



Just What the Doctor Ordered

*A system approach to assessing patient
adherence*

**Presented to the CME community including
Pfizer Medical Education Group**

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Introduction

Increasing the effectiveness of adherence interventions might have a far greater impact on the health of the population than any improvement in specific medical treatments¹

The impact of adherence extends from global financial resources to increased mortality and morbidity. The Archives of Internal Medicine reported that heart disease patients who skipped medications were more than twice as likely to experience a significant cardiovascular event as compared to patients faithful to their medication regime. Another study cites that only 42% of glaucoma patients meet minimal adherence after having been told that they would go blind. Patients who had already gone blind in one eye increase medication adherence to only 58%.² Researchers at the American Heart Association meeting in November 2007 reported that "the number one epidemic in medicine today is patient compliance "leading to under-protection of heart disease".³ A Canadian study of statin use reported that over 50% of patients discontinued their statin within the first six months. At the end of the five-year study only 13% of patients continued taking their statin.⁴ Examples of adverse effects of non-adherence continue into breast cancer, diabetes, asthma, infectious disease, kidney disease, psychiatric disorders, organ transplantation and most every chronic disease.

In the late 1990s, the National Institutes of Health identified patient adherence as a strategic study area and created the Adherence Research Network to identify and research in patient adherence. Yet today, no NIH funds are being focused on patient adherence – what has been called the "key mediator between medical practice and patient outcomes." ⁵

Adherence involves many factors from understanding the diagnosis and prognosis, the role of therapy, the safety aspects of the medication, instructions for use, frequency, formulary choices, delivery mechanisms (e.g., inhaler, injection), caregiver support, cost, and patient co-morbidities. Patients and physicians make choices that influence each others' actions, often without communicating the reason why. Understanding how these parties interact impacts the success of the treatment. Improving adherence requires physicians, licensed healthcare professionals, the healthcare system, and patients to work together.

The implications for continuing medical education focused on improving adherence rates align with the ACGME competencies for physicians. Key findings in this report are highlighted below. While education can focus on any of these areas, a comprehensive educational initiative will incorporate aspects of each competency.

- Patient Care
 - Engage patients on an ongoing basis.
 - Make a therapy contract.
 - Include the patient's support network
- Medical Knowledge
 - Link non-response to therapy with adherence
- Practice-Based Learning and Improvement
 - Develop systems to monitor and measure adherence
 - Use available tools
- Interpersonal and Communication Skills
 - Tailor communication to disease state
 - Develop scripts
 - Address communication between specialists
- Professionalism
 - Evaluate patients' commitment to therapy
- Systems-Based Practice
 - Develop a concrete adherence plan
 - Take action at the time of prescription
 - Use available information and communication systems
 - Identify adherence champions

Through the competency-based curriculum supported by this needs assessment, providers can address the many factors that influence how a patient perceives his or her illness, belief in the efficacy of treatment, the therapy prescribed, follow-up treatment, health records, and clinical outcome. We will integrate the existing data and provide practical solutions for accredited providers to use as they develop medical education curriculum.

Objectives

This needs assessment is designed to:

- Summarize current literature on patient adherence, focusing on chronic care
- Identify successes and failures across therapeutic areas
- Provide a *qualitative* and *quantitative* assessment, categorization, and elaboration of the forces for change, attitude toward change and image of change for target audiences
- Identify, with key stakeholders, the perceived barriers to patient compliance
- Compare physician perception of compliance with practice assessment
- Develop a curriculum for CME providers including tools & resources

Information collection and analysis methods included:

- A qualitative analysis of the literature, with a focus on chronic care, to provide a background of current research and to identify issues associated with non-adherence
- A quantitative meta-analysis of research literature on patient adherence within the fields of asthma and diabetes. The results of the hypertension meta-analysis will be available as a supplement at a later date. These diseases represent significant mortality and varied therapeutic response.
- Interviews with key stakeholders – including physicians, nurses, case managers, pharmacists, and patients – to identify perceived barriers to patient adherence
- Administration of a Change Readiness Inventory[®] (CRI) to a target audience of physicians in order to quantify findings from the interviews and assess competencies and barriers to change in clinical practice
- Development of explanatory adherence models that integrate health care provider, patient, system, and external factors
- A CME curriculum for use by accredited providers within their CME activities

Results will be broadly shared throughout the CME community. This needs assessment will be submitted to the Alliance for CME Needs Assessment Database and will be published on

www.ipmameded.org. A session titled *Beyond Knowledge Education – Focusing on Competency-Based Education* will be presented at the 2009 Alliance for CME meeting in San Francisco. Of particular focus will be addressing adherence through multiple ACGME competencies. The CME curriculum developed as part of this project will be validated within the CME community by supplying accredited providers with adherence-based curriculum for integration into therapeutically delivered education. Findings from the adherence meta-analyses in asthma and diabetes will be submitted to peer-reviewed journals for future publication.

Literature Analysis

Methodology

This needs assessment is designed to inform the development of educational interventions to provide optimal impact on educational, behavioral, and clinical outcomes. The initial literature evaluation serves to guide selection of the appropriate vertical interviews, focus groups and research questions for the meta-analysis.

A further literature analysis was conducted in August 2008 through PubMed to assess the distribution of literature in the past 5 years. The search of English-language adherence literature from the past five years produced 9267 results. Restricting the search to the three chronic conditions studied in detail – asthma, diabetes, and hypertension – yielded 317, 397, and 625 results, respectively. Notably, 1151 results (twelve percent of the total literature) addressed HIV-related adherence.

Most adherence studies are found in specialty-specific journals, with a smaller number in publications devoted to general medicine. Adherence literature can also be found in nursing, psychology, and pharmacy periodicals. About half the articles are from American journals and a quarter from British journals, while the rest represent places as widespread as Jamaica, Pakistan, and South Africa.

Terminology

'Compliance' and 'adherence' are interchangeable terms that refer to the extent to which a patient's actions agree with his or her physician's treatment recommendations.

'Compliance,' the traditional term, can carry paternalistic connotations; it implies that the patient unquestioningly accepts the physician's suggestions, even if he or she does not necessarily understand them. The more patient-centered term 'adherence' is increasingly used to signify that both parties have come to a mutual agreement as to the best course of action.

'Persistence', another term often found in adherence literature, refers to the length of time that a patient continues treatment, usually for chronic conditions that necessitate long-term therapy.

Persistence is largely addressed in the hypertension literature, because the asymptomatic nature of that disease presents a particular challenge to long-term adherence.

Research shows that patients who discontinue a medication rarely resume taking it. In addition, approximately one out of five prescriptions have a persistence rate of zero; that is, they are never filled in the first place.⁶

Adherence Assessment Methods

There are many ways to measure adherence, each with its own advantages and disadvantages. The three most common methods used in studies are self-report, pharmacy data, and electronic monitoring.

Self-report: Patients may provide information about their adherence behavior by maintaining medication diaries, participating in interviews, or completing questionnaires, all which have the advantage of being comparatively inexpensive and easy-to-implement techniques. The validity of self-report measures varies according to method.⁷ Self-reported adherence levels are generally high compared to measurements gathered through other processes, which suggests that patients may overestimate their own adherence. In one study of children with asthma and their parents, one-third of participants reported full adherence to medication when none had been taken.⁸

The literature identifies several validated instruments that assess a patient's adherence or risk of non-adherence. These can be general, like the widely-used Morisky scale (below), or condition-specific, such as the Hill-Bone Compliance Scale for hypertensive patients. Many of these surveys have high tested levels of validity and reliability.⁹

Question	Motivation	Knowledge
1. Do you ever forget to take your medicine?	Yes(0) No(1)	
2. Are you careless at times about taking your medicine?	Yes(0) No(1)	
3. When you feel better do you sometimes stop taking your medicine?		Yes(0) No(1)
4. Sometimes if you feel worse when you take your medicine, do you stop taking it?		Yes(0) No(1)
5. Do you know the long-term benefit of taking your medicine as told to you by your doctor or pharmacist?		Yes(1) No(0)
6. Sometimes do you forget to refill your prescription medicine on time?	Yes(0) No(1)	

Case Management Adherence Guidelines v. 2.0, pg 40. June 2006

Pharmacy refill data: This method consists of accessing and analyzing data from pharmacy databases to determine prescription refill frequency. In addition to being objective, this information has the advantage of reflecting 'real-world' behavior more accurately than data gathered from clinical studies. Although useful for detecting discontinuation of therapy, this method provides no information on correct use; there is no guarantee that filled prescriptions are being taken correctly, or even at all. In addition, it is often difficult for researchers to gain access to pharmacy databases.

An important factor to keep in mind is that the structure of a health system will always influence how information is collected and what conclusions can be drawn from it. Many countries maintain nationalized pharmacy and medical databases, but this is not so in the

United States. This can result in unreliable or skewed data when patients frequent more than one pharmacy.

Electronic monitoring: Electronic monitoring has been called the 'gold standard' of adherence assessment.^{10,11} With this method, a computer chip on a medication dispensing device – most often a pill bottle – records the date and time that a dose is distributed. Unfortunately, this method is expensive, and knowing that they are being monitored may affect patients' adherence.¹² Indeed, some studies^{13,14} have even tested electronic monitors as tools for *improving* adherence, with mixed results. The most common monitoring device is the Medication Event Monitoring System (MEMS), manufactured by Aardex, which has been used in several hundred clinical studies.¹⁵

Other less commonly used methods of assessing adherence include pill counts, medication weight measurements, and biochemical assays that measure the concentration of a substance in the patient's body.

Difficulties in Assessing Adherence

There is no foolproof way to accurately measure adherence. In fact, even the definition of the word is not always clear. Behavior can be quantified as *taking adherence* (whether the dose was administered), *timing adherence* (how close to the scheduled time the dose was administered), or *persistence*. Research on adherence focuses on dosage administration. Adherence to the prescribed dose is rarely studied. Although $\geq 80\%$ adherence is commonly considered 'good,' different studies designate various adherence cutoff points. The adherence level necessary to achieve satisfactory clinical results may differ depending on the medication. Currently there is no standard of acceptable adherence, which is an obstacle when comparing data from more than one study.

Another barrier to measuring adherence is that data from most assessment methods are subject to 'white-coat adherence', a phenomenon in which patients' adherence behavior improves during the few days before an appointment. In addition, most adherence measurement data (excluding pharmacy refill data) are collected during clinical trials, and thus may not accurately reflect real-world behavior.

Quantitative Studies

The majority of adherence literature consists of quantitative studies that assess adherence to treatment and identify risk factors for non-adherence. Some studies simply measure adherence, often among specialized populations. It is frequently taken for granted that increased adherence will lead to disease improvement, and some studies measure clinical outcomes to test this. For example, a trial might look for the relationship between adherence to insulin and glycemic control.¹⁶ However, the nature of the relationship between adherence and clinical outcomes is not yet clear; in particular, the association between medication adherence and blood pressure has been contested.^{17,18,19} Further research must be conducted to determine the exact relationship between adherence and objectively measured clinical outcomes.

A number of studies address experimental interventions and their effect on adherence, clinical outcomes, or both. Because of the variety of intervention types, adherence assessment methods, and measured outcomes, it is difficult to reach specific conclusions about which methods yield the best results.^{20,21}

Interventions

Few adherence interventions are directed toward health care professionals, with the majority targeting patients. Programs may focus on patient behavior, motivation, or education; 'affective' interventions provide emotional support to build patients' self-efficacy and coach them through behavioral changes.²² Most interventions produce at least a slight improvement in adherence, but the extent of change varies greatly.²³ In general, the most effective interventions focus on patient motivation,²⁴ provide specific targeted information instead of general information,²⁵ incorporate patient perspective,²⁶ and utilize a combination of interventions and techniques.^{27,28,29}

Adherence in Specific Diseases

Most articles on the subject focus on adherence within one specific disease. The largest body of adherence literature addresses HIV therapies, HAART (highly active antiretroviral therapy) in particular. High levels of adherence to these drugs are crucial to keep the virus in check; to effectively suppress viral load, patients must take 90-95% of their medicine.³⁰ In addition, low adherence can cause strains of HIV to become drug resistant.³¹

Asthma: Although non-pharmaceutical behaviors such as avoiding triggers or implementing environmental control measures are often considered major components of treatment, almost all asthma adherence literature addresses adherence to medications.

As one of the only major chronic diseases to affect children, much of the asthma literature focuses on the pediatric age group, which presents a unique set of challenges. Often the responsibility for administering medication lies with the caregiver, who may also have to manage dosing while the child is at school or a care facility. For this reason interventions may be directed at the caregiver instead of the patient,³² or may be specially tailored for a younger demographic.³³ Researchers have studied ways to improve the dosing experience for reluctant children, such as the 'Funhaler' asthma spacer³⁴ or assessing the palatability of different medications.³⁵

Another issue unique to asthma is inhaler misuse. Proper use of aerosol devices requires performing a series of actions in the correct order and coordinating inhaler discharge with inspiration, which may be difficult for some patients. Problems may be compounded by the fact that different types of inhalers have different instructions for use.³⁶ Many patients do not use their inhalers correctly, or do not know how to clean or maintain them; in one study, only 18% of patients using metered dose inhalers (MDIs) without spacers were able to demonstrate acceptable technique.³⁷ In addition, physicians who prescribe inhaled therapy may not know how to use the device,³⁸ and thus cannot instruct patients or assess their technique effectively. Education on inhaler use for both patients and health care professionals (including nurses, physicians, and pharmacists) would be beneficial in improving asthma adherence.³⁹

Adherence to preventative asthma drugs is particularly low because they do not provide immediate symptom relief. Research has consistently found that combining a corticosteroid (a preventative drug) with a long-lasting β_2 antagonist (which yields immediate effect) in the same inhaler is associated with better adherence⁴⁰ and persistence⁴¹ to the corticosteroid than concurrent therapies.

Diabetes: Despite the fact that many chronic diseases incorporate non-pharmaceutical therapies, most literature about adherence to self-care and lifestyle behaviors is concentrated in the diabetes literature. This includes topics such as self-monitoring of glycemic blood levels, foot care, diet, and exercise. Objective measurement of adherence to these behaviors is even more difficult to obtain than data about medication-taking behaviors.

For some patients, insulin therapy as part of a treatment regimen can manage diabetes better than oral antidiabetic agents alone.⁴² Patients may be wary of the prospect of regular injections, and both patients and physicians may perceive insulin treatment to be an overly complex or last-resort therapy.⁴³ Alternative medication delivery devices are useful in overcoming these barriers; insulin pens, for example, are associated with better adherence than traditional syringes.⁴⁴ Inhaled insulin, another alternative technique, is associated with promising levels of adherence,⁴⁵ but is not currently available in the United States.

In the **hypertension** adherence literature, persistence is a prevailing theme. Although most patients diagnosed with high blood pressure would benefit from lifelong treatment, research shows that 50% of newly-diagnosed patients discontinue their therapy within the first year.⁴⁶

Most individuals require a combination of antihypertensive drugs to successfully control their condition. Patients on fixed-dose therapy have a 24% lower risk for nonadherence than patients on free-combination treatment.^{47,48} Diuretic drugs also have lower rates of adherence and persistence than other antihypertensive agents.^{49,50} A new hypertension vaccine,⁵¹ an angiotensin II immunization currently in the clinical testing stages,⁵² could be a potentially beneficial treatment for non-adherent hypertensive patients.

Factors Associated With Non-Adherence

Much research has been done on the association of patient-related variables – such as age, ethnicity, disease severity, and psychological characteristics – and adherence. However, most statistically significant findings are contradictory and apply only to specialized populations; they are not generalizable. Only a few factors have been consistently associated with adherence.

Cost: A medication's increased burden of cost on the patient repeatedly predicts lower adherence^{53,54} and persistence.^{55,56} This variable is often overlooked in clinical studies, where treatments and medical care are usually provided to the test subjects free of charge.⁵⁷

Dose frequency has also been associated with lower adherence. Once-a-day treatment is associated with better adherence than twice- or three-times-a-day medications.^{58,59} Long-acting drugs may have better 'drug-forgiveness' – that is, may better accommodate minor deviations from the prescribed drug schedule – than short-acting drugs.⁶⁰ On a similar note, multiple medications combined into a single dose show better adherence than the same drugs taken separately.

Among psychological and cognitive characteristics, increased levels of **self-efficacy** – belief in one's ability to reach a goal – are associated with increased adherence.^{61,62,63}

Depressive symptoms are associated with lower adherence to medication,^{64,65,66} lower levels of self-care,⁶⁷ and worse quality of life.⁶⁸ In pediatric cases, treating caretakers' depression is associated with improved disease management for the child.⁶⁹

Alternative Perspectives of Adherence

Studies in the field of **psychology and behavioral health** address adherence by measuring and analyzing personal characteristics such cognitive functioning, health beliefs, social support, and self-efficacy. Researchers determine how these characteristics relate to patients' adherence and create models to illustrate decision-making and adherence behavior. These include Fisher's information-motivation-behavioral skills model⁷⁰ (see below, where this model has been applied to HAART therapy for HIV), Simoni's cognitive-affective model,⁷¹ and Johnson's social problem-solving model.⁷²

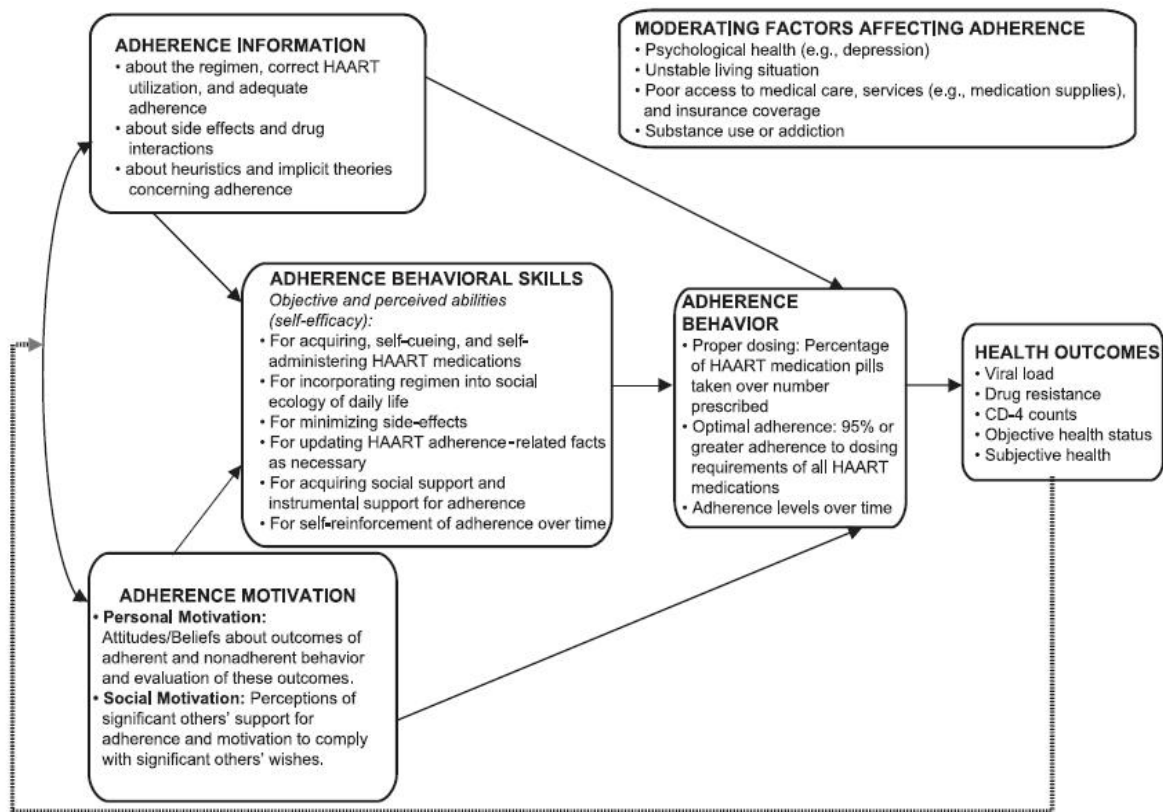


Figure 1. An information-motivation-behavioral skills model analysis of adherence to antiretroviral medication. Solid lines indicate an effect between constructs. The dashed line indicates a feedback loop where health outcomes affect future levels of adherence-related information, motivation, behavioral skills, and subsequent adherence behavior and health outcomes. HAART = highly active antiretroviral therapy.

Fisher JD, Fisher WA, Amico KR, Harman JJ. An information-motivation-behavioral skills model of adherence to antiretroviral therapy. *Health Psychol.* 2006;25:462-73.

Issues associated with adherence in many models include social support,^{73,74,75} depression,^{76,77} and motivation.^{78,79} Researchers analyze the intricate connections between these factors, such as Williams' assertion that motivation mediates the relationship between patients' perception of physician support and their own adherence.⁸⁰ They find that the interactions between personal, social, behavioral, and medication factors are complex; many factors play into a patient's level of adherence. Because conclusions determined by psychology and behavioral health researchers apply to patients regardless of condition, they can be useful to health professionals from all specialties.

The **case management approach** to adherence was first outlined in the Case Management Adherence Guidelines, a 2005 publication from the Case Management Society of America.⁸¹ The guidelines present a system of tests and questionnaires to determine a patient's potential for adherence based on his or her health literacy, readiness to change, motivation, and social support. Only when the patient scores high on the 'readiness to change' assessment should the clinician begin to address adherence; to do otherwise would be counter-productive.

