2011 form asked about attendance in the past three years. The latter was used in data collection of this study.

If patients did not come for a wellness visit due to available screening results from a physician's office, no wellness screening forms existed. The wellness screening forms for both baseline and follow-up visits can be seen in appendix C.

Lexi-Comp Online and Micromedex 2.0 are authorized drug information databases. They were used in the evaluation of medication adherence to identify target drugs from all other medications subjects were using and to categorize medications as food supplements, prescription drugs or OTC medications.

Some patients brought written or printed medication lists to the wellness visits. In that case, they were copied to the wellness screening form. They were preferred as a reference of self-reported medications and food supplements.

National Preferred Formulary: Express Scripts for the United States is a list of the most commonly prescribed medications in the country, and is the core of drugs that are covered by the health insurance. The pharmacy benefit management company for Wingate University's insurance plan publishes the formulary yearly. The 2009, 2010, and 2011 versions were thought helpful in the identification of target drugs so a list of applicable medications from it was made and used in this study along with the drug information databases. These forms can be seen in appendix C.

***Table: 3 All sources (databases and paper forms) used in data collection and the variables collected from each source.***

| Source | Variables collected |
|---|---|
| **Databases** | |
| Healthgram (managed care database) | Age, gender, screening results, general wellness, newest information on diagnoses, medication adherence |
| **Paper forms** | |
| Wellness Screening form | Age, gender, screening dates and self-reported information on lifestyle, general wellness, target and other diseases, medications and screening results |
| Health risk assessment (HRA) application | Gender, race, screening dates if wellness screening forms were not available, target and other diseases, general wellness (except osteoporosis), exercise, smoking, sleep, screening results |
| Data from physician office or the university's health facility | Screening results |

## 3.5 Part I: Adherence to prescription therapy

Medication adherence was assessed as prescription refills from pharmacy claims according to Healthgram. The criterion for medication adherence was set at baseline to make sure subjects were using one or more target medications at the primary visit with the pharmacist. All prescription refills belonging to subjects' study periods were imported from the medication list in Healthgram to an excel spreadsheet. Those refilled at the same date as wellness visits were included. Lexi-Comp Online and Micromedex 2.0, were used to obtain information such as brand and generic drug names, pharmacologic categories,

along with labeled and off-labeled indications. Every medication from a subject's medication list was marked as a target drug, if it had a labeled or off-labeled indication for one or more of the target disease groups, and fulfilled the criterion made for assessment on medication adherence. Target medications with only one refill in the study period and new target drugs started after baseline visit, along with other than target medications, were especially marked as well. Dose, strength, and pharmaceutical form of a drug were not recorded.

### 3.5.1 Operationalization of medication adherence

If at least one target medication with at least two refills was present at baseline, and in the study period, a Medication Possession Ratio (MPR) was calculated as a measure of medication adherence. Random checks were made on the days' recorded with the quantity of the prescriptions, in order to ensure a reasonable fit with the method used for adherence assessment. In this project the time between baseline and follow-up visit was the observation period. The MPR was estimated as the total number of day supplies of a medication refilled during the observation period, divided by number of days in that period. MPR values higher than 100% were truncated to 100%, before calculations on mean or median MPR. An example of MPR calculations for one subject can be seen in appendix D.

Adherence to a target medication was defined as MPR ≥ 80%, so subjects were non-adherent if they had a target medication with a MPR < 80%. To be categorized as adherent, subjects needed to have all target medications of MPR higher than 80%.

### 3.5.2 Recoding of variables

The multichotomous variables age, race, and number of target medications were made dichotomous before data analysis due to uneven distribution of subjects within categories (table 4).

***Table: 4 Recoding of the ordinal variables age and number of target medication and the nominal variable race into dichotomous variables.***

| Variable | Multichotomous | Dichotomous |
|---|---|---|
| Age (years) | 20-29, 30-39, 40-49, 50-59, 60+ | 20-59 and 60+ |
| Race | Caucasian, African-American, Hispanic, Other | Caucasians and all others |
| Number of target drugs | 1, 2, 3, 4, 5, 6, 7 | 1 and 2+ |

Target medications were classified in pharmacologic categories according to the drug database Lexi-Comp Online.

## 3.6 Part II: Comparisons between the two wellness visits in relation to medication adherence

Clinical, wellness seeking, lifestyle, and economic factors were examined at the two wellness visits and in relation to subjects' adherence to target medications between baseline and follow-up visit.

### 3.6.1 Clinical indicators

Screening measurements on height, weight, blood pressure and blood work (blood glucose and lipoprotein analysis), were measured at wellness visits, the university's health facility or physician's office. Body mass index (BMI) was calculated from data on height and weight. Printed and/or written screening results were used as data in this project. If printed copies of screening results from physician's office, university's health facility, or wellness clinic were available, they were preferred as the main source of data for screening measurements, instead of handwritten results. Abnormal results were defined as all observations that were outside an ideal value range according to authorized standards shown in table 5. Therefore, continuous variables of clinical indicators were made dichotomous (normal versus abnormal).

***Table: 5 Normal values for the eight clinical indicators evaluated in the study.***

| Clinical indicator (unit) | Ideal value for adults (>20 years) | Reference |
|---|---|---|
| Blood pressure (SBP/DBP) (mmHg) | <120/<80 | (Lloyd-Jones et al., 2010) |
| BMI ($kg/m^2$) | < 25 | (Lloyd-Jones, et al., 2010) |
| Waist Circumference – male (in) | ≤40 | (National Institute of Health, 2008) |
| Waist Circumference – female (in) | ≤35 | (National Institute of Health, 2008) |
| Fasting plasma glucose (mg/dL) | < 100 | (Lloyd-Jones, et al., 2010) |
| Total Cholesterol (mg/dL) | < 200 | (American Heart Association, 2011) |
| LDL-Cholesterol (mg/dL) | < 100 | (American Heart Association, 2011) |
| HDL-Cholesterol – Male (mg/dL) | > 40 | (American Heart Association, 2011) |
| HDL-Cholesterol – Female (mg/dL) | > 50 | (American Heart Association, 2011) |
| Triglycerides (mg/dL) | < 150 | (American Heart Association, 2011) |

Data on general wellness in the study refers to subjects' physician visits in the prior three years from a wellness visit date and the following three secondary prevention cancer screenings: Colonoscopy, mammogram, and

prostate check. Since the three screenings apply to certain age groups and gender, approved guidelines listed in table 6 were followed to make an assessment if subjects were following the recommendations. Therefore, the multichotomous variables collected were made dichotomous by classifying subjects as those who attended a screening according to recommendations and those who did not (table 6).

***Table: 6 Accepted guidelines for colonoscopy, mammogram and prostate screening (American Cancer Society, 2012a; National Cancer Institute, 2010; U.S. Preventive Services Task Force, 2008, 2011).***

| Type of screening | Recommendation |
|---|---|
| *Colonoscopy* | *Adults 50-75 years old every 10 years, despite of gender* |
| *Mammogram* | *Women ≥ 40 years old, every 1-2 years* |
| *Prostate screening* | *Men ≥ 50 years old, every 2 years* |

### 3.6.2 Lifestyle seeking behavior

Diet, exercise, sleep and smoking were the lifestyle factors reviewed in the project. Due to changes of the wellness screening form between baseline and follow-up visit, information about diet was obtained differently at baseline compared to follow-up. At baseline visit, eight ordinal variables regarding the patient's diet with five response choices were available. It was decided that two of them: "I eat at least 5 servings of fruits and vegetables per day," and "I eat lean meat, fish and beans regularly," were equal to the variable "Typical meals are well rounded, including fruits and vegetables" on the data collection form. The following response choices were available on the questionnaire: 1 = never, 2 = rarely, 3 = sometimes, 4 = often and 5 = always. The patient needed to have responses of 3, 4, or 5 for both variables to correspond to a well-rounded diet on the data collection form.

Subjects were analyzed in relation to well-rounded diet, exercise on three or more days per week, 7 to 8 hours sleep per night and if they were smokers. Accepted guidelines recommends a physical activity of 150 minutes or more per week of moderate-intensity, or 75 minutes per week of vigorous-intensity or an

equivalent combination (U.S. Department of Health and Human Services, 2008). As detailed information was not obtainable it was decided to categorize subjects who exercised three or more days per weeks as having acceptable frequency of physical activity. Hours needed of sleep per night is individual but it was decided to use persons sleeping 7 to 8 hours per night as getting adequate sleep. These multichotomous ordinal variables were made dichotomous (table 7).

***Table: 7 Transformation of the multichotomous ordinal variables exercise and sleep to dichotomous variables used in data analysis.***

| Variable | Multichotomous | Dichotomous |
|---|---|---|
| Exercise (days per week) | None, 1-2, 3-4, ≥5 | <3 and ≥3 |
| Sleep (hours) | <5, 5-6, 7-8, 9-10, >10 | 7-8 and all other |

## 3.6.3 Economic outcomes

All costs were examined in United States dollars and from the perspective of the employer, Wingate University. Economic information on three types of direct costs (medical, prescription, and total health care) was obtained from the insurance company serving Wingate University, but no available data were on other types of costs. The total health care costs are the sum of medical and prescription costs. The difference in amounts at follow-up and baseline visits was calculated and subjects categorized as either having decreased or increased costs. Medical, prescription, and total health care costs included only the costs of services subjects pay for through their self-insurance coverage. Reports for the academic year 2009 to 2010 and the calendar year 2011 were evaluated as quarters of each year studied, since it could not be done monthly. This means that every report included all participants in the self-insured program having a wellness visit for three months of the year, but reports were marked by the last month included. All financial information spanned a year previous from the date it was marked. Thus reports for subjects having a visit

between January and March 2011 included financial information from March 2010 to March 2011.

## 3.7 Data entry and processing

Data were entered into a password protected excel spreadsheet under subjects' identification numbers. A random sample of ten data collection forms was made, and all data belonging to those subjects re-entered into the database to test for errors in data import and entry.

## 3.8 Data analysis

Two versions of the spreadsheet program Microsoft Excel, 2007 and 2010, were used to analyze data and perform statistics. The add-in software for Excel, Analyse-it, was used to perform all statistical tests, except for t-tests. They were performed in Excel.

Non-parametric statistics were performed for most variables as normality could not be assumed. Fisher's Exact and Chi-Square tests were used for dichotomous variables, but the Fisher's Exact test was preferred for 2 x 2 contingency tables, due to more accuracy and small sample size. It was used to test for a difference in medication adherence and between wellness visits for the dichotomous variables gender, age, race, number of target medications, clinical indicators, along with general wellness, and lifestyle seeking behaviors.

Two-tailed Pearson's Chi-Square statistics for r x k contingency tables were performed to test for associations of medication adherence and pharmacologic categories, disease groups, and number of target diagnoses. Mann-Witney *U* test was used for comparisons by medication adherence for continuous data. It was performed to test for a difference in number of other than target medications between adherers and non-adherers.

Kruskal Wallis one-way analysis of variance, the non-parametric equivalence of the one-way analysis of variance (ANOVA), was used to compare more than two independent samples of continuous data. It was performed to test whether the median MPR of five pharmacologic categories, four target disease groups and four numbers of target diagnoses originated from the same distribution.

Parametric statistics were performed on economic observations after logarithmic transformations on the data, which resulted in approximate normal distribution. Histograms of the distribution in cost in relation to medication adherence at both visits can be seen in appendix E. Two tailed t-test for paired samples was performed to test for a difference in cost between baseline and follow-up visit. Two tailed t-tests for two samples, assuming unequal variances, were performed to test for a difference in cost between adherent and non-adherent subjects, both at baseline and follow-up visit. Spearman's Rank-Order Correlation was conducted to test for correlation between total cost and number of target diseases for adherent and non-adherent subjects at both wellness visits.

Statistical significance was set at 0.05 and all p-values were unadjusted.

## 3.9 Data privacy

At the top of the data collection form was identification (ID) number, which is a code assigned to each subject. Every code was made of a number between 0 and 500. Therefore, no identifying information was collected, which is very important due to subjects' protection and health information security. The attribute age was made as an ordinal variable on data collection form rather than date of birth, at the request of Wingate's Research Review Board, to increase subjects' privacy protection. The following age categories were made as years of age: 20-39, 40-49, 50-59, and 60 years or older. Age range was then assigned to each subject by using their actual age in the year 2012. The key for subject's identification was stored in a password protected spreadsheet on the investigator's computer. In order to make sure any two or more subjects did not get the same ID number, it was checked twice, during data collection and again at the end.

# 4. RESULTS

The sample frame used in the study included 363 individuals. Of those, 169 (46.6%) persons had both a baseline and follow-up visit, along with one or more of the following target disease groups: Diabetes, heart disease, hyperlipidemia and hypertension. Of the 169 subjects, 91 (53.8%) met the inclusion criteria. Sixty-seven (39.6%) individuals were excluded from the study, because they had no target medications at the baseline visit, even though 13 (19.4%) of those started using one or more target medication after the baseline visit. Eleven (6.5%) persons were excluded due to none or insufficient information for calculations on medication adherence.

## 4.1 Demographics and study periods

Eighty-eight percent of the study population (*n* = 80) was 50 years or older and males were 49 (54%). The study population were mostly Caucasians (91% [*n* = 83]). Others were African-American (7% [*n* = 6]), Hispanic (1% [*n* = 1]), or of some other race (1% [*n* = 1]) not recorded.

The time between subjects´ baseline and follow-up visits was not always one year, due to changes in how wellness visits were booked after the first year of the wellness program. Subjects with less than 6 months and more than 18 months between visits, made up 30% (28 of 91) of the study population. Overall, the mean time between visits was 14 months (range 1-25 months), but the mode was 11 months.

## 4.2 Adherence to prescription therapy

### 4.2.1 Characteristics of study population by medication adherence

Forty-five subjects (49.5%) were non-adherers. Four characteristics of them can be seen in table 8. No statistically significant difference was between gender and age in the two groups, although when subjects were divided into two age groups, 20-59 years old and 60 years or older some difference albeit not significant was apparent. In the younger age group 53.5% (23 of 43) were non-

adherent to their target medications, compared to 45.8% (22 of 48) of subjects who were 60 years or older (p = 0.60).

Number of target medications at baseline ranged from one to seven drugs and most subjects were using either one, two or three medications. Non-adherers had the median of 2 target medications, with lower and upper quartile of 1 and 3 medications, while adherers had the median of 1.5 target medications, with lower and upper quartile of 1 and 2 medications. Figure 2 shows that the proportion of non-adherers increased with increasing number of target medications. Of subjects using one target medication, 44% (18 of 41) were non-adherent to the medication, compared to 54% (27 of 50) of subjects using two or more target medications which did not reach statistical significance (p = 0.45).

***Table: 8 Number of all subjects and number and proportion of non-adherers (subjects with at least one target medication of MPR<80%) by gender, age, race, and number of target medications.***

| Characteristic | Subjects | Non-adherers (MPR<80%) |
|---|---|---|
| Study population, n (%) | 91 (100) | 45 (49.5) |
| **Gender** | **N** | **n (%)** |
| Males | 49 | 21 (42.9) |
| Females | 42 | 24 (57.1) |
| *P* value* | Males vs. Females | 1.00 |
| **Age (years)** | **N** | **n (%)** |
| 20-29 | 1 | 1 (100) |
| 30-39 | 2 | 2 (100) |
| 40-49 | 8 | 3 (37.5) |
| 50-59 | 32 | 17 (53.1) |
| 60+ | 48 | 22 (45.8) |
| *P* value* | 20-59 vs. 60+ | 0.60 |
| **Race** | **N** | **n (%)** |
| Caucasian | 83 | 40 (48.2) |
| African-American | 6 | 4 (66.7) |
| Hispanic | 1 | 1 (100) |
| Other | 1 | 0 (0) |
| *P* value* | Caucasian vs. all other | 0.69 |
| **Target medications** | **N** | **n (%)** |
| 1 | 41 | 18 (43.9) |
| 2 | 28 | 14 (50.0) |
| 3 | 9 | 5 (55.6) |
| 4 | 4 | 3 (75.0) |
| 5 | 5 | 2 (40.0) |
| 6 | 3 | 2 (66.7) |
| 7 | 1 | 1 (100) |
| *P* value* | 1 drug vs. ≥2 drugs | 0.45 |

*Two-tailed Fisher's exact test.

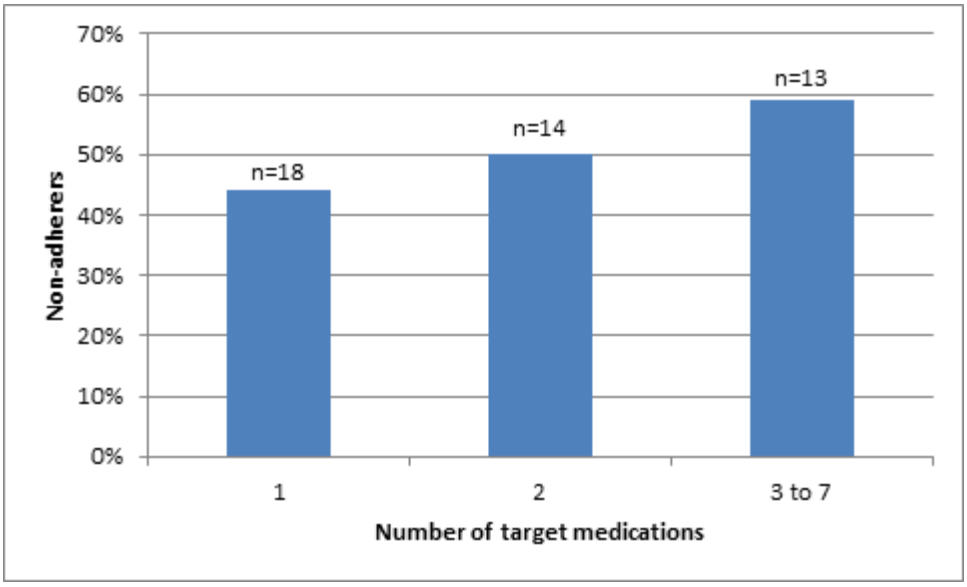


***Figure: 2 Number and proportion of non-adherers, by number of target medications.***

### 4.2.2 Adherence to target medications

Of the 91 subjects included in the study, 15 (16%) subjects had one or more of the target medications with only one refill in their study period. Therefore, MPR could not be calculated for these drugs and they were excluded in the overall medication adherence assessment. Seven (8%) subjects had warfarin and two types of insulin, Lantus Solostar and Novolog. These were the only target drugs for this population which are known to need frequent dosing changes. Therefore, these medications were excluded in the overall medication adherence assessment. More detailed data on medications used at baseline can be seen in Appendix E.

Table 9 lists the eight most common target mediations subjects were using between baseline and follow-up visit. The anti-hyperlipidemic agent, simvastatin, was the most commonly used drug agent, and with the highest adherence. Subjects were least adherent to the anti-hyperlipidemic agent niacin (55.6%).

***Table: 9 Top eight most commonly used target medications among the study population (n=91), by total number of users and total number and proportion of non-adherers (subjects using at least one target medication with MPR<80%).***

| **Active ingredient** | **All subjects** | **Non-adherers (MPR<80%)** | |
|---|---|---|---|
| Name | $N_{users}$ | $n_{users}$ | % |
| Simvastatin | 20 | 3 | 15.0 |
| Lisinopril | 14 | 4 | 28.6 |
| Atorvastatin | 11 | 4 | 36.4 |
| Metoprolol | 10 | 3 | 30.0 |
| Metformin | 9 | 3 | 33.3 |
| Niacin | 9 | 5 | 55.6 |
| Rosuvastatin | 9 | 3 | 33.3 |
| Hydrochlorothiazide | 6 | 1 | 16.7 |

MPR values ranged from 0.105 (10.5%) to 1.0 (100%). Subjects were non-adherent to agents in 14 of the 19 pharmacologic categories that were targeted, but table 3 describes the most common pharmacologic categories used by the study population. The most common categories were: Anti-hyperlipidemics (12 agents), ACE inhibitors (5 agents), Anti-diabetics (6 agents), Diuretics (5 agents), and ARBs (5 agents). Most subjects (n = 71) were using medications categorized as anti-hyperlipidemic agents, but the second and third most used categories among the study population were ACE inhibitors (n = 21) and anti-diabetic agents (n = 19). All five categories described in table 3 include subjects with a wide variation in adherence rates. The proportion of non-adherent subjects by pharmacologic category is in following increasing order:

ARB < ACE < Anti-hyperlipidemic < Diuretics < Anti-diabetic

Adherence rates for combined drugs were higher than for single drugs, i.e. calcium channel blockers and ACE inhibitors (1 of 5 with MPR < 80%), and the combinations of the diuretic, Hydrochlorothiazide, and ARB (0 of 3 with MPR<80%), ACE inhibitors (1 of 5 with MPR<80%) and Beta blockers (1 of 4 with MPR<80%). An exception was the combination of the anti-hyperlipidemic

agents, ezetimibe and simvastatin, but no one of the five subjects using the combination were adherent to it.

***Table: 10 The five most common pharmacologic categories used by the study population (n=91), mean and median medication possession ratio (MPR), number of users, and number and proportion of non-adherers (subjects using at least one target drug with MPR<80%).***

| Pharmacologic category | Mean MPR (SD) | Median (range) | *P* value** | Number of users | Non-adherers n (%) | *P* value‡ |
|---|---|---|---|---|---|---|
| Anti-hyperlipidemics | 76.7 (26.2) | 88.2 (10.5,100) | | 71 | 27 (38.0) | |
| Anti-diabetics | 74.7 (26.4) | 87.4 (26.5,100) | | 19 | 8 (42.1) | |
| Diuretics | 74.8 (30.8) | 95.9 (23.7,100) | 0.83 | 15 | 6 (40.0) | 0.96 |
| ACE inhibitors* | 81.4 (24.3) | 93.5 (21,100) | | 21 | 7 (33.3) | |
| ARB* | 81.1 (26.0) | 95.7 (36.4,100) | | 7 | 2 (28.6) | |

*ACE inhibitors: Angiotensin-converting-enzyme inhibitors, ARB: Angiotensin II receptor blockers

**Kruskal-Wallis one-way analysis of variance

‡Two-tailed Chi-Square test.

## 4.2.3 Other than target medications

Most subjects (89% [*n* = 81]) were also taking other than target medications during the study period. Adherers had a median of 4 other medications between baseline and follow-up visit, with lower and upper quartile of 3 and 7 drugs. Non-adherers had a median of 7 other drugs between visits, with lower and upper quartile of 3 and 9 drugs. This difference in the use of other medications was statistically significant (p = 0.045).

Minority of subjects was prescribed a new target drug between the wellness visits, but 27 (30%) subjects started a new target drug, after baseline visit. The number of new drugs ranged from 1 to 3 drugs.

## 4.3 Target disease groups and medication adherence

Table 11 summarizes the distribution of subjects by disease group and number of diagnoses (disease groups) per subject, by medication adherence.

The same subject was counted more than once if he had been diagnosed with more than one target disease group at baseline. Most subjects had been diagnosed with high cholesterol (hyperlipidemia), followed by hypertension, diabetes and heart disease as the least prevalent disease group. Table 11 shows that all disease groups had a mean MPR of around 80%, but the distribution of medication adherence was quite even with no statistical significance. Most subjects had two and three target diagnoses at baseline. The mean MPR (82.6%) was highest for subjects with three target diagnoses. Subjects with four target diagnoses were least adherent to their target medications, and those with two target diagnoses most adherent, although the difference was not statistically significant.

***Table: 11 Distribution of subjects (n = 91) by disease group and number of diagnoses per subject, along with mean medication possession ratio (MPR), number and proportion of non-adherers (subjects using at least one target drug with MPR<80%).***

| | **Subjects** | **MPR** | | | **Subjects (MPR<80%)** | ***P* value**$^{\Delta}$ |
|---|---|---|---|---|---|---|
| **Target disease group** | $N_{total}$$^{\ddagger}$ (%) | Mean (SD) | Median (range) | P value$^{\dagger}$ | n (%) | Adh vs. Non-adh$^{**}$ |
| Diabetes | 29 (32) | 82.4 (22.7) | 92.1 (25.7,100) | 0.88 | 15 (51.7) | 0.96 |
| Heart disease | 25 (27) | 79.5 (24.0) | 93.9 (19.0,100) | | 14 (56.0) | |
| Hypertension | 72 (79) | 80.1 (24.4) | 92.1 (19.0,100) | | 36 (50.0) | |
| Hyperlipidemia | 80 (88) | 79.6 (25.4) | 91.9 (10.5,100) | | 40 (50.0) | |
| **Number of target diagnoses per subject** | $N_{total}$$^{*}$ (%) | Mean (SD) | Median (range) | P value$^{\dagger}$ | n (%) | Adh vs. Non-adh$^{**}$ |
| **1** | 19 (20.9) | 70.0 (30.2) | 82.7 (10.5,100) | 0.27 | 10 (52.6) | 0.24 |
| **2** | 36 (39.6) | 79.6 (26.1) | 92.1 (21.0,100) | | 15 (41.7) | |
| **3** | 29 (31.9) | 82.6 (22.0) | 93.3 (19.0,100) | | 15 (51.7) | |
| **4** | 7 (7.69) | 78.2 (25.7) | 94.9 (26.5,100) | | 5 (71.4) | |

*The percentages do not sum up to 100% due to rounding of the numbers

$^{\ddagger}$ The percentages do not sum up to 100%, since subjects can have more than one disease

**Adh: Adherers, Non-adh: Non-adherers.

$^{\dagger}$Kruskal-Wallis one-way analysis of variance

$^{\Delta}$Two-tailed Chi-Square test.

## 4.4 Clinical indicators and medication adherence

Screening results from physicians or wellness visits are shown in Table 12. Data were most often available for mandatory screening values (blood glucose and lipoprotein analysis).

Most subjects had abnormal body mass index but they were most likely to have normal values for diastolic blood pressure and total cholesterol. The distribution of subjects with abnormal values by medication adherence was similar for all indicators and no statistically significant difference was observed, although it was close for body mass index at follow-up visit ($p = 0.053$) and waist circumference at baseline ($p = 0.052$), where non-adherers were more likely to have abnormal values for these factors. The total number of subjects with abnormal values decreased for all factors but three (systolic blood pressure, waist circumference and high-density lipoprotein) between baseline and follow-up, but this was not statistically significant. The median and interquartile range for all clinical factors can be seen in Appendix E.

