

The Potential Use of Handheld Computers for Continuing Medical Education

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Abstract

This study investigated the potential for providing CME on a handheld computer to family physicians. National guidelines on four topics were summarized and converted to a format that could be read on the most popular type of handheld computer. Seventeen physicians were randomly allocated modules and a case study on two of the four topics. Before and after receiving the modules, they completed surveys of their knowledge on all four topics and provided estimates of their confidence in managing patients with those conditions. There were trends towards greater improvement in knowledge scores on the topics that had been reviewed, with a statistically significant improvement in knowledge scores on two modules. While there are increasing numbers of content providers employing this technology to deliver CME, this study provides only modest evidence to support its effectiveness.

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CHAPTER I: INTRODUCTION

... the more serious problem relates to the education of the practitioner after he has left the schools. Sir William Osler (1903)

Statement of Problem

For a century it has been clear that physicians require ongoing professional education to keep abreast of advances in the field of medicine. The need to stay current became even more critical with the rapid pace of discovery during the 20th century. Yet, while medical schools did an excellent job of creating physicians, their influence was demonstrably less after the physician entered practice. Multiple studies have evaluated the impact of continuing medical education initiatives on practicing medical doctors, and the effects have been minimal to modest.

Purpose

This project was to determine if continuing medical education could be delivered through handheld computer technology in a manner that was satisfactory to physicians and resulted in effective learning.

The following were the research questions posed in this study.

1. What were some professional development needs for Maritime family physicians that could potentially be delivered by handheld computers?
2. Was currently available PDA/Internet technology a dependable and acceptable means of delivering professional education modules to family physicians as measured by physician satisfaction with this mode of delivery?
3. Was the handheld computer capable of providing effective education to practicing physicians, as measured by knowledge retention and application in practice?
4. What were the barriers that prevented PDA CME from achieving this potential?

Literature Review

It was in Osler's time that Medicine began to experience rapid change and evolution. An accelerated pace of scientific discovery heightened the need for an effective means of keeping physicians current.

Despite the pace of change, reading appeared to continue as the preferred means of study for physicians, a fact reinforced by studies in the decades between 1980 and 1998 (Curry & Putnam, 1981, Goulet, Gagnon, Desrosiers, Jacques, & Sindon, 1998). However, it was appreciated early on that reading alone had little measurable impact on adherence to standards of care (Cohen, Weinberger, Hui, Tierney, & McDonald, 1985).

A shift away from independent self-study towards organized instruction had already begun in the first part of the 20th century. The result was the establishment of formal Continuing Medical Education (CME). Over the intervening years this innovation became an industry unto itself. A variety of organizations offered structured physician education including universities, colleges, hospital facilities, health maintenance organizations and for-profit concerns such as pharmaceutical companies. Considerable amounts of time and money were invested in the enterprise. Several accrediting bodies and professional colleges e.g. The College of Family Physicians of Canada, the Royal College of Physicians and Surgeons of Canada, required that continuing membership be contingent upon completion of a prescribed amount of formal CME.

The initial approach to physician education followed the traditional techniques used in medical schools: lectures and seminars in a conference setting. Those perceived as knowledgeable in the domain usually delivered the presentations to offer their perspective and expert opinion. For all of the emphasis upon and investment in them, medical conferences themselves were shown to have little assessable impact on improving professional practice (Davis, Thompson, Oxman, & Haynes, 1995).

The late 20th century also saw the emergence of evidence-based medicine. This movement called for less emphasis on the opinions of experts and approaches based on physiology alone. It required that rational therapeutic decision-making be grounded in the results of properly conducted trials that demonstrated measurable outcomes. This critical evaluation of research evidence led to the establishment of rational treatment policies, in an attempt to translate evidence in practice. Called clinical practice guidelines, or CPG's, these protocols were created and disseminated to clinicians in another effort to effect changes in physician behavior.

Unfortunately, research suggested that physicians were not altering practice simply because published guidelines recommended change. Reviews by Grimshaw & Russell (1993) and Davis & Taylor-Vaisey (1997) showed very variable and modest results of the effect of guideline dissemination.

With acceptance of this movement, it was perhaps inevitable that physician education would come under similar scrutiny for effectiveness. By 1992 Davis and colleagues were able to compile 50 articles on physician education for analysis of results. This was repeated in a more extensive analysis in 1995, and was refined by several of the same authors for a 1999 review (Davis, O'Brien, Freemantle, Wolf, Mazmanian, & Taylor-Vaisey, 1999). Their analysis of 14 studies suggested that there was a wide chasm between ideal and actual medical practice. This raised the prospect that formal physician continuing education employed interventions that did not effect the desired outcomes. Given the widespread adoption of the principles of evidence-based medicine, the CME industry itself seemed largely unsupported by research evidence.

A variety of educational techniques have been attempted to provide professional education to physicians. Oxman, Thompson, Davis, & Haynes (1995) reviewed 102 trials of CME between 1970 and 1993.

They categorized the different approaches they found as:

1. Distribution of printed material
2. Conferences, lectures and workshops
3. Outreach visits
4. Local opinion leaders
5. Patient-mediated interventions
6. Audit and feedback
7. Reminders
8. Marketing
9. Multifaceted interventions and
10. Local consensus process.

Research into the outcomes of physician education employed a number of measures of effectiveness. These could be divided into two types. The first (and easier to measure) was physician behavior. The number of tests ordered, drug prescribing patterns, and guideline adherence were examples of this. The second yardstick was patient outcome. While considerably more important, this was much more difficult to track and more difficult to link directly to the educational intervention.

Oxman and colleagues concluded that some educational efforts consistently failed to demonstrate effectiveness in affecting either physician behaviour or patient outcomes. These included unsolicited mail outs and lectures that were not based on physician needs. Other interventions such as use of local leaders, audit and feedback, showed mixed effects, ranging from minimal to substantial. Multifaceted interventions demonstrated some effectiveness in both domains.

Subsequent publications by Balas, Weingarten, Garb, Blumenthal, Austen Boren, & Brown, (2000) have claimed that prompting could improve preventive care, but the effects were modest, ranging from 5.8-18%, while multimodal interventions demonstrated 11.5% improvement in practice patterns on preventative care (Lemelin, Hogg, & Baskerville, 2001).

In a systematic review in 2004, Grimshaw et al. reviewed 23 multifaceted interventions on educational outreach and observed that most recorded only “modest to moderate improvements in care.” They concluded that there was an “imperfect evidence base to support decisions about which guideline dissemination and implementation strategies are likely to be efficient under different circumstances.”

Several problems have been acknowledged with traditional CME. It has been suggested that mail outs and publication of guidelines failed to alter behavior because they did not address the social aspects of learning (Mittman, Tonesk, & Jacobson, 1992). Lectures, an inherently passive experience in which a speaker delivered a lecture to a group of attendees, provided some social context but the participants did not interact with the speaker or the material in any meaningful way. Furthermore, the material may not have been presented in a manner that was relevant to their clinical needs or their particular learning styles. In addition, traditional CME required the attendance of physicians, which necessitated their leaving their practices. This made traditional CME costly in both time and money. The lack of linkage between the information, the physician and the patients’ problems was also perceived as a shortcoming. In addition, it must be acknowledged that physicians attended CME events for reasons other than educational needs, e.g. to travel, to socialize or to network with colleagues.

One of the reasons for the lack of efficacy of traditional CME was that it typically sought only to alter a physician’s understanding of a topic. There was an assumption that this would result in a modification of practice. It was presumed that reasonable and motivated professionals

would automatically accept the information and incorporate it into their day-to-day practice. It has been repeatedly demonstrated that simply changing attitudes or knowledge alone was not enough to effect a change in behaviour. A discipline has developed over the past few decades to explore this process more fully. It was best summarized by the work of Rogers (2003). The process of accepting an innovation actually involves a number of stages, including:

1. the knowledge stage, where the new idea is first understood and can be recalled
2. the persuasion stage, when the individual forms a positive impression of the innovation through discussion with others and is influenced by positive messages and support
3. the decision stage, in which the individual comes to the resolution to change
4. an implementation stage, wherein the individual gathers sufficient information and resources to alter behaviour and carries through on the intention, and
5. a confirmation stage, in which the decision is evaluated and reinforced.

More recently, new efforts have been made to try and incorporate learning techniques that incorporated principles of adult education. These included soliciting input from the learners in an attempt to design curricula that met their learning needs. Education began to occur in smaller groups and incorporated peers instead of experts. Social learning theory suggested that interaction with peers around real problems was important, so interactive workshops began to replace passive lectures.

Even by incorporating the theoretical principles of social learning theory, research on effecting change continued to demonstrate mixed results. While Hux, Melday, & DeBoer (1999) and Verstappen et al. (2003) demonstrated that behavior could be altered through structured feedback, a prior educational intervention had shown no difference in behavior between control and test groups (Borgiel, 1999). Even when modified by the standards of peer best practice

(“achievable benchmarks”), structured feedback demonstrated variable results which sometimes failed to achieve statistical significance (Kiefe, Williams, Person, Weaver, Weissman, 2001).

Oxman et al. (1995) concluded that there were “no magic bullets.”

Davis stated “where performance change is the immediate goal of a CME activity, the exclusively didactic CME modality has little or no role to play.” This presumed that only learning activity which immediately changed behavior was of value. This position could be disputed on several grounds. It could be argued that CME which only reinforced a clinician’s current practice probably had benefit, even though no behavior change resulted. As well, knowledge that was not immediately implemented may still prime a clinician for behavior change at an opportune moment later. Physicians may integrate the information but elect not to act on it until it is validated. This may be done by interaction with a peer, another reference or a similar educational influence.

Another focus of attention had been the realization that to work, guidelines and reminders must be provided at the point of care. Work done in Australia with medical specialists has suggested that effectiveness was less a function of the quality of the guidelines and more a property of how the information was delivered (Sintchenko, Coiera, Iredell, Gilbert, 2004).

This finding was consistent with the recommendations of Shaughnessy, Slawson, & Bennett (1994) who maintained that the usefulness of medical information was a product of its relevance and its validity, divided by the work involved in obtaining it. Hence, even very pertinent and robust information was not useful if it was difficult to obtain.

Computers provided a new opportunity to deliver educational content to physicians electronically. Advances in Information Technology held out the prospect of providing physicians with relevant information to guide their clinical practice. There was potential to provide up-to-date educational material that was tailored to the specific needs of the physician

and was easy to use. Furthermore, electronic resources could be incorporated into a variety of venues and at a pace which suited the needs of the recipient.

However, until recently, access to information technology was a barrier. Even with the ready availability of personal computers and the internet, it was sometimes difficult to obtain relevant, valid information at the point of care. Potential reasons for this might have included the need to use a personal computer workstation, poor keyboarding skills, lack of an internet connection, and delays in using online material. As well, many electronic continuing medical education (CME) activities required commitment of a block of devoted time, which could be assumed to be difficult to find in a physician's schedule.

Handheld computers (also known as Personal Digital Assistants or PDAs) changed the access problem. The devices were portable, very easy to use (e.g. had touch sensitive screens which reduced or even eliminated the need to use a keyboard) and were considerably faster than a personal computer (e.g. they provided "instant on" capability, with no need for the delay incurred by the "booting up" process of personal computers). Besides being inexpensive, reliable and easy to use, handheld computers allowed for instant access of resources at the point of care. Handheld computers allowed MDs to access the relevant information they needed when and where they needed it.

For these reasons, handheld computers found rapid acceptance among physicians. As early as 2002, a survey by a Chicago-based association for healthcare information technology professionals suggested that more practicing MD's used a PDA than used a regular personal computer in clinical application (HIMSS, 2002). The 2003 Canadian Medical Association Physician survey reported that one third of this country's doctors were using a PDA in clinical applications, a large increase over the 19% who did so just two years previously. Over half of physicians under the age of 35 were said to be users of handheld or wireless computers (Martin,

2003). The National Physician Survey [NPS] Medical Student Component (2004, Q24) indicated that 72% of 4th year medical students were PDA users (although how they were used was not explored). The NPS Resident Component (2004, Q16) gave a figure of 79% PDA use for Family Medicine Residents.

There was also some evidence that use of handheld computers could alter physician behavior. In a 2002 survey Rothschild, Lee, Bae, & Bates stated that physicians using a PDA drug reference program reported that they significantly reduced preventable medication errors. This reported effect may simply have been the result of easier access to relevant clinical information, but was noteworthy nevertheless.

Despite these attributes, handheld computers were only recently tapped for their CME potential. While 11% of family doctors reported using PDAs to perform drug interaction checks on the 2004 survey, only 0.8% were using them to do CME (NPS, 2004, Q23). A few vendors began offering PDA CME to their subscribers, most notably the ePocrates® mobile clinical practice suite (<http://www.epocrates.com>). However, there was little evidence for or against the effectiveness of this approach.

CHAPTER II: METHODOLOGY

Introduction

To determine if the PDA CME was effective, physicians were assessed on two domains. Their knowledge of the content was tested by the same multiple choice quiz administered before and four months after the intervention (Appendix A page 44). The quiz comprised a 40 item questionnaire with 10 questions on each of the four topics. Each of the quizzes was reviewed by the local content expert and any changes recommended were implemented.

Secondly, their confidence levels for managing the clinical topics were also estimated before and four months after the intervention. This was done through a series of questions on self-efficacy on managing the conditions. (Appendix B page 50). Subjects were also asked their demographic characteristics and practice profiles.

It was presumed that physicians might improve their knowledge in some of the test areas between quizzes without any intervention. Independent learning might occur when physicians found themselves in doubt attempting to answer some questions in the pre-CME quiz. This might spur some subjects to seek out the answers independently. To compensate for the potential for independent learning between testing, the subjects were divided into two groups. Group A received two of the modules and Group B received the other two modules. All subjects were tested on all four modules before and after the intervention, to detect any difference between the scores on topics they had received by PDA with the scores on topics they did not receive serving as controls (Figure 1).

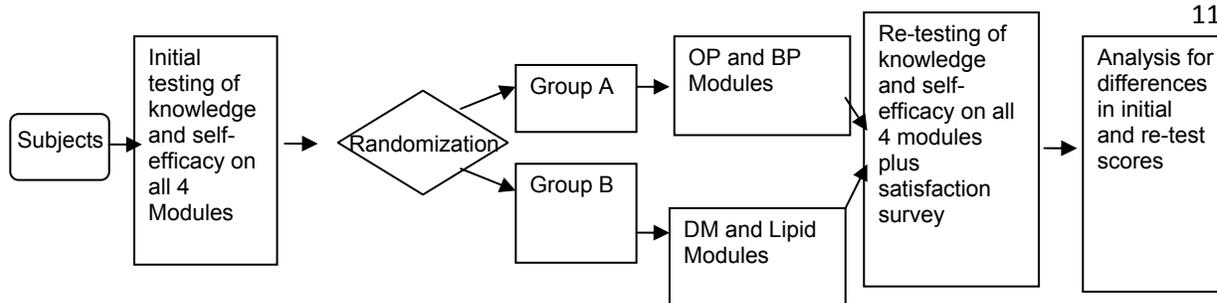


Figure 1. Flowchart of Study Design

Physician scores for each of the four topic areas were totaled, awarding one point for each correct response out of a possible 10 points. The self-efficacy scores were calculated by assigning the following values to responses to statements expressing competency in the domains of screening, diagnosis, management, and goal attainment in each topic area on a Likert scale. Zero was awarded for a response of “a. Strongly Disagree,” 1 point for a response of “b. Somewhat Disagree,” 2 points for a response of “c. Somewhat Agree,” and 3 points for a response of “d. Strongly Agree.”

