

Abstract:

Mobile Tools for Improving Health Care

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The widespread usage of portable digital assistants (PDAs) by health care professionals provides opportunity for developing new tools to educate and motivate both patients and care providers. The Mobile Lipid Clinic™ combines databases, PDAs, and desktops into a comprehensive framework to assess and manage patients with, or at risk for, coronary heart disease from lipid metabolism disorders.

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Each year more than 500,000 people in the US die from coronary heart disease (CHD) out of the 1.1 million with new or recurrent cases of CHD. Clinical studies have shown decreases up to 40% in morbidity and mortality of CHD by lowering elevated low-density lipoprotein cholesterol (LDL-C). To insure realizing these benefits across the population, the American Heart Association (AHA) and National Cholesterol Education Program (NCEP) have issued guidelines and strategies for risk reduction by effecting therapeutic lifestyle changes and medical treatment.

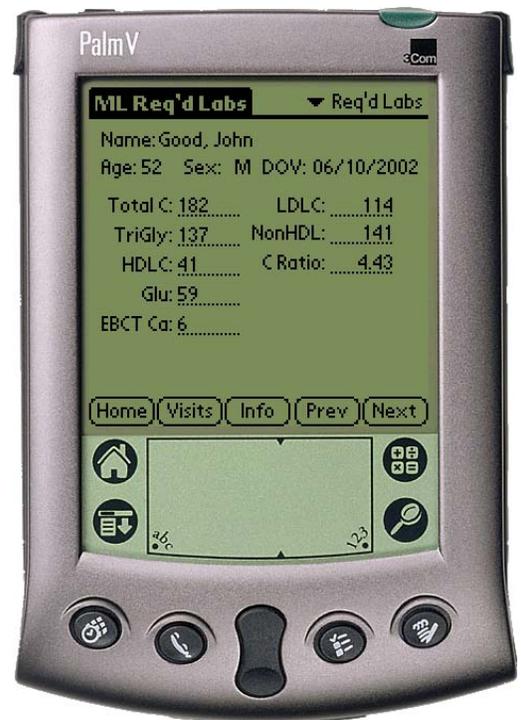
A number of factors, such as patient motivation, failure to identify at-risk patients, and health-care worker awareness, hinder compliance with the AHA and NCEP guidelines that target the multiple primary and secondary risk factors of CHD. To assist patients and health-care workers to better adhere to the guidelines, Michael Davidson, M.D., F.A.C.C, developed the innovative idea for the Mobile Lipid Clinic™, a Windows® and personal digital assistant (PDA) program for managing patients with disorders of lipid metabolism.

Mobile Lipid Clinic

The Mobile Lipid Clinic is a complete patient management system centered around a database for recording the medical history, physical and laboratory findings, clinical treatments, and risk calculations for patients being evaluated for lipid abnormalities. Health care professionals can enter patient data using either a Windows desktop application or any PDA running the Palm OS.

Both programs immediately calculate cardiac risk assessments based on the identified risk factors in the Framingham Heart Study and the NCEP's Adult Treatment Panel III Treatment Guidelines. Risk factors include

- Lipoprotein profile (total cholesterol, LDL-C, triglycerides)
- Presence of clinical atherosclerotic disease
- Major risk factors, such as smoking, hypertension, premature family history of CHD, low HDL-C, age, and diabetes.



The Mobile Lipid Clinic also uses additional risk factors identified in clinical studies, but not included in the Framingham equations or ATP III guidelines to assess cardiac risk. These ancillary risk factors include

- Inflammatory markers, such as C-reactive protein
- Noninvasive imaging of atherosclerosis (EBCT)
- Other lipid parameters

Using the above risk factors, the Mobile Lipid Clinic calculates a patient's risk assessment for coronary heart disease. The programs compute a number of metrics including