**Table: 12** ***Total number of subjects with available screening results for clinical indicators, along with number and proportion of these subjects with abnormal values according to accepted guidelines, by medication adherence and wellness visit. Results from statistical tests (P values) are also shown, at baseline and follow-up and between these two wellness visits.***

| Factor* | Baseline | | | | Follow-up | | | | Baseline vs. Follow-up |
|---|---|---|---|---|---|---|---|---|---|
| | Total with value | Abnormal values | | | Total with value | Abnormal values | | | |
| | | Total | Non-adherers | Adherers vs. Non-adherers | | Total | Non-adherers | Adherers vs. Non-adherers | |
| | N | N (%) | n (%) | *P* value** | N | N (%) | n (%) | *P* value** | *P* value** |
| BMI | 79 | 66 (83.5) | 34 (51.5) | 0.11 | 59 | 49 (83.1) | 29 (59.2) | 0.053 | 1.00 |
| SBP | 80 | 54 (67.5) | 28 (51.9) | 0.58 | 56 | 40 (71.4) | 22 (55.0) | 0.96 | 0.77 |
| DBP | 80 | 30 (37.5) | 16 (53.3) | 0.69 | 56 | 15 (26.8) | 8 (53.3) | 1.00 | 0.26 |
| WC | 68 | 35 (51.5) | 22 (62.9) | 0.052 | 50 | 26 (52.0) | 17 (65.4) | 0.16 | 1.00 |
| BG | 88 | 42 (47.7) | 21 (50.0) | 1.00 | 90 | 36 (40.0) | 20 (55.6) | 0.41 | 0.37 |
| Total-C | 90 | 28 (31.1) | 14 (50.0) | 1.00 | 91 | 27 (29.7) | 14 (51.9) | 0.95 | 0.96 |
| LDL | 86 | 52 (60.5) | 21 (40.4) | 0.23 | 87 | 50 (57.5) | 24 (48.0) | 1.00 | 0.81 |
| HDL | 89 | 44 (49.4) | 20 (45.5) | 0.75 | 89 | 46 (51.7) | 24 (52.2) | 0.59 | 0.88 |
| TRG | 90 | 35 (38.9) | 18 (51.4) | 0.87 | 88 | 30 (34.1) | 16 (53.3) | 0.71 | 0.61 |

*BMI: Body mass index, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, WC: Waist circumference, BG: Blood glucose, Total-C: Total cholesterol, LDL: Low-density lipoprotein, HDL: High-density lipoprotein, TRG: Triglycerides.
**Two-tailed Fisher's Exact test.

## 4.5 General wellness seeking behavior and medication adherence

All 91 subjects, had visited a physician for some reason during the past three years from wellness visits.

Three cancer screenings (Colonoscopy, Mammogram, and Prostate screening), considered preventive against colon, breast and prostate cancers, were assessed among study population. Data were available for all 91 subjects, at both visits. Subjects' attendance to these screenings regard to accepted guidelines is summarized in table 13.

Of the 88 subjects who had reached the age of fifty, 59 (67%) had attended a screening for colon cancer (colonoscopy) in the past ten years from the date of baseline visit and 65 (74%) subjects at follow-up visit. About half of these subjects were non-adherers (49.2%) to target prescription therapy between baseline and follow-up visit, with no statistical significant difference in medication adherence and between wellness visits.

Of the 40 female subjects who were 40 years or older, 34 (85%) had attended a screening for breast cancer, or mammogram, in the past five years from baseline and follow-up visit. The distribution between adherers and non-adherers at both visits were quite even, or 58.8% non-adherers. Therefore, no statistical significant difference was seen between subjects by medication adherence and wellness visit.

Of the 44 male subjects, who were fifty years or older, 40 (91%) had attended a prostate screening in the past two years from baseline visit, but 37 (84%) at follow-up visit. The decrease between visits was though not statistical significant ($p>0.05$). Adherers were more likely than non-adherers to attend a prostate screening according to authorized recommendations, but the difference was small and not statistical significant.

***Table: 13 Number of subjects, who met recommendations for three preventive screenings (colonoscopy, mammogram and prostate check), by wellness visit and medication adherence.Statistical results (P values) are shown as well.***

| Type of screening | | Colonoscopy | Mammogram | Prostate check |
|---|---|---|---|---|
| **Baseline** | | | | |
| All subjects | N (%) | 59 (67.0) | 34 (85.0) | 40 (90.9) |
| Non-adherers | N (%) | 29 (49.2) | 20 (58.8) | 17 (42.5) |
| Number of Adherers vs. Non-adherers | *P* * | 1.00 | 1.00 | 0.82 |
| **Follow-up** | | | | |
| All subjects | N (%) | 65 (73.9) | 34 (85.0) | 37 (84.1) |
| Non-adherers* | N (%) | 32 (49.2) | 20 (58.8) | 14 (37.8) |
| Number of Adherers vs. Non-adherers | *P* * | 1.00 | 1.00 | 0.38 |
| **Baseline vs. Follow-up** | | | | |
| Number of all subjects | *P* * | 0.48 | 1.00 | 0.48 |
| Number of non-adherers | *P* * | 0.73 | 1.00 | 0.60 |

*Two-tailed Fisher's exact test.

## 4.6 Lifestyle and medication adherence

Data on lifestyle factors were available for all or most subjects at both wellness visits. Data on exercise were missing for 7 (7.7%) subjects at baseline and 1 (1.1%) at follow-up visit and data on diet were missing for 21 (23%) subjects at baseline and 37 (41%) at follow-up visit.

Most subjects had well rounded meals, slept 7-8 hours per night and did not smoke. About half of all subjects exercised three or more days per week (table 14). Adherers were slightly more likely to have well rounded meals at baseline, exercise three days or more per week and sleep 7-8 hours per night, but the

difference was not statistically significant. The percentage of non-adherers between baseline and follow-up visits increased for all factors, except for non-smokers, but one more subject smoked at follow-up visit compared to baseline. The difference between visits was not statistical significant for neither adherers nor non-adherers ($p > 0.05$).

***Table: 14 Number and proportion of subjects who adapted four positive lifestyle behaviors, by medication adherence and wellness visit.***

| Lifestyle | | Well rounded meals | Exercise ≥ 3 days a week | 7-8 hour sleep | Non-smokers |
|---|---|---|---|---|---|
| **Baseline** | | | | | |
| All subjects | N (%) | 51 (72.9) | 43 (51.2) | 67 (74.4) | 84 (92.3) |
| Non-adherers | N (%) | 24 (47.1) | 20 (46.1) | 30 (44.8) | 42 (50.0) |
| Adherers vs. Non-adherers | *P** | 0.59 | 1.00 | 0.15 | 1.00 |
| **Follow-up** | | | | | |
| All subjects | N (%) | 44 (81.5) | 51 (56.7) | 65 (71.4) | 83 (91.2) |
| Non-adherers | N (%) | 23 (52.3) | 24 (47.1) | 31 (47.7) | 41 (49.4) |
| Adherers vs. Non-adherers | *P** | 0.51 | 0.85 | 0.77 | 1.00 |
| **Baseline vs. Follow-up** | | | | | |
| Total subjects | *P** | 0.36 | 0.57 | 0.77 | 1.00 |
| Non-adherers | *P** | 0.66 | 0.84 | 1.00 | 1.00 |

## 4.7 Economic outcomes and medication adherence

Economic information on three cost factors (medical, prescription and total healthcare costs) was available for all 91 subjects. Two subjects had some prescription cost at baseline but no prescription cost at follow-up visit.

Table 15 shows that the mean cost increased slightly and non-significantly between wellness visits. Non-adherers had higher mean costs and a broader range for all three cost types at baseline and medical and higher total health care cost at follow-up visit. However, no statistical significance was observed between adherers and non-adherers. Non-adherers had more increased costs between visits compared to adherers, but the difference between wellness visits was though not statistical significant for neither group.

About half of all subjects, irrespective of adherence and wellness visit, had some decrease in costs for all factors between wellness visits, while the other half increased their costs to some extent.

**Table: 15** ***Mean medical, prescription, and total health care costs for the study population (n = 91), according to medication adherence at baseline and follow-up wellness visits.***

| | Medical ($) | Prescription ($) | Total ($) |
|---|---|---|---|
| | **Baseline visit** | | |
| All subjects *(mean, range)* | 5,242 (42, 60,166) | 3,120 (15, 24,373) | 8,362 (413, 62,651) |
| Non-adherers *(mean, range)* | 6,132 (42, 60,166) | 3,306 (15, 24,373) | 9,438 (413, 62,651) |
| Adherers *(mean, range)* | 4,371 (223, 54,230) | 2,938 (59, 22,233) | 7,309 (650, 56,191) |
| Mean cost of adh vs. non-adh* *(p**)* | 0.23 | 0.91 | 0.23 |
| | **Follow-up visit** | | |
| All subjects *(mean, range)* | 5,960 (244, 153,375) | 3,331 (0, 26328) | 9,291 (354, 154,904) |
| Non-adherers *(mean, range)* | 8,075 (354, 153,375) | 3,320 (0, 21,273) | 11,395 (354, 154,904) |
| Adherers *(mean, range)* | 3,892 (244, 37,996) | 3,341 (56, 26,328) | 7233 (789, 64,324) |
| Mean cost of Adh vs. Non-adh* *(p**)* | 0.64 | 0.61 | 0.48 |
| | **Baseline vs. Follow-up (*P*‡)** | | |
| All subjects | 0.60 | 0.51 | 0.59 |
| Non-adherers | 0.50 | 0.47 | 0.57 |

*Adh: Adherers, Non-adh: Non-adherers
**Two-tailed t-test for two samples, assuming unequal variances
‡Two-tailed t-test for paired samples

Table 16 shows that a weak positive correlation with statistical significance could be observed between the number of target diagnoses and total cost, for all 91 subjects, both at baseline ($R_s$=0.28) and follow-up ($R_s$=0.46). Adherers showed slightly more correlated relationship between the two variables than

non-adherers, but the tests were only statistical significant at follow-up for these two groups.

***Table: 16 Correlation coefficients measuring statistical dependence between the number of target diagnoses and total cost within all subjects in the study population (n=91), and in relation to medication adherence at baseline and follow-up. Statistical significance of the test is shown as a P value.***

| | **Baseline** | | | **Follow-up** | | |
|---|---|---|---|---|---|---|
| **Correlation*** | **Total** | **Adherers** | **Non-adherers** | **Total** | **Adherers** | **Non-adherers** |
| $R_s$ | 0.28 | 0.27 | 0.25 | 0.46 | 0.50 | 0.40 |
| P-value | 0.0066 | 0.0645 | 0.0994 | <0.0001 | 0.0004 | 0.0068 |

*Spearman's Rank-order correlation

# 5. DISCUSSION

The project will be discussed here below and compared to other studies when possible. Recent studies on medication adherence evaluated different populations, diseases, drug classes, and/or used different methods of assessing adherence rates, making comparison of results from this project with other studies difficult. This heterogeneity is commonly found within the literature and has been affecting studies of medication adherence for decades (DiMatteo, 2004; DiMatteo, Giordani, Lepper, & Croghan, 2002). The project will be discussed in relation to the study population and demographics, medication adherence and target disease groups, in addition to secondary outcomes in relation to medication adherence. Then, strengths and limitations of the study will be discussed, followed by ideas of the next steps in further evaluations of Wingate's university-based wellness clinic.

## 5.1 Study population and demographics

Of the 363 subjects that had both baseline and follow-up visits, about half (46.6%) had one or more of the following disease groups at baseline: Diabetes, heart disease, hyperlipidemia, and hypertension. This fairly high number indicates that these chronic conditions are rather prevalent among employees and spouses at Wingate University, but is in line with the prevalence in the U.S. population (Centers for Disease Control and Prevention, 2009). Only 91 (53.8%) subjects met the inclusion criterion, and had at least one target medication at the baseline wellness visit. One might think that this percentage should be higher, but drug therapies are not always necessary to achieve therapeutic goals. The prevalence of pharmacologic treatment in USA in 2005-2008 was 69.9% for hypertension, 48.1% for high LDL-C, and 84% for diabetes (Centers for Disease Control and Prevention, 2011; Gillespie, Kuklina, Briss, Blair, & Hong, 2011; Kuklina, Shaw, & Hong, 2011).

The age distribution of all participants in the wellness program, irrespective of health status, was quite even in the year 2010, but most subjects included in this study had reached the age of fifty (88% [n = 80]). This is not surprising

since chronic conditions are generally of slow progression and long duration (World Health Organization, e.d.), and average health gets worse with increasing age.

## 5.2 Medication adherence and target disease groups

Only half (49.5%) of the study population had a MPR of 80% or higher. This indicates that there is room for improvement in this population with regard to medication adherence. This finding is in concordance with previous studies, indicating that patients with chronic conditions have difficulties with medication adherence (Briesacher, et al., 2008; P. M. Ho, et al., 2006; Pittman, et al., 2011; Wiegand, et al., 2012; Yeaw, et al., 2009; Zhang, et al., 2011).

Some subjects probably do not feel or understand the importance of medication compliance. Limited disease-related knowledge and health literacy can in some cases explain low adherence rates within a study population (Briesacher, Gurwitz, & Soumerai, 2007; Gellad, et al., 2011), despite many highly educated subjects within this study population.

Females were slightly less adherent than males, and studies on populations taking cholesterol lowering drugs have shown a similar gender pattern (Pittman, et al., 2011; Wiegand, et al., 2012). Non-adherence was more common among subjects in the age range 20 – 49 years old compared to the older population (50 years or older). Recent studies have shown similar results, where medication compliance has improved with age (Briesacher, et al., 2008; P. M. Ho, et al., 2006; Pittman, et al., 2011; Vegter, et al., 2011; Wiegand, et al., 2012; Yeaw, et al., 2009). However, this comparison is not statistically significant since most subjects belonged to the older age group. These data suggests that attention should be paid to the medication adherence of females and the younger population.

Most subjects were taking one (n = 41) or two (n = 28) target medications, but the remaining 22 subjects had three or more target drugs at baseline. It is not unusual that people who have been diagnosed with chronic conditions are treated with a combination of drugs, as a recent prospective study showed (Corrao, et al., 2011). The impact of poly-pharmacy on medication adherence

has been detected in the USA among the elderly population with different chronic conditions (Gellad, et al., 2011). The results of this project indicated, without statistical significance, that number of non-adherent subjects increased with the number of target medications. These non-adherent individuals were also using significantly more other medicines, in addition to target drugs, than adherent persons. The total number of other drugs was only collected without further examination of their characteristics, but there are few possible reasons for the difference in adherence.

Generally, there is a relationship between the number of medications and increased prescription costs. Some people cannot afford them all or do not want to spend a large amount of money on medications, so they might choose between drugs. Some of these medications might be short-term therapy, so they are chosen over the target drugs, which most often are long-term or life-long therapy. Cost-related medication non-adherence was shown to be related to poly-pharmacy in heart failure patients (Dunlay, 2011), although this was not observed in another study (Briesacher, et al., 2007). Some subjects using other medications probably have other medical conditions, in addition to their target diseases. This could impact medication adherence with target drugs since subjects might feel the efficacy of these medications sooner and have more faith in them. They could be the reason they can get to work every day, affecting their daily life and present health condition. Conversely, medications indicated for the four target conditions are often used for preventive purposes and for asymptomatic diseases, so people without an understanding of future risks and possible complications might choose not to refill these medications. As an example, depression has been associated with lower adherence to oral antihypertensive, hypoglycemic, and lipid-lowering agents (Lin et al., 2004).

Most subjects had been diagnosed with hyperlipidemia (88%) and hypertension (79%), followed by diabetes (32%) and heart disease (27%), which is in concordance with the distribution of these diseases (Centers for Disease Control and Prevention, 2011; Gillespie, et al., 2011; Kuklina, et al., 2011). Heart disease is a broad term so diagnoses of heart disease can overlap with diagnoses of hypertension and/or hyperlipidemia. This overlap in addition

to lack of information on drug indications were the reasons medication adherence was not evaluated by disease groups. The mean MPR rate and number of non-adherent subjects were similar for the four target disease groups, showing almost no difference between groups. Similar results were found in a study comparing drug adherence among seven different medical conditions, e.g. hypertension, hypercholesterolemia, and type 2 diabetes mellitus (Briesacher, et al., 2008).

Four of the eight most commonly used target medications among the study population were anti-hyperlipidemic agents, but a majority of subjects (n=71) were using medications within this category. One possible reason is the large proportion of subjects with a diagnosis of high cholesterol, but it could also be explained by the fact that lipid-lowering drugs are part of treatment for more than one medical condition and are the primary therapeutic modality for reducing the risk of cardiovascular outcomes (National Institutes of Health, 2002). As an example, it was observed in a large cohort study that more than 25% of subjects receiving antihypertensive medications, experienced co-treatments with lipid-lowering drugs (Corrao, et al., 2011). It is also well known that diabetes patients have high cholesterol levels and increased frequency of hypertension (National Institutes of Health, 2002). That can in part explain the fact that most subjects had either two or three target diagnoses.

The anti-hyperlipidemic agent, simvastatin, was the most commonly used agent in the study population. Three of the four most commonly used cholesterol lowering agents were HMG CoA reductase inhibitors, or statins. This was expected, as this drug class is most effective and practical for reducing LDL-cholesterol concentrations and allows attainment of the LDL goal in most higher risk patients (National Institutes of Health, 2002). When looking at the most commonly used statins (simvastatin, atorvastatin, and rosuvastatin), subjects were most adherent to simvastatin, but least adherent to atorvastatin. The five subjects using the combination of ezetimibe and simvastatin were all non-adherent. One possible reason for greater proportional adherence to simvastatin compared to atorvastatin, rosuvastatin, and the combination of exetimibe and simvastatin is lower prescription cost. However, studies have

shown that they are even more intensive therapies compared to simvastatin, so compliance to these drugs is of great importance (Furman, Meier, Malmstrom, Lopez, & Schaefer, 2011; Simpson et al., 2009). Rosuvastatin and the combination therapy are only available as brand name drugs, which are generally more expensive than generic medications.

Subjects were least adherent to the active ingredient niacin, but all subjects using it were prescribed the brand drug Niaspan, which is a proprietary extended-release formulation of nicotinic acid. It has been detected before that individuals using niacin products were significantly more likely to be non-adherent than patients receiving other lipid-lowering therapy, such as statins (Wiegand, et al., 2012). Niaspan, and other nicotinic acid therapies have been accompanied by number of side effects, such as hyperglycemia and a variety of gastrointestinal system interactions, but statins are normally well tolerated (National Institutes of Health, 2002). These adverse outcomes are probably the main reason for noncompliance, as studies have found that patients who experience side effects are more likely to be non-adherent to their medications (Grant, et al., 2003).

Since most subjects were treated with lipid-lowering agents it would be helpful if a pharmacist informs participants about the importance of medication adherence since non-adherence to these agents is well known (Briesacher, et al., 2008; Yeaw, et al., 2009; Zhang, et al., 2011). It is also important because people often do not feel the effects of the drug since there are no direct symptoms from high cholesterol levels (National Institutes of Health, 2002).

When the most common pharmacologic categories were compared, subjects were least adherent to anti-diabetic agents, followed by diuretics, anti-hyperlipidemics, ACE inhibitors, and ARBs. There was a small non-significant difference in the number of non-adherent subjects, indicating almost no difference between categories. Even though the researcher was unable to obtain subjects‘ drug indications from available data, ACE inhibitors and ARBs are well known drug classes for treatment of high blood pressure, and diuretics are often recommended as the initial treatment of hypertension (B. V. Patel, Remigio-Baker, Thiebaud, Preblick, & Plauschinat, 2008). Greater adherence

rates for anti-hypertensive agents compared to anti-diabetic and lipid-lowering therapy have also been detected in the literature (Briesacher, et al., 2008; Chapman et al., 2005; P. Michael Ho, et al., 2008; Vegter, et al., 2011). Overall, adherence tends to be lower for statins relative to anti-hyperglycemic agents in most (Briesacher, et al., 2008; Yeaw, et al., 2009; Zhang, et al., 2011), but not all cross-sectional, retrospective analyzes (Lau & Nau, 2004). A study found that type 2 diabetes patients were less adherent to anti-hyperglycemic drug regimens (28.9%), compared to lipid-modifying drugs (26.9%), and antihypertensive agents (18.8%) (Lau & Nau, 2004), which is the same pattern as was observed in this project.

The larger proportion of non-adherent subjects using anti-diabetic compared to lipid-lowering agents is surprising in the sense that high cholesterol is generally asymptomatic (National Institutes of Health, 2002), while type 2 diabetes is often associated with symptoms such as hypoglycemia and hyperglycemia ("Standards of Medical Care in Diabetes—2012," 2012). However, the comparison between the most common categories is limited. No clear conclusions can be drawn due to unequal distribution in number of users and drug agents within each pharmacologic category.

Only two subjects from the study population were using insulin, which indicates that most participants had been diagnosed with type 2 diabetes. Of the six anti-diabetic agents subjects were using, about half (9 of 19) were receiving Metformin, which is the recommended initial therapy at the time of type 2 diabetes diagnosis ("Standards of Medical Care in Diabetes—2012," 2012). The other half was using agents within other anti-diabetic categories, i.e. sulfanylureas, thiazolidinediones, glucagon-like peptide-1 (GLP-1) agonists, and dipeptidyl peptidase four (DPP-4) inhibitors. About 33% of subjects receiving metformin were non-adherent. Recent studies have found that regimen complexity, including more frequent dosing, is related to poorer adherence (Claxton, et al., 2001; Ingersoll & Cohen, 2008). This can possibly be the reason for inadequate adherence to metformin and some other anti-diabetic agents (Donnan, MacDonald, & Morris, 2002) where complex regimens and frequent doses are needed to reach glycemic goals in type 2 diabetes (Nathan

et al., 2009). The once-daily regimen of lipid-lowering drugs, such as statins (National Institutes of Health, 2002), could among other things explain the difference in adherence rates between anti-diabetic and anti-hyperlipidemic categories in this project.

Overall, subjects were more adherent to metformin compared to other anti-diabetic classes. Metformin has been used safely and causes weight stability, or moderate weight loss, but most subjects in this project (83.5%) had abnormal values for body mass index. Generally, metformin is well tolerated, with minimal side effects (Nathan, et al., 2009). Conversely, the other anti-diabetic agents used among subjects are new on the market or have been associated with less safety, weight gain, or number of side effects (Nathan, et al., 2009). All these factors can explain lower adherence rates among these medications but side effects are a common problem with medication use among type 2 diabetes (Grant, et al., 2003). Self-management is also important in diabetes treatment, so a lack of disease knowledge and health literacy can affect these skills (Williams Mv, 1998). Lack of conviction on the patient's part that the medicines are helping either current symptoms or future health has also been seen among patients with type 2 diabetes (Grant, et al., 2003), which could possible cause medication non-compliance.

## 5.3 Secondary outcomes and medication adherence

Screening results of biometric values from physicians or wellness visits were more often available for mandatory screening values (blood glucose and lipoprotein analysis), compared to other clinical indicators. This means that data were not available for all 91 subjects, but that size of a study population is already limited for statistical testing. The varying number of subjects with available data for the nine measures makes comparison difficult.

Lifestyle modifications are important in treatment and management of the chronic diseases studied in this project, either alone as an initial treatment or in combination with drug therapy. Low fat and well-rounded diet, weight loss, adequate physical activity, and smoking cessation are all part of the program (National Institutes of Health, 2002, 2004; "Standards of Medical Care in

Diabetes—2012," 2012). Therefore, it was interesting to examine whether an association existed between lifestyle and medication adherence among subjects. Missing data on exercise and diet reduced the ability to do so. Data on diet were more often not available, since they were not recorded if subjects opted for no wellness visits due to documentation from a physician's visit to fulfill all requirements.

Most subjects had adapted a healthier lifestyle, but an increase in exercise frequency would be beneficial for participants since only half of the study population exercised three or more days per week. Small or no difference was seen between adherent and non- adherent subjects, but adherent subjects were slightly more likely to have well rounded meals at baseline and adequate sleep at nights. Overall, non-adherent subjects improved their lifestyle behavior between wellness visits, but the difference was rather small and non-significant.

Subjects with abnormal values for body mass index comprised 83.5% of the study population, and an improvement between visits was negligible. Weight loss is recommended to prevent further complications and improve health for all overweight and obese individuals with diagnosis of diabetes, hyperlipidemia, and hypertension (He, Whelton, Appel, Charleston, & Klag, 2000; National Institutes of Health, 2002; "Standards of Medical Care in Diabetes—2012," 2012). Therefore, it would be beneficial for subjects' health to reduce their weight.

Non-adherent subjects were more likely than adherent individuals to have abnormal body mass index and waist circumference, but without statistical significance. Inadequate health literacy has been related to deficient medication compliance and fewer important lifestyle modifications. This has been detected among the elderly (Gellad, et al., 2011), and subjects with chronic conditions (Williams Mv, 1998). There is a possibility that these subjects have not been well informed by their physicians or other healthcare professionals about the importance of weight reduction and other lifestyle modifications.

Total number of subjects with abnormal biometric values decreased non-significantly for all factors but three (high-density lipoprotein, systolic blood pressure, and waist circumference). Other pharmacist-directed intervention and

wellness programs (B. M. Bluml, et al., 2000; Bunting, et al., 2003; Bunting, et al., 2008; Morgado, et al., 2011; Villeneuve, et al., 2010) have also detected improvements for these clinical outcomes during follow-up visits, but no or limited improvement in high-density lipoprotein has been seen before (Aldana, et al., 2002; Bunting, et al., 2008). This suggests that participants in Wingate's wellness program achieved clinical improvements between two wellness visits. Despite of non-significant improvement between baseline and follow-up visits, the program should put more emphasis on the three factors, which did not improve between visits.

When subjects were asked about frequency of physician visits, all 91 individuals had an appointment sometime in the past three years from wellness visits. These data are rather reliable and valid since subjects' self-report was most often confirmed by medical claims. This time period, three years, is rather long but could not be truncated to one year due to unavailable data. The physician-patient relationship is important to make sure of optimal medication adherence. Regular physician visits have shown to decrease the risk of non-adherence among patients in the USA receiving antihypertensive and lipid-lowering therapy (Chapman, Petrilla, Benner, Schwartz, & Tang, 2008; Wiegand, et al., 2012), but no assumptions can be made of possible association between physician visits and medication adherence since all subjects had at least one appointment.

Certain types of cancer can be detected early through screenings but attendance to them is under the patients' control. Physicians' recommendations to attend these screenings are probably a determining factor in patients' decisions. Participants in the wellness program at Wingate University were asked if they had been to breast, colon, and prostate cancer screenings. Recommendation were made when appropriate, which could encourage participants. Subjects' attendance to recommended breast, colon, and prostate cancer screenings were in concordance or slightly higher than has been seen among the U.S. population (Andriole, et al., 2005; Centers for Disease Control and Prevention, 2012). A likely reason is the study population's optimal visit rate to physicians and pharmacist's intervention in the wellness program. Present

chronic conditions might influence people's decisions, since they might not want to risk their health condition any further. No association between attendance to the three cancer screenings and adherence to target medications could be seen among the study population, except slightly increased probability that adherent subjects would attend prostate cancer screening.

The economic evaluation in this study was a simple calculation of costs. Data were reported by the insurance company serving Wingate University so no primary data collection done. Reliable and valid data were used to obtain financial information, but there was a great possibility of overlapping since data could not be collected exactly twelve months prior to wellness visits. That means that costs for some subjects covered less or more than a year, which can both over-and underestimate costs.