Determination of sample size requirements was based on the effect sizes found in pilot testing. Some of the quizzes had been conducted on family medicine residents who had attended seminars on the topics. The average score for 12 second year family medicine resident trainees on the 10 point hyperlipidemia quiz was 4 prior to the seminar and 8.45 after. The corresponding figures for osteoporosis were 4.75 and 7.7. A sample size of 10 subjects in each of the two groups was determined to be adequate to detect a learning effect of the magnitude envisioned.

Results would be subject to analyses of variance, both single and multiple. A post-hoc analysis would be used if there were trends in the data that warranted further study.

Selection of Participants

Subjects for the study were recruited in multiple ways. Notices were circulated by the Dalhousie CME Department to its mailing list of family doctors in the Maritimes in 2004 (estimated to be 550-600 physicians). Information was posted on the DoctorsNS website

soliciting interest and a notice was included in the fall edition of the newsletter of the Nova Scotia College of Family Physicians (membership 650 at the time). The study was also promoted during several local and one regional CME presentations. To participate, subjects had to be a Maritime family physician, actively engaged in primary care, and with at least six months experience using a Palm® OS based PDA. This platform was chosen as it was the most popular one at the time and was available in a number of inexpensive models. Starting in November 2004 those expressing interest (N = 43) were sent further information (Appendix C page 53).

These physicians were also issued a survey requesting topics of interest to them. The survey included checkboxes listing a number of current Canadian guidelines, one topic recently covered by Dalhousie Continuing Medical Education Academic Detailing Program, as well as eight common problems recently reviewed by the College of Family Physicians of Canada as part of their Self Learning Interactive Continuing Professional Development program.

The physicians were not limited in their responses, and were also offered the option of suggesting additional topics.

The number of responses for each topic was counted.

Sixteen respondents replied with preferences. There was a clear preference for four topics on commonly seen diagnoses (diabetes, hypertension, osteoporosis, hyperlipidemia) and these were selected for creation of the CME modules.

Additional topics suggested were: stroke prevention guidelines, concussion: guidelines for return to sports, the office management of depression, attention deficit disorder diagnosis and treatment.

The responses are shown in table 1.

Table 1.

CME Preferences

Topic	Responses
Guidelines for diagnosis and management of diabetes	12
Guidelines for the management of hyperlipidemia	11
Guidelines for the diagnosis and management of hypertension	10
Screening and management of osteoporosis	9
Issues in post-menopausal hormone replacement	7
Management of dyspepsia	2
Emergency contraception	5
Anaphylaxis	7
Acute otitis media	3
Chronic bronchitis	6
Polycystic ovarian syndrome	4
Urinary tract infection in women	3
Pulmonary embolism	3
Croup	2

Instruments

The national guidelines in place at the time for each of the topics were reviewed. For hypertension, the 2006 guidelines of the Canadian Hypertension Education Program were obtained from <http://hypertension.ca> (these were since replaced by 2008 guidelines). For osteoporosis, several sources were used including the Osteoporosis Update Workbook from the

Dalhousie University Division of CME and the 2002 Osteoporosis Society of Canada guidelines, which were accessed from <http://www.osteoporosis.ca>. For diabetes, the Canadian Diabetes Association 2003 clinical practice guidelines for the prevention and management of diabetes were used. For lipids, published guidelines from the Canadian Journal of Cardiology (McPherson, Frohlich, Fodor, & Genest 2006) and the Canadian Medical Association (Genest, Frohlich, Fodor, & MacPherson, 2003) were used.

From each of the guideline documents, a summary of points relevant to the family physician was created. The summaries were reviewed by local content experts. Each consultant provided suggestions and edits to each of the modules. One suggestion was to provide some interactivity by guiding the user through a typical case, including diagnosis, investigation and management. Accordingly, for two of the modules, a case was created to accompany each module. In each of the two case presentations, a fictional patient was described and questions were posed for case management. Participants were asked multiple choice questions on various aspects of the case as it evolved to emphasize salient guideline issues. Answers were provided for immediate feedback on the issues as the case unfolded to a conclusion. The material in the cases was essentially the same as that in the modules (refer to Appendices D-I, pages 54-84 for modules and case studies). This phase took several months for completion of content, review and revision.

The cases and modules were created in MSWord and exported to Hypertext Markup Language (HTML) format. They were subsequently encoded in iSilo® Reader format for viewing on the handheld computer. iSilo is a proprietary reader which was commonly used in handheld computer publishing for the Palm OS. This reader format supported the use of different fonts, colours, tables and hyperlinks. As a result, the modules and cases were able to have advanced navigation features such as linked tables of contents. Users were able to customize the font display size on their handheld computers.

Subsequently, the modules were assigned between two packages. Because of their clinical relationship, the diabetes and hyperlipidemia modules were paired, along with the diabetes case. The osteoporosis and hypertension modules were paired and augmented by the hypertension case. To each package, the iSilo reader software and an electronic manual was added. A public domain calculator for determining cardiovascular risk (STAT Cholesterol) was added to the diabetes and hyperlipidemia package.

Each package was compiled by the computer program Nutshell® (<http://www.ecamm.com/palm/nutshell/>). This utility compresses multiple files and programs into a single executable file which self-extracts on the user's handheld computer. In this way, subjects were required to load only a single program into their devices. Once opened, this one file decompressed and installed all the modules, the case, the reader and the iSilo manual. Nutshell then removed its installation files. The only other task required by the participants was to enter a code number into their PDAs to unlock the full features of the iSilo program.

The project received approval from the Mount Saint Vincent University Research Ethics Board in October of 2004 and 22 physicians completed the MSVU approved consent forms. Subsequently, the study received a grant from the Capital District Health Authority (CDHA) Research Fund Competition. A requirement of the funding was that the study obtain additional approval from the Capital Health Research Ethics Board. This necessitated revisions to the consent form. Approval from the Capital Health Capital Health Research Ethics Board was granted in September of 2005. A combined consent form was endorsed by both bodies, and the approvals were renewed for 2006-2007.

Three physicians who had signed the original MSVU Consent Form did not sign the CDHA consent form and were dropped from the study. The 19 physicians who completed the final consent form were enrolled and were sent the pre-CME quiz and demographic information

questionnaire. The 17 who completed the surveys were randomized to receive either the diabetes and lipid modules, or the hypertension and osteoporosis modules. These subjects were sent a file by email which included the bundled PDA modules and iSilo reader. An instruction sheet on downloading and installing the file was included, along with basic instructions in registering and using the reader (see Appendices J and K, pages 85 and 86). A phone number and email address was provided for support for any questions or problems experienced by the users. Four months after the modules were sent, the subjects were asked to complete the post-CME questions and satisfaction survey.

Data Collection

The study was based on three outcomes: the physician scores on knowledge quizzes before and after the modules were distributed, the physician scores on self-efficacy questionnaires before and after the module distribution and satisfaction surveys conducted after the intervention period ended. A demographic questionnaire was also collected prior to the intervention. It included basic information on the subjects and their practices as well as comfort levels with computers.

Initially the quizzes and demographic questionnaires were completed online using the WebCT® system of Dalhousie University. The responses were collected on a university web server for analysis. In the spring of 2007 the university replaced the WebCT system with the Blackboard Learning System®. Use of the latter required the users to undertake extensive software upgrades to the Java software platform on their computers. Since this process could be difficult and time consuming, a decision was made not to request this of subjects. Completed results were extracted from the WebCT database prior to retirement of the old system and were converted into an Excel® spreadsheet. From this point on, the subjects were sent their

questionnaires and quizzes in paper format. The subsequent results were manually transcribed into the Excel spreadsheet for analysis.

During the conduct of the study, new guidelines were released on one of the modules, hyperlipidemia.

The module was updated and re-sent to those physicians who had received it. The new guidelines had an effect on the correct response on one of the questions in the quiz. This question was re-worded to reflect that it referred to the original guidelines, so the correct answer did not change.

Data Analysis

The results for the knowledge scores were entered in the SAS System (version 9.1) statistical analytical software. Analysis of variance was completed using the General Linear Model for each of the two groups as independent variables against 8 dependent variables: the difference in pre- and post-scores for each of the four knowledge quizzes and each of the four self-efficacy scores.

CHAPTER III: RESULT AND DISCUSSION

Nineteen physicians completed the combined consent form and were enrolled from April to October of 2006. Of these, 17 completed the pre-CME quiz and self-efficacy survey and were randomized between two groups. Group A was composed of 7 physicians and they received modules for osteoporosis (OP) and hypertension (BP). Group B was composed of 10 physicians and they received modules on diabetes (DM) and hyperlipidemia (Lipids).

Only four of the physicians in group A completed the pre- and post-CME quizzes. One physician did not load the modules because of hardware problems, the other two did not submit the post-CME quizzes.

Seven participants in the B group completed both sets of quizzes. One physician of the original 10 switched to an incompatible PDA platform, a second did not load the modules or complete the post-intervention questionnaires and a third did not complete the post CME self-efficacy questionnaires. The number of subjects with complete results and entered in the analysis was therefore 11 (Figure 2).

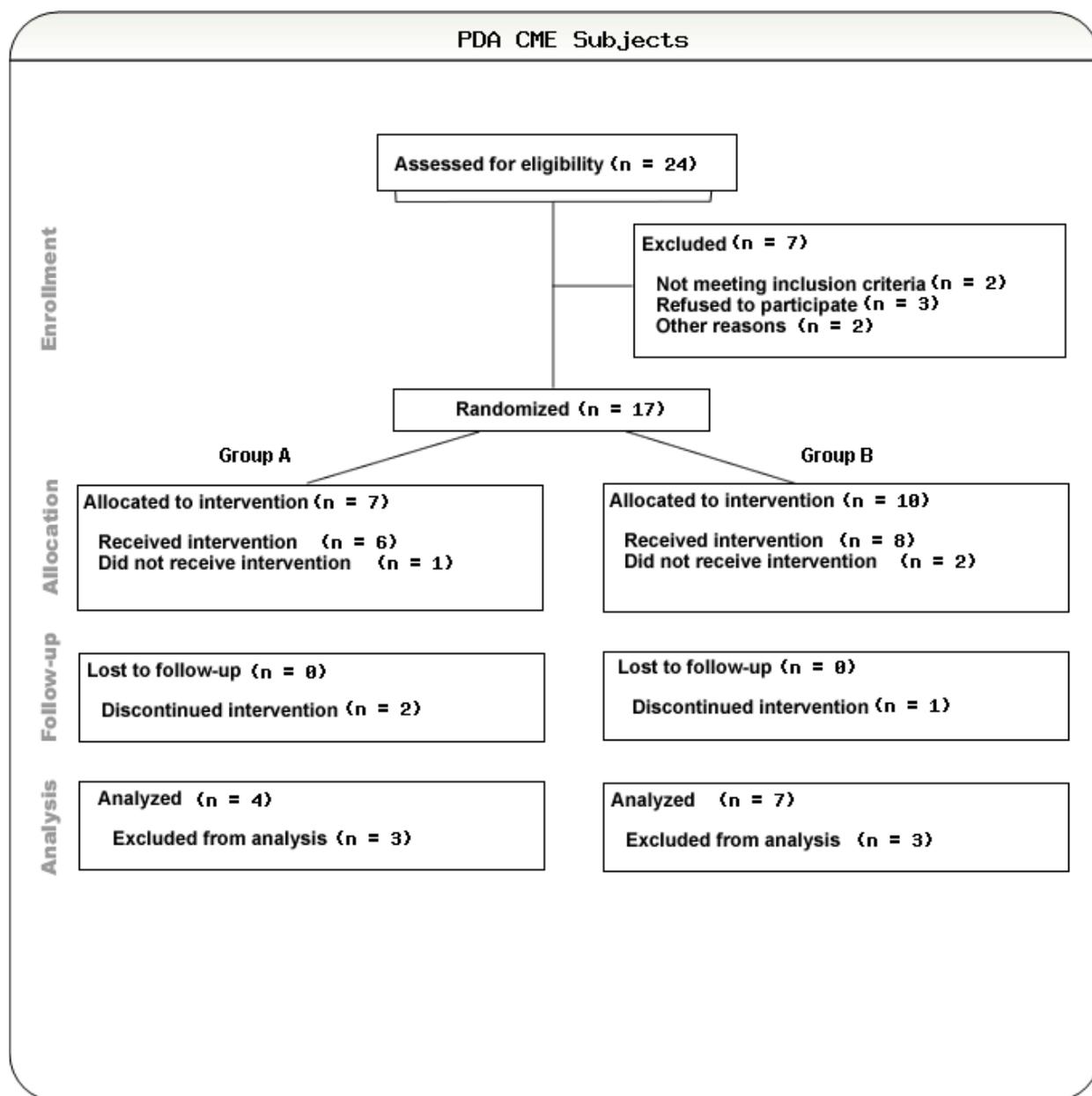


Figure 2: CONSORT diagram of subjects

The subjects analyzed represented both sexes, multiple ages and a wide range of experience as summarized in Table 2.

Table 2.

Subjects Analyzed

Characteristics of Subjects		
	Mean	Range
Years in Practice	18	6-36
Annual CME Time in hours per year	66	20-150
Ages		
30-39	2 female, 1 male	
40-49	4 females	
50-59	1 female, 1 male	
Over 60	2 males	

The subjects included in the analysis reported spending an average of 15-49 minutes reviewing the content (Table 3).

Table 3.

Average Time Spent on Modules

Module	Time to complete	n	Group
Hyperlipidemia	15 (range 0-60)	7	B
Hypertension	49 (range 0-120)	4	A
Osteoporosis	25 (range 0-60)	4	A
Diabetes	41 (range 10-120)	7	B

Table 4 shows the scores achieved on the quizzes by each of the participants before and after the module review.

Table 4.

Quiz Score Data Tables

Group A	Pre-intervention				Post-intervention			
	DM	OP	BP	Lipids	DM	OP	BP	Lipids
Subject								
100	7	6	7	7	8	10	9	7
101	7	8	8	2	8	9	8	3
102	6	10	5	4	7	10	6	5
104	9	9	5	6	8	8	6	3
Group B	Pre-intervention				Post Intervention			
	DM	OP	BP	Lipids	DM	OP	BP	Lipids
Subject								
200	5	8	5	5	8	8	3	7
201	8	10	6	6	8	9	8	3
202	4	9	8	5	8	8	8	5
203	5	5	2	2	8	5	6	4
204	5	8	6	6	8	3	5	4
205	4	7	3	4	6	7	4	9
207	5	4	5	4	8	4	7	1

Table 5 shows the mean and standard deviation of the physician scores before and after the intervention. For group A, who received only the osteoporosis and hypertension modules, the group average score on the diabetes questions improved by 0.5 point. However, the physicians in Group B who had received the diabetes and hyperlipidemia modules, improved by 2.6 points. On the osteoporosis questions, the average score of Group A physicians improved by 1.0, while the Group B subjects actually dropped their average score by 1 point. These results suggest there may have been a positive effect from these respective modules on the physicians who reviewed them.

Table 5.

Results of Mean Quiz Scores with Standard Deviations. Asterisk Indicates Modules Received

Group A N=4				
Test	DM	OP *	Lipids	BP *
PRE	7.3 (1.26)	8.3 (1.71)	4.8 (2.22)	6.3 (1.50)
POST	7.8 (0.50)	9.3 (0.96)	4.5 (1.91)	7.3 (1.50)
Difference	0.5	1.0	-0.3	1.0
Group B N=7				
Test	DM *	OP	Lipids *	BP
PRE	5.1 (1.35)	7.3 (2.14)	4.6 (1.40)	5.0 (2.00)
POST	7.7 (0.76)	6.3 (2.29)	4.9 (2.63)	5.9 (1.95)
Difference	2.6	-1.0	0.3	0.9

On the other hand, the results on the lipid questions were down 0.3 in Group A (who did not get the module on lipids) and rose 0.3 in the Group B physicians, who did receive the module. In

the hypertension quiz, the average score rose in both groups, suggesting that the hypertension and hyperlipidemia modules had no measurable positive effect on knowledge of these common diagnoses.

