THE DEVELOPMENT OF A PROTOTYPE
COMPUTER APPLICATION FOR
PROSTATE CANCER EDUCATION

_____

A DISSERTATION

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN THE

GRADUATE SCHOOL OF THE

TEXAS WOMAN'S UNIVERSITY

COLLEGE OF HEALTH SCIENCES

BY

GREGORY GLIEMI, M. S.

_____

DENTON, TEXAS

DECEMBER 1994

DEDICATION

To the greatest father a son could ever have

ABSTRACT

Gliemi, G. R. <u>The Development of a Prototype Computer Application for Prostate Cancer Education</u>. Ph. D. in Health Education, 1994, 110 pp. (S. Ward)

The purpose of this study was to develop a prototype prostate cancer software program. The program provides users with information about the prostate gland, different prostate cancer treatments, information on the possible symptoms, preventive considerations, detection options, and support groups. Treating prostate cancer has become a very controversial issue, therefore, this program was designed to assist the user with information needed to make an informed personal decision. It also stresses the importance of early detection with information about the different exams available. The application was developed using the NeXTSTEP operating system. It is now available for viewing via the Oregon State University ftp site.

TABLE OF CONTENTS

Treatments and Stages

Questions

TABLE

FIGURE

CHAPTER ONE

INTRODUCTION

With public demand for health information on the rise, computer based technology provides a means for delivering individualized information, education, and advice (Lieberman, 1992). Computers can deliver some types of instruction more efficiently or economically than face-to-face instruction, depending on the needs of the learner and the quality of the instructional software. The software can individualize the content or format of health education. In addition, protocols can give individualized advice to the user according to the rules within the developed application and will vary according to the user input (Lieberman, 1992).

Problem Statement

The question of how best to tackle prostate cancer--to screen, or not to screen--is fast coming to symbolize a fundamental health issue. What priority should governments attach to illnesses that usually occur in old age, particularly when health resources are

scarce and populations as a whole are aging? (Siddall, 1993, p. 6).

Due to doubts regarding the cost-benefit of mass screening, new

methods need to be developed for prevention and early detection

(Walsh, 1992).

If the causes and risk factors associated with prostate cancer

were understood, developing a clinically structured expert system

would be a practical software development project. But this is not the

case. Therefore, the problem is to develop an application that

provides information that is useful in assisting men with making

informed health care decisions. This application provides the user

with information in a user friendly environment about the prostate

gland, prostate cancer, treatments, symptoms, risk factors, and

support groups.

<div align="center">Purpose of the Study</div>

The purpose of this project was to develop a prototype software

application capable of providing readily accessible information and

risk awareness to asymptomatic men about the risk factors

associated with prostate cancer. It demonstrates that a custom

application can be developed, using technology available for desktop

computers.

Research Question

The following research question was analyzed:

1. Does the information provided in the prototype have content validity?

Definition of Terms

1. <u>Applications</u>. A software package that is created for a specific purpose or industry.

2. <u>C</u>. A computer programming language.

3. <u>Chartsmith</u>. A third party charting package.

4. <u>Class Browsers</u>. Viewing and editing the class hierarchy of the objects in an object oriented programming language.

5. <u>Classes</u>. In object oriented programming, a user defined data type that categorizes objects. A class member (object) is an "instance" of the class (Freedman, 1993).

6. <u>Class Libraries</u>. Objective oriented programming classes supplied by third parties.

7. <u>Client-Server</u>. System in which the client is a requesting personal computer and the server is the supplying computer

(Freedman, 1993).

8. <u>Code</u>. Computer language, such as C or pascal, to write a programming.

9. <u>Compiler</u>. Software that translates software language to computer language.

10. <u>Debugging</u>. Finding problems or mistakes in a program.

11. <u>Edit Application</u>. An Application for writing and editing programming code.

12. <u>Editor</u>. A program that links a compiled or assembles program to a particular environment.

13. <u>EPS</u>. Encapsulated Postscript: Postscript file format that contains Postscript code for the document.

14. <u>Folder</u>. A file in a computer that holds documents. Like a file folder.

15. <u>Hypercard</u>. Application development system from Apple Computer, Inc. that operates on Macintosh and Apple computers and provides an array of integrated features. Resembles an on-screen Rolodex card that can be designed with fixed fields, scrolling fields, and graphics (Freedman, 1993).

16. <u>Icon</u>. A small, pictorial, on-screen image of an object.

17. <u>Image</u>. A third party image editing and processing application for Appsoft, Inc.

18. <u>Interface Builder</u>. Manages all files, develops interfaces, extends class hierarchy, integrates with C (Garfinkel & Mahoney, 1993).

19. <u>intuitiv' 3d</u>. A third party 3 dimensional application package.

20. <u>Languages</u>. Sets of symbols and rules used to convey information.

21. <u>Network</u>. Interconnected hardware and software.

22. <u>Objects</u>. Self contained chunks of code containing data and associated behavior (Freedman, 1994).

23. <u>Object Oriented</u> (OOP). A programming technology that allows for different section of software to interact.

24. <u>Operating System</u>. A control program that runs a computer.

25. <u>Postscript</u>. Language from Adobe Systems, Inc. that is used in a variety of printers.

26. <u>Project Builder</u>. Creates skeletal code and provides specifics on how to build connections between objects.

27. <u>Prototyping</u>. Creating a demonstration application.

28. <u>Raster</u>. A technique for representing picture image a matrix of dots.

29. <u>Rules</u>. Sets of conditions or standards.

30. <u>SCSI</u>. Small Computer System Interface. A system for different computer devices to mesh, such as a disk and a CD-ROM.

31. <u>Software Tools</u>. Software packages that aids in the development of other software.

32. <u>Third Party</u>. Independent software capable of integrating into the NeXSTEP operating environment.

