Thinking Outside the Pillbox

A System-wide Approach to Improving Patient Medication Adherence for Chronic Disease

A NEHI Research Brief – August 2009

New England Healthcare Institute

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About the Initiative:

NEHI's project takes a unique, system-wide and multi-stakeholder approach to addressing patient medication adherence, a key issue in the treatment of chronic disease. The goals of the initiative are to first identify and then test strategies that will improve the health of patients with chronic disease and create cost savings.

Introduction

In its 2007 report, "Waste and Inefficiency in the Health Care System – Clinical Care: A Comprehensive Analysis in Support of System-wide Improvements," the New England Healthcare Institute estimated that a full third of the $2.4 trillion spent on health care in the U.S. could be eliminated without reducing the quality of care. The overuse and misuse of medical services and unwarranted practice variation across the country account for much of this waste.

Poor medication adherence – another source of health care inefficiency

Poor medication adherence is increasingly recognized as another significant source of waste in our health care system. Poor adherence often leads to preventable worsening of disease, posing serious and unnecessary health risks, particularly for patients with chronic illnesses. An estimated one third to one half of all patients in the U.S. do not take their medications as prescribed by their doctors.[1] Nonadherence has been shown to result in $100 billion each year in excess hospitalizations alone.[2] NEHI estimates that nonadherence along with suboptimal prescribing, drug administration, and diagnosis could result in as much as $290 billion per year in avoidable medical spending or 13 percent of total health care expenditures.

A problem with many symptoms

Precise definitions of medication adherence vary, but the World Health Organization provides an all-encompassing description of poor adherence: any deviation from the prescribed course of medical treatment. Indicators of poor medication adherence range from a patient's failure to pick up or renew prescriptions, to failure to take prescribed medicine at the prescribed dosage level or at the prescribed interval, to failed persistence and the abandonment of a medication regimen altogether.

Solutions must address many barriers

There are many barriers to medication adherence. Cost, side effects, the challenge of managing multiple prescriptions (polypharmacy), patients' understanding of their disease, forgetfulness, cultural and belief systems, imperfect drug regimens, patients' ability to navigate

the health care system, cognitive impairments, a reduced sense of urgency due to asymptomatic conditions ("I don't feel sick – I don't need the medicine"): all these and more are important barriers to sustained drug adherence.

Adherence and Chronic Disease: Scope of the Problem

Today, more than one half of all Americans live with at least one chronic condition.[3] This percentage is anticipated to rise substantially in coming years as our population ages and health risks such as obesity continue to rise.

Chronic disease and poor adherence are linked

In general, adherence rates are lower among patients with chronic conditions than among those with acute conditions. Likewise, medication persistence – the length of time a patient continues to take a prescribed drug - tends to be very low for those with chronic illness. Studies have shown a significant drop in adherence shortly after a drug is prescribed. Among a large cohort of patients with coronary artery disease, over 25 percent of patients discontinued drug therapy within 6 months.[4] Another study of patients receiving statin drugs found that while adherence was nearly 80 percent within the first three months of treatment, adherence dropped to 56 percent within 6 months and only one in four patients had an adherence level of 80 percent or greater after five years.[5]

Poor adherence leads to poor outcomes

Reaching the improved health outcomes that prescription drugs offer depends on patients following their drug regimens. Patients with chronic disease are particularly vulnerable to poor health outcomes if they do not adhere closely to their medications, with a resultant increase in need for both outpatient medical care and hospitalizations. In a recent study of diabetes and heart disease patients, nonadherent patients had significantly higher mortality rates than adherent patients (12.1 percent versus 6.7 percent) [6] A large observational study of patients with diabetes, hypertension, high cholesterol and congestive heart failure found that for all four conditions, hospitalization rates were significantly higher for patients with low medication adherence.[7] Among diabetes patients, the one-year risk of hospitalization was 13 percent for patients with high adherence and 30 percent for patients with low adherence. Similarly, hypertension patients with high adherence had a 19 percent risk of hospitalization compared to a 28 percent risk for patients with low adherence.

Poor adherence also leads to increased medical costs

This increased risk of hospitalizations due to poor health outcomes translates to significant excess costs. Several studies have found that overall health care costs are much higher for patients with poor adherence. For example, among diabetes patients, those with high levels of adherence had total annual health care costs of $8,886 while patients with low levels of adherence had almost twice the total annual health care costs totaling $16,498.[8]

The system-wide costs of poor adherence are enormous: In 2001, Ernst and Grizzle estimated the annual cost of "drug-related morbidity" in the ambulatory care setting to be

$177 billion, an estimate that encompassed poor adherence, as well as suboptimal prescribing, drug administration, and diagnosis. NEHI has updated this estimate, adjusting the average costs and number of medical events to reflect more current data. NEHI now estimates that the current cost of drug-related morbidity, including poor adherence, to be as much as $290 billion annually. A detailed explanation of NEHI's analysis is available in Appendix I. To put this in context: for a typical mid-sized employer with $10 million in claims, poor adherence may generate avoidable health care spending of about $1 million.

The relevance of adherence policy to U.S. health care reform

Since 75 percent of U.S. health care spending now goes to the treatment of chronic disease, poor adherence should be seen as a serious roadblock to improved efficiency in the health care system, as well as a threat to public health.[9] The debate in Washington over national health care reform provides an ideal opportunity for policymakers to assess the evidence for effective adherence promotion and to link appropriate strategies to the larger goals of health care reform. Several of the major objectives of health care reform are directly relevant to adherence promotion, including payment reform (especially a transition to outcomes-based payments), widespread adoption of health care information technologies, primary care reform and care coordination.

