POLYPHARMACY IN OLDER ADULTS: THE EFFECTIVE DESIGN OF AN ONLINE INFORMATION RESOURCE

by

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Polypharmacy -- problems associated with a regimen of multiple drugs, both prescription and over-the-counter -- is a major problem in the elderly (65+) , and will become increasingly prevalent over the coming decades as the U.S. population ages. Polypharmacy is associated with increases in mortality, hospital ER admissions, auto injuries, falls, cognitive deterioration, adverse drug reactions, drug regimen non-compliance and nursing home admissions. While the patient has ultimate responsibility for taking medications as prescribed, there are many steps that physicians and pharmacists can take to increase drug compliance and decrease polypharmacy.

This project designs and implements a Web site aimed primarily at an audience of older adult users that provides information on the topic of polypharmacy. The site also includes a subsection for healthcare professionals and a bibliographic database of polypharmacy research.

Headings:

Web sites -- design

Information services -- special subjects -- aged

Information systems -- special subjects -- drugs

Polypharmacy in Older Adults:

The Effective Design of an Online Information Resource

Polypharmacy is a medical term that literally means "many drugs." There is some debate over the precise definition of the term, but it either refers to several medications being taken concurrently, or the prescribing of excessive medications (Colley & Lucas, 1993). These can include prescription medications, over-the-counter (OTC) products like antacids and laxatives, and dietary supplements such as vitamins and herbs. Of course, what can be considered excessive in one patient may not be excessive in another. For a comprehensive discussion of the various definitions of polypharmacy see Lee, R.D., 1998. The term may also refer to the practice of treating a single disease with multiple drugs (AIDS, epilepsy), which is more correctly known as polymedicine. For the purposes of this project, the definition used is "the prescribing of more medications than are clinically indicated."

Polypharmacy can often be considered an iatrogenic illness, meaning that it is caused by the actions or recommendations of a physician. As an illness, it has symptoms, complications, outcomes and risk factors. Polypharmacy is particularly prevalent in the elderly - those people aged 65 or older - but it is not just a problem in older adults. Anyone with a chronic condition, such as asthma or diabetes, that requires medications is at risk for polypharmacy. It can also occur in children, who may be overmedicated with non-prescription formulas by well-meaning parents.

While this project concentrates on polypharmacy in the elderly, the same general principles of avoidance of polypharmacy can be applied to any patient suffering from its effects. *Healthy People 2000* and *Healthy People 2010: National Health Promotion and Disease*

Prevention Objectives , are U.S. Government publications that are part of an ongoing series of decade-long health promotion initiatives and include a chapter devoted to medical product safety issues, including drugs. The government considers the issue of medication safety to be of primary importance as we enter the 21st century (Larsen & Martin, 1999).

The purpose of this project is to design an online information resource on the topic of polypharmacy aimed primarily at an audience of elderly patients, their families and caregivers, and secondarily at health care professionals involved in geriatric care. It involves researching literature on polypharmacy to create Web site content, as well as the topic of user interface design for elderly users.

Background

The elderly comprise about 13% of the population yet take 25-30% of all prescription drugs sold in the U.S. (National Institute on Aging), with many patients taking several drugs concurrently. Geriatric patients tend to metabolize drugs less efficiently than younger patients, their bodies tend to be frailer, and their organs function less efficiently. Drugs are distributed in the body and eliminated from the body differently than in younger patients, and the elderly are more likely to be suffering from chronic, degenerative disorders, such as Alzheimer's or

While polypharmacy is already a concern, it will become increasingly important as the population ages. In the year 2011 the first members of the baby boom cohort (the generation born between the years of 1946 and 1964) will turn 65. While in 1990 there were approximately 30 million elderly people in the U.S., by 2029 the baby boomers will have added

around 76 million to that age group and elderly people will represent a projected 20% of the total population. The "oldest old", aged 85+, will number more than 8 million, with the majority of this group being women. Life expectancy for women is about 7 years more than for men, and the Administration on Aging estimates that while 66% of men over the age of 75 will be living with a spouse, only 24% of women of the same age group will be living with spouse (http://www.aoa.dhhs.gov/aoa/stats/aging21/ table6a.html). One study has shown that elderly women take on average 5.2 prescription medications plus 3 over the counter prescriptions daily (Everitt, 1986), and living alone increases the risk of non-compliance with a drug regimen. Nearly one in five individuals taking prescription drugs is also taking herbs or mega-doses of vitamins. This translates into nearly 3 million older adults at risk for adverse drug reactions between OTC and prescription medications. (Eisenberg et al., 1998).

In the elderly, medications play a vital role in maintaining health, both in prevention or slowing of further decline and treatment of acute disease. However, some drugs have conflicting effects, and some drugs have the same or similar effects. Taking multiple medications puts the patient at risk of polypharmacy. Also, the majority of patients have their own, unique drug regimen, and individuals age differently, making it difficult to generalize about the elderly population.

For ethical and practical reasons, it can be difficult to conduct research in the area of polypharmacy as subjects cannot be randomly assigned to receive multiple medications. Some studies have looked at hospital patients, but much information can be obtained from secondary sources, such as case studies or adverse drug events reported by physicians. There are many other sources of secondary information. There have been several longitudinal studies in the U.S.

over the past decades that have amassed huge amounts of data about health care and health behaviors. Databases of prescription information are kept by many types of organizations, such as Health Maintenance Organizations (HMOs) and insurance companies.

Many elderly people suffer from multiple, chronic ailments, for which there is no other option than to take several medications concurrently. According to one study (Eisenberg et al., 1998), nearly 3 million elderly people are at risk of adverse drug reactions involving prescription drugs and herbal or vitamin supplements. Alcohol is a compounding factor in polypharmacy. Elderly people may have one or more alcoholic drinks daily, and alcohol has a greater effect on older bodies because of slower metabolism times and increased brain sensitivity to chemicals. One study found that primary care physicians typically "underdetect" alcohol use disorders in older patients. (Reid, 1998).

It is important for physicians to be aware of all medications that a patients may be taking, including self-administered ones. Polypharmacy may cause significant cognitive problems that mimic symptoms of Alzheimer's disease, such as memory loss, absent-mindedness, confusion, disorientation, and emotional outbursts. It has been estimated that 5% of cases of cognitive deterioration are due to drug-related dementia (Gray, 1989). Polypharmacy is associated with an increased rate of hip fractures, falls, motor vehicle crashes resulting in injury, and because side-effects may cause additional symptoms, it is associated with additional unnecessary tests and scans and related cost increases.

A regimen of multiple drugs increases the chance that some of them will be taken incorrectly or even missed completely (noncompliance), with elderly patients often using harmful strategies to lower costs such as only taking medications when they feel they need them, only

taking half the prescribed dose, or not filling the prescription. Sometimes this is due to fear of side effects, however rare, after reading the information leaflets that come with the medications. (Sheperd, 1998). Research into compliance, defined as taking a drug in exactly the manner is was prescribed to be taken, is a field in itself, but it has great relevance to health care practitioners who are trying to reduce the risks of polypharmacy.

Health care providers should also be concerned with providing adequate information to the caregivers of elderly patients, many of whom are elderly themselves and may also be taking medications. One study that looked at caregivers nationwide found that 25% were aged 65-75 and a further 10% were older than 75%, with the majority being female (Stone et.al., 1987).