33. <u>TIFF</u>. Tagged Image File Format. Widely used graphics file format.

34. <u>User Friendly</u>. An easy to use computer program.

35. <u>Windowing System</u>. Any operating system or application that provides multiple windows or screens.

Limitation

This prototype is a proof of concept application. The following limitation has been identified:

1. Only content validity of the application material was

determined.

Delimitation

The following delimitations were identified:

1. The prototype was developed for use by asymptomatic men, though women may benefit from an expanded application.

2. A 10th grade reading level was used in the application.

Significance of the Prototype

This prototype was designed to show that custom software applications can be designed for health education. The significance of the work is that it contributes a prototype to the field of health education from which future applications can be based. Interest in this application by educators has already be begun, although it is not yet available. Although only available in a second beta version, this interest shows that there is a sizable market for health education applications.

This prototype is intended as a pioneering effort in developing custom software for health education. This dissertation will assist educators with recommendations and insight on the development process. It is not proper to conclude that this dissertation is a manual

for development. Development requires much trial and error. This work does provide a platform from which to work from for the development of bigger and better development projects.

CHAPTER TWO

REVIEW OF LITERATURE

Prostate Cancer-Information Sources

Prostate cancer is presently the second leading cause of cancer death in men. In any given year 122,000 new prostate cancer cases will develop, and 32,000 men will die from it (American Cancer Society, 1991). Silverberg and Lubera (1988) have estimated that a male newborn has a 9% to 11% chance of prostate cancer developing and a 2.6% to 4.3% chance of dying from it during his lifetime. The warning signs are not clear indicators of the disease. Therefore, one out of every eleven men will develop it without any distinguishable symptoms.

The symptoms that do develop include the need to urinate frequently, difficulty starting urinating, weak or interrupted flow of urine, painful or burning urination, blood in urine, and pain in the lower back, hip, or upper thighs (National Cancer Institute, 1990). However, overall awareness of the disease is very low. Only 8% of

men polled identified prostate cancer when asked about illnesses and diseases discussed with their doctors during their most recent physical examination. In addition almost 75% of those surveyed were not personally concerned about getting the disease (Moon & Clejan, 1991).

On a national basis, the problem of implementing a mass screening program exists. Studies have not clearly demonstrated that an early diagnosis of prostate cancer increases survival (Chodak, 1993; Wasson, 1994). But studies of breast cancer have demonstrated an increased chance of survival when the cancer is detected in the early stages. "Breast cancer is an adenocarcinoma that cannot be cured once the disease has escaped the primary organ and it has a natural history not dissimilar from prostate cancer. Therefore, it is likely that screening studies in prostate cancer will demonstrate improved survival as they have in breast cancer" (Walsh, 1992, p. 853). These contrasting views of Chodak, Wasson, and Walsh demonstrate the conflicting beliefs of whether or not a mass screening for prostate cancer is a practical public health initiative.

Another problem involves treatments. Almost no randomized trial data exist comparing various treatments, or comparing alternative treatments for early prostate cancer (Andriole, 1994).

Gathering data for treatment studies is also difficult. Only a single recent study had a sample size greater than 100. Recently a randomized trial by the Southwest Oncology Group ended after recruiting only 6 patients in 12 months (Talcott, 1994). Patients reluctant to accept randomization in trials may be accepting advise from their physicians, whose bias regarding a preferred treatment is evident. Even if it were available, comparative survival data alone would be inadequate to determine treatment. Because survival following treatment is prolonged, the great majority of patients with early prostate cancer will be long term survivors by the usual definition of living more than 5 years after diagnosis (Wasson, 1994). As a rule, the available potentially "curable treatments," radical prostatectomy and radiotherapy, may result in immediate serious and long lasting complications. These are widely employed in order the increase years of survival. Information about outcomes after alternative treatments, including studies pertaining to quality of life,

are now necessary in order to assist a patient in choosing the best overall treatment (Phillips, 1994).

This is illustrated by the American College of Surgeons Commission on Cancer report that showed that in 1990 about 60% of patients with newly diagnosed prostate cancer were treated with either surgery, radiation, or hormone therapy. Thirty percent were given no immediate treatment (Mettlin, Jones, & Murphy, 1993). In recent years the largest increase in treatment choice has been with surgery. Reasons given include: (a) improved surgical techniques that reduce the potential for incontinence and impotency; (b) the increase in early detection with a combination of digital rectal exam (DRE) and prostate specific antigen (PSA); and (c) an increase in the number of cases detected by urologists, who believe that surgery is a superior treatment method (Andriloe, 1994).

Treatments: Present Outlook

"The optimal method of managing patients with early stage prostate cancer is not known" (Andriole, 1994). This occurs because both of the unpredictability of the disease and the fact that prostate cancer is often diagnosed in elderly men who have more than one

physical ailment and a shorter life expectancy. Because it is difficult

to predict tumor growth, it is often difficult to make a definitive

treatment recommendation (Garnick, 1994).

Delay Treatment

Again, recent studies have questioned the need for immediate

therapy for all men with localized prostate cancer (Chodak, 1993).

Current findings in the United States have suggested that patients

with localized cancer often have low prostate cancer death rates

(Mettlin, Jones, & Murphy, 1993). Factors such as the presumed

aggressiveness, or lack of, and the age of the patient are used to

support the belief that immediate treatment might not be necessary.

Radiation

The best results with radiation therapy for patients with localized

prostate cancer appear to be with external beam therapy. Even so,

resent studies have reported that only a "small minority of radiation

treated patients have actually been cured of the disease" (Kaplan,

Cox, & Bagshaw, 1993). These findings have contributed to the

increase in surgery as the preferred treatment method by urologists

(Oesterling, 1994).