Adherence Initiatives: The Landscape

New initiatives to promote medication adherence have increased as chronic disease management has become a national priority. Improved adherence is a goal of the 2003 Medicare Modernization Act that created the Medicare Part D drug benefit. The legislation promotes creation of Medication Therapy Management services that utilize professional pharmacists to counsel targeted Medicare beneficiaries on their prescription use. Adherence is also an implicit goal of well-known initiatives in chronic care such as the Asheville Project and the Ten-City Challenge of the American Pharmacists Association Foundation (both for diabetes management), and the Medicare disease management pilot program.

Much of the innovation in adherence efforts is not yet scientifically controlled

Some initiatives such as the Medicare demonstration projects have been designed as randomized controlled trials, but a great many of the adherence initiatives now underway in the field are not designed as trials. They are designed primarily to demonstrate the capabilities of specific health care providers in promoting adherence or to demonstrate the utilization of new tools and technologies. For example, the pharmacy profession and the pharmacy industry have developed new tools (such as patient assessment tools) and new initiatives that expand the role of pharmacists and pharmacies in improving adherence. The movement among many corporations towards proactive patient/consumer health management and the use of value-based insurance design (VBID) is demonstrating the use of financial incentives to promote healthier behaviors, including medication adherence. The new generation of Internet, health information technology and communications

technologies have inspired a host of new inventions and entrepreneurial start-ups designed to provide medication adherence prompts and monitoring capability to patients and caregivers.

Research Findings

Literature Review: Findings from Controlled Trials

An examination of findings from randomized, controlled trials provides some suggestive evidence on broad categories of interventions that have proven effective in improving adherence. NEHI derived findings from seven previously performed reviews and a total 40 peer-reviewed studies relevant to adherence among the chronically ill. Appendix II includes a list of the reviews we identified.

Simplified drug regimens
Modifying a patient's drug regimen to reduce the number of pills a patient is required to take at each dose is one way to address adherence. One study found that among hypertension patients, those who took once-daily therapy had 11 percent better adherence (as defined by the percentage of correct doses) than those who took twice-daily therapy.[10] Similar improvements were seen among patients with high cholesterol. Patients prescribed to take their medication twice daily had 10 percent better adherence (as measured by pill counts) than patients with a four times daily dosing schedule.[11]

Patient education
Providing patients with appropriate education has been shown to improve adherence. Education materials generally attempt to provide patients with information about their disease, useful background information on their medications and how they work, and the importance of adherence. Materials may come in the form of educational sessions, videos or written material. One study found that among elderly patients with three or more medications, visits by a pharmacist to provide education improved adherence by nearly 12 percent (adherence defined as the percentage of correct doses).[12] Another study found that providing depression patients with multiple forms of educational materials improved pharmacy refills (a proxy for adherence) by 25 percent.[13]

Case management
While case management comes in many forms, some approaches have been successful in improving medication adherence. Key elements of case management may include instructing patients on how to recognize symptoms and side effects, regular phone calls to monitor and prompt adherence, and regular reviews of clinical reports to check on outcomes and to spot adherence failures. For example, among diabetes patients, those who received bi-weekly automated assessment calls and self-care training by a nurse had 21 percent better adherence (as measured by self report of missed doses) than those patients who received usual care.[14]

Discharge counseling
Patients who receive counseling immediately preceding and/or following a discharge from the hospital are more apt to adhere. Interventions often include in-hospital discharge counseling by a pharmacist or nurse, as well as post-discharge home visits to provide pharmaceutical counseling. One study found that among elderly patients with more than three medications, adherence improved by 43 percent (as defined by self-report of "never missing a dose") among patients who received pharmacist counseling before and after hospital discharge, compared to patients who did not receive the intervention. [15]

Pharmaceutical counseling
Another successful intervention to improve adherence is counseling by community pharmacists. The details of the counseling may vary but likely include a review of the medication list, assessment of patient knowledge about their condition and medications, education on adherence strategies, and suggestions for lifestyle changes to decrease symptoms. One study of patients with heart failure found that among patients who received monthly pharmacist counseling, non-adherence (defined as percentage of missed daily doses) was less than half of that observed among the usual care patients.[16] Similarly, another study of patients with heart failure found that pharmaceutical counseling combined with dose simplification increased adherence by 46 percent ('adherent' defined as medication possession ratios between 80 and 120 percent).[17]

Limitations of the Literature Review
Findings from the literature come with important qualifications and limitations. Very few of the conducted studies are of high methodological quality. Even within the peer reviewed literature, sample sizes tend to be small and follow-up periods are short. Measurements of adherence vary across studies and the focus of studies is often very narrow – focusing on one disease among a specific population. Interventions often include multiple components, making it difficult to determine the exact impact of individual elements of the intervention. Studies examining similar interventions often found conflicting results, making it difficult to draw conclusions about the impact of specific or discrete interventions.

Findings from Expert Interviews: Three Pillars of Improved Adherence

NEHI and analysts from Avalere Health interviewed and examined a total of 34 adherence programs and experts in the field. The interviews provided insights into current initiatives that serve as 'living laboratories' for new adherence practices. A full list of interviews is available in Appendix III.

Findings from the interviews suggest three pillars of improved adherence (see Figure 1). It is important to note that while presented in the following order, these three pillars do not necessarily need to be addressed in this order. Additionally, the relationship between these pillars is not necessarily linear either and for many patients it is important to address and re-address these pillars several times along their care and regimen continuum.