Literature Review

I looked for published medical literature, as well as online and print sources of information available to professionals and the public. I searched several electronic, bibliographic databases for citations to journal articles, including MEDLINE, HealthSTAR (for financial and administrative information), HSRProj (for current health services research), CINAHL (for information relevant to nurses and pharmacists) and HSTAT (for full-text documents useful in clinical decision making, such as consumer brochures and clinician guidelines). I also searched HAPI (Health and Psychosocial Instruments) for scales and instruments used in assessing geriatric patients and medication use. The terms I searched on included **polypharmacy**, **multiple drug interactions**, **baby boom**, **elderly**, **adverse drug events**, **aging**, **aged**, **geriatric** and **compliance**. I also looked at a reference book aimed at a general public audience (Graedon & Graedon, 1997) called “The People’s Guide to Deadly

Drug Interactions." This contained a relevant chapter called "Lethal Drug-drug Interactions" with a useful and easy-to-read table of common drug interactions. It even includes a paragraph about polypharmacy, urging families to be vigilant for signs and symptoms indicating problems in elderly relatives.

One fruitful source of information about polypharmacy was the NCME (Network for Continuing Medical Education) video series. Two relevant titles were: "Adverse Drug Reactions in the Elderly" (NCME637, 1993) and "Avoiding the Pitfalls of Polypharmacy" (NCME749, 1999). The latter was a one-hour lecture and an excellent synopsis of the whole topic, including lists of drugs that should not be prescribed to elderly patients, lists of drugs that needed to be adjusted to take into account smaller muscle mass of elderly patients, and stressed the importance of communication with patients and patient counseling as a helpful tool. This video lecture was aimed at an audience of practicing physicians and contained in-depth biochemical and physiological information about drug metabolism and organ function in elderly people. It contained many statistics and cited various journal articles. There was also an interesting discussion about patient perceptions of doctors, and the effects of direct advertising on both doctors and patients. The lecture stressed the importance of the physician asking the patient about herbal products, OTC drugs and recreational drugs such as alcohol, caffeine and tobacco.

The NCME video about adverse drug reactions was a 20 minute segment of a longer program. It also included statistics relevant to this topic, such as patients' chances of developing drug-induced dementia are 1 in 10 when taking 5 or more drugs concurrently, and that typically 20% of all elderly patients admitted to hospital are suffering from an ADE. It also

discussed in depth the importance of recalculating body size due to decreased muscle mass and decreased kidney function in elderly people.

There is no conflict in the literature as far as acknowledging that polypharmacy is a genuine and self-evident problem. Research methods involving actual patients are typically interview- or survey-based. Cohort studies tend to use pre-existing cohorts, such as the veterans being followed in the longitudinal Normative Aging Study (Fincke, et al., 1998). Many statistical studies use secondary data sources such as large healthcare- related data sets.

A short but informative article called “How should clinical care of the aged differ?” (Resnick & Marcantonio, 1997) made some interesting points about old age and how to treat elderly patients. The authors said that people can be physically quite different from each other in old age, and while there is no such thing as typical old age, there is such a thing as healthy old age. The article also impresses that many findings that would be abnormal in younger patients are within normal limits for seniors. Symptoms can often be due to multiple causes, and interventions may actually be more valuable in older people insofar as the difference they can make to quality of life. It is important to note that polypharmacy is not an inevitable outcome of a multiple drug regimen. Proper management includes regular reviews of a patient's medication by the physician and pharmacist, open discussion along all sides of the "prescription triangle" made up of patient, pharmacist and physician, and simplification of the medication schedule to help the patient keep noncompliance to a minimum.

An article discussing the risk of adverse drug events (ADEs) in polypharmacy patients (Hanlon et al, 1997) had surveyed a population of ambulatory veterans participating in a yearlong, randomized, controlled health interventions trial. They were interview about ADEs

and side effects, and self-reported problems. These problems were then checked by a pharmacist to see if they were genuine. They found that approximately 35% of patients had experienced at least one confirmed ADE.

One study used a quality of life questionnaire to determine patient perception of overmedication (Fincke, et al., 1998). This used surviving members of an existing cohort: the Normative Aging Study, which has been following 2,280 male veterans since 1963. The questionnaire was completed by 75% of surviving members who were asked whether they thought they were taking too much medication, too little medication, or the right amount. The discussion section of the paper mentioned both the benefits and limitations of this type of research, paying particular attention to the small percentage of patients who perceive themselves to be overmedicated. Such patients were more likely to be non-compliant and have higher rates of depression. Another study that documented similar associations between drug use and quality of life found an inverse correlation between number of medications taken and mobility, self-perceived health and satisfaction with other areas of life (Smith et al., 1995). More research of this type would be useful, given the oft-repeated premise that the patient bears ultimate responsibility for taking medications correctly.

Factors that contribute to polypharmacy

Once the Baby Boomers reach older adulthood, between 2011 and 2029, their sheer numbers will transform health care in the 21st century. In an article published in *The Journal of Health Care Finance* entitled "The New Health Care Consumer" (Bartlett, 1999), the author refers to this generation as "preeminent consumers". In 1995 the U.S. Department of Health

and Human Services estimated that Boomers spent $203 billion on out-of-pocket health care expenses, with $14 billion spent on alternative or complementary therapies. It is important that physicians and pharmacists be aware of these trends and keep the channels of communication open with their patients. The author speculates about the main health care trends of the 21st century, and envisions far greater specialization over the next few decades, to meet the needs and perceived needs of consumers.

Conflict over alternative therapies emerges when comparing attitudes of healthcare providers and patients. Typically, patients are reluctant to inform their physicians of over-the-counter remedies or dietary supplements such as herbs or mega-doses of vitamins. In a Canadian study (Montbriand, 1997) physicians, pharmacists, nurses and seniors who were living independently were interviewed about their perceptions of alternative therapies. Seniors believed that alternative therapies were safe and natural, but rarely considered trying psychological therapies. Professionals thought well of psychological therapies but were concerned about the lack of regulation of alternatives, and the false hopes generated by their practitioners. Doctors were also concerned that they lacked evidence on alternative therapies to give their patients, who typically obtain information from peers or stores selling alternative therapies. Professionals tended to greatly overestimate how much their patients told them about alternative therapy use.

Another indication that all is not well in communication between doctor and patient comes from a report in JAMA about health literacy (Ad Hoc Committee on Health Literacy for the Council on Scientific Affairs, American Medical Association, 1999). Health literacy refers to how able a person is to understand health information given to them, whether in printed form,

such as on a medication label or package insert, or when given verbally, such as during a doctor's visit. Age is strongly correlated with poor health literacy. Sixteen percent of adults aged 65-69 were found to have inadequate health literacy while the percentage jumps to 58% for the 85+ age group. A Danish study (Clementsen et al., 1992) showed that polypharmacy is associated with patients' poor knowledge about their medications and about the correct dosages and possible adverse effects. The AMA report suggests that physicians should take extra time to interact with elderly patients, perhaps asking them to demonstrate in some way if they have understood instructions.

There are, of course, other economic aspects to polypharmacy. Prescription drug formularies (lists that restrict health care providers to certain approved or "preferred" drugs) are an important element in the increasingly popular practice of prescription drug benefit management (Gross, 1998). The use of formularies can reduce the costs of prescription drug therapy, but probably not without some price to the consumer. As approximately 30% of all prescriptions for drugs are written to elderly patients, who are typically less able to afford them, this represents another facet of polypharmacy. A formulary in Nova Scotia has been developed specifically to provide optimum care for seniors at affordable cost, and is a collaboration between health care providers, the government, private sector and elderly patients (Carruthers, 1999). It will be used to educate professionals and patients and help make informed choices regarding medications.