- Statistical probability of CHD based on patient's risk factors and Framingham equations
- Comparative CHD probability for patient of same age without risk factors
- Cardiovascular age equivalency based on the Framingham risk probability
- CHD probability for patient's risk factors using NCEP ATP III adaptation of Framingham score
- NCEP ATP III treatment goals for LDL-C and non-HDL-C based on risk factors
- Lifetime risk of developing type 2 (adult-onset) diabetes
- Stroke risk based on Framingham equations
- Presence of metabolic syndrome, a combination of lipid and non-lipid risk factors independent of LDL-C

| Risk Variables | | Results | |
|-------------------|-----------|------------------------------|-----------|
| Age | 42 | Cardiovascular Risk Adj. Age | 70 |
| Sex | Male | 10 Year Probability | 13% |
| Height | 70 in | 10 Year Low Probability | 4% |
| Weight | 226 lb | 10 Year ATP III Probability | 8% |
| Waist | 43 in | NCEP LDL Goal | 130 mg/dL |
| Current ATHS | No | At NCEP LDL Goal | No |
| Family CHD | Yes | LDL Reduc. to Meet Goal | 38% |
| Smokes | No | Ca. Adjusted Age | 59 |
| Diabetic | No | Ca. Adjusted 10 Year Prob. | 8% |
| LV Hypertrophy | No | Body Mass Index | 32 |
| Atrial Fib | No | BMI Type 2 DM Relative Risk | 6.1 |
| Blood Pressure | 130/80 | Ankle-Brachial Index | 0.97 |
| Blood Pressure Rx | No | 10 Year Stroke Risk | 3.5% |
| Total Cholesterol | 280 mg/dL | Low 10 Year Stroke Risk | <2.6% |

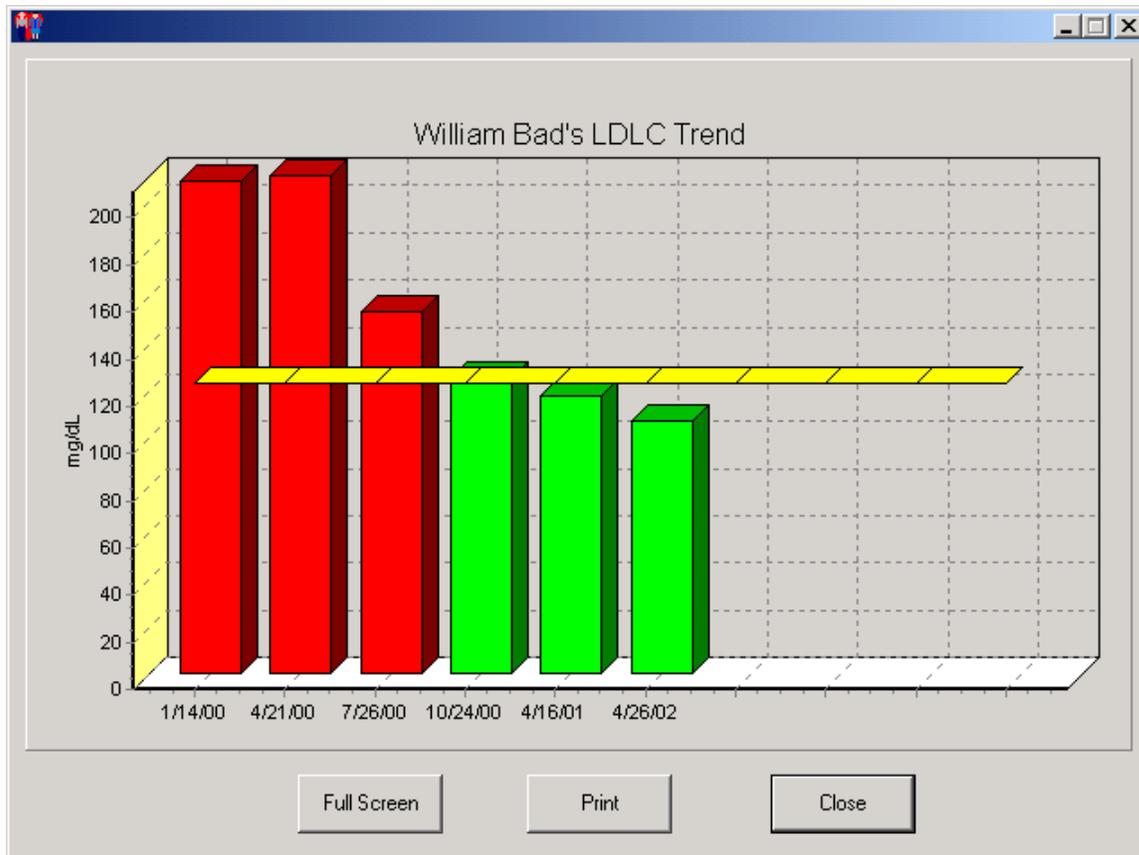
The two most important results are LDL-C goal and cardiovascular age equivalent. For the health care professional, the LDL-C goal is the ATP III therapeutic objective to meet by weight reduction, lifestyle changes, and medications, when indicated. Compliance