The MANOVA test compared the two independent variables (Group A and B) with the whole set of dependent variables (test scores). The MANOVA indicated that the overall effect of group was not statistically significant with p values of 0.48 (Table 6).

Table 6.

MANOVA statistics

MANOVA Test Criteria and Exact F Statistics
for the Hypothesis of No Overall group Effect
H = Type III SSCP Matrix for group
E = Error SSCP Matrix

S=1 M=2.5 N=0.5

Statistic	Value	F Value	Num DF	Den DF	Pr > F
Wilks' Lambda	0.2631426	1.20	7	3	0.4832
Pillai's Trace	0.7368573	1.20	7	3	0.4832
Hotelling-Lawley Trace	2.8002203	1.20	7	3	0.4832
Roy's Greatest Root	2.8002203	1.20	7	3	0.4832

When examined individually, the univariate analysis shown in Table 7 indicated that there was a statistically significant association found for the diabetes module group and the diabetes quiz scores (p value 0.02).

Table 7.

ANOVA for Diabetes Module.

	D	Sum of			
Source	F	Squares	Mean Square	F Value	Pr > F
Model	1	10.92207792	10.92207792	7.73	0.0214
Error	9	12.71428571	1.41269841		
Corrected Total	10	23.63636364			

There was also a trend to association for the osteoporosis module group and quiz scores, but it did not reach statistical significance in univariate analysis (Table 8).

Table 8.

ANOVA for osteoporosis module

	D	Sum of			
Source	F	Squares	Mean Square	F Value	Pr > F
Model	1	10.18181818	10.18181818	2.70	0.1351
Error	9	34.00000000	3.77777778		
Corrected Total	10	44.18181818			

The data were further assessed in a post-hoc analysis to explore the trend in the osteoporosis module. A nonparametric analysis was performed on a revised set of participants. Two subjects who noted in their surveys that they had not loaded any modules were removed from the dataset. One subject was added who was not included in the initial analysis; an individual who loaded all modules, completed the quizzes but not the post-CME self-efficacy scores. Using rank scores

and this dataset, a Cochran-Mantel-Haenszel Statistic (Table 9) suggested that the osteoporosis module reached statistical significance.

Table 9.

CMH statistics for osteoporosis module

Cochran-Mantel-Haenszel Statistics (Based on Rank Scores)				
Statistic	Alternative Hypothesis	DF	Value	Prob
1	Nonzero Correlation	1	4.3006	0.0381
2	Row Mean Scores Differ	1	4.3006	0.0381

The self-efficacy scores are shown in Table 10 and the summary statistics for self-efficacy are shown in Table 11. In Group A the post-intervention scores were greater in the two modules that had been reviewed and slightly less in the two modules that had not been. In Group B the results were mixed, with the greatest improvement in the hypertension questions, the module for which they had not received. There were no statistically significant differences in the analysis of self-efficacy scores for either group.

Table 10.

Self-efficacy Score Data Table. Maximum Score = 12.

Group A	Pre-intervention				Post Intervention			
	DM	OP	BP	Lipids	DM	OP	BP	Lipids
Subject								
100	8	6	7	9	8	10	9	8
101	11	10	10	8	11	11	11	11
102	9	9	9	10	10	9	11	9
104	11	9	10	10	8	8	8	8
Group B	Pre-intervention				Post Intervention			
	DM	OP	BP	Lipids	DM	OP	BP	Lipids
Subject								
200	11	10	11	12	12	10	12	11
201	9	7	9	9	10	10	11	10
202	9	7	12	10	10	10	10	12
203	12	12	12	12	12	12	12	12
204	12	8	11	11	7	8	12	10
205	9	11	10	10	12	8	12	12
207	12	8	9	12	12	8	12	12

Table 11.

Self-efficacy Survey Summary Statistics Showing Means and Standard Deviations. Asterisk

Indicates Modules Received

Group A N=4				
Test	DM	OP *	Lipids	BP *
PRE	9.8 (1.50)	8.5 (1.73)	9.3 (0.96)	9.0 (1.41)
POST	9.3 (1.50)	9.5 (1.29)	9.0 (1.41)	9.8 (1.50)
Difference	-0.5	1.0	-0.3	0.8

Group B N=7				
Test	DM *	OP	Lipids *	BP
PRE	10.6 (1.50)	9.0 (2.00)	10.9 (1.21)	10.6 (1.27)
POST	10.7 (1.89)	9.4 (1.51)	11.3 (0.95)	11.6 (0.79)
Difference	0.1	0.4	0.4	1.0

The satisfaction survey asked several questions about usability of the application (Table 12).

Table 12.

Usability Responses

	Not at all	Barely	Somewhat	Very much	Completely
Was the material easy to read on the handheld computer screen?	1	0	6	3	1
Did the technology work reliably for you, i.e. consistently and without problems?	1	0	1	7	2

With respect to the first question, those who did have trouble with readability might be expected to drop out, so this represents a selected group and cannot be generalized other than to say that for some persons the content was readily legible.

To the question “Did you recall any of the module material in your clinical care of patients?” 10 of the 11 subjects reported they had.

In response to the question “Did you access or review any of the material in the modules from your PDA in the clinical care of your patients?” 9 of the 11 subjects reported they had.

To the question “Is this a type of CME you would use again?” 9 of the 11 subjects replied “Yes.”

On the satisfaction survey, two subjects commented it was easy to navigate around the modules. The two who had not activated the full version of the viewer stated that they were not able to use the hyperlinks. There were suggestions to place icons on the main screen and one person commented that the small screen size made it difficult to scan the content. Subjects reported that the modules worked reliably for them. The barriers cited by subjects included remembering to download the modules and to refer to them at relevant clinical encounters. There was an apparent divide between participants who found the process of downloading and

installation quite easy and those who were challenged by the process. Finding the time to review the material was cited as a barrier by five subjects.

When asked what they liked about PDA CME, accessibility, portability and convenience were common themes cited by subjects. The small screen and the lack of interactivity were recorded by multiple subjects as disadvantages to the technology.

Two respondents suggested that reminders to use the modules would be appreciated. Two requested more modules and one looked forward to the convergence of handheld computers with cell phones.

User Comments on Satisfaction Survey

Do you have any suggestions to improve navigation around the module?

- No, it was easy
- No, navigation was pretty easy
- Hyperlinks were not available on the free mode. This would have helped (from a physician who had not entered the password provided to unlock the full featured version of the reader)
- Icons on main menu for each module
- I find that reading off the small PDA screens for any length of time is annoying because one is limited to such a small field – it is harder to give things a quick scan.
- “site map” type page

Comments on reliability

- Once downloaded this was easy to access.... When I remembered it was there!
- Once I was able to download the program on the handheld, it was easy
- Good

What are the barriers to using this technology?

- Palm Pilots - easy to steal
- Remembering to download the modules and then remembering that they are on your PDA, if you don't get to them right away.
- Have to have Palm available and I don't always have mine on my person. Have to remember it is there to use. Have to have time to use it. I don't find the text easy to read on a PDA
- Time without interruption
- Time (2)
- Problems with downloading
- Few if you are computer friendly
- None
- As with all CME, time constraints
- Technological saavy (sic), which I don't have yet. The ability to use and handle it and be comfortable with it.

What do you like about PDA-delivered CME?

- Compact, accessible
- Accessible
- Convenient- I could read it if I found myself waiting somewhere e.g. at the IWK for a delivery
- Portable, can do anytime have a few minutes
- Could access at unusual times - when flying for example
- At my convenience
- Work at own pace in spare time anywhere

- Convenient, anytime
- Handy, can be done anywhere, anytime
- I could do it on my own time and anywhere. Point of care!
- Portability
- Easy accessibility to handling day to day pt. problem

What don't you like about PDA-delivered CME?

- Myopia- tunnel vision
- Still want to write down certain figures which defeats the purpose of PDA CME
- Reading off of the small screen and not being able to scan a whole page to quickly find a certain area – rather one has to scroll through the whole thing. With the trial version of the iSilo software, the links to items further down in the module didn't work (from a physician who had not entered the password provided to unlock the full featured version of the reader)
- No reminders to do it. Too much info on small screen. Not interactive. Lonely activity – therefore somewhat dry and boring
- Lack of interactive discussion
- Small screen (2)
- Somewhat difficult to pick up where you left off
- Inability to access the CME (physician who developed problems after loading and using the package for a period)

What are some suggestions that might make this technology more useful?

- More attention to information needed during patient contact. Even restrict Palm Pilot presentation to patient contact info only.

- This CME is about the same as CME that one would read. Overall, I prefer something like the PBSGL (Problem Based Group Learning) that allows discussion and interaction with one's colleagues
- Use the full program so easier to navigate to useful part of the guidelines (from a physician who had not entered the password provided to unlock the full featured version of the reader). Make reminders to trigger use. Make it interactive – self quiz for example.
- More modules to study
- Email alerts on new ones
- As handhelds evolve, become more used, better screens, become our cell phones, they will be everywhere

Discussion

The creation of the modules was a fairly time intensive process. Current guidelines had to be summarized and edited for reading on the small PDA screen. Material was selected that was deemed to be most important, e.g. critical or new recommendations. Narrative text was excluded as much as possible so the content could be displayed in a succinct way. Extensive use was made of bulleted lists. It was estimated this process took 4-12 hours per module (some modules had been reviewed and summarized already for presentation at resident seminars). Then the modules had to be reviewed by the content experts and revisions made, which required another 2-4 hours. Formatting into HTML and then iSilo reader format was a relatively quick process because it was performed by the software itself (MS Word and iSilo).

Positive Outcomes

The surveys indicated that most of those physicians who remained in the study devoted time to the modules and referred to them to help guide their patient care. Many subjects were enthusiastic about the potential for this method of learning and expressed satisfaction with the modules. Despite the small numbers and considerable dropout rate, this study provided a statistically significant result for two modules. This suggested that new content was actually learned by users.

Even participants who had experienced difficulties with the modules, e.g. because of hardware problems, expressed a willingness to try this form of CME again. This suggested a strong motivation on the part of these subjects to exploit the availability, portability, and the flexibility of this type of CME.

Barriers

Despite a fairly extensive call for subjects, fewer than 50 physicians expressed interest in participating. The penetration of PDA use may not have been as high in the Maritimes as reported nationally, or physicians may already have felt their CME needs were well met. Less than half that initial number completed enrollment and were randomized. This likely represented a common problem in CME research: finding busy physicians who are willing to take the additional time to complete surveys and review educational material.

The requirement to pass two separate institutional Research Ethics Boards incurred considerable delay in the project, which may have contributed to the loss of three potential participants, who signed the original MSVU form but not the CDHA one. REB approval is essential for any study involving human subjects, but the increasing demands for achieving compliance create formidable hurdles for researchers. While the university based REB seemed informed on educational research and used appropriate criteria for the study, the health authority

REB seemed to have difficulty considering protocols that did not involve clinical experimentation on patients.

Three physicians in each group did not complete all aspects of the study. There were failures both to complete the pre-CME quizzes and demographic survey as well as the post-CME quizzes and satisfaction surveys. It is possible that the time required to complete the quizzes and surveys was a barrier to physician participation. The pilot studies suggested that the time required to complete a 10 item quiz was an average of less than 3.5 minutes. However, there was considerable variation, with resident times ranging from 1 minute to 10 minutes. Extrapolation would suggest that the 40 item quiz would take an average of 15 minutes to complete, but for some individuals it could be considerably longer. This might have represented too much to ask of the subjects and may have contributed to the high dropout rate. Since it had not been planned to switch from web-based quizzes to paper ones, participants were not asked about their preferences. It is difficult to know if either format, or the switch between them, contributed to non-completion. Given the many competing demands upon the time of family doctors, finding time was often cited as a barrier for participating in CME. Practicing physicians have been constantly approached to complete surveys by a variety of academic, professional and commercial organizations on top of the demands of their professional lives. It has become common now for physicians to be offered money for completing brief surveys for some companies. There is therefore considerable competition for physicians' time, and this project was not able to provide similar financial incentives for participation.

Four subjects signed the consent form, completed the pre-test studies and were randomized and sent modules but reported that they did not load them onto their PDAs. Even of the subjects who loaded the modules, time spent reviewing them was modest. One subject reported reviewing

only one module. This suggests that even physicians with an interest in participating can fail to follow through.

Two physicians reported not activating the full version of the iSilo viewer. This was a one-time matter of entering a password to unlock the advanced features of the program. Without activation features such as hyperlinks and tables, the content was more difficult to view and navigate. The instructions for activation were included in the setup letter sent with their modules, but on the third page. Neither of these subjects requested assistance with activating this feature and it was not evident they were using the limited “evaluation version” until they had completed their 4 month trial. The activation process was assumed to be a simple matter, quite consistent with standard practice in the software industry. Yet, this study suggested that such conclusions cannot necessarily be made with confidence.

One subject was not able to download and install the software package, citing difficulty with the instructions. This had not been anticipated as a potential problem. It seemed to be a simpler matter than the multistage process employed by several current software vendors. The popular commercial PDA software Lexi-Drugs required the loading of an installer to the desktop followed by rebooting of the handheld device and subsequent installation of the database through hot-syncing. The user then entered an authorization code, a much more complicated process than the one used for this study.

It must be remembered that to enter, all subjects had at least six months’ experience with their PDAs. Downloading and installation of files were fairly fundamental functions that were assumed to be achievable by experienced users. This assumption may not have been correct. In future, an assessment of specific PDA competencies at the outset may identify participants who are more likely to encounter these barriers.

Moreover, several subjects did not request assistance in the face of difficulties with the installation. This was despite ready availability of support by phone and email. A log was kept of requests for assistance and only 6 calls were received. All identified issues were corrected satisfactorily (see Appendix L, page 88).

This indicated that some physicians were not in a position to devote more than basic attention to setup, nor were they always willing to seek support for their devices. To ensure that these physicians' needs are met, setup must be very straightforward. It also suggested that reminders or support calls may be useful for some users, and face-to-face training may be useful.

One subject changed to a different, incompatible handheld platform during the course of the study. While this is expected in a domain as rapidly changing as handheld computers, it is likely relevant in any field of technology. There were few areas in this field which were not in constant evolution. This limited the applicability of educational innovations unless the initiative could be used by multiple platforms as the users preferences shifted among hardware and software options. (A case in point in this study was the university's dropping of one educational software package, WebCT, for another, incompatible system, Blackboard Learning Systems. This necessitated an alteration in the collection and analysis of data midway through the study).

Some physicians expressed a preference for a more social type of learning, where they could network with others. The convergence of cell phone technology and handheld computers may soon offer this means of interacting and collaborating with colleagues in real time. The growing popularity of online networking sites such as FaceBook™ showed how quickly virtual communities could be created and fostered.

Limitations

Caution should prevail when attempting to generalize the results to the larger population of physicians given the small numbers involved, per protocol analysis, and the use of a post-hoc analysis. There were some additional results which may inform further investigation.

At the time the study was performed, handheld computing was a mature technology, but it was certainly not in use by a majority of physicians. This factor contributed to the limited enrolment, and it is possible that a greater number of subjects could be recruited today given the increased adoption of PDAs and mobile devices like the Blackberry™ since then.