Managing a multiple drug regimen that is causing problems may require that some medications be discontinued. A study that looked at drug discontinuation intervention found that only about 26% of instances where drugs were stopped resulted in adverse drug withdrawal

events, with just over one-third of these instances requiring hospitalization. Some of these ADWEs occurred as long as 4 months after the withdrawal of the drug. Most problems occurred with cardiovascular and central nervous system drug classes and were due to worsening of the underlying disease. (Graves et al., 1997).

Management of polypharmacy should also include consideration of non-drug treatments by physicians. These may include calorie restriction, exercise, stopping tobacco use and limiting alcohol use, depending on the disease conditions present. (Magini & Lowenthal, 1998).

Ongoing research in polypharmacy

There are a number of recent or ongoing studies and task forces looking at polypharmacy and associated problems.

The South Dakota Medication Reduction Project (Schrader et al., 1996). This was a community-based program following a cohort of 1,100 elderly adults in 16 counties in South Dakota during 1993. It used educational presentations and one-on-one medication reviews conducted by a pharmacist specializing in geriatrics. Participating adults showed increased compliance, dosage reductions, fewer medications, increased use of non-drug alternatives, and lower expenses. Participants also reported feeling "better", with improved physical and mental functioning and increased levels of independence.

The impact of geriatric care on drug-related problems. This study currently ongoing at Duke University is looking at a multidisciplinary geriatric health service known as Geriatric Evaluation and Management (GEM) to see if it is effective in reducing drug-related problems in the elderly, including polypharmacy.

Vermont Program for Quality in Health Care (http://www.vpqhc.org) has formed a Geriatric Drug Treatment Task Force to identify one or more problems in prescribing and drug use patterns among elderly people in Vermont, and to design a quality improvement project to address the problem(s). The task force has narrowed its focus to polypharmacy issues.

Online resources

I looked at online sources to review the types of information currently available to the public. A Web search using the term **polypharmacy** on AltaVista, Infoseek and Google search engines came up with hundreds or thousands of hits each time. Some of these are pointers for health care practitioners, such as prescribing guidelines, position statements by professional organizations, and physician visit checklists for patients. There are some excellent informational Web sites for elderly people that included information on polypharmacy, drug compliance and how to communicate with physicians. However, when I did find such information, it tended to be included as part of a much larger series of information for an elderly population, and not as a stand-alone topic. Although I found useful and pertinent information from well-documented and reliable sources, I often had to dig several layers deep in order to find it. Such consumer-oriented sites include the Merck Manual Home Edition (www.merck.com/pubs/mmanual_home/ content.htm), the Mayo Clinic Health Oasis (http://www.mayohealth.org) and InteliHealth (www.intelihealth.com/ IH/ihtIH**)**

User Interface Design for the Elderly: I searched information science literature and human-computer interaction (HCI) literature for research specific to designing for the elderly and the needs of elderly users. Two good online resources are the ACM Digital Library (www.acm.org/dl) and the HCI Bibliography (www.hcibib.org). There is relatively little written

about interface design specifically for the elderly (Hawthorn, 2000). However, research has found that older users are more likely to make mistakes due to design issues (Mayer, 1967) and find it more difficult to hit a target when using a mouse than younger users (Worden et al., 1997). One study with elderly users compared text and multimedia interfaces as a means of providing health information (Orgozalek, 1994). Some interesting gender differences were found, namely that while both men and women preferred multimedia to text-only on the computer, men preferred text-only to printed information just because they liked using the computer, whereas women strongly disliked the text-only interface, preferring to read information printed on paper. Both sexes liked the use of such multimedia components as video and audio.

The aging of the Baby Boomers is a common theme in the literature. Generally a computer-savvy cohort, there is no reason to believe that this generation will stop using computers as they age. Even now there is evidence that a small percentage of the "oldest old", those aged 85 and above, go online. Health on the Net Foundation conducts an annual survey of computer users habits in seeking health-related information on the Internet. The results of each survey are available in a format for manipulation by researchers by downloading free software from the site. Although the sample is entirely voluntary, consisting of those who visit the HON Website (www.hon.ch/) and therefore not random, the 1999 survey (N=4,368) indicates that 1 out of every 1000 users were from the oldest-old age group.

The SPRY Foundation, a research arm of the National Committee to Preserve Social Security and Medicare (www.spry.org), has published a booklet entitled "Older Adults and the World Wide Web" which is available online as a PDF document and is aimed at Web

designers. It is a comprehensive overview of aging-related issues and commonly used heuristics for testing Web sites. I also found an heuristic-based Health-Related Web Site Evaluation Form (Teach, L., 1999) and an article entitled Creating Senior-Friendly Web Sites from The Center for Medicare Education (www.MedicareEd.org). The latter includes a check list for rating Web sites. All these publications have similar content, reinforcing what I found in my literature searches and similar to, or based on, Jakob Nielsen's heuristic guidelines (www.useit.com).

To recap briefly before discussing the engineering of the Web site:

- polypharmacy, the problems caused by patients taking more drugs than are clinically indicated, is recognized by health professionals to be a problem;
- the incidence of polypharmacy is likely to grow as the number of older adults increases, with associated increases in medical costs and unnecessary medical procedures or treatments;
- informative and informed monitoring by doctor, pharmacist, patient, and family or caregiver, and communication between all parties, are important;
- the Web is a good way of distributing information -- it is popular with baby boomers, many of whom are currently caring for aging parents, and will continue to use it as they themselves age;
- Web design must take into account the characteristics and needs of elderly users, who are a highly diverse group of people.

Engineering the Web site

The polypharmacy Web site is aimed primarily at an audience of elderly patients and their caregivers and families, and secondarily at healthcare professionals involved in geriatric care such as physicians, pharmacists and nurses. It is important to take characteristics of these target groups into account during the design process, and use appropriate type and level of language and technical terms. Although many users may have minimal computer experience at the moment, in coming decades, when the boomers are elderly and as retirement communities and nursing homes become networked, computer use may be very prevalent, even ubiquitous, among seniors.

Methodology

As polypharmacy is acknowledged to be an serious issue, and one that will assume increasing importance in coming decades, I set out to design a Web site that primarily meets the needs of an audience of elderly patients, their families and caregivers. While there are ever-increasing numbers of Web sites aimed at an audience of seniors, many of which contain credible and useful healthcare information, finding information on a specific topic, such as polypharmacy, often requires the user to "drill down" through multiple layers to locate information.

I researched both the topic of polypharmacy for the Web site content, and the topic of user interface design for elderly people. A subsection of the site is dedicated to providing information for healthcare professionals and includes a bibiliographic database of polypharmacy-related research and useful links for healthcare professionals. This database was created using Procite bibliographic management software, and a Web interface was created by

using Reference Web Poster, which allows the user to search by a number of fields, including author, title, keyword and year of publication. However, the home page and majority of content is for patients, their families and their caregivers. One problem I envisioned was recognition of the term "polypharmacy". Even among health science librarians the term is not well known and tends only to appear in the literature in the last few years, although it has been included in the AgeLine (Thesaurus of Aging Terminology, AARP) since 1977. The term is, however, becoming increasingly used in consumer health articles in the mass media probably because it is a single word that replaces phrases such as "problems due to multiple medication use". The home page contains images designed to explain the title and reinforce the content: an elderly woman, pills and medication bottles.