The case management method emphasizes 'motivational interviewing,' a patient-centered technique often used in the field of addiction⁸² that has been utilized in many adherence-related studies and interventions.^{83,84,85} Motivational interviewing involves discoursing with the patient to explore and address his or her resistance to change. Once the reasons for resistance are identified, the interviewer and the patient work to resolve them and enhance the patient's motivation to change his or her behavior.

An important benefit to the case management approach is that its approach is tailored to the needs and concerns of the specific patient. Although developed specifically for case managers, its techniques and concepts can be useful for physicians, nurses, and other medical professionals.

Trends Within Adherence Literature

- *Pharmaceutical bias*: Existing adherence literature concentrates on drug therapy. Few studies address adherence to non-pharmaceutical therapies, such as diet, exercise, and lifestyle changes.
- *Patient responsibility bias*: Most literature addresses patients' demographic, behavioral, or psychological attributes when looking at causes of non-adherence. This demonstrates that the medical system continues to place responsibility for adherence almost solely on the patient, instead of considering physician-related and health system factors as well.
- *Lack of cross-cultural comparisons*: Although studies on adherence have been conducted throughout the world, none have compared findings across countries, continents, or cultures. Given that health systems and perspectives on disease and

treatment differ broadly according to culture, such comparisons may provide additional insight into factors that promote or impede adherence.

- *Lack of cross-condition comparisons:* Most research on adherence is limited to treatment for one, or at most two, illnesses. Consequently, it is difficult to make conclusions about adherence independent of condition. Studies of a broader scope could compare levels of adherence, barriers to adherence, and the interventions to promote it, between specialties and disciplines.

A great deal of valuable research has been conducted on the topic of adherence, particularly concerning specific illnesses. However, the disadvantage of the existing literature lies in its heterogeneity. Because of the non-standardization of study outcomes, methods, and definitions and measurements of adherence, it is difficult to compare findings and come to conclusions about adherence risk factors and the efficacy of intervention types. If these issues could be overcome, in-depth comparisons that analyze adherence across a range of cultures and diseases would be a welcome addition to the literature.

It is essential for health care providers to know that non-adherence is a common and widespread problem. Physicians should be aware of adherence literature specific to their specialty, know that it is not always easy to identify patients at risk for non-adherence, and should always consider it as a possible factor when patients do not respond to medication. In addition, it is important to recognize that the causes of non-adherence are often complex. By becoming aware of the reasons for non-adherence and the tools available to address it, health care professionals can work with their patients to optimize treatment and provide the best possible health care.

Literature Meta-Analysis

Literature Search Methodology

The literature analysis highlighted many similarities in researchers' approach to adherence examination in each of the major chronic conditions (i.e., asthma, diabetes, and hypertension). To maintain parity across the meta-analyses, identical search strategies were used to accumulate the research literature for each clinical condition. Four major bibliographic databases (PubMed, PsychINFO, EMBASE, and CINAHL) were searched. All searches were conducted in July of 2008. The PubMed database was searched for the five previous years. All other databases were searched from 2002 through 2008. The following tables present the search results for each of the three clinical topics. The terms "compliance" or "patient compliance" were used as accepted keyword searches rather than "adherence". For the diabetes literature, we searched under "diabetes," "diabetes mellitus," and/or "non-insulin dependent diabetes mellitus" to locate the largest number of citations. We limited all searches to English language citations on studies of adults 18 years and older. Studies on pediatric patients, where parents/caregivers were included in the research as a primary source of data, were also included in the search strategy.

PubMed, a service of the National Library of Medicine, includes over 18 million citations from *Medline* and other life sciences journals. PsychINFO is a database sponsored by the American Psychological Association containing more than 2.6 million citations from the behavioral and social sciences. EMBASE is a citation database developed by Elsevier with over 12 million records. This database is heavily weighted toward drug and pharmacological research but contains citations from over 2,000 journals that are not included in *Medline*. CINAHL, a database developed by EBSCO Publishing, indexes publications in nursing and the allied health sciences. Over 800,000 records including multi-media material, web site references, teaching materials, dissertations, abstracts, and research tools are included. After completing the searches in all four databases for the three clinical conditions, duplicated citations were eliminated. We found fewer than 10% duplication across the four databases.

Table 1: Asthma Literature Search

Database	Search Terms	Search	Time Period	Publication	Number of
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		Limitations		Language	Citations *
PubMed	"Patient compliance" and "Asthma"	All adults (19+ years)	"last 5 years"	English	156
PsychINFO	"Compliance" and "Asthma"	"Age 18 yrs and older"	"2002 – 2008"	English	41
EMBASE	"Patient compliance" and "Asthma"	Adult (18 to 64 yrs and 65+ years)	"2002 – 2008"	English	317
CINAHL	"Patient Compliance" and "Asthma"	All adult	"2002 – 2008"	English	138

* Total citations found (with duplicates eliminated) = 623

Table 2: Diabetes Literature Search

Database	Search Terms	Search Limitations	Time Period	Publication Language	Number of Citations *
PubMed	"Patient compliance" and "Diabetes Mellitus"	All adults (19+ years)	"last 5 years"	English	386
PsychINFO	"Compliance" and "diabetes or diabetes mellitus"	"Age 18 yrs and older"	"2002 – 2008"	English	92
EMBASE	"Patient compliance" and "Non Insulin Dependent Diabetes Mellitus"	Adult (18 to 64 yrs and 65+ years)	"2002 – 2008"	English	319
CINAHL	"Patient Compliance" Diabetes Mellitus, Non-Insulin-Dependent"	All adult	"2002 – 2008"	English	138

* Total citations found (with duplicates eliminated) = 895

Table 3: Hypertension Literature Search

Database	Search Terms	Search Limitations	Time Period	Publication Language	Number of Citations*
PubMed	"Patient compliance" and "Hypertension"	All adults (19+ years)	"last 5 years"	English	286
PsychInfo	"Compliance" and "hypertension"	"Age 18 yrs and older"	"2002 – 2008"	English	38
EMBASE	"Patient compliance" and "Hypertension"	Adult (18 to 64 yrs and 65+ years)	"2002 – 2008"	English	736
CINAHL	"Patient Compliance" and "Hypertension"	All adult	"2002 – 2008"	English	146

* Total citations found (with duplicates eliminated) = 1136

Meta-Analysis Research Questions

The purpose of the meta-analyses was inform potential educators of educational interventions that could help improve patient care in the three clinical areas. Citations from each of the three clinical areas were reviewed revealing similarities in research questions across the three areas. These similarities were guided development of questions used in each area. Our goal was to develop a single set of meta-analysis question that would be relevant to each of the chronic conditions. Our general interest was to identify positive changes or actions that healthcare providers could employ to increase adherence for patients with asthma, diabetes, and/or hypertension.

The majority of studies in all three areas were observational. These studies fell into two types: studies in which patient adherence was measured as a primary or secondary outcome, and studies that measured adherence as a patient characteristic, or risk factor, for health outcomes. Studies measuring patient adherence as an outcome examined demographic and psychosocial variables related to patient adherence. Characteristics such as age, gender, education, health belief model, socioeconomic status, and health literacy were common variables found to have some impact on patient adherence across all three clinical conditions. Studies measuring adherence as a patient characteristic for health outcomes identified increased healthcare utilization, other co-morbid conditions, increased risk of poor health and shortened life

expectancy as factors linked to non-adherence. The observational studies were did not provide insight into improving adherence and therefore were not included in the evaluation criteria.

A relatively small number of studies were conducted as experimental studies that attempted to improve patient adherence through the introduction of one or more planned interventions. Although the research designs varied from single-group and pre-test/post-test to randomized controlled trials, patient adherence was always one of the measured outcomes in these studies. Since these interventions were designed to improve patient adherence, the working hypothesis for all three meta-analyses would be to test the ability of planned interventions to change patient adherence to physician-prescribed care plans.

Study Selection Criteria

Common criteria were developed for including research studies in each of the three meta-analyses. Supplemental criteria were developed to capture unique differences between asthma, diabetes and hypertension., These criteria were applied by two to four independent reviewers. Each reviewer examined every study in the three literature searches.

The common criteria for selection were:

1. The study must be interventional.
 - The study must specify one or more investigator-controlled interventions.
 - The intervention must be designed to directly or indirectly improve patient adherence to a healthcare provider-prescribed care plan.
 - Clinical drug trials are excluded unless the study design explicitly includes some aspect of the drug and/or delivery mechanism that is designed to improve patient adherence (i.e., easier mode of delivery, fewer side effects).

2. Patient adherence must be measured using at least one objective and/or validated tool.
 - Patient perceptions alone are insufficient measures of adherence unless a validated patient report tool is used.
 - Patient adherence can be related to any portion of a care plan

- taking prescribed medication
 - monitoring health indicators
 - exercise and diet
 - Health outcomes, such as hospital admissions and emergency room visits, can be considered valid surrogates for non-adherence if there is a clear connection between non-adherent behavior and the health outcome.
3. The study must contain statistically analyzable data.
- The study may include qualitative data but quantitative data must also be included.

Asthma Meta-Analysis

Asthma, as a chronic health condition, has a number of unique features that create adherence challenges for both healthcare providers and patients. While the condition can be asymptomatic for much of the time, episodes of shortness of breath can be both frightening and dangerous resulting in increased healthcare utilization. Preventive use of medication, mostly in the form of inhalers, can dramatically reduce emergency situations. The greatest issues for adherence in asthma treatment have been the regular, and correct, use of inhaled preventative medications. Efforts to increase patient adherence of preventive inhalers have included strategies to increase technical knowledge and skills using medication delivery devices as well as device modifications for ease of use..

The focus of this meta-analysis is to examine the effectiveness of interventions to improve patient adherence with prescription medications to prevent and control asthma exacerbations. An extensive literature review was conducted to identify research on patient adherence and asthma. The details of this search are described in the Literature Search Methodology. Using the terms "compliance" and "asthma," 623 unique citations were identified. These studies were independently reviewed by four investigators. The following screening criteria grounded in the common search questions were used to identify investigations to test our research question:

1. Interventional study.
2. Outcomes must include a valid direct or indirect measure of adherence to asthma preventive medication.

3. Quantitative analysis must be used to examine data.

Initial reviews examined study abstracts and summaries. This review eliminated over 575 of the original 623 citations by unanimous agreement of the four independent reviewers. The remaining studies were reviewed in detail by at least two of the four investigators. After the second level of review, 27 studies remained. Each of these studies was discussed in a group meeting of three of the four investigators. Unanimous agreement was required to include a study in the final meta-analysis. Five additional studies were removed after discussion. The remaining 22 studies all meet the criteria stated above. **Please see Appendix 1 for a detailed description of each study.**

All studies met the research criteria designed to examine interventions that improve patient adherence to asthma preventative medications. However, there was significant variability in the nature of the interventions and how the interventions were implemented. Each of these clusters were examined separately to provide more detailed analysis. The major characteristics that distinguish the sub-groups of studies were: 1) focus on educating the patient, 2) focus on improving healthcare provider knowledge or practice, and 3) focus on aspects of the medication delivery (e.g., inhaler v. oral; number of doses per day).

Educational interventions directed toward patients

The predominant type of intervention to improve adherence to prescribed preventive medication was an educational intervention delivered directly to the patient. Fourteen of the 22 studies focused exclusively on patient education to a variety of healthy behaviors, including taking preventive medications. Six of the 14 educational interventions had sample sizes of less than 100; two large studies included sample sizes over 1,000. Studies with short interventions and longer follow-up periods tended to find no significant differences between patients receiving interventions and those in the control groups. Most of the studies (10 of 14) did not have extended follow-up beyond the period of the intervention and it was not possible to measure persistence of the adherence behavior. Educational content and method of delivery varied but, in general, focused on three content areas: 1) knowledge about asthma, 2) technical instruction regarding the use of inhalers, and 3) information focused on avoiding

environmental triggers. Other topics in the educational programs included self-efficacy training, anxiety avoidance training, and self-monitoring instructions. In addition to education, half of the studies incorporated regular follow-up contact between the educator and the patient to provide reminders and encouragement and to gather data. Effect sizes for this group of intervention studies will be included in a forthcoming manuscript for publication.

The patient populations in the educational intervention studies were quite diverse. Five studies recruited asthma patients that were identified as non-compliant or were recruited as a result of an asthma-related hospital admission or emergency department visit. Conversely, several studies recruited patients from broad health plans with unknown or limited information on the patient's history of adherence. Three of the studies were not randomized controlled trials. In one study (Delaronde), some subjects could 'opt in' or 'opt out' of the intervention because it was offered through an HMO. Patients who placed themselves in or out of the intervention were analyzed separately from those who agreed to be placed randomly. In another study, intervention patients were selected based on their adherence history (Feifer) and matches were found as controls. The third non-randomized trial was a single group intervention in which pre- and post-study adherence was measured (Prabhakaran). The outcomes of the non-random intervention studies were consistent with those of the RCTs.

Improving healthcare provider knowledge/practice

Four of the 22 studies focused on interventions that were designed to change delivery of care to asthma patients (Kritikos, Mitchell, Saini, and Schneider). Two of these studies (Kritikos and Saini) trained pharmacists to deliver specific educational material to patients and to monitor patients' self-care. The other two interventions targeted primary care physicians. The physician intervention studies focused primarily on quality improvement measures and not the delivery of specific educational messages for asthma patients. Although all four studies demonstrated improvement in patient adherence, the effect size of the findings is difficult to calculate since the unit of analysis is not always individual patients. In particular the physician studies reported patient outcomes at a 'practice' level. Additionally, at least one study noted that compliance by the health care providers was low and patients may not have been receiving the intended intervention. Nevertheless, the findings indicate that interventions delivered by

healthcare providers seem to have higher success rates than those delivered by others not directly involved in the patient's care.

Medication delivery studies

Four included studies examined some aspect of medication delivery (Guest, Rand, Ronmark, and van Schayck). The combined number of patients in these studies is under 1,000 (n=962) with study size ranging from 34 to 380. Easier and less complicated mechanisms of drug delivery (e.g., pills v. inhalers and once a day v. multiple times a day) showed slightly higher rates of refill and use. This finding is less true for patients with high baseline compliance or with experience with inhalers.

Summary

Interventions aimed at improving patient adherence with preventive asthma medication have been found to be at least moderately effective. Educational interventions are most effective when they include regular contact between an educator and patient and target improved knowledge about the disease and technical information regarding the correct use of preventive inhalers. Interventions aimed at changing behavior of healthcare providers are less effective than educational interventions aimed directly at patients. An important factor in determining the impact of interventions targeting providers is their compliance and persistence with the changes included in the interventions. Finally, improving the convenience of the medication while reducing the need for technical skills with inhalers has been shown to increase the likelihood of patient adherence to asthma medication.

Diabetes Meta-Analysis

The management of diabetes is far more complex than either asthma or hypertension. Patients must both monitor and control their disease. While the primary focus of monitoring is blood glucose level, diabetic patients must also track weight and blood pressure as well as cholesterol. Control of blood glucose level and disease activity requires adherence to medications, diet and exercise - all factors in diabetes as well as hypertension, hypercholesterolemia and obesity. Regular foot and eye exams are also important features of diabetes care.

As the monitoring and treatment regimen becomes more complex, adherence becomes more difficult to define and measure. The outcome measures related to glycemic control are well established and easy to measure. Hemoglobin A1c and blood glucose levels are the most direct measures used by healthcare providers and patients. Blood pressure and weight control, secondary control variables for diabetes, are also easily monitored by patients. However, the monitoring itself has become an adherence issue and the outcome markers for monitoring are more difficult to measure accurately. The frequency of blood sugar, weight or blood pressure monitoring does not necessarily produce measurable consequences yet self-monitoring is a critical part of the prescription for diabetes care.

The diabetes literature related to patient adherence reflects the complexity of diabetes care and the dichotomy of monitoring and control. The focus of the diabetes adherence meta-analysis was to assess the efficacy of interventions to improve adherence to prescribed care regimens. We conducted a literature review, described in the general methodology of the meta-analysis section of this report, using the terms "diabetes," "diabetes mellitus," "non-insulin dependent diabetes mellitus," and/or "diabetes mellitus, non-insulin dependent" paired with "compliance," or "patient compliance." The search yielded 895 unique citations. These studies were independently reviewed by three investigators. The following screening criteria customized for diabeteses were used to identify investigations suitable to examine our research question.

1. Interventional study.
2. Outcomes must include a valid direct or indirect measure of adherence to diabetes control and/or monitoring prescriptions.
3. The study included patients with verified Type 2 Diabetes Mellitus.
4. Quantitative analysis must be used to examine data.

Initial reviews examined study abstracts/summaries. The primary elimination criterion for the initial review was inclusion of an intervention aimed at changing adherence. One hundred and seventy-two studies met (or appeared to meet) the intervention criterion. These studies were further reviewed by two investigators to assess the remaining criteria. After two additional independent reviews the two investigators unanimously agreed upon 41 studies that met all the

criteria for inclusion in the meta-analysis. See Appendix 2 for detailed descriptions of each study.

All 41 studies describe a specific intervention designed to impact some aspect of health monitoring and/or control of diabetes-related health markers. Approximately a third of the studies measured adherence directly (medication-taking behavior or frequency of blood-glucose monitoring). The studies, in general, focused on three types of interventions: 1) education/coaching/support mechanisms to promote/reinforce/measure adherence to monitoring and control prescriptions, 2) feedback mechanisms to provide patients and providers with data regarding health status, and 3) mechanisms of delivery and availability of prescribed medications. All three interventions types included studies on both monitoring and control aspects of diabetes health.

Educational interventions directed to patients

More than half of the interventional studies included some type of educational or counseling intervention (25 of 41). The studies ranged from 3 months to over 7 years and sample sizes varied from 38 to over 35,000. Several of the interventions also provided feedback to patients regarding their health status as a basis for customized educational messages. The educational interventions were generally directed by a healthcare provider in person or over the phone. However, some educational messages were provided via printed materials, Internet-based information, and phone recordings. Additionally, multi-modal delivery mechanisms were tested against single mode mechanisms. There were two general strategies for linking the patient to the educational message. The single educational message included educational events or printed materials provided to patients at the study commencement. The multi-engagement message included regular contact in person, over the phone, or via the Internet. The latter strategy almost always included counseling, directed interventions, or other individually customized feedback throughout the course of the study.

Hemoglobin A1c levels was one of the primary outcome measures for 19 of 24 educational intervention studies. The outcome measures for the remaining 6 studies included a variety health and behavioral variables (eg., weight, adherence to medication regimens, exercise, diet,

foot exams, self-monitoring behavior). Two of the 19 studies measuring HbA1c levels found no change as a result of the educational intervention (although one of those studies did find changes in other outcomes variables). The remaining 16 educational intervention studies found significant reductions in HbA1c both over time and compared to control groups receiving “usual care.” In most studies the “standard care” group showed no improvements over time. It should be noted that subjects in these studies were typically recruited from among either “non-compliant” or “uncontrolled” diabetic patients.

Feedback interventions designed to provide health data to patients and providers

Nine of the 41 studies (22%) tested interventions that provided patients feedback to help them improve health markers. In general, these interventions were adjuncts to prescribed self-monitoring mechanisms focused on providing reinforcing feedback to the patient. Three of the 9 studies incorporated provider delivered feedback interventions as part of individualized treatment programs. In two of those three studies showed significant improvement in HbA1c levels compared with controls receiving “usual care.” In the third study only women showed improvement with a personalized care plan that included feedback. Specific tools were used to provide feedback to patients in three of the studies. Graphic presentations of blood glucose levels, accelerometers to provide activity feedback to sedentary patients, and an Internet-based self-monitoring system were tested to examine if added/enhanced feedback would enhance adherence and improve health markers. The interventions aimed at lowering glucose levels were shown to be successful but the feedback system to promote activity in sedentary patients resulted in a short-lived increase in activity that diminished after six weeks. The three remaining feedback studies examined exercises to enhance memory related to taking medication, patient goal-setting/feedback, and enhanced adherence to self-monitoring prescriptions. All three interventions were found to improve health markers in intervention groups compared with control groups and baseline markers.

Mechanisms for delivery and availability of prescribed medication and monitoring supplies

The seven studies that examined delivery and availability interventions can be divided into two types: those that tested the convenience of dosing or delivering medications and those that

addressed cost factors. As with other areas of adherence, fewer and more convenient dosing mechanisms were found to increase adherence as measured by HbA1c. Single doses improved adherence over multiple doses. In the two studies that compared insulin pens with syringes, one study found that the pens resulted in improved adherence and the other did not. While the pens were perceived as more convenient, the health marker (HbA1c) was not found to be significantly different between the two modes of delivery. Two studies looked at the cost issues related to monitoring supplies. Both studies compared groups who had free access to glucose monitoring strips with patients who had to purchase them. As expected, free access to the strips increased the level of self-monitoring compared with patients who paid for their supplies.

Summary

Interventions to improve patient adherence with prescriptive monitoring and control behaviors have generally been found to be effective for diabetics. The most effective, and common, interventions are those that target patient education and engagement. Long-term engagement between a member of the care team and the patient has been shown to increase adherence to prescribed diabetic medications, lifestyle changes (diet, weight loss, exercise) and care of comorbid conditions such as hypertension and dyslipidemia. Diabetes care plans are multifaceted and complex: this complexity was reflected in the nature of the interventions and care plans designed to improve adherence. Feedback mechanisms have been shown to be successful adjuncts to regular self-monitoring prescriptive plans, especially when linked to individualized care plans. Cost and convenience of medications and monitoring supplies were also found to be significant factors in adherence.