As expected, the financial data was not normally distributed and the standard deviation of the mean was very high. That can be explained by the fact that some subjects had extremely high costs and therefore skewed the picture. Log-transformation on the data resulted in approximately normal distribution. Studies have found decrease in medical and total healthcare costs, despite an increase in prescription costs, among populations as a consequence of a pharmacist´s interventions (Bunting, et al., 2003; Bunting, et al., 2008). However, this project suggested rising costs for all factors between wellness visits. Overall, non-adherent subjects had higher mean costs and broader range that adherent subjects. They also had greater increased costs between wellness visits, even if the difference was not significant.

## 5.4 Strengths and limitations of the study

Originally, the primary objective of this project was to compare already evaluated medication adherence to prescription therapy between baseline and follow-up wellness visits with the pharmacist, looking one year back from each visit. It turned out when work started that required data were unfortunately not available. Therefore, medication adherence was assessed from prescription refills in order to get a snapshot of the medication adherence among participants with certain chronic diseases in the wellness program. However,

this decision prevented an evaluation of pharmacist's impact in Wingate's wellness clinic and possible causal relationships. It gave instead a description of the study population regarding to medication adherence, which was then examined in relation to secondary outcomes. Due to limited time and resources in this project a pilot study was conducted to build some foundation for further evaluations of the University-based Wellness Program.

Most previous studies, using pharmacy claims, have focused on one disease or drug class, by using variety of methods for adherence assessment. Therefore, additional studies are needed to compare medication adherence among different medical conditions and drug classes within similar or the same population. Two recent studies compared medication adherence among few diseases or medication classes (Briesacher, et al., 2008; Yeaw, et al., 2009). The limitations of these studies were partly dealt with in this project by evaluating clinical, economic, and health behavior related correlates with non-adherence, which have rarely been assessed in relation to medication compliance. A standardized approach was applied to measure adherence and to identify the sample by using the same criteria.

The researcher spent three mornings a week, from February 15$^{th}$ to March 16$^{th}$, shadowing the pharmacist in the wellness clinic and participating in the screening process. Therefore, she developed a basic understanding of the overall process in addition to the knowledge obtained from the literature.

Descriptive studies are important to record and transfer ideas, but the number of available subjects and a weak study design prevented firm recommendations to administrators at Wingate University to assess the health and impact on costs of the wellness program. A complete list was of all participants in Wingate University's self-insured medical plan was used in this project. The benefit of this method is that all available subjects meeting the inclusion criteria were included in the study, preventing the risk of selection bias. It also decreased bias that all subjects were within the same health plan, but at the same time the external validity is negatively affected. Therefore, it is difficult to generalize the results to other populations, places, and times. The effort of maintaining data privacy in this study was an advantage.

Information bias was minimized in the data collection. Same methods were used in collecting data for subjects despite of their adherence to prescription therapy, since data for secondary outcomes were collected before the evaluation of medication adherence. Same data sources were used at baseline and follow-up visit. Some variables had undergone changes between years in this study, but this only affected how data on diet and physician visits was collected in this study.

The study period was rather short, or about a year. However, it could not have been extended due to limited available data before the start of the mandatory wellness program in the year 2009 and the short time between the last follow-up visit in the year 2011 and the onset of this study. Many previous retrospective studies evaluating medication adherence and/or clinical and economic outcomes do not extend over longer periods than twelve months (Dunlay, 2011; P. M. Ho, et al., 2006; Pittman, et al., 2011; Wiegand, et al., 2012). Less than six months or more than eighteen months between wellness visits could possibly cause bias. Subjects did not have the opportunity to show some improvement for measured factors in just a few months, but those who had more time between wellness visits had more chance to show improvements. These subjects made up 30% of the study population, but were not excluded from the study due to limited sample size.

The research is also limited due to its design. This secondary data analysis is limited to existing data and their availability, reliability, and validity. Results from retrospective analyses can be problematic. The relationship between covariates and non-adherence cannot be interpreted as causal, as the association may be confounded by latent or unmeasured variables. The study design and limited sample size prevented an approach to adjusting for possible confounding factors. The One-Group Pretest-Posttest design is a weak study design (Shadish, Cook, & Campell, 2002). Since the baseline visit takes place before the follow-up visit, improvements found between visits might have occurred for many reasons. Confounding factors could possibly have threatened the internal validity of the results.

Only one difference between adherent and non-adherent subjects emerged to be statistically significant. Statistical conclusion validity was reduced by low sample size and consequent low power. The size of the study probably influenced the magnitude of the *P* value and the likelihood that almost all observed differences attained statistical significance. In addition, almost all data were skewed.

Pharmacy claims records are relatively efficient data for evaluation of medication adherence and persistence in large populations if data are deemed complete (Andrade, et al., 2006). The dispensing data used in this project were a reliable and valid source of prescription refills, and the medication possession ratio is an accepted standard for evaluation of medication adherence, using retrospective data (Halpern, et al., 2006). The small sample size impacted this evaluation as well, making it harder to make assumptions of overall medication adherence from rather few prescription refills. Although, by using automated dispensing data, the medication adherence could be assessed accurately for each subject, independent of varying lengths of study periods.

The use of pharmacy records has its limitations. Certain factors could have confounded the estimation of adherence rate to some extent. It is possible that patients acquired prescription medications from sources other than the pharmacies included in the database, which could have led to underestimation of medication adherence. Drug acquisition was assessed rather than drug exposure. Therefore, it is possible that subjects switched between drugs within the same pharmacologic category or discontinued therapy from a physician's advice sometime within the study period. In that case they would have been evaluated as non-adherers even though they were actually adherers, resulting in underestimation of the overall medication adherence. On the other hand, the adherence could have been overestimated as well since it is unknown if subjects consumed their medications at all, occasionally, or at the right time.

The validity and reliability of data sources varied in this project. Subjects' self-report probably caused some information bias, but data obtained from the electronic database, Healthgram, was reliable and valid. If a subject opted for documentation from a physician's visit to fulfill the wellness program's

requirement, no intervention and consultation could be made. That resulted in no available self-reported data from the Wellness Screening Forms, affecting the measurement of some variables and outcomes. If subjects opted for a physician visit, different equipment and persons performed measurements on clinical indicators, reducing the reliability of available data. The Wellness Screening Forms were handwritten, and sometimes it was difficult to understand the writing, which might have resulted in errors in data recording. All these factors might have compromised the internal validity of the study.

The primary objective, to describe medication adherence to prescription therapy for participants in Wingate University's wellness program, was obtained. Secondary objectives, to assess changes in various outcomes between wellness visits and in relation to medication adherence, were obtained as well. On the other hand, the overall evaluation was a pilot study and had its limitations.

## 5.5 Suggestions of further evaluation of the wellness program

It was hard to make any recommendations base on the results of this study due to its limitations. Interventions to improve medication adherence and overall health among participants with chronic conditions would be useful addition to the program. Results from this pilot study would be a good basis for an extended study, but with improvements.

An extended study period is recommended, but a study, which observed the impact of a wellness program, indicated that it takes time to see changes in health outcomes and costs (Loeppke, et al., 2010). A retrospective cohort study is one possibility to overcome barriers and improve the study design of this project.

If the same population would be evaluated in a retrospective study, an extension of the follow-up period is necessary. Therefore, a few years' wait is needed before next assessment of the wellness program, and this would allow for calculating the basis of person time in the project. A retrospective cohort study for evaluation on medication adherence from pharmacy claims would be useful, giving the opportunity of few years of follow-up, which would greatly

increase the internal validity of the study to a great extent. Personal factors such as peoples' belief in medications, health literacy, disease knowledge, and complications with drugs are all factors believed to interfere with non-adherence among this study population. Therefore, qualitative interviews would be an important addition to further study to get insight into subjects' life and their experiences. This would strengthen the study design and build a better foundation for hypothesis making. This study only focused on direct medical cost, but it would be interesting to evaluate indirect, and intangible costs as well. More extensive economic evaluation would be beneficial to get more valid results for administrators as basis for decisions about the wellness program.

Descriptive studies are useful for the formulation of hypothesis that can subsequently be tested, using an analytic design. It would be interesting to evaluate the impact of pharmacist's interventions in the wellness clinic prospectively for a longer time than a year.

# 6. CONCLUSIONS

Evaluations of worksite wellness programs are few, especially within the university area. According to covered literature, this study is among the first to assess medication adherence among more than one chronic disease in relation to several outcomes. Possible suggestions of clinical, economic, and health behavior related effect on medication adherence also emerged.

Currently, the wellness program at Wingate University only includes primary and secondary prevention care performed by a pharmacist, but the results of this study suggested interventions to increase participants' health consciousness. The results also supported need for improvement in medication adherence among employees and spouses participating in Wingate University's wellness program. A specially trained and experienced healthcare professional, e.g. pharmacist, would be a suitable provider, but the impact of pharmacist interventions on medication adherence has been detected.

One idea is to implement a disease management program, which focus on individuals at great risk for chronic conditions. Since subjects were least adherent to anti-diabetic agents, a certified diabetes educator would be an appropriate option, which is the specialty of the pharmacist who directed the wellness clinic at the time of this project. Adding tertiary prevention care would not only be beneficial for increased medication adherence, since the results showed that lifestyle factors, and biometric measures needed much improvement.

This project provided an idea of the situation among individuals in the wellness program that had been diagnosed with diabetes, heart disease, hypertension and/or hyperlipidemia. However, further and more extensive evaluation of factors measured in this study is a worthy project, but a stronger study design is recommended. It is also important to assess the foundation for a disease management program as an addition to current wellness program.

# 7. GRATITUDE

I would like to thank those who contributed their time and effort to help me on this project.

I would like to thank my instructors, Angela Pegram and Sabrina W. Cole, for all guidance and help related to this project. I am also very grateful for the experience I got in the wellness clinic during my research project at Wingate. I would also like to thank Tracy Hunter for making all necessary connections in relation to the creation of this project.

My coordinator, Pétur Sigurður Gunnarsson, and co- instructor, Anna Birna Almarsdóttir, did an unvaluable job regarding all instructions and help related to this thesis.

I would also like to thank my boyfriend, Ólafur Björn Loftsson, for all the support and help during this process. My family and friends deserves a lot of compliments as well for all their help and support during my pharmacy program

# REFERENCES


Aldana, S. G., Greenlaw, R., Diehl, H. A., Englert, H., & Jackson, R. (2002). Impact of the coronary health improvement project (CHIP) on several employee populations. [Multicenter Study]. *J Occup Environ Med, 44*(9), 831-839.

American Cancer Society. (2012a). American Cancer Society recommendations for prostate cancer early detection. Retrieved 06.02., 2012, from http://www.cancer.org/Cancer/ProstateCancer/MoreInformation/ProstateCancerEarlyDetection/prostate-cancer-early-detection-acs-recommendations

American Cancer Society. (2012b). *Cancer Facts & Figures 2012*. Atlanta: American Cancer Society.

American Heart Association. (2011). What Your Cholesterol Levels Mean. Retrieved 06.02., 2012, from http://www.heart.org/HEARTORG/Conditions/What-Your-CholestrolLevels-Mean_UCM_305562_Article.jsp

Andrade, S. E., Kahler, K. H., Frech, F., & Chan, K. A. (2006). Methods for evaluation of medication adherence and persistence using automated databases. *Pharmacoepidemiol Drug Saf, 15*(8), 565-574.

Andriole, G. L., Levin, D. L., Crawford, E. D., Gelmann, E. P., Pinsky, P. F., Chia, D., et al. (2005). Prostate Cancer Screening in the Prostate, Lung, Colorectal and Ovarian (PLCO) Cancer Screening Trial: Findings From the Initial Screening Round of a Randomized Trial. *Journal of the National Cancer Institute, 97*(6), 433-438.

Bae, J. P., Dobesh, P. P., Klepser, D. G., Anderson, J. D., Zagar, A. J., McCollam, P. L., et al. (2012). Adherence and dosing frequency of common medications for cardiovascular patients. *Am J Manag Care, 18*(3), 139-146.

Baicker, K., Cutler, D., & Song, Z. (2010). Workplace wellness programs can generate savings. [Meta-Analysis]. *Health Aff (Millwood), 29*(2), 304-311.

Balkrishnan, R., Rajagopalan, R., Camacho, F. T., Huston, S. A., Murray, F. T., & Anderson, R. T. (2003). Predictors of medication adherence and associated health care costs in an older population with type 2 diabetes

mellitus: a longitudinal cohort study. [Research Support, Non-U.S. Gov't]. *Clin Ther, 25*(11), 2958-2971.

Balkrishnan, R., Rajagopalan, R., Camacho, F. T., Huston, S. A., Murray, F. T., & Anderson, R. T. (2003). Predictors of medication adherence and associated health care costs in an older population with type 2 diabetes mellitus: A longitudinal cohort study. *Clinical Therapeutics, 25*(11), 2958-2971.

Barber, N. (2001). Pharmaceutical care and medicines management - is there a difference? *Pharmacy world & science, 23*(6), 210-211.

Beney, J. (2010). What is Clinical Pharmacy? Retrieved 25.04, 2012, from http://www.escpweb.org/cms/Clinical_pharmacy

Bluml, B. M., Cziraky, M. J., & McKenney, J. M. (2000). Pharmaceutical Care Services and Results in Project ImPACT: Hyperlipidemia. *Journal of the American Pharmacists Association, 40*(2).

Bluml, B. M., Ellis, W. M., & Fera, T. (2009). Diabetes Ten City Challenge: Final economic and clinical results. *Journal of the American Pharmacists Association, 49*(3).

Bodenheimer, T. S., & Grumbach, K. (2009). Paying for Health care. In T. S. Bodenheimer & K. Grumbach (Eds.), *Understanding Health Policy: A Clinical Approach* (5 ed.). New York: McGraw-Hill.

Bouvy, M. L., Heerdink, E. R., Urquhart, J., Grobbee, D. E., Hoe, A. W., & Leufkens, H. G. M. (2003). Effect of a pharmacist-led intervention on diuretic compliance in heart failure patients: a randomized controlled study. *Journal of Cardiac Failure, 9*(5), 404-411.

Briesacher, B. A., Andrade, S. E., Fouayzi, H., & Chan, K. A. (2008). Comparison of drug adherence rates among patients with seven different medical conditions. *Pharmacotherapy, 28*(4), 437-443.

Briesacher, B. A., Gurwitz, J. H., & Soumerai, S. B. (2007). Patients at-risk for cost-related medication nonadherence: a review of the literature. *J Gen Intern Med, 22*(6), 864-871.

Brouwers, M. C., De Vito, C., Bahirathan, L., Carol, A., Carroll, J. C., Cotterchio, M., et al. (2011). What implementation interventions increase cancer screening rates? a systematic review. *Implement Sci, 6*, 111.

Buck Consultans. (2010). *Working Well: A Global Survey of Health Promotion and Workplace Wellness Strategie*.

Bunting, B. A., & Cranor, C. W. (2006). The Asheville Project: Long-Term Clinical, Humanistic, and Economic Outcomes of a Community-Based Medication Therapy Management Program for Asthma. *Journal of the American Pharmacists Association, 46*(2), 133-147.

Bunting, B. A., Cranor, C. W., & Christensen, D. B. (2003). The Asheville Project: Long-Term Clinical and Economic Outcomes of a Community Pharmacy Diabetes Care Program. *Journal of the American Pharmacists Association, 43*(2), 173-184.

Bunting, B. A., Smith, B. H., & Sutherland, S. E. (2008). The Asheville Project: Clinical and economic outcomes of a community-based long-term medication therapy management program for hypertension and dyslipidemia. *Journal of the American Pharmacists Association, 48*(1), 23-31.

Butler, R. J., Davis, T. K., Johnson, W. G., & Gardner, H. H. (2011). Effects of nonadherence with prescription drugs among older adults. *Am J Manag Care, 17*(2), 153-160.

Carnethon, M., Whitsel, L. P., Franklin, B. A., Kris-Etherton, P., Milani, R., Pratt, C. A., et al. (2009). Worksite Wellness Programs for Cardiovascular Disease Prevention: A Policy Statement From the American Heart Association. *Circulation: Journal of the American Heart Association, 120*, 1725-1741.

Carter, B. L., Bergus, G. R., Dawson, J. D., Farris, K. B., Doucette, W. R., Chrischilles, E. A., et al. (2008). A cluster randomized trial to evaluate physician/pharmacist collaboration to improve blood pressure control. *J Clin Hypertens (Greenwich), 10*(4), 260-271.

Centers for Disease Control and Prevention. (2008). *National Ambulatory Medical Care Survey: 2008 Summary Tables*: National Center for Health Statistics.

Centers for Disease Control and Prevention. (2009). *National Ambulatory Medical Care Survey: 2009 Summary Tables*: National Center for Health Statistics.

Centers for Disease Control and Prevention. (2011). *National diabetes fact sheet: national estimates and general information on diabetes and prediabetes in the United States, 2011.* Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention.

Centers for Disease Control and Prevention. (2012). Cancer Screening - United States, 2010. *MMWR, 61*(3), 41-44.

Chapman, R. H., Benner, J. S., Petrilla, A. A., Tierce, J. C., Collins, S. R., Battleman, D. S., et al. (2005). Predictors of adherence with antihypertensive and lipid-lowering therapy. *Arch Intern Med, 165*(10), 1147-1152.

Chapman, R. H., Petrilla, A. A., Benner, J. S., Schwartz, J. S., & Tang, S. S. (2008). Predictors of adherence to concomitant antihypertensive and lipid-lowering medications in older adults: a retrospective, cohort study. *Drugs Aging, 25*(10), 885-892.

Choo, P. W., Rand, C. S., Inui, T. S., Lee, M. L., Cain, E., Cordeiro-Breault, M., et al. (1999). Validation of patient reports, automated pharmacy records, and pill counts with electronic monitoring of adherence to antihypertensive therapy. *Med Care, 37*(9), 846-857.

Claxton, A. J., Cramer, J., & Pierce, C. (2001). A systematic review of the associations between dose regimens and medication compliance. *Clinical Therapeutics, 23*(8), 1296-1310.

Colkesen, E. B., Niessen, M. A., Peek, N., Vosbergen, S., Kraaijenhagen, R. A., van Kalken, C. K., et al. (2011). Initiation of health-behaviour change among employees participating in a web-based health risk assessment with tailored feedback. *J Occup Med Toxicol, 6*, 5.

Corrao, G., Parodi, A., Nicotra, F., Zambon, A., Merlino, L., Cesana, G., et al. (2011). Better compliance to antihypertensive medications reduces cardiovascular risk. *J Hypertens, 29*(3), 610-618.

Cushing, A. a. M., R. (2007). Optimizing medicines management: From compliance to concordance. *Therapeutics and Clinical Risk Management, 3*(6), 1047–1058.

Dawber, T. R., Meadors, G. F., & Moore, F. E. Jr. (1951). Epidemiological Approaches to Heart Disease: The Framingham Study*. *41*(3), 279-286. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1525365/

The Definition of Clinical Pharmacy. (2008). *Pharmacotherapy, 28*(6), 816-817.

DiMatteo, M. R. (2004). Variations in patients' adherence to medical recommendations: a quantitative review of 50 years of research. [Meta-Analysis

Research Support, Non-U.S. Gov't]. *Med Care, 42*(3), 200-209.

DiMatteo, M. R., Giordani, P. J., Lepper, H. S., & Croghan, T. W. (2002). Patient adherence and medical treatment outcomes: a meta-analysis. [Meta-Analysis

Research Support, Non-U.S. Gov't]. *Med Care, 40*(9), 794-811.

Donnan, P. T., MacDonald, T. M., & Morris, A. D. (2002). Adherence to prescribed oral hypoglycaemic medication in a population of patients with Type 2 diabetes: a retrospective cohort study. *Diabet Med, 19*(4), 279-284.

Dunlay, S. M. *e. a.* (2011). Medication Adherence Among Community-Dwelling Patients With Heart Failure. *Mayo Clinic Proceedings, 86*(4), 273-281.

Fairman, K., & Motheral, B. (2000). Evaluating Medication Adherence: Which Measure Is Right for Your Program? *J Managed Care Pharm, 6*(6), 499-504.

Fletcher, R. H., & Fletcher, S. W. (2005). Prevention *Clinical Epidemiology: The Essentials.* (Vol. 4, pp. 147-167): Lippincott Williams & Wilkins.

Ford, E. S., Ajani, U. A., Croft, J. B., Critchley, J. A., Labarthe, D. R., Kottke, T. E., et al. (2007). Explaining the Decrease in U.S. Deaths from Coronary Disease, 1980–2000. *New England Journal of Medicine, 356*(23), 2388-2398.

Framingham Heart Study. (e.d.). Retrieved 19.04., 2012, from http://www.framinghamheartstudy.org/

Fronstin, P. (2001). The history of employment-based health insurance: the role of managed care. [Historical Article]. *Benefits Q, 17*(2), 7-16.

Furman, A., Meier, J. L., Malmstrom, R. A., Lopez, J. R., & Schaefer, S. (2011). Comparative efficacy of ezetimibe/simvastatin, rosuvastatin, and atorvastatin in uncontrolled hyperlipidemia patients. [Comparative Study]. *Am J Manag Care, 17*(8), 538-544.

Garrett, D. G., & Bluml, B. M. (2005). Patient self-management program for diabetes: first-year clinical, humanistic, and economic outcomes. *J Am Pharm Assoc (2003), 45*(2), 130-137.

Gellad, W. F., Grenard, J. L., & Marcum, Z. A. (2011). A Systematic Review of Barriers to Medication Adherence in the Elderly: Looking Beyond Cost and Regimen Complexity. *The American Journal of Geriatric Pharmacotherapy, 9*(1), 11-23.

Gillespie, C., Kuklina, E., Briss, P., Blair, N., & Hong, Y. (2011). Vital Signs: Prevalence, Treatment, and Control of Hypertension --- United States, 1999--2002 and 2005--2008. *60*(4), 103-108. Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6004a4.htm

Goetzel, R. Z. (2010). A Multi-Worksite Analysis of the Relationships Among Body Mass Index, Medical Utilization, and Worker Productivity. *JOEM, 52*(1), 52-58.

Goetzel, R. Z., Carls, G. S., Wang, S., Kelly, E., Mauceri, E., Columbus, D., et al. (2009). The relationship between modifiable health risk factors and medical expenditures, absenteeism, short-term disability, and presenteeism among employees at novartis. *J Occup Environ Med, 51*(4), 487-499.

Goetzel, R. Z., & Ozminkowski, R. J. (2008). The health and cost benefits of work site health-promotion programs. [Review]. *Annu Rev Public Health, 29*, 303-323.

Grant, R. W., Devita, N. G., Singer, D. E., & Meigs, J. B. (2003). Polypharmacy and medication adherence in patients with type 2 diabetes. [Research Support, Non-U.S. Gov't

Research Support, U.S. Gov't, P.H.S.]. *Diabetes Care, 26*(5), 1408-1412.

Gu, Q., Dillon, C. F., & Burt, V. L. (2010). *Prescription drug use continues to increase: U.S. prescription drug data for 2007-2008. NCHS data brief.* Hyattsville: National Center for Health Statistics.

Halpern, M. T., Khan, Z. M., Schmier, J. K., Burnier, M., Caro, J. J., Cramer, J., et al. (2006). Recommendations for evaluating compliance and persistence with hypertension therapy using retrospective data. *Hypertension, 47*(6), 1039-1048.

He, J., Whelton, P. K., Appel, L. J., Charleston, J., & Klag, M. J. (2000). Long-Term Effects of Weight Loss and Dietary Sodium Reduction on Incidence of Hypertension. *Hypertension, 35*(2), 544-549.

Hepler, C. D., & Strand, L. M. (1990). Opportunities and responsibilities in pharmaceutical care. *Am J Hosp Pharm, 47*(3), 533-543.

Hess, L. M., Raebel, M. A., Conner, D. A., & Malone, D. C. (2006). Measurement of adherence in pharmacy administrative databases: a proposal for standard definitions and preferred measures. *Ann Pharmacother, 40*(7-8), 1280-1288.

Hewitt, A. (2010). Health Care Cost Trends from http://www2. hewittassociates.com/Intl/NA/en-US/KnowledgeCenter/ArticlesReports/ ArticleDetail.aspx?cid=7116.

Ho, P. M., Magid, D. J., Shetterly, S. M., Olson, K. L., Maddox, T. M., Peterson, P. N., et al. (2008). Medication nonadherence is associated with a broad range of adverse outcomes in patients with coronary artery disease. *American Heart Journal, 155*(4), 772-779.

Ho, P. M., Rumsfeld, J. S., Masoudi, F. A., McClure, D. L., Plomondon, M. E., Steiner, J. F., et al. (2006). Effect of medication nonadherence on hospitalization and mortality among patients with diabetes mellitus. *Arch Intern Med, 166*(17), 1836-1841.

Howard, R. L., Avery, A. J., Slavenburg, S., Royal, S., Pipe, G., Lucassen, P., et al. (2007). Which drugs cause preventable admissions to hospital? A systematic review. *Br J Clin Pharmacol, 63*(2), 136-147.

Hughes, C., Hawwa, A., Scullin, C., Anderson, C., Bernsten, C., Björnsdóttir, I., et al. (2010). Provision of pharmaceutical care by community pharmacists: a comparison across Europe. *Pharmacy world & science, 32*(4), 472-487.

Ingersoll, K. S., & Cohen, J. (2008). The impact of medication regimen factors on adherence to chronic treatment: a review of literature. *J Behav Med, 31*(3), 213-224.

Kheir, N. M., Foppe van Mil, J. W., Shaw, J. P., & Sheridan, J. L. (2004). Health-related quality of life measurement in pharmaceutical care Targeting an outcome that matters. *Pharmacy world & science, 26*(3), 125-128.

King, D. E., Mainous, A. G., 3rd, Carnemolla, M., & Everett, C. J. (2009). Adherence to healthy lifestyle habits in US adults, 1988-2006. *Am J Med, 122*(6), 528-534.

King, D. E., Mainous Iii, A. G., & Geesey, M. E. (2007). Turning Back the Clock: Adopting a Healthy Lifestyle in Middle Age. *Am J Med, 120*(7), 598-603.

Kripalani, S., Yao, X., & Haynes, R. B. (2007). Interventions to enhance medication adherence in chronic medical conditions: a systematic review. *Arch Intern Med, 167*(6), 540-550.

Kuklina, E. V., Shaw, K. M., & Hong, Y. (2011). Vital Signs: Prevalence, Treatment, and Control of High Levels of Low-Density Lipoprotein Cholesterol --- United States, 1999--2002 and 2005--2008. *60*(4), 109-114. Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6004a5.htm?s_cid=mm6004a5_w

Lars Osterberg, M. D., and Terrence Blaschke, M.D. (2005). Adherence to Medication. *N Engl J Med, 353*, 487-497.

Lau, D. T., & Nau, D. P. (2004). Oral antihyperglycemic medication nonadherence and subsequent hospitalization among individuals with type 2 diabetes. [Research Support, Non-U.S. Gov't]. *Diabetes Care, 27*(9), 2149-2153.

Laubscher, T., Evans, C., Blackburn, D., Taylor, J., & McKay, S. (2009). Collaboration between family physicians and community pharmacists to enhance adherence to chronic medications: opinions of Saskatchewan family physicians. *Can Fam Physician, 55*(12), e69-75.