I first developed a general structure for the site, using a hierarchical task analysis to look at typical user tasks when seeking information on this topic (Appendix A). I also wrote use cases (Appendix B) and scenarios for the different user groups. Once I had identified the tasks that users would perform on the site, I drew a state transition diagram to show the structure of the site and how the user navigates it (Appendix C). Transitions between pages are initiated by mouse clicks. Because design is an iterative process, these documents reflect early versions of the site and do not necessarily correspond to the final version.

Next I added the content, starting with a broad overview of the topic on the home page and then breaking more detailed information into separate sections, each on its own page. When writing for the public, language must be non-technical and simple while still conveying the main concepts. The home page contains general information about the use of prescription and over-the-counter drugs, and dietary supplements in elderly people, and the problems that can

occur. One design decision was to keep the layout of the page consistent with the commonly-used format of links on a menu bar to the left of the screen. Each link from the home page goes to another page on the polypharmacy site, with any external links being accessed from the second level. The content of some of the pages is summarized into "patient guides" designed to be printed and kept as handy reference material. Content was mainly taken from published research articles, with some information coming from other Web sites. References for all the sources used are included on a page of their own linked from the home page.

The home page also includes a check list entitled “Are you at risk?” for those people who come across the site while browsing or for those who are not sure if the information is relevant to them. It includes a link to personal anecdotes and photographs of older adults to give the site more personal and conversational tone. These anecdotes come from my interviews with elderly subjects. Finally, there is a disclaimer in the bottom paragraph of the home page.

When designing a site for the elderly, several points should be taken into consideration. I decided to user the term "older adults" as having fewer negative connotations than "elderly" or "aged" and being slightly more formal than "senior."

Deterioration of eyesight is one of the most predictable physical ailments of older adults. Yellowing of the cornea means that some people have altered perception of color (Microsoft, 1999). Literature has shown that, for older adults, combinations of text and background other than black on white are hard to read (Charness & Bosman, 1990). Mayhew (1992) states that "combinations including black or white may be better than combinations of two colors." Consequently, other than page titles and menu side-bar, most of the text is black and backgrounds are white.

The font size needed to be large enough to be read easily by elderly users (Shneiderman, 1998) so I used a large font (14 point) for the majority of the site. According to Horton and Lynch (1997), "Type faces used in electronic documents should be always be judged solely by their appearance on the computer screen, and not by the esthetics of a particular font as printed on paper." Other research by Tullis, Boynton and Hersch (1995) notes that "The most preferred fonts were Arial and MS Sans Serif ..." The font I used consistently throughout the site is Arial.

Users have the opportunity to read real stories about elderly people who have either experienced polypharmacy or who are following a multiple drug regimen successfully. They can access these stories by clicking on the photograph on the home page. These interviews are anecdotal rather than case studies, and their inclusion is an attempt to personalize the information and make it more meaningful to the reader.

Extraneous graphics tend to distract older users (Hawthorn, 2000) so I tried to use graphics functionally - either to enhance understanding of the text or to aid in navigation. One reason for using large graphics for navigation is that elderly users often need a large target to click on as failing eyesight or physical inability to maneuver a mouse, due to arthritis or other deterioration, make it difficult to click on a small link or button (Hawthorn, 2000). On each level below the home page there is a large, graphic link that returns the user to the home page. Text links are bold and in a larger font that the rest of the text. Whenever a link goes to an external site, such as from the drug search page, a new browser window opens, smaller than the screen size, that allows the user to browse while remaining within the polypharmacy site.

After the first prototype was complete, I wanted a heuristic evaluation of the site. I sent an e-mail to all staff at the Health Sciences Library in Chapel Hill. Staff use computers daily as part of their jobs, and are familiar with medical terminology. In this respect they could be considered "expert users". Several of the staff are involved in developing online education modules and are familiar with the design procedure for Web sites that provide health information. In my e-mail message I asked for volunteers to complete an anonymous questionnaire covering a list of heuristics designed to identify major and minor problems with the design and navigation of the site, and appropriateness of the language. I adapted elements from several sources (Nielsen & Molich, 1990, Rudin, 2000, Teach, 1998, Horton & Lynch, 1997, Instone, 1997) to come up with a questionnaire for heuristic evaluation of the Web site, which is included as Appendix D.

While heuristic evaluations were taking place, I interviewed a small number of older adults in search of personal experiences with drug interactions, side effects and successful management of a regimen of several drugs without experiencing polypharmacy. (Consent statements are attached as Appendix E. Interview questions are attached as Appendix F). As so many older adults take several drugs concurrently and these drugs may have great benefits, I thought it was important to illustrate that polypharmacy is not inevitable and that a properly-managed drug regimen is possible if patient, doctor and pharmacist communicate freely. I obtained participants by asking colleagues, acquaintances, friends and relatives if they or older adults they knew would allow me to interview them about their medications. Interviews were conducted by telephone after first reading an oral consent statement. No drug names are used,

just classes of drugs, such as "antidepressant" or "laxative." Excerpts from some of the interviews were then summarized on the page entitled "Real Life Stories."

The final stage of the project was to test the site using subjects from the intended audience of the site, namely older adults and health care professionals. User testing was conducted once changes resulting from the heuristic evaluation were complete and the Web site could be considered in its final prototype version. User testing with members of the target audiences was valuable as the heuristic evaluators were frequent computer users and, for the most part, familiar with medical terminology - characteristics that might be relatively rare in real users. The goal of user testing was simply to find out if the subject could successfully complete a range of typical user tasks (see Appendix G) within a time that the users themselves thought reasonable. The Web site is structured in a way commonly seen on the World Wide Web, meaning that it consists of several pages of information joined by hyperlinks contained within a menu bar, with a number of external links on each page and each page returning to the home page. I needed to know if users could find what they were looking for without becoming frustrated due to unclear navigation through the site, taking too much time to find information or any other reason. If a user was unable to complete a task I needed to know why, so I could address the problem.

Originally I wanted to sit with each subject individually and tape record any comments. However, this was not practical due to time constraints. Having already obtained oral consent from subjects by telephone (consent statements attached as Appendix E), I then e-mailed a cover letter and the list of tasks and questions, which each subject then mailed back to me.

Results

While the primary goal of this project was to construct a Web site designed to be easily used by older adults, it was important and useful to have feedback from testers to determine whether this had been accomplished. Navigation of the Web site had to be intuitive enough for people to be able to successfully locate information the first time they used it. Ten people responded to my request for heuristic evaluators. Jakob Nielsen (www.useit.com) suggests that around 5 gives an adequate evaluation because each evaluator discovers different problems, and too many more does not improve results enough to justify the time and expense of using them.

Analysis of Heuristic Evaluation

Evaluators agreed with each other on the majority of the questions. I collated the answers and looked at the ones that showed the greatest spread of results, indicating possible problems. These included 3b (The sources of information are identified), and 3c (There is contact information for the author). The mixed results showed that sources needed to be in an easily identifiable place so I created a separate page just for citations. I also reorganized part of the site, creating a section named "About this site" that includes information about the author, the sources of the information and an evaluation form for feedback.

The other area where evaluators gave conflicting answers was Question 7, the Bibliographic Database. One evaluator found the interface difficult to use, one evaluator did not like the term "bibliographic", while two each thought the results were confusing and that more text explanation is needed about using the database. I think one possible reason for some of the confusion is that for the purposes of the prototype the database is housed on a remote server and the polypharmacy database is only one of several on that server, forcing the user to select it

specifically before searching. When this Web site finds a final home the database will be on the same server, and the intermediary explanation page should be unnecessary.