Surgery

In men with clinically localized prostate cancer and a life expectancy of greater than 10 years, the goal of treatment should be a cure, and surgery does offer a high probability for curing those patients whose cancer is localized. Studies have shown that any relapse of cancer occurs in only 10-15% of men ten years after surgery (Partin, Pound, Clemens, Epstein, & Walsh, 1993).

Initial complications from surgery occur in about 7.5% of all patients. Knowledge of long-term complication rates are less precise as evidenced by studies that have found impotency rates ranging from 30% to 100% (Wasson, 1994).

Cryosurgery

No exact consensus exists regarding the most appropriate use of this treatment (Andriole, 1994). Relapse rates are not known. Also this treatment has not been approved for payment by medicare, but is covered by most medicare-supplement insurance plans.

Hormone Therapy

The pace of hormonal therapy research has been increasing, as evidenced by resent studies using RU-486 for prostate cancer

therapy. Luteinizing hormone-releasing therapy (LHRH) is becoming the preferred hormal therapy. This substance blocks the action of testosterone. It is rarely being used for men diagnosed with early stage prostate cancer (Morganstern & Abrahams, 1994).

Prostate Cancer Exams

In order to detect prostate cancer as early as possible, guidelines for the two prominent evaluation exams, the digital rectal exam (DRE) and prostate specific antigen (PSA), are under question.

Digital Rectal Exam

The DRE has been the traditional method for detecting prostate cancer. But because only about one-third of DRE detected cancers are confined to the prostate gland, the use of the DRE alone is now in doubt (Oesterling, 1994).

Prostate Specific Antigen

It was not until the mid 1980's that PSA received consideration as a possible superior diagnostic marker for prostate cancer. The American Cancer Society and the American Urological Association now recommend that men 50 years of age and older undergo an annual evaluation using both PSA and the DRE (Oesterling, 1994).

Computers in Health Education

The benefits of using desktop computing technology in health education are understood, but barriers to usage still are prevalent (Zannis, 1992). According to Coggan, Hoppe,and Hadac (cited in Gold, 1991) these barriers include:

1. Poor understanding of the educational capabilities of the technology and how to achieve its potential.

2. Lack of knowledge about the complexities of the educational system itself and how to integrate a new technology in such away that is not threatening.

3. Weaknesses in the research data on efficiency and effectiveness with respect to attitude change.

4. Technological problems, including poor reliability of earlier equipment and difficulty in programming sophisticated applications. Bergson adds "expect the unexpected....if everyone got rid of their first application, they'd be better programmers" (Bergson, Gugielmo, & Whitmore, p. 27).

5. Production and distribution problems, including lack of faculty interest and incentives, and poor-quality applications. Guglielmo

adds that this can also be a problem with object-oriented programming. "Without a thorough understanding of object-oriented architectures developers may have a hard time setting project goals that fully exploit its advantages..." (Bergson, Guglielmo, & Whitmore, p. 25).

6. High cost of hardware and software.

Computer Usage in Health Education

Surveying the present usage in college and university health education programs, Randolfi (1986) found that 20% of the departments offered a course in microcomputer applications, 25% required that the student take a class in computers from a different department, and 38% used computers in health education classes.

Zannis (1992) surveyed the use of computers by health educators in graduate programs. Competency, with 75% feeling proficient, was high with word processing applications. Among the remaining applications of, statistical packages, spreadsheets, Email, databases, and bulletin boards, the highest percentage of users feeling competent was 40% with statistical packages.

Reasons for using computers were research (83%), teaching

(77%), authorship (63%), and recreation (51%). With the high percentage of recreational use, Zannis noted that "appropriate software could be designed which has research, teaching, and authorship as its goals and has a recreational format for teaching its use" (p. 153). The major reason for non-use of computer applications was the lack of available training. Access to hardware was a minor inconvenience.

Among the recommendations, Zannis suggested that:

1. Training should be provided in every needed application, encouraging health educators to use a variety of applications in their educational activities.

2. Health education departments should foster communication by utilizing telecommunications with health educators in other institutions.

3. Since many health educators found friends or colleagues most helpful in learning microcomputer technology, a "buddy system" or grouping could be organized that encourages communication about various microcomputer applications of interest.

4. Clearly directive manuals that encourage experimentation should be written and tested. (p. 173)

In clinical applications, there are a variety of different applications available. For nursing alone, Gold (1991) provides a sample of available training applications:

1. AIDS for the Health Care Worker

2. Blueprint for Decision Making

3. CAI Nursing Research

4. Chronic Illness and Disability CAI

5. Communicable Diseases in Children

6. Computer Literacy for Nurses in the Control of Hypertension

7. Infant Nutrition: Newborn to Two years

8. Shock

9. Nursing Research CAI

A sample of other types of health education related applications include:

1. Lung Cancer Staging: A Tutorial (Chariot Software Group)

2. Year Book 1993 Edition (Creative Multimedia Corporation)

3. STAT!-Ref (Teton Data Systems)

4. The Family Doctor, 3rd Edition (Creative Multimedia

Corporation)

The future of computers in health education holds many

possibilities, some more certain than others (Gold, 1991, p. 191).

These uncertainties include the fast paced technological changes.

In hardware, while the cost of hardware appears to be decreasing,

newer, bigger, and faster machines are quickly taking their place, and

these newer desktop machines for todays operating systems require

sizable investment (Ayre, 1994). Four specific areas of change

(Lieberman, 1992) include: (a) The increasing communications

ability for the fast transfer of data, information, pictures, voice, etc.;

(b) networking or the ability to work with others or share information

over a wide interconnected group of computers, workstations, etc.