Lin, E. H. B., Katon, W., Von Korff, M., Rutter, C., Simon, G. E., Oliver, M., et al. (2004). Relationship of Depression and Diabetes Self-Care, Medication Adherence, and Preventive Care. *Diabetes Care, 27*(9), 2154-2160.

Lloyd-Jones, D., Adams, R. J., Brown, T. M., Carnethon, M., Dai, S., De Simone, G., et al. (2010). Heart disease and stroke statistics--2010 update: a report from the American Heart Association. [Research Support, N.I.H., Extramural]. *Circulation, 121*(7), e46-e215.

Loeppke, R., Edington, D. W., & Beg, S. (2010). Impact of the prevention plan on employee health risk reduction. *Popul Health Manag, 13*(5), 275-284.

Malhotra, S., Karan, R. S., Pandhi, P., & Jain, S. (2001). Drug related medical emergencies in the elderly: role of adverse drug reactions and non-compliance. *Postgrad Med J, 77*(913), 703-707.

Malhotra, S., Karan, R. S., Pandhi, P., & Jain, S. (2001). Drug related medical emergencies in the elderly: role of adverse drug reactions and non-compliance. *Postgraduate Medical Journal, 77*(913), 703-707.

Maniscalco-Feichtl, M., & Whalen, K. L. (2009). Community/Ambulatory Care. In R. E. N. In K.L. Kier (Ed.), *Pharmacy Student Survival Guide* (Vol. 2).

McCarthy, R. L., & Schafermeyer, K.W. (2007). *Health Care Delivery: A Primer for Pharmacists* (Vol. 4): Jones and Bartlett Publishers, Inc.

Morgado, M., Rolo, S., & Castelo-Branco, M. (2011). Pharmacist intervention program to enhance hypertension control: a randomised controlled trial. *International Journal of Clinical Pharmacy, 33*(1), 132-140.

Nathan, D. M., Buse, J. B., Davidson, M. B., Ferrannini, E., Holman, R. R., Sherwin, R., et al. (2009). Medical management of hyperglycemia in type 2 diabetes: a consensus algorithm for the initiation and adjustment of therapy: a consensus statement of the American Diabetes Association and the European Association for the Study of Diabetes. *Diabetes Care, 32*(1), 193-203.

National Cancer Institute. (2010). Mammograms. Retrieved 06.02., 2012, from http://www.cancer.gov/cancertopics/factsheet/detection/mammograms

National Institute of Health. (2008). *Weight and Waist Measurement: Tools for Adults*: National Institute of Health.

National Institutes of Health. (2002). *Third Report of the Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (ATP III Final Report)*: National Institutes of Health.

National Institutes of Health. (2004). *The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood pressure.*: National Heart, Lung, and Blood Institute.

National Prescribing Centre, & National Primary Care Research and Development Centre. (2002). Modernising Medicines Management: A guide to achieving benefits for patients, professionals and the NHS (Book 1) Available from http://www.npc.nhs.uk/developing_systems/intro/resources/library_good_practice_guide_mmmbook1_2002.pdf

National Quality Forum. (2010). *National Voluntary Consensus Standards for Medication Management: A Consensus Report.* Washington, DC.: National Quality Forum (NQF).

Osilla, K. C., Van Busum, K., Schnyer, C., Larkin, J. W., Eibner, C., & Mattke, S. (2012). Systematic review of the impact of worksite wellness programs. [Research Support, U.S. Gov't, Non-P.H.S.]. *Am J Manag Care, 18*(2), e68-81.

Parker, D. L. (2012). Drug Information in Ambulatory Care. In K. L. K. In P.M. Malone, J.E. Stanovich (Ed.), *Drug Information: A Guide for Pharmacists* (Vol. 4).

Patel, B. V., Remigio-Baker, R. A., Thiebaud, P., Preblick, R., & Plauschinat, C. (2008). Improved persistence and adherence to diuretic fixed-dose combination therapy compared to diuretic monotherapy. *BMC Fam Pract, 9*, 61.

Patel, P., & Zed, P. J. (2002). Drug-related visits to the emergency department: how big is the problem? [Review]. *Pharmacotherapy, 22*(7), 915-923.

Pegram, A., & Cole, S. W. (2011). Evaluation of a Pharmacist's Impact in a University-based Wellness Clinic.

Pegus, C., Bazzarre, T. L., Brown, J. S., & Menzin, J. (2002). Effect of the Heart At Work program on awareness of risk factors, self-efficacy, and health behaviors. *J Occup Environ Med, 44*(3), 228-236.

Person, A. L. *e. a.* (2010). Barriers to participation in a worksite wellness program. *Nutrition Research and Practice, 4*(2), 149-154.

Petrilla, A. A., Benner, J. S., Battleman, D. S., Tierce, J. C., & Hazard, E. H. (2005). Evidence-based interventions to improve patient compliance with antihypertensive and lipid-lowering medications. *Int J Clin Pract, 59*(12), 1441-1451.

Pharmaceutical Care Network Europe Foundation. (2010). *The PCNE Classification V 6.2*: Pharmaceutical Care Network Europe Foundation.

Pittman, D. G., Chen, W., Bowlin, S. J., & Foody, J. M. (2011). Adherence to Statins, Subsequent Healthcare Costs, and Cardiovascular Hospitalizations. *The American Journal of Cardiology, 107*(11), 1662-1666.

Primary PhysicianCare. (2010). Care Management System. Retrieved 05.04.2012, 2012, from http://healthgram.com/contentPages.cfm?id=49

Promotion, I. A. f. W. H. (2009). *Atlanta announcement on worksite health promotion*.

Rothman, R. L., Malone, R., Bryant, B., Shintani, A. K., Crigler, B., Dewalt, D. A., et al. (2005). A randomized trial of a primary care-based disease management program to improve cardiovascular risk factors and glycated hemoglobin levels in patients with diabetes. *Am J Med, 118*(3), 276-284.

Scroccaro, G. A., MA.; Floor-Schreudering, A.; Hekster, YA.; Huon, Y. (2000). The need for clinical pharmacy. *Pharmacy world & science, 22 FEB*(1), 27-29.

Shadish, W. R., Cook, T. D., & Campell, D. T. (2002). *Experimental and Quasi-Experimental Designs for Generalized Causal Inference*. USA: Houghton Mifflin Company.

Sherman, B. W. *e. a.* (2011). Physician-Specific Variation in Medication Adherence Among Diabetes Patients. *The American Journal of Managed Care, 17*(11), 729-736.

Siegel, R., Naishadham, D., & Jemal, A. (2012). Cancer statistics, 2012. [Comparative Study]. *CA Cancer J Clin, 62*(1), 10-29.

Simpson, R. J., Jr., Signorovitch, J., Birnbaum, H., Ivanova, J., Connolly, C., Kidolezi, Y., et al. (2009). Cardiovascular and economic outcomes after

initiation of lipid-lowering therapy with atorvastatin vs simvastatin in an employed population. *Mayo Clin Proc, 84*(12), 1065-1072.

Siren, R., Eriksson, J. G., & Vanhanen, H. (2012). Waist circumference a good indicator of future risk for type 2 diabetes and cardiovascular disease. *BMC Public Health, 12*(1), 631.

Sokol, M. C., McGuigan, K. A., Verbrugge, R. R., & Epstein, R. S. (2005). Impact of medication adherence on hospitalization risk and healthcare cost. [Evaluation Studies]. *Med Care, 43*(6), 521-530.

Standards of Medical Care in Diabetes—2012. (2012). *Diabetes Care, 35*(Supplement 1), S11-S63.

Strand, L. M., Morley, P.C., Cipolle, R.J., Ramsey, R., & Lamsam, G.D. (1990). Drug-Related Problems: Their Structure and Function. *DICP. The Annals of Pharmacotherapy, 24*, 1093-1097.

Taitel, M., Jiang, J., Rudkin, K., Ewing, S., & Duncan, I. (2012). The impact of pharmacist face-to-face counseling to improve medication adherence among patients initiating statin therapy. *Patient Prefer Adherence, 6*, 323-329.

The Health Strategies Consultancy LLC. (2005). *Follow The Pill: Understanding the U.S. Commercial Pharmaceutical Supply Chain*: The Health Strategies Consultancy LLC.

The Henry J. Kaiser Family Foundation. (2010). *The uninsured: A Primer*.

The Kaiser Family Foundation, & Health Research & Educational Trust. (2011). *Employer Health Benefits: 2011 Annual Survey*.

Thier, S. L., Yu-Isenberg, K. S., Leas, B. F., Cantrell, C. R., DeBussey, S., Goldfarb, N. I., et al. (2008). In chronic disease, nationwide data show poor adherence by patients to medication and by physicians to guidelines. [Research Support, Non-U.S. Gov't]. *Manag Care, 17*(2), 48-52, 55-47.

Tsuyuki, R. T., Johnson, J. A., Teo, K. K., Simpson, S. H., Ackman, M. L., Biggs, R. S., et al. (2002). A Randomized Trial of the Effect of Community Pharmacist Intervention on Cholesterol Risk Management: The Study of Cardiovascular Risk Intervention by Pharmacists (SCRIP). *Arch Intern Med, 162*(10), 1149-1155.

U.S. Cancer Statistics Working Group. (2012). *United States Cancer Statistics: 1999-2008 Incidence and Mortality Web-based Report.* Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention and National Cancer Institute.

U.S. Census Bureau. (2011). *The 2012 Statistical Abstract*: U.S. Census Bureau.

U.S. Department of Health and Human Services. (2008). *2008 Physical Activity Guidelines for Americans*: U.S. Department of Health and Human Services.

U.S. Preventive Services Task Force. (2008). Screening for Colorectal Cancer: U.S. Preventive Services Task Force Recommendation Statement. *149*(9), 627-637

U.S. Preventive Services Task Force. (2011). Screening for Osteoporosis: U.S. Preventive Services Task Force Recommendation Statement. *Annals of Internal Medicine, 154*(5), 356-364.

U.S. Sensus Bureau. (2011). *The 2011 Statistical Abstract*: U.S. Sensus Bureau.

Vegter, S., Nguyen, N. H., Visser, S. T., de Jong-van den Berg, L. T., Postma, M. J., & Boersma, C. (2011). Compliance, persistence, and switching patterns for ACE inhibitors and ARBs. [Comparative Study]. *Am J Manag Care, 17*(9), 609-616.

Viktil, K. K., & Blix, H. S. (2008). The Impact of Clinical Pharmacists on Drug-Related Problems and Clinical Outcomes (Vol. 102, pp. 275-280): Wiley-Blackwell.

Villeneuve, J., Genest, J., Blais, L., Vanier, M. C., Lamarre, D., Fredette, M., et al. (2010). A cluster randomized controlled Trial to Evaluate an Ambulatory primary care Management program for patients with dyslipidemia: the TEAM study. [Randomized Controlled TrialResearch Support, Non-U.S. Gov't]. *CMAJ, 182*(5), 447-455.

Wells, K. J., Luque, J. S., Miladinovic, B., Vargas, N., Asvat, Y., Roetzheim, R. G., et al. (2011). Do community health worker interventions improve

rates of screening mammography in the United States? A systematic review. *Cancer Epidemiol Biomarkers Prev, 20*(8), 1580-1598.

Wiegand, P., McCombs, J. S., & Wang, J. J. (2012). Factors of hyperlipidemia medication adherence in a nationwide health plan. *Am J Manag Care, 18*(4), 193-199.

Williams Mv, B. D. W. P. R. M. N. J. R. (1998). Relationship of functional health literacy to patients' knowledge of their chronic disease: A study of patients with hypertension and diabetes. *Archives of Internal Medicine, 158*(2), 166-172.

Wong, M. C. S., Jiang, J. Y., & Griffiths, S. M. (2011). Adherence to lipid-lowering agents among 11,042 patients in clinical practice. *International Journal of Clinical Practice, 65*(7), 741-748.

World Health Organization. (2005). *Preventing chronic diseases: a vital investment: WHO global report.*: World Health Organization.

World Health Organization. (2009). *Global health risks: mortality and burden of disease attributable to selected major risks*: World Health Organization.

World Health Organization. (2012). Global Health Expenditure Database: NHA indicators. In W. H. Organization (Ed.).

World Health Organization. (e.d.). Chronic diseases. Retrieved 20 April., 2012, from http://www.who.int/topics/chronic_diseases/en/

Yeaw, J., Benner, J. S., Walt, J. G., Sian, S., & Smith, D. B. (2009). Comparing adherence and persistence across 6 chronic medication classes. [Research Support, Non-U.S. Gov't]. *J Manag Care Pharm, 15*(9), 728-740.

Zed, P. J., Abu-Laban, R. B., Balen, R. M., Loewen, P. S., Hohl, C. M., Brubacher, J. R., et al. (2008). Incidence, severity and preventability of medication-related visits to the emergency department: a prospective study. [Research Support, Non-U.S. Gov't]. *CMAJ, 178*(12), 1563-1569.

Zhang, Q., Zhao, C., Davies, M. J., Radican, L., & Seck, T. (2011). Compliance and persistence with concomitant statin and oral antihyperglycemic therapy. [Research Support, Non-U.S. Gov't]. *Am J Manag Care, 17*(11), 746-752.

# APPENDIX

# APPENDIX A

Study approval:

- The application and approval from Wingate University's Research Review Board
- E-mailed response from the Research Review Board at the time of approval

# Wingate University
# RESEARCH REVIEW BOARD APPLICATION

Date: 8/15/11

| Investigator Name: Sabrina Cole, PharmD, BCPS | Phone: 704-233-8974 | Email: s.cole@wingate.edu |
|---|---|---|

Names of other investigators: Angela Pegram, PharmD, CDE and Hrefna Sif Bragadottir

| Type of Review Requested | ❑ exempt | ■ expedited | ❑ renewal |
|---|---|---|---|

Project Title: Evaluation of a Pharmacist's Impact in a University-based Wellness Clinic

General Purpose of the Research: To evaluate the impact of a pharmacist's intervention and counseling session on patient adherence with prescription therapy

Data will be obtained by:

| | | | |
|---|---|---|---|
| ❑ mail | ❑ observation | ❑ questionnaire/survey | ❑ interview/telephone |
| ❑ experiment | ❑ secondary source | ■ other (explain) retrospective chart review/managed care organization data and statistics | |

Attach Project Description Containing At Least The Following:

a. **An overview of the proposed research** (including risks, benefits, methodologies, and analytics)
**b. Specific aims of the project**
**c. A listing of personnel and their qualifications for participation in the research**
**d. Pertinent recent research impacting the proposed investigation**
e. Consent forms
f. Surveys or interview questions
g. Test forms
h. Subject screening forms
i. Recruitment materials (posters, phone scripts, etc.)
j. Letters of agreement, or other supporting documentation to assure the RRB that appropriate coordination has been done with outside organizations or institutions (clearances to perform research or distribute surveys, etc., at any facility or institution where the research will be conducted)
**k. Data collection form**

Will any subjects be less than 18 years old? ❑ yes ■ no If Yes, also complete the Investigator Checklist for Research Involving Children

| How many subjects will participate? ~300 | Are subjects students at Wingate University? ❑ yes ■ no | Are any subjects incarcerated, institutionalized, pregnant, or wards of the state? ❑ yes ■ no | Will the proposed research involve deception of the subjects? ❑ yes ■ no |
|---|---|---|---|

How will subjects be selected?
All participants who entered the Wingate University Wellness Screening Program during the 2009-2010 academic year and completed a screening appointment in 2011 will be included in data collection. Therefore, participants undergoing screening during the voluntary program prior to 2009 will be excluded from data collection.

How will subjects be informed of procedures, intent of the study, and potential risks to them? n/a, this is a retrospective chart review

What steps will be taken to allow subjects to withdraw at any time without prejudice? n/a, this is a retrospective chart review

How will subjects' privacy be maintained and confidentiality guaranteed? Patient records will be de-identified and data will be collected based on chart number, which has been randomly assigned. Data will be entered into a password-protected electronic spreadsheet for analysis and paper data collection forms will be stored in the investigator's office in a locked cabinet.

In making this application, I certify that I have read and understand the **Wingate University Guidelines for Research Projects Involving Human and Animal Subjects** and I intend to comply with the letter and spirit of the university policy. I agree that significant changes in the protocol will be submitted to the RRB for written approval prior to changes being put into practice, that adverse outcomes, unexpected events, or research subject complaints will be reported immediately to the RRB, and that informed consent records of subjects will be kept for at least 3 years after completion, closure, or cancellation of the research.

Signature (Principal Investigator):
Sabrina W. Cole

| This application has been reviewed by the Wingate University Research Review Board: | ❑ Full Review | X Exempt | ❑ Expedited | |
|---|---|---|---|---|
| This project has been: | X Approved | ❑ Deferred | ❑ Disapproved | |

Reasons for disapproval:

Signature of RRB Chair: 

**Following is the e-mail which explains the Research Review Board's decision of approval:**

"Thanks for sending the information over. Here are some points about conducting a retrospective chart review from the RRB standpoint:

A retrospective chart review does not constitute research if the data are collected for quality assurance or other purposes. If the chart review falls under the definition of research, it may be exempt from RRB review if the information is recorded by the investigator in such manner that subjects cannot be identified, directly or through identifiers linked to the subjects [45CFR46.101(b)(4)].

However, if the chart review is done for research purposes and the information is recorded with identifiers (e.g., name, medical record number, date of birth, social security number, or initials), RRB review and approval is required.

Thus - two items for question:

Can this be classified as a QA project? It could still be published with grouped data.

Also, is DOB actually needed for this study, or is there a way that you could band the ages: 20-29, 30-34, 35-39, 40-44, 45-49, 50-54, etc. so that there is sufficient ambiguity involved to direct the reader away from identifying the person conclusively?"

# APPENDIX B

Data collection:

- The final version of the data collection form

**Evaluation of a Pharmacist's Impact in Wingate University's Wellness Clinic**

***Data Collection Form***

ID: _____

Gender: ❑ Male ❑ Female Age (years): ❑ 20-29 ❑ 30-39 ❑ 40-49 ❑ 50-59 ❑ ≥60

Race: ❑ White ❑ Black ❑ Asian
❑ Hispanic ❑ American Indian ❑ Other

Baseline visit date: _____/_____/_____ Secondary visit date: _____/_____/_____
mmm dd yy mmm dd yy

Time between visits (months): _____

## DIET, PHYSICAL ACTIVITY AND SLEEP

Typical **meals** are well rounded, including fruits and vegetables:

**BL** ❑ Yes ❑ No ❑ N/A

**S** ❑ Yes ❑ No ❑ N/A

*BL = Baseline; S = Secondary visit; N/A = not available.*

**Days per week** of exercise:

**BL** ❑ None ❑ 1-2 ❑ 3-4 ❑ ≥5

**S** ❑ None ❑ 1-2 ❑ 3-4 ❑ ≥5

*At least **150 minutes per week** of moderate intensity physical activity is recommended for health benefits*[1]

Typical **hours slept** per night:

**BL** ❑ < 5 ❑ 5-6 ❑ 7-8 ❑ 9-10 ❑ >10

**S** ❑ < 5 ❑ 5-6 ❑ 7-8 ❑ 9-10 ❑ >10

### Self-reported number of current medications from wellness screening

**Baseline total $R_x$:** _____ **Secondary visit total $R_x$:** _____

**Baseline total *OTC*:** _____ **Secondary visit total *OTC*:** _____

*$R_x$ = prescribed drug; OTC = over-the-counter drug*

[1] http://www.health.gov/PAguidelines/pdf/paguide.pdf

**Baseline total** ***Food supplements (herbal and vitamins):*** _____

**Secondary visit total** ***Food supplements (herbal and vitamins):*** _____

## GENERAL WELLNESS

**Physician visit** during the past 3 years:

**BL** ❑ Yes ❑ No

**S** ❑ Yes ❑ No

Last **colonoscopy** (in years):

**BL** ❑ No need for ❑ Never ❑ <5 ❑ 5-10 ❑ >10 ❑ N/A

**S** ❑ No need for ❑ Never ❑ <5 ❑ 5-10 ❑ >10 ❑ N/A

*In general, guidelines recommend screening in adults* ***50-75 years old every 10 years***[2]

Last screening for **osteoporosis** (in years):

**BL** ❑ No need for ❑ Never ❑ <5 ❑ 5-10 ❑ >10 ❑ N/A

**S** ❑ No need for ❑ Never ❑ <5 ❑ 5-10 ❑ >10 ❑ N/A

*In general, guidlines recommend screening in all* ***women ≥65 years old and men ≥70 years old every 10 years*** [3]

Mammogram in the past 5 years, if the subject is a **woman**:

**BL** ❑ No need for ❑ Yes ❑ No ❑ N/A

**S** ❑ No need for ❑ Yes ❑ No ❑ N/A

*Women age* ***≥40 years old*** *should have mammograms* ***every 1-2 years***[4]

Prostate screening in the past 2 years, if the subject is a **man**:

**BL** ❑ No need for ❑ Yes ❑ No ❑ N/A

**S** ❑ No need for ❑ Yes ❑ No ❑ N/A

*In general, men* ***≥50 years old*** *should have a screening for prostate cancer, every* ***2 years***[5]

---

[2] http://www.uspreventiveservicestaskforce.org/uspstf08/colocancer/colors.pdf
[3] http://www.uspreventiveservicestaskforce.org/uspstf10/osteoporosis/osteors.pdf
[4] http://www.cancer.gov/cancertopics/factsheet/detection/mammograms
[5] http://www.cancer.org/Cancer/ProstateCancer/MoreInformation/ProstateCancerEarlyDetection/prostate-cancer-early-detection-acs-recommendations

Current **smoker**:

**BL** ❑ Yes ❑ No
**S** ❑ Yes ❑ No

## SCREENING RESULTS

| Labs and vitals | BL | Status | | | | S | Status | | | | Difference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Height** | | | | | | | | | | | |
| **Weight** | | | | | | | | | | | |
| **BMI** | | N | M | H | H+ | | N | M | H | H+ | |
| **SBP** | | N | M | H | H+ | | N | M | H | H+ | |
| **DBP** | | N | M | H | H+ | | N | M | H | H+ | |
| **WC** | | | | | | | | | | | |
| **BG** | | N | M | H | H+ | | N | M | H | H+ | |
| **Total-C** | | N | M | H | H+ | | N | M | H | H+ | |
| **LDL-C** | | N | M | H | H+ | | N | M | H | H+ | |
| **HDL-C** | | N | M | H | H+ | | N | M | H | H+ | |
| **TRG** | | N | M | H | H+ | | N | M | H | H+ | |

*BMI = body mass index; Height (ft and in); Weight (lbs); SBP = systolic blood pressure (mmHg); DBP = diastolic blood pressure (mmHg); WC = waist circumference (inches); BG = blood glucose (mg/dL); Total-C = total cholesterol (mg/dL); LDL-C = LDL cholesterol (mg/dL); HDL-C = HDL cholesterol (mg/dL); TRG = triglycerides (mg/dL).*
*N = normal; M = moderate risk; H = high risk; H+ = very high risk.*
*BL = baseline; S = secondary visit; Difference: indicates difference between BL and S values.*

## DISEASES AND CONDITIONS ($D_x$)

| | BL $D_x$ | BL ES | S $D_x$ | S ES |
|---|---|---|---|---|
| **Heart Disease** | | | | |
| **Diabetes** | | | | |
| **Hypertension** | | | | |
| **High Cholesterol (Lipid Panel)** | | | | |

*BL = baseline; $D_x$ = diagnosis; ES = elevated severity of condition; S = secondary visit*
*0 = no Dx/ES; 1 = Dx/ES.*

**BL total number of other current $D_x$: _____**

**S total number of other current $D_x$: _____**

## Rx INFORMATION AND ADHERENCE FROM PRESCRIPTION REFILLS

The subject has at least one target **$R_x$** drug with at least two refills between baseline and secondary visit:

- ❑ Yes
- ❑ No

*If **no**, go to the „FINANCIAL DATA" section.*

Total number of $R_x$ from **target drug list**: _____

Indicate **adherence** to target drugs:

❑ Adherent ❑ Non-adherent

Total number of **other** $R_x$: _____

## FINANCIAL DATA

| Visit | Medical Costs ($) | Prescription Costs ($) | Total Costs ($) |
|---|---|---|---|
| **BL** | | | |
| **S** | | | |
| **Difference** | | | |

**NOTES:**

# APPENDIX C

Data sources:

- Health risk assessment (HRA) application
- Wellness Screening Form for 2009 to 2010 (baseline wellness visit)
- Wellness Screening Form for 2011 (Follow-up wellness visit)
- National Preferred Formulary: Express Scripts for the United States 2009
- National Preferred Formulary: Express Scripts for the United States 2010
- National Preferred Formulary: Express Scripts for the United States 2011
- A list of applicable medications from 2009, 2010, and 2011 National Preferred Formulary: Express Scripts

# Health Risk Assessment

Last Name | First Name | MI

Social Security Number | Alternate ID Number (if directed by your employer)

Birth Date (mm/dd/yyyy) | Gender ○ Male ○ Female

Street Address

City | State | Zip Code

Phone Number | Relation to Employee ○ Self ○ Spouse ○ Child

Race/ Ethnicity ○ White ○ Black ○ Asian ○ Hispanic ○ American Indian ○ Other

Email Address ( to receive your results )

**Instructions**

**MARK BOXES WITH BLACK PEN ONLY!**

**Please use UPPERCASE characters.**

A B C 1 2 3

**Correct Mark** ○ ● ○

**Incorrect Mark** ○ ⊗ ○

Please complete each question as accurately as possible. Your information will be kept confidential.