Designing the right medication regimen for the individual patient

The design of a medically appropriate drug regimen for each individual patient is a crucial factor in sustained medication adherence. Medication appropriateness should be considered in the context of all other prescriptions and medical orders to which the patient is subject – not always an easy task when patients have multiple prescriptions written by multiple prescribers. Some experts interviewed by NEHI claim that prescribers could reduce non-adherence to only 10-15 percent simply by getting the correct drug regimen in place.

Reducing drug cost barriers

Out-of-pocket drug costs exert a powerful influence on adherence that is largely independent of other behavior-related factors. The impact of out-of-pocket drug costs has likely increased in recent months. Recent survey data from the Kaiser Family Foundation and the National Business Group on Health suggest that poor adherence has increased since the recession in 2008.[18,19]

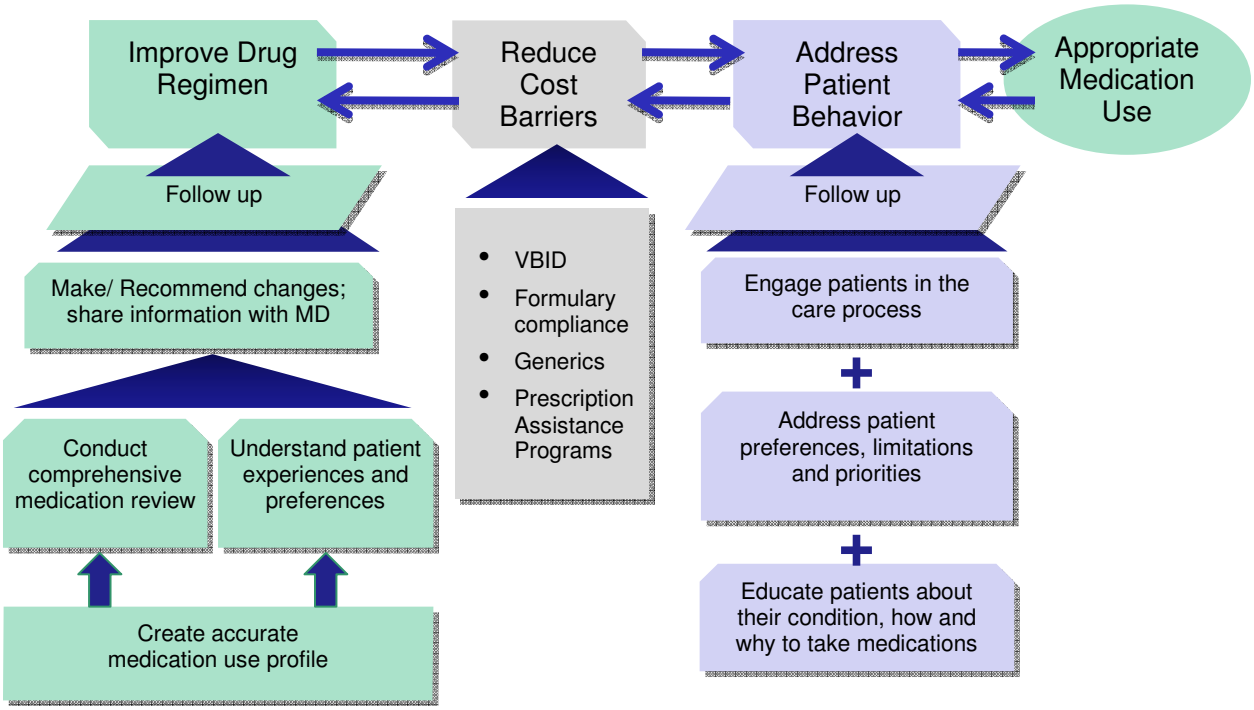
Economists confirm a strong price elasticity of demand between drug costs and adherence (higher costs lead to lower adherence). Many corporations are now seeking to improve adherence and reduce unnecessary medical spending by employing value-based insurance design (VBID) plans that lower employee contributions and out-of-pocket costs for cost effective medications for chronic disease. Experts suggest that lowering medication co-payments for specific chronic conditions can be linked to improved medication possession ratios.

Addressing the behaviors and preferences of individual patients

Experts stress that patients not only vary across a continuum of knowledge (their health literacy, their understanding of their disease and so on), they vary across a continuum of willingness and ability to adhere as well. This variability among patients also extends to patients' proclivity to persist in adherence over time – thus a successful adherence strategy must provide continuity of care and follow-up. The odds that an adherence strategy will be successful are related to how well the strategy can first identify the varying needs of individual patients, and then match services accordingly. An ideal adherence strategy should be patient-centered and holistic taking into account everything from lifestyle to cultural and belief systems.

As a result, promising adherence strategies are invariably multi-component strategies. They do not rely on single 'silver bullet' interventions but typically involve a suite of interventions or services. For example, in many of the programs studied by NEHI, interventions involve one-on-one patient interviews with health care professionals, patient education and follow-up reminder systems.

Figure 1. Three Pillars of Improved Adherence



Source: Avalere Health, NEHI Analysis

Design Principles for Adherence Interventions

Findings from the expert interviews suggest a number of key design principles for medication adherence interventions.

Patient-centered
Adherence interventions should utilize direct contacts with the patient (face-to-face, through telephone or other contact) and should tailor the overall intervention to meet the patient's preferences and address the patient's readiness to adhere to and persist with prescribed medication.

A holistic view of the patient
Adherence interventions should be built around an understanding of the patient's overall medical condition, particularly reconciliation with the patient's full set of prescription drug orders.

Multiple components
Successful interventions should pull together and integrate a complete set of tools and incentives that achieve an optimal drug regimen, overcome cost barriers and address behavior factors unique to each patient.