The third area of change (c) is in the large quantities of data and

that can be stored both on more affordable hard drives and on the

new CD-ROMs. Finally (d), visual displays will improve with the

further development of higher definition TV. Health educators

wanting to capture the impact of an image, will find this a welcome

improvement. Together with the visual display improvements, is the

increasing use of Multimedia. For health educators, multimedia software development applications by 3rd party providers are presently available, making it possible to produce custom multimedia applications specifically for a target audience (Evans and Clarke, 1989).

Another area for software development for health educators is the development of expert systems. These systems, used mostly in clinically based applications, are developed for the purpose of providing expert analysis and information in the absence of a human expert. Basic expert systems have been available for about 10 years and can be supported by many of the more advanced operating systems being used today.

Finally, software development requires a huge investment, especially in the health field (Lieberman, 1992). Because of this and the other barriers reviewed previously, Gold (1991) believes that computer technology will be an area of specialty for those that are interested, while computer literacy will be a basic competency for all health educators.

Application Development-Today

The original IBM PC was introduced only 13 years ago. It's maximum RAM was one megabyte, so all software had to be written to fit inside a small amount of memory (Freedman, 1993). Since 1981 there has not only been a revolution in the computer, but in the software it utilizes. Cox and Novoblilski (1991, p. v) claim that a revolution in software development has been underway for 25 years, long before the development of the desktop computers.

With capable hardware supporting the new operating systems now available, custom application development is a desktop reality. The majority of these 32-bit systems include not only C compilers, but graphical development environments that ease the building process (Garfinkel & Mahoney, 1993).

CHAPTER THREE

APPLICATION DEVELOPMENT

Procedure

This application was developed using the rapid prototype method. The method is based on the following a five phase development procedure:

1. Requirements

2. Rapid Prototyping

3. Design

4. Implementation

5. Maintenance

Requirements

The requirements phase of the rapid prototyping method is used to develop system and software tools. Function of the system, potential, and general look and feel of the program were considered. The benefits of NeXTSTEP platform are given in the next section, but the potential of the system to work as a application server in a

broader network is appealing for health education. It can be the platform for exchanging and working on projects with images and data moving through networks across the country and world.

Rapid Prototype

In the rapid prototype phase the goal is to develop the application quickly. The following is a summary of the objects and 3rd party applications used in the development of the prototype. The page in parenthesis is the appendix page of this dissertation.

The Cover, the Contents Page, and the Usage Page

As was previously pointed out, the application was designed in a book format. Upon opening the cover (page 53), the user finds the table of contents (page 54). By clicking on a "chapter" button the program turns directly to the chosen chapter. A large button is provided to open the system usage page (page 55), which briefly explains how to use the application. Included on the system usage page is a brief statement regarding prostate cancer. It is important for the user to understand that this is not an expert system. This application can not and does not attempt to provide all the necessary information required in order to make an informed decision about

tests for and treating prostate cancer. This point is made in various sections in the application.

Every image on each page was developed with intuitiv' 3d as were the icons that are used at the bottom corner for application navigation. Each image was saved as a TIFF file, and imported into the application. The buttons and arrows are provided by NeXTSTEP.

Chapter One: What is Cancer?

This page (page 56) contains one image, the DNA molecule, that was imported from the Webster's Dictionary. The complete dictionary is a file that is included in NeXTSTEP system. With Apsoft Image the image was processed for this application.

Chapter Two: The Prostate Gland

This chapter contains two pages (pages 57 & 58). The image for prostate gland is from the same TIFF file as the contents page.

Chapter 3: How Does it Grow?

This chapter explains the classifications generally used to describe the development of stages of prostate cancer. The images for stages A through C (pages 59-64) were made with intuitiv 3'd. To

illustrate stages A1/A2 and B1/B2 the user is asked to move the mouse over the image on the screen. When the mouse is within the image boundary the image changes from a stage 1 to a stage 2. When the mouse is moved outside the image boundary, the original image is shown. The skeleton for stage D page was imported from the Webster's dictionary and processed with Apsoft Image.

Chapter 4: Risk Factors and Symptoms

The pages of this chapter (pages 66-72) contain the different known fisk factors for prostate cancer. Each chart was made using Chartsmith, saved as a TIFF file, and imported into the document.

Chapter 5: Detection and You

This chapter (pages 73-82) summarizes the different exams for prostate cancer detection. The first seven pages explain the different exams. The last 3 pages are for guidance on when to begin receiving the exams. The user is given the option of viewing a review chart that is opened by clicking the image on page 81.

Chapter 6: Treatment Options

This is the longest single chapter. In order to make the navigation through the chapter as easy as possible a menu of the

different treatments is provided on the opening page (page 83). By clicking a treatment option, the user can go directly to the specific treatment. The surgery treatment includes three choices. Arrows (pages 90-93) can be activated by a user to illustrate the direction taken by the surgeon to reach the prostate.

Chapter 7: Treatments + Stages

The chapter is designed to help the user understand matching the stage of prostate cancer with the appropriate treatment.

Chapter 8: Questions

This chapter includes five multiple choice questions. The user is asked to respond by clicking the appropriate button, which immediately activates a "correct" or "try again" response. A correct response is illustrated on page 102. An incorrect response is illustrated on page 103.

Chapter 9: Support Groups

This chapter provides the user with a list of six different support groups. The user is given the name of the organization, the address, and the telephone number.

Design Phase

The design phase includes consideration for the structure and flow of the application. This was not a major area of concern for this application. The application was designed in a book like format with each section referred to as a chapter. While this was not an area of concern here, it could pose problems for the development of a larger cancer application. It could be a inappropriate to automatically use this application as a baseline for an expanded system. This application would have to be broken down into smaller sections in order to fit within a larger network.

Implementation

The implementation phase is the coding phase. Because NeXTSTEP is an object-oriented platform, building code was not difficult. Objects from window to window were similar. This allowed for writing consistent code within and between each section.