with a treatment plan, especially one requiring life-style changes, requires a highly motivated patient. For most people, statistical risks have little motivational impact, but the Mobile Lipid Clinic transforms the patient's statistical risk into the age of a patient with equivalent CHD risk but no risk factors. Most patients can easily and quickly grasp the medical significance that their asymptomatic risk factors "age" their hearts decades older than their chronological age. Similarly, when patients see their heart ages decrease to their chronological age with treatment, patients experience powerful feedback and motivation to maintain therapeutic compliance.

A Complete Patient Management and Educational System

Mobile users of the Mobile Lipid Clinic can rapidly input patient data and calculate risk as they perform clinical rounds using a Palm handheld. On returning to their Windows desktops and docking their Palm into its cradle, mobile users automatically synchronize the Palm data with any updates entered in the database by the desktop version of Mobile Lipid Clinic.

The desktop component of Mobile Lipid Clinic, besides allowing rapid entry of address and laboratory results for patients by practice support staff, also provides several additional patient education and practice management features. Dietary therapy plays a key role in management of dyslipidemias. The Mobile Lipid Clinic can print patient handouts for the therapeutic diet the health care professional has prescribed. The desktop program also provides trend graphs for the patient showing the progress they are making to achieve ATP III treatment goals. For many patients, a graphic is another powerful motivation tool, in addition to the equivalent cardiovascular age, for maintaining adherence to the treatment plan. The program also prints for patients a visit report summarizing key lab tests, the treatment plan, and date of next visit.



The database and documents underlying the Mobile Lipid Clinic system use familiar Microsoft Office technology for easy access by computer-sophisticated practices. The diets and report documents use Microsoft Word templates so that practices can customize document headers with practice contact information or modify the contents to support special needs. Practices serving large minority populations can translate the Word documents into other languages as needed.

The patient management database uses a relational model and is implemented using Microsoft Access. This serves the needs of practices that are conducting research trials or self-assessment programs and want to query aggregated data from multiple patients.

Impact of Mobile Lipid Clinic

The Mobile Lipid Clinic system is available free of charge through the World-Wide Web at <http://www.mobilelipidclinic.com/> and is also distributed at many medical trade shows. Initial medical community reception has been enthusiastic, but the real objective is fostering better patient management of lipid disorders. Previously published studies showed that only 18% of patients with CHD reached the less complex therapeutic goals of the earlier ATP II guidelines.

The Mobile Lipid Clinic provides the foundation for designing clinical studies on the management and response of patients with dyslipidemias. Using Web technology, de-identified patient data from participating patients and practices can be securely transferred to a central server for statistical analysis. As part of the beta test phase of the

Mobile Lipid Clinic, a small, unpublished study using such techniques demonstrated the potential for using an electronic tool to improve health care. Compared to only 18% of patients meeting goals in previous studies, this test showed over 40% of patients achieved their therapeutic goals.

The potential to improve medical care is significant using lightweight, easy-to-carry computers that can educate, motivate, and calculate about patient data, risks, and treatments for health care workers. Many other high-impact disease conditions, such as obesity, diabetes, hypertension, and stroke, present the opportunities for improved clinical care using mobile tools similar to the Mobile Lipid Clinic.