The average scores on the pre-CME quizzes were somewhat higher for the practicing physicians than encountered in the pilot study with family medicine residents. For all physicians who completed the pre-CME quiz, the mean scores and standard deviations were: diabetes 5.9 (1.7), for osteoporosis 7 (2), for hyperlipidemia 4.6 (1.5) and for hypertension 5.3 (1.6). This would reduce the power of the study to detect significant differences for a given n, given the smaller effect size.

As with all tests of statistical inference, there was the possibility of error. In this study, all randomized subjects who completed the set of assessments were analyzed in the groups they were allocated to. The only exclusions were subjects who did not complete a full data set. A true intention to treat analysis would have included results on subjects who did not complete the study, which was not done in this study. There always exists the possibility of a type 1 error, in which a false hypothesis is erroneously accepted as true. This type of inferential error is expected to occur 1 time in 20 with the 95% confidence interval used for the analysis of variance.

In this study, no difference was found on the self-efficacy of the physicians who took part. This could be interpreted as an indication that the modules had no such effect, or that the instrument used failed to detect a significant difference. The values reported by physicians were

fairly high to begin with. As 12 was the maximum score possible for self-efficacy on each module, many physicians were already expressing considerable confidence in their ability to manage these conditions before the CME was reviewed. Therefore, the tool used had limited ability to detect a small difference. Future studies might consider a post-intervention interview with the physicians to explore this area further.

CHAPTER IV: CONCLUSION

This study suggested that Maritime Family Physicians had an interest in learning about national guidelines for common problems seen in practice, with osteoporosis, diabetes, hypertension and hyperlipidemia management foremost.

These guidelines could be summarized and delivered in a format readable on handheld computers. Those who completed the project felt that the technology was acceptable and worked reliably. The ease of retrieval and use at the point of care were common themes among users. Subjects who completed the trial reported high level of use of the content in their clinical practices.

The large number of dropouts suggested however that there are substantial barriers to use for many physicians. The shortcomings of this technology included difficulty of reading material on a small screen, difficulty finding devoted time, failure to remember that the material was available on their devices, and lack of interactivity/social learning. Reminders to load and use the technology might have enhanced the uptake of the content.

Conclusive evidence for effectiveness of this means of delivery is still elusive, although there is a statistically significant result for enhanced knowledge among users of two PDA modules. Given the small effect sizes observed, a larger study with more power to detect small differences would be of interest. An attempt to incorporate suggestions made by users of this project, and to address barriers encountered, would potentially make the technology more useful and acceptable.

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Appendix A:

Pre- and Post-CME Quiz

(correct answers underlined)

1. What is the current level of the minimum fasting plasma glucose at which a diagnosis of diabetes is made?
 - a. 6.8 mmol/L
 - b. 7.0 mmol/L
 - c. 7.8 mmol/L
 - d. 11.1 mmol/L

2. Which of the following can immediately establish a diagnosis of diabetes when the casual blood glucose is 13 mmol/L?
 - a. symptoms of weight loss, polyuria and polydipsia
 - b. concurrent hypertriglyceridemia (TGL 1.7 mmol/L or greater)
 - c. concurrent obesity (BMI 30 kg/m² or over)
 - d. presence of risk factors for diabetes

3. A patient with a fasting glucose of 6 and a glucose of 11 mmol/L 2 hours after a 75 gram glucose load would be classified as
 - a. Normal
 - b. Having the metabolic syndrome
 - c. Having impaired glucose tolerance
 - d. Diabetic

4. The following management options should be considered for patients with impaired glucose tolerance to reduce the risk of progression to overt diabetes
 - a. lifestyle modifications
 - b. metformin
 - c. acarbose
 - d. all of the above

5. Which of the following is NOT a goal when treating diabetics?
 - a. A1C of 7.0 mmol/L or less
 - b. Pre-prandial plasma glucose of 4.0 to 7.0
 - c. Post-prandial levels of 5.0 to 10.0
 - d. None of the above

6. How often should healthy patients over the age of 39 be screened for diabetes?
 - a. annually
 - b. every two years
 - c. every three years
 - d. screening is not indicated

7. In a newly diagnosed Type 2 diabetic patient with a HgbA1C of 10 appropriate therapy would include
- biguanide alone
 - sulfonylurea alone
 - acarbose
 - combination of a) and b) or insulin
8. In people with mild to moderate type 2 diabetes how long should one wait trying to reach targets using lifestyle management before starting antihyperglycaemic medication?
- 12 months
 - 4-6 months
 - 2-3 months
 - 1 month
9. As of August 2006, which would be a minimum goal for a diabetic patient
- HgbA1C under 7.5, LDL 3 Total Chol/HDL ratio of 5
 - HgbA1C under 7.0, LDL 2.5 Total Chol/HDL ratio of 4
 - HgbA1C under 6.5, LDL 2 Total Chol/HDL ratio of 3
 - HgbA1C under 6.0, LDL 1.5 Total Chol/HDL ratio of 2
10. Intensive therapy for diabetes (to achieve euglycemia and an A1C level of 6 or under) is associated with
- quadruple the risk of hypoglycaemia
 - triple the risk of hypoglycaemia
 - double the risk of hypoglycaemia
 - insignificant increased risk of hypoglycaemia
11. Which of the following is NOT a major risk factor for developing osteoporosis?
- weight below 57 kilograms (125 pounds)
 - malabsorption syndrome
 - menopause before age 45
 - family history of osteoporotic fracture
12. To make the diagnosis of osteoporosis you require:
- presence of a fragility fracture
 - a bone mineral density of -2.5 or less in a post-menopausal woman
 - a) or b)
 - both a) and b)
13. Which of the following should NOT have bone mineral density testing done?
- a healthy man aged 66
 - a healthy premenopausal woman
 - a 50 year old man whose mother had osteoporotic fractures
 - a 40 year old woman with a non-traumatic vertebral fracture
14. The goal of osteoporosis treatment is to
- raise the T-score to normal

- b. reduce the fracture risk to low
- c. raise the T-score to over -2.5
- d. reduce the incidence of fractures

15. Which of the following is NOT true about an osteoporotic vertebral fracture?

- a. it may be asymptomatic
- b. it may only manifest as a loss of height
- c. it may only be detectable on an AP film of the spine
- d. it is typically involves 15-20% loss of vertebral height

16. A reported 10 year fracture risk of 21% in a postmenopausal woman is rated as :

- a. low risk
- b. moderate risk
- c. high risk
- d. extreme risk

17. What is the recommended daily intake of Calcium in persons over age 50?

- a. 1500 mg elemental calcium
- b. 1500 mg calcium carbonate
- c. 1000 mg elemental calcium
- d. 1000 mg calcium carbonate

18. The decision to treat osteoporosis with drugs is now based upon

- a. the fracture risk
- b. the T-score
- c. the patient's age
- d. the type of osteoporosis

19. Which of the following is true about raloxifene (Evista) when used in postmenopausal women

- a. it decreases the risk of fractures at all sites
- b. it increases the risk of thromboembolic disease
- c. it increases the risk of endometrial cancer
- d. it increases the risk of breast cancer in some women

20. Each of the following is true about calcitonin (Miacalcin) EXCEPT

- a. can be used to treat pain symptoms of acute vertebral fracture
- b. second line therapy for postmenopausal osteoporosis
- c. first line therapy in glucocorticoid induced osteoporosis
- d. can be used in men

21. The DASH diet is only effective in lowering blood pressure if

- a. the patient reduces sodium intake
- b. the patient loses weight
- c. both a and b
- d. none of the above

22. For hypertensives, exercise is recommended
- daily for 30 minutes
 - at moderate intensity 30-45 minutes most days of the week
 - at sustained high intensity for 30 minutes three times a week
 - so that the patient loses weight at 2 kg per month to BMI of 25 or less
23. Which drug class is NOT recommended as first line in black patients?
- thiazides
 - beta blockers
 - ACE Inhibitors
 - calcium channel blockers
24. All of the following are true EXCEPT:
- alpha blockers are not recommended as first line therapy
 - short acting calcium channel blockers are not recommended in angina patients
 - beta blockers are acceptable in cases of mild peripheral vascular disease
 - ace inhibitors are not recommended in cases of atherosclerosis
25. Which is an appropriate target BP?
- Under 140/90 in an otherwise healthy patient
 - Under 140/90 in a diabetic patient
 - Under 140/90 in a patient with nephropathy
 - none of the above are appropriate
26. When is a renal ultrasound indicated in the investigation of suspected hypertension?
- when there is renal insufficiency
 - when there are possible endocrine causes
 - when there is established vascular disease
 - in all cases
27. If you initiated therapy with a thiazide diuretic and needed to add a second agent, which if the following would NOT be recommended
- an ACE
 - an ARB
 - a CCB
 - a beta blocker
28. Which would be a recommended daily sodium intake in a hypertensive patient?
- 50 mmol
 - 100 mmol
 - 150 mmol
 - 200 mmol
29. Which of the following is true?
- Most patients will require only one drug to control blood pressure
 - Diabetics are more likely to require more than one drug for hypertension
 - Fewer drugs in higher doses are usually better tolerated than more drugs in lower doses

- d. Alpha blockers are recommended as initial therapy in the elderly
30. How many hypertensive patients will require 3 or more drugs to achieve target values?
a. 1 in 3
b. 1 in 4
c. 1 in 5
d. 1 in 6
31. How many cigarettes per day does one need to smoke to double the risk of coronary artery disease?
a. 5
b. 10
c. 15
d. 20
32. The effectiveness of statin use in preventing stroke is:
a. greater than that for preventing cardiac disease
b. equal to that for cardiac disease
c. less than that for cardiac disease
d. has not been well studied
33. Which statement is not supported by strong evidence?
a. statin use in men has resulted in a statistically significant reduction in major cardiac events in primary prevention.
b. Statin use in women has resulted in a statistically significant reduction in all cause mortality in primary prevention.
c. For men and the elderly, trials have shown a statistically significant reduction in all cause mortality when statins are used as secondary prevention.
d. Statins decrease the incidence of coronary deaths in secondary prevention.
34. As of August 2006, what were the lipid goals for patients with diabetes?
a. TotalC < 5.0 and HDL-C > 1.0
b. LDL-C < 4.5 and TotalC/HDLC < 6
c. TotalC < 4.5 and HDL-C > 1.3
d. LDL-C < 2.5 and TotalC/HDLC < 4
35. Which of the following is not true of triglyceride levels
a. They can be treated with fibrates
b. They should be treated if you cannot get the TotalC/HDL ratio to target
c. They should be treated if over 5.0
d. They can be treated with salmon oil
36. Which of the following situations is not a risk factor for rhabdomyolysis in patients treated with a statin?
a. personal or family history of hereditary muscle disorder
b. concomitant use of niacin or fibrate
c. hypothyroidism

d. African heritage

37. Which of the following is true of ezetrol (ezetimibe)?
- a. It is not absorbed so it causes only local GI side effects
 - b. it can interact with warfarin
 - c. it is safe to use in patients with liver disease
 - d. it is safe to use in patients who have had rhabdomyolysis from statins
38. Which of the following can increase HDL levels?
- a. reducing alcohol intake
 - b. a diet high in monounsaturated fats
 - c. fibrates
 - d. bile acid sequestrants
39. When should one start screening healthy women for hyperlipidemia?
- a. over age 40 or after menopause
 - b. over age 45 or after menopause
 - c. over age 50 or after menopause
 - d. over age 55 or after menopause
40. Which are the correct criteria for abdominal obesity?
- a. waist >102 cm in men or >88 cm in women
 - b. waist >100 cm in men or >90 cm in women
 - c. waist >104 cm in men or >90 cm in women
 - d. waist >104 cm in men or >96 cm in women

Appendix B:

Self-efficacy survey questions

1. I can appropriately screen for diabetes in my practice
 - a. Strongly Disagree
 - b. Somewhat Disagree
 - c. Somewhat Agree
 - d. Strongly Agree

2. I can effectively diagnose diabetes, impaired glucose tolerance and impaired fasting glucose
 - a. Strongly Disagree
 - b. Somewhat Disagree
 - c. Somewhat Agree
 - d. Strongly Agree

3. I can appropriately select the appropriate therapy for Type II diabetics
 - a. Strongly Disagree
 - b. Somewhat Disagree
 - c. Somewhat Agree
 - d. Strongly Agree

4. I can determine when a diabetic patient has achieved recommended goals for blood pressure, lipids and glycaemic control
 - a. Strongly Disagree
 - b. Somewhat Disagree
 - c. Somewhat Agree
 - d. Strongly Agree

5. I can appropriately screen for hypertension in my practice
 - a. Strongly Disagree
 - b. Somewhat Disagree
 - c. Somewhat Agree
 - d. Strongly Agree

6. I am able to diagnose hypertension according to current (2006) criteria.
 - a. Strongly Disagree
 - b. Somewhat Disagree
 - c. Somewhat Agree
 - d. Strongly Agree

7. I am able to select the appropriate therapy for hypertensives
 - a. Strongly Disagree
 - b. Somewhat Disagree
 - c. Somewhat Agree
 - d. Strongly Agree

8. I know when a hypertensive patient has achieved recommended goals for blood pressure
 - a. Strongly Disagree
 - b. Somewhat Disagree
 - c. Somewhat Agree
 - d. Strongly Agree

9. I am able to appropriately screen for dyslipidemia in my practice
 - a. Strongly Disagree
 - b. Somewhat Disagree
 - c. Somewhat Agree
 - d. Strongly Agree

10. I am able to investigate dyslipidemic patients in my practice
 - a. Strongly Disagree
 - b. Somewhat Disagree
 - c. Somewhat Agree
 - d. Strongly Agree

11. I am able to select the appropriate therapy for dyslipidemia
 - a. Strongly Disagree
 - b. Somewhat Disagree
 - c. Somewhat Agree
 - d. Strongly Agree

12. I know when a dyslipidemia patient has achieved recommended goals
 - a. Strongly Disagree
 - b. Somewhat Disagree
 - c. Somewhat Agree
 - d. Strongly Agree

13. I know when to appropriately screen for osteoporosis in my practice
 - a. Strongly Disagree
 - b. Somewhat Disagree
 - c. Somewhat Agree
 - d. Strongly Agree

14. I am able to evaluate risks for osteoporosis in my practice
 - a. Strongly Disagree
 - b. Somewhat Disagree
 - c. Somewhat Agree
 - d. Strongly Agree

15. I am able to diagnose osteoporosis according to current (2006) criteria.
 - a. Strongly Disagree
 - b. Somewhat Disagree
 - c. Somewhat Agree

d. Strongly Agree

16. I am able to select the appropriate therapy for osteoporosis

- a. Strongly Disagree
- b. Somewhat Disagree
- c. Somewhat Agree
- d. Strongly Agree

Appendix C:
Invitation Letter

Date

Dear Doctor:

There is a lot of interest among Maritime family physicians in new information technology, especially on handheld computers (PDA's). These devices now make it possible to get CME that is more convenient than ever before. Imagine getting medical information delivered automatically to your handheld. You could get CME credits simply by using your PDA to review this information, at your convenience and at your own pace. The material could even be used later as a reference when you are providing patient care.

This is an invitation to participate in a research project I am conducting on Physician Continuing Medical Education. I am attempting to investigate just such a method of providing CME using a handheld computer.

My project will seek to determine how feasible this method is, and to assess its acceptability to busy physicians in clinical practice. It is my thesis project for a Masters of Arts in Medical Education.