Maintenance

The maintenance phase centers around evaluating proposed changes to the system. To fulfill the requirement of this dissertation, content validity of the system was evaluated. But changes in the

system will occur on a continuous basis. Advances and changes in the technology will require that the application be adaptable to changes as soon as possible.

Computer Hardware and Software

This prototype was developed with NeXTSTEP 3.2 (1994) by NeXT Computer, Inc. The operating system was chosen for several reasons. First, NeXTSTEP is designed to run on personal computers, which is desirable for ease of use and versatility. Second, NeXTSTEP 3.2 includes all the development tools, editors, languages, class libraries, class browsers, object inspectors, and a windowing system needed to develop highly adaptable, graphical, and object oriented applications.

The primary NeXTSTEP tools include the interface builder, the edit application, the project builder, and the GNU C compiler. The interface builder is a complete object-oriented user interface developer, layout prototyping, and testing tool.

The edit application will provide the platform for entering, editing, and debugging the programming code. The edit application also functioned as a text editor.

Project builder supports and manages the components of project including files, C interface,, image files, and icons. Because this application was built partly as a demonstration of how desktop computer technology can be used in health education, only the images of the skeleton and the DNA molecule were imported into the application. These images were imported from the inventory of pictures provided by Webster's Dictionary that is a separate folder in the NeXTSTEP system. The images were edited for use here using a 3rd party image processing application, Image by Appsoft, Inc. Charts were produced with Chartsmith by Blacksmith, Inc. All other anatomical images and icons were produced specifically for this application using intuitiv'3d by Cube' X systemes, Inc.

The completed application was designed to use as a stand alone or as a component of a cancer education program, which is an advantage of developing applications in an object oriented environment. Objects are blocks of programming and data in a domain. Objects are reusable and adaptive. Therefore, objects developed can be used across different applications, refined, and remodeled. For example, the stand alone application bundled

together with a breast and lung cancer tutorial, with the other breast and lung cancer applications being imported directly into the prostate program. Also, changes and refinements could take place as the building of the new application continues.

The computer used was a Gateway 2000 486DX50LB with 20 MB of Ram and a 424 MB SCSI Hard Drive. In order to install NeXTSTEP 3.2, a NEC 3x Multispin SCSI CD-ROM was required, and was added to the system. Other internal modifications and improvements to the computer were made in order to support NeXTSTEP 3.2.

<div align="center">Window Design Information Sources</div>

Clinical screening for early detection of prostate cancer in men is highly controversial because of the high prevalence of the malignancy and an associated low clinical incidence (Mann, 1993). Due to doubts regarding the cost-benefit of mass screening, new preventive methods need to be developed for prevention and early detection (Walsh, 1992). If the causes and risk factors associated with prostate cancer ware understood, developing a clinically structure expert system would be a practical software development

project. But since this is not the case, this prototype was developed to provide information that is useful in assisting men with making informed health care decisions. Recent advances in detecting prostate cancer earlier with the Prostate Specific Antigen justify the development of newer methods for creating awareness of the disease. It does not provide all the information necessary for prostate cancer care or treatment. Rather, this prototype serves as a foundation for further investigation by the user of the application.

The pages for the educational elements were built from information from the following sources (complete citations in references):

1. American Society of Clinical Oncology (Andriole, Oesterling, Talcott, Wasson)

2. ICI Pharma

3. TAP pharmaceutical, Inc

4. US TOO (Chodak)

5. National Cancer Institute

6. American Foundation for Urologic Disease, Inc.

7. University of Chicago Urological-Oncology Group

8. American Cancer Society

9. Texas Cancer Data Center-Online

10. The Prostate Sourcebook (Morganstern & Abrahams)

11. Coping with Prostate Cancer (Phillips)

CHAPTER FOUR

EVALUATIONS AND IMPRESSIONS

According to the procedures set forth in chapter one, the application was tested for content validity. Although the aim of this project was to demonstrate the potential of developing custom made software applications, testing is important because it gives the developer the opportunity of seeing how potential users react to the finished product. Often a developer loses touch with the real goals in designing a software application and concentrates solely on the technical aspects of design and implementation.

Figure 1 is a copy of the questionnaire that was given to ten members of the Denton and North Dallas US TOO groups. US TOO is a national organization comprised of men who have had prostate cancer, or are interested in understanding more about care and treatment. In the Dallas area, there are five different affiliates.

The application was presented to the two groups at different locations and at separate times. Because attendance at the support

group meetings is usually lower during the summer months, the application was presented to two support groups rather than one. This allowed for sufficient time for each user to inspect the application at a more relaxed pace. The Denton presentation was made on July 9, 1994 and the Dallas presentation was made on July 12, 1994. Each group was given a short explanation of why, and for what audience, the application was developed. Each member was then asked to review the application and complete the questionnaire.

The results of the survey and the comments were very positive. The mean scores are listed in Table 1. The remainder of this chapter covers comments made by the group members after reviewing the application. US TOO considers increasing public awareness about prostate cancer an important organizational issue. The question of why an application such as this prototype had not been developed previously was asked often. The reviewers also found it easy enough for use by someone who is usually not comfortable with computers. Other comments included criticism on application navigation. The application should allow for movement between chapters by going directly to the chapter without having to return to the contents page.

The quantity of information regarding treatments was also questioned. This was expected. It is important to remember that most of the members of US TOO are men who have had, or do have, prostate cancer. They are interested in issues related to curing the disease. It was suggested that a separate application for detailing the different treatments along with a data base of physicians who specialize in the different treatments would be a worthwhile application.

Figure 1. Evaluation Form

PROSTATE CANCER USER'S EVALUATION FORM

DIRECTIONS: PLEASE ASSIST ME EVALUATE THE PROGRAM. PICK A NUMBER FROM THE SCALE BELOW TO SHOW HOW MUCH YOU AGREE OR DISAGREE WITH EACH STATEMENT.