Physician support and engagement
While interventions may rely on services delivered outside the physician practice (such as pharmacy-based counseling or medication reconciliation), interventions should engage directly with the prescribing physician. Interventions should support the physician with accurate and complete information on the patient and, with appropriate privacy safeguards, gain access to patient data from the doctor that may prove important to the overall intervention.

Continuity of care and follow-up
Follow-up care is crucial if interventions are to overcome the propensity of many patients to drop treatment (failure to persist). Interventions should support patients as they undergo transitions, such as hospital discharges, that may disrupt adherence or reduce the patient's sense of urgency to adhere.

Data and data infrastructure
Few of the design principles outlined here can succeed without making timely and complete data available to patients, physicians and other providers when they need it. Data on patients and on relevant medications must be available at the point of prescription and at every point of patient follow-up. Lack of complete and timely data will hinder the ability of health care providers to identify and track non-adherent patients.

Targeting and stratifying key populations
An ideal, system-wide approach to medication adherence would entail "mass customization" of adherence interventions. Infrastructure would be put in place to serve great numbers of chronically ill or at-risk patients in highly individualized ways. As a practical matter, promising adherence interventions rely heavily on targeting that identifies those patient populations most at risk and most likely to avoid serious illness through improved adherence. Promising interventions also stratify target populations in order to match an appropriate mix of services, from "low-touch" services to "high-touch" services," and thus achieve the highest level of cost effectiveness.

Levers to Improve Adherence: Choices for Policymakers

In the course of our research NEHI identified broad categories of actions that can improve patient adherence, categories we refer to as "levers" to improve adherence. None represent a single, discrete intervention; they must be used in some combination with each other. However, each one represents a fairly discrete investment decision for decisionmakers such as health plans, employers and government agencies. The key decision for policymakers is on which levers to focus, how to weigh the utilization of one lever against others and how the introduction of each should be sequenced within an overall strategy for adherence. NEHI presented these levers to a multi-stakeholder expert panel and audience and asked them to vote on the levers that they would invest in to see the greatest improvement in adherence. Four levers rose to the top: appropriate care teams, patient engagement and education, payment reform and health information

technology. While the remaining six levers received only a small portion of the vote, they are still important and viable options to consider.

Most Promising Levers as Identified by Expert Roundtable

Use of health professionals: assembling appropriate care teams
The adherence process begins with the individual patient and with the prescribing physician. Research and expert interviews underscored the limitations faced by physicians today in promoting adherence, including too-brief encounters with patients, inadequate information on which to act, and limited reimbursement for "cognitive services" like counseling.

As a result, adherence initiatives point in two directions; 1) they provide further support to physicians through physician extenders; or 2) they provide new support outside the physician practice to fill the void in promoting and managing patient medication adherence. Pharmacists and pharmacy researchers have been especially active in the last decade in developing new tools and techniques for meeting the adherence challenge. For example, Medication Therapy Management (MTM) strategies have been largely developed by the pharmacy profession.

Whether an initiative involves providing support to physicians within the phyisician's office or outside the office, such efforts will involve the establishment of some form of care team. There is certainly room for team members from within the traditional physician practice as well as outside.

Programs are using many variants of care teams, but the most fundamental variables relative to care teams are the locus of care and how the care is delivered.

Care teams may be centered:

> Within the physician or medical practice, as exemplified by the patient medical home.
>
> Outside the physician or medical practice, as exemplified by interventions led by pharmacists or pharmacies, such as the Asheville Project, in which pharmacists play a leading role in monitoring and counseling diabetics. Other interventions outside the phyisican or medical practice include those led by third parties, such as health coaching or disease management services led by nurses and other care managers, which may be retained directly by employers or health care payers.

And care team services may be delivered:

- On a face-to-face basis.
- Through telephone-based alternatives, such as call center-based services (utilizing nurses, pharmacists or other professionals), automated voice responses, and/or Web-based services.

The profusion of care team models raises important issues for policymakers. For example, if physician office care teams prove effective, how will physicians make the investments necessary to create care teams? If care teams outside the physician office are effective, then how will the efforts of these teams coordinate with physicians and other clinicians? Finally, experts have noted that providers at all levels are not sufficiently trained to address adherence issues. Thus, how will the care teams of the future be trained to most effectively improve medication adherence?

Some answers to these questions lie in how care teams will utilize tools, incentives and enabling technologies that undergird promising adherence strategies.

Patient Engagement and Education

Experts distinguish between patient "activation," which refers primarily to assessment of the patient, and patient engagement and education, which motivates the patient over time to sustain adherence. Many experts emphasize the importance of ensuring that the patient understands his or her disease, the role and function of their medication, and the importance of good adherence. These interactions should take into account the patient's level of health literacy, as well as language and cultural factors.

Much of the current work that applies patient engagement and education tools to adherence comes out of the pharmacy sector. A leading example is applied motivational interviewing (MI). Experts describe MI as "directive, patient-centered counseling designed to motivate patients for change by helping them recognize and resolve the discrepancy between their behavior, personal goals and values."[20] A recent study found that patients who underwent MI maintained their medication adherence levels over time, compared to a significant decline in adherence among patients who received usual care.[21]

Payment Reform/Pay-for-Performance or Outcomes

Improved adherence is directly relevant to the growing health policy debate over reform of physician and provider reimbursement. The ongoing debate focuses on realigning current health care reimbursement incentives away from rewarding volume (fee-for-service reimbursements) and towards rewarding good outcomes, of which medication adherence may qualify as either a means toward that end or an endpoint itself. Performance-based or global service reimbursements could also serve the purpose of creating incentives for investments that will facilitate adherence, including investment in new staff, adherence-related tools and enabling technologies such as clinical decision support, electronic prescribing and electronic medical records. Given the emerging role of non-physicians such as pharmacists in adherence promotion, payment reform to promote adherence could be extended to non-physicians as well. Currently, community pharmacists are not reimbursed for patient counseling (beyond limited MTM programs) which leaves these providers with little incentive to provide additional adherence-related services.