## Personal History

For each condition, please mark all that apply to you.

| Do you have: | In the past 5 years | Have currently | Under medical care | Taking medication | | In the past 5 years | Have currently | Under medical care | Taking medication |
|---|---|---|---|---|---|---|---|---|---|
| Allergies (Environmental) | ○ | ○ | ○ | ○ | Heartburn/ Acid Reflux | ○ | ○ | ○ | ○ |
| Arthritis | ○ | ○ | ○ | ○ | High Blood Pressure | ○ | ○ | ○ | ○ |
| Asthma (adult onset) | ○ | ○ | ○ | ○ | High Cholesterol | ○ | ○ | ○ | ○ |
| Back Pain | ○ | ○ | ○ | ○ | Migraine Headaches | ○ | ○ | ○ | ○ |
| Breast Cancer | ○ | ○ | ○ | ○ | Osteoporosis | ○ | ○ | ○ | ○ |
| Chronic Bronchitis | ○ | ○ | ○ | ○ | Ovarian Cancer | ○ | ○ | ○ | ○ |
| Chronic Pain | ○ | ○ | ○ | ○ | Prostate Cancer | ○ | ○ | ○ | ○ |
| Colorectal Cancer | ○ | ○ | ○ | ○ | Skin Cancer | ○ | ○ | ○ | ○ |
| Depression | ○ | ○ | ○ | ○ | Sleep Apnea | ○ | ○ | ○ | ○ |
| Diabetes | ○ | ○ | ○ | ○ | Stroke | ○ | ○ | ○ | ○ |
| Heart Disease or Attack | ○ | ○ | ○ | ○ | | | | | |

## Key Screenings

Indicate the last time that you had any of these preventive services or screenings.

| Select one answer for each item: | *Less than 6 months* | *6-12 months* | *1-2 years ago* | *2-3 years ago* | *3-4 years ago* | *4-6 years ago* | *7 or more years ago* | *Never* |
|---|---|---|---|---|---|---|---|---|
| Routine Physical | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Colon Cancer Screen | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Dental Exam | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Flu Shot | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Pap Smear (females only) | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Mammogram (females only) | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| PSA Test (males only) | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| *For diabetics only:* | | | | | | | | |
| Eye Exam | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Foot Exam | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| HbA1c | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Pneumococcal Vaccine | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

## Lifestyle

1. Do you exercise? ○ Yes ○ No
   If yes, how many days a week do you engage in moderate physical activity? [ ] days
   If yes, how many minutes on average are you active each time? [ ][ ] minutes
2. Do you smoke? ○ Yes ○ No
   If yes, how many cigarettes do you usually smoke per day? [ ][ ] cigarettes
3. Do you use smokeless tobacco products? ○ Yes ○ No
4. Do you drink alcohol? ○ Yes ○ No
   If yes, how many days a week do you drink 3 or more alcoholic beverages? [ ] days
5. Do you eat breakfast? ○ Yes ○ No
   If yes, how many days a week do you eat breakfast? [ ] days
6. On average, how many hours per day do you sleep? [ ][ ]

## Overall Health

1. Do you feel knowledgeable and well informed about your health? ○ Yes ○ No ○ Not sure
2. Do you have a primary care physician? ○ Yes ○ No
3. In the past 12 months, how many times have you:

| | None | 1-2 | 3-5 | 6 or more |
|---|---|---|---|---|
| Visited a clinic or physician's office? | ○ | ○ | ○ | ○ |
| Gone to an emergency room for treatment? | ○ | ○ | ○ | ○ |
| Stayed overnight in the hospital as a patient? | ○ | ○ | ○ | ○ |

4. In general, how strong are your relationships with family and friends? ○ Very strong ○ About average ○ Weaker than average ○ Not sure
5. During the past year, how much has stress affected your health? ○ Often ○ Some ○ Seldom ○ None
6. Considering your age, how would you describe your overall physical health? ○ Excellent ○ Very good ○ Good ○ Fair ○ Poor
7. If you were provided support, how ready are you to make changes to improve your health? ○ Not ready ○ Somewhat ready ○ Definitely ready

## Job Related

1. In the past year, how many days of work have you missed due to personal illness? ○ 0 ○ 1-2 days ○ 3-5 days ○ 6-10 days ○ 11-15 days ○ 16+ days ○ does not apply
2. During the past 3 months, how much did your health problems affect your job performance while you were working? ○ None ○ Some of the time ○ Most of the time ○ All of the time ○ Does not apply
5. Please enter today's date: Month [ ][ ] Day [ ][ ] Year [ ][ ][ ][ ]

*Thank you for your participation!*

By completing this form, I authorize Wellness Coalition America, a division of Primary PhysicianCare Inc, to collect, manage, and store my personal health information in a private medical record file, in conformity with all applicable federal privacy laws.The contents of this form are confidential, and will not be disclosed unless the disclosure is protected under federal law.

## Test Results to be completed by medical personnel only

Cholestech Printout

| | | | | | |
|---|---|---|---|---|---|
| Triglycerides | [ ][ ][ ] | Blood Pressure SYS | [ ][ ][ ] | Height | [ ] ft [ ][ ] in |
| Total Cholesterol | [ ][ ][ ] | Blood Pressure DIA (ex. 090) | [ ][ ][ ] | Weight | [ ][ ][ ] lbs |
| Blood Glucose (ex. 078) | [ ][ ][ ] | HDL Cholesterol | [ ][ ][ ] | Waist Circumference | [ ][ ] in |
| TC/ HDL Ratio | [ ][ ].[ ] | LDL Cholesterol | [ ][ ][ ] | Hip Circumference | [ ][ ] in |
| HbA1C | [ ][ ].[ ] | Fasting ○ yes ○ no | | | |

Provider Signature

122974

**Wingate University Wellness Center**
**2009-2010 Wellness Screening**

Name:_____ DOB:_____ Age:_____

Circle One: Male Female

***MOVE YOUR BODY (Lifestyle Assessment)SCORE: _____/35 possible points***

Yes No Would you like to change your workout regimen?

Yes No Do you feel like you need more motivation to work out?

***FUEL YOUR BODY (Lifestyle Assessment) SCORE: _____/ 60 possible points***

How many servings of the following do you have daily?

| Milk | Cheese | Yogurt |
|---|---|---|
| __None | __None | __None |
| ___ 1-2 per day | ___ 1-2 per day | ___ 1-2 per day |
| ___ 3-5 per day | ___ 3-5 per day | ___ 3-5 per day |

Yes No Do you take Calcium supplement daily? If yes, please list in medication section.

Yes No Do you take Vitamin D supplement daily? If yes, please list in medication section.

***REST YOUR BODY (Lifestyle Assessment) SCORE: _____/ 25 possible points***

**FAMILY HISTORY:**

| Relationship | Age if Living | Age at Death | State of Health or Cause of Death |
|---|---|---|---|
| Father | | | |
| Mother | | | |
| Sibling #1 | | | |
| Sibling #2 | | | |
| Sibling #3 | | | |

| **Medical Conditions (check if applicable)** | Father | Mother | Sibling(s) | Grandparents |
|---|---|---|---|---|
| Diabetes | | | | |
| Heart Disease | | | | |
| High Blood Pressure | | | | |
| High Cholesterol | | | | |
| Mental Illness | | | | |
| Stroke | | | | |
| Thyroid Disease | | | | |
| Migraines | | | | |
| Cancer | | | | |

**PERSONAL MEDICAL HISTORY**

Have you ever been told that you have:

| **CONDITION** | **YES (year if known)** | **NO** |
|---|---|---|
| Asthma | | |
| Allergies | | |
| Diabetes | | |
| Heart Disease | | |
| High Blood Pressure | | |
| High Cholesterol | | |
| Mental Illness/ Depression/Anxiety | | |
| Migraine Headaches | | |
| Thyroid Problems | | |

**CURRENT MEDICATIONS--**all current Rx, OTC, herbal and vitamins you take on a regular basis.

**Medication Name** **Strength or # tabs** **Times a day taken** **What med is for**

**ALLERGIES-**any allergies (including medications, foods, environmental allergens, etc.)

| **What you are allergic to:** | **What kind of reaction you have to it:** |
|---|---|

**GENERAL WELLNESS**

Yes No Have you seen a physician during the past year?
If yes, how often: _____

Yes No Have you been hospitalized in the last year?
If yes, for what condition: _____

Yes No Have you had any kind of opertation in the past year?
If yes, for what condition: _____

Yes No Are you up to date on all of your vaccines (tetanus, etc.)?

Yes No Have you ever had a colonscopy?
If yes, when was the last one? _____

Yes No Have you ever had a bone scan completed for osteoporosis?
If yes, when was the last one? _____

**Women's Health Only:**

Yes No Do you currently perform self breast exams?

Yes No Have you had a mammogram in the past 5 years?

Yes No Have you had a PAP smear in the past 2 years?

Yes No Have you gone through menopause?

**Men's Health Only:**

Yes No Have you had your prostate checked in the past 2 years?

***MAINTAIN YOUR BODY (Lifestyle Assessment) SCORE: _____/20 possible points***

**TOBACCO HISTORY:**

Yes No Do you use tobacco products or have you used them in the past?

- If currently smoking, how many cigarettes do you have per day?
  1-5 cigarettes per day 11-15 cigarettes per day
  6-10 cigarettes per day 16-20 cigarettes per day
- If currently using chewing tobacco, how much per day? _____
- Have you tried to quit in the past? Yes No
  - If yes, when? _____
  - What method (s) did you use to try and quit?
    Cold turkey (none) Nicotine replacement (patch, gum, lozenge)
    Prescription product Other:_____
- If you quit, how long were you successful? _____
- Are you interested in quitting now? Yes No, not at this time

***TOTAL WELL BEING (Lifestyle Assessment) SCORE: _____/30 possible points***

## PHYSICAL EXAM/SCREENING RESULTS

Height: _____ Weight: _____

BP:_____ Pulse: _____

Waist Circumference:_____ inches Blood Sugar:_____

Lifestyle Assessment TOTAL Score: _____

**Cholesterol Results:**

Total Cholesterol:_____ LDL Cholesterol:_____

HDL Cholesterol: _____ Triglycerides:_____

**Screening Completed by:_____ Date:_____**

**Wingate University Wellness Center**
**2011 Wellness Screening**

Name:_____ DOB:_____ Age:_____

Circle One: Male Female Screening Date: _____

**FUEL YOUR BODY (Diet Review)**

Typical meals (or 24 hour recall):

Breakfast:

Snack:

Lunch:

Snack:

Dinner:

Snack:

How many times per week do you eat out? _____ Which meal(s)?_____

Food choices when eating out?_____

Yes No Are typical meals well rounded, including fruits and vegetables?

Yes No Do you take a multivitamin daily? If yes, please list in medication section.

How many servings of calcium do you eat daily? (milk, cheese, yogurt, ice cream)_____

Yes No Do you take Calcium supplement daily? If yes, please list in medication section.

Yes No Do you take Vitamin D supplement daily? If yes, please list in medication section.

**MOVE YOUR BODY (Exercise)**

Yes No Do you currently exercise? If no, are you willing to start? _____

Type of Exercise:_____

Duration:_____ Days per week:_____

**REST YOUR BODY (Sleep/Relaxation)**

Typical hours slept per night? _____

Yes No Do you feel well rested when you wake up in the morning, ready to face the day?

Yes No Do you have activities that help you relax and unwind?

Yes No Do you spend some time at least 3 times a week to just be "you"?

**FAMILY HISTORY**

| Relationship | Age if Living | Age at Death | State of Health or Cause of Death |
|---|---|---|---|
| Father | | | |
| Mother | | | |
| Sibling #1 | | | |
| Sibling #2 | | | |
| Sibling #3 | | | |

| Medical Conditions (check if applicable) | Father | Mother | Sibling(s) | Grandparents |
|---|---|---|---|---|
| Diabetes | | | | |
| Heart Disease | | | | |
| High Blood Pressure | | | | |
| High Cholesterol | | | | |
| Mental Illness | | | | |
| Stroke | | | | |
| Thyroid Disease | | | | |
| Migraines | | | | |
| Cancer | | | | |

**PERSONAL MEDICAL HISTORY**

| CONDITION | YES (year if known) | NO |
|---|---|---|
| Asthma | | |
| Allergies | | |
| Diabetes | | |
| Heart Disease | | |
| High Blood Pressure | | |
| High Cholesterol | | |
| Mental Illness/ Depression/Anxiety | | |
| Migraine Headaches | | |
| Thyroid Problems | | |

**Other Personal Medical Problems not listed:**

**ALLERGIES-**any allergies (including medications, foods, environmental allergens, etc.)

**What you are allergic to:** **What kind of reaction you have to it:**

**CURRENT MEDICATIONS--**all current Rx, OTC, herbal and vitamins you take on a regular basis.

| Medication Name | Strength or # tabs | Times a day taken | What med is for |
|---|---|---|---|

**GENERAL WELLNESS**

Yes No Have you seen a physician during the past 3 years?

If yes, for what reason: _____

Yes No Have you been to the dentist in the past year?

Yes No Have you had an eye exam in the past 3 years?

Yes No Are you up to date on all of your vaccines (tetanus, etc.)?

Tetanus Date:_____ Flu Vaccine Date:_____

Yes No Have you ever had a colonscopy?

If yes, when was the last one? _____

Yes No Have you ever had a bone scan completed for osteoporosis?

If yes, when was the last one? _____

**Women's Health Only:**

Yes No Do you currently perform self breast exams?

Yes No Have you had a mammogram in the past 5 years?

Yes No Have you had a PAP smear in the past 2 years?

**Men's Health Only:**

Yes No Have you had your prostate checked in the past 2 years?

**TOBACCO HISTORY**

Yes No Do you use tobacco products or have you used them in the past?

- If currently smoking, how many cigarettes do you have per day?
  1-5 cigarettes per day 11-15 cigarettes per day
  6-10 cigarettes per day 16-20 cigarettes per day
- If currently using chewing tobacco, how much per day? _____
- Have you tried to quit in the past? Yes No
  - If yes, when? _____
  - What method (s) did you use to try and quit?
    Cold turkey (none) Nicotine replacement (patch, gum, lozenge)
    Prescription product Other:_____
- If you quit, how long were you successful? _____
- Are you interested in quitting now? Yes No, not at this time

**PHYSICAL EXAM/SCREENING RESULTS**

Height: _____ Weight: _____ BP:_____

Waist Circumference:_____ inches Blood Sugar:_____

**Cholesterol Results:**

Total Cholesterol:_____ LDL Cholesterol:_____

HDL Cholesterol: _____ Triglycerides:_____

**ASSESSMENT**

**PLAN AND RECOMMENDATIONS GIVEN TO PATIENT**

**Screening Completed by:_____ Date:_____**

EXPRESS SCRIPTS®

# 2009 Express Scripts National Preferred Formulary

The following is a list of the most commonly prescribed drugs. It represents an abbreviated version of the drug list (formulary) that is at the core of your prescription-drug benefit plan. The list is not all-inclusive and does not guarantee coverage. In addition to using this list, you are encouraged to ask your doctor to prescribe generic drugs whenever appropriate.

**PLEASE NOTE: The symbol * next to a drug signifies that it is subject to nonformulary status when a generic is available throughout the year. Not all the drugs listed are covered by all prescription-drug benefit programs; check your benefit materials for the specific drugs covered and the copayments for your prescription-drug benefit program. For specific questions about your coverage, please call the phone number printed on your ID card.**

## A

ABILIFY (excluding Discmelt & solution)
acarbose
ACCU-CHEK MULTICLIX lancets
acebutolol
acetaminophen w/codeine
acetazolamide
ACTIVELLA*
ACTONEL with calcium
ACTOPLUS MET
ACTOS
ACULAR, LS, PF *
acyclovir
ADDERALL XR*
ADVAIR DISKUS, HFA
ADVICOR
AGGRENOX
albuterol
alendronate sodium
ALLEGRA-D*
ALPHAGAN P*
ALTABAX
amantadine
AMBIEN CR*
aminophylline
amitriptyline
amlodipine besylate
amox tr/potassium clavulanate
amoxicillin
amphetamine salt combo
anagrelide
ANAPRAM-HC
ANDRODERM
ANDROGEL
antipyrine w/benzocaine
apri
aranelle
ARANESP [INJ]
ARICEPT, ODT
ASACOL
ASCENSIA AUTODISC, BREEZE/2
ASCENSIA BRIO METER
ASCENSIA CONTOUR SYSTEM
ASCENSIA ELITE/XL
ASTELIN
ASTEPRO
atenolol, -chlorthalidone
atropine sulfate
AUGMENTIN XR
AVELOX
aviane
AVINZA
AVODART
AXID solution only
AZASITE
azathioprine
azithromycin
AZOR

## B

balsalazide disodium
baziva
benazepril, /hctz
BENZACLIN
benzonatate
benzoyl peroxide
betamethasone dp, valerate
BETASERON [INJ]
bisoprolol fumarate/hctz
BONIVA TAB
brimonidine tartrate
bupropion, sr
butalbital/apap/caffeine
BYETTA [INJ]

## C

calcipotriene
calcitriol
camila
CANASA
captopril, /hctz
CARAC
carbamazepine
carbidopa-levodopa, er
CARDIZEM LA*
carisoprodol
carvedilol
cefaclor, er
cefadroxil
cefdinir
cefpodoxime
cefprozil
cefturoxime
CELEBREX
CELLCEPT*
cephalexin
cetia
CETROTIDE [INJ]
chlorzoxazone
cholestyramine
choline mag trisalicylate
chorionic gonadotropin [INJ]
ciclopirox
cilostazol
cimetidine
CIPRODEX*
ciprofloxacin, er
citalopram
clarithromycin, er
CLIMARA PRO
clidinium-chlordiazepoxide
clindamycin phosphate
clobetasol propionate
clomiphene citrate
clotrimazole troche
clozapine
colestipol
COMBIPATCH
COMBIVENT
CONCERTA*
COPAXONE [INJ]
COREG CR
COZAAR
CREON
CRESTOR
CRINONE
cryselle
cyclobenzaprine hcl
cyclosporine, modified
CYMBALTA [SNRI]

## D

desmopressin acetate
desonide
desoximetasone
dexmethylphenidate
dextroamphetamine sulfate
diclofenac sodium
dicyclomine hcl
DIFFERIN
diflunisal
diltiazem, extended release
DIOVAN, HCT
diphenhydramine
dipyridamole
divalproex sodium
dorzolamide, -timolol
doxepin hcl
DUAC CS
DUETACT
DYNACIRC CR*

## E

econazole
EDEX [INJ]
EFFEXOR XR [SNRI]
ELIDEL
eliphos
ENABLEX
enalapril, hctz
ENBREL [INJ]
enpresse
enulose
EPIPEN, JR [INJ]
errin
erythromycin
erythromycin/benzoyl perox.
ESTRADERM
estradiol, tds
ESTRATEST, H.S.
estropipate
etidronate disodium
etodolac
EUFLEXXA [INJ]
EVAMIST
EXELON
EXFORGE

## F

famciclovir
famotidine
felodipine er
fenofibrate
fentanyl citrate
fexofenadine
FINACEA
finasteride
FLOMAX
FLOVENT DISKUS, HFA
fluconazole
fluocinonide
fluorouracil
fluoxetine hcl
fluphenazine
flurazepam
fluticasone nasal spray
fluvoxamine maleate
folic acid
FOLLISTIM AQ [INJ]
FOLTX
FORADIL
FORTEO [INJ]
fortical
fosinopril, /hctz

## G

gabapentin
GANIRELIX ACETATE [INJ]
gemfibrozil
GENOTROPIN [INJ]
gentamicin sulfate
glimepiride
glipizide, er, xl
glipizide/metformin
GLUCAGEN [INJ]
glyburide, micronized
glyburide/metformin
GONAL-F, RFF [INJ]
granisetron
guaifenesin w/pseudoephedrine

## H

HALFLYTELY, -BISACODYL
haloperidol
HECTOROL
HUMALOG [INJ]
HUMIRA [INJ]
HUMULIN [INJ]
hydrochlorothiazide
hydrocodone w/guaifenesin
hydrocodone/acetaminophen
hydrocortisone
hydromorphone
hydroxyurea
hyoscyamine sulfate
HYZAAR

## I

ibuprofen
imipramine
indomethacin
INTAL inh
ipratropium bromide
ipratropium-albuterol
isosorbide mononitrate
isotretinoin
itraconazole

## J

JANUMET
JANUVIA
jolessa
jolivette
junel, fe

## K

kariva
kelnor
KEPPRA XR
ketoconazole

## L

labetalol hcl
lactulose
lamotrigine
LANTUS, SOLOSTAR [INJ]
leena
leflunomide
lessina
LETAIRIS
leucovorin
leuprolide acetate [INJ]
LEVAQUIN
LEVEMIR, FLEXPEN [INJ]
levetiracetam
LEVITRA
levora
levothyroxine sodium
levoxyl
LEXAPRO
LIALDA
LIDODERM
LIPITOR
lisinopril, /hctz
LOTEMAX
LOTREL*
lovastatin
LOVAZA
LOVENOX* [INJ]
low-ogestrel
LUMIGAN
lutera
LYRICA

## M

MAXALT, MLT
meclizine hcl
medroxyprogesterone acetate
megestrol
meloxicam
MENEST
MENOPUR [INJ]
mercaptopurine
MERIDIA
METANX
metaproterenol
metformin, er
methocarbamol
methotrexate
methylphenidate hcl
methylprednisolone
metoclopramide hcl
metolazone
metoprolol, hctz
METROGEL
metronidazole
microgestin, fe
mirtazapine, soltab
moexipril/hctz
mometasone
mononessa
morphine sulfate
MUSE

## N

nabumetone
nadolol
NAMENDA
naproxen
NASACORT AQ
NASONEX
necon
neomycin/polymyxin/dexamethasone
neomycin/polymyxin/hc
NEXIUM
NIASPAN
nifedipine er
nisoldipine
nitrofurantoin macrocrystal
nitroglycerin
NITROLINGUAL SPRAY
nizatidine
nora-be
nortrel
NOVAREL [INJ]
NOVOFINE
NOVOLIN [INJ]
NOVOLOG [INJ]
NUTROPIN, AQ [INJ]
nystatin

## O

ofloxacin
ogestrel
omeprazole
ondansetron
ONETOUCH II, BASIC, PROFILE
ONETOUCH FASTTAKE
ONETOUCH INDUO
ONETOUCH SURESTEP
ONETOUCH ULTRA,-2, -SMART
ONETOUCH ULTRAMINI
OPANA ER
orphenadrine citrate
ORTHO TRI-CYCLEN LO*
oxcarbazepine
oxybutynin, er
oxycodone w/acetaminophen
OXYCONTIN
OXYTROL

## P

paroxetine
PATADAY
PATANOL
peg 3350/electrolyte
PEGASYS [INJ]
penicillin v potassium
PERFOROMIST
perphenazine
phentermine hcl
phenytoin sodium, extended
pilocarpine hcl
pindolol
PLAVIX
polymyxin b sul/trimethoprim
portia
PRAMOSONE
PRANDIN*
pravastatin
PRECARE PREMIER
PRECISION SURE DOSE

(continued)

**THIS DOCUMENT LIST IS EFFECTIVE JANUARY 1, 2009 THROUGH DECEMBER 31, 2009. THIS LIST IS SUBJECT TO CHANGE.**
You can get more information and updates to this document at our web site at www.express-scripts.com.



PRMT22157-08 (02/15/08)

PRECISION XTRA
prednisolone
prednisolone acetate
prednisone
PREMARIN
PREMPHASE
PREMPRO
PREVACID NAPRAPAC*
previfem
PREVPAC
PRIMACARE, ADVANTAGE, ONE
PROAIR HFA
PROCHIEVE
prochlorperazine
PROCRIT (INJ)
promethazine
promethazine w/codeine
promethazine w/dm
PROMETRIUM
propranolol hcl, w/hctz
PROTOPIC*
PROVENTIL HFA
pseudoephedrine w/chlorpheniramine
PULMICORT FLEXHALER

## Q

quasense
quinapril
quinaretic
QVAR

## R

ramipril
RANEXA
ranitidine
REBIF (INJ)
reclipsen
RELENZA
RENAGEL
RENVELA
ribasphere
ribavirin
risperidone
ropinirole

## S

salsalate
selenium sulfide
SEREVENT DISKUS
SEROQUEL, XR
sertraline
SIMCOR
simvastatin
SINGULAIR
SKELAXIN*
sodium sulfacetamide/sulfur
SOFT TOUCH lancets
SOFTCLIX lancets
solia
SPIRIVA
sprintec
stromyx
STARLIX
STRATTERA
STRIANT
SULAR
sulfacetamide sodium
sulfasalazine
sumatriptan tab, inj
SYMBICORT
SYMBYAX
SYMLIN, SYMLINPEN (INJ)

## T

TAMIFLU
tamoxifen
TAZORAC
TEGRETOL XR
TEKTURNA, HCT
temazepam
terbinafine hcl
terbutaline sulfate
TEV-TROPIN (INJ)
theophylline anhydrous, er
thioridazine hcl
thyroid
tilia fe
timolol maleate
tobramycin sulfate
TOPAMAX*
TRACLEER
trandolapril
trazodone hcl
tretinoin
TREXIMET
triamcinolone acetonide
triazolam
TRICOR
tri-legest fe
trimethobenzamide
trimethoprim
trinessa
tri-previfem
tri-sprintec
trivora
TUSSICAPS
TUSSIONEX
TWINJECT (INJ)

## U

ULTRASE, -MT
UROXATRAL
URSO, FORTE
ursodiol

## V

VAGIFEM
VALTREX*
velivet
venlafaxine (immediate release)
VENLAFAXINE ER (SNRI)
VENTOLIN HFA
VERAMYST
verapamil hcl
verelan
VESICARE
VIGAMOX
VIVELLE-DOT
VOLTAREN GEL

## W

warfarin
WELCHOL

## X

XALATAN
XENICAL*
XOPENEX neb solution
XYZAL

## Y

YASMIN*
YAZ

## Z

zaleplon
zamicet
zanchent
ZETIA
zolpidem tartrate
ZOMIG, ZMT
zonisamide
zovia
ZYLET
ZYMAR*
ZYPREXA (excluding Zydis)

## Examples of Nonformulary Medications With Selected Formulary Alternatives

The following is a list of some nonformulary brand-name medications with examples of selected alternatives that are on the formulary.

Column 1 lists examples of nonformulary medications.
Column 2 lists some alternatives that can be prescribed.