Two evaluators indicated that there were grammatical or typographical errors. One of them had evaluated a printed version of the Web site, which caused line endings to be truncated, rather than looking at the site online. Another mentioned that errors were "mainly some commas in the wrong places." One evaluator commented that the color of the visited links, initially navy blue, did not offer enough contrast.

After reading the comments I received I altered some of the text (one comment suggested that "OTC" be defined on each page), and changed the color of visited links to a pale yellow color. The patient guides are formatted to be printable, but the other pages are not. One way to resolve the problem regarding the truncation of lines when the page is printed, would be to make a printable version of each page accessible at the click of a button in case the user did want to print the whole site or portions of it other than the patient guides. I have not done this as part of my project, but it would not be difficult to accomplish. However, I also feel that Web pages should be designed to be primarily viewed in that same medium -- online -- and not as though their first function is to be printable, causing the pages take up only part of a computer screen.

I decided to change the name "bibliographic database" to "citation database" as the database also includes URLs of Web sites and the meaning might be clearer.

Personal Interviews

The personal interviews I conducted yielded some interesting stories which I have included in the Web site to illustrate some of the facets of the problem of polypharmacy and the

issues that impact it. Another reason for including such anecdotes is to put a personal face on the problem and to show that taking several drugs need not cause problems. Indeed, one interviewee was a perfect example of a well-managed multiple-drug regimen: he had regular check-ups, a computerized drug record, used only one pharmacy, informed his doctor of all OTC products he took, and reported that there was communication between patient, physician and pharmacist. Although I only interviewed a small number of people, answers I obtained concur with findings that most people who take OTC products or herbs do not discuss them with their doctors or pharmacists, nor do they even think of the products as drugs. An interesting commment came from one of the interviewees about his brother, who had recently suffered a massive heart attack. Noncompliance might be caused in some cases by patients who are in denial about their illness. The mentality of such patients is "if I don't take the pill then I'm not sick." The brother refused to allow his wife to buy him a pill container to organize his medications because he was having a difficult time accepting that he had a chronic condition.

Analysis of user tests

The final stage of testing used subjects representing the target audiences of elderly users and healthcare professionals. In this project all the participants at least used computers for e-mail. Two of the older adult testers, who used e-mail regularly, admitted that they had to ask another person to help them find the Web site - not because it was hard to find, but because they did not know how to find *any* Web site.

I used convenience samples of 3 health care professionals, and 4 older adults. Some of the comments from the professionals reflect the conflict in the literature over the definition of polypharmacy. I felt that I had to make the definition I had settled on for this project (of more

medications than clinically indicated) clearer on the home page of the site, so I re-worded the first paragraph to reflect this.

One suggestion was to position a "return to home page" button at the top of each page, as well as at end, to avoid the necessity of scrolling down. Another suggestion was for each drug search interface to open up a new browser window to prevent the user getting lost. I have implemented both of these changes. I had included a question about what users thought was missing from the site in order to furnish possible ideas for future development. Additional user comments are summarized in Appendix H.

Future development of the Web site

This site will be maintained by the Program on Aging (POA) in the School of Medicine at the University of North Carolina, Chapel Hill. It will be linked from POA's home page and the URL will be included in a database of aging-related URLs produced by UNC's Institute on Aging. Much of the information is fairly static. The links to the drug search pages will need to be checked regularly, but the drug information itself should be current as it comes from reliable, external sources. Program on Aging will be responsible for additions to the bibliographic database as new publications become available in the fields of polypharmacy, related aging issues such as compliance. One option would be to include citations to online resources in the database as it currently only includes journal articles. However, this would increase the maintenance demands considerably.. The site includes an online feedback form that users have the option of submitting. Such a model is used by a popular learning module on Evidence-Based Medicine, a collaboration between UNC Health Sciences Library and Duke University,

that has resulted in interesting and comments from users around the world as well as suggestions for inclusion (www.hsl.unc.edu/ebm/welcome.htm). POA will be able to evaluate the usefulness of the online feedback form over time and can decide whether it is worth maintaining although I hope that information obtained from real-world users will shape future content.

Conclusion

Within a few years older adults will make up approximately 20% of the U.S. population and an increasing number of them will be capable computer users, searching for health and medical information on the Internet. Designers must reflect these statistics when designing for an audience composed of an age-group that, while neatly described as "elderly" in reality spans several decades and is very diverse. In a short article (included as part of a composite article entitled User Interface Design for Young and Old (Brouwer-Jansen et al., 1997)) the author discussed the concept of "designing for our future selves", ending with the inevitable: "While reading this you have aged 10 minutes." (Coleman, 1997). Another author in the same article discussed the new field of gerontechnology -- the design and development of technologies for the aged -- and the idea that older adults will react to new technology based on past experiences:

"... unlearning may be as important as the new learning required to use the new product." (Fozard, 1997).

Designers and developers in all areas, not just computer interfaces, would do well to keep in mind that designs for the elderly are often translate well to other age groups. Usability testing should become an integral part of the design all new technology, whoever the target user group. The rising numbers of elderly people in the U.S. and in many other parts of the world represent a user population that designers can ill afford to ignore.

Healthcare services will also be affected greatly by the growing numbers of older adults. It is well worth health care providers taking a little extra time to make sure that the patient or caregiver, who may also be elderly, has understood instructions. It is important to ask questions about OTC usage, or to make sure that the patient with poor eyesight and arthritis can read the drug label and open the container easily, while creating an atmosphere where the patient feels comfotable asking questions.

One of the older adult testers indicated that a list of drugs that commonly cause problems in the elderly would be useful. However, I feel that information on this type of problem should be general rather than specific and merely give pointers to medically- qualified, credible and reliable sources. The disclaimer on the home page states that the purpose of the Web site is to disseminate information on the topic of polypharmacy, not to substitute for advice from a professional health care provider, and there is danger in overstepping that boundary.

Excessive medications mean excessive costs for all parties concerned in terms of time, money, and unnecessary medical procedures to find the "cause" of symptoms caused by polypharmacy. I hope this Web site will help to increase awareness of the problems associated with multiple drug use and will encourage patients to do their own research and be responsible for taking their medicines safely.