If you wish to participate and are selected as subject, training and support will be provided. The CME content will be automatically delivered to your PDA at intervals when you synchronize. I am currently planning to provide 4 short modules over 3-4 months. To participate as a subject, you must be a Palm-OS PDA owner who has used the device for at least 6 months. You must have an internet connection to take part and be willing to try the CME, complete some tests of your knowledge on the topics, and fill in a brief satisfaction survey of your experience.

There will be no cost to you for participating and the CME will be provided free. You may choose to discontinue your participation at any time in the process if you wish.

If you are interested in learning more, please contact me by any of the methods listed here. You can also mail this form back to me in the envelope provided.

Stewart Cameron MD
Associate Professor, Family Medicine, Dalhousie University
E-mail ([REDACTED])
Fax [REDACTED]
[REDACTED]

Appendix D:

Diabetes Case

Copyright Stewart Cameron MD 2005
Reviewed by Dr. R. Rowe January 2006

1. A 35 year old woman presents for her Pap smear. She has an unremarkable medical and family history and a normal functional enquiry. Her exam is normal except for her weight (BMI is 32). Do the guidelines recommend that she be screened for diabetes?

- a) Yes
- b) No

Answer: a) Yes. In otherwise healthy people, screening for type II diabetes is recommended every three years starting at age 40. However, in the presence of risk factors, earlier and more frequent screening is recommended. These include: having a first degree relative with diabetes, being Aboriginal, Asian, Hispanic or African, having a history of a macrosomic infant, gestational diabetes, Impaired Glucose Tolerance or Impaired Fasting Glucose, the presence of complications associated with diabetes, hypertension, dyslipidemia, obesity, abdominal obesity, polycystic ovarian syndrome, schizophrenia, or acanthosis nigricans.

2. Her fasting blood glucose is 6.8 mmol/L. What does this mean?

- a) she is definitely diabetic
- b) she is definitely normal
- c) she is neither

Answer: c). The threshold for diagnosing diabetes is a fasting glucose of 7 or greater. 6 or less is normal. Her fasting blood glucose is elevated, but is not clearly diabetic. She may have impaired fasting glucose (IFG). More testing is indicated.

3. You order a 75 gm oral glucose tolerance test. Her 2 hour result is 8 mmol/L. You can now say

- a) she is definitely diabetic
- b) she is definitely normal
- c) she is neither

Answer c). The threshold for diagnosing diabetes with a 2 hour OGTT is a level of 11.1 or greater. This patient therefore cannot be called diabetic at this stage. However, the normal 75 gm OGTT 2 hour value is under 7.8. Her 75 g OGTT value is called impaired glucose tolerance (IGT). It's possible to have one or both IGT and IFG and not be diabetic. These states are sometimes called prediabetes because they are associated with a high risk to progress to overt diabetes.

4. Is there anything which has good evidence for the delay or prevention of diabetes in the obese person with IGT?

- a) lifestyle modifications
- b) acarbose
- c) metformin
- d) thiazolidinediones

Answer: a) There is good evidence that a lifestyle modification program including weight loss and exercise should be implemented to reduce progression to overt diabetes in overweight patients with IGT. There is fair evidence for using acarbose for overweight patients with IGT to prevent cardiovascular events and hypertension (but not for preventing progression diabetes).

5. After counseling in lifestyle modification you arrange to follow your patient carefully. She returns in 6 months. She feels well and has lost some weight, with her BMI now down to 30. Her BP is 129/80. However, she describes some polyuria. A random glucose in your office is 13.

Which answer is most correct:

- a) she is diabetic and you should start therapy
- b) a fasting blood glucose is needed to confirm the diagnosis of diabetes
- c) a 75 gm OGTT is needed to confirm the diagnosis
- d) b or c

Answer: d). Her casual sugar of over 11.1 with her symptoms (weight loss, polyuria) meet the criteria for diabetes. Usually it is recommended that a second reading be done to confirm the diagnosis. This would not be done if there is any metabolic decompensation, when immediate treatment is recommended.

6. You order a fasting blood sugar which is 8. Her HgbA1C is 8.2. You diagnose her as being diabetic. Aside from more intensive dietary therapy and studies of her renal function and lipids, what diabetic therapy is indicated now?

- a) Biguanide (e.g. metformin)
- b) insulin sensitizer (e.g. rosiglitazone)
- c) alpha glucosidase inhibitor (e.g. acarbose)
- d) insulin secretagogue (e.g. sulfonylurea)
- e) any of the above

Answer: e) Any of the above, or insulin is indicated for an obese patient with mild to moderate diabetes (defined as an A1C of under 9%). For patients with an A1C above 9% starting with two agents is recommended.

7. The patient returns for follow up in another 3 months. Her A1C has fallen to 7.5. Is additional medical therapy indicated at this time?

- a) Yes
- b) No

Answer: b) No. It is reasonable to wait for 6-12 months to see if goals are reached as long as the patient is not decompensating or unstable.

8. You see her 3 months later and her A1C is 7.2. Her LDL is 3 and her total cholesterol/HDL ratio is 5. How is she doing with respect to goals for her diabetes and lipids?

- a) she has achieved goals for diabetes but not lipids
- b) she has achieved goals for lipids but not diabetes
- c) she has achieved goals for both
- d) she has achieved goals for neither

Answer: d). The goal for diabetics is an A1C of 7.0 or less. Her lipids would be acceptable for a person of low risk, but diabetics are automatically considered high risk. The goal for lipids in diabetics is an LDL under 2.5 and a total Chol/HDL ratio of under 4. She should be considered for a second diabetic drug and a lipid lowering agent.

Appendix E:
Diabetes Module

The 2003 Guidelines for the Prevention and Management of Diabetes

Summary by Dr. Stewart Cameron
Reviewed by Dr. R. Rowe January 2006

This case is part of a PDA CME project under the supervision of Dr. Stewart Cameron. It is provided for educational research and is not intended for use in any other situation.

TOPICS

- Objectives
- Take Home Messages
- Classification
- Diagnosis
- Dysglycemia
- Screening
- Targets
- Therapy

OBJECTIVES

1. Understand the criteria for screening and diagnosing Type 2 diabetes
2. Understand the criteria for diagnosing other dysglycemic states
3. Know the targets for diabetic control
4. Have an approach to therapy of Type 2 diabetes
5. Be aware of strategies to prevent diabetes in patients with dysglycemia

TAKE HOME MESSAGES

- Screen the fasting plasma glucose every three years in low-risk patients over the age of 39
- Screen earlier and more frequently in those with risk factors
- There is evidence for using lifestyle modification, acarbose, or metformin in patients with Impaired Glucose Tolerance to prevent development of frank Type 2 diabetes.
- For goals in management of blood pressure and lipids, diabetics are considered high risk (i.e. the same as patients with established atherosclerosis)
- If it can be safely achieved in your diabetic patients, aim for an A1C of 6 or less.
- In newly diagnosed type 2 diabetics with A1C over 9 it is appropriate to start two drugs immediately or insulin.

CLASSIFICATION

Type 1 diabetes is primarily a result of pancreatic cell destruction. These patients are prone to ketoacidosis.

Type 2 diabetes encompasses a range, from predominant insulin resistance with relative insulin deficiency to a predominant secretory defect with insulin resistance.

DIAGNOSIS of Diabetes:

A fasting plasma glucose of 7 mmol/L or greater OR

A casual plasma glucose of 11.1 mmol/L or greater and the presence of symptoms (unexplained weight loss, polyuria, polydipsia) OR

A plasma glucose of 11.1 or greater 2 hours after a standard 75 g. oral glucose tolerance test.

An abnormal test must be confirmed by a repeat laboratory test of one of the above (unless the patient has overt hyperglycemia and metabolic decompensation.)

Other states of dysglycemia

-A fasting plasma glucose of 6.1-6.9 mmol/L with a normal 75 g. OGTT - impaired fasting glucose (IFG)

-A normal fasting plasma glucose but a 2 hour 75 g OGTT value of 7.8-11 - impaired glucose tolerance (IGT)

-It is possible to have both impaired fasting glucose and impaired glucose tolerance, without being diabetic. Patients with these conditions can be considered to have prediabetes. Some will progress to become diabetics.

-The metabolic syndrome is a syndrome of abdominal obesity, hypertension, dyslipidemia, insulin resistance and dysglycemia. It has a prevalence in the U.S. of 20-25%. There is no agreement on an exact definition.

SCREENING:

Type 1: Not indicated except in research studies

Type 2: Assess risk in all patients annually

-Check the FPG every three years in low-risk patients over the age of 39

-Check earlier and more frequently in those with risk factors

-Risk factors: age of 40 or greater, first degree relative with DM, Aboriginal, Asian, Hispanic or African descent, history of macrosomic infant, gestational diabetes, IGT or IFG, presence of complications associated with diabetes, hypertension, dyslipidemia, obesity, abdominal obesity, polycystic ovarian syndrome, schizophrenia, acanthosis nigricans

TARGETS FOR TYPE 2 DM:

-A1C of 7.0 mmol/L or less

-Preprandial plasma glucose of 4.0-7.0 mmol/L

-2-hour postprandial plasma glucose of 5.0-10.0 mmol/L

-If it can safely be achieved, aim for normal values of A1C 6.0 mmol/L or less. Note that intensive therapy is associated with a tripling of the risk of hypoglycemia. In those at risk of hypoglycemia, it may not be appropriate to aim for normoglycemia.

-Blood pressure should be under 130 systolic and 80 diastolic. If either value is elevated, consider lifestyle modification, ACE inhibitor, ARB, cardioselective beta blocker, thiazide diuretic or long acting CCB (listed in order of preference)

-Diabetics are treated as high risk patients for lipid control: the goal for LDL is under 2.5, Total Chol/HDL ratio of under 4.

For LDL above target- lifestyle modification + statin,

For HDL < 1, TG between 1.5-4.5, and acceptable LDL - lifestyle modification + statin or fibrate

TG above 4.5 - lifestyle modification + fibrate

TARGETS For IGT and IFG patients :

- Consider for cardiovascular risk reduction

- There is good evidence that a lifestyle modification program including weight loss and exercise should be implemented to reduce progression to overt diabetes in overweight patients with IGT.

- There is evidence for use of acarbose and metformin for patients with IGT to prevent progression to overt type 2 diabetes.

THERAPY of Hyperglycemia in Type II Diabetes

a. Mild-Moderate (A1C under 9%) The CDA 2003 recommendations state “In people with type 2 diabetes, if glycemic targets are not achieved using lifestyle management within 2 to 3 months, antihyperglycemic agents should be initiated”

If overweight (BMI 25 or over) biguanide alone or in combination with insulin sensitizer, insulin secretagogue, insulin or alpha glucosidase inhibitor. If patient fails to reach target, see * below.

For non-overweight 1 or 2 agents from different classes: biguanide, insulin sensitizer, insulin secretagogue, insulin or alpha glucosidase inhibitor. If patient fails to reach target, see * below.

* If patient fails to reach targets in 6-12 months, whether obese or not, add a drug from a different class or use insulin, alone or with a biguanide, an insulin secretagogue or alpha glucosidase inhibitor. Note that insulin plus an insulin sensitizer is recommended in the guidelines but is not an approved indication because of the risk of fluid retention/heart failure.

b. Marked Hyperglycemia (A1C 9 or over), either:

2 agents from different classes: biguanide, insulin sensitizer, insulin secretagogue, insulin or alpha glucosidase inhibitor or

Basal +/- preprandial insulin.

If the first group of marked hyperglycemic patients fail to reach goals in 6-12 months, add an oral med from another class or insulin. If goals are not reached in the second group, intensify the insulin regime or add: biguanide, insulin secretagogue, insulin or alpha glucosidase inhibitor. Note that insulin plus an insulin sensitizer is recommended in the guidelines but is not an approved indication because of the risk of fluid retention/heart failure.

DRUGS FROM EACH CLASS

Alpha-Glucosidase Inhibitor: acarbose (Prandase®) This agent has less effect on A1C than the other classes

Biguanide: metformin (Glucophage®)

Insulin secretagogues:

Sulfonylureas

glicazide (Diamicon®)

glimepiride (Amaryl®)

glyburide (DiaBeta®, Euglucon®)

Non-sulfonylureas

nateglinide (Starlix®)

repaglinide (Gluconorm®)

Insulin Sensitizers (TZDs)

rosiglitazone (Avandia®)

pioglitazone (Actos®)

MONITORING

-Check the A1C every 3 months

Reference: the 2003 CDA Clinical Practice e-Guidelines at <http://www.diabetes.ca/cpg2003>

Appendix F:

Hypertension Case

Written by Stewart Cameron MD, FCFP

Reviewed and Edited by Carl Abbott MD, FRCP

You see a 48 year old non-smoking Caucasian man in your practice for a minor infection. His blood pressure has always been good in the past but you take a reading today and it is 154/98. His pulse is 76 and regular. He has no family history of heart disease or hypertension. Which of the following is not recommended at this stage?

- a) repeat the measurement at that visit
- b) enquire about end organ damage and exogenous factors such as use of alcohol and NSAIDs
- c) schedule a follow up visit in a month
- d) make a diagnosis of hypertension.

Answer d). The diagnosis of hypertension is not made on a single visit unless it is a hypertensive emergency (severely elevated pressure with signs and symptoms of end organ injury such as encephalopathy, renal failure, stroke, myocardial ischemia, aortic dissection or pulmonary edema). Some authorities recommend treatment on the first visit but only if the BP is over 200/130. The other actions are prudent. It is appropriate to recheck the reading and schedule a specific visit for the assessment of the hypertension. Some authorities recommend rescheduling the follow up in one week if the BP is over 180/110

The patient returns in a few weeks after his infection has settled. His BP reading in your office is 150/96. All of the following are appropriate except:

- a) make a diagnosis of hypertension
- b) take several more BP readings at that visit
- c) order some diagnostic testing
- d) perform a targeted physical exam

Answer a) It is not recommended that a diagnosis of hypertension be made on the first assessment visit unless, as above, it's a hypertensive emergency. It is recommended that, if the first reading is 140 systolic or over, or the diastolic reading is 90 or over, 2 more readings be taken. The first is discarded, the second two averaged. At this stage a physical exam focusing on the cardiovascular system would be reasonable e.g. do fundoscopy, check peripheral pulses, auscultate the heart and listen for bruits over major vessels. Some testing (ECG, CBC, creatinine, urinalysis, serum electrolytes, a fasting blood sugar and serum lipids) would be recommended.

The patient returns for his second assessment visit as requested in a month. His average BP over several readings in your office is 156/98. His blood work and ECG were unremarkable but his waist circumference is elevated at 106. Which is reasonable to do at this stage?

- a) make a diagnosis of hypertension
- b) arrange a captopril renal scan

- c) recommend lifestyle modification
- d) start drug treatment

Answer c: The diagnosis of hypertension can only be made on the second assessment visit if the BP is 140/90 or over and there is end organ damage, chronic kidney disease or diabetes. You can also make the diagnosis if the reading is 180/110 or over. Otherwise further visits would be required. There are three possible approaches to diagnosis at the next visit: using office BP's only, arranging Ambulatory Blood Pressure Monitoring (where available) or setting up Home/Self BP monitoring. It would be reasonable to recommend lifestyle measures at this stage. The DASH diet, weight reduction and exercise can all lower elevated blood pressure. In fact, lifestyle modification can be the sole treatment for low-risk patients with mild hypertension (<160/100). There is no indication for a captopril renal scan unless there is some suspicion of renovascular hypertension. An assessment of overall cardiovascular risk would be appropriate.

Your patient is not inclined to try ambulatory or self BP monitoring but is interested in the DASH diet. Which of the following is true?