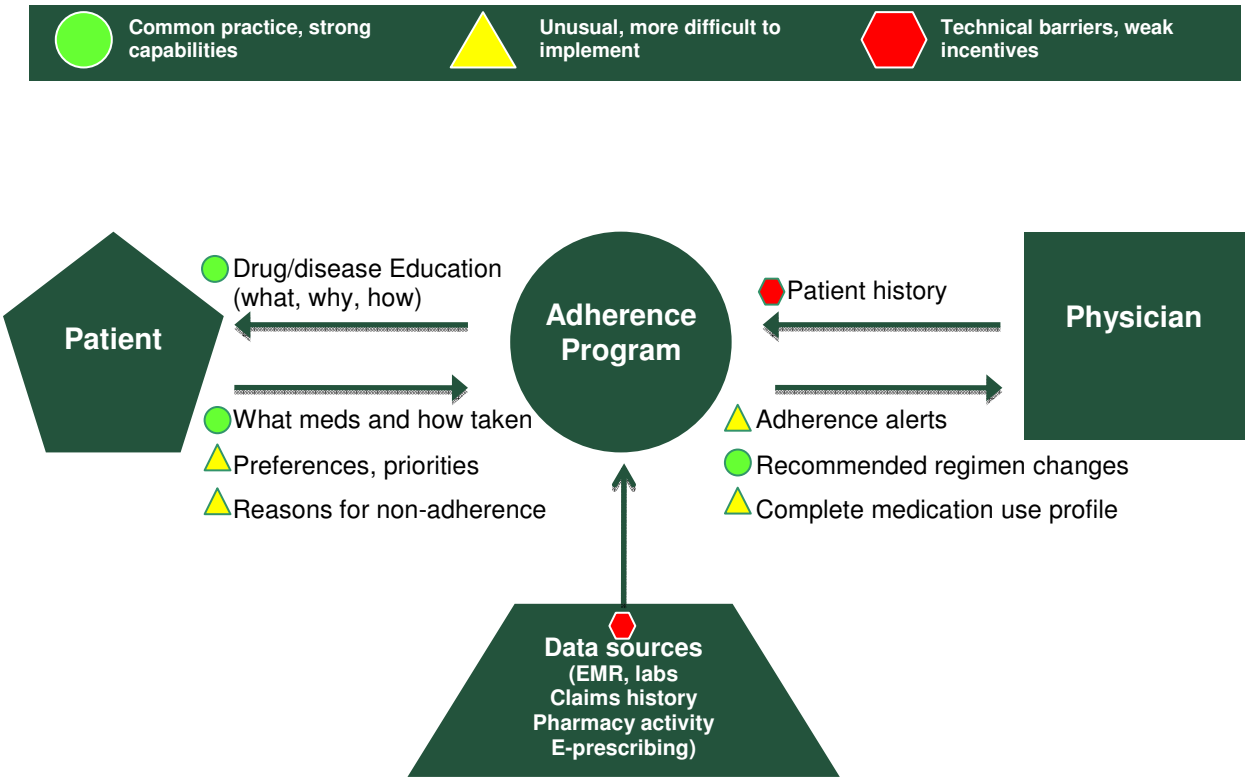
Health Information Technology (Health IT)

Secure, reliable and robust information flows are essential to improved adherence: patients, caregivers, physicians, pharmacists and other professionals need information at the right time and the right place across the medication adherence process. Data is needed to improve physician prescribing decisions and provider follow up, including data on appropriate drug regimens, patient medical and prescribing history, and pharmacy data on medication pick-up and refills. Supporting technologies include electronic health records, e-prescribing and clinical decision support systems.

When used with appropriate security and privacy safeguards, patient data and pertinent pharmacological data is also useful to other stakeholders, including employers and health plans looking to design targeted adherence programs. Accurate and timely data is particularly important as a patient moves throughout the health care system and care is provided by professionals other than the patient's primary care physicians, such as occurs during hospitalizations and/or visits to specialists.

Despite the importance of these data flows, there are significant gaps in how data is currently shared. Figure 2 outlines how adherence-related data moves throughout the health care system, where and between which players data is currently shared as common practice, where data sharing is more difficult to implement and is not as common, and where data flows are inhibited by technical barriers and weak incentives.

Figure 2. Critical Information Flows



Source: Avalere Health, NEHI Analysis

Additional Tools, Incentives and Technologies to Improve Adherence

Medication Reconciliation and Regimen-setting

Some experts believe that a great portion of non-adherence could be corrected if doctors had a comprehensive and accurate medication list of what medications patients are taking and what they should be taking and could tailor a patient's regimen to their preferences and priorities. Given the high number of patients on multiple prescriptions, reconciliation of new drug orders with old orders is essential. While it is not necessarily a new technique, medication reconciliation has assumed new importance as an increasing number of patients are prescribed multiple prescription medicines, often by multiple prescribing physicians. A recent study found that multiple providers increased the risk of an adverse drug event, many of which may be related to poor adherence. Each additional provider prescribing medications increased the odds of such an event by 29 percent.[22]

Doctors are frequently at a disadvantage in reconciling medications, as multiple prescriptions are often prescribed by multiple doctors who may or may not communicate with each other. Yet reconciliation can be as straightforward as asking patients to bring all their medications in a paper bag for the doctor or pharmacist to review. A more systematic approach to medication reconciliation and good regimen design will require use of other levers identified below, including the circulation of timely and accurate data through health information technology and supportive payment policies that allow doctors or other providers – including pharmacists – to review patient medication regimens. Medication Therapy Management (MTM) programs have focused on this aspect of adherence improvement, but have important limitations. MTM programs are only for Medicare and Medicaid patients with very complex regimens, provide counseling only once a year, and follow-up is not required.