In-Depth Interviews

Interview Methodology

The literature analysis provided the foundation for the interview portion of the adherence needs assessment. Sixty-one in-depth interviews were conducted with stakeholders, including:

- Specialists
- Primary care physicians
- Nurse practitioners/Physician assistants
- Nurses
 - Primary care
 - Specialty
 - Hospital
- Case managers
- Employers
- Hospital directors/administrators
 - Physicians
 - Nurses
- Pharmacists
- Managed Care
 - Medical director
 - Pharmacy director
 - Case manager
- Patients

These interviews provided insight into the learners' perceived needs and the problems surrounding adherence. They imparted perspective to other data sources including published guidelines, literature, and surveys. The interviews also highlighted clinical competencies needed for optimizing adherence as well as barriers to best practice.

Interview subjects were recruited through personal contact, fax/phone, referrals, email and other means. The primary requirement was that interviewees be able to provide information about adherence in the three chronic disease conditions that were the focus of this project. Additional criteria were specific to the individual stakeholder groups.

The interviews were conducted either in person or by telephone and lasted approximately 1 hour. Participants were compensated \$75- \$300 based on their stakeholder group. The interviews started with a general disclosure describing the project and proceeded to identify the participants' responsibilities and collect thoughts and concerns about adherence. Interviewees were asked to identify significant adherence-related problems and their causes. During the overall interview process, competency statements were derived from best practices, refined through the

interviews, and discussed with physicians, thereby validating them for use in the Change Readiness Inventory®.

Interviews were organized into two broad categories: “horizontal” and “vertical”. The primary purpose of the horizontal interviews was to explore how patient adherence relates to each stakeholder group. The interviews were conducted with unconnected members of the various groups; participants in the horizontal interviews were each deemed to represent their respective stakeholder role.

The purpose of the vertical interviews was to identify system-specific issues that may influence patient adherence; thus, they were conducted with stakeholders from within a single health system, that of the University of Virginia. Representative stakeholders included nurses, specialists, primary care physicians, pharmacists, and patients. In addition to individual interviews, a focus group was held with a mixed group of UVA stakeholders. The focus group format enabled participants to hear and respond to each other’s views on patient adherence and helped to broaden the understanding obtained from the vertical interviews.

Horizontal Interview Findings

Terminology

While the literature tends to use the term “patient adherence”, the expression commonly used by all stakeholder groups is “patient compliance”. While many were not familiar with adherence or defined it differently than other stakeholders, all subjects understood the term compliance. While some stakeholders thought of compliance primarily in terms of compliance with medications, the interviews incorporated the whole spectrum of compliance including such non-medication issues as follow-up visits, diet, and exercise.

Size of problem

The vast majority of interview subjects feel that compliance is a significant problem in healthcare. The exception is patients, who do not consider it a major problem. Even when doses are missed 10% of the time, patients may not perceive it as an issue. Sometimes lack of compliance is intentional, resulting from a variety of factors including

cost of medication and lack of symptoms. Healthcare professionals do feel that compliance is clinically important and costly to the healthcare system.

Problems associated with non-compliance

Stakeholders are well aware of the consequences of non-compliance; they describe a variety of clinical and non-clinical problems that can result. These include:

- Costs of additional office visits, labs, ER visits, follow-up calls, extended illness, and time
- Patient safety issues
- Frustration for physicians and staff
- Perceived lack of efficacy of therapy

Causes of non-compliance

Patients describe both intentional and unintentional reasons for non-compliance. The major source of *unintentional* non-compliance is a break in daily routine. Older patients taking a variety of medications rely on their routine to facilitate taking medications at the appropriate time. A disruption in this schedule causes patients to unintentionally miss doses. Examples of a break in routine are:

- Going out to dinner
- Going on vacation
- Having company
- Working late

Sometimes, when physicians do not provide a dosing schedule, patients make up their own, which can be quite complicated. One patient modified his dosing schedule to take medications throughout the day, because he remembered taking them that way when he was in the hospital. These more complicated schedules can result in patients being more likely to forget doses.

There is also *intentional* lack of compliance. High cost of medications may lead patients to cut their dose or quit completely. Furthermore, patients often do not understand the

connection between appropriate dosing and the benefits of the treatment. Patients report that they stop taking some medications because they feel better. This is frustrating to physicians, who know that the underlying disease often progresses even when symptoms have resolved. It is particularly problematic in “silent diseases,” such as hypertension and diabetes, where symptoms are not obvious. Patients also may quit taking medications that they do not believe are working. This is a particular challenge in disease areas such as arthritis, where there may be a delay in resolution of symptoms after treatment has begun. Finally, patients may alter their dose due to side effects of the medication.

System barriers also play a role in non-compliance. Communication between pharmacies and physicians’ offices may be inefficient, resulting in patients not receiving appropriate medications in a timely manner. Communication can also be an issue between specialists and primary care physicians, resulting in confusion, non-compliance, and lack of coordinated care for the patient. Another breakdown may occur between laboratories and physicians offices and/or patients, sometimes resulting in clinicians not having the current laboratory values necessary to counsel patients appropriately. This is sometimes unavoidable – such as when a physician decides on a particular lab test at the time of the visit – but is also often caused by poor scheduling of the lab test and office visit. This may result in a missed opportunity to counsel the patient about compliance with the support of current lab values.

Insurance and managed care coverage are additional system-related barriers to adherence. Varying formularies and policies result in confusion about coverage of medications or other treatments. Patients may have misperceptions of the amount they are expected to pay for a treatment. They may experience gaps or delays in receiving the appropriate medication when pharmacies run short of supply, or when patients don’t receive mail order medications in time.

Indicators of non-compliance

Interviewees were asked if they could anticipate whether or not a patient would be adherent. Surprisingly, most physicians reported no awareness of potential indicators of

non-compliance. In fact, lack of belief in the need for therapy was the only prominent indicator mentioned.

Some indicators of potential non-compliance mentioned by non-physician stakeholders include:

- Cognitive impairment
- Substance abuse or social issues
- History of non-compliance
- Lack of interest in their condition
- Lack of insurance coverage
- Lack of belief in the need for medication
- Gender (men less compliant than women)
- Resistance to lifestyle changes
- Missed appointments

Indicators at follow-up

Interviewees were asked how they assess compliance on follow-up visits. Physicians report that they gauge compliance during follow-up appointments by asking the patient whether they are taking the medication, typically phrased as “Are you still taking the [medication]?”. There was little investigation beyond that initial question. Physicians and other stakeholders point out that there may be clues to non-compliance, such as lack of efficacy as indicated by symptoms or test results. Lack of refills is another indicator of non-compliance, although physicians often do not have ready access to that information.

In most cases, patients indicated no recollection of the physician asking specifically about taking their medications.

Perceived role

Patients and physicians feel that it is ultimately the patient’s responsibility to follow instructions. Physicians’ views of their own level of responsibility vary. Some feel that their duty is limited to prescribing and advising the patient on therapy. Others take a

more active role and feel that it is their personal responsibility, or that of their office, to make sure the patient understands the instructions and *is able* to comply. Others in the healthcare system – including managed care, nurses, and pharmacists – also play an important role. Managed care administrators often employ various disease management strategies for patients on chronic medications.

Stakeholders

Physicians and patients both report that other stakeholders in the system may support compliance with treatments. Family members are especially important in helping patients to understand instructions and reminding them to comply. Pharmacies and managed care companies can play a role as well. Many use systems and processes to instruct patients on appropriate use and remind them to refill medications. In particular, case managers are a highly effective, though costly, way to increase compliance. Disease management programs in various chronic disease areas often utilize case managers to communicate with, educate and assist patients. The relationship they build with patients helps to improve patients' desire to comply faithfully with their treatment regimen. Both patients and case managers report this perspective.

Resources

Although few respondents actually use resources to aid in compliance, interviewees from all groups recognize the important role of various methods used to improve patient compliance. These range from human resources, such as medical assistants and case managers, to web-based information and tools. Various measures are used by physician offices, managed care organizations, insurance companies and pharmacies.

Some examples of resources mentioned include:

- Product information brochures or printouts
- Websites
- Home health services infusion/injection
- Case managers, medical assistants, nurses
- Electronic health record used to track prescriptions, refills, etc.
- Weekly pill boxes

- Reminder emails and phone calls

Changes in practice

Changes that physicians report having taken are often directly related to the problems they describe. Some report trying to be more conscious of the cost of medications and medical care. They are aware that these costs are a large factor in non-compliance and are willing to take steps to mediate them. These steps may include:

- Prescribing generic medications
- Using samples to ensure the patient can comply and is tolerant before filling the prescription
- Using telephone follow-ups instead of return visits

Other changes described address communication issues. Physicians and patients both report that there is less “talking down” to the patient. Physicians are less authoritative and more encouraging. Other communication measures include:

- Communicating with family members to support compliance
- Providing written instructions to patients
- Using support staff to communicate more with patients

Education

Many physicians acknowledge the need for education around patient compliance. However, there is variation on the role and responsibility of various stakeholders, predominantly the physician. The Change Readiness Inventory data (below) illustrates the role that physician attitude can play with respect to patient adherence.

There is also difference of opinion as to what form education should take. Some feel that stand-alone compliance programs are appropriate to physicians, while others believe that compliance should be incorporated into clinical content. Clearly, compliance is clearly not strictly a knowledge issue; therefore, interventions should include

information on tools, resources, techniques and system processes that can improve patient compliance.

Barriers

Several barriers to best practices in patient compliance were described in the interviews. These included time, communication skills, and a perceived lack of resources to aid in patient education. The barriers were quantified in the CRI data.

Vertical Interviews and Focus Group

In addition to horizontal interviews with various stakeholder groups, a series of interviews and a focus group study were conducted to discover barriers and gaps from a vertical systems perspective. This analysis provided an in-depth look at patient adherence issues within a single health system. Three clinical areas – asthma, diabetes, and hypertension – were assessed as the patient interacts with the healthcare system, addressing adherence through multiple contact points. This perspective identified the inconsistencies, barriers, and systems issues that may not be independently assessed by the individual stakeholders and provides a "real time" snapshot of the myriad of issues that can negatively impact patient adherence. This vertical view helped to clarify the role of system issues, such as continuity of care, through a case-study approach.

The vertical interviews were completed within the University of Virginia Health System and related community clinics in Charlottesville, VA. The system is made up of a large tertiary/quaternary hospital that serves much of the Piedmont and Shenandoah Valley regions of Virginia, as well as eastern and southern West Virginia and eastern Tennessee. The UVA hospital is a 572-bed facility with over 29,000 admissions, 653,357 outpatient visits, and 58,000 emergency department visits per year. The University of Virginia Health System is served by 722 full-time faculty, 667 residents and 1,860 nurses. The vertical interviews included primary care physicians, specialists, nurses, diabetes educators, and patients.

In general, the same issues that were revealed in the horizontal interviews exist within a health system. A combination of patient, disease, and physician issues and barriers

conspire to reduce patient adherence, whether the patient is inside or outside a closed system. Additional findings revealed in the vertical interviews are detailed below.

Continuity of care

Many of the system problems are expressed as an interruption in continuity of care for the patient. This often occurs when the provider does not have the complete or correct information at the point of contact with the patient. Even when a system that has electronic health records, as does University of Virginia, these issues persist. Often problems occur when the patient is relied upon to deliver information from physician to physician. For example, a patient visits the emergency room for high blood pressure, is examined and released, and told to follow up with their PCP. The patient makes an appointment but fails to mention the emergency visit to the receptionist, so upon arrival at the PCP office there are no records from the emergency room. The patient and physician must wait until appropriate documentation can be obtained.

The vertical interviews yielded many such examples, in which breaks in the continuity of care resulted in adherence problems. In the case above, the patient may decline to wait until the record is available. In other examples, patients were given conflicting instructions from different physicians because complete information was not available. In either case, patients lose faith in the system and/or the physician and may not adhere to medical instructions.

Overbooking is also a problem that reduces adherence and increases medical errors. Emergency medicine physicians reported that when clinics are crowded, patients are told to go to the emergency room to receive care. This simply results in overcrowding the emergency room, causing patients to wait longer to see a physician or nurse. Many patients will simply leave. This practice also results in the ER being used as a primary care clinic, a costly and inefficient use of resources.

Patient communication/relationship/rapport

Communication plays a key role in adherence whether it is within an integrated healthcare system or not. Anything in a system that enhances rapport will increase

compliance; the opposite is true as well. Good communication, whether personal or system-generated, will enhance the relationship with the patient and make them more likely to follow medical instructions. The diabetes specialty clinic is an example of how good communication can enhance patient rapport and adherence. Certified Diabetes Educators (CDEs) and nurses in this clinic build a close relationship with patients. Many of these patients have multiple conditions, including diabetes, hypertension, and hyperlipidemia. Adherence is crucial to the health of these patients. Because of this strong relationship, patients are willing to "try harder" and "stick with it" because they do not want to disappoint the nurse or CDE.

Communication problems are often physician-specific and unrelated to the system. Patients report that sometimes physicians do not know what patients do 'on their own'. This refers to over-the-counter medications, nutritional supplements, and "natural" treatments used in addition to prescribed medications. Because patients often will not volunteer this information, physicians may be unaware of these therapies unless they specifically ask.

Several physicians reported that they have made changes in the *way* they communicate with patients, such as tone of voice or language. They take an understanding or empathetic approach rather than scolding the patient. Some physicians change their office procedures for communication with patients. Some specific ways healthcare providers improve their communication are as follows:

- **'Double checking' patient understanding.** The physician gives instructions, then the nurse spends a few minutes reviewing the instructions and checking the patient's understanding. *"Most patients really don't get it the first time, even if they say they do."*
- **Coordinating communication between the physician and the nurse.** The physician and nurse work together to reinforce the patient's goals, expectations, and instructions. The system must provide for and support coordinated communication by use of appropriate tools and processes.

- **Developing scripts to begin a conversation.** Sometimes physicians need guidance to find the appropriate words to open a conversation, particularly with sensitive topics.

System Communication/Issues

When there are system communication breakdowns, adherence suffers. One specialist reported that the department phone system was changed to a "rolling system", whereby a call was routed from one phone to another if the line was busy. Previously, calls had been routed to voicemail. Now, instead of voicemail, the patient received no answer at all. The specialist reported that patients were unhappy and less adherent.

Other systems issues involve communication between specialists and primary care physicians (PCPs). Some specialists complained that they always send a follow-up note or make a phone call to the PCP, but receive no information in return when the PCP changes treatment that the specialist has prescribed.

Additional systems communication issues were reported, including:

- The electronic health record (EHR) does not provide immediate access to information from outside physicians or institutions.
- Central scheduling system - patients are scheduled for clinic through a central system. If the patient calls to change ("I'm running late") this information is not updated for the clinic.
- EHR shows what a patient is prescribed, NOT what is filled at the pharmacy. The patient may never attempt to fill the prescription in the first place, for cost or other reasons, or the pharmacy may not have the entire prescription in stock.
- There are inconsistent messages given by different healthcare providers. One physician might discontinue another's prescription and not inform the prescribing physician. One patient reported that she was on put on a medication by a pulmonologist for asthma. Her OB/GYN assumed the medication was for allergies, and discontinued the drug when she became pregnant. She subsequently suffered an asthma attack and was hospitalized.

- No single physician has all the necessary information from other physicians.
- Multiple physicians prescribing medications leads to complicated drug regimens and side effects.

Interview Summary

The qualitative interviews and focus group yielded a variety of stakeholder perspectives around the issue of patient compliance or adherence. The findings were similar in the horizontal and vertical interviews and focus group. The systems issues identified in the vertical interviews mostly revolve around communication and coordination of care as described above. These problems exist even in a health system with electronic health records, such as the University of Virginia Health System.

There are successes that are fostered by a well-coordinated health system. The University of Virginia Diabetes Center is an example of well-coordinated patient care and communication. Because diabetic patients also often suffer from other diseases or conditions, the coordination of care with these patients is essential.

Below are some of the lessons learned from these interviews and the educational implications for physicians and other health care practitioners.

Successes

- Coordinated communication with the patient, with the same message coming from physician, nurse and other stakeholders, can help improve patient understanding and willingness to comply.
- Patient education materials are very helpful. Many are readily available, but there is variable use. Offices and clinics must make sure that a supply is placed where it is easily accessible.
- "Small goals" are the most effective for improving adherence (walk 15 minutes a day to begin, versus 30 minutes). Patients can achieve goals more quickly and set new goals. Success at these small goals builds confidence and promotes adherence.
- Other resources used for aiding compliance include: the Walmart \$4 list, pill splitting to reduce costs, and use of a weekly pill box.

Educational Implications

- Education for physicians should emphasize the importance of adherence by addressing patient safety concerns and lack of therapeutic effectiveness (inability to meet goal).
- Awareness efforts should emphasize how lack of adherence complicates and confuses the clinical judgment of the physician. They do not know the degree of non-compliance and thus cannot assess the true effect of therapy.
- Clinicians need to better assess the patient's ability and motivation to comply with therapy to ensure the patient fills the original prescription.
- Education should address appropriate communication skills to include probing questions and listening skills. Adherence questions to patients are phrased as a yes/no question – with little or no effort to understanding whether the patient is truly adhering to the treatment regimen.
- Clinical topics, especially in chronic diseases with low compliance, should include some aspect of adherence education. Tools and techniques used to increase adherence should be part of the curriculum.
- Cases in CME should include a patient failing related to non-adherence, in order to increase physician motivation to improve compliance among patients.

Change Readiness Inventory

A modified Change Readiness Inventory[®] (CRI) was administered to the physician target audience in order to quantify the information gleaned from interviews. The CRI, customized to adherence, is an assessment survey that measures competencies and barriers that affect change in clinical practices. Additionally, practice assessment questions were asked to enable analysis based on physician adherence-related practices.

Clinical and educational experts developed a list of clinical competencies for adherence. These competencies were based on current guidelines, literature, and clinical expertise. The competencies were rated by the target audience physicians according to their 'current' and 'desired' abilities. The difference, or gap, between current and desired ability indicates the **perceived need** of the audience. Barriers included on the CRI were revealed during the interviews and adapted by both clinical & educational experts.

The Change Readiness Inventory[®] was posted online as an electronic survey. A broadcast e-mail consisting of a cover letter from the University of Cincinnati Center for Continuing Professional Development requesting assistance from physicians was sent to a purchased list of physicians. The quality of the e-mail list was unknown, but was purchased from a reputable source with verification through AMA records. One of the limitations of an electronic survey sent by e-mail is the spam interception that occurs. Therefore, we have calculated a response rate based only on the number of physicians for whom there is confirmation of receipt of the email. Physicians were identified from AMA records as having the specialties of cardiology, endocrinology, asthma/allergy, or primary care (both family medicine & internal medicine). A \$15 donation to the American Red Cross was made for each physician's participation in the assessment. Although providing this link and assessment electronically poses inherent problems of its own, the sample of participants invited is believed to approximate the demographics of practicing physicians in the target specialties.

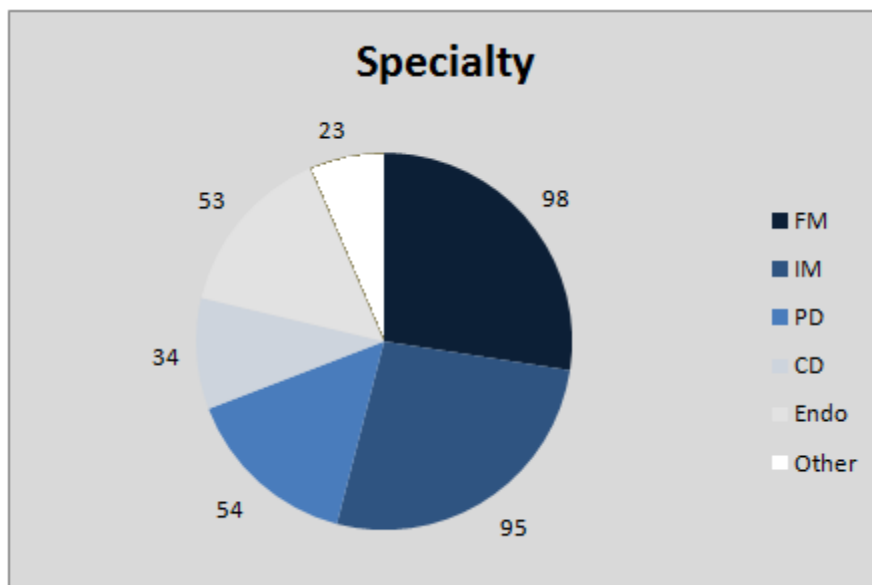
Additionally, a panel of primary care physicians was engaged through e-Rewards to complete the assessment consisting of primary care physicians (both family medicine & internal medicine). This panel was assessed independently and deemed to be

representative of the target audience. This sample was combined with the e-mail sample to develop a more robust response.

CRI Results

The e-mail broadcast was sent to a total of 18,108 physicians. It is impossible to estimate the number of messages actually viewed by the audience because spam filters intercept messages differently. However, a total of 374 (2.0%) clicked on the link to access the survey and 265 completed the assessment. For the e-Rewards portion of the assessment, an email was sent to 500 physicians on the e-Rewards panel who fit the criteria for this project. 140 physicians (28%) clicked on the link to access the assessment, and 103 completed it. Together, a total of 405 physicians of the 514 (79%) that accessed the Change Readiness Inventory completed the assessment. 357 were used for the analysis after eliminating incomplete assessments.