- a) the DASH diet can lower BP even if there is no weight lost
- b) the DASH diet can lower BP even in the absence of changes to his sodium intake.
- c) it emphasizes fruit, vegetables, nuts, whole grains fish and low fat dairy products
- d) all of the above

The answer is d), all of the above. The DASH diet restricts sugars, total fats and saturated fats.

The patient resolves to exercise. What is a recommended minimum activity level?

- a) 30 minutes of moderate exercise most days of the week
- b) 60 minutes of moderate intensity exercise each day
- c) 30 minutes of high intensity exercise each day
- d) 60 minutes of high intensity exercise most days of the week

Answer a) A half hour of walking, swimming or cycling 4-7 days of the week is the current recommendation.

Your patient returns in one month. The office readings are 158/98, 156/96 and 160/97. Can you now make a diagnosis of hypertension?

Answer: In this patient there are three avenues to make a diagnosis at assessment visit 3. If using office BP's only, you would need readings of 160/100 or greater to make the diagnosis at this stage. Otherwise some more visits are recommended for this patient. (If the patient had collected home BP's the criterion to diagnose hypertension is equal to or greater than 135/85. If using Ambulatory monitoring you could make a diagnosis if the mean awake BP is equal to or greater than 135/85, or the mean 24 hour BP is equal to or greater than 130/80.)

Your patient returns monthly for the next 2 months. He has lost 5 kg, is exercising and is following a DASH diet. His average blood pressures in the office are 166/102. Which of the following would not be appropriate?

- a) making a diagnosis of hypertension

- b) continuing lifestyle therapy
- c) starting therapy with an alpha-blocker
- d) starting therapy with a b-blocker
- e) starting therapy with hydrochlorothiazide

Answer: c) It is recommended that you make a diagnosis of hypertension at this stage (assessment visit 5). Alpha blockers are not recommended as initial therapy, however. The other actions would be reasonable.

The patient is now more interested in ambulatory blood pressure monitoring. Would that be appropriate here?

Answer: It may not be necessary but could be useful. Ambulatory blood pressure monitoring can be used in

- a) untreated patients with mild to moderate hypertension and no end organ damage
- b) treated patients who are drug resistant
- c) patients have symptoms suggestive of hypotension
- d) in the presence of fluctuating office measurements

Unfortunately ambulatory blood pressure monitoring is not always available and can be expensive. Home BP readings may be useful in diagnosing white coat hypertension (an elevated BP in the office which is normal outside) and masked hypertension (a normal BP in the office when elevated elsewhere).

You decide to treat with hydrochlorothiazide 12.5 mg. The patient returns in a month and his blood pressure is 140/92. What is the goal of therapy in uncomplicated hypertension?

- a) 120/80
- b) Under 125/75
- c) 130/80
- d) Under 140/90

The answer is d) under 140/90. Under 125/75 is an appropriate goal for patients with proteinuria exceeding a gram a day. 130/80 is the target level for diabetics and those with renal disease.

When should your patient switch to follow up every 3-6 months?

- a) as soon as drug treatment starts
- b) as soon as you record one BP reading at goal level
- c) as soon as you have recorded two BP readings at goal level
- d) after three consecutive readings at goal level

Answer c). Patients started on drug treatment should be seen monthly until 2 readings are below target. Then they can be followed every 3-6 months

You recheck next month and now your patient has a blood pressure reading of 175/104. You discuss this with the patient and agree you need better control. He admits he has a problem remembering to take his pills. Which is least likely to be effective in improving compliance?

- a) taking pills as part of a regular daily activity
- b) taking a higher dose of one pill
- c) using long acting once daily dosing
- d) using fixed dose combinations where appropriate

Answer: b) It is important to provide strategies to assist your patient to adhere. Using more agents at lower doses may be better tolerated than fewer agents at high dose. (At least 50% of patients will require more than one drug to reach goals). Fixed dose combinations, and long acting once a day medications are more likely to help patient adhere to their regimes. Unit packaging, like blister packs, may also be useful. It is also recommended that you assist your patient and their family to become more involved in their treatment. Promote autonomy in monitoring and provide education (e.g. written materials) on the treatment plan.

You decide to start your patient on a once a day ACE/diuretic combination. Your patient returns monthly for 3 months and his blood pressure is consistently under 140/90. You place your patient on follow up every 3 months.

End of Case

Appendix G:
Hypertension Module

2006 Canadian Guidelines for the Management of Hypertension

Extracted by S. Cameron MD
Reviewed and Edited by Carl Abbott MD, FRCP

This module is part of a PDA CME project under the supervision of Dr. Stewart Cameron. It is provided for educational research and is not intended for use in any other situation.

TOPICS

Take Home Messages
Screening
Diagnosis
Lifestyle Treatment
Drug Treatment
Goals and Follow Up
Adherence
Ambulatory and Home monitoring
Secondary Hypertension

TAKE HOME MESSAGES

- Assess BP at all appropriate visits
- Significant hypertension can be diagnosed and treated quickly
- Mild hypertension takes 4-5 visits to diagnose
- Assess global CV risk in all hypertensives
- Lifestyle modifications are the cornerstone of therapy
- The DASH diet is as effective as some drugs.
- Weight reduction can reduce BP by 1.6 / 1.1 mm Hg for every kg lost
- 30-60 minutes per week of moderate intensity exercise can reduce BP. High intensity exercise offers no additional benefit.
- Angiotensin Converting Enzyme Inhibitors (ACEI's) are recommended for all patients with atherosclerosis
- To reach BP targets, 2/3 patients require two or more drugs, especially diabetics
- Using more agents at lower doses may be better tolerated than fewer agents at high dose
- Treat to target values: <140/90 or <130/80 in diabetics and those with kidney disease

TO BE AVOIDED

- Beta blockers are not recommended as first line treatment in those age 60 and above
- ACEI's are not recommended as first line treatment in blacks
- Alpha blockers are not recommended as first line therapy for anyone.
- Short acting calcium Channel Blockers (CCB's) are not recommended

- Avoid the combination of non-dihydropyridine CCB (cardizem, verapamil) and a beta blocker

SCREENING

- Check BP of “all adult patients” at “all appropriate visits”
 - Calibrated aneroid at eye level
 - Bladder encircles 80% of arm
 - Lower edge of cuff 3 cm above elbow crease centred over brachial artery
 - Patient sitting 5 minutes, silent, legs uncrossed, back and arm support
 - Antecubital fossa at heart level
 - Inflate cuff to 30 mm Hg above pulse
 - Listen over brachial artery
 - Release pressure at 2 mm Hg/beat
 - Systolic: first appearance of sound (K. I)
 - Diastolic: end of sound (K. V)
 - Use level of muffling (K. IV) if sounds continue down to zero
 - Once in both arms, 1’ between readings
- If random BP is up, recheck at that visit and schedule follow up (unless it’s a hypertensive emergency, see below)

DIAGNOSIS

- Hypertension Visit 1
 - History and physical exam (fundoscopic exam, auscultate heart sounds and check for bruits over major vessels, peripheral pulses).
 - Assess for end organ damage (TIA’s, CVA’s, hypertensive retinopathy, LVH, coronary artery disease, peripheral arterial disease)
 - Check exogenous factors (alcohol, NSAIDS, steroids, hormones, decongestants. MAOI’s, sleep apnea, stimulants e.g. cocaine)
- ... unless it’s a hypertensive emergency: Severely elevated BP with signs or symptoms of end organ damage or dysfunction:
- Renal failure,
 - Encephalopathy
 - Stroke
 - Aortic dissection
 - Pulmonary edema
 - MI or ischemia
 - Malignant/accelerated eclampsia
 - when immediate diagnosis & management is required

If BP stays up (visit 2)

- Order lab work
 - CBC
 - Urinalysis
 - Creatinine
 - Lytes
 - FBS
 - Lipids

- ECG
- If DM or renal disease present- order urinary protein excretion
- If renal insufficiency- order an U/S
- Consider possible endocrine causes if indicated
- If BP is 140/90 or over and there is target organ damage, diabetes or chronic kidney disease the diagnosis of hypertension can be made at this time.
- If BP is 180/110 then the diagnosis of hypertension can be made at this time.
- For BP's which are elevated but do not meet the criteria, reschedule patient for more visits. Home or ambulatory monitoring can be arranged.

If BP is still elevated (visit 3)

- If BP 160/100 or greater, diagnosis can be made
- Self/Home measurement and Ambulatory BP measurement can be used to make the diagnosis on visit three. BP's of 135/85 and over on home or ambulatory measurement will allow diagnosis of hypertension to be made. A 24 hour average exceeding 130/80 on ambulatory monitoring will do the same.
- Otherwise, 2 or 3 more visits over 6 months
- If BP <140/90 and there is no end organ damage or other risk factors, assess yearly (130/85-139/89) or two-yearly (120/80-129/84)

If BP remains above 140/90 on visits 4-5 then diagnosis of hypertension can be made.

TREATMENT

Lifestyle recommendations may be used a sole therapy in patients with Stage 1 Hypertension (140-159/90-99)

1. Smoke free environment
2. Obesity: Recommend a BMI between 18.5-24.9, a waist circumference under 102 for men and under 88 for women
3. Diet: DASH diet emphasizes fresh fruits and vegetables, low fat dairy, whole grains, fish, nuts and reduces sugars, total fats and saturated fats. DASH reduces BP in hypertensive patients by 11.4 / 5.5 mmHg on average even without changes in weight or sodium intake.
4. Sodium 65-100 mmol (100 mmol= 2.4 gm Na) per day in hypertensive patients (equivalent to 4-6 gm salt)
5. Physical activity 30-45 minutes of moderate intensity (walking, swimming, cycling) most days of the week
6. Alcohol: 0-2 drinks per day (Men 14 per week, women <9 per week)
7. Stress
 - If implicated, consider stress management
 - "Individualized cognitive behavioral interventions are more likely to be effective when relaxation techniques are employed"
8. Nutritional supplements are not recommended but potassium intake of 80 mmol/day is recommended

DRUG THERAPY

Pharmacotherapy is recommended for patients with atherosclerosis even if their BP is normal.

ACE-I's are recommended for all hypertensive patients with any form of symptomatic atherosclerosis even if their BP is controlled on another medication.

Situation	Use	Avoid
Uncomplicated hypertension	Thiazides, β -blockers, ACEI's, ARB's or long acting DHP CCB's	α -blockers as initial therapy, β -blockers in those age 60 or over, hypokalemia
Isolated systolic hypertension	Thiazides, ARB's, long acting DHP-CCB's	Hypokalemia. With diuretics use a K sparing agent
Diabetics with nephropathy (>30 mg albumin excretion/day)	ACEI's or ARB's	
Diabetics without nephropathy	ACEI's, ARB's or thiazides	
Angina patients	β -blockers +/- ACEI's.	Short acting nifedipine
Patients with prior MI	β -blockers + ACEI's	
CHF	ACEI's (or A2RB's if ACE intolerant) plus β -blockers and spironolactone	Non-dihydropyridine calcium channel blockers such as diltiazem, verapamil
Post CVA / TIA	ACEI/diuretic combinations	
Renal disease	ACEI's unless bilateral renal stenosis exists. ARB if ACE not tolerated	

Combination Therapy

At least 2/3 patients will require more than one drug to reach goals. 1/3 will require 3 or more.

If you started with a thiazide diuretic or a long acting DHP-CCB (amlodipine and nifedipine) then use an ACEI, ARB or β -blocker as your second agent and vice versa.

If patients are not responding to single agent therapy consider:

- Non-compliance or White coat hypertension. Home monitoring may be useful
- secondary causes of hypertension: renovascular, hormonal (hyperaldosteronism, pheochromocytoma, etc)
- exogenous factors (use of alcohol, NSAIDS)

Consider: statins if there are 3 or more additional CV risk factors (male, over 55 years of age, smoker, diabetic, total cholesterol HDL ratio 6 or greater, microalbuminuria or proteinuria, LVH, PVD, cerebrovascular or coronary disease, family history of premature CV disease, abnormal ECG)

Consider: - ASA once BP controlled

GOALS

- Uncomplicated hypertension: aim for systolic BP under 140, diastolic BP under 90
- Non diabetic renal disease: <130/80
- If patient has proteinuria >1 gm/day, <125/75
- Diabetes 130/80

Follow Up

- Lifestyle modification: recheck 3-6 months unless BP “higher”
- On Rx: monthly until 2 readings below target, then every 3-6 months

Ambulatory Measurement may be indicated when an office induced increase in BP is suspected e.g.:

- untreated patients with mild to moderate hypertension and no end organ damage
- treated patients who are drug resistant
- patients have symptoms suggestive of hypotension
- in the presence of fluctuating office measurements

Home Blood Pressure Monitoring

- Consider for non-compliant patients, in renal disease, where white coat effect is suspected, or diabetics
- Should take multiple readings morning and night
- Use validated devices approved by AAMI, BHS or IP
- Train, observe, calibrate
- 136/83 at home is equivalent to 140/90

ADHERENCE

Compliance with the treatment plan can be improved with a multi-faceted approach comprising

- Assisting the patient to adhere
 - Teaching them to take pills as part of a daily routine
 - Providing simple pill regimes with once a day dosing
 - Using combination meds and unit-of-use packaging where appropriate
- Enhancing patient engagement through
 - Encouraging them to take responsibility for regular measurement
 - Educating patients and families about the disease and their treatment plan
- Office strategies such as
 - Enquiring about compliance on each visit
 - Making telephone follow ups
 - Communication with workplace health providers if present for monitoring

SECONDARY HYPERTENSION

Renovascular hypertension

Suspect with

- Sudden onset or accelerated hypertension in an under 30 or over 55 year old
- If an abdominal bruit is present
- If the patient is drug resistant (3 agents)
- If creatinine rises with an ACEI or A2RB
- Recurrent pulmonary edema associated with hypertensive surges

If suspected do a captopril renal scan, Doppler sonography, MRI (or CT) angiography,
Hyperaldosteronism

Suspect if a hypertensive has

- Low [K+], spontaneously under 3.5 mmol/L
- Low [K+], post-diuretic, under 3.0

- If are drug resistant (3 agents)

If suspected, assess plasma aldosterone and renin: morning samples, taken in sitting position after resting 15 minutes.

Pheochromocytoma

Suspect in hypertensive cases where BP is

- Paroxysmal/severe/sustained/refractory
- Assoc with catecholamine symptoms (headaches, palpitations, sweating, panic, pallor)
- Triggered by MAOI's, B-blockers, micturition, changes in abdominal pressure
- Adrenal masses, neurofibromatosis, MEN 2A, 2B, von Hippel-Lindau disease

Order 24 h urinary metanephrine. (VMA no longer considered adequate)

Reference: The 2006 Canadian Hypertension Education Program Guidelines at www.hypertension.ca

Appendix H:

Osteoporosis Module

Summary by Dr. Stewart Cameron MD, FCFP

Reviewed by Dr. D. Theriault

This case is part of a PDA CME project under the supervision of Dr. Stewart Cameron. It is provided for educational research and is not intended for use in any other situation.

TOPICS

Objectives

Take Home Messages

Definition

Risk Factors

Diagnosis

Assessment

Risk Table

Summary Treatment Guidelines

Secondary Osteoporosis

References

OBJECTIVES

1. Understand the criteria for diagnosing osteoporosis
2. Understand the risk factors for osteoporosis
3. Review the criteria for ordering and interpreting bone mineral density testing
4. Understand the primary and secondary treatment options for osteoporosis in men and women and when they are indicated.