Patient Assessment

Adherence experts emphasize that understanding the needs, preferences and medication history of the individual patient is critical to improving adherence. Patient assessment begins with understanding a patient's existing and complete prescription history so that a patient's overall prescription regimen can be reviewed and optimized.

Patient assessment techniques extend to issues of patient behavior and patient preferences. An increasing number of psychometric tools and surveys allow health care teams to predict a patient's likely adherence patterns or assess the patient's readiness to change adherence behaviors. For example, the "Adherence Estimator" developed by Colleen McHorney and others at Merck and Company is a three-item test that measures "intentional non-adherence," specifically medication non-fulfillment and non-persistence.[23] Also, "patient activation" tools have been pioneered by Dr. Judith Hibbard and colleagues at the University of Oregon. "Activation" refers to the patient's ability and willingness to take on the role of

managing their health and health care.[24] The Patient Activation Measure (PAM) determines a patient's knowledge, skill and confidence in managing their health. Research has shown that a patient's level of activation correlates with adherence. As such, some providers are now administering the PAM, both online and in the physician's office, as a screening tool to identify patients who are likely to be nonadherent. Once providers have this information, they may choose to provide the patient with additional services or refer them to another program. Assessment of the patient's level of "activation" may extend to his or her ability to pay for prescription medicine and hence to the prescriber's ability to make the drug regimen affordable for the patient. For instance, based on a patient's level of "activation" a provider may choose to prescribe a simplified drug regimen, recommend a patient assistance program, start a patient on a generic form of a drug or recommend the use of mail order.

Plan Design/Value-based Insurance Design

Employers in the U.S. are increasingly taking a new approach to managing health care benefit costs by designing health insurance benefit programs that provide employees with incentives to utilize preventive medicine and wellness services. Adherence is an implicit goal of many such programs, and could well become an explicit goal if employers and health care payers gain greater confidence in the effectiveness of adherence interventions. Value-based insurance design (VBID) programs reduce employee cost sharing for high value services that prevent or encourage good management of chronic diseases. Accordingly, many employers are offering to reduce employees' costs for highly effective medications for specific chronic conditions such as diabetes and asthma.

Other Employer-sponsored Incentives

Adoption of VBID plans is one manifestation of a larger movement among employers and health care payers to utilize direct financial incentives to promote preventive medicine and healthier lifestyles. Current practices include differential premium contribution levels for employees who participate in wellness activities or maintain good behaviors, and one-time or annual rewards for specific activities (many employers offer rewards for employees who self-administer a Health Risk Assessment). Other incentives are designed to reward adherence among employees/patients enrolled in specific disease management programs, or to provide employees with enhanced benefits in exchange for participation in activities, such as health coaching, that promote adherence and other health goals.

Redirecting Manufacturer Rebates

Pharmaceutical manufacturers engage in direct negotiations with purchasers (health plans, pharmacy benefit managers, some employers) to provide access to specific drugs for specific tiers on a drug formulary. Interest is growing among some manufacturers in securing placement of drugs on health plan formularies and linking discounts and rebates for the drugs to improved adherence among patients. From the manufacturer's standpoint the cost of discounts and rebates will be offset

by increased revenues resulting from improved adherence. For example, Merck and Cigna recently announced a new deal under which Merck will provide discounts on its diabetes drugs to Cigna if the health insurer's diabetic members adhere to their diabetes medications. This approach is a 'lever of levers' in that it could provide financing for direct adherence initiatives deployed downstream, among patients, physicians, pharmacists and others.

Another way to redirect manufacturer rebates is to provide rebates/other financial incentives directly to the patient. These financial incentives could come in the form of reduced health insurance premiums or co-payments for patients adherence closely to their medications.

Technologies for Reminders and Monitoring

Technologies to facilitate adherence have greatly increased in recent years, enabled in part by Internet, cellular telephone and automated voice advances. The new technologies create new capabilities to remind patients to take medications at prescribed times and to monitor adherence from remote locations. Examples include customizable messaging systems that contact patients by phone, email or text message, electronic pill bottles and caps, electronic medication dispensers and boxes, mobile phone applications, and in-home monitoring devices. Many of these technologies also have the capability to transmit data back to the provider's office and/or pharmacy as well as to place prescription refill requests. Some technology vendors are linking products to call centers that provide patients with immediate access to health care professionals.

Conclusion

Patient medication adherence is a complex problem for which no simple and over-arching solutions have yet appeared. Promising approaches have emerged in peer-reviewed literature and in targeted initiatives and programs that appear in different areas within the health care system. But questions remain as to whether even the most promising approaches can be scaled-up to a point where major advances in adherence can occur throughout the system.

A fundamental question is whether poor adherence can and should be addressed as a stand-alone issue, or whether it is best addressed more indirectly by intensifying effort on other health policy reforms and calibrating those reforms so as to promote adherence. For example, fundamental payment reform that rewards outcomes should have the effect of promoting adherence. A strong nationwide investment in health IT should have the effect of providing patients and clinicians with information they currently lack to devise appropriate drug regimens and provide adequate follow-up. The ongoing movement to improve health care quality by tracking metrics of quality should encompass metrics of adherence.