SCALE

1 = STRONGLY AGREE
2 = AGREE
3 = NEUTRAL
4 = DISAGREE
5 = STRONGLY DISAGREE

1. The directions for using the system were clear   _____

2. It is easy to move from chapter to chapter   _____

3. For men without knowledge of prostate cancer, this system provides important information   _____

4. The information provided is accurate   _____

5. The information provided is current   _____

6. The graphics support the information provided   _____

7. Not enough attention is given to the treatments   _____

8. The importance of getting good medical advise is presented thoroughly   _____

9. The importance of getting an annual exam is presented thoroughly   _____

Table 1

Evaluation Survey Results

Question	Score
1. The directions for using the system were clear	1.3
2. It is easy to move from chapter to chapter	2.3
3. For men without knowledge of prostate cancer, this system provides important information	1.3
4. The information provided is accurate	1.7
5. The information provided is current	1.8
6. The graphics support the information provided	1.4
7. Treating prostate cancer is not stressed enough	2.2
8. The importance of getting good medical advise is presented thoroughly	2.4
9. The importance of getting an annual exam is presented thoroughly	1.6

Note: The scale reflects values from 1-5 with 1 showing the strongest agreement and 5 showing least agreement.

CHAPTER FIVE

CONCLUSIONS

For this study, a prostate cancer application was been developed. It demonstrates that in the current desktop computing environment, health educators can build applications specifically designed for a target audience. Interest in this application exhibited by those who examined it suggests that there is a sizable potential market for computer packages developed by health educators .

As can be expected when pursuing a research path that is uncommon in a particular discipline, anticipating resource expenses and barriers to producing the intended product was challenging. The investment required for the hardware and software packages was much greater than expected. Also while NeXTSTEP provides much of the code needed to develop the application, a thorough understanding of the C programming language was required.

While the potential for the package as a section of a broader cancer education program was considered, in this particular

application it was considered secondary to the development of a stand alone application. Upon completion of the prototype this changed. The requirements to run the application on a "typical" home computer are greater than what was originally considered. This application requires almost 9 megabytes of space. A second improved version of the application will be given to MCI in Dallas and Swiss Bank in Chicago. These two corporations have developed technological networks that will provide for file transfer and viewing throughout their networks. The second version will utilize images to a greater extent.

Also a number of new operating systems are entering the market place. In the past, Disk Operating System (DOS) has been the platform by which most personal computers operate. But this is changing quickly. With these new operating systems, of which NeXTSTEP is one, reading applications built on one platform might not be possible on another platform. For this prototype and others developed for health education needs this is not all bad. What is important is that now heath education applications can be developed quickly for a specific target audience.

But sizable barriers do exist because while technology can be exciting, it is demanding. Exciting because of its potential, demanding because of the pace of technological advancement. This advancement requires a sizable professional commitment, therefore, it is questionable as to whether or not health educators will ever embrace the potential of the computer. Most likely we will be users of applications built for others, and not builders of our own applications.

For health educators with the desire to venture into software development, a few recommendations:

1. Learning a computer programming language is required. This does not mean simply being able to read the code. Developing applications requires good code writing skills.

2. Technology is evolving at a rapid pace. Don't become frustrated with change. Embrace it. It is very exciting.

3. Developing software requires a sizable commitment, not only financially but in time. It is reasonable to expect application development the area of professional interest. If there is limited interest in developing quality software, consider working with a programmer in a joint development partnership.

4. Software applications for health education are few and the desire for applications is great. Lack of imagination is the only barrier to finding a viable application project. The amount of interest in this application, without attempting any marketing, has been amazing. Educators from as far away as England and Germany have asked for it.

5. Finally, be prepared to succeed. With a commitment to a project it is impossible to fail.

REFERENCES

American Cancer Society. (1991). Cancer facts and figures.

Atlanta, GA..

American Foundation for Urologic Disease. (1992, Spring).

Foundation Focus. Baltimore, MD: Author.

Anderson, G., & Anderson, P. (1988). Advanced C: Tips and

Techniques. Hayden.

Andriole, G. (1994, March). The treatment of early stage prostate

cancer. Proceedings for the 30th Annual Meeting of the American

Society of Clinical Oncology, Dallas, Texas.

Antony, R., & Merk, A. (1993). Determinator: decision support

system and tool-kit using the profuse method. Proceeds for the

BANKAI Workshop on Adaptive Intelligent Systems, Brussels.

Ayre, R. (1994, May 17). How much memory do you need?

PC Magazine, pp. 115-133.

Babian, R., Miyashita, H., Evans, R., von Eschenbach, A., &

Ramierez, E. (1991). Early detection program for prostate

cancer: Results and identification of high-risk patient population. Urology, 37(3), 193-197.

Bergson, E., Guglielmo, C., & Whitmer, C. (1993, December). Evolution of a nextstep project: How customers evaluate, develop, and deploy. Nextworld, pp. 22-27.

Breckon, D. J. (1988, March/April). Reflections: Health education in the year 2000. Health Values, 12(2), 53-57.

Brown, M., Potosky, A., Thompson, G., & Kessler, L. (1990). The knowledge and use of screening tests for correctal and prostate cancer: Data from the 1987 national health interview survey. Preventive Cancer, 19, 562-574.

Budd, T. (1991). An Introduction to Object-Oriented Programming. Reading, MA: Addison-Wesley.

Carter, H.B., Piantadosi, S., & Isaacs, J.T. (1990). Clinical evidence for and implications of a multistep development of prostate cancer. The Journal of Urology, 143, 742-746.

Catalona, W., & Basler, J. (1991). Return of erections and urinary continence following nerve-sparing radical retropubic prostatectomy. Journal of Urology, 150, 905-907.