TAKE HOME MESSAGES

1. The traditional diagnosis of osteoporosis was based on either
 - a T-score of -2.5 or less in a postmenopausal woman or
 - the presence of a fragility fracture
 - *More recently the trend is to assess the 10 year fracture risk.*
2. The purpose of screening and treatment is to reduce fractures, not to treat the BMD.
3. Alendronate (Fosamax®) and risendronate (Actonel®) are first line therapies for reducing the incidence of osteoporotic fractures as is Raloxifene for selected postmenopausal women.
4. These guidelines refer only to postmenopausal women. For management of risk factors and initiation of treatment in children, pediatric consultation is recommended.

DEFINITION

Osteoporosis is a deficiency in bone strength which predisposes a person to increased risk of fracture. It results from decreased bone density, quality or both.

Osteoporosis is further subdivided into primary (e.g. post-menopausal) or secondary (e.g. due to glucocorticoid use or any of several dozen systemic illnesses- see appendix).

RISK FACTORS

These describe those at increased risk of fracture. (The list is used both to determine who should get densitometry as well as who should be treated, as outlined later)

Major

Age 65 or over
 Vertebral compression fracture
 Fragility Fracture over age 40
 Family History of osteoporotic fracture (especially maternal hip fracture)
 Propensity to fall
 Osteopenia on x-ray
 Systemic glucocorticoid therapy of at least 3 months' duration
 Malabsorption syndrome
 Primary hyperparathyroidism
 Hypogonadism
 Menopause before age 45

Minor:

Weight below 57 k (125 lb)
 Weight loss of >10% of weight at age 25
 Smoking
 Excess alcohol intake
 Excess caffeine intake (more than 4 cups coffee/day)
 Low calcium intake
 Rheumatoid arthritis
 History of clinical Hyperthyroidism
 Long-term anticonvulsant therapy.
 Long-term heparin therapy

DIAGNOSIS

The diagnosis of osteoporosis must be considered in light of the patient's fracture risk.

The T-score indicates the number of standard deviations from the mean of bone density in healthy young adults.

In Postmenopausal women:

A T-score over -1.0 is normal

T-scores between -2.5 to -1.0 represent *osteopenia*

T-scores of -2.5 or less represent *osteoporosis*.

In Premenopausal Women and men:

Normal is greater than -2.5 . Less is *reduced bone density*

A more useful way to assess your patient is through the 10 year fracture risk calculation. In a way similar to cardiovascular risk, the risk of fracture can be determined as low (<10%), moderate (10-20%) or high (>20%). This may become the preferred method for reporting BMD testing. It is restricted to

- adults over fifty years of age
- tests done on central DXA machines (not other densitometry techniques)

Remember that the value is for risk assessment and does not equate with need to treat with medications

Bone quality cannot be measured, but if a patient has a *fragility fracture* quality is presumed to be poor. A fragility fracture is one incurred without trauma or minimal force (e.g. a fall from standing height at walking speed or less).

Patients with a T-score below -2.5 and a fragility fracture are considered to have severe osteoporosis.

Bone densitometry should be performed with a DXA densitometer assessing the hip, spine and forearm only. Peripheral devices (e.g. which examine the heel or hand) are not suitable for making the diagnosis. There is some variability in measurement between densitometers and baseline and follow-up testing is recommended with the same machine and technician. Because densitometry measurements have inherent error, a value called the least significant change (LSC) will become the standard for reporting. Only changes in BMD which exceed the LSC have a 95% confidence that the change is real.

Discrepancies between these sites is common. Bone turnover in the spine is greater than at the femur, so bone loss or gain may be seen first in the spine.

A osteoporotic vertebral compression fracture is a non-traumatic loss of vertebral height of 20% or more (15% by some definitions). It may be asymptomatic and over 60% may not come to clinical attention.

A historical height loss is the amount lost from a person's maximum height over their lifetime. A loss of > 4 cm in someone under age 60 or > 6 cm in someone over 60 is a concern.

Prospective height loss is the amount lost during a period of observation. The loss of > 2 cm during observation, especially if 3 years or less raises concern for hidden fractures.

Such fractures may only be evident on lateral spinal x-rays (termed a radiographic vertebral fracture). If it is symptomatic and confirmed by x-ray it is called a clinical vertebral fracture.

ASSESSMENT

All men over 50 and all post-menopausal women should be assessed for risk factors.

These people should have BMD done:

- all men and women 65 and over
- anyone who has been on systemic glucocorticoids (2.5 g prednisone per day or more) for 3 months or more
- anyone over 40 with a fragility or vertebral fracture (also a criterion for treatment according to some experts)
- men over 50 with 1 major or two minor risk factors
- postmenopausal women with 1 major or two minor risk factors

These people should NOT have BMD done:

- men under 50
- premenopausal women
- men and women under 65 with no risk factors
 - ... unless there is a risk for secondary osteoporosis (see list)

RISK TABLE for women

Nearest Age	Lowest T Score from all sites		
	Low Risk <10%	Moderate Risk 10-20%	High Risk >20%
50	> -2.3	-2.3 to -3.9	< -3.9
55	> -1.9	-1.9 to -3.4	< -3.4
60	> -1.4	-1.4 to -3.0	< -3.0
65	> -1.0	-1.0 to -2.6	< -2.6
70	> -0.8	-0.8 to -2.2	< -2.2
75	> -0.7	-0.7 to -2.1	< -2.1
80	> -0.6	-0.6 to -2.0	< -2.0
85	> -0.7	-0.7 to -2.2	< -2.2

TREATMENT

Goals

- The goal of therapy is to prevent fractures.
- Treatment is now based not on BMD, but on the patient's 10 year risk of fracture.
 - The risk of fracture is determined from a table based on their age and their lowest T score from any of the 4 sites.
 - Additional clinical issues may increase the risk of fracture. If a patient has a fragility fracture after age 40 or has a history of systemic steroid use exceeding three months, they are moved to the next higher risk category. If a patient has both they are put into the highest risk category.

The current guidelines do not specify who to treat.

Generally speaking:

- patients in the high risk category for fractures should be treated
 - patients at low risk should not be treated (regardless of T score)
 - Clinical judgment should be used in those in the intermediate risk category
- Use of glucocorticoids in adult patients.
 - Some experts recommend treatment be considered in anyone receiving 3 months' treatment with 2.5 mg. prednisone or more a day. Bisphosphonate therapy is used unless there are contraindications.
 - Some guidelines on the other hand suggest that these patients have their BMD measured rather than starting directly on treatment.
 - There is agreement that those with a history of prednisone use at ≥ 7.5 mg for 3 months or more should be started on a bisphosphonate.

What to Use

All patients require adequate calcium and Vitamin D intake, whether on treatment for osteoporosis or not. Calcium and vitamin D are not as effective as anti-resorptive therapy. Calcium and Vitamin D alone will slow the rate of bone loss but will not prevent it. In persons over 50, 1,500 mg of elemental calcium (equivalent to 5 cups of milk) is recommended daily along with 800 IU of vitamin D3. This intake does not increase the risk of renal calculi.

First Line Therapy Summary

Alendronate (Fosamax®) and risendronate (Actonel®) are first line therapy for prevention of osteoporosis in postmenopausal women with low bone density, prevention of glucocorticoid-induced osteoporosis, treatment of postmenopausal women with osteoporosis, treatment of glucocorticoid induced osteoporosis, and treatment for men with low BMD or osteoporosis.

Raloxifene (Evista®) is first line therapy only for postmenopausal osteoporosis in women under 70 and prevention of further bone loss in postmenopausal women with low BMD.

Specifics: alendronate and risendronate

- are bisphosphonates which reduce bone resorption
- can be given weekly (although the studies on reducing fracture rates have all been done with daily dosing).
- contraindications include hypocalcaemia, renal insufficiency, pregnancy and breast feeding and delayed esophageal emptying.
- common side effects include nausea, dyspepsia and diarrhea.
- should not be taken within one hour of taking calcium or antacids.
- can cause esophageal ulceration if not taken correctly. While there are several dosing regimes, for fasting morning dosing it is recommended that these drugs be taken with water (at least 8 fluid oz with alendronate and 4 fluid oz for risedronate) and the patient not lie down, take other meds or eat for 30 minutes. Patients may lie down only after eating some food (or after 1 full hour).

Dosages Alendronate (Fosamax®): 10 mg/day or 70 mg once weekly

Risendronate (Actonel®): 5 mg/day or 35 mg once weekly

Specifics: Raloxifene (Evista®)

- a selective estrogen receptor modulator (SERM)
- estrogenic effects on bone, lipids and clotting
- anti-estrogenic effects on endometrial and breast tissue
- contraindicated in women with venous thromboembolic disease
- common side effects include hot flushes and leg cramps
- serious side effect is venous thromboembolism
- may reduce the risk of breast cancer and cardiovascular events in certain high risk women.
- A first line therapy only in post-menopausal women under age 70 without pre-existing fracture

Second line therapy shows evidence for increasing bone mass, but not fracture rates. It includes:

Etidronate (Didronel® and Didrocal®, which includes calcium)

Hormone Replacement Therapy

- Increases BMD at all sites measured in menopausal women.
- evidence for reducing fracture rates is fair.

The Osteoporosis Society of Canada recommends HRT as

- first line preventative therapy for women who undergo menopause before age 45.
- first line therapy for prevention of osteoporosis in postmenopausal women with low bone density,
- second line therapy for treatment for postmenopausal women with osteoporosis although the risks of using HRT for osteoporosis treatment probably outweigh the benefits.

Calcitonin (Miacalcin®) nasal spray

- recommended for pain management in acute vertebral fracture
 - second line therapy for post-menopausal and glucocorticoid induced osteoporosis.
- Most specialists consider it an inferior treatment for postmenopausal osteoporosis.
- Can be used for glucocorticoid induced osteoporosis only when bisphosphonates are contraindicated or not tolerated.
 - Not studied in men, can be used only when bisphosphonates are contraindicated or not tolerated.

SUMMARY TREATMENT GUIDELINES

Postmenopausal Osteoporosis in Women over age 70 or with pre-existing fracture:

First Line: alendronate (Fosamax®), risendronate (Actonel®)

Second Line: raloxifene (Evista®), HRT, etidronate (Didronel®), calcitonin

Postmenopausal Osteoporosis in Women under age 70 and without pre-existing fracture:

First Line: alendronate (Fosamax®), risendronate (Actonel®), raloxifene (Evista®)

Second Line: HRT, etidronate (Didronel®), calcitonin (Miacalcin®)

Glucocorticoid Induced:

First Line: alendronate (Fosamax®), risendronate (Actonel®)

Second Line: etidronate (Didronel®), calcitonin (Miacalcin®)

Men: alendronate (Fosamax®)

Retesting BMD

- no good evidence on when to perform this
- guidelines suggest
 - o in 1 year for those with rapid bone loss (primary hyperparathyroidism, glucocorticoid use, immobilization)
 - o in 1-2 years for those on anti-resorptive therapy

- In 2-3 years for those with a normal T-score

SECONDARY OSTEOPOROSIS

There are a number of medical conditions for which risk of osteoporosis is increased.

Endocrine

Acromegaly
Addison's disease
Cushing's syndrome
Gonadal insufficiency
Hyperparathyroidism
Hyperthyroidism
Insulin-dependent diabetes
Turner's syndrome

Gastrointestinal

Celiac Disease
Crohn's disease
Gastrectomy
Malabsorption syndromes
Nutritional disorders
Parenteral nutrition
Severe liver disease, especially primary biliary cirrhosis
Cystic fibrosis

Hematological

Congenital Porphyria
Hemochromatosis
Hemophilia
Lymphoma and Leukemia
Multiple myeloma
Pernicious anemia
Thalassemia

Renal

Renal failure
Renal transplant

Respiratory

Sarcoidosis
COPD
Cystic Fibrosis

Drugs

Adrenocorticotropin
Aluminum
Anticonvulsant

Chemotherapy/cytotoxic drugs
Excessive thyroxine
Glucocorticosteroids
Prolonged Depo-Provera use in teens
Heparin
LHRH analogs (used for prostate cancer)
Lithium
Tamoxifen (premenopausal use)
Anti-rejection drugs (post transplantation)

Miscellaneous

Amyloidosis
Anorexia nervosa
Endometriosis
Epidermolysis bullosa
Hypophosphatasia
Mastocytosis
Multiple sclerosis
Poor health/fragility
Osteogenesis imperfecta
Post-transplant

Neurological

Duchenne' Muscular Dystrophy
Cerebral Palsy
Quadriplegia
Non-weight bearing/Neuromuscular diseases

Rheumatological

Ankylosing spondylitis
Idiopathic scoliosis
Rheumatoid arthritis

REFERENCES

This module is based on the Osteoporosis Update Workbook from the Dalhousie University Division of CME. It is used and adapted with their permission. It has been revised with new (2004 and 2005) recommendations from the Osteoporosis Society of Canada under the guidance of Dr. Diane Theriault.

The original Dal CME document is available at <http://cme.medicine.dal.ca/files/OPBook.pdf>

The OPC Guidelines are at <http://www.osteoporosis.ca>

Appendix I:

Hyperlipidemia Module

Summary of recommendations for the management of dyslipidemias and the prevention of cardiovascular disease

Summarized by S. Cameron MD, Dalhousie Family Medicine

Reviewed and edited by Dr. Stephanie Kaiser May 2006

Updated October 2006

This case is part of a PDA CME project under the supervision of Dr. Stewart Cameron. It is provided for educational research and is not intended for use in any other situation.

TOPICS

Objectives

Take Home messages

Who to check

How to assess risk

 Assessing Basic Risk

 Other risks

 the ABI

 The Metabolic Syndrome

How to treat

 General treatment

 Treatment Drugs

 Goals of treatment

 Intervention Levels

 Testing on statins

 Rhabdomyolysis risks

 Preventing myopathy

Other Issues:

 Triglycerides

 Homocysteine

 Low HDL levels

 Who to Refer

OBJECTIVES

1. Know the criteria for lipid screening
2. Understand the method of assessing risk for cardiovascular disease
3. Know the risks of treatment
4. Know the goals for treatment

TAKE HOME MESSAGES

1. The primary target for treatment is now the LDL level. It should be under 2.0 in the high risk patient. The Total C/HDL-C ratio is now a secondary target.
2. The intervention level for patients at low risk has been relaxed to an LDL of 5 or over.
3. People with Type 2 diabetes, chronic kidney disease or existing atherosclerosis are considered high risk and treatment is recommended (lifestyle, diet and immediate use of drugs)
4. Diet should decrease total energy consumption, especially refined carbohydrates and sugars, saturated and trans fats. Fruit, vegetables, omega-3 fatty acids, poly- and monounsaturated fats are promoted.
5. Statins are the first line drug treatment
6. Women should not be put on HRT to lower CV risk (primary or secondary prevention). Women already on it for over 5 years and aged 55 or more should be considered for discontinuation, as should women awaiting CABG or angioplasty. Discuss risks and benefits with patient
7. Published evidence is typically restricted to cardiac disease. There have been no large trials which look at stroke alone as a primary endpoint.
8. Use your judgment- screen anyone you feel should be assessed.

WHO TO CHECK

Lipid Screening: Recommended for:

- men 40 and over
- women 50 and over or after menopause
- diabetics
- hypertensives
- smokers
- those with abdominal obesity (waist >102 cm in men or >88 cm in women)
- those with a family history of premature cardiovascular disease
- exertional chest discomfort, dyspnea or erectile dysfunction
- chronic kidney disease or SLE
- Any physical sign of hyperlipidemia (xanthelasma, xanthoma, corneal arcus)
- Any evidence of atherosclerosis, symptomatic or not (see below for how to check)
- children with a family history of monogenic lipid disorder e.g. familial hypercholesterolemia, chylomicronemia.