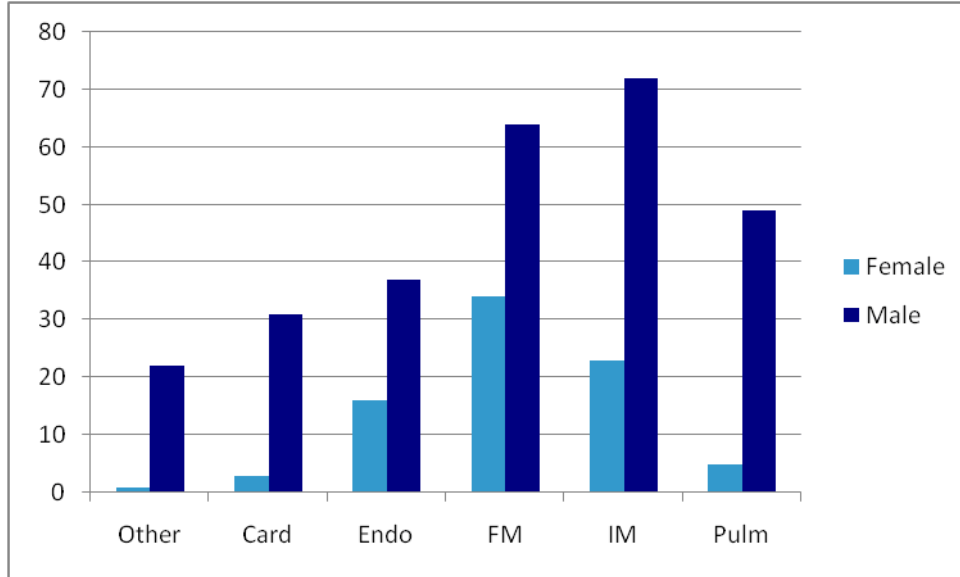
Figure 1 Distribution of CRI responses by specialty



The largest group of respondents from the broadcast e-mail was pulmonology (n=54) followed by endocrinology (53), family medicine (48), internal medicine (45) and cardiology (34). 23 respondents listed themselves as "other". The e-Rewards portion

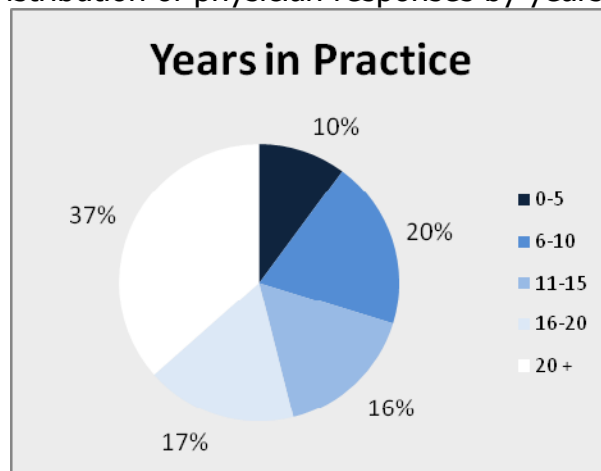
had 50 family medicine and 50 internal medicine respondents, to bring the total number in these specialties to 98 and 95 respectively.

Figure 2 Distribution of physician responses by gender



Of the total, 82 (23%) of the respondents were female and 275 (77%) were male. The percentage of females varied in each specialty group from a high of 35% in family medicine to a low of 9% in endocrinology.

Figure 3 Distribution of physician responses by years in practice



The 20+ years in practice category was the largest for each specialty group. The family medicine specialty had equal numbers of respondents with 20+ and 6-10 years in practice.

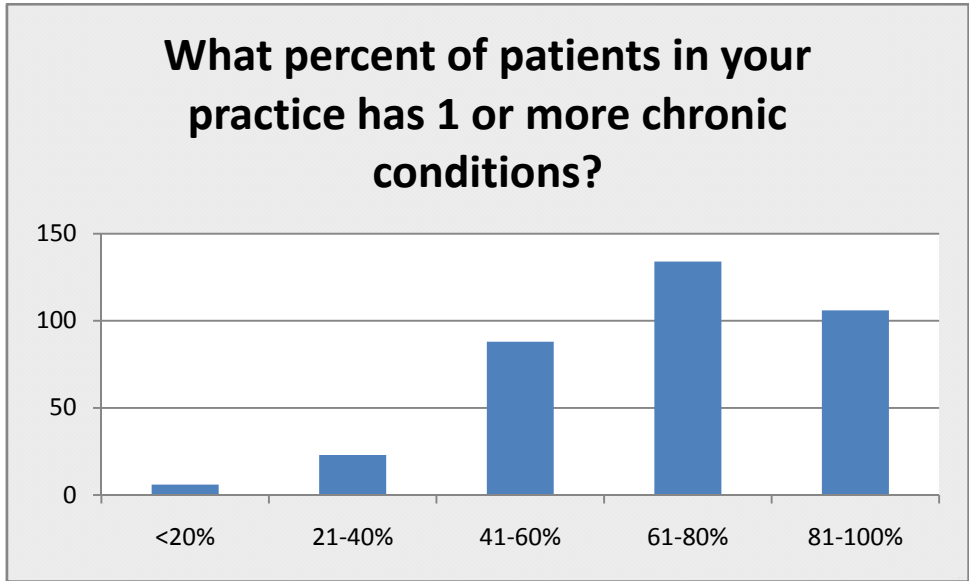
Table 4 Physician responses by practice type

Practice Type	# of Responses
Solo	78
Single Specialty	108
Multi-specialty	101
Hospital	40
Other	30

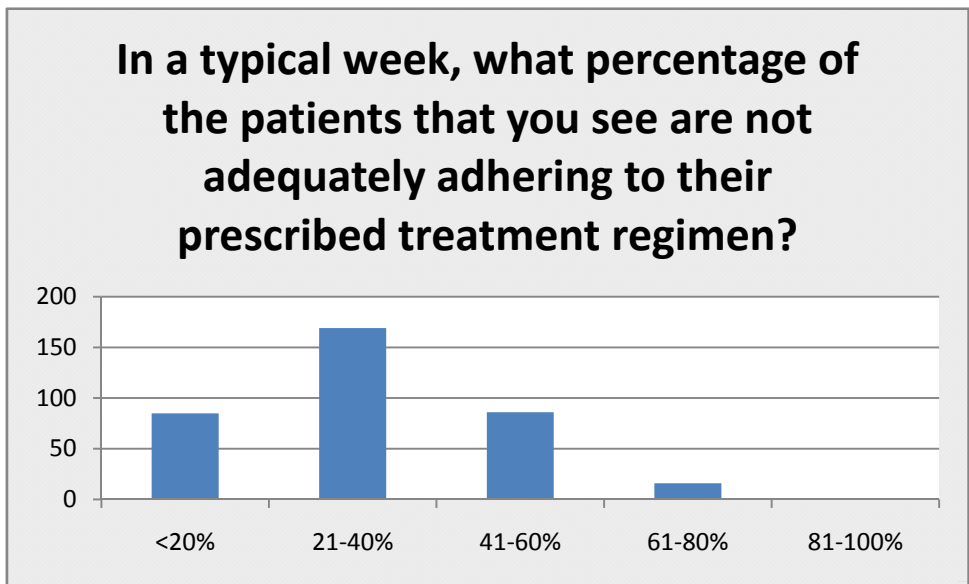
Single-specialty group practice was identified as the most common practice type overall. Cardiologists, pulmonologists, and family medicine physicians all reported this as the most common practice type. General internists and endocrinologists most often reported multi-specialty groups as their practice type.

Practice Assessment

Several questions on the CRI were used to assess the degree to which respondents' practices were affected by poor patient adherence, how they deal with adherence issues, and their attitudes and opinions about patient adherence. These questions constitute the practice assessment portion of the CRI.

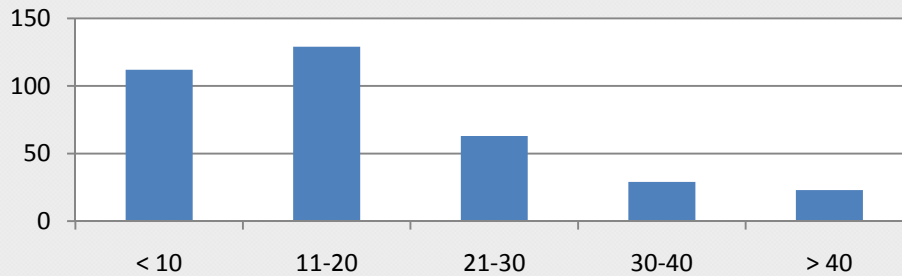


Responses indicate that a large portion of the respondents' patients have 1 or more chronic conditions – a strong predictor of adherence problems. This was higher for specialists than for primary care physicians, with 48% of specialists reporting that 81-100% of their patients were in this category while only 15% of primary care physicians indicated the same.



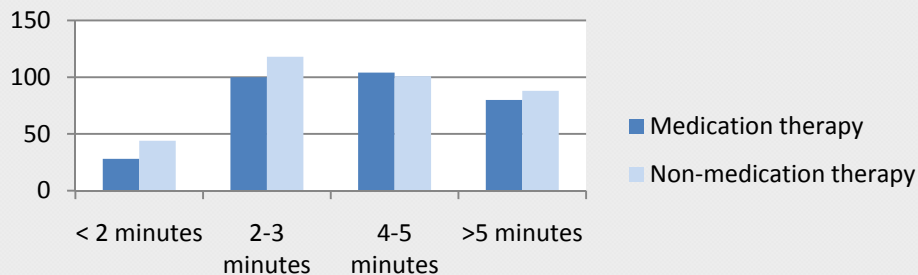
Most of the respondents indicated at least 20% of the patients seen in a typical week are not adequately adhering to their prescribed treatment regimen. There was no difference between specialists and primary care physicians.

In a typical week, how many patients do you see in which patient adherence to a prescribed regimen is a significant problem?



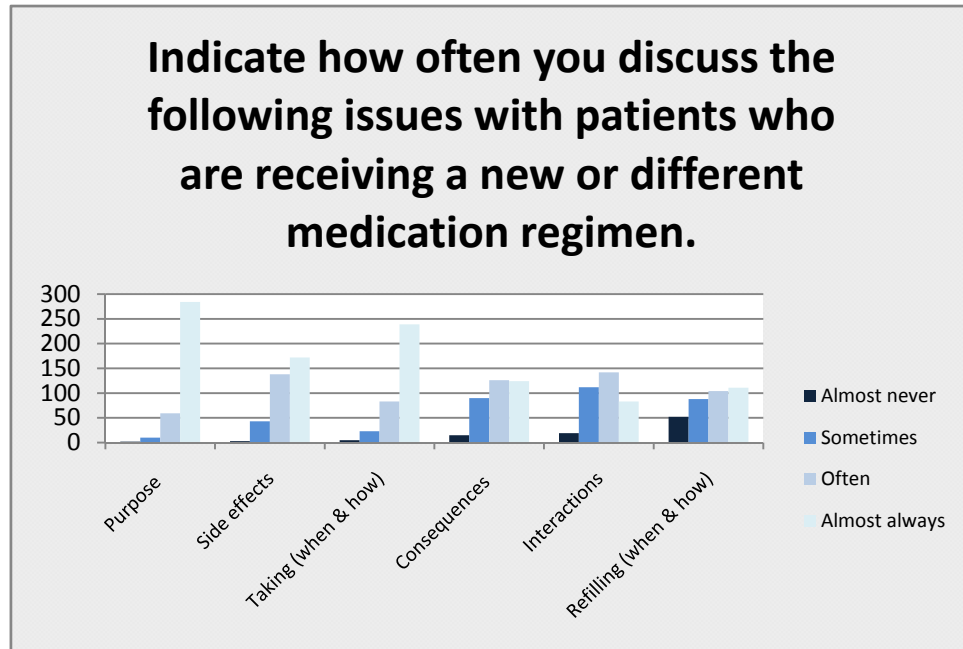
Most physicians see at least 11 patients a week, and in fact, 32% of them see more than 21 a week, for whom adherence is a *significant* problem. Primary care physicians did report seeing a higher number of patients with adherence issues.

When prescribing a new or different treatment regimen for a patient, approximately how much time do you spend explaining the treatment?

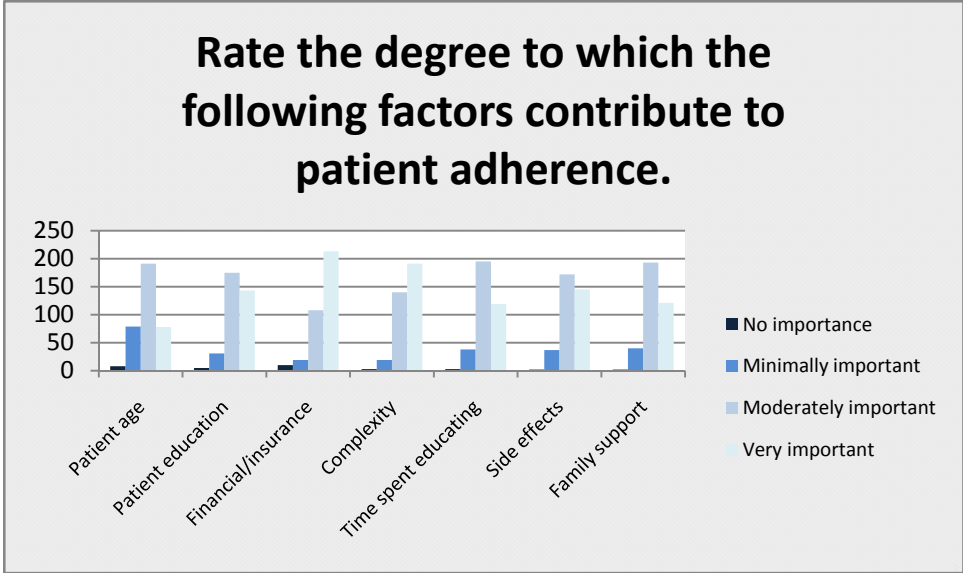


Respondents reported that they devote approximately equal amounts of time explaining new medication and non-medication therapies. Most spend between 2 and 5 minutes

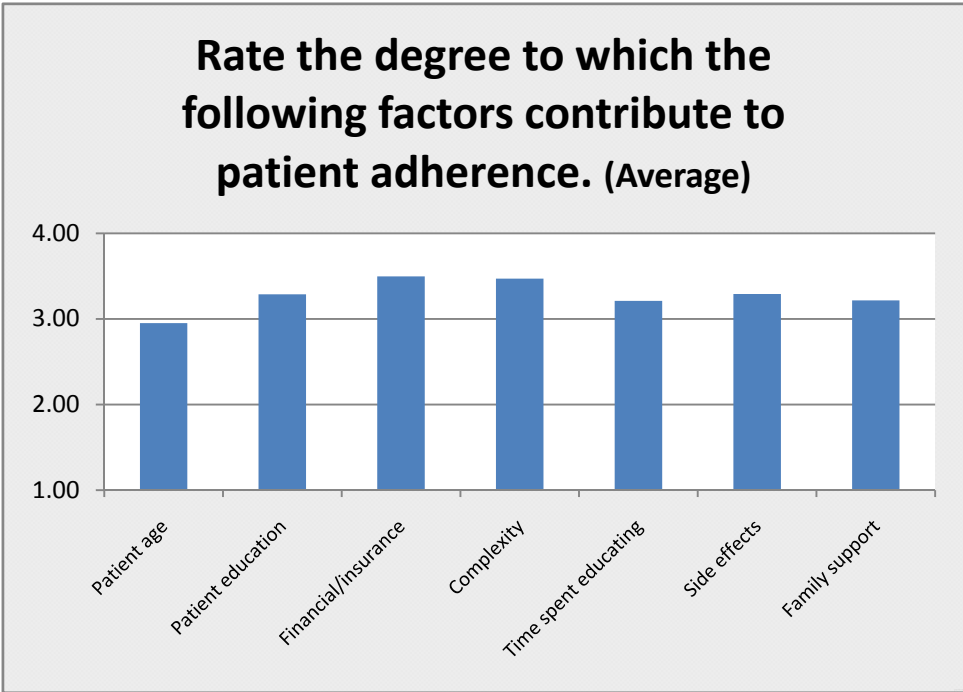
explaining new therapy. There was a correlation between time spent on medication therapy and non-medication therapy. Those physicians that spend time counseling report they do so for both types of therapy. There is also a correlation between the perception of adherence being an issue and time spent counseling, i.e., those that perceive adherence to be an issue spend more time counseling and vice versa.



When prescribing new or different medication regimens, physicians spend most of their time explaining the purpose, side effects, and how to take the medication. Little time is spent on *consequences* of non-compliance, potential interactions, and refills. Specialists reported discussing the first 5 topics more often than primary care physicians. There was no difference on discussing how and when to refill the prescriptions. Physicians who reported more time explaining the treatment were also more likely to discuss the issues above more often.

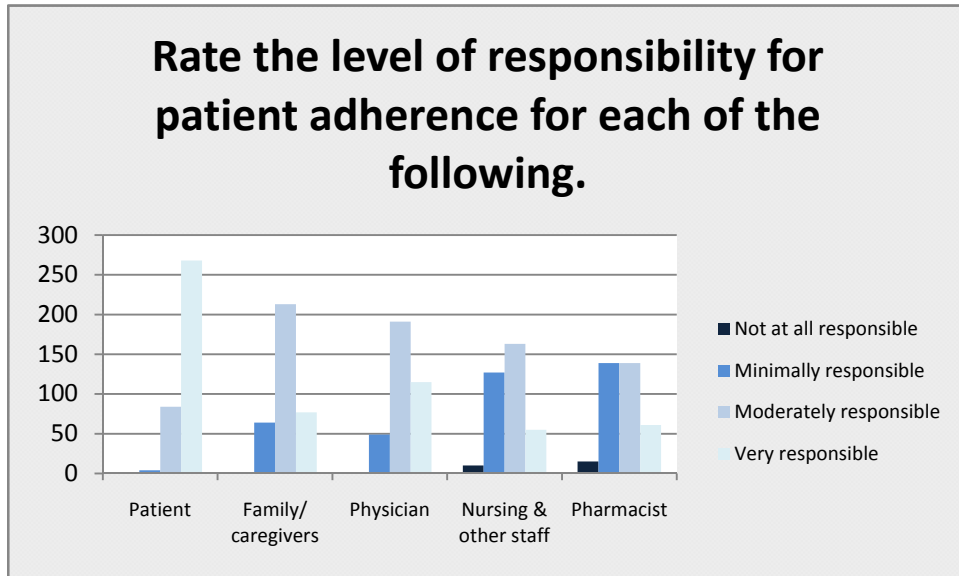


Physicians believe that insurance and financial issues and complexity of the regimen are the biggest factors contributing to patient adherence. Averaging responses in the chart below allowed for a better comparative perspective of the factors.

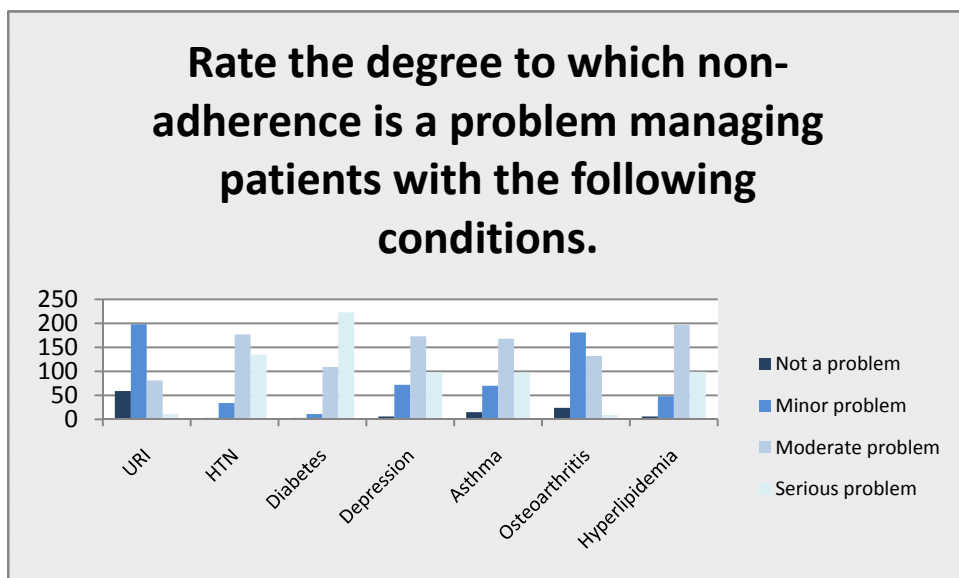


Physicians rated all the factors presented on average as “moderately important” or higher, with the exception of patient age, which averaged slightly less than “moderately

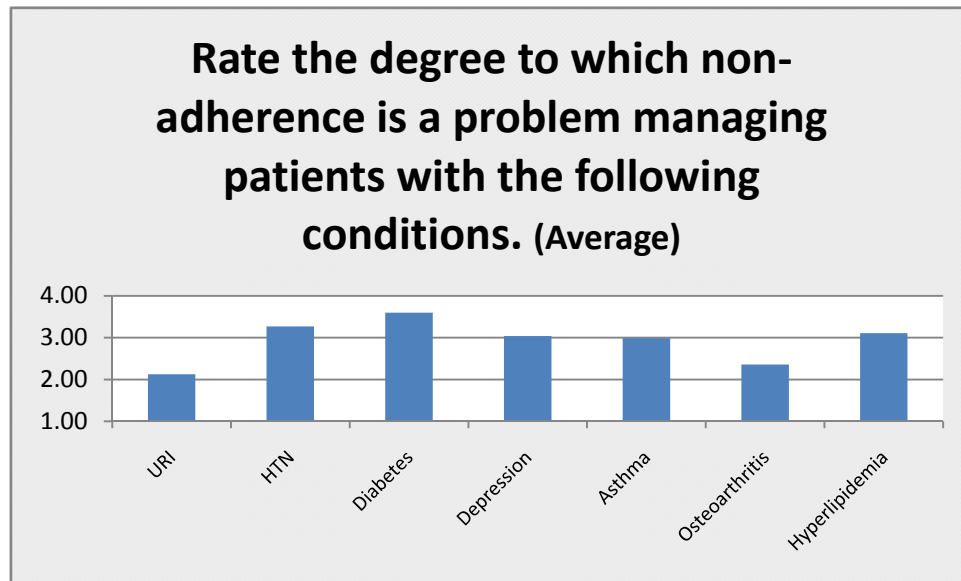
important". The responses here indicate that physicians believe that all of these factors are important contributors to patient adherence.