Chadwick, D. J., Kemple, T., Astley, J. P., MacIver, A. G., Gillatt, D., Abrams, P., & Gingell, J. C. (1991, September 7). Pilot study of screening for prostate cancer in general practice. The Lancet, 338, 613-616.

Chariot Software Group. Lung cancer staging: A tutorial [Computer program. San Diego.

Chodak, G. (1989). Early detection of prostate cancer. Hormone Research, 32(Suppl. 1), 35-37.

Chodak, G. (1993, Oct/Nov/Dec). An upcoming treatment for prostate cancer: Cryosurgery. US TOO, pp. 1,4.

Coleman, D., Hayes, F., & Bear, S. (1992). Introducing objectcharts or how to use statcharts in object-oriented design. IEEE Transactions on Software Engineering, 18(1), 9-18.

Cox, B., & Novobilski, A. (1991). Object-oriented programming: An evolutionary approach. Reading, MA: Addison-Wesley.

Creative Multimedia Corporation. The family doctor, 3rd edition [Computor program]. Portland.

Creative Multimedia Corporation. Year book: 1993 edition [Computer program]. Portland.

Dear, B. (1986, July). Artificial intelligence techniques: Applications

for courseware development. Educational Technology,

pp. 7-15.

Dole, R. (1992, July). Of Cancer and candor. Men's Health,

pp. 65-67.

Durand, D., & VanHuss, S. (1992). Creativity software and dss.

Information & Management, 23, 1-6.

Evans, S., & Clarke, P. (1989). The interactive videodisc as

microscope for study of human information processing. Paper

presented at the annual meeting of the International

Communication Association, San Francisco.

Foster, S. (1991). C by Discovery. New York: Scott/Jones

Freedman, A. (1993). The computer glossary: The complete

illustrated desk reference. Amacom: New York.

Garfinkel, S., & Mahoney, M. (1993). NeXTSTEP Programming.

Telos: Santa Clara, CA.

Garnick, M. (1994). The dilemmas of prostate cancer.

Scientific American, 270(4), 72-81.

Gerber, G., & Chodak, G. (1991). Assessment of value of

routine bone scans in patients with newly diagnosed prostate cancer. Urology, 37(5), 418-422.

Gold, R. (1991). Microcomputer applications in health education. Dubuque, IA: Brown.

Hardeman, S., Wake, R., & Soloway, M. (1989). Two new techniques for evaluation prostate cancer. Postgraduate Medicine, 86(2), 197- 208.

Harper, G. (1993). Copyright & the University Community. Austin: Office of General Counsel, UT System.

Hesgnat, M., Kaut, L., Kovi, J., Jackson, R., Jackson, A., Jones, J., Edison, M., Enterline, J., Worrell, R., & Perry, S. (1985). Nutrition and prostate cancer: A case-control study. The Prostate, 6, 7-17.

Howell, G. (1992). Building hypermedia applications. New York: McGraw-Hill.

ICI Pharma. (1989). Prostate cancer: What it is and how it is treated. Wilmington, DE.

Kaplan, I., Cox, R., & Bagshaw, M. (1993). Prostate specific antigen as external beam radiation therapy for prostate cancer: Follow-

Up. <u>Journal of Urology,</u> <u>142</u>, 519-522.

Kaps, E. (1991, Fall). Prostate cancer support groups. <u>Coping,</u> pp. 24-25.

Karake, Z. (1990). Enhancing the learning process with expert systems. <u>Computers in Education,</u> <u>14</u>(6), 495-503.

Kritz, F. (1992, July 1). Psa plus rectal exam may detect most prostate tumors. <u>Medical World News,</u> <u>33</u>(6), pp. 28,30.

Kumar, N. (1992). <u>An experimental comparison of three methods of instruction in health education for cancer prevention: Traditional paper prose text, passive non-interactive computer presentation and overt-interactive computer presentation.</u> Unpublished doctoral dissertation, University of South Florida.

Lange, P. (1991). Early detection of prostate cancer? <u>Journal of the National Cancer Institute,</u> <u>83</u>(17), 1199-1203.

Lee, F., Torp-Pedersen, S., Cooner, W., Drago, J., Holtgrewe L., Littrup, P., Resnick, M. (1992, July 1). Detection and screening for prostate cancer. <u>Cancer</u> (Suppl). <u>70</u>(1), 355-356.

Le Marchand, L., Kolonel, L., & Yoshizawa, C. (1991). Lifetime occupational physical activity and prostate cancer risk.

<u>American Journal of Epidemiology</u>, <u>133</u>(2), 103-107.

Lieberman, D. (1992). The computer's potential role in health education. <u>Health Communication</u>, <u>4</u>(3), 211-225.

Lorentzen, T., Nerstrom, H., Iversen, P., & Torp-Pedersen, S. (1992). Local staging of prostate cancer in with transrectal ultrasound: A literature review, <u>The Prostate</u> (Suppl), 11-16.

Mann, C. (1993, November). The prostate-cancer dilemma. <u>The Atlantic Monthly</u>, pp. 102-107.

Marchand, L., Hankin, J., Kolonel, L., & Wilkens L. (1991). Vegetable and fruit consumption in relation to prostate cancer risk in hawaii: A reevaluation of the effect of dietary beta-carotene. <u>American Journal of Epidemiology</u>, <u>133</u>(3), 215-219.

McHaney, J. (1990). Using computer simulations as part of a field based model for training student teacher supervisors. <u>Proceedings of the National Education Computing Conference</u>.

McLauglin, J. (1991). Tobacco use and prostate cancer: 26-year follow-up of u.s. veterans. <u>American Journal of Epidemiology</u>, <u>133</u>(5), 437-440.

McNeely, E. (1988). <u>Computer-assisted instruction: A health</u>

education strategy for the older adult. Unpublished doctoral dissertation, Georgia State University.