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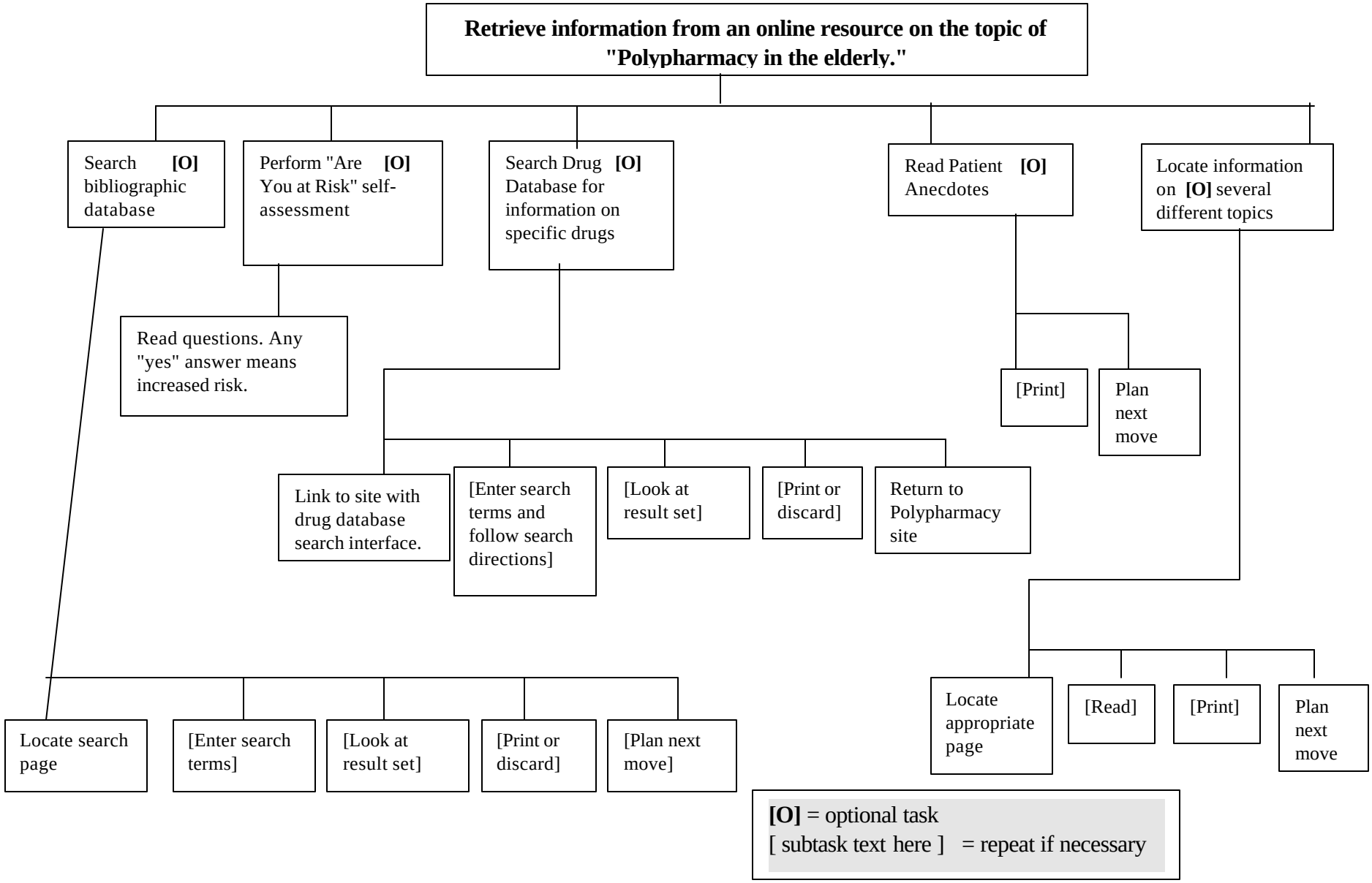
Appendix A:
Hierarchical Task Analysis


Retrieve information from an online resource on the topic of "Polypharmacy in the elderly."
Search [O] bibliographic database
Perform "Are You at Risk" self-assessment [O]
Search Drug Database for information on specific drugs [O]
Read Patient Anecdotes [O]
Locate information on several different topics [O]
Read questions. Any "yes" answer means increased risk.
[Print]
Plan next move
Link to site with drug database search interface.
[Enter search terms and follow search directions]
[Look at result set]
[Print or discard]
Return to Polypharmacy site
Locate search page
[Enter search terms]
[Look at result set]
[Print or discard]
[Plan next move]
Locate appropriate page
[Read]
[Print]
Plan next move
[O] = optional task
[subtask text here] = repeat if necessary

Appendix B:
Use Cases

Search Bibliographic Database
User located page with database search interface, enters search term(s) and performs search. User then looks at result set and may discard or print and/or search again.

Perform "Are You at Risk?" self-assessment
User looks at a series of questions answerable with yes or no. The more questions that are answered with a "yes" mean a higher potential risk of polypharmacy for the patient.

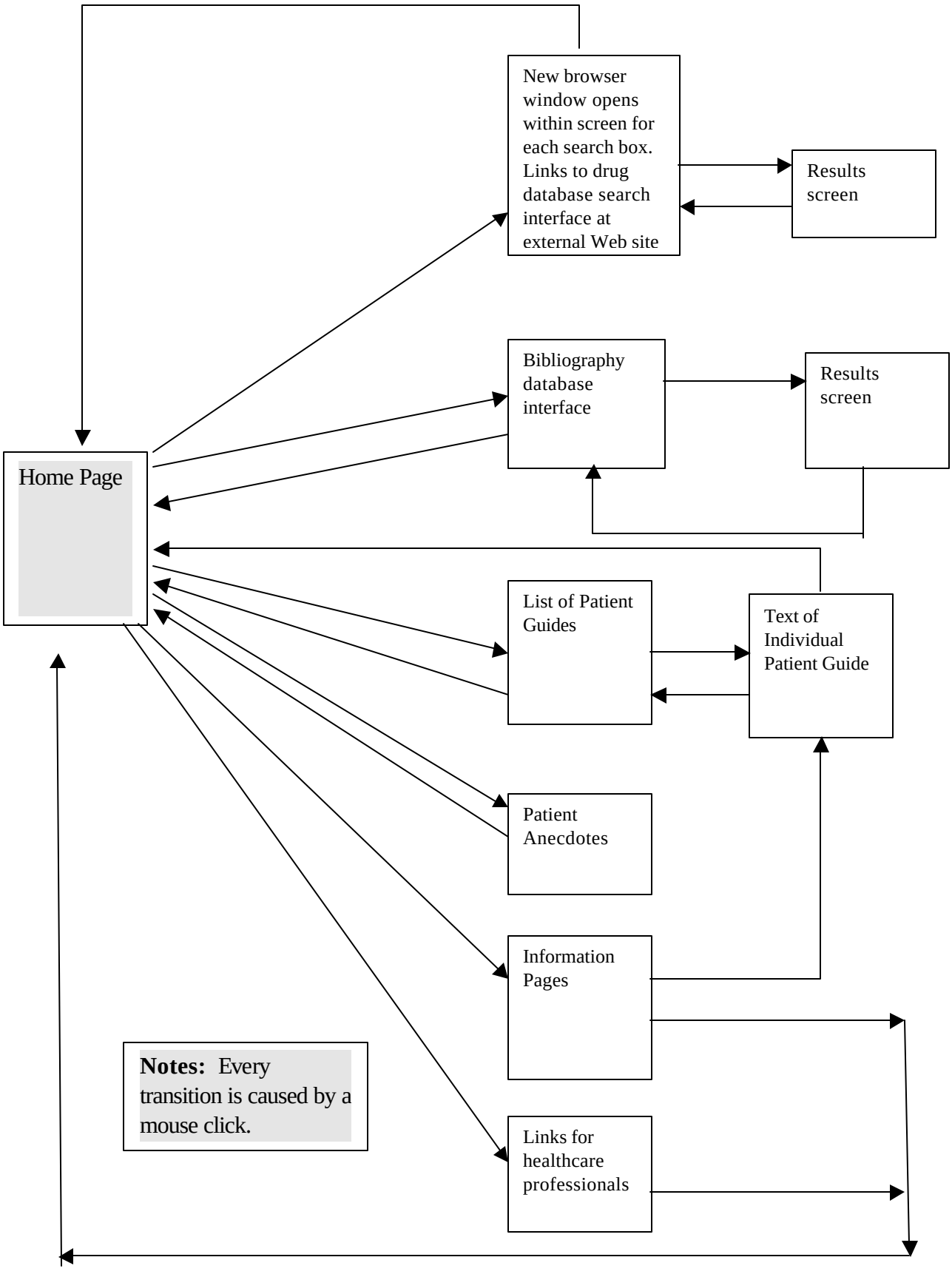
Search drug database for information on specific drugs
Patient links to existing database with searchable interface on another site.