Physicians believe that the patients are by far the most responsible for their own adherence. On average, they believe all of the listed stakeholders bear **some** responsibility, but a significant number believe that nurses and pharmacists bear minimal or no responsibility for patient adherence. Specialists reported significantly higher responsibility for nursing and other staff than did primary care physicians.



Physicians view adherence as a “serious problem” far more often with diabetes than with other conditions. They view non-adherence as a lesser problem with upper respiratory infections and osteoarthritis.



Averaging showed that physicians rated diabetes and hypertension as the chronic conditions where non-adherence caused the most problems, while non-adherence was seen as less of a problem with osteoarthritis and upper respiratory infections. The primary care physicians rated all but URI and osteoarthritis higher than the specialists.

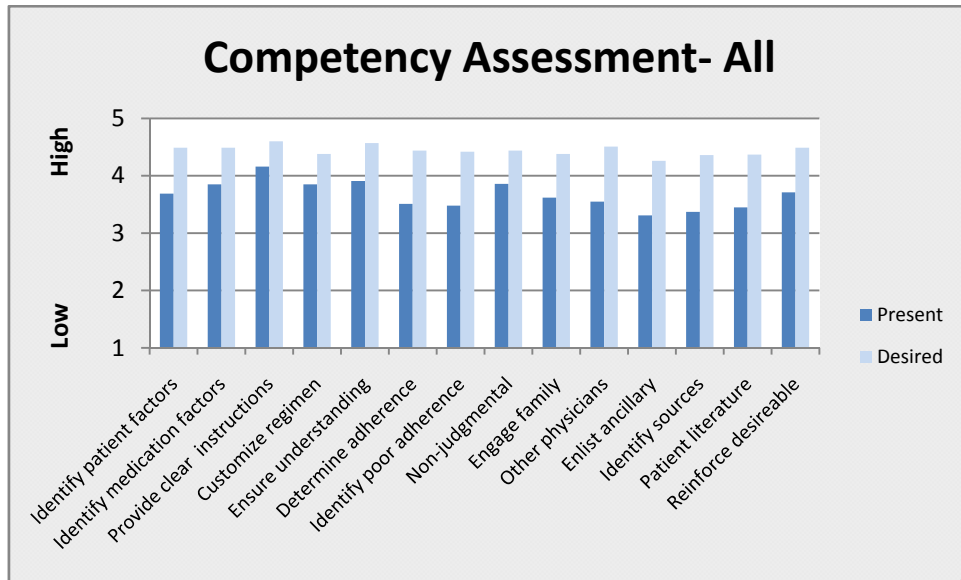
Competency Assessment

The respondents were asked to rate their present and desired level of ability on a 1-5 scale (1=low, 5=high) for the list of required competencies for best practices developed from the literature and experts. The physicians rated themselves on the following competencies:

Please consider the following statements and indicate your PRESENT ability to perform each item and then below it, your DESIRED level of ability to perform that item.

- Identify patient factors that may contribute to non-adherence (cognitive impairment, lack of belief in the treatment, etc.)
- Identify medication factors that may contribute to non-adherence (complex regimen, side effect, etc.)
- Provide simple clear instructions on the regimen
- Customize the regimen according to patient wishes and needs
- Ensure that patients understand the value and effect of adherence
- Determine whether a given patient will be able to adhere to directions
- Identify poor adherence using questioning, refill dates, blood levels, etc.
- Use non-judgmental language to ask questions about adherence
- Engage family and other caregivers when needed
- Identify therapies and medications prescribed by other physicians that your patients see
- Enlist ancillary healthcare providers to help patients comply
- Identify sources of free or reduced-cost medications for my patients
- Provide patient literature in language that your patients can understand
- Reinforce desirable behavior and results when appropriate

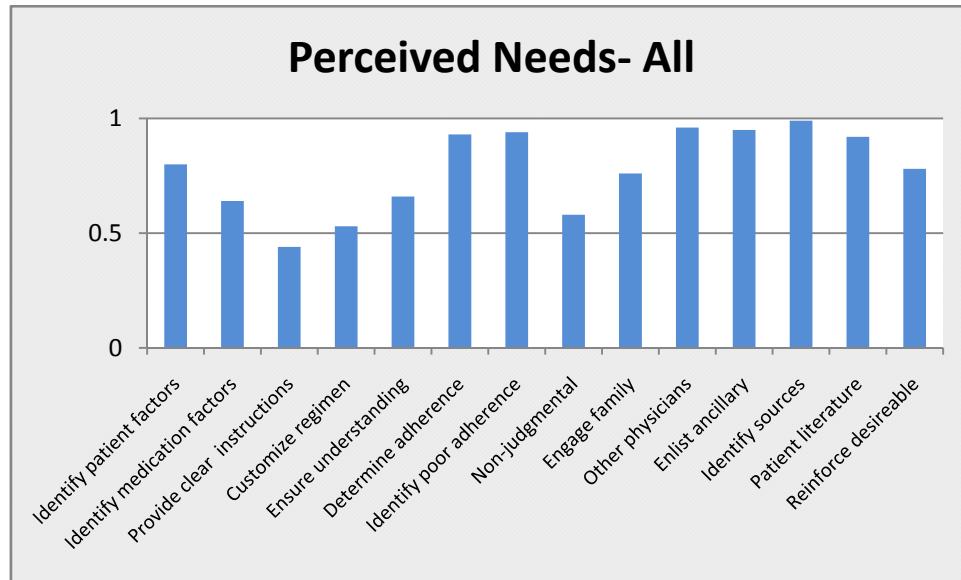
Results show that the desired level of ability is high for each of the identified competency statement, as evidenced by the average rating being above 4 for each (red bars). The present abilities of the physicians show more variation (blue bars).



The physicians report their current ability is highest on 'provide simple, clear instructions on the regimen', and lowest for 'enlist ancillary healthcare providers to help patients comply'.

Perceived Needs

The competency 'gap' between present and desired ability reveals the perceived needs of the audience from the survey. This gap between the perception of 'what is' and 'what ought to be' will indicate physicians' perception of their own abilities on each of these competencies and to the problem of adherence overall. The gaps are also a strong indicator of their motivation to learn and change in this area. A gap of .5 or higher is considered to be *significant* while gaps between 1 and 2 are considered *ideal* for learning and change.



The perceived needs are significant for all competencies except *provide simple, clear instructions on the regimen*. The larger gaps show the physicians to be motivated to increase their abilities for the competencies listed. None of the gaps fell within the 'ideal' range of 1 to 2, although several were only slightly below 1. The degree to which the physicians perceived their responsibility in adherence did not affect perceived needs.

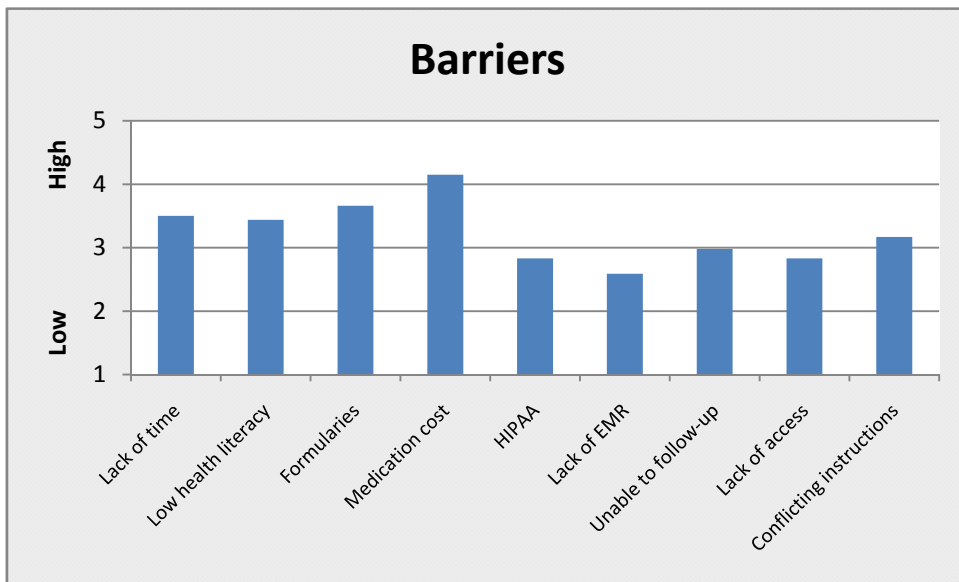
Barriers

Barriers to change are real or perceived issues that may prevent physicians from utilizing best practices. A knowledge of the nature and magnitude of these barriers helps educational designers to address them within the scope of the interventions, thereby allowing for changes in performance (Level 4) as compared to changes in knowledge (Level 3).⁸⁶ These barriers were derived from the adherence interviews and from the literature on physician change.

Barriers were assessed through the Change Readiness Inventory. Respondents were asked to rate their agreement (1=low, 5=high) with the following barrier statements:

Reflecting on patient adherence, please rate the following statements according to your extent of agreement with each.

- Lack of time to communicate effectively with my patients reduces their adherence.
- Low health literacy of my patients reduces adherence.
- Formularies make it difficult to prescribe treatments with which my patients can comply.
- The cost of medications is a reason for non-adherence.
- HIPAA regulations restrict my ability to involve other family members and caregivers.
- The absence of electronic medical records makes it difficult to assess adherence.
- I am unable to follow-up with patients often enough to increase adherence.
- Lack of timely access to patient test results or other medical information makes it difficult to assess adherence.
- Conflicting instructions from other healthcare providers reduces adherence.



Results show that physicians do perceive barriers to patient adherence. Five of the statements were rated above the midpoint. *The cost of medication is a reason for non-compliance* was rated the highest and *the absence of electronic medical records makes*

it difficult to assess adherence was rated the lowest of the barrier statements. However, all of the barriers were rated high (a 4 or 5 on a 5 point scale) by a subset of the physicians.

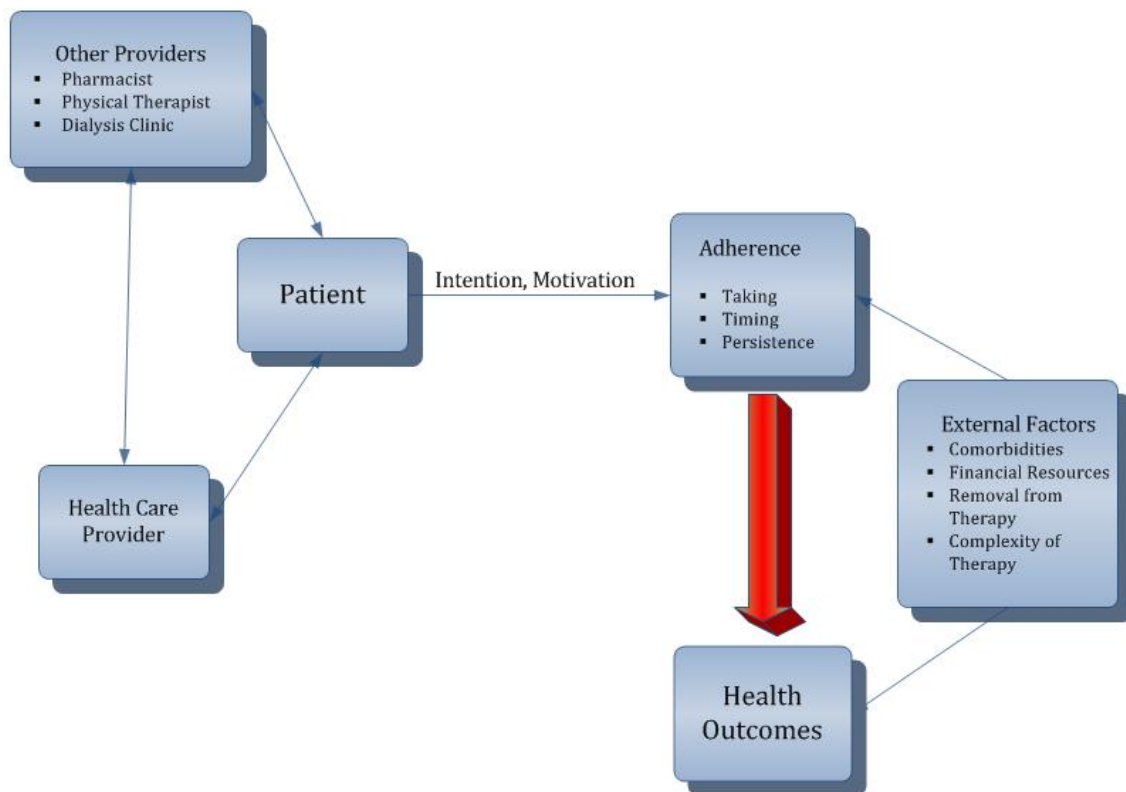
All barriers had more than 25% of the respondents rating them as high. The following table shows the percentage of physicians rating the barrier high.

Statement	% rating "high"
Medication cost	74%
Formularies	59%
Lack of time	52%
Low health literacy	52%
Conflicting instructions	38%
HIPAA	35%
Unable to follow up	35%
Lack of access	32%
Lack of EHR	26%

The primary care physicians rated the lack of time to communicate effectively with patients as a higher barrier than did specialists. Also, the time spent counseling did not affect barrier perception.

Models of Adherence

Previous models of adherence have been developed largely in the field of behavioral medicine and tend to center around patient characteristics such as mental health, social support, and health beliefs. We have created a model of adherence behavior that integrates health care professionals, the health care system, and patient and external factors as well.



Adherence: Timing, Taking, Persistence

The left section of our model illustrates that the interaction between patient, physician, and other members of the health care system involves multi-dimensional communication and dialogue. These stakeholders, along with the patient's level of intention and motivation, can directly influence adherence.

Adherence to medication consists of three variables: **taking the medication correctly, at the correct time, for as long as necessary**. We refer to this as three-part model as TTP: Taking, Timing, Persistence. In order to be fully adherent, all three of these requirements must be fulfilled. Unfortunately, most literature and measurements of adherence assess only one or two of these factors; they rarely take all three into account.

Health Outcomes

The ultimate goal of investigating and improving adherence is the patient's improved state of health. Health outcomes can be clinical measures, such as blood pressure or blood glucose, or events, like emergency department visits.

These variables can be affected by any number of external factors: co-morbidities, the patient's financial resources, removal from therapy, et cetera. In addition to influencing health state directly, external factors can also positively or negatively affect adherence, thus indirectly influencing health outcomes.

The therapeutic outcomes of adherence are specific to the disease state. In some cases, results of adherence are immediately quantifiable. In diabetes, the clinical outcome of adherence is blood glucose level; in hypertension, it is blood pressure. In both of these diseases it is possible for patients to receive immediate feedback through self-monitoring. In this way they can directly experience the effect of their adherence behavior.

Association Between Adherence and Health Outcomes

In our model, the red arrow (edit this) represents the association between patient adherence and health outcomes. The strength of the association between adherence and health – represented by the length of the red line – varies according to condition. In some cases, improved adherence leads to direct results; diabetes medication affects blood glucose almost immediately, and non-adherence can directly cause negative consequences. Thus, in the case of diabetes, the red line would be relatively short.

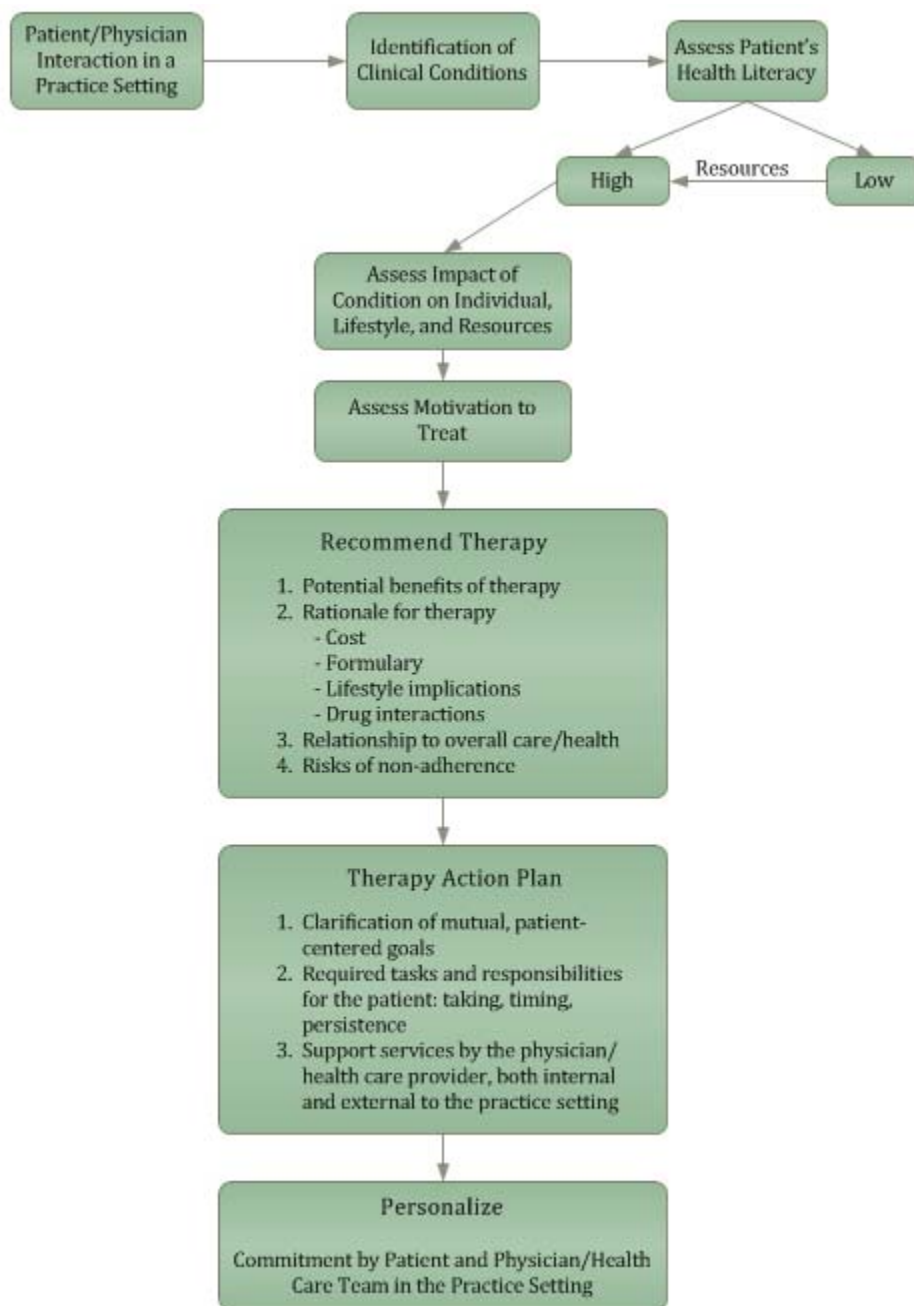
However if long term complications of diabetes were the outcome used, the arrow would be longer.

For asthma, the line would be somewhat longer, because improved adherence to asthma controller medications may not immediately impact clinical outcomes such as rescue inhaler use.

Hypertension represents a very long red arrow, because the consequences of adherence are long-term. High blood pressure is asymptomatic, so patients may get no feedback until years later when complications ensue in the form of a heart attack or stroke. However, although the clinical outcomes of untreated hypertension are long-term risks, patients do receive short-term feedback in the form of lowered blood pressure. By stressing the effect of improved adherence on blood pressure readings in addition to the risk of cardiovascular events, doctors are in effect shortening the line between adherence and outcome, thus providing a more immediate result of adherence behavior. When patients can observe the direct results of their adherent behavior, they are more likely to continue the behavior. For this reason studies have shown that patients with home blood glucose monitors or home blood pressure monitors have higher rates of adherence.

Adherence in the Practice Setting

We have developed two simple models of communication in the practice setting that implement our findings. These models integrate concepts from both the literature and case management theory to promote patient adherence. The following figure is a model of communication at the time a condition is first diagnosed.



Initial Diagnosis

In a practice setting, the physician identifies the patient's clinical condition. She assesses the patient's level of health literacy, by either using a validated tool or through communication clues. Low health literacy has been identified as a risk factor for non-adherence; if this is the case, the physician should take steps and utilize resources to ensure that the patient has a full understanding of the diagnosis and available treatment.