Thank you for your compliance.

| Nonformulary | Formulary Alternative |
|---|---|
| ACCOLATE | Singulair |
| ACCU-CHEK meters/strips | Ascensia, OneTouch |
| ACIPHEX | omeprazole, Nexium |
| AEROBID, M | Flovent Diskus/HFA, Pulmicort Flexhaler, Qvar |
| ALAMAST | Pataday, Patanol |
| ALOCRIL | Pataday, Patanol |
| ALORA | Generic patches, Estraderm, Vivelle-Dot |
| ALREX | Generic steroids |
| ALTOPREV | lovastatin, pravastatin, simvastatin, Crestor, Lipitor |
| ALVESCO | Flovent Diskus/HFA, Pulmicort Flexhaler, Qvar |
| AMERGE | sumatriptan, Maxalt/MLT, Zomig/ZMT |
| ANGELIQ | Activella*, Prempro/Premphase |
| ANTARA | fenofibrate, Tricor |
| ANZEMET | granisetron, ondansetron |
| APIDRA | Humalog, Novolog |
| ASMANEX | Flovent Diskus/HFA, Pulmicort Flexhaler, Qvar |
| ATACAND | Cozaar, Diovan |
| ATACAND HCT | Diovan HCT, Hyzaar |
| ATRALIN | tretinoin, Differin |
| AVALIDE | Diovan HCT, Hyzaar |
| AVANDAMET | Actoplus Met |
| AVANDARYL | Duetact |
| AVANDIA | Actos |
| AVAPRO | Cozaar, Diovan |
| AVITA | tretinoin, Differin |
| AXERT | sumatriptan, Maxalt/MLT, Zomig/ZMT |
| AZELEX | tretinoin, Differin, Finacea |
| AZMACORT | Flovent Diskus/HFA, Pulmicort Flexhaler, Qvar |
| AZOPT | brimonidine tartrate, dorzolamide, Alphagan P* |
| BECONASE AQ | flunisolide, fluticasone, Nasacort AQ, Nasonex, Veramyst |
| BENICAR | Cozaar, Diovan |
| BENICAR HCT | Diovan HCT, Hyzaar |
| BRAVELLE | Follistim AQ, Gonal-F/RFF |
| BROVANA | Perforomist |
| CARDENE SR | amlodipine, felodipine er, nifedipine er, Dynacirc CR*, Sular |
| CEDAX | amox trihydrate clavulanate, cefdinir, Augmentin XR |
| CENESTIN | estradiol, Menest, Premarin |
| CIALIS | Levitra |
| CIPRO HC | ofloxacin, Ciprodex* |
| CLARINEX | fexofenadine, Xyzal |
| COSOPT | dorzolamide-timolol |
| DETROL, LA | oxybutynin/er, Enablex, Vesicare |
| DIVIGEL | Generic patches, Evamist |
| DUREZOL | Generic steroids, Lotemax |
| ELESTAT | Pataday, Patanol |
| ELESTRIN | Generic patches, Evamist |
| ENJUVIA | estradiol, Menest, Premarin |
| EPOGEN | Aranesp, Procrit |
| ESTRASORB | Generic patches, Evamist |
| ESTROGEL | Generic patches, Evamist |
| FACTIVE | ciprofloxacin, ofloxacin, Avelox, Levaquin |
| FemHRT | Activella*, Prempro/Premphase |
| FEMTRACE | estradiol, Menest, Premarin |
| FENOGLIDE | fenofibrate, Tricor |
| FERTINEX | Follistim AQ, Gonal-F/RFF |
| FML FORTE | Generic steroids, Lotemax |
| FOCALIN, XR | dexmethylphenidate, methylphenidate, Concerta* |
| FOSRENOL | Renagel, Renvela |
| FREESTYLE | Ascensia, OneTouch |
| FROVA | sumatriptan, Maxalt/MLT, Zomig/ZMT |
| GEODON | risperidone, Abilify (regular tabs), Seroquel/XR, Zyprexa (non-Zydis) |
| HUMATROPE | Genotropin, Nutropin/AQ, Tev-Tropin |
| HYALGAN | supartz, Euflexxa |
| IMITREX Nasal | Zomig Nasal |
| IMITREX tab, inj | sumatriptan tab, inj |
| INVEGA | risperidone, Abilify (regular tabs), Seroquel/XR, Zyprexa (non-Zydis) |
| IOPIDINE | brimonidine tartrate, dorzolamide, Alphagan P* |
| KEPPRA | levetiracetam |
| LESCOL, XL | lovastatin, pravastatin, simvastatin, Crestor, Lipitor |
| LIPOFEN | fenofibrate, Tricor |
| LUNESTA | zolpidem tartrate, Ambien CR* |
| MAXAIR AUTOHALER | Proair HFA, Proventil HFA, Ventolin HFA |
| MENOSTAR | Generic patches, Estraderm, Vivelle-Dot |
| METADATE CD | methylphenidate, Concerta* |
| MICARDIS | Cozaar, Diovan |
| MICARDIS HCT | Diovan HCT, Hyzaar |
| NEVANAC | diclofenac sodium, Acular/LS/PF* |
| NORDITROPIN | Genotropin, Nutropin/AQ, Tev-Tropin |
| NOROXIN | ciprofloxacin/er, ofloxacin, Avelox, Levaquin |
| NUVARING | Ortho Tri-Cyclen Lo*, Yasmin*, Yaz |
| OMNARIS | flunisolide, fluticasone, Nasacort AQ, Nasonex, Veramyst |
| OMNITROPE | Genotropin, Nutropin/AQ, Tev-Tropin |
| OPTIVAR | Pataday, Patanol |
| ORTHO EVRA | Ortho Tri-Cyclen Lo*, Yasmin*, Yaz |
| ORTHOVISC | supartz, Euflexxa |
| OVIDREL | chorionic gonadotropin, Novarel |
| PATANASE | Astelin, Astepro |
| PEG-INTRON, REDIPEN | Pegasys |
| PRECISION QID, PCX | Ascensia, OneTouch |
| PREFEST | Activella*, Prempro/Premphase |
| PREVACID | omeprazole, Nexium |
| PRISTIQ | Cymbalta, Effexor XR, Venlafaxine ER |
| PROZAC WEEKLY | fluoxetine (daily), citalopram, paroxetine, sertraline, Lexapro |
| QUIXIN | ciprofloxacin, ofloxacin, Vigamox, Zymar* |
| RELPAX | sumatriptan, Maxalt/MLT, Zomig/ZMT |
| RETIN-A, MICRO | tretinoin, Differin |
| RHINOCORT AQUA | flunisolide, fluticasone, Nasacort AQ, Nasonex, Veramyst |
| RITALIN LA | methylphenidate, Concerta* |
| SANZEN | Genotropin, Nutropin/AQ, Tev-Tropin |
| SANCTURA, XR | oxybutynin/er, Enablex, Vesicare |
| SOF-TACT | Ascensia, OneTouch |
| SPECTRACEF | amox trihydrate clavulanate, cefdinir, Augmentin XR |
| SYNTHROID | levothyroxine sodium, levoxyl |
| SYNVISC | supartz, Euflexxa |
| TESTIM | Androderm, Androgel |
| TEVETEN | Cozaar, Diovan |
| TEVETEN HCT | Diovan HCT, Hyzaar |
| TRAVATAN, Z | Lumigan, Xalatan |
| TRIGLIDE | fenofibrate, Tricor |
| TRUSOPT | dorzolamide |
| VIAGRA | Levitra |
| VYTORIN | simvastatin, Crestor, Lipitor |
| VYVANSE | methylphenidate, Concerta* |
| XIBROM | diclofenac sodium, Acular/LS/PF* |
| XOPENEX HFA | Proair HFA, Proventil HFA, Ventolin HFA |
| ZEGERID | omeprazole, Nexium |

**KEY**
The symbol (INJ) next to a drug name indicates that the drug is available in injectable form only.
The symbol (SNRI) stands for Serotonin-Norepinephrine Reuptake Inhibitor.
**For the member:** Generic medications contain the same active ingredients as their corresponding brand-name medications, although they may look different in color or shape. They have been FDA-approved under strict standards.
**For the physician:** Please prescribe preferred products and allow generic substitutions when medically appropriate. Thank you.
Brand-name drugs are listed in CAPITAL letters.
Generic drugs are listed in lower case letters.

**THIS DOCUMENT LIST IS EFFECTIVE JANUARY 1, 2009 THROUGH DECEMBER 31, 2009. THIS LIST IS SUBJECT TO CHANGE.**
**You can get more information and updates to this document at our web site at www.express-scripts.com.**



PRMT22157-08 (02/15/08)

EXPRESS SCRIPTS®

# 2010 Express Scripts National Preferred Formulary

The following is a list of the most commonly prescribed drugs. It represents an abbreviated version of the drug list (formulary) that is at the core of your prescription-drug benefit plan. The list is not all-inclusive and does not guarantee coverage. In addition to using this list, you are encouraged to ask your doctor to prescribe generic drugs whenever appropriate.

**PLEASE NOTE: The symbol * next to a drug signifies that it is subject to nonformulary status when a generic is available throughout the year. Not all the drugs listed are covered by all prescription-drug benefit programs; check your benefit materials for the specific drugs covered and the copayments for your prescription-drug benefit program. For specific questions about your coverage, please call the phone number printed on your ID card.**

## A

ABILIFY (excluding Discmelt & solution)
acarbose
ACCU-CHEK MULTICLIX lancets
acebutolol
acetaminophen w/codeine
acetazolamide
ACTONEL with calcium
ACTOPLUS MET
ACTOS
ACULAR, LS*
acyclovir
ADVAIR DISKUS, HFA
ADVICOR
AGGRENOX
albuterol
alendronate sodium
ALPHAGAN P*
ALTABAX
amantadine
AMBIEN CR*
aminophylline
amitriptyline
amlodipine besylate
amox trihydrate/potassium clavulanate
amoxicillin
amphetamine salt combo
anagrelide
ANALPRAM-HC
ANDRODERM
ANDROGEL
antipyrine w/benzocaine
apri
aranelle
ARANESP [INJ]
ARICEPT ODT
ARIMIDEX*
ARIXTRA [INJ]
ASACOL HD
ASCENSIA AUTODISC, BREEZE/2
ASCENSIA CONTOUR SYSTEM
ASCENSIA ELITE
ASTELIN*
ASTEPRO
atenolol, -chlorthalidone
atropine sulfate
AUGMENTIN XR
AVANDAMET
AVANDARYL
AVANDIA
AVELOX
aviane
AVODART
AXID solution only
AZASITE
azathioprine
AZILECT
azithromycin
AZOR

## B

balsalazide disodium
baliviva
benazepril, /hctz
BENZACLIN (excluding carekit)*
benzonatate
benzoyl peroxide
betamethasone dp, valerate
BETASERON [INJ]
bisoprolol fumarate/hctz
BONIVA TAB
brimonidine tartrate
bupropion, sr
butalbital/apap/caffeine
BYETTA [INJ]

## C

calcipotriene
calcitriol
camila
CANASA
captopril, /hctz
carbamazepine, xr
carbidopa-levodopa, er
CARDIZEM LA*
carisoprodol
carvedilol
cefaclor, er
cefadroxil
cefdinir
cefpodoxime
cefprozil
cefturoxime
CELEBREX
CELLCEPT oral susp*
cephalexin
cesia
CETROTIDE [INJ]
chlorzoxazone
cholestyramine
choline mag trisalicylate
chorionic gonadotropin [INJ]
ciclopirox
cilostazol
cimetidine
CIPRODEX
ciprofloxacin, er
citalopram
clarithromycin, er
CLIMARA PRO
clidinium-chlordiazepoxide
clindamycin phosphate
clobetasol propionate
clomiphene citrate
clotrimazole troche
clozapine
colestipol
COMBIPATCH
CONCERTA*
COPAXONE [INJ]
COREG CR*
COZAAR*
CREON
CRESTOR
CRINONE
cryselle
cyclobenzaprine hcl
cyclosporine, modified
CYMBALTA

## D

desmopressin acetate
desonide
desoximetasone
dexmethylphenidate
dextroamphetamine-amphetamine
dextroamphetamine sulfate
diclofenac sodium
dicyclomine hcl
DIFFERIN*
diflunisal
diltiazem, extended release
DIOVAN, HCT
diphenhydramine
dipyridamole
divalproex sodium
dorzolamide, -timolol
doxepin hcl
DUAC GS
DUETACT
DYNACIRC CR*

## E

econazole
EFFEXOR XR*
ELIDEL
eliphos
ENABLEX
enalapril, hctz
ENBREL [INJ]
enpresse
enulose
EPIPEN, JR [INJ]
errin
erythromycin
erythromycin/benzoyl perox.
ESTRADERM
estradiol, tds
estropipate
etidronate disodium
etodolac
EUFLEXXA [INJ]
EVAMIST
EXELON
EXFORGE, HCT

## F

famciclovir
famotidine
felodipine er
fenofibrate
fentanyl citrate
fexofenadine
FINACEA, PLUS
finasteride
FLECTOR
FLOMAX*
FLOVENT DISKUS, HFA
fluconazole
fluocinonide
fluorouracil
fluoxetine hcl
fluphenazine
flurazepam
fluticasone nasal spray
fluvoxamine maleate
folic acid
FORADIL
FORTEO [INJ]
fortical
fosinopril, /hctz
FOSRENOL

## G

gabapentin
gemfibrozil
GENOTROPIN [INJ]
gentamicin sulfate
glimepiride
glipizide, er, xl
glipizide/metformin
GLUCAGEN [INJ]
glyburide, micronized
glyburide/metformin
GONAL-F RFF [INJ]
granisetron

## H

HALFLYTELY, -BISACODYL
haloperidol
HUMALOG [INJ]
HUMATROPE [INJ]
HUMIRA [INJ]
HUMULIN [INJ]
hydrochlorothiazide
hydrocodone/acetaminophen
hydrocortisone
hydromorphone
hydroxyurea
hyoscyamine sulfate
HYZAAR*

## I

ibuprofen
imipramine
indomethacin
INTAL inh
ipratropium bromide
ipratropium-albuterol
isosorbide mononitrate
isotretinoin
itraconazole

## J

JANUMET
JANUVIA
jolessa
jolivette
junel, fe

## K

kariva
kelnor
KEPPRA XR
ketoconazole

## L

labetalol hcl
lactulose
lamotrigine
LANTUS, SOLOSTAR [INJ]
leena
leflunomide
lessina
LETAIRIS
leucovorin
leuprolide acetate [INJ]
LEVAQUIN
LEVEMIR, FLEXPEN [INJ]
levetiracetam
levora
levothyroxine sodium
levoxyl
LEXAPRO
LIALDA
LIDODERM
LIPITOR
lisinopril, /hctz
LOTEMAX
LOTREL*
lovastatin
LOVAZA
LOVENOX* [INJ]
low-ogestrel
LUMIGAN
lutera
LYRICA

## M

MAXALT, MLT
meclizine hcl
medroxyprogesterone acetate
megestrol
meloxicam
MENEST
mercaptopurine
MERIDIA
METANX
metaproterenol
metformin, er
methocarbamol
methotrexate
methylphenidate hcl
methylprednisolone
metoclopramide hcl
metolazone
metoprolol, hctz
METROGEL
metronidazole
microgestin, fe
MIRAPEX*
mirtazapine, soltab
moexipril/hctz
mometasone
mononessa
morphine sulfate
MOVIPREP
MUSE
mycophenolate mofetil

## N

nabumetone
nadolol
NAMENDA
naproxen
NASACORT AQ
NASONEX
nateglinide
necon
NEEVO
neomycin/polymyxin/dexamethasone
neomycin/polymyxin/hc
NEVANAC
NEXIUM
NIASPAN
nifedipine er
nisoldipine
nitrofurantoin macrocrystal
nitroglycerin
NITROLINGUAL SPRAY
nizatidine
nora-be
nortrel
NOVOFINE
NOVOLIN [INJ]
NOVOLOG [INJ]
NUTROPIN, AQ [INJ]
nystatin

## O

ofloxacin
ogestrel
omeprazole
ondansetron
ONETOUCH BASIC
ONETOUCH FASTTAKE
ONETOUCH SURESTEP
ONETOUCH ULTRA,-2,-SMART
ONETOUCH ULTRAMINI
OPANA ER
orphenadrine citrate
ORTHO TRI-CYCLEN LO
OSMOPREP
oxcarbazepine
oxybutynin, er
oxycodone w/acetaminophen
OXYCONTIN
OXYTROL

## P

paroxetine
PATADAY
PATANOL
peg 3350/electrolyte
PEGASYS [INJ]
PEG-INTRON, REDIPEN [INJ]
penicillin v potassium
PERFOROMIST
perphenazine
phentermine hcl
phenytoin sodium, extended
pilocarpine hcl
pindolol
PLAVIX
polymyxin b sul/trimethoprim
portia
PRAMOSONE
PRANDIMET
PRANDIN*
pravastatin
PRECISION SURE DOSE
PRECISION XTRA

(continued)

**THIS DOCUMENT LIST IS EFFECTIVE JANUARY 1, 2010 THROUGH DECEMBER 31, 2010. THIS LIST IS SUBJECT TO CHANGE.**
You can get more information and updates to this document at our web site at www.express-scripts.com.

prednisolone
prednisolone acetate
prednisone
PREMARIN
PREMPHASE
PREMPRO
PRENATE ELITE
previfem
PRISTIQ
PROAIR HFA
PROCHIEVE
prochlorperazine
PROCRIT (INJ)
promethazine
promethazine w/codeine
promethazine w/dm
PROMETRIUM
propranolol hcl, w/hctz
PROTOPIC*
pseudoephedrine w/chlorpheniramine
PULMICORT FLEXHALER
PYLERA

## Q

quasense
quinapril
quinaretic
QVAR

## R

ramipril
RANEXA
ranitidine
REBIF (INJ)
reclipsen
RELENZA
RENAGEL
RENVELA
reprexain
REQUIP XL
RESTASIS
ribasphere
ribavirin
risperidone, odt
ropinirole
RYTHMOL SR

## S

salsalate
selenium sulfide
SEREVENT DISKUS
SEROQUEL, XR
sertraline
SIMCOR
simvastatin
SINGULAIR
SKELAXIN*
sodium sulfacetamide/sulfur
SOFT TOUCH lancets
SOFTCLIX lancets
solia
SOMATULINE DEPOT (INJ)
SPIRIVA
sprintec
sronyx
STRATTERA
STRIANT
SULAR
sulfacetamide sodium
sulfasalazine
sumatriptan tab, inj
SYMBICORT
SYMBYAX
SYMLIN, SYMLINPEN (INJ)

## T

TAMIFLU
tamoxifen
TAZORAC
TEKTURNA, HCT
temazepam
terbinafine hcl
terbutaline sulfate
theophylline, anhydrous, er
thioridazine hcl
thyroid
tilia fe
timolol maleate
tobramycin sulfate
topiramate
TRACLEER
trandolapril
trazodone hcl
tretinoin
TREXIMET
triamcinolone acetonide
triazolam
tri-legest fe
TRILIPIX
trimethobenzamide
trimethoprim
trinessa
tri-previfem
tri-sprintec
trivora
TUSSICAPS
TUSSIONEX
TWINJECT (INJ)

## U

ULTRASE, -MT
UROXATRAL
ursodiol

## V

VAGIFEM
VALTREX*
VECTICAL
vellivet
venlafaxine (immediate release)
VENTOLIN HFA
VERAMYST
verapamil hcl
veripred
VESICARE
VIAGRA
VIGAMOX
VIMPAT
VIVELLE-DOT
VOLTAREN GEL
VYVANSE

## W

warfarin
WELCHOL

## X

XALATAN
XOPENEX neb solution
XYZAL

## Y

YAZ

## Z

zaleplon
zamicet
zenchent
ZETIA
zolpidem tartrate
ZOMIG, ZMT
zonisamide
zovia
ZYLET
ZYMAR*
ZYPREXA (excluding Zydis)

### Examples of Nonformulary Medications With Selected Formulary Alternatives

The following is a list of some nonformulary brand-name medications with examples of selected alternatives that are on the formulary.

Column 1 lists examples of nonformulary medications.
Column 2 lists some alternatives that can be prescribed.

Thank you for your compliance.

| Nonformulary | Formulary Alternative |
|---|---|
| ACCOLATE | Singulair |
| ACCU-CHEK | Ascensia, OneTouch |
| metered strips | |
| ACIPHEX | omeprazole, Nexium |
| ADDERALL XR | dextroamphetamine-amphetamine |
| AEROBID, M | Flovent Diskus/HFA, Pulmicort Flexhaler, Qvar |
| ALAMAST | Pataday, Patanol |
| ALOCRIL | Pataday, Patanol |
| ALOMIDE | Pataday, Patanol |
| ALORA | Generic patches, Estraderm, Vivelle-Dot |
| ALTOPREV | lovastatin, pravastatin, simvastatin, Crestor, Lipitor |
| ALVESCO | Flovent Diskus/HFA, Pulmicort Flexhaler, Qvar |
| AMERGE | sumatriptan tab, Maxalt/MLT, Zomig/ZMT |
| ANGELIQ | Prempro/Premphase |
| ANTARA | fenofibrate, Trilipix |
| APIDRA | Humalog, Novolog |
| APRISO | balsalazide, Asacol/HD, Lialda |
| ASMANEX | Flovent Diskus/HFA, Pulmicort Flexhaler, Qvar |
| ATACAND | Cozaar*, Diovan |
| ATACAND HCT | Diovan HCT, Hyzaar* |
| ATRALIN | tretinoin, Differin* |
| AVALIDE | Diovan HCT, Hyzaar* |
| AVAPRO | Cozaar*, Diovan |
| AVINZA | morphine sulfate er |
| AVITA | tretinoin, Differin* |
| AXERT | sumatriptan tab, Maxalt/MLT, Zomig/ZMT |
| AZMACORT | Flovent Diskus/HFA, Pulmicort Flexhaler, Qvar |
| AZOPT | brimonidine tartrate, dorzolamide, Alphagan P* |
| BECONASE AQ | flunisolide, fluticasone, Nasacort AQ, Nasonex, Veramyst |
| BENICAR | Cozaar*, Diovan |
| BENICAR HCT | Diovan HCT, Hyzaar* |
| BESIVANCE | ciprofloxacin, Vigamox, Zymar* |
| BRAVELLE | Gonal-F/RFF |
| BROVANA | Perforomist |
| CARDENE SR | amlodipine, felodipine er, nifedipine er, Dynacirc CR*, Sular |
| CEDAX | amox tr/potassium clavulanate, cefdinir, Augmentin XR |
| CENESTIN | estradiol, Menest, Premarin |
| CETRAXAL | Ciprodex |
| CIALIS | Viagra |
| CIMZIA | Enbrel, Humira |
| CIPRO HC | Ciprodex |
| CLARINEX | fexofenadine, Xyzal |
| DETROL, LA | oxybutynin/er, Enablex, Vesicare |
| DIVIGEL | Generic patches, Evamist |
| DUREZOL | Generic steroids, Lotemax |
| EDEX | Caverject, Muse |
| EDLUAR | zolpidem tartrate, Ambien CR* |
| ELESTAT | Pataday, Patanol |
| ELESTRIN | Generic patches, Evamist |
| EMADINE | Pataday, Patanol |
| ENJUVIA | estradiol, Menest, Premarin |
| EPOGEN | Aranesp, Procrit |
| ESTRASORB | Generic patches, Evamist |
| ESTROGEL | Generic patches, Evamist |
| FACTIVE | ciprofloxacin/er, ofloxacin, Avelox, Levaquin |
| FemHRT | Prempro/Premphase |
| FEMTRACE | estradiol, Menest, Premarin |
| FENOGLIDE | fenofibrate, Trilipix |
| FERTINEX | Gonal-F/RFF |
| FML FORTE | Generic steroids, Lotemax |
| FOCALIN, XR | dexmethylphenidate, dextroamphetamine-amphetamine, Concerta*, Vyvanse |
| FOLLISTIM AQ | Gonal-F/RFF |
| FREESTYLE | Ascensia, OneTouch |
| FROVA | sumatriptan tab, Maxalt/MLT, Zomig/ZMT |
| GELNIQUE | oxybutynin er, Oxytrol |
| GEODON | risperidone, Abilify (regular tabs), Seroquel/XR, Zyprexa (non-Zydis) |
| HYALGAN | Euflexxa |
| IMITREX Nasal | Zomig Nasal |
| INVEGA | risperidone, Abilify (regular tabs), Seroquel/XR, Zyprexa (non-Zydis) |
| IQLIX | ciprofloxacin, Vigamox, Zymar* |
| KADIAN | morphine sulfate er |
| KAPIDEX | omeprazole, Nexium |
| LESCOL, XL | lovastatin, pravastatin, simvastatin, Crestor, Lipitor |
| LEVITRA | Viagra |
| LIPOFEN | fenofibrate, Trilipix |
| LUNESTA | zolpidem tartrate, Ambien CR* |
| MAXAIR AUTOHALER | ProAir HFA, Ventolin HFA |
| MENOSTAR | Generic patches, Estraderm, Vivelle-Dot |
| METADATE CD | dextroamphetamine-amphetamine, methylphenidate, Concerta*, Vyvanse |
| MICARDIS | Cozaar*, Diovan |
| MICARDIS HCT | Diovan HCT, Hyzaar* |
| NORDITROPIN | Genotropin, Humatrope, Nutropin/AQ |
| NOROXIN | ciprofloxacin/er, ofloxacin, Avelox, Levaquin |
| NUVARING | Ortho Tri-Cyclen Lo, Yaz |
| OMNARIS | flunisolide, fluticasone, Nasacort AQ, Nasonex, Veramyst |
| OMNITROPE | Genotropin, Humatrope, Nutropin/AQ |
| OPTIVAR | Pataday, Patanol |
| ORTHO EVRA | Ortho Tri-Cyclen Lo, Yaz |
| ORTHOVISC | Euflexxa |
| PATANASE | Astelin*, Astepro |
| PRECISION PCX, QID | Ascensia, OneTouch |
| PREFEST | Prempro/Premphase |
| PREVACID | omeprazole, Nexium |
| PREVPAC | Pylera |
| PROVENTIL HFA | ProAir HFA, Ventolin HFA |
| PROZAC WEEKLY | fluoxetine (daily), citalopram, paroxetine, sertraline, Lexapro |
| QUIXIN | ciprofloxacin, Vigamox, Zymar* |
| RAPAFLO | doxazosin, Flomax*, Uroxatral |
| RELPAX | sumatriptan tab, Maxalt/MLT, Zomig/ZMT |
| RETIN-A MICRO | tretinoin, Differin* |
| RHINOCORT AQUA | flunisolide, fluticasone, Nasacort AQ, Nasonex, Veramyst |
| RITALIN LA | dextroamphetamine-amphetamine, methylphenidate, Concerta*, Vyvanse |
| SAIZEN | Genotropin, Humatrope, Nutropin/AQ |
| SANCTURA, XR | oxybutynin/er, Enablex, Vesicare |
| SIMPONI | Enbrel, Humira |
| SOF-TACT | Ascensia, OneTouch |
| SPECTRACEF | amox tr/potassium clavulanate, cefdinir, Augmentin XR |
| STARLIX | nateglinide |
| SUMATRIPTAN Nasal | Zomig Nasal |
| SUPARTZ | Euflexxa |
| SYNTHROID | levothyroxine sodium, levoxyl |
| SYNVISC ONE | Euflexxa |
| TESTIM | Androderm, Androgel |
| TEVETEN | Cozaar*, Diovan |
| TEVETEN HCT | Diovan HCT, Hyzaar* |
| TEV-TROPIN | Genotropin, Humatrope, Nutropin/AQ |
| TOVIAZ | oxybutynin/er, Enablex, Vesicare |
| TRAVATAN, Z | Lumigan, Xalatan |
| TRICOR | fenofibrate, Trilipix |
| TRIGLIDE | fenofibrate, Trilipix |
| VENLAFAXINE ER | Cymbalta, Effexor XR*, Pristiq |
| VYTORIN | simvastatin, Crestor, Lipitor |
| XIBROM | diclofenac sodium, AcularLS*, Nevanac |
| XOPENEX HFA | ProAir HFA, Ventolin HFA |
| ZEGERID | omeprazole, Nexium |

**KEY**
The symbol (INJ) next to a drug name indicates that the drug is available in injectable form only.
**For the member:** Generic medications contain the same active ingredients as their corresponding brand-name medications, although they may look different in color or shape. They have been FDA-approved under strict standards.
**For the physician:** Please prescribe preferred products and allow generic substitutions when medically appropriate. Thank you.
Brand-name drugs are listed in CAPITAL letters.
Generic drugs are listed in lower case letters.

**THIS DOCUMENT LIST IS EFFECTIVE JANUARY 1, 2010 THROUGH DECEMBER 31, 2010. THIS LIST IS SUBJECT TO CHANGE.**
**You can get more information and updates to this document at our web site at www.express-scripts.com.**



PRMT2215T-10 (09/15/09)

EXPRESS SCRIPTS®

# 2011 Express Scripts National Preferred Formulary

The following is a list of the most commonly prescribed drugs. It represents an abbreviated version of the drug list (formulary) that is at the core of your prescription-drug benefit plan. The list is not all-inclusive and does not guarantee coverage. In addition to using this list, you are encouraged to ask your doctor to prescribe generic drugs whenever appropriate.