ASSESSING RISK

- First, determine the ten year risk of coronary artery disease using a risk calculator. (The STAT! Cholesterol™ calculator, a separate PDA program, was installed with your CME modules). The risks are based on North American Caucasians under age 79.
- Categories are based on the risk of a CV event in the next 10 years.
- High risk is defined as 20% or greater
- Moderate risk is over 10 but under 20%
- Low risk is 10% or less
- Anyone who has Type 2 diabetes, atherosclerotic disease or chronic kidney disease is automatically in the high risk category (i.e. there is no need to use a calculator!)

- It is recommended that you check the ankle-brachial index to test for asymptomatic atherosclerosis. (see below for how to check)
- If they have risk factors, it may be useful to get a carotid echo, an ECG or an exercise stress test in men over 40 or women over 50, to detect asymptomatic atherosclerosis.
- South Asians and First Nations people have a higher risk of developing CAD.

Other Risk Issues

... can push a patient into a higher category or require more aggressive treatment

- Risk is doubled in those with a family history of premature cardiovascular disease (CAD in first degree relatives: men under 55 and women under 65)
- Presence of the metabolic syndrome ([definition](#)) increases risk
- Taking oral hormone replacement therapy increases the risk level
- There are other risk factors including apolipoprotein B, lipoprotein (a), homocysteine and hsC-reactive protein. The value of these results is debated by specialists and are not routinely ordered.
- Smoking. According to the INTERHEART Study
 - 6-10 cigarettes/day increases CV risk 100%
 - 20/day increases risk 400%
 - 40/day increases risk 900%

Asymptomatic atherosclerosis

can be detected by the *ankle-brachial index (ABI)*. Place a BP cuff above the ankle. Using a Doppler sensor, measure the systolic BP in the dorsalis pedis or posterior tibial artery. Divide the value by the same reading in the brachial artery. If the ratio is less than 0.9 there is a high likelihood the patient has peripheral vascular disease. This makes them higher risk for developing CV disease.

The Metabolic Syndrome.

There are several different definitions of this.

The NCEP3 definition is 3 or more of:

- Abdominal obesity (waist >102 cm in men or >88 cm in women)
- TGL 1.7 or greater
- Low HDL (under 1 mmol/L in men or 1.3 in women)
- BP of 130/85 or greater
- Fasting Glucose of 6.1-7.0

TREATMENT GENERAL

- Diet designed to decrease energy consumption, especially refined carbohydrates and sugars. Aim to get BMI under 25 kg/m².
- Lifestyle changes
- Drug treatment:
 - Those in the high risk category should start statin therapy immediately.
 - The equivalent of 40 mg/day of simvastatin should be used.
 - If the maximum recommended statin dose doesn't get the goal levels, consider augmenting with ezetimibe, niacin or a resin. Statins with fibrates can be used but require close monitoring. This combination can increase creatinine levels

Treatment Drugs

- Statins: (simvastatin, atorvastatin, lovastatin, pravastatin, rosuvastatin, fluvastatin) First line, steady state in 6 weeks. Monitor results and LFT's q 6-12 months
- Niacin (nicotinic acid) Cheap, non-prescription, can increase HDL, useful combination with statin, proven efficacy, nuisance and serious side effects possible, should monitor LFT's more frequently
- Resins: (colestyramine, colestipol) Nuisance side effects common
- Fibrates (bezafibrate, fenofibrate, gemfibrozil) Avoid in patients with renal insufficiency. Use cautiously and frequent monitoring, in combination with statins
- Ezetimibe: Blocks absorption in gut. Originally thought to have few side effects but recent warnings suggest an association with myalgia, rhabdomyolysis, hepatitis, pancreatitis, thrombocytopenia
- Salmon oil (1-3 g TID) or omega-3 fatty acids is a useful combination with statins for hypertriglyceridemia.

There is good evidence that statins can reduce major cardiac events when used for primary prevention in men. There is insufficient evidence that statins reduce all cause mortality in this population.

There is insufficient evidence that statins reduce major cardiac events when used for primary prevention in women and the elderly.

There is good evidence that statins reduce all cause mortality when used for secondary prevention in men, diabetics and the elderly.

GOALS

Risk	Primary Target: LDL	Secondary Target: TC/HDL
High (20% or more)	< 2.0	< 4

INTERVENTION LEVELS

Risk	Intervene if LDL	Intervene if TC/HDL
Moderate (10-20%)	3.5 or over	5 or over
Low (under 10%)	5 or over	6 or over

Testing while on Statins

- LFT's baseline, 8-12 weeks, then periodically
- Stop statin if progressive rise in ALT, AST or reach 3x upper limit normal

- Try another class of drug

Risk factors for Rhabdomyolysis

- History of hereditary muscular disorders
- Previous muscle toxicity with another statin
- Concomitant use of fibrate or niacin
- Severe hepatic impairment
- Severe renal impairment
- Hypothyroidism
- Small framed females
- Alcohol abuse
- Asians
- Patients over 70
- Excessive physical exercise
- Diabetes with fatty liver
- Surgery and trauma
- Frailty
- Situations increasing plasma statin levels

Preventing Myopathy

- Advise patients to report symptoms
- Flu like illness
- Myalgia
- Weakness
- Dark urine
- Avoid excessive grapefruit juice
- Stop drug, rehydrate and seek help if above occur
- Avoid combinations
- Start low, go slow

Issues and warnings with Crestor

- Caution with 40 mg dose
- Contraindicated if risk factors for rhabdomyolysis
- Restrict prescribing to specialists
- Start at 5 mg/day in Asians, renal patients, those requiring less aggressive treatment

OTHER ISSUES:

TGL

- There is no recommended target level for triglycerides, but they may need treatment:
 - o if they are very high (over 10) because of the risk of pancreatitis or
 - o you can not get the total cholesterol:HDL-C ratio to target
 - o can be treated with a fibrate, niacin or salmon oil
 - o Alcohol and oral estrogens can elevate TGL levels and should be avoided if they are up.

Homocysteine

- While it may play a role in CV disease there is no indication at present to screen for homocysteine levels

Low HDL

- Low HDL levels can be improved by exercise, weight loss, a diet rich in monounsaturated fats, niacin and moderate alcohol intake. Quitting smoking will raise HDL.

Referral

- Consider referral for: resistant cases, extreme hyperlipidemia, unexplained atherosclerosis

References:

Can J. Cardiol Sept 2006; 913- 927

CMAJ Oct 28, 2003;169 (9)

NCEP3 is the National Cholesterol Education Program of the U.S. National Heart, Lung and Blood Institute. (<http://www.nhlbi.nih.gov/guidelines/cholesterol/>)

Appendix J:

Instructions

Dear PDA CME participant,

Thanks for completing your pre-CME quizzes. Your PDA CME is attached to this e-mail!

One file needs to be saved on your PDA. It should be done in the usual way you load files. (If you need to review how to do this there is a help sheet. It is also attached as an MSWord document called Help.doc).

When you save the program to your PDA it will appear as PDA CME A or PDA CME B.

Just tap on it and it will unpack itself automatically. It will install a reader program called iSilo, complete with a manual, two CME modules and a case study. (There may be another program to calculate heart disease risk if you got the lipid module). You only need to do this once, and the installer removes itself from your PDA.

From then on, you access your CME by going to the new iSilo program you will have on your PDA.

I have tested this with several models of PDA and it seems to work fine. If you have any problems call me at [REDACTED] or send an e-mail to [REDACTED]

Thanks for taking part

Stewart Cameron

Appendix K:

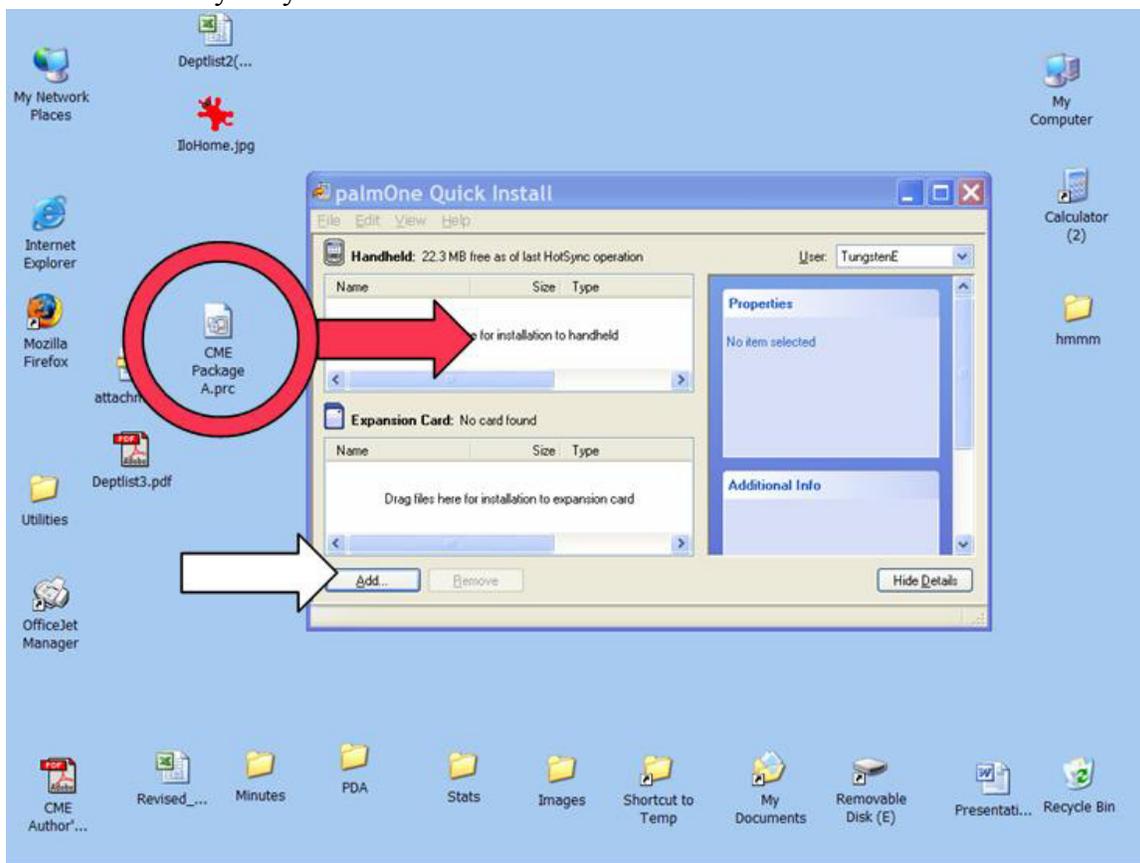
Help

Help and Supplemental Information for Dr. Stewart Cameron's PDA CME Study

How to Install the file on your PDA.

Simply save the attachment on the desktop of the computer where you sync your PDA. It will be a file called "CME Package A.prc" or "CME Package B.prc". Open the "PalmOne Quick Install" program on that computer. (If you don't have that program you can also open "Palm Desktop" and select the "Quick Install" button.)

You can drag the CME file into the Handheld Window (like the red circle and arrow) or click the "Add" button (white arrow) and tell the program to look on your desktop for it. It will be installed next time you sync.



Your installer might look slightly different depending on the version you are using.

The package itself is only about 400 kb. It expands but doesn't require a lot of space. There is an iSilo manual in your documents but you do not need to read it to use the program and you can delete it if you need to.

iSilo Features

iSilo is easy to use. Just tap on the iSilo icon in your PDA menu to start it.

When you first open iSilo you should tap the "Unregistered" button and enter the following license registration code to unlock all its features: UKIA-WOPC-UYT8-W4X4 (including dashes) Again, you should only have to do this once.

Just tap on the name to open your modules (names like DM Case, DM Module, Lipid module, Osteoporosis or BP Case, BP Module). I recommend reviewing the modules you received at your convenience.

If you tap on linked text you will jump to the indicated place in the document.

This way you can go back to them at any time to quickly review the information, even with a patient in front of you at the office.

You can scroll up and down in your module by dragging your stylus up and down on the screen. You can also move the slider bar on the right, or use a jog button if your PDA has one. You can choose whether the program scrolls a line at a time or a whole screen.

You can enlarge or reduce the size of the print by tapping on the document name at the top of the screen, and selecting “Options”, then “Font” then “Size”. There are several other options you can play with in this menu.

You do not need to know about all the following features but getting familiar with a few will help speed up your reading.

At the bottom of your document are several buttons to navigate around.

If part of your document is too wide for your screen, a slider bar allows you to view it.

- The “X” at the bottom of the screen closes the document you are in.
- The two page icon allow you to copy sections to another document.
- The magnifying glass will search for words in your document.
- The little bookmark allows you to jump to sections with bookmarks
- The forward and back arrows move you to the previous and following screens you have visited, just like a web browser.
- The little home takes you back to the start of your current document.
- The counter shows where you are in the document. It counts pages or percentages.



iSilo

can be customized to suit your preferences. Tap on the name of the document you are in and select “Options”, then “Interface”. For instance, if you are left-handed, you can move the slider bar to the left side. If you check the “Default” box your preferences will be saved for all documents.

The iSilo program is free for you to keep. There are many free medical programs for the PDA written in iSilo format. After the study I will send you a list of where to get more iSilo documents for your PDA

If you want to learn more about iSilo, there is an online tutorial at www.isilo.com/Support/Tutorials/QuickStart/Quickstart.htm

Appendix L:

Log File of Support

September 15, 2006 Subject left a voice mail message to report they were unable to save the PDA CME attachments to her device, A Sony Clié. *Action:* I spoke with the subject in person Monday 18th and watched as they attempted to save the attachment from their mail program.

Diagnosis: The subject did not know how to save an attachment to the desktop, only how to open them, and the mail program used did not know how to handle PRC files. *Solution:* I showed the subject how to save the attachment to the desktop. We did this and when the subject double clicked on the attachment, the sync program understood what to do and readied it for synchronization.

January 5, 2007. When asked to complete the exit studies, the subject reported they had never been able to load the package on their PDA. After three tries, each resulting in a PDA crash, the subject had abandoned the effort without seeking help.

Action: I replied asking for details on January 8th. The subject replied on the same day. The subject indicated that they had been able to load the package B onto their machine but the device crashed when they tried to open it.

Diagnosis: Assumption that this was a problem with the Nutshell installer.

Solution: The subject agreed to try loading the individual files. These were sent on January 11, 2007. The subject replied by e-mail that everything worked that time and they have been using the modules since.

January 15, 2007. The subject made an appointment to see me about the PDA CME.

Action: We met and I reviewed the subject's device. The subject had loaded the nutshell installer and successfully unpacked it. The subject had registered their copy of the iSilo program, but was unsure of how to proceed.

Diagnosis: The subject did not know where to find the modules.

Solution: I showed the subject where the modules were stored, in the iSilo program's document folder. This was on the document iSilo is Easy to Use sent with the original package but the subject had forgotten.

January 17, 2007. The subject e-mailed to say password had not worked on Web CT for the post CME surveys.

Action: Tested and found to work fine. Responded by e-mail reminding the subject to use lower case when logging in and sent an MSWord document attachment with instructions.

Solution: The subject was able to log on and complete exit survey Jan 17

January 18, 2007. Examined exit surveys of two physicians. They had indicated that they were using the unregistered version of iSilo and so did not have access to the advanced navigation features such as hyperlinks and tables.

Solution: sent a reminder e-mail to all physicians who were sent modules and were still enrolled giving them the registration code.

February 2, 2007 The subject paged me needing assistance installing package from their e-mail.

Action: Walked the subject through the steps on a phone call.

Solution: Package successfully saved to the subject's PDA, installed and iSilo was registered. Briefly discussed navigating through iSilo.