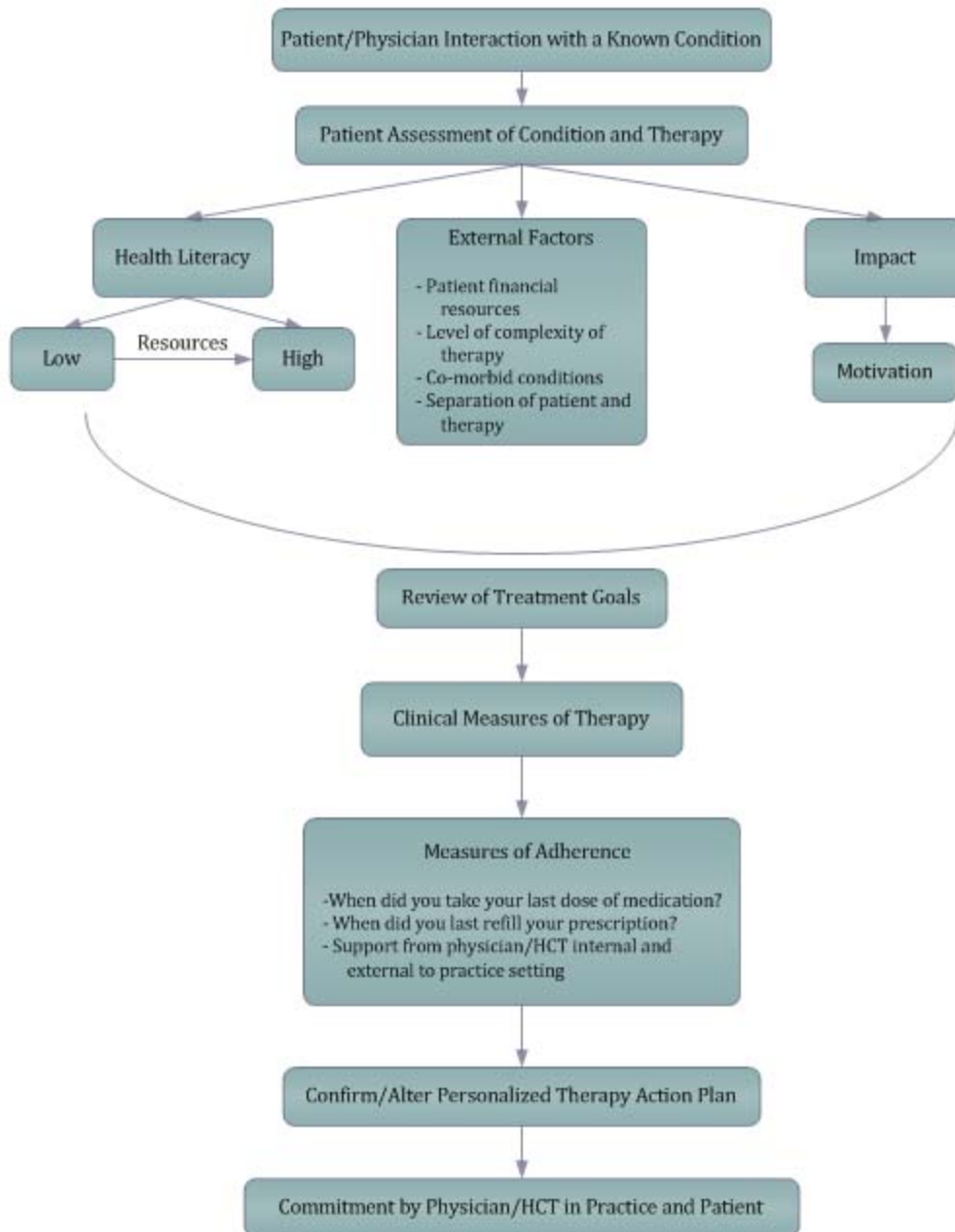
The physician should then assess the impact of the condition on the patient's lifestyle and financial resources to determine if he is **able** to comply with therapy, and assess motivation level to determine if he is **willing** to comply. Only then can the physician recommend a therapeutic regimen. In doing so, she should explain the benefits of the therapy, the rationale for choosing it over other available choices, how the therapy relates to the patient's overall health and plan of care, and the potential consequences of non-adherence.

The physician then involves the patient by creating a mutual plan of action for the therapy. The parties should clarify their mutual goals – centered around the patient – and define their respective responsibilities: the patient's responsibility of 'taking, timing, persistence' and the physician's responsibility to provide support, which may include follow-up visits or future communication.

The physician should finish the interaction by placing the treatment in a personalized context to get the patient emotionally invested the therapy plan.

Follow-Up Visit

We have developed a second adherence model for interaction after a plan of action for therapy has previously been developed.



The patient should present her assessment of the clinical condition and therapeutic regimen. The physician should reassess the patient's health literacy and identify external factors such as co-morbid conditions or financial resources that may be affecting treatment. The physician should also assess the impact of the condition and treatment on the patient and determine, once again, the patient's motivation for therapy.

Together, the patient and physician should review their mutual goals for treatment. The physician should interpret any clinical measures of therapy, such as symptoms or laboratory results. He should assess adherence using a validated tool or by asking questions such as, "When did you take your last dose of medication?" or "When did you last refill your prescription?"

Finally, the patient and physician should either confirm the continuation of the previous personalized therapy action plan or modify it accordingly. Both parties should review their commitment and responsibility to the treatment plan.

Implications for CME

Continuing medical education assesses the environment within which physicians and health care professionals deliver care to their patients, address gaps in knowledge, provide assets to change attitude, overcome barriers and modify behavior resulting in improved patient outcomes. This needs assessment set out to survey the literature, attitudes and clinical research that impact adherence. Our goal is to identify strategies for delivery of medical education that will impact physician behavior and consequently patient outcomes. We anticipated many of the factors that influence adherence, but we underestimated the complexity of the systems at play.

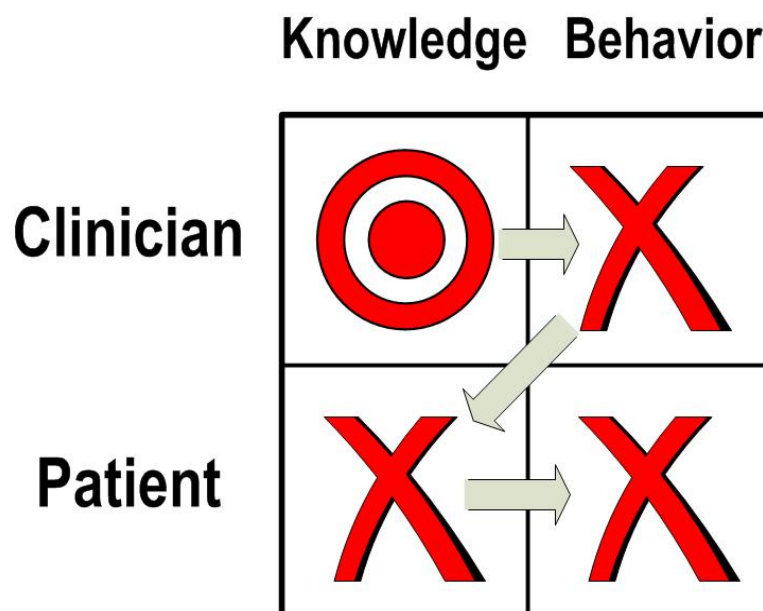
Our analysis reveals the incongruous views about adherence held by patients and health care providers. Although patients' adherence – affected by depression, co-morbid conditions, pill burden, and lack of self-efficacy – leaves much to be desired, patients still do not view non-adherence as a major problem. Although they know they *should* take their medicine, patients often do not fully understand the clinical impact of adherence on their health. Physicians, on the other hand, are aware that adherence is a significant issue, with considerable economic, clinical, and patient safety repercussions, but face barriers that prevent them from contributing to patient adherence.

Physicians are aware of the importance of adherence, yet they believe it is the patient's responsibility to improve adherence, not their own. Consequently, physicians often do not take actions to improve their patients' adherence. They rarely assess patients' initial ability or intent to adhere or use available tools or techniques to assess or improve adherence. The belief that adherence is the patients' problem is reflected in existing adherence research, which focuses on patient characteristics and patient-directed interventions, rather than including systems- or provider-related factors.

Knowledge → Behavior = Adherence

There are two factors in play when we discuss the concept of adherence. The first is **knowledge**: realization that non-adherence is indeed a serious problem for patients, awareness of the risk factors for non-adherence, and understanding of the consequences that may thus result. Applying this knowledge in practice is **behavior**, or action taken on the part of the patient, physician or health care professional to ensure or improve adherence. In order for the patient to attain best adherence, physician and patient must address both variables.

The results of our interviews and Change Readiness Inventories indicate that patients generally lack both knowledge and behavior; they are unaware of the importance of adherence, which contributes to corresponding non-adherent behavior. On the other hand, physicians and other health care professionals understand the impact of non-adherence on clinical outcomes, but are constrained in changing their behavior. Physicians realize that adherence is crucial to successful therapy and recognize that non-adherence is a widespread problem, but they lack skills to implement strategies that address the barriers. In addition, they may believe that adherence is not their responsibility, an attitude that hinders their potential to learn adherence-improving strategies.



Just What the Doctor Ordered
December 2008

By targeting the 'clinician knowledge' quadrant of the diagram shown above, adherence-related CME curriculum can help physicians take responsibility for adherence and inform effective strategies to improve adherence. When the physicians' behavior changes to reflect this knowledge, they in turn will begin to pass these strategies and information on to their patients, ultimately resulting in patients changing their own behavior.

Therefore, to produce improved patient adherence, three things must happen:

- physicians must translate adherence knowledge into changed attitudes and behavior
- patients must become more knowledgeable about the importance and clinical implications of adherence
- patients must adopt behaviors that will result in improved adherence to their medication

The ABMS competences demand that physicians embrace life-long learning focused on patient care, medical knowledge, practice based learning and improvement, interpersonal and communications skills, professionalism, and systems based practice. CME curriculum must be grounded in each competency area. Our implications for CME are structured around the competencies not by design, but as a reflection of the interlacing of adherence in many aspects of clinical practice.

Patient Care

- **Engage patients on an ongoing basis.** A successful physician-patient relationship involves active engagement by both the patient and the provider. Ideally, this contact should be regular, one-on-one communication to provide a support system and a means for the patient to resolve concerns and questions regarding therapy. Active, ongoing communication is a common thread found in many successful adherence interventions.

- **Make a therapy contract.** The responsibility for adherence is shared between the patient, the physician and the health care system. At the time the prescription is written, both patient and physician should state their goals for therapy and their respective responsibilities needed to achieve those goals. A written contract is ideal, but even a verbal one can be helpful.
- **Include the patient's support network.** Our CRI results indicate that doctors feel that family support is an important contributing factor to patient adherence. Therefore, a good way to encourage adherence is to involve the patient's support network in the treatment plan. This is especially helpful, of course, with pediatric patients or those who have caregivers. HIPAA regulations present a systems barrier to family involvement, but one that can be overcome with minimal effort.

Medical Knowledge

- **Link non-response to therapy with adherence.** Today's therapeutic options offer physicians many choices to treat chronic disease. Routine medication checks may find a less than desired response. Therapeutic ineffectiveness is often the first conclusion reached, resulting in medication changes. Failure to adhere to therapy as prescribed may be a factor in non-response and should be assessed before medication switch.

Practice-based learning and improvement

- **Develop systems to monitor adherence.** Physicians report that they often assess adherence at follow-up visits by asking patients if they are taking their medication. This approach is ineffective and provides an incomplete view of actual behavior. Providers should be aware of existing tools to assess adherence, such as the Morisky scale, and use them if appropriate. Other possible ways to monitor adherence include examining pharmacy refill data, including adherence during medication reviews or using motivational interviewing

techniques to expose barriers to adherence. Wherever possible systems should be measurable.

- **Use available tools.** Physicians should be aware of the various tools that have been developed to improve patient adherence to medication. These can include visual aids such as cards for commonly-used medications that detail side effects, consequences of non-adherence, and what to do in the case of a skipped dose. For some patients, adherence can be improved by strategies as simple as suggesting or providing a weekly pillbox, or ensuring that they know how to take the medicine correctly.

Interpersonal & Communication Skills

- **Tailor communication to disease state.** Each disease presents unique barriers to adherence. Physicians should tailor their communication style and suggestions to the patient's condition. In doing so, they should attempt to create a causal direct link between adherence and positive clinical outcomes, and explain the negative clinical outcomes that may occur as a result of non-adherence. For example, a doctor might stress to a hypertensive patient that taking her medications will lower her blood pressure and that stopping her pill regimen will raise her risk of heart attack and stroke.
- **Develop scripts.** Conversations about adherence can be awkward, especially when discussing topics such as ability to pay and belief in the recommended clinical therapy. Role-playing or pre-written scripts to direct the flow of the conversation can assist the physician and health care provider as they address these topics in a respectful manner so the patient will feel comfortable discussing them candidly. Scripts can be developed not only for initial visits, but also for follow-up appointments to assess adherence and explore the possibility of non-adherence as a reason for non-response to therapy.

Non-adherent patients often worry that their doctor will judge them, or that they are letting their physician down. By showing that he or she recognizes and

empathizes with the difficulty of adherence, the physician can reassure the patient and, in doing so, encourage more open communication.

- **Address communication between specialists.** Lack of communication within the healthcare system contributes to non-adherence. Communication is especially problematic when the patient sees more than one doctor; specialists may not know which medications the primary care physician has prescribed, and vice versa, even when electronic health records are used. Consequently, the responsibility of transmitting information from one health care professional to another often lies with the patient, who may not understand or remember important information about diagnoses, prescriptions, or dosage. In the long run, patients may end up with an extensive set of instructions that are confusing or may even conflict with each other.

Professionalism

- **Evaluate patients' commitment to therapy.** Cultural barriers, health literacy and economic status impact patients' belief in treatment. Therapy for chronic disease requires patients to accept their illness and their role in treatment. For many patients, the options are confusing due to cultural barriers and low health literacy. Physicians need to provide therapeutic options sensitive to any cultural values.

Systems-based practice

- **Develop a concrete adherence plan.** In most office settings, the responsibility for adherence is not a designated duty in any person's job description. Therefore, it is crucial for offices to develop a definite, evidence-based strategy for adherence that clearly delegates responsibility for each facet of the plan. Many steps to improve adherence can be carried out by health care professionals other than physicians, such as nurses, physician assistants, or other support staff. However, it is essential that the physician – as head of the

healthcare team and the primary source of patient counsel – have an active interest in the adherence plan and be fully committed to its successful execution.

- **Take action at the time of prescription.** Studies show that 20% of prescriptions are never initially filled; even when patient adherence is assessed at a follow-up visit, by then it is often too late. Physicians should assess patients' ability and intent to adhere at the time the prescription is written. Methods can include assessing their health literacy or asking patients about their ability to pay, their belief in the efficacy of the therapy, and any foreseeable problems that might make adherence difficult.
- **Use available information and communication systems.** Resources such as electronic medical records can be an invaluable source of information that can help determine and improve patient adherence. Physicians who are fortunate enough to have access to these resources should make full use of them. For example, physicians in a health care system that includes a pharmacy can utilize available records to determine when patients last filled their prescription.
- **Identify adherence champions.** Among the various stakeholders in the medical sphere, no one person is specifically responsible for adherence (with occasional exceptions; case managers and diabetes educators, for example). In addition, in a payer-based system there is no direct compensation for time and energy spent on improving patient adherence, which discourages adherence-improving actions and interventions. Luckily this is changing as outcomes-focused 'pay for performance' systems become more prevalent.

Core Curriculum for Patient Adherence

The core curriculum for patient adherence crosses the fabric of all disease conditions but most importantly the chronic and co-morbid conditions experienced by many patients on a daily basis. Adherence to recommended medical and lifestyle therapies is critical to improvement in patient quality of life and longevity with a minimum of side effects or sequela from these conditions.

The core curriculum is focused on the coordination of physician and healthcare team knowledge and behavior that in turn fosters new knowledge, skills and behaviors in patients. The overall outcome is improved patient ability to manage their disease and maintain their quality of life. The following outline describes implementation approaches that develop core skills and behaviors delivered through continuing education and performance improvement initiatives focused on improved patient outcomes.

Patient Adherence Core Curriculum

Professional Practice Gap	Educational Objective	Educational Strategy	Educational Content
Lack of knowledge and appreciation of provider and systems factors that can impact adherences	Identify and describe barriers to effective patient adherence	Develop a mechanism that identifies common provider and systems barriers to promoting patient adherence. Develop a tutorial or case that identifies provider and systems strategies that demonstrate effective management of provider and systems barriers to patient adherence.	Epidemiological and systems data about barriers to patient adherence. Qualitative data about provider behavior that can positively or negatively impact adherence.
Lack of assessment in patient health literacy and acceptance of disease condition	Describe approaches to assessment of health literacy. Apply strategies to address health literacy about disease condition.	Create scripts or motivational interviewing outlines for assessing health literacy for physicians AND healthcare team. Create templates for therapy plans.	Critical elements for assessing health literacy in patients. Identify cross-cultural issues in health literacy. Tools to assess and measure health literacy. Create therapy plans for disease condition.
Lack of physician/provider accountability in adherence Adherence is considered a patient problem	Link provider and systems strengths and weaknesses to patient knowledge, application and persistence in adhering to recommended therapy. Identify the importance of provider and patient commitment to adherence as a critical component of care.	Create cases that model effective integration of patient adherence strategies by providers/systems to support and educate patients. Self Assessment of importance of patient adherence in effective delivery of care. Develop script/motivational interviewing strategies that	Critical components of patient adherence to therapy to desired patient outcomes. Presence of bias as a patient problem. Provider responsibilities to promote adherence. Patient responsibilities to

Professional Practice Gap	Educational Objective	Educational Strategy	Educational Content
		<p>identify strengths and weaknesses in adherence approaches. Create templates for therapy plans.</p>	<p>promote adherence. Therapy plans as communication and adherence strategy for management of disease condition</p>
<p>Need to identify adherence as a factor related to non-effective treatment</p>	<p>Identify that adherence issues/barriers could be a primary factor in non-effective treatment of disease</p>	<p>Relate pathophysiology of disease condition and recommended therapy to patient outcomes. Create scripts/tools for assessment and monitoring of adherence. Create monitoring system for adherence. Integrate non-adherence as reason for therapy failure into case based curriculum.</p>	<p>Evidence linking disease condition, medical therapy and patient outcomes. Common barriers to adherence by disease state. Communication strategies for communicating link between effective disease management and adherence. List of systems monitoring tools/approaches for adherence.</p>
<p>Need to differentiate the three elements of patient adherence-taking, timing and persistence</p>	<p>Identify the three different aspects of adherence and apply appropriate interventions to address each of these aspects of adherence</p>	<p>Create cases or video vignettes that highlight each aspect of patient adherence and then incorporate these elements into case management approaches. Create chart documentation for physician and healthcare team to document discrepancies in each aspect of patient adherence. Implementation of therapy plans as strategy for identification and monitoring of</p>	<p>Characteristics of each aspect of patient adherence- taking, timing, and persistence. Interventions to maximize patient understanding and commitment to recommended therapy. Communication strategies for fostering mutual commitment to recommended therapy. Use of therapy plan as an assessment and monitoring tool in patient management.</p>

Professional Practice Gap	Educational Objective	Educational Strategy	Educational Content
		adherence	
Need to relate patient adherence to patient safety	Relate inconsistencies in patient adherence to overall patient safety	Self assessment tool for providers that links patient safety to patient adherence. Create case scenarios that incorporate patient safety issues affected by non-adherence	Pros and cons of recommended therapies. Implications for patient safety – taking, timing, persistence. Communication strategies to patients/families about relationship of adherence to patient safety.
Need to identify differences in adherence based on disease condition	Identify the major barriers/issues to adherence by disease condition	Tutorial on patterns of adherence by disease condition. Case studies that reflect common issues in adherence by disease condition and effective management strategies. Tools to link patient health literacy, about disease to adherence	Common challenges to adherence by disease condition. Effective strategies for addressing adherence by disease condition. Effective strategies for monitoring adherence over time
Need to relate adherence to overall long term relationship with patient/family	Identify the role of trust and communication to successes and challenges in adherence	Create video vignettes that highlight effective and ineffective examples of mutual trust and long term relationships on adherence. Case scenario questions that reflect the impact of communication and long term relationships on adherence.	Effective communication strategies that foster a long term and mutual trust relationship. Scripts/motivational interviewing strategies for addressing/clarifying adherence and building long term relationships.
Lack of awareness of resources to help facilitate adherence	Identify system, family, community resources to	Convene panel discussions to describe effective resource	Identify system, family and community resources that can

Professional Practice Gap	Educational Objective	Educational Strategy	Educational Content
	support adherence	utilization for adherence. Create lists/web-based resources that can foster adherence for patients and families.	foster adherence—including churches, neighbors, family members, pharmacists, caregivers etc.
Need to measure results of adherence strategies on overall patient outcomes	Identify and measure short and long term effects of communication	Develop performance measures that reflect interventions that link adherence to improved performance and patient outcomes.	List of clinical performance measures that reflect effective approaches linking adherence to effective patient management.