**PLEASE NOTE: The symbol * next to a drug signifies that it is subject to nonformulary status when a generic is available throughout the year. Not all the drugs listed are covered by all prescription-drug benefit programs; check your benefit materials for the specific drugs covered and the copayments for your prescription-drug benefit program. For specific questions about your coverage, please call the phone number printed on your ID card.**

## A

ABILIFY (excluding Discmelt & solution)
acarbose
ACCU-CHEK MULTICLIX lancets
acebutolol
acetaminophen w/codeine
acetazolamide
ACTONEL with calcium
ACTOPLUS MET, XR
ACTOS
acyclovir
ADCIRCA
ADVAIR DISKUS, HFA
ADVICOR
AGGRENOX
albuterol
alendronate sodium
ALPHAGAN P*
ALTABAX
amantadine
AMBIEN CR*
AMITIZA
amitriptyline
amlodipine besylate
amox tr/potassium clavulanate
amoxicillin
amphetamine salt combo
anagrelide
ANALPRAM E, -HC
anastrozole
ANDRODERM*
ANDROGEL
antipyrine w/benzocaine
apri
aranelle
ARANESP [INJ]
ARICEPT, ODT*
ARIXTRA [INJ]
ASACOL, HD
ASTELIN*
ASTEPRO
atenolol, -chlorthalidone
AVANDAMET
AVANDARYL
AVANDIA
AVELOX
aviane
AVODART
AZASITE
azathioprine
azelastine
AZILECT
azithromycin
AZOR

## B

balsalazide disodium
beloiva
BAYER ASCENSIA AUTODISC
BAYER BREEZE 2
BAYER CONTOUR (excluding USB meter)
benazepril, /hctz
BENICAR, HCT
BENZACLIN PUMP (excluding carekit)
benzonatate
benzoyl peroxide
betamethasone dp, valerate
BETASERON [INJ]
BONIVA TAB
brimonidine tartrate
bupropion, sr
butalbital/apap/caffeine
BYETTA [INJ]
BYSTOLIC

## C

calcipotriene
calcitriol
camila
CANASA
captopril, /hctz
carbamazepine, xr
carbidopa-levodopa, er
carvedilol
cefadroxil
cefdinir
cefprozil
cefuroxime
CELEBREX
cephalexin
cesia
CETROTIDE [INJ]
chlorzoxazone
cholestyramine
chorionic gonadotropin [INJ]
CIALIS
ciclopirox
cilostazol
cimetidine
CIPRODEX
ciprofloxacin, er
citalopram
clarithromycin, er
CLIMARA PRO
clindamycin phosphate
clobetasol propionate
clomiphene citrate
clotrimazole troche
clozapine
colestipol
COMBIGAN
COMBIPATCH
CONCERTA*
COPAXONE [INJ]
COREG CR*
CREON DR
CRESTOR
CRINONE
cryselle
cyclosporine, modified
CYMBALTA

## D

desmopressin acetate
desonide
desoximetasone
dexmethylphenidate
dextroamphetamine-amphetamine
dextroamphetamine sulfate
diclofenac sodium
dicyclomine hcl
DIFFERIN*
diltiazem, extended release
DIOVAN, HCT
divalproex sodium
dorzolamide, -timolol
doxazosin
DUAC CS*
DUETACT
DYNACIRC CR*

## E

EFFEXOR XR*
EFFIENT
ELIDEL
eliphos
EMBEDA
ENABLEX
enalapril, hctz
ENBREL [INJ]
ENDOMETRIN
enpresse
EPIDUO
EPIPEN, JR [INJ]
errin
erythromycin
erythromycin/benzoyl perox.
ESTRADERM
estradiol, tds
estradiol/norethindrone
EUFLEXXA [INJ]
EURAX
EVAMIST
EXELON PATCH
EXFORGE, HCT

## F

famciclovir
famotidine
felodipine er
fenofibrate
fentanyl citrate
fexofenadine
fexofenadine-pse
FINACEA, PLUS
finasteride
FLECTOR
FLOVENT DISKUS, HFA
fluconazole
flunisolide nasal spray
fluocinonide
fluorouracil
fluoxetine, dr
fluticasone nasal spray
fluvoxamine maleate
folic acid
FORADIL
FORTAMET
FORTEO [INJ]
fortical
fosinopril, /hctz
FOSRENOL

## G

gabapentin
galantamine
GELNIQUE
gemfibrozil
GENOTROPIN [INJ]
gentamicin sulfate
ganvi
glimepiride
glipizide, er, xl
glipizide/metformin
GLUCAGEN [INJ]
glyburide, micronized
glyburide/metformin
GONAL-F, RFF [INJ]
granisetron

## H

HALFLYTELY-BISACODYL*
haloperidol
HECTOROL
HUMALOG [INJ]
HUMATROPE [INJ]
HUMIRA [INJ]
HUMULIN [INJ]
hydrochlorothiazide
hydrocodone/acetaminophen
hydrocortisone
hydromorphone
hydroxyurea

## I

ibuprofen
imipramine
imiquimod
indomethacin
ipratropium bromide
ipratropium-albuterol
isosorbide mononitrate
isotretinoin

## J

JALYN
JANUMET
JANUVIA
jolessa
jolivette
junel, fe

## K

kariva
kelnor
KEPPRA XR*
ketoconazole
ketorolac

## L

labetalol hcl
lactulose
LAMICTAL ODT*
LAMICTAL XR
lamotrigine
lansoprazole
LANTUS, SOLOSTAR [INJ]
leena
leflunomide
lessina
LETAIRIS
leucovorin
leuprolide acetate [INJ]
LEVAQUIN*
LEVEMIR, FLEXPEN [INJ]
levetiracetam
levora
levothyroxine sodium
levoxyl
LEXAPRO
LIALDA
LIDODERM
LIPITOR*
lisinopril, /hctz
losartan, /hctz
LOTEMAX
LOTREL*
lovastatin
LOVAZA
LOVENOX* [INJ]
low-ogestrel
LUMIGAN
lutera
LYRICA

## M

MAXALT, MLT
meclizine hcl
medroxyprogesterone acetate
megestrol
meloxicam
MENEST
mercaptopurine
MERIDIA
metaxalone
metformin, er
methocarbamol
methotrexate
methylphenidate hcl
methylprednisolone
metoclopramide hcl
metolazone
metoprolol, hctz
METROGEL
metronidazole
micronized progestin, fe
MIGRANAL nasal spray
mirtazapine, soltab
moexipril/hctz
mometasone
mononessa
morphine sulfate
MOVIPREP
MULTAQ
MUSE
mycophenolate mofetil

## N

nabumetone
NAMENDA
naproxen
naratriptan
NASONEX
nateglinide
necon
NEEVO
neomycin/polymyxin/dexamethasone
neomycin/polymyxin/hc
NEVANAC
NEXIUM
NIASPAN
nifedipine er
nitrofurantoin macrocrystal
nitroglycerin patch
nora-be
nortrel
NOVOFINE
NOVOLIN [INJ]
NOVOLOG [INJ]
NUCYNTA
NUTROPIN, AQ [INJ]
NUVARING
nystatin

## O

ocella
ofloxacin
ogestrel
omeprazole
ondansetron
ONETOUCH BASIC
ONETOUCH FASTTAKE
ONETOUCH SURESTEP
ONETOUCH ULTRA, -2, -SMART
ONETOUCH ULTRAMINI
ONGLYZA
OPANA ER*
ORTHO TRI-CYCLEN LO
ORTHOVISC [INJ]
OSMOPREP
oxcarbazepine
oxybutynin, er
oxycodone w/acetaminophen
OXYCONTIN

## P

paroxetine
PATADAY*
PATANOL*
peg 3350/electrolyte
PEGASYS [INJ]
PEG-INTRON, REDIPEN [INJ]
penicillin v potassium
PERFOROMIST
phentermine hcl
phenytoin sodium, extended
pilocarpine hcl
PLAVIX
portia
PRANDIMET
PRANDIN*
pravastatin
PRECISION SURE DOSE
PRECISION XTRA

(continued)

**THIS DOCUMENT LIST IS EFFECTIVE JANUARY 1, 2011 THROUGH DECEMBER 31, 2011. THIS LIST IS SUBJECT TO CHANGE.**
**You can get more information and updates to this document at our website at www.express-scripts.com.**



PRMT2215T-11 (09/15/10)

prednisolone
prednisolone acetate
prednisone
PREMARIN
PREMPHASE
PREMPRO
PRENATE DHA, ELITE
previfem
PRISTIQ
PROAIR HFA
PROCHIEVE
prochlorperazine
PROCRIT (INJ)
promethazine
promethazine w/codeine
promethazine w/dm
PROMETRIUM
propranolol hcl, w/hctz
PROTOPIC
PULMICORT FLEXHALER
PYLERA

## Q

quasense
quinapril
QVAR

## R

ramipril
RANEXA
ranitidine
REBIF (INJ)
reclipsen
RELENZA
RENAGEL
RENVELA
reprexain
REQUIP XL
RESTASIS
REVATIO
ribavirin
RIOMET
risperidone, odt
rivastigmine caps
ropinirole
RYTHMOL SR*

## S

SANCUSO
SAVELLA
SEREVENT DISKUS
SEROQUEL XR
sertraline
SIMCOR
simvastatin
SINGULAIR
sodium sulfacetamide/ sulfur
SOFT TOUCH lancets
SOFTCLIX lancets
solia
SOMATULINE DEPOT (INJ)
SPIRIVA
sprintec
sronyx
STRATTERA*
STRIANT
SUBOXONE*
SULAR*
sulfacetamide sodium
sulfasalazine
sumatriptan tab, inj
SYMBICORT
SYMBYAX
SYMLIN, SYMLINPEN (INJ)

## T

TAMIFLU
tamoxifen
tamsulosin
TAZORAC*
TEKTURNA, HCT
temazepam
terbinafine hcl
theophylline, anhydrous, er
thyroid
tilia fe
timolol maleate
tobramycin sulfate
topiramate
TRACLEER
trandolapril
trandolapril/verapamil
trazodone hcl
tretinoin
TREXIMET
triamcinolone acetonide
triazolam
tri-legest fe
TRILIPIX
trinessa
tri-previfem
tri-sprintec
trivora
TUSSICAPS
TUSSIONEX
TWINJECT (INJ)

## U

ULORIC
UROXATRAL*
ursodiol

## V

VAGIFEM
valacyclovir
VALTURNA
velivet
VENTOLIN HFA
VERAMYST
verapamil hcl
veripred
VESICARE
VIAGRA
VIGAMOX
VIMOVO
VIMPAT
VIVELLE-DOT
VOLTAREN GEL*
VYVANSE

## W

warfarin
WELCHOL

## X

XALATAN*
XOPENEX neb solution
XYZAL

## Z

zaleplon
zamicet
zenchent
ZETIA
zolpidem tartrate
ZOMIG, ZMT
zonisamide
zovia
ZYCLARA
ZYLET
ZYMAR*
ZYMAXID
ZYPREXA (excluding Zydis)*

### Examples of Nonformulary Medications With Selected Formulary Alternatives

The following is a list of some nonformulary brand-name medications with examples of selected alternatives that are on the formulary.

Column 1 lists examples of nonformulary medications.
Column 2 lists some alternatives that can be prescribed.

Thank you for your compliance.

| Nonformulary | Formulary Alternative |
|---|---|
| ACCOLATE | Singulair |
| ACCU-CHEK meters/strips | Bayer Breeze 2/Contour (excluding USB meter), OneTouch |
| ACIPHEX | lansoprazole, omeprazole, Nexium |
| ACUVAIL | diclofenac sodium, ketorolac, Nevanac |
| AEROBID, M | Flovent Diskus/HFA, Pulmicort Flexhaler, Qvar |
| ALAMAST | azelastine, Pataday*, Patanol* |
| ALOCRIL | azelastine, Pataday*, Patanol* |
| ALOMIDE | azelastine, Pataday*, Patanol* |
| ALORA | Generic patches, Estraderm, Vivelle-Dot |
| ALTOPREV | lovastatin, simvastatin, Crestor, Lipitor* |
| ALVESCO | Flovent Diskus/HFA, Pulmicort Flexhaler, Qvar |
| ANGELIQ | estradiol/noreth, Prempro/Premphase |
| ANTARA | fenofibrate, Trilipix |
| APIDRA | Humalog, Novolog |
| APRISO | balsalazide, Asacol/HD, Lialda |
| ASMANEX | Flovent Diskus/HFA, Pulmicort Flexhaler, Qvar |
| ATACAND | losartan, Benicar, Diovan |
| ATACAND HCT | losartan/hctz, Benicar HCT, Diovan HCT |
| ATRALIN | tretinoin, Differin*, Epiduo |
| AUGMENTIN XR | amox/clavulanate er |
| AVALIDE | losartan/hctz, Benicar HCT, Diovan HCT |
| AVAPRO | losartan, Benicar, Diovan |
| AVINZA | morphine sulfate er |
| AVITA | tretinoin, Differin*, Epiduo |
| AXERT | sumatriptan tab, Maxalt/MLT, Zomig/ZMT |
| AZOPT | brimonidine tartrate, dorzolamide, Alphagan P*, Combigan |
| BECONASE AQ | flunisolide, fluticasone, Nasonex, Veramyst |
| BEPREVE | azelastine, Pataday*, Patanol* |
| BESIVANCE | ciprofloxacin, Vigamox, Zymar*, Zymaxid |
| BRAVELLE | Gonal-F/RFF |
| BROVANA | Perforomist |
| CARDENE SR | amlodipine, felodipine er, nifedipine er, Dynacirc CR*, Sular* |
| CARDIZEM LA | diltiazem 24 hr er |
| CENESTIN | estradiol, Menest, Premarin |
| CETRAXAL | Ciprodex |
| CIMZIA | Enbrel, Humira |
| CIPRO HC | Ciprodex |
| CLARINEX | fexofenadine, Xyzal |
| DETROL, LA | oxybutynin er, Enablex, Vesicare |
| DEXILANT | lansoprazole, omeprazole, Nexium |
| DIVIGEL | Generic patches, Evamist |
| DUREZOL | Generic steroids, Lotemax |
| EDEX | Caverject, Muse |
| EDLUAR | zolpidem tartrate, Ambien CR* |
| ELESTAT | azelastine, Pataday*, Patanol* |
| ELESTRIN | Generic patches, Evamist |
| EMADINE | azelastine, Pataday*, Patanol* |
| ENJUVIA | estradiol, Menest, Premarin |
| EPOGEN | Aranesp, Procrit |
| ESTRASORB | Generic patches, Evamist |
| ESTROGEL | Generic patches, Evamist |
| EXELON CAPS | rivastigmine |
| FACTIVE | ciprofloxacin/er, ofloxacin, Avelox, Levaquin* |
| FemHRT | estradiol/noreth, Prempro/Premphase |
| FEMTRACE | estradiol, Menest, Premarin |
| FENOGLIDE | fenofibrate, Trilipix |
| FERTINEX | Gonal-F/RFF |
| FML FORTE | Generic steroids, Lotemax |
| FOCALIN, XR | dexmethylphenidate, Concerta*, Vyvanse |
| FOLLISTIM AQ | Gonal-F/RFF |
| FREESTYLE | Bayer Breeze 2/Contour (excluding USB meter), OneTouch |
| FROVA | sumatriptan tab, Maxalt/MLT, Zomig/ZMT |
| GEODON | risperidone, Abilify (regular tabs), Seroquel/XR, Zyprexa (non-Zydis)* |
| HYALGAN | Euflexxa, Orthovisc |
| IMITREX Nasal | Zomig Nasal |
| INNOHEP | Arixtra |
| INVEGA | risperidone, Abilify (regular tabs), Seroquel/XR, Zyprexa (non-Zydis)* |
| IQUIX | ciprofloxacin, Vigamox, Zymar*, Zymaxid |
| KADIAN | morphine sulfate er |
| LESCOL, XL | lovastatin, simvastatin, Crestor, Lipitor* |
| LEVITRA | Cialis, Viagra |
| LIPOFEN | fenofibrate, Trilipix |
| LUNESTA | zolpidem tartrate, Ambien CR* |
| MAXAIR AUTOHALER | ProAir HFA, Ventolin HFA |
| MENOSTAR | Generic patches, Estraderm, Vivelle-Dot |
| METADATE CD | dextroamphetamine-amphetamine, methylphenidate, Concerta*, Vyvanse |
| MICARDIS | losartan, Benicar, Diovan |
| MICARDIS HCT | losartan/hctz, Benicar HCT, Diovan HCT |
| NASACORT AQ | flunisolide, fluticasone, Nasonex, Veramyst |
| NORDITROPIN | Genotropin, Humatrope, Nutropin/AQ |
| NOROXIN | ciprofloxacin/er, ofloxacin, Avelox, Levaquin* |
| OMNARIS | flunisolide, fluticasone, Nasonex, Veramyst |
| OMNITROPE | Genotropin, Humatrope, Nutropin/AQ |
| ORTHO EVRA | gianvi, Ortho Tri-Cyclen Lo |
| OXYTROL | oxybutynin er, Gelnique |
| PATANASE | Astelin*, Astepro |
| PRECISION PCX, QID | Bayer Breeze 2/Contour (excluding USB meter), OneTouch |
| PREFEST | estradiol/noreth, Prempro/Premphase |
| PREVACID | lansoprazole |
| PREVPAC | Pylera |
| PROVENTIL HFA | ProAir HFA, Ventolin HFA |
| QUIXIN | ciprofloxacin, Vigamox, Zymar*, Zymaxid |
| RAPAFLO | doxazosin, tamsulosin, Uroxatral* |
| RELPAX | sumatriptan tab, Maxalt/MLT, Zomig/ZMT |
| RETIN-A MICRO | tretinoin, Differin*, Epiduo |
| RHINOCORT AQUA | flunisolide, fluticasone, Nasonex, Veramyst |
| RITALIN LA | dextroamphetamine-amphetamine, methylphenidate, Concerta*, Vyvanse |
| SAIZEN | Genotropin, Humatrope, Nutropin/AQ |
| SANCTURA XR | oxybutynin er, Enablex, Vesicare |
| SIMPONI | Enbrel, Humira |
| SUMATRIPTAN Nasal | Zomig Nasal |
| SUPARTZ | Euflexxa, Orthovisc |
| SYNTHROID | levothyroxine sodium, levoxyl |
| SYNVISC, ONE | Euflexxa, Orthovisc |
| TESTIM | Androderm*, Androgel |
| TEVETEN | losartan, Benicar, Diovan |
| TEVETEN HCT | losartan/hctz, Benicar HCT, Diovan HCT |
| TEV-TROPIN | Genotropin, Humatrope, Nutropin/AQ |
| TOVIAZ | oxybutynin er, Enablex, Vesicare |
| TRAVATAN Z | Lumigan, Xalatan* |
| TRICOR | fenofibrate, Trilipix |
| TRIGLIDE | fenofibrate, Trilipix |
| VYTORIN | simvastatin, Crestor, Lipitor* |
| XIBROM | diclofenac sodium, ketorolac, Nevanac |
| XOPENEX HFA | ProAir HFA, Ventolin HFA |
| YAZ | gianvi, Ortho Tri-Cyclen Lo |
| ZEGERID | lansoprazole, omeprazole, Nexium |

**KEY**
The symbol (INJ) next to a drug name indicates that the drug is available in injectable form only.
**For the member:** Generic medications contain the same active ingredients as their corresponding brand-name medications, although they may look different in color or shape. They have been FDA-approved under strict standards.
**For the physician:** Please prescribe preferred products and allow generic substitutions when medically appropriate. Thank you.
Brand-name drugs are listed in CAPITAL letters.
Generic drugs are listed in lower case letters.

**THIS DOCUMENT LIST IS EFFECTIVE JANUARY 1, 2011 THROUGH DECEMBER 31, 2011. THIS LIST IS SUBJECT TO CHANGE.**
**You can get more information and updates to this document at our website at www.express-scripts.com.**

A list of applicable medications from 2009, 2010, and 2011 National Preferred Formulary: Express Scripts

| HEART DISEASE | DIABETES | HYPERTENSION | HIGH CHOLESTEROL |
|---|---|---|---|
| **Acetazolamide** | **Acarbose** | **Acebutolol** | Advicor (**Niacin and Lovastatin**) |
| Aggrenox (**Aspirin and Dipyridamole**) | Actoplus Met (**Pioglitazone and Metformin**) | **Amlodipine besylate** | **Cholestyramine** |
| **Anagrelide** | Actos (**Pioglitazone**) | **Atenolol,-chlorthalidone** | **Colestipol** |
| Bystolic (**Nebivolol**) (**2011**) | Avandamet (**Rosiglitazone and Metformin**) (**2010&2011**) | Azor (**Amlodipine and Olmesartan**) | Crestor (**Rosuvastatin**) |
| **Cilostazol** | Avandia (**Rosiglitazone**) (**2010&2011**) | **Benazepril, -hctz** | **Fenofibrate** |
| **Dipyridamole** (**2009&2010**) | Avandaryl (**Rosiglitazone and Glimepiride**) (**2010&2011**) | Benicar, hct (**Olmesartan, hctz**) (**2011**) | **Gemfibrozil** |
| Effient (**Prasugrel**) (**2011**) | Byetta [INJ] (**Exenatide**) | **Bisoprolol fumarate/hctz** (**2009&2010**) | Lipitor (**Atorvastatin**) |
| **Isosorbide mononitrate** | **Desmopressin acetate** | Bystolic (**Nebivolol**) (**2011**) | **Lovastatin** |
| Lovenox* [INJ] (**Enoxaparin**) | Duetact (**Pioglitazone and Glimepiride**) | **Captopril,/hctz** | Lovaza (**Omega-3-Acid Ethyl Esters**) |
| Multaq (**Dronedarone**)(**2011**) | Fortamet (**MetFORMIN**) (**2011**) | Cardizem la* (**Diltiazem**) | Niaspan (**Niacin**) |
| **Nitroglycerin** | **Glimepiride** | **Carvedilol** | **Pravastatin** |
| Nitrolingual spray (**Nitroglycerin**) (**2009&2010**) | **Glipizide, er, xl** | Coreg cr (**Carvedilol**) | Simcor (**Niacin and Simvastatin**) |
| Plavix (**Clopidogrel**) | **Glipizide/metformin** | Cozaar (**Losartan**) (**2009&2010**) | **Simvastatin** |
| Ranexa (**Ranolazine**) | Glucagen [INJ] (**Glucagon**) | **Diltiazem** | Tricor (**Fenofibrate**) (**2009**) |
| Rhythmol SR (**Propafenone**) (**2010 & 2011**) | **Glyburide, micronized** | Diovan, hct (**Valsartan, hctz**) | Trilipix (**Fenofibric Acid**) (**2010&2011**) |

A list of applicable medications from 2009, 2010, and 2011 National Preferred Formulary: Express Scripts

| | | | |
|---|---|---|---|
| **Warfarin** | **Glyburide/metformin** | **Doxazosin (2011)** | Welchol (**Colesevelam**) |
| | Humalog [INJ] (**Insulin Lispro**) | Dynacirc cr* (**Isradipine**) | Zetia (**Ezetimibe**) |
| | Humulin [INJ] (**Insulin, different types**) | **Enalapril, hctz** | |
| | Janumet (**Sitagliptin and Metformin**) | Exforge (**Amlodipine and Valsartan, hctz**) (**2009**) Exforge, Hct (**2010&2011**) | |
| | Januvia (**SitaGLIPtin**) | **Felodipine er** | |
| | Lantus, solostar [INJ] (**Insulin Glargine**) | **Fosinopril, hctz** | |
| | Levemir, flexpen [INJ] (**Insulin Detemir**) | **Hydrochlorothiazide (hctz)** | |
| | Metanx (**vitamin**) (**2009 &2010**) | Hyzaar (**Losartan and Hydrochlorothiazide**) (**2009&2010**) | |
| | **Metformin, er** | **Labetalol hcl** | |
| | Nateglinide (**2010&2011**) | **Lisinopril, /hctz** | |
| | Novolin [INJ] (**Insulin, different types**) | **Losartan, /hctz (2011)** | |
| | Novolog [INJ] (**InsulinAspart/ Insulin Aspart Protamine and Insulin Aspart** if it is a mixture) | Lotrel* (**Amlodipine and Benazepril**) | |
| | Onglyza (**Saxagliptin**)(**2011**) | **Metolazone** | |
| | Prandimet (**Repaglinide and Metformin**) (**2010&2011**) | **Metoprolol, hctz** | |

A list of applicable medications from 2009, 2010, and 2011 National Preferred Formulary: Express Scripts

| | | | |
|---|---|---|---|
| | Prandin* (**Repaglinide**) | **Moexipril/hctz** | |
| | Riomet (**MetFORMIN**) (**2011**) | **Nadolol (2009&2010)** | |
| | Starlix (**Nateglinide**) (**2009**) | **Nifedipine er** | |
| | Symlin, Symlin Pen (**Pramlintide, Acetate**) | **Nisoldipine (2009&2010)** | |
| | | **Pindolol (2009&2010)** | |
| | | **Propranolol hcl, w/hctz** | |
| | | **Quinapril** | |
| | | **Quinaretic (2009&2010)** | |
| | | **Ramipril** | |
| | | Sular (**Nisoldipine**) | |
| | | Tekturna, hct (**Aliskiren,hctz**) | |
| | | **Trandolapril** | |
| | | **Trandolapril/verapamil (2011)** | |
| | | Valturna (**Aliskiren and Valsartan**) (**2011**) | |
| | | **Verapamil hcl** | |

**xl, er**: extended release.
**hcl**: hydrochloric acid.
**hctz, hct**: hydrochlorothiazide.

# APPENDIX D

Methods:

- An example of calculations on Medication Possession Ratio (MPR) for one subject (table 1 and 2)

**Table 1: Prescription refills of Simvastatin for one subject between baseline and follow-up visit.**

| Drug | Quantity | Days of supply | Date filled |
|---|---|---|---|
| Simvastatin 20 mg tablet | 30 | 30 | 02.10.2011 |
| Simvastatin 20 mg tablet | 30 | 30 | 03.09.2011 |
| Simvastatin 20 mg tablet | 30 | 30 | 03.08.2011 |
| Simvastatin 20 mg tablet | 30 | 30 | 05.07.2011 |
| Simvastatin 20 mg tablet | 30 | 30 | 07.06.2011 |
| Simvastatin 20 mg tablet | 30 | 30 | 28.04.2011 |
| Simvastatin 20 mg tablet | 30 | 30 | 07.04.2011 |
| Simvastatin 20 mg tablet | 30 | 30 | 25.02.2011 |
| Simvastatin 20 mg tablet | 30 | 30 | 18.01.2011 |
| Simvastatin 20 mg tablet | 30 | 30 | 07.12.2010 |
| Simvastatin 20 mg tablet | 30 | 30 | 29.10.2010 |