What is needed now is greater awareness of the adherence crisis, a careful effort to make adherence a goal and a measure of progress for U.S. health care reform, and new effort to generate data on scalable, real-world solutions. NEHI looks forward to educating public and private policymakers on the scope of the adherence crisis, and on sound, data-based findings from tested adherence interventions in the months ahead.

About the New England Healthcare Institute

The New England Healthcare Institute (NEHI) is a nonprofit, health policy institute focused on enabling innovation that will improve health care quality and lower health care costs. Working in partnership with members from across the health care system, NEHI brings an objective, collaborative and fresh voice to health policy. We combine the collective vision of our diverse membership and our independent, evidence-based research to move ideas into action.

Appendix I: Estimated Cost of Poor Adherence

We sought to update the annual cost of drug-related morbidity and mortality using the model developed by Johnson and Bootman in 1995 and updated by Ernst and Grizzle in 2000. As in the 2000 update, we used the same decision-analytic model design and probability data, but changed the estimated average costs and number of medical events to reflect more current data. Whenever possible we used data from the same year, primarily 2007; some data was used from 2004, 2006 and 2008. Because earlier data was used, the total figure may be an underestimate.

The study estimated the likelihood of a patient experiencing one or more drug-related problem (DRP) in the ambulatory care setting and the cost of the subsequent negative outcomes. Specifically, DRPs included untreated indication, improper drug selection, subtherapeutic dosage, failure to receive drugs, overdosage, adverse drug events, drug interactions, and drug use without indication. The study did not delineate poor adherence from other DRPs, so the estimate includes the overall impact of all DRPs. There are five possible negative outcomes in the Johnson and Bootman model that create additional costs to the system (the two that do not are death and no treatment): an additional physician visit, additional treatment, ED visit, hospital admission or LTC admission. We replicated the Johnson and Bootman method for determining the number of events by multiplying the cumulative conditional probabilities for each of the six outcomes by the 2008 number of total physician visits estimated by the CDC, which was 901,954,000. The results of this calculation are listed in the table.

Whenever possible, cost updates came from the same sources used by Ernst and Grizzle. The average cost of a hospital admission, $17,271, was determined by dividing total hospital revenue in 2007 by the total number of admissions in the same year, figures obtained from the American Hospital Association. The average cost of a physician visit, from the Agency for Healthcare Research and Quality (AHRQ), was $155 in 2004, $46 more than in 2000. The average cost of an ED visit, $993, was also obtained from 2006 AHRQ data. Using 2007 Kaiser Family Foundation data to divide total reported sales by the total number of prescriptions sold, the average prescription cost was updated from $42 to approximately $58. Finally, the average cost of a long-term care admission was updated using 2008 data from the U.S. Department of Health and Human Services. The average daily expenditures on nursing homes and assisted living facilities were averaged and multiplied by the average length of stay, producing a figure of $13,761, which is $4,272 more than the 2000 reported figure.

The updated cost estimate, approximately $289 billion, was obtained by multiplying the number of events for each possible outcome by each respective cost estimate. This is a rough estimate of the increase in costs between 2000 and 2008, and is intended to be used as such.

Summary of Cost of Illness for Drug-Related Morbidity and Mortality				
	No. of Events (millions)	**Cost per Event**	**Total Cost (billions)**	**% Increase Since 2000**
Total Physician Visits	156.9	$155	$24.2	57%
Total Hospital Admissions	11.5	$17,271	$197.8	61%
Total ED Visits	23.5	$993	$23.3	24%
Total LTC Facility Admissions	4.3	$13,761	$58.8	56%
Total Additional Prescriptions	100.3	$58,49	$5.9	60%
Total Deaths	1.1	--	--	--
Total	**--**	**--**	**$289.0**	**161%**

Appendix II: Review Articles

Haynes RB, Ackloo E, Sahota N, McDonald HP, Yao X. Interventions for enhancing medication adherence. Cochrane Database of Systematic Reviews 2008(2).

Higgins N, Regan C. A systematic review of the effectiveness of interventions to help older people adhere to medication regimes. Age Ageing 2004 May;33(3):224-9.

Kripalani S, Yao X, Haynes RB. Interventions to enhance medication adherence in chronic medical conditions: a systematic review. Arch Intern Med 2007 Mar 26;167(6):540-50.

Krueger KP, Berger BA, Felkey B. Medication adherence and persistence: a comprehensive review. Adv Ther 2005 Jul-Aug;22(4):313-56.

McDonald HP, Garg AX, Haynes RB. Interventions to enhance patient adherence to medication prescriptions: scientific review. JAMA 2002 Dec 11;288(22):2868-79.

Osterberg L, Blaschke T. Adherence to medication. N Engl J Med 2005 Aug 4;353(5):487-97.

Peterson AM, Takiya L, Finley R. Meta-analysis of trials of interventions to improve medication adherence. Am J Health Syst Pharm 2003 Apr 1;60(7):657-65.

Appendix III: Expert Interviews

Programs and Organizations Examined and Analyzed

Amgen
Blue Cross Blue Shield of Massachusetts
BlueCross BlueShield of South Carolina
Boston Scientific
Community Care of North Carolina
Continua Health Alliance
CVS Caremark
EMC Corporation
Geisinger Health System
Group Health
Innovation Rx
Kaiser Permanente
Kerr Drugs
Medco
Medication Management, LLC
Medication Management Systems
Novartis
Outcomes
Partners HealthCare
Mount Sinai Hospital, Chicago
Surescripts
Thomson Reuters
Varolii
Vitality

Additional Experts Consulted

Bruce Bagley, MD, *Director, Quality Improvement,* American Academy of Family Physicians

Bruce Berger, PhD, *Professor and Department Head, Pharmacy Care Systems,* Auburn University Harrison School of Pharmacy