Conclusions

“Medicines don’t work in patients who don’t take them”

- C. Everett Koop, MD

Adherence is not a patient problem, nor a physician problem. The medical assistant cannot solve it, nor can the pharmacist. Each individual can, however, contribute to improving patient adherence as part of a care team rooted in the patient-physician relationship. The literature analysis, meta-analyses, interviews and Change Readiness Inventory support the continuous assessment of a patient’s ability to adhere to prescribed therapy and the ongoing monitoring of a patient’s success in adherence.

Continuing medical education focuses on changing physician behavior. To effectively improve adherence, the system must address the following:

- ***Embed adherence in clinical education.*** Adherence should not be presented as a stand-alone issue. By including adherence as a factor in clinical cases, and learning to consider patient adherence to be an ever-present risk, health care providers can consistently consider non-adherence as a potential cause of treatment failure. CME can provide physicians with successes in adherence improvement followed by tools, techniques, and strategies that can improve and measure their own adherence efforts.
- ***Adherence is a patient safety issue.*** When patients’ adherence suffers, they do not receive the full beneficial effect of the therapy. Patients may combine skipped doses or take them with other medications, compromising medication effectiveness. Furthermore, physicians may not be aware that lack of clinical response is due to

non-adherence and may subsequently up the dose, resulting in additional health risks and side effects.

- ***Adherence issues differ according to disease.*** Each condition, and its treatments, presents specific challenges to adherence. Specialists should be aware of the issues unique to their field as well as available resources to improve adherence. We have seen that the distance of the link between adherence and clinical outcomes can vary; by emphasizing as direct a link as possible, health care professionals can increase motivation and improve adherence.
- ***Communication.*** Long-term relationships between patient and healthcare professional improve patient adherence. In order to foster adherence, a clear, positive, ongoing dialogue between the patient, the doctor, and the health system must exist. While the physician is a critical resource in adherence improvement, other resources in the health care system are more effective providing long-term follow-up. Communication from the care team back to the physician completes the loop.
- ***Accountability.*** Both the results of our interviews and the Change Readiness Inventory indicate that adherence is a serious issue. Nevertheless, physicians often do not take steps to improve adherence because they believe it is not their responsibility. Only when the players in the healthcare system take ownership of the adherence problem will they be able to work together with patients to improve adherence.
- ***Health care providers must have knowledge of and access to local resources to support adherence.*** These resources may include case managers, pharmacists, nurse educators, or adherence tools, all of which have previously demonstrated positive results in improving patient adherence.
- ***Measurable Results.*** The quality improvement movement including PQRI demand that any system change be based in data that is continually evaluated. Some

practices may have access to pharmacy data through EMRs while others keep chart notes. Both techniques provide valuable information on initial fill rates, refill frequency, and medication changes.

- ***Systems barriers need to be addressed.*** Physicians perceive systems variables such as medication costs and formularies as significant barriers to patient adherence. Physicians need to be aware of these issues and be prepared with potential solutions.

The next step is integrating the findings from this study into continuing medical education curriculum to improve patient care.

Everyone in the health care system – from patients and caregivers to health care providers, patient advocates and payors – has a significant role to play in improving prescription medicine adherence. Thus, an agenda that removes barriers and advances education and information sharing is a critical step to improving the health status of all Americans. Clearly the time for action is now.⁸⁷

Appendix 1: Asthma Meta-Analysis Resources

Study	Subjects	Design	Description	Findings
Brown MD, Reeves MJ, et al.	239 adult and pediatric patients visiting an emergency room for problems related to asthma	A randomized controlled trial of an educational intervention with a 6-month follow-up	The intervention was an education program delivered by phone 3-5 days after ED visit vs. standard care. The outcome measures included ED/unscheduled visits, reported compliance with medications.	Hazard Ratio analysis found a non-significant trend toward a positive impact of the intervention. The finding was stronger among children.
Charrois TL, Newman SC et al.	70 high-risk asthma patients identified through the Canadian Health System and community pharmacists	A randomized controlled trial of an educational intervention with a 6-month follow-up	The intervention program was administered by trained community pharmacists. The outcome measures included increased use of ICS and ED visits.	Nonparametric comparisons were found to be non-significant between the two groups. Compliance with protocol was poor among pharmacists.
Chatkin JM, Blanco DC, et al.	271 chronic asthma patients selected by their PCP	A multi-center randomized intervention trial that examined adherence with prescribed medications over a three month period.	The intervention was a phone-based educational intervention (every two weeks) during the three month study. The controls received usual care. The outcome measures were collected during	Comparisons between the two groups found a 47% higher adherence rate among the intervention subjects. This difference was statistically significant.

Study	Subjects	Design	Description	Findings
			the intervention with no long-term follow-up.	
Couturaud F, Proust A, et al.	72 moderate to severe asthmatic patients selected from an outpatient setting	A randomized controlled trial with a run-in period to optimize care prior to educational intervention over a 1 year period.	The intervention consisted of a five-session educational intervention vs. usual care for controls. The major outcome variable was symptom-free days over the study period. A validated measure of adherence to medications was also used.	Patients who fully complied with the instructions of the intervention had significantly more symptom-free days. However, compliance with the plan was very low. Intervention group showed a significant increase in compliance compared with the control group.
Delaronde S, Peruccio DL, and Bauer BJ	399 asthma patients who were identified as non-compliant with medications through an HMO.	A randomized controlled trial that allowed subjects to "opt in" or "opt out" of a telephone intervention for a 1 year study	The intervention consisted of phone call interventions (monthly for six months) vs. usual care. There were several outcome variables including adherence to medications	All groups showed a significant improvement in medication use but the intervention group's improvement was twice that of the control group at 1 year.
Feifer RA, Verbrugge RR, et al.	35,450 asthma patients enrolled in a drug benefit plan	A non-randomized intervention study that matched control patients with intervention patients based on demographic characteristics over a 1	Educational materials were sent to the intervention group and their physicians. The control subjects received usual care. The primary outcome	The intervention group had significantly higher fill rates of controller medications and lower rates of using rescue inhalers over the 1 year study period.

Study	Subjects	Design	Description	Findings
		year period.	variables were prescription records related to asthma medication refills.	
Guest JF, Davie AM, et al.	222 asthma patients managed in primary care	A case-control study comparing patients who had switched from twice/day to once/day ICS (cases) vs. patients who continued on twice/day medications over 1 year.	Patients who switched to once/day medications were compared over a 2 year period (one year prior to switch and one year after). Controls also switched medications but to another twice/day treatment. The outcome variables included prescription refill records.	No significant differences were found between cases and controls with regard to prescription refills over the year after switch.
Hesselink AE, Penninx B, Danielle A, et al	276 asthma and COPD patients recruited from primary care practices. Most subject (approximately 100 in each group) were asthma patients.	A randomized controlled intervention with measures taken at 1 and 2 years.	The intervention group received customized educational interventions focusing on technical skills related to medication adherence and coping with the disease. The control group received usual care. The outcomes included the observation of correct inhaler use and medication adherence.	The intervention group had significantly better technical skills (use of inhaler) than the control group. No differences were found for adherence to medication use.

Study	Subjects	Design	Description	Findings
Janson SL, Fahy JV, et al.	65 adults with mild-moderate asthma.	A randomized controlled intervention trial over 7 weeks.	The intervention group received educational information about asthma and technical training regarding inhaler use. They received the education during 5 visits over 7 weeks. The control subjects attended visits but received no education. The outcomes included computer recordings of inhaler use over 7 weeks.	The intervention group demonstrated significantly better inhaler adherence than the control group over the course of the study.
Kritikos V, Armour CL, and Bosnic-Anticevich SZ	48 asthma patients	A randomized intervention study with three groups: specially trained pharmacists, pharmacist/asthma educator, and usual care. The randomization was accomplished at the level of the pharmacy	The education was delivered in small groups (5-8 pts) by trained pharmacists. There was a single intervention. The control group received usual care. Outcomes were measured at 6 and 12 weeks post intervention. Measures included inhaler use and technique.	Both intervention groups showed significant improvements in technique over 6 and 12 weeks. The intervention groups also were significantly better than the control group. As 6 weeks, the intervention groups showed improved medication adherence over baseline but the improvement was not

Study	Subjects	Design	Description	Findings
				present at 12 weeks.
Mehuys E, Van Bortel L, et al.	201 Asthma patients selected from pharmacies	66 pharmacies participated in randomized controlled intervention over a 6-month period	The intervention consisted of educational visits at baseline and 1 and 3 months. Control patients received usual care. The education focus on control and technical information about inhaler use. The outcomes included prescription refills and validated, self-report adherence to medications.	At 6 months, the intervention group had significantly high medication refill rates than the control group. However, self-reported adherence rates between the two groups was not significant.
Mitchell EA, Didsbury PB, et al	270 general practitioners. Unknown number of pediatric asthma patients (estimated to be 104,501).	Practices were randomly assigned to one of two practice conditions: use of asthma clinical pathway, and usual care. This was a 9 month study	Practitioners in the intervention group were trained to utilize an asthma clinical pathway with pediatric asthma patients. Control physicians provided usual care. The primary outcomes were asthma hospital admissions and emergency department visits.	No statistical differences were found for the major outcome variables between the two groups. However, outcomes in both groups improved over time.
Prabhakaran L, Abisheganaden J. et al	97 patients with hospital admissions for asthma-related emergencies	A single group intervention study conducted over 1 year	An individualized educational intervention was administered to subjects based on	Most outcomes measures significantly improved from baseline.

Study	Subjects	Design	Description	Findings
			baseline information about their condition, knowledge, and adherence. Outcomes included hospital admissions, emergency department visits, inhaler compliance, and knowledge of inhaler technique.	
Put C, and van den Burgh O, et al.	23 mild-moderate asthma patients	A randomized controlled intervention in which control patients were put on a "waiting list" for the intervention. This is a 6 month study with measures at baseline, 3 months, and 6 months.	The intervention consisted of a variety of educational materials (with some instruction) that subjects used on their own. They included some asthma education as well as psychological self-assessments and exercises. The outcome variables included medication adherence, symptoms, and peak flow readings.	Adherence and peak flow readings showed significant improvement in the intervention group but not in the control group.
Rand C, Bilderback A, et al	380 adult asthma patients	This is a multi-center (N=39) double-blind randomized controlled medication study comparing an inhaled therapy with an oral	The medication comparison study used electronic monitors to measure medication adherence over the course of the study.	The oral administration group had less than half the number of non-adherence days than did the inhaler group.

Study	Subjects	Design	Description	Findings
		therapy. The trial switched from blinded after 12 weeks and continued as an open label study for an additional 36 weeks.		
Ronmark, E and Jogi R et al	326 asthmatic patients not currently on inhalers	This is a Phase IV open randomized controlled trial examining patients' ability to correctly use one of three different types of powder inhalers.	Subjects were observed using inhalers at baseline, 2 weeks, and 4 weeks. The outcome variable was the correct use of the inhaler.	All three groups demonstrated significant improvement in the correct use of the inhaler over the 4 week trial. There were no differences among the three inhalers.
Saini B, Filipovska, J et al.	The primary unit of analysis is a pharmacy (n=20) 90 asthma patients were recruited by participating pharmacies	This is a parallel-group controlled intervention study. Pharmacies were recruited to deliver an educational intervention. Control pharmacies were recruited to be a match for the intervention pharmacies. The patients represented a convenience sample recruited by each participating pharmacy. The intervention takes place over a 6 month period with no follow-	The intervention group meets with patients 3-4 times over six months. The pharmacist provides education, monitoring, and a review of past visits. The control pharmacists provide standard care and meet with patients at the beginning and end of the intervention period. The outcomes include an asthma severity scale measure (including adherence to medications) and	The intervention group had better asthma severity scores and lower risk for non-adherence both compared with baseline and with the control group.

Study	Subjects	Design	Description	Findings
		up.	demonstrated proficiency with the prescribed inhaler.	
Schaeffer SD and Tian L	46 adult asthmatics	This is a random controlled intervention trial with a combination of 3 interventions and 1 control condition. The study period is 6 months.	The intervention tools are a motivational audiotape, standard printed educational material, both, or none (control). The outcome measure was pharmacy-verified adherence with preventive medication examined at baseline, 3 months, and 6 months.	All three interventions were found to significantly improve adherence over time and compared with the control group.
Schneider A, Wensing M, et al	96 general practitioners. 256 asthma patients	Physicians were randomly assigned to one of two quality circle methods aimed at improving asthma practice and care. Patients participated by completing a questionnaire describing their care and behavior after 1 year.	There are two interventions and no control group in this study. One quality circle (QC) group was implemented without benchmarks and the other with benchmarks. Both groups implemented QC methods to improve appropriate prescribing and monitoring of asthma in their practices. The outcomes include	Patient self-monitoring measures improved with both intervention groups. The number of emergency visits by patients in both groups was reduced over the course of the 1 year intervention. Most, however, did not reach statistical significance.

Study	Subjects	Design	Description	Findings
			patient survey data regarding their asthma symptoms, control, and medication adherence.	
Teach SJ, Crain EF	488 pediatric asthma patients identified at an ED visit.	A randomized controlled intervention trial with a 6 month follow-up	The intervention is a face-to-face educational intervention shortly after an asthma ED visit. The intervention focused on self-monitoring, management, establishing links with providers, and trigger control. The outcomes included reported use of ICS, unscheduled visits, and limitations. Data were collected at 1, 3, and 6 months.	The intervention group had significantly fewer unscheduled visits throughout the follow-up period. The intervention and control groups showed non-significant differences in inhaler use at 1 and 3 months but had a significantly higher reported use as 6 months.
van Schayck CP, Bijl-Hofland ID, et al	34 patients with asthma	A single group, multiple intervention study of three different types of inhalers: a metered dose inhaler (twice daily), an auto-inhaler (twice daily) and an auto-inhaler (four times a day). Each patient used all three over the course of a 12 week	Patients were placed on three different inhalers sequentially and asked to comment on each. Medication adherence and patient preferences were both outcome measures	Patients significantly preferred the auto-inhaler over the metered dose inhaler. Medication adherence rates were significantly lower when patients were on the auto-inhaler four times a day.

Study	Subjects	Design	Description	Findings
Weinberger M, Murray MD, et al	1,113 asthma and COPD patients recruited through pharmacies	<p>period.</p> <p>This is a 3 group randomized controlled intervention study with 2 interventions and 1 control. This is a 1 year study with assessments at 6 months and 12 months.</p>	<p>The interventions in this study include 1 of 2 monitoring/educational interventions by community pharmacists in which they work with patients to improve health outcomes. In a "full care" intervention, pharmacists are provided with a range of patient data and intervention training. In a "monitoring" intervention, pharmacists are provided with some data but no training. In the control arm, pharmacists are provided with no data and provide usual care. The outcomes include peak flow readings and medication adherence.</p>	<p>At 12 months, the full care group had significantly higher peak flow readings than the usual care group but not higher than the monitoring group. There were no differences found in medication adherence.</p>

Asthma Meta-Analysis References

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Appendix 2: Diabetes Meta-Analysis Resources

Study	Subjects	Design	Description	Findings
Babu AR, Herdegen J, et. al.	25 Type 2 diabetic patients referred for an evaluation of sleep apnea	Single-group intervention study over 30-90 days	A 72-hour continuous glucose monitoring system measured changes in glucose levels and HbA1c before, during and after CPAP treatment for SDB.	Mean postprandial glucose levels were significantly reduced. Compliance with CPAP treatment was correlated with lower hemoglobin A1c levels.
Borges WJ and Ostwald SK	167 adult Type 2 diabetic patients in a Mexican-American community	Experimental randomized three-group design	Subjects were randomized to usual care, a risk assessment, or a 15-minute foot care intervention program. At a one-month follow-up, subjects were asked to demonstrate foot self-care.	A significant increase in foot self-care knowledge was noted in the control group only. Foot self-care behavior was improved in the control group and intervention group. Baseline self-efficacy was positively correlated with foot self-care behavior.
Charpentier G, Fleury F, et. al.	233 poorly-controlled Type 2 diabetic patients aged 35-65	A randomized, open, parallel-group study. The study consisted of a 2-week observation period, followed by a 10-week dose titration period and a 16-week maintenance period.	Patients were randomized into two groups taking glimepiride once a day or glibenclamide 2-3 times daily. Adherence was assessed using a MEMS device. HbA1c	Compliance was generally good, but was better in patients taking once-a-day glimepiride. Compliance with glibenclamide twice a day was better than three times a day.

Study	Subjects	Design	Description	Findings
			and FBG were measured at the start of the titration phase and the end of the maintenance period.	Glycemic control and patient satisfaction were similar in both groups.
Cho JH, Chang SA, et. al.	80 patients with Type 2 diabetes	Prospective, randomized, controlled intervention over 30 months	Subjects in the interventional group used an internet-based glucose monitoring system. They entered their glucose levels and other pertinent information into a website and received feedback and recommendations every two weeks. Patients in both groups visited an outpatient clinic every three months for recommendations and HbA1c tests.	Mean A1C and CFI were lower for patients in the experimental group. The glucose monitoring system improved both glucose control and glucose stability.
Chapin RB, Williams DC, and Adair RF	127 patients with Type 2 diabetes in an inner-city clinic	Randomized controlled trial to test a communication tool to improve diabetes care. Results were tracked over 15 months	Patients were assigned to control and intervention groups based on the first letter of their primary resident's last name. The intervention consisted of a "Take-Home Diabetes Record,"	Both groups reported a decrease in GHb; the decrease in the experimental group was significantly larger than that of the control group.

Study	Subjects	Design	Description	Findings
			a card on which patients could mark when they reached simple goals. The endpoint was change in GHb.	
Clancy DE, Brown SB, et. al.	120 underinsured patients with uncontrolled Type 2 diabetes	Randomized controlled intervention over 6 months	Control group received usual care. Intervention group subjects participated in group visits, led by an internal medicine PCP and a diabetes nurse educator, with 18-19 other patients once a month. Outcome variables included HbA1C, lipid levels, other clinical measures of diabetes control, and Patient Care Assessment Tool score.	Patients in the experimental group exhibited significantly higher levels of trust in their physician and better compliance of process-of-care indicators. HbgA1C levels and diabetes control measurements were improved in the experimental group, but the differences were not statistically significant.
Clancy DE, Huang P, et. al.	186 underinsured patients with uncontrolled Type 2 diabetes	Randomized controlled intervention over 12 months. This study was very similar to Clancy 2003, with the following differences: larger group of participants, multiple providers, and longer duration.	Control group received usual care. Intervention group subjects participated in group visits, led by an internal medicine PCP and a diabetes nurse educator, with 13-16 other patients once a month. Outcomes included clinical measurements –	Patients in the experimental group met significantly more ADA process-of-care indicators and reported higher cancer screening rates. There were no significant differences in medical outcomes such as HbA1C between the two groups.