**Table 2: Medication Possession Ratio (MPR) calculations for the subject referred to in table 1.**

| | |
|---|---|
| Date of last refill before baseline | 24.09.2010 |
| Days of supply for last refill before baseline | 30 |
| Baseline date | 25.10.2010 |
| Number of days from last refill before baseline and baseline visit | 31 |
| Days of supply from last refill before baseline, belonging to the study period | 0 |
| Sum of days of supply for all refills occurring within study period, minus days of supply for the last refill. | (30*11) – 30 = 300 |
| Date of last refill in study period | 02.10.2011 |
| Days of supply for last refill in study period | 30 |
| Date of follow-up visit | 14.10.2011 |
| Number of days between last refill in study period and follow-up visit | 12 |
| Days of supply from last refill, belonging to study period | 12 |
| Days between baseline and follow-up visit | 349 |
| MPR (%) | $\frac{300+0+12}{349}*100=89.4$ |

# APPENDIX E

Figures and tables which were left out from the results chapter:

- All medications used at baseline visit (table 3)
- Median,  interquartile range (IQR), and P values for clinical indicators (table 4)
- Histograms of costs (medical, prescription, and total) after logarithmic transformation, in relation to medication adherence at baseline and follow-up wellness visits (figure 1-12)

**Table 3: List of all target medications (active inredients) by pharmacologic category, number of agents within each category, mean Medication Possession Ratio (MPR) for each category, number of total users, and number and proportion of non-adherers (MPR<80%) for all medications.**

| **Active ingredient (N = total users)** | **MPR<80% *n* (%)** | **Active ingredient (N = total users)** | **MPR<80% *n* (%)** |
|---|---|---|---|
| **Anti-hyperlipidemic agents (n = 12)** *Mean MPR (%): 76.5 (10.5,100)* | | **ARBs (n = 5)** *Mean MPR (%): 81.1 (36.4,100)* | |
| Atorvastatin (11) | 4 (36.4) | Irbesartan (1) | 0 (0) |
| Ezetimibe (5) | 2 (40) | Losartan (2) | 1 (50) |
| Ezetimibe+Simvastatin (5) | 5 (100) | Olmesartan (2) | 0 (0) |
| Fenofibrate (3) | 1 (33.3) | Telmisartan (1) | 1 (100) |
| Fluvastatin (1) | 0 (0) | Valsartan (1) | 0 (0) |
| Gemfibrozil (1) | 0 (0) | **Antiplatelet agents (n = 1)** *MPR (%): 99.5* | |
| Lovastatin (2) | 2 (100) | | |
| Niacin (9) | 5 (55.6) | Clopidogrel (1) | 0 (0) |
| Niacin + Simvastatin (1) | 1 (100) | **Alpha $_1$ Blocker (n = 1)** *Mean MPR (%): 99.9 (99.8,100)* | |
| Pravastatin (4) | 1 (25) | | |
| Rosuvastatin (9) | 3 (33.3) | Terazosin (2) | 0 (0) |
| Simvastatin (20) | 3 (15) | **Beta Blocker (n = 2)** *Mean MPR (%): 70.1 (51.9,96.0)* | |
| | | Carvedilol (3) | 1 (33.3) |
| | | Nebivolol (2) | 2 (100) |
| **Antianginal; Cardiovascular (n = 1)** *MPR (%): 65.5* | | **CCBs (n = 1)** *MPR (%): 96.7* | |
| Ranolazine (1) | 1 (100) | Felodipine (1) | 0 (0) |
| **ACE inhibitors (n = 5)** *Mean MPR (%): 81.4 (21.0, 100)* | | **Diuretics (n = 5)** *Mean MPR (%): 74.8 (23.7,100)* | |

| | | | |
|---|---|---|---|
| Benazepril (3) | 2 (66.7) | Bumetanide (1) | 1 (100) |
| Enalapril (1) | 1 (100) | Furosemide (4) | 2 (50) |
| Lisinopril (14) | 4 (28.6) | HCTZ (6) | 1 (16.7) |
| Quinapril (1) | 0 (0) | Indapamide (1) | 1 (100) |
| Trandolapril (2) | 0 (0) | Triamterene + HCTZ (3) | 1 (33.3) |
| **Antiarrhytmic agents (n = 2)** *Mean MPR (%): 88.5 (74.0,100)* | | **ARB + Diuretic (n = 2)** *Mean MPR (%): 96.2 (88.5,100)* | |
| Digoxin (2) | 1 (50) | Losartan + HCTZ (2) | 0 (0) |
| Propafenone (1) | 0 (0) | Valsartan + HCTZ (1) | 0 (0) |
| **ACE + Diuretic (n = 1)** *Mean MPR (%): 80.5 (21.3,100)* | | **Antianginal; antiarrhytmic;Beta Blocker (n = 1)** *MPR (%): 100* | |
| Lisinopril + HCTZ (5) | 1 (20) | Propranol (1) | 0 (0) |
| **Beta Blocker + Diuretic (n = 1)** *Mean MPR (%): 83.0 (51.4,100)* | | **Antianginal;CCB (n = 1)** *Mean MPR (%): 85.0 (23.7,100)* | |
| Bisoprolol + HCTZ (4) | 1 (25) | Amlodipine (6) | 1 (16.7) |
| **CCB + ACE (n = 1)** *Mean MPR (%): 87.1 (45.9,100)* | | **Antidiabetics (n = 6)** *Mean MPR (%): 74.7 (26.5,100)* | |
| Amlodipine + benazepril (5) | 1 (20) | Ezenatide (2) | 1 (50) |
| **Antianginal; antiarrhytmic;CCB (n = 2)** *Mean MPR (%): 87.2 (66.9,100)* | | Glipizide (2) | 0 (0) |
| | | Metformin (9) | 3 (33.3) |
| | | Pioglitazone (4) | 2 (50) |
| Diltiazem (3) | 2 (66.7) | Pioglitazone + Metformin (1) | 1 (100) |
| Verapamil (2) | 0 (0) | Saxagliptin (1) | 1 (100) |
| **Antianginal;Beta Blocker (n = 3)** *Mean MPR (%): 84.1 (32.3,100)* | | | |

| | | | |
|---|---|---|---|
| Atenolol (5)<br>Metoprolol (10)<br>Nadolol (1) | 1 (20)<br>3 (30)<br>0 (0) | | |

*ARBs: Angiotensin II receptor blockers
ACE inhibitors: Angiotensin-converting-enzyme inhibitors,
CCBs: Calcium Channel Blockers

**Table 3: Screening results for clinical indicators (median and IQR‡) in relation to medication adherence at baseline and follow-up wellness visits.**

| Clinical indicator* | Baseline | | | Follow-up | | |
|---|---|---|---|---|---|---|
| | Adherers | Non-adherers | *P*** | Adherers | Non-adherers | *P*** |
| | Median (IQR‡) | | | Median (IQR‡) | | |
| BMI (kg/m$^2$) | 28.2 (25.1,32.6) | 30.3 (26.9,35.6) | 0.0847 | 28.0 (24.9,33.4) | 29.3 (27.3,35.9) | 0.0789 |
| SBP (mm Hg) | 124 (112,130) | 128 (118,132) | 0.375 | 125 (118,132) | 125 (119,130) | 0.905 |
| DBP (mm Hg) | 75.0 (68.0,82.0) | 76.0 (70.0,82.0) | 0.412 | 73.0 (68.0,79.5) | 72.0 (68.0,79.5) | 0.447 |
| WC (in) *male* | 36.5 (34.0,40.0) | 39.0 (37.5,42.5) | 1.00 | 36.5 (35.3,39.0) | 38.0 (35.0,40.5) | 0.0847 |
| WC (in) *female* | 37.3 (32.8,39.5) | 38.5 (36.1,42.6) | 0.362 | 43.0 (32.0,47.0) | 38.3 (36.9,43.5) | 0.910 |
| BG (mg/dL) | 99.0 (90.0,108) | 99.0 (92.0,115) | 0.593 | 95.0 (88.3,106) | 95.5 (91.0,115) | 0.436 |
| Total-C (mg/dL) | 183 (152,201) | 169 (148,209) | 0.516 | 182 (153,200) | 180 (154,217) | 0.987 |
| LDL cholesterol (mg/dL) | 111 (89.5,126) | 104 (72.0,132) | 0.368 | 109 (91.0,133) | 110 (84.0,127) | 0.497 |
| HDL-C (mg/dL) *male* | 39.5 34.5,44.8) | 40.5 (34.8,46.3) | 0.933 | 42.0 (35.0,45.3) | 38.0 (32.5,46.0) | 0.487 |
| HDL-C (mg/dL) *female* | 48.5 (37.3,56.3) | 50.0 (44,57.5) | 0.773 | 45.5 (38.8,52.0) | 49.0 (44.8,61.0) | 0.186 |
| TRG (mg/dL) | 117 (80.3,177) | 138 (94.3,200) | 0.302 | 105 (81.0,165) | 117 (92.0,186) | 0.239 |

*BMI: Body mass index, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, WC: Waist circumference, BG: Blood glucose, Total-C: Total cholesterol, LDL: Low-density lipoprotein, HDL: High-density lipoprotein, TRG: Triglycerides.
**Mann-Witney *U* test.
‡IQR: Interquartile range

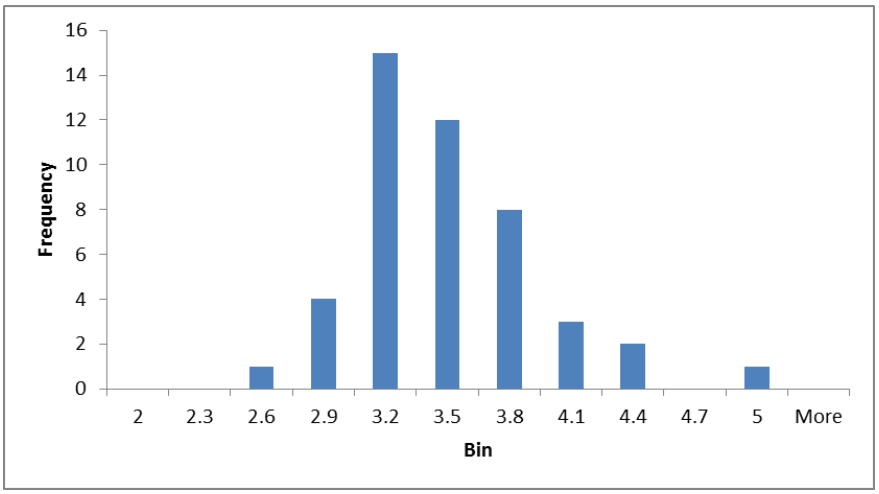


**Figure 1: Histogram showing the distribution in medical cost of adherent subjects at baseline visit, after transformation of observations were made.**

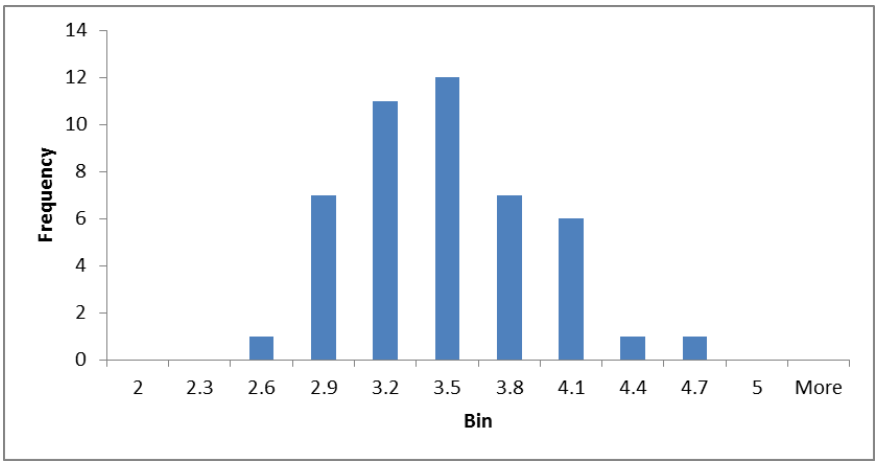


**Figure 2: Histogram showing the distribution in medical cost of adherent subjects at follow-up visit , after transformation of observations were made.**

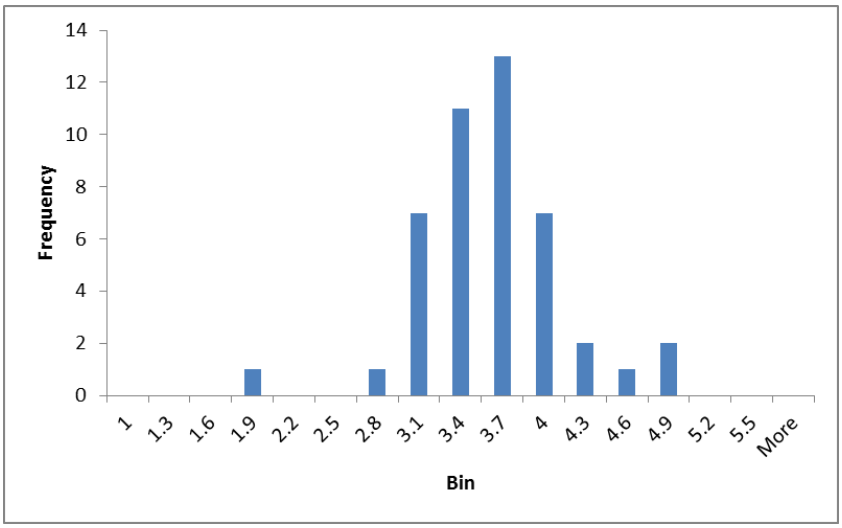


**Figure 3: Histogram showing the distribution in medical cost of non-adherent subjects at baseline visit, after transformation of observations were made.**

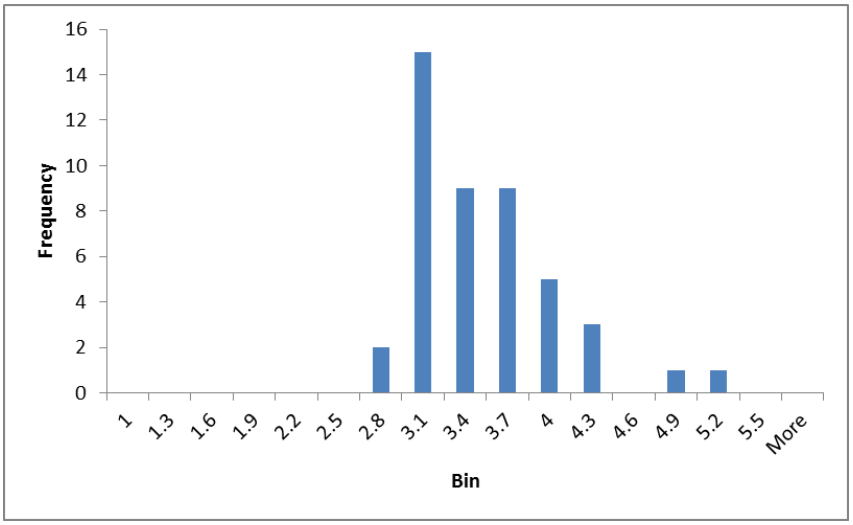


**Figure 4: Histogram showing the distribution in medical cost of non-adherent subjects at follow-up visit, after transformation of observations were made.**

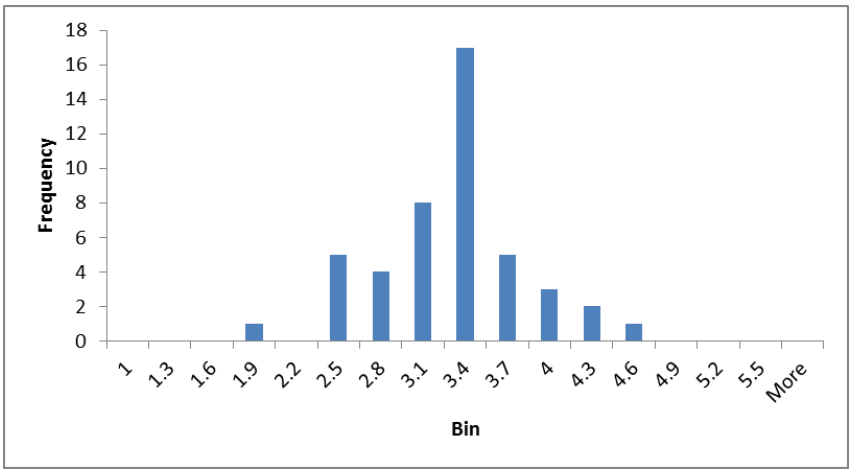


**Figure 5: Histogram showing the distribution in prescription cost of adherent subjects at baseline visit, after transformation of observations were made.**

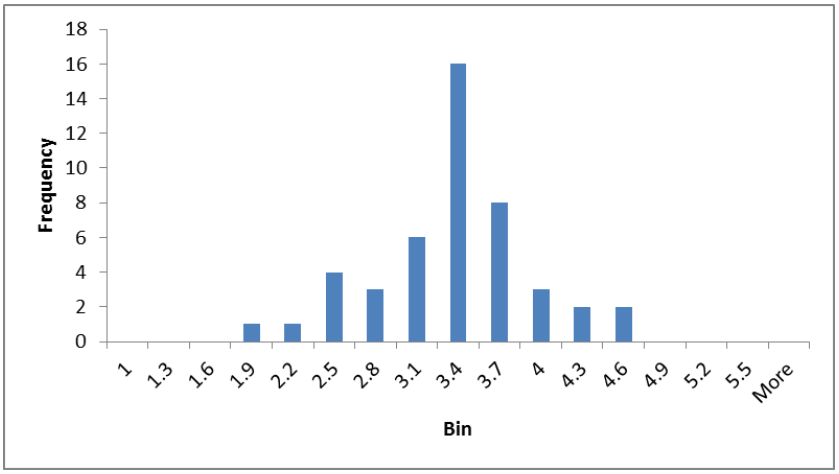


**Figure 6: Histogram showing the distribution in prescription cost of adherent subjects at follow-up visit, after transformation of observations were made.**

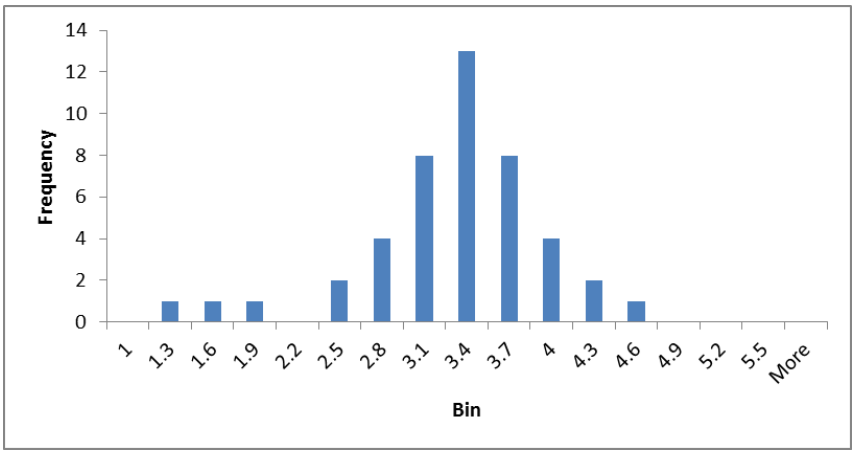


**Figure 7:** ***Histogram showing the distribution in prescription cost of non-adherent subjects at baseline visit, after transformation of observations were made.***

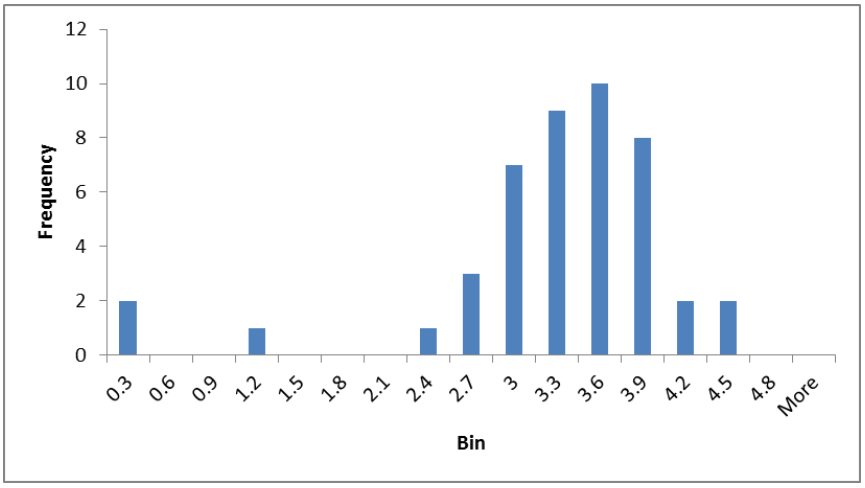


**Figure 8: Histogram showing the distribution in prescription cost of non-adherent subjects at follow-up visit, after transformation of observations were made.**

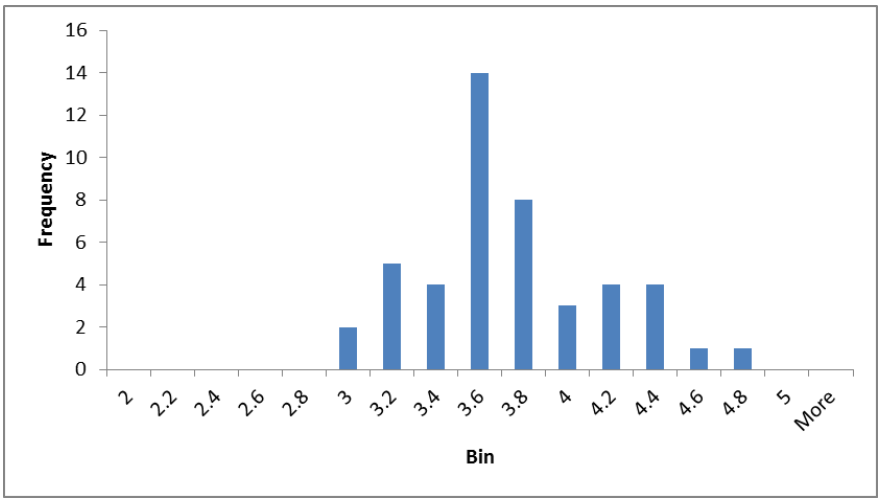


**Figure 9: Histogram showing the distribution in total healthcare cost of adherent subjects at baseline visit, after transformation of observations were made.**

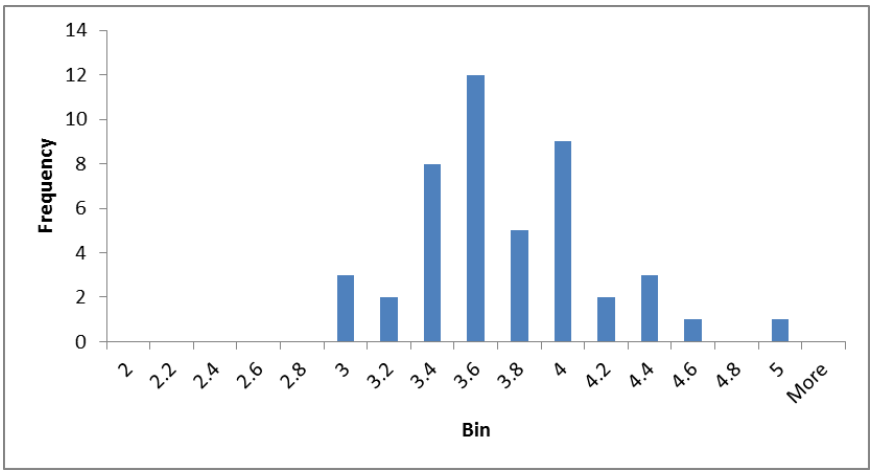


**Figure 10: Histogram showing the distribution in total healthcare cost of adherent subjects at follow-up visit, after transformation of observations were made.**

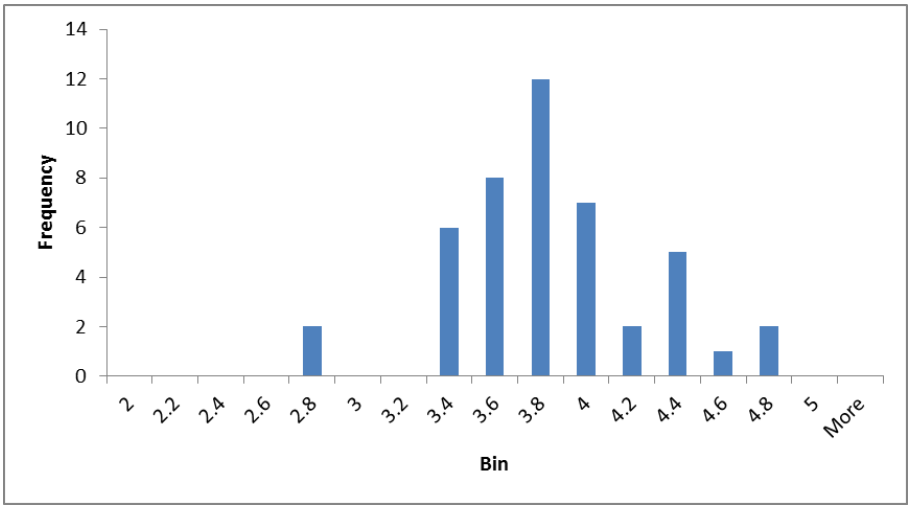


**Figure 11: Histogram showing the distribution in total healthcare cost of non-adherent subjects at baseline visit, after transformation of observations were made.**

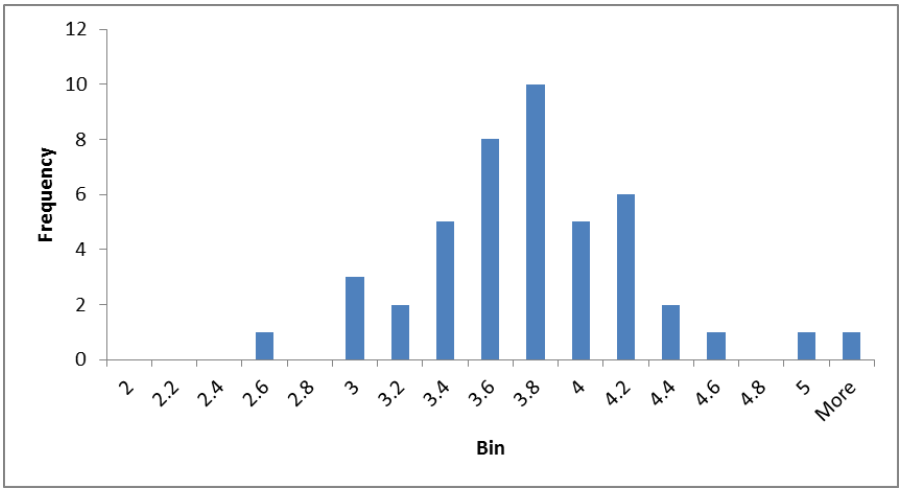


**Figure 12: Histogram showing the distribution in total healthcare cost of non-adherent subjects at follow-up visit, after transformation of observations were made.**