Read patient anecdotes
User reads personal story of an elderly person who experienced some form of polypharmacy. These stories are anecdotal. User can print page if desired.

Locate information pages on various topics
User locates desired information and can read or print the page. Some pages are summarized and patient can print out a patient guide related to the topic.

Appendix C: State Transition Diagram

State Transition Diagram



Appendix D:
Heuristic Evaluation of the Web Site

Note: The list of usability heuristics* upon which these questions are based is included at the end of this document. The square brackets under each question heading show the heuristics to which the questions refer. Evaluators did not see the list of heuristics nor the information now contained in the square brackets.

Heuristic Evaluation of Web Site
Title: Polypharmacy in Older Adults: Information for people taking several medications
URL: www.ils.unc.edu/~varrc/PP.htm

I have created this Web site for my master's project at SILS. It is intended to provide information on the topic of polypharmacy in the elderly, referring to the problems that occur when a patient is taking several drugs concurrently, including over-the-counter drugs and dietary supplements (herbs, vitamins). Older adults are the primary audience, with some information for healthcare professionals also being provided.

You are under no obligation to fill in this evaluation form.

This evaluation is divided into 8 sections and is designed to identify problems. It will be used to make changes to the Web site, if indicated.

Please rate each question by circling your choice on a scale of 1 to 5 as follows:

1=Strongly Agree 2=Agree 3=Not sure/neutral 4= Disagree 5=Strongly Disagree

1. Page Layout
[Heuristics: 1. Visibility of system status 2. Consistency]

a. Each page has a heading or logo that makes it identifiable.	1	2	3	4	5
b. There are meaningful subheadings on each page.	1	2	3	4	5
c. The text is divided into meaningful chunks.	1	2	3	4	5
d. There is too much text on each page.	1	2	3	4	5
e. There are common navigation aids on each page.	1	2	3	4	5
f. Each page is similar in "look and feel".	1	2	3	4	5

2. Page Content
[Heuristic: 3. Flexibility and efficiency of use.]

a. The target audience(s) is/are identifiable. 1 2 3 4 5
b. The purpose of the Web site is clear. 1 2 3 4 5
c. The content is relevant to the site's purpose. 1 2 3 4 5
d. The content expands the user's knowledge of the topic. 1 2 3 4 5
e. Important concepts are explained. 1 2 3 4 5
f. The content is based in fact. 1 2 3 4 5
g. The content is current. 1 2 3 4 5
h. There is a "date of last update" on every page. 1 2 3 4 5

3. Author/information sources

[Heuristics: 4. Respectful interaction with the user. 5. Don't lie to the user.]

a. The author is identified. 1 2 3 4 5
b. The sources of information are identified. 1 2 3 4 5
c. There is contact information for the author. 1 2 3 4 5
d. There is a disclaimer on the site. 1 2 3 4 5

4. Language

[Heuristics: 6. Speak the user's language. 2. Consistency.]

a. The writing style is consistent. 1 2 3 4 5
b. The language is at an appropriate level for the audience. 1 2 3 4 5
c. The language is grammatical and error free. 1 2 3 4 5
d. The language contains too much jargon. 1 2 3 4 5

5. Style

[Heuristic: 7. Aesthetic and minimalist design.]

a. There are sharp contrasts in color (such as black/white). 1 2 3 4 5
b. There is a common font throughout the site. 1 2 3 4 5
c. The font size is adequate. 1 2 3 4 5
d. The user is told how to change the font size. 1 2 3 4 5
f. Graphics serve a useful purpose. 1 2 3 4 5
g. Graphics take a long time to download. 1 2 3 4 5
h. Graphics clutter the screen. 1 2 3 4 5

6. Links

[Heuristics: 8. Recognition rather than recall. 9. Help. 10. Information should be broken into readable chunks.]

a. There are relevant links to other sites. 1 2 3 4 5
b. The name of each link corresponds to the name of the page it links to. 1 2 3 4 5

c. The links are easy to click. 1 2 3 4 5
d. The links are obviously links. 1 2 3 4 5
e. A description accompanies each link to help the user decide its usefulness. 1 2 3 4 5
f. The browser's back buttons work well (user doesn't get lost). 1 2 3 4 5
g. Users don't need to remember information from one page to the next. 1 2 3 4 5
h. It is easy to return to the home page. 1 2 3 4 5

7. Bibliographic Database

[Heuristic: 8. Recognition rather than recall. 3. Flexibility and efficiency of use.]

a. The database interface is easy to use. 1 2 3 4 5
b. The results are presented in a confusing manner. 1 2 3 4 5
c. More text explanation is needed about the database. 1 2 3 4 5

8. In your opinion:

a. This Web site is easy for older adults to use. 1 2 3 4 5
b. The Web site is well organized. 1 2 3 4 5
c. The information is useful and relevant to the intended audience(s). 1 2 3 4 5
d. The Web site is visually appealing. 1 2 3 4 5

Thank you for your time.

Claire de la Varre
June 12, 2000

***List of Usability Heuristics**

1. Visibility of System Status
From each page can you answer the questions "Where am I?" and "Where can I go next?"

2. Consistency.
Is the layout uniform with regard to formatting, typeface, labeling and navigation? Do links and page names match?

3. Flexibility and efficiency of use.
Accommodate a range of user sophistication and diverse user goals.

4. Respectful interaction with the user.

User interaction with the system should enhance the quality of his or her experience. Is the user treated with respect?

5. Don't lie to the user.
Information should not contain misleading links or refer to missing information.

6. Speak the users' language. Is each section written in language appropriate for the user group at which it is aimed?

7. Aesthetic and minimalist design. Dialogues should not contain irrelevant information. Site should be organized in progressive levels of detail, with most general information on the home page with links to more detailed information.

8. Recognition rather than recall.
The user should not have to remember information from one part of the site to another.

9. Help.
Can the system be used for most tasks without needing explanation or help? If help is needed, is the documentation specific enough to be useful?

10. Information should be broken into readable chunks.

Appendix E:
Consent Statements

Consent to Participate in User Testing of Web site entitled "Polypharmacy in Older Adults Information Site."

Introduction:
This study involves designing a Web site for use by older adults, their families and caregivers, and health care professionals with an interest in the topic. The Web site is designed to provide information to the community of older adults who may be at risk for polypharmacy (the problems associated with multiple drug use).

Purpose:
In order to test whether this Web site is easy to use, the researcher needs some older adults to look at the site, perform some tasks and answer some questions. This is not a test of the participant, just a test to see whether the Web site is designed in a way that makes it is easy to find information.

What Will Happen During the Study:
1. The researcher will email you a list of 5 tasks to complete and some questions to answer after you have attempted the tasks.

2. These tasks will include looking at and interacting with the Web site on a computer and finding certain information. Some of the questions will ask you about your experience with the Web site after you have finished the task.

3. You will only have to complete the set of tasks once and that is the only time you will be participating in this study.

4. If you have any questions or concerns about being in this study, you should contact Claire de la Varre at (919) 403-5889, or her Faculty Advisor, Dr. Stephanie Haas at (919) 962-8360.

Your Privacy is Important:
We will make every effort to protect your privacy. We will not use your name in any of the information we get from this user test, or in any of the research reports, or on the Web site itself.

Any information from the study will, in written or electronic form be in the sole possession of Claire de la Varre and it will be used only to make changes to the Web site, if indicated.

Risks and Discomforts:
We do not know of any personal risk or discomfort you will have from being in this study.

Your Rights:
You decide on your own whether or not you want to be in this study. You are not under any obligation to participate and may refuse to do so.