Study	Subjects	Design	Description	Findings
			such as HbA1C, blood pressure, and lipid profiles – and quality of care measures. Data were collected at baseline, 6 months, and 12 months.	
Clark M, Hampson SE, et. al.	100 Type 2 diabetic patients with a BMI over 25	Randomized controlled intervention lasting 3 months; follow-up measurements were taken at 12 months	Intervention consisted of a personalized self-management program that included initial assessment, goal-setting, and personalized strategies to overcome barriers, using principles of motivational interviewing. Follow-up was conducted by phone and in person. Outcomes included diabetes self-management, dietary habits, physical activity, BMI, cholesterol, and HbA1c.	Both groups showed significantly improved dietary behavior; the intervention group improved significantly more than the control group. Most change occurred between baseline and 3-month assessment, and was maintained at the 12-month assessment. There was no significant change in physical activity or physiological outcomes. Waist circumference increased significantly in the control group and decreased significantly in the interventional group.
Coberley C, Hamar B, et. al.	5640 members from 13 health plans identified	Retrospective, observational	Effect of a telephonic intervention and disease	Members who received calls had a 30.2%

Study	Subjects	Design	Description	Findings
	as non-adherent to A1C and LDL-C testing	cohort study before and after disease management program implementation. There was a 1-year baseline period followed by a 1-year interventional period.	management mailings to encourage testing for A1C and LDL-C. Outcome: adherence, defined as 1 or more tests in a 1-year period.	improvement in A1C testing compared to those who received only mailings. Statistically significant improvements were also found in LDL testing. Testing improvement was greater in patients with a higher disease burden.
Deakin TA, Cade JE, et. al.	314 adults with Type 2 diabetes from 16 general practices	Randomized controlled trial of six weekly group education sessions. Outcomes assessed at baseline, four months, and 14 months.	Intervention was the X-PERT Programme, six 2-hour group sessions of self-management education based on theories of empowerment and discovery learning. Outcomes were assessed at baseline, four months, and 14 months; primary outcome was glycated hemoglobin.	Experimental group showed lower HbA1c, total cholesterol, BMI, and waist circumference. There was no statistically significant difference between the groups in BP, cholesterol or triglycerides. At 14 months, 16% of the experimental patients lowered their diabetic medication, versus 1% of the control group.
Durso SC, Wendel I, et. al.	Seven Type 2 diabetic patients over 60	12-week pilot study using a pre-test, post-test design.	All participants used the automated, telephonic Personal Diabetes Management System, which collected glucose	After the intervention, patients reported greater participation in physical activity. Out of seven participants, three

Study	Subjects	Design	Description	Findings
			levels and provided customized feedback and recommendations for self-care behaviors. Outcomes included physiological measurements and diabetes knowledge and behavior.	had increased diabetes knowledge scores, four had decreased glycosylated hemoglobin, and four had decreased BMI. All patients were satisfied with the system.
Gallegos EC, Ovalle-Berúmen F, and Gomez-Meza MV	45 patients with Type 2 diabetes in urban Mexico	Quasi-experimental, 2-group design lasting 50 weeks. Measurements were taken at baseline and every three months.	Intervention consisted of six 90-minute educational sessions and around twenty 30-90-minute individual counseling sessions providing information about diabetes and self-care strategies such as diet and physical exercise. Clinical measurements were taken as well as self-reported assessment of self-care.	Mean HbA1c values decreased in the experimental group and increased in the control group. Patient agency, adaptation, and barriers were predictors of self-care behavior.
Grant RW, Devita NG, et. al.	232 patients with Type 2 diabetes who had undergone lab testing in the past year and visited the clinic in the past 6 months.	Prospective, randomized, controlled trial of a pharmacist-provided educational and disease management intervention, with	Physicians administered questionnaires to all subjects. They provided education on medication and scheduling to the experimental group and communicated	Self-reported adherence was very high at baseline and neither group showed significant improvement. Among intervention patients, the majority of

Study	Subjects	Design	Description	Findings
		follow-up at 3 months	information on patients' medication discrepancies and adherence barriers to the primary care provider. Outcomes were changes in self-reported adherence and resolution of medication discrepancies.	medication discrepancies were resolved by the end of the three months; the authors believe that most discrepancies were caused by inaccuracies in the medical record.
Gucciardi E, DeMelo M, et. al.	61 Portuguese-speaking Canadian adults with type 2 diabetes	Randomized controlled trial of two culturally appropriate educational interventions	Subjects were randomly assigned to either a diabetes education counseling group (control) or a diabetes education counseling group in conjunction with group education over a three-month period (intervention). Education programs were designed using a Theory of Planned Behavior framework. Outcomes were nutrition adherence and glycemic control.	Subjects' attitudes, subjective norms, intention to adhere, and self-reported nutrition adherence improved in both groups; the interventional cohort showed more improvement than the control group, but the differences were not all statistically significant. HbA1c decreased similarly in both groups.
Guerci B, Drouin P, et. al.	689 patients with Type 2 diabetes poorly controlled with oral medication	Open-label, randomized, prospective controlled study over 24 weeks	Intervention patients received initial training, underwent self-monitoring of blood	Change in HbA1c occurred primarily in the first three months; 57.1% of subjects in the

Study	Subjects	Design	Description	Findings
			glucose by performing at least 6 capillary assays per week. The control group received care as usual; both groups were followed up every 6 weeks. Primary outcome was HbA1c.	intervention group improved their HbA1c levels versus 46.8% in the control group.
Kim CJ and Kang DH	72 adults in Korea with Type 2 diabetes	Randomized trial, with a pre-test/post-test design, of two interventions lasting 12 weeks	Comparison of two interventional programs to promote physical activity based on the Transtheoretical Model and one control group. The control group received a diabetes information sheet. The interventional groups received an individualized prescription for exercise, plus counseling strategies; The first group received strategies in printed booklet form; the second group received the same content in a web-based format with personalized, interactive features. Physical	Both intervention groups showed a significant increase in physical activity. There was no increase in the control group. There was no significant difference between the web-based and the printed material interventions.

Study	Subjects	Design	Description	Findings
			activity was recorded in diaries and with k-cal pedometers.	
Kim HS and Oh JH	36 patients with Type 2 diabetes in urban South Korea	Randomized controlled intervention study over 3 months	Telephonic intervention provided by a nursing PhD student. Patients were called twice a week for the first month and weekly for the remainder of the study. Subjects received a diabetes care booklet and a diet and exercise log, and received individualized dietary recommendations by mail.	Subjects in the adherence group decreased their mean HbA1c levels by 1.2%; subjects in the control group increased levels by 0.6%. The intervention group had showed improved adherence to blood glucose testing and diet.
Kim HS, Kim NC et. al.	33 patients with Type 2 diabetes in urban South Korea	Quasi-experimental, 1-group pre-test/post-test study lasting 12 weeks	HbA1c and adherence were measured pre- and post-intervention. Subjects input their blood glucose levels and medication dosage information into a website. A nurse reviewed the information and sent weekly SMS (text messages) with treatment recommendations.	Subjects lowered their mean HbA1c levels from 8.1 to 7.0. Adherence to physical activity and medication adherence improved by about 1 day/week. There was no significant change in adherence to diet.

Study	Subjects	Design	Description	Findings
Kim SH, Lee SJ et. al.	58 subjects with Type 2 diabetes	Randomized controlled intervention study over 6 months	Intervention consisted of an individualized 16-lesson curriculum covering diet, exercise and lifestyle modification. Patients also participated in an exercise program. After the intervention subjects attended monthly educational sessions until the end of the 6 months. Control group participants received 1 session of dietary counseling.	Physical activity increased significantly and HbA1c and fasting blood glucose decreased significantly for intervention subjects. The interventional group also had significantly decreased carotid mean IMT progression.
Krass I, Armour CL et. al.	56 community pharmacies in Australia serving 289 subjects with Type 2 diabetes	Multi-site interventional repeated-measures study over 6 months	Pharmacies were randomly allocated to the control or intervention group. Intervention pharmacists received a diabetes education manual and attended a 2-day workshop. Intervention patients met with pharmacists five times for support, counseling, and advice and were given a blood glucose meter that	The interventional group exhibited a statistically larger decrease in HbA1c compared to the control group. Both groups showed a reduction in cholesterol and triglycerides. Exercise levels were unchanged. The intervention group also showed improvements in blood pressure and quality of life.

Study	Subjects	Design	Description	Findings
Krass I, Taylor SJ, et. al.	23 community pharmacists multiple sites in Australia delivered interventions to 188 patients with Type 2 diabetes	Parallel-group, multi-site, interventional repeated measures study over 9 months	<p>recorded readings.</p> <p>Intervention group pharmacists met monthly with patients to conduct medication reviews and provide feedback and education. Intervention patients were given a blood glucose monitor and instructed on to use it.</p>	Adherence – assessed by a validated self-report instrument and pharmacy records – increased significantly for the intervention group but not the control group. The mean number of medications prescribed at follow-up decreased for the intervention group but remained unchanged in the control group.
Lee WC, Balu S, et. al.	1156 patients with Type 2 diabetes in a managed care setting. Subjects were identified in an integrated medical and pharmacy claims database and had newly-initiated treatment with an insulin pen device	A 4-year, longitudinal, retrospective, pre-/post-event analysis of patients switching therapy delivery system.	<p>Researchers identified patients who switched from using a vial-and-syringe insulin delivery system to an insulin analogue pen device. Primary outcome was change in adherence measured by a medication possession ratio; data were gathered from pharmacy records. Secondary outcomes were treatment costs and</p>	After the switch to the pen device, patient adherence increased from 62% to 69%. The proportion of patients with adherence rates $\geq 80\%$ rose from 36.1% to 54.6%. Health care costs per patient also decreased significantly.

Study	Subjects	Design	Description	Findings
			hypoglycemic events.	
Maier C, Mustapic D, et. al.	2081 Type 2 diabetes patients taking multiple daily doses of medication	Prospective, randomized, open-label study with two parallel groups, lasting 6 months	Subjects in the interventional group received a pocket-size tablet-dispensing device. Clinical outcome was HbA1c, taken at baseline, 3 months and six months.	HbA1c levels declined in both groups; the intervention group improved significantly more than the control group. Effects were more pronounced in patients who took more medications per day.
Maislos M and Weisman D	Two primary care clinics in semirural Israel, randomly assigned to control and intervention; 82 patients with poorly controlled diabetes	Prospective randomized controlled study lasting 6 months	Interdisciplinary intervention provided by a mobile diabetes care clinic. The program emphasized patient education in improved compliance and changing lifestyle; subjects received dietary counseling, therapy adjustment and education throughout the course of the study.	85% of intervention patients returned for the six-month follow-up, compared to 68% of the control group.
Martinus R, Corban R et. al.	40 newly-diagnosed Type 2 diabetes patients	Study of a dual-group intervention lasting 12 weeks with a 6-month follow-up	Both groups received a physical exercise intervention of two sessions a week at a fitness center; one group also attended short psychological counseling sessions.	Both groups had significant improvement in physiological variables such as body mass and flexibility. Program attendance for the psychological intervention group was

Study	Subjects	Design	Description	Findings
			Outcomes were adherence to and maintenance of exercise behaviors.	83.26%, compared with 65.1% for the exercise-only group; they also had better adherence at the 6-month follow-up.
McCord AD	316 adult patients with Types 1 and 2 diabetes	Retrospective chart review comparing baseline results with results after a 6-month interventional program	Patients received a drug therapy management and education service provided by an interdisciplinary team (pharmacist, nurses, dietician).	Participants experienced clinical improvement; the percentage of subjects with A1c levels < 7% increased from 14.8% to 43.2%. Adherence to self-care behaviors also increased.
Moreland EC, Volkening L et. al.	199 patients with Types 1 and 2 diabetes with hemoglobin A1c > 8%	6-month prospective randomized controlled trial with three study groups	Both intervention groups received a blood glucose monitor and were instructed how to use it. One group also received a glucose monitoring manual. Control group received care as usual.	98% of subjects who received manuals increased their BG monitoring frequency; monitoring increased significantly from baseline, while interventional subjects without manuals increased monitoring frequency only slightly. 61% of the manual group improved their glycemic control, compared to 44% of the other two groups.
Nielsen ABS, Gannik D	874 subjects in Denmark	Cross-sectional	Subjects were	Women only

Study	Subjects	Design	Description	Findings
et. al.	with diabetes, mostly Type 2	subgroup study of a 6-year, cluster-randomized controlled trial	randomized to routine care or structured personal care. Interventional care included quarterly consultations, and individualized goal-setting. The study focused specifically on gender differences between the outcomes of the two groups.	experienced an interventional effect on A1C. Intervention-group women had more consultations and intervention-group men had fewer consultations than their control counterparts. Women in both groups had more adaptive attitudes but lacked support compared with men.
Nyomba BLG, Berard L and Murphy LJ	62 insulin-treated diabetic patients	1-year, single-blinded control-matched longitudinal study	All subjects received a glucometer and were instructed how to use it; one group was given a one-time package of reagent strips and told to purchase more as needed, while the second group received a full supply of strips every month.	Frequency of blood glucose self-monitoring, as measured by the glucometer memory, improved in the experimental group; they also maintained their HbA1c levels on average, while HbA1c increased over time in the control group. Differences were most pronounced during the 4 th -6 th months.
Orr PM, McGinnis MA et. al.	36,327 diabetes patients from 16 health plans with moderate-to-severe risk of complications	Focused 6-month intervention study with no control group	All subjects received ongoing telephonic support from nurses and dietitians. Conversation	Adherence to A1c testing was determined by administrative records. The

Study	Subjects	Design	Description	Findings
			focused on the importance of A1c testing in diabetes management. Subjects also received written materials in the mail.	percentage of members receiving tests increased from 40.9 to 52.9, a 29% relative increase.
Pan F, Chernew ME, Fendrick AM	9179 patients with diabetes	Longitudinal data from a large claims database; each patient was followed for 180 days after the index claim	Researchers compared adherence rates of patients prescribed either a fixed-dose combination therapy or a two-pill regimen. Adherence was determined by medication possession ratio.	Fixed-dose combination users had approximately 13% higher medication possession ratios than individuals prescribed two pills.
Paschali AA, Goodrick GK et. al.	26 obese, sedentary adults with Type 2 diabetes	3 month randomized controlled intervention study	Both groups participated in a home-based walking exercise program and wore an accelerometer. The control group was blinded to the accelerometer data; the experimental group received graphs of their exercise data and counseling based on the feedback. Outcome was adherence to the walking program.	The feedback group had increased physical activity over the three months. The non-feedback group experienced a temporary increase in activity, but reverted to their former activity levels by 3 months. However, these results are not necessarily statistically significant.

Study	Subjects	Design	Description	Findings
Pawaskar MD, Camacho FT et. al.	11,878 Medicaid-enrolled patients with Type 2 diabetes on insulin therapy	Noncurrent, comparative, retrospective data analysis of pair-matched cohorts with 24 months of follow-up	This study compared patients using vial/syringe insulin who switched to pen therapy with those who did not switch; it also compared patients who initiated vial/syringe therapy with patients who initiated pen therapy. Outcomes were adherence and annual health care costs.	Patients using the vial/syringe and pen devices had comparable adherence rates as measured by prescription refills. Patients using pen devices had considerably lower overall healthcare costs.
Polonsky WH, Earles J et. all.	196 patients with Types 1 and 2 diabetes in poor glycemic control	Randomized controlled trial of an interventional program with case management and follow-up over 6 months	The control group received standard care with quarterly educational mailings; the intervention group participated in a Diabetes Outpatient Intensive Treatment (DOIT) program, a 3.5-day group education and skills training experience followed by case management support	The DOIT group experienced a significantly greater drop in A1C than the control group. They also had more frequent blood glucose monitoring and greater attention to diet.
Rachmani R, Slavacheski I	141 patients with Type 2 diabetes, hypertension, and dyslipidemia	2 nd 4-year phase of an 8-year randomized prospective study	Intervention was a patient participation program that included two teaching sessions	Patients in the intervention program initiated an average of one additional

Study	Subjects	Design	Description	Findings
			and an individualized lifestyle modification program.	consultation per year. Incidence of cardiovascular events and stroke were lower for the interventional group; they also had significantly lower BP, cholesterol, and HbA1c.
Ryan EA, Todd KR et. al.	91 Type 2 diabetes patients	Three-group 6-month randomized prospective interventional study, with an additional 6-month follow-up	All subjects attended a 4-day diabetes education program that covered medication, monitoring procedures, diet and exercise. Outcome was diabetes knowledge and self-care practices assessed at 6 and 12 months; group 1 was also assessed at 2 weeks and group 2 was also assessed at 3 months.	Diabetes knowledge increased after the education program and was maintained regardless of when groups were tested. Both frequency of snacks and meals and exercise increased after the program but subsequently fell back to or below previous levels. Compliance to foot examinations increased and HbA1c decreased among all groups.
Sakamaki H, Ikeda S et. al.	613 patients with Type 2 diabetes in Japan	1-group non-blinded pre-test/post-test interventional study lasting 4-6 months	Intervention consisted of patients and health professionals collaborated in evaluating lifestyle and setting attainable goals, then monitoring results	After the intervention subjects significantly improved HbA1c, diet, and knowledge of diabetes, regardless of level of dairy use; BMI and cholesterol were

Study	Subjects	Design	Description	Findings
Soumerai SB, Mah C et. al.	3219 adult patients with diabetes continuously enrolled in a multispecialty medical group	Interrupted retrospective time-series analysis of a policy change. Data were collected for 19 months before the change, 5 months during the change, and 17 months after implementation.	with a diary. Study evaluated whether an HMO's new policy of free blood glucose monitors would increase self-monitoring of blood glucose, increased adherence to medication, and improved glycemic control.	unchanged. There was a small, significant increase in self-monitoring of blood glucose. Initiators of SMBC showed significant improvements in regularity of medication use and reduced HbA1c.
Suppavitiporn S, Chindavijak B et. al.	360 patients over 40 with Type 2 diabetes	Randomized controlled trial with four interventional groups; measurements were performed at 0, 3 and 6 months	This study included four groups, all which received diabetic drug counseling by a pharmacist; one group also received a diabetes booklet, one group received special medication containers and a third group received both booklet and container.	Fasting plasma glucose and HbA1c decreased in all intervention groups; the group with medication containers and booklet showed the most improvement. FPG and HbA1c remained unchanged in the control group.
Thomas PD, Miceli R	347 patients with Type 2 diabetes, hypertension, or both.	Six-month randomized unblinded study	Intervention was the Know Your Health program, designed for patients with low health literacy, integrated culturally sensitive self-management education with communication	Significantly more patients in the interventional group reached their clinical goals. There were no significant differences for changes in A1C levels.

Study	Subjects	Design	Description	Findings
			strategies. Results were measured at baseline, 3 and 6 months.	
Young RJ, Taylor J, et. al.	591 patients with Type 2 diabetes in an inner-city environment in the UK	1-year randomized controlled implementation trial	Control group received care as usual. The experimental group received 1-3 telephone calls every 3 months, depending on their HbA1c levels. Calls incorporated diabetes knowledge, motivational interviewing techniques, adherence and blood glucose control.	HbA1c improved by 0.31% in the intervention group compared with the control group. Improvement was greater for patients whose HbA1c levels were lower to start out with.

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Appendix 3: Change Readiness Inventory

Welcome to the University of Cincinnati Office of CME assessment on patient adherence. This information will be used to develop continuing medical education (CME) in adherence. It will take approximately 7 minutes to complete the questionnaire. Your responses will be strictly confidential and data from this research will be reported only in the aggregate. We will not ask for any information that can personally identify you. Upon completion of your survey, a donation of \$15 will be made to the American Red Cross to support disaster relief in the U.S. Please start with the assessment now by clicking on the Continue button below.

Please select the answer that best describes your specialty:

1. Family Medicine
2. General Internal Medicine
3. Pulmonology
4. Cardiology
5. Endocrinology
6. Other (please specify) _____

Please indicate how many years you have been in practice (since residency).

1. 0-5
2. 6-10
3. 11-15
4. 16-20
5. 20+

Please indicate your gender:

1. Male
2. Female

Please indicate the type of practice you are in:

1. Solo
2. Single specialty
3. Multi-specialty
4. Hospital
5. Other _____

What percent of patients in your practice has 1 or more chronic conditions?

1. <20%
2. 21-40%
3. 41-60%
4. 61-80%
5. 81-100%

In a typical week, what percentage of the patients that you see are not adequately adhering to their prescribed treatment regimen?

1. <20% are non-adherent
2. 21-40% are non-adherent
3. 41-60% are non-adherent
4. 61-80% are non-adherent
5. 81-100% are non-adherent

In a typical week, how many patients do you see in which patient adherence to a prescribed treatment regimen is a significant problem?

1. Less than 10
2. 11-20
3. 21-30
4. 30-40
5. More than 40

When prescribing a new or different treatment regimen for a patient, approximately how much time do you spend explaining the treatment?

	< 2 min.	2 - 3 min.	4 - 5 min.	> 5 min.
For medication therapy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
For non-medication therapy (exercise, diet, etc)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Indicate how often you discuss the following issues with patients who are receiving a new, or different, medication regimen.

	Almost Never	Sometimes	Often	Almost Always
The purpose of the prescription	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Side effects of the medication	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
When and how to take the medication	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Consequences of not taking the medication	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Interactions with other medications	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How and when to refill the prescription	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Rate the degree to which the following factors contribute to patient adherence:

	Of no importance	Minimally important	Moderately important	Very important
Patient age	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patient education	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Finances/insurance coverage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Complication level of treatment regimen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Time spent educating patient about the treatment regimen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Side effects of treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Family and caregiver support	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please rate the level of responsibility for patient adherence of each of the following.

	Not at all responsible	Minimally responsible	Moderately responsible	Very responsible
Patients	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Family/Caregivers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Physician	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nursing and other staff	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pharmacist	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please list any others that you think are responsible for patient adherence:

Please rate the degree to which non-adherence is a problem in managing patients with the following conditions.

	Not a problem	Minor problem	Moderate problem	Serious problem
Upper respiratory infection	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hypertension	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Diabetes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Depression	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Asthma	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Osteoarthritis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hyperlipidemia	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please consider the following statements and indicate your PRESENT ability to perform each item and then below it, your DESIRED level of ability to perform that item.

	Low		ABILITY		High
Your PRESENT ability to identify patient factors that may contribute to non-adherence (cognitive impairment, lack of belief in the treatment, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your DESIRED ability.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your PRESENT ability to identify medication factors that may contribute to non-adherence (complex regimen, side effect, etc.).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your DESIRED ability.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your PRESENT ability to provide simple clear instructions on the regimen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your DESIRED ability.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your PRESENT ability to customize the regimen according to patient wishes and needs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your DESIRED ability.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your PRESENT ability to ensure that patients understand the value and effect of adherence.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your DESIRED ability.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Your PRESENT ability to determine whether a given patient will be able to adhere to directions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your DESIRED ability.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your PRESENT ability to identify poor adherence using questioning, refill dates, blood levels, etc.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your DESIRED ability.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your PRESENT ability to use non-judgmental language to ask questions about adherence.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your DESIRED ability.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your PRESENT ability to engage family and other caregivers when needed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your DESIRED ability.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your PRESENT ability to identify therapies and medications prescribed by other physicians that your patients see.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your DESIRED ability.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your PRESENT ability to enlist ancillary healthcare providers to help patients comply.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your DESIRED ability.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your PRESENT ability to identify sources of free or reduced-cost medications for my patients.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your DESIRED ability.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your PRESENT ability to provide patient literature in language that your patients can understand.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your DESIRED ability.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your PRESENT ability to reinforce desirable behavior and results when appropriate.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your DESIRED ability.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Reflecting on patient adherence, please rate the following statements according to your extent of agreement with each.

	Low		AGREEMENT		High
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Lack of time to communicate effectively with my patients reduces their adherence.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low health literacy of my patients reduces adherence.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Formularies make it difficult to prescribe treatments with which my patients can comply.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The cost of medications is a reason for non-adherence.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
HIPPA regulations restrict my ability to involve other family members and caregivers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The absence of electronic medical records makes it difficult to assess adherence.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am unable to follow-up with patients often enough to increase adherence.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of timely access to patient test results or other medical information makes it difficult to assess adherence.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Conflicting instructions from other healthcare providers reduces adherence.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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