Ray Bullman, *Executive Vice President,* National Council on Patient Information and Education

Michael E. Chernew, PhD, *Professor of Health Care Policy, Department of Health Care Policy,* Harvard Medical School

Mark Fendrick, MD, *Professor, Division of General Medicine, Department of Internal Medicine and Department of Health Management and Policy,* University of Michigan

Brian Haynes, MD, PhD, *Professor, Department of Clinical Epidemiology and Biostatistics; Chief, Health Information Research Unit,* McMaster University

Judith Hibbard, PhD, *Senior Researcher, Institute for Policy Research and Innovation; Professor, Department of Planning, Public Policy & Management,* University of Oregon

David Hom, *President,* David Hom, LLC

Eve Slater, MD, *Associate Clinical Professor of Medicine,* Columbia College of Physicians & Surgeons

Norrie Thomas, PhD, RPh, *Executive Vice President, Business Development,* HWB, Inc.

Notes and References

[1] Osterberg L, Blaschke T. Adherence to medication. N Engl J Med. 2005 Aug 4;353(5):487-97.
[2] *Ibid.*
[3] Robert Wood Johnson Foundation. Chronic conditions: Making the case for ongoing care. September 2004.
[4] Jackevicius CA, Mamdani M, Tu JV. Adherence with statin therapy in elderly patients with and without acute coronary syndromes. JAMA. 2002 Jul 24-31;288(4):462-7.
[5] Benner JS, Glynn RJ, Mogun H, Neumann PJ, Weinstein MC, Avorn J. Long-term persistence in use of statin therapy in elderly patients. JAMA. 2002 Jul 24-31;288(4):455-61.
[6] Ho PM, Magid DJ, Masoudi FA, McClure DL, Rumsfeld JS. Adherence to cardioprotective medications and mortality among patients with diabetes and ischemic heart disease. BMC Cardiovasc Disord. 2006 Dec 15;6:48.
[7] Sokol MC, McGuigan KA, Verbrugge RR, Epstein RS. Impact of medication adherence on hospitalization risk and healthcare cost. Med Care. 2005 Jun;43(6):521-30.
[8] *Ibid.*
[9] CDC. Chronic Disease. Available online: http://www.cdc.gov/nccdphp/overview.htm
[10] Mounier-Vehier C, Bernaud C, Carre A, Lequeuche B, Hotton JM, Charpentier JC. Compliance and antihypertensive efficacy of amlodipine compared with nifedipine slow-release. Am JHypertens. 1998;11(4 pt 1):478-486.
[11] Brown BG, Bardsley J, Poulin D, Hillger LA, Dowdy A, Maher VM, Zhao XQ, Albers JJ, Knopp RH. Moderate dose, three-drug therapy with niacin, lovastatin, and colestipol to reduce low-density lipoprotein cholesterol <100 mg/dl in patients with hyperlipidemia and coronary artery disease. Am J Cardiol. 1997 Jul 15;80(2):111-5.
[12] Lowe CJ, Raynor DK, Purvis J, Farrin A, Hudson J. Effects of a medicine review and education programme for older people in general practice. Br J Clin Pharmacol. 2000 Aug;50(2):172-5.
[13] Katon W, Rutter C, Ludman EJ, Von Korff M, Lin E, Simon G, Bush T, Walker E, Unützer J. A randomized trial of relapse prevention of depression in primary care. Arch Gen Psychiatry. 2001 Mar;58(3):241-7.
[14] Piette JD, Weinberger M, McPhee SJ, Mah CA, Kraemer FB, Crapo LM. Do automated calls with nurse follow-up improve self-care and glycemic control among vulnerable patients with diabetes? Am J Med. 2000 Jan;108(1):20-7.
[15] Lipton HL, Bird JA. The impact of clinical pharmacists' consultations on geriatric patients' compliance and medical care use: a randomized controlled trial. Gerontologist. 1994 Jun;34(3):307-15.
[16] Bouvy ML, Heerdink ER, Urquhart J, Grobbee DE, Hoes AW, Leufkens HG. Effect of a pharmacist-led intervention on diuretic compliance in heart failure patients: a randomized controlled study. J Card Fail. 2003 Oct;9(5):404-11.
[17] Varma S, McElnay JC, Hughes CM, Passmore AP, Varma M. Pharmaceutical care of patients with congestive heart failure: interventions and outcomes. Pharmacotherapy. 1999 Jul;19(7):860-9.
[18] Kaiser Family Foundation. Many Americans still delaying care, struggling to pay medical bills. April 2009
[19] National Business Group on Health. NBGH survey finds recession driving many American workers to make lifestyle changes to help control health care costs. May 27, 2009
[20] Rollnick S, Miller W. What is Motivational Interviewing? Behav Cogn Psychter 1995; 23:325-224.
[21] Ogedegbe G, Chaplin W, Schoenthaler A, Statman D, Berger D, Richardson T, Phillips E., et al. A practice-based trial of motivational interviewing and adherence in hypertensive African Americans. Am J Hypertens. 2008 Oct;21(10):1137-43. Epub 2008 Jul 24.
[22] Green JL, Hawley JN, Rask KJ. Is the number of prescribing physicians an independent risk factor for adverse drug events in an elderly outpatient population? Am J Geriatr Pharmacother. 2007 Mar;5(1):31-9.
[23] McHorney C. The adherence estimator: Abrief, proximal screener for patient propensity to adhere to prescription medications for chronic disease. Current Medical Research and Opinions. 2009; 25(1):215-238.
[24] Hibbard J, Cunningham P. How engaged are consumers in their health and health care, and why does it matter? Res Briefs. 2008 Oct;(8):1-9.