If you decide to be in the study, you will have the right to stop being in the study at any time.

The Academic Affairs Institutional Review Board (AA-IRB) of the University of North Carolina at Chapel Hill has approved this study.

If you have any concerns about your rights in this study you may contact the Chair of the AA-IRB, David A. Eckerman, at CB# 4100, 201 Bynum Hall, UNC-CH, Chapel Hill, NC 27599-4100, (919) 962-7761 email: aa-irb@unc.edu

Summary:
I understand this is a research study to test whether the Web site is easy to use.

If I agree to be in the study:

1. I will be asked to complete 5 tasks and answer some questions about my experience with the Web site.

2. I will e-mail my answers back to the principal investigator.

[For participants with whom the investigator has direct contact:]

I have had the chance to ask any questions I have about this study, and they have been answered for me.

I have read the information in this consent form, and I agree to be in the study. There are two copies of this form. I will keep one copy and return the other to the investigator.

_____ _____

Signature of Participant Date

[For oral consent with participants only contacted by telephone:]

"By saying "Yes" at the end of this statement you agree to participate in this study. Your name or any other identifying information will not be used. You are under no obligation to participate and may decide not to participate at any time. You may also withdraw consent at any time during or after the study and your answers will not be used.

If you have any questions, please ask them now. To give consent, you may say "Yes" now."

2. Oral Consent form (to be read to participants in telephone interview)

This study involves designing a Web site to provide information to the community of older adults who may be at risk for polypharmacy (the problems associated with multiple drug use), their caregivers and families, and health care professionals with an interest in the topic.

The Principal Investigator (PI) for this research project is Claire de la Varre, a graduate student in the School of Information and Library Science at UNC-Chapel Hill. The Faculty Advisor for this project is Dr. Stephanie Haas.

The information collected from this interview will remain in the sole possession of the Principal Investigator and will be used only to make changes or additions to the Web site, if indicated. In no instance will names or other identifying information be used on the Web site or in literature about the Web site or the project.

You may contact the Principal Investigator, Claire de la Varre (919) 403-5889, or Faculty Advisor, Dr. Stephanie Haas (919) 962-8360, if you have any further questions about this study.

You may contact the UNC-CH Academic Affairs Institutional Review Board at the following address and telephone number. If you have questions or concerns about your rights as a research participant, please contact Dr. David A. Eckerman, Chair of the Academic Affairs Institutional Review Board, CB#4100, 201 Bynum Hall, The University of North Carolina at Chapel Hill, Chapel Hill, NC 27599-4100. ((19) 962-7761, email: aa-irb@unc.edu

By saying "Yes" at the end of this statement you agree to participate in this interview and you know that any information from the interview may be used as an anecdote on the Web site. You are under no obligation to participate and may decide not to participate at any time. You may also withdraw consent at any time during the interview. The format of any information used from this interview will be approved by you before it is made public on the Web site. If you wish to withdraw consent at that time you may do so.

If you have any questions, please ask them now. To give consent, you may say "Yes" now.

Appendix F:
Interview Questions for Older Adults about Medication Use

"I would like to know if you have ever had any problems with drugs you have been taking or have taken in the past. If any question makes you uncomfortable just let me know. You don't have to answer if you don't want to."

1. How many prescription medications are you taking just now?

2. Do you know what each drug is for?

3. Do you take vitamins? If yes, What? Why do you take X?

4. Do you take herbs? If yes, What? Why do you take X?

5. Do you take any other over-the-counter products such as antacids or laxatives? If yes, What?

6. Do family members or friends ever bring you anything they think you should take?
   If yes, What do they bring you?
   - Do you take what they bring?
   - Do they ask you what else you are taking?
   - Are they working in the healthcare field?
   - Do you tell your doctor about OTC products you are taking?

7. Have you ever had any problems with your medications?
If yes: Have you ever been hospitalized or had to see a doctor because of medications?

8. Have you ever stopped taking a prescribed medication without telling your doctor?
If yes: Why? How did you feel after you stopped?

9. What times of the day do you take your medications?

10. How do you remind yourself to take your medications?

Note: Real names of participants will not be used. Drug names will not be used, just drug type (i.e. antidepressant, antacid, laxative).

Appendix G:
Tasks and Questions for User Testing

Can you:

1. Print out the patient guide called: "Talking to your Doctor"?

2. Search for and print out information on a drug of your choice? If you can't think of one, use "aspirin"

3. Name a book or article from the further reading list?

4. Read the personal stories from patients?

5. Find information about the author?

6. Find out what sources the information on the site comes from?

After attempting the tasks above, please take a few minutes to answer the following questions - write as much or as little as you like:

A. What do you think about the Web site?

B. Did any link take you to an unexpected place?

C. Did you get lost at all?

D. What is the most useful part of the site to you personally?

E. Is there anything missing that you would like to see included in the information?

F. Part of the site contains information for health care professionals such as doctors, nurses and pharmacists. Do you think you might also be interested in looking at this section of the site?
If yes, which parts in particular?

Appendix H:
Comments from User Testing

From health care professionals:

"It will be a valuable resource not only to the older person but to other groups of people as well. One comment I would like to make is that quite often,it is the relative/carer/spouse who buys OTC drugs for the older person because they think it will do them good.I have a patient whose son had bought her five different OTC remedies and insisted that she took them without any reference to what she was on already!"

"The site seems to be both comprehensive and easy to navigate..."

"I think it is simple (in navigation and ease of use), straightforward, and very useful."

"I'm happy to see someone focusing on polypharmacy. As you know it is a big concern."

"I would distinguish polypharmacy from problems of polypharmacy -- a confusion which bullet 1, how to avoid, aggravates. "Polypharmacy has many causes ..." It has one cause: eating more than one medication. What you want to avoid is *problems with* polypharmacy."

"I bet there's data out there on average # of meds per senior to add to your salvo of stats. Or a bar graph: % eating 0, 1 to 2, 3 to 5, 6 to 10 meds ..."

"I'm sure having a primary caregiver is itself a risk factor for polypharmacy."

"I would add to 'how to avoid':

When triaging OTC meds, avoid combination products (cold formulas) ...
Make sure the primary caregiver is aware of all other doctors/caregivers who prescribe...
Bring you pill bottles to every appointment ...
Learn your medicines by name, not just color ...
Ask your primary caregiver or your pharmacist to run your med list through an interactions database (widely available) ...
Carry your current med list everywhere ..."

"The links were very interesting. Of course I got distracted once I started browsing ..."

From patients/family members/caregivers:

"The most useful part of the site for me is to realize how useful this Web site will be for the elderly to understand the precautions necessary about mixing medications."

"I think you have created a great page of information to help us old fools not to mix up our medications ... your presentation is clear and properly defined and certainly easy enough to read and comprehend."

"The most useful part of the site to me personally was the info about drugs."

"I probably would not be interested in the part of the site that contains info for health care professionals."

"I would be very interested in the section for professionals ..."

"The 'back to home page' was very helpful in getting me back to the main menu."

"Since I believe in chiropractic, I thought the sentence on back problems and manipulation could have been more favorable." [Note: this tester had obviously followed a link to an external site and had not realized that he or she was no longer in the Polypharmacy site.]

"I spent 40 minutes reading, thinking and evaluating your site. It is very impressive, very detailed and interesting. Something you could add would be information about where to order those memory aids you talk about - like the buzzing gadget."

"A list of drugs that often cause problems in old people would be useful."

"I had to ask someone in the office how to go on the Internet to find a web site ..."