Mettlin, C., Jones, G., & Murphy, G. (1993). Trends in prostate cancer care in the united states, 1974-1990: Observations from the patient care evaluation studies of the american college of surgeons commission on cancer. Cancer Journal for Clinicians, 43, 83-91.

Mettlin C., Lee., F., Drago, J., Murphy, G. (1991, July 15). The american cancer society national prostate cancer detection project. Cancer, 67(12), 2949-2958.

Molnar, A.. R. (1990). Computers in education: A historical perspective of the unfinished task. Technological Horizons in Education Journal, 18(4), 80-83.

Moon, T., & Clejan, S. (1991). Prostate cancer a screening in younger men: Prostate specific antigen and public awareness. Urology, 38(3), 216-219.

Morganstern S., & Abrahams, A. (1994). The Prostate Sourcebook. Los Angeles: Lowell.

Nash, J. (1994, April 25). Stopping cancer. Time, pp. 54-61.

National Cancer Institute. (1990). What you need to know about prostate cancer (NIH Publication No. 90-1576). Bethesda, MD: National Cancer Institute.

National Cancer Institute. (1991, November 1). State of the art pdq information for patients-prostate cancer. Bethesda, MD: National Cancer Institute.

NeXT. (1994, January). Next in healthcare. Menlo Park, CA: Author.

NeXTSTEP: Development tools and techniques. (1993). Reading, MA: Addison-Wesley.

Oesterling, J. (1991, July). The role of psa in detecting prostate cancer. Medical aspects of human sexuality, pp. 22-27.

Osness, D., & Marsh, J. (1983). Computerized health education: Due yesterday-ready tomorrow. Health Education and Microcomputers, 10, 26-27.

Partin, A., Pound, C., Clemens, Q., Epstein, J., & Walsh, P. (1993). Serum psa after anatomic radical prostatectomy. Urological Clinicians of North American, 20, 713-724.

Phillips, R. (1994). Coping with Prostate Cancer. New York: Avery.

Pinson, L. (1991). <u>Objective-C: Object Oriented Programming Techniques</u>. Reading, MA: Addison-Wesley.

Raloff, J. (1992). Fat may spur spread of prostate cancer. <u>Science News, 144</u>, 228.

Randolfi, E. (1986). <u>The diffusion of a curriculum in higher education: A course in microcomputer applications for health educators</u>. Unpublished doctoral dissertation, University of Oregon.

Shneiderman, B. (1992). <u>Designing the user interface</u>. Reading, MA: Addison-Wesley.

Siddal, R. (1993, February 6). Time to screen for prostate cancer? <u>New Scientist</u>, pp. 27-30.

Silverberg, E., & Lubera, A. (1988). Statistical and epidemiologic data on urologic data on urologic cancer. <u>Cancer, 60</u>, 693-718.

Small, E. (1993). Prostate cancer: Who to screen, and what the results mean. <u>Geriatrics, 48</u>(12), 28-38.

Soloway, M. (1990). The importance of prognostic factors in advanced prostate cancer. <u>Cancer, 66</u>, 1017-1021.

Spitz, M., Currier, R., & Fueger, J. (1991). Familial patterns of

prostate cancer: Case-control analysis. <u>The Journal of Urology,</u> <u>146</u>(5), 1305-1310.

Stricker, H., Ruddock, L., Wah J., & Belville, W. (1992). Detection of non-palpable prostate cancer. A mathematical and laboratory model. <u>British Journal of Urology, 71</u>, 43-46.

Talcott. J. (1994). Complications and costs of treatment for early prostate cancer. <u>Proceeds from the 30th Annual Meeting of the American Society of Clinical Oncology,</u> Dallas, Texas.

TAP Pharmaceutical. (1991). <u>Prostate cancer: What everyone should know.</u> Deerfield, IL.

Terris, M., McNeal, J., & Stamey, T. (1991). Efficacy of transrectal ultrasound for identification of clinically undetected prostate cancer. <u>The Journal of Urology, 146</u>(1), 78-84.

Teton Data Systems. <u>Stat!-ref</u> [Computer program]. Jackson, WY.

Texas Cancer Data Center. <u>Online cancer information.</u> Houston.

The University of Chicago Urological-Oncology Group. <u>Summary of treatment options for early prostate cancer.</u> Chicago.

Verity, J., & Schwartz, E. (1991, September 30). Software made simple. <u>BusinessWeek,</u> pp. 92-97.

Walsh, P. C. (1992). Why make an early diagnosis of prostate cancer. TheJournal of Urology, 147, 853.

Wasson, J. (1994). Prostate cancer screening and treatment: The battle of the 1990's? Proceeds from the 30th Annual Meeting of the American Society of Clinical Oncology, Dallas, Texas.

Whittmore, A. (1994, Jan/Feb/Mar/Apr). Nutrition and other risk factors for prostate cancer. US TOO, 1,3-5.

Zannis, M. (1992). Health educators use of microcomputer technology in graduate programs. Unpublished doctoral dissertation, University of Maryland.

APPENDIX: APPLICATION PAGES

PROSTATE CANCER

TABLE OF CONTENTS

WHAT IS CANCER?

THE PROSTATE GLAND

HOW DOES IT GROW?

RISK FACTORS & SYMPTOMS

[DETECTION] & YOU

TREATMENT OPTIONS

[DIAGNOSIS] / STAGES

QUESTION?

FINDING SUPPORT

HOW TO USE THIS TUTORIAL? WITH THE MOUSE CLICK THIS BUTTON

There are only a few simple commands. At the bottom right hand corner of the page are two arrows. Click the arrow to move to the prior or next screen.

Located at the bottom left corner is a small picture of the opening screen. Click it and you will return to the contents page. If the image is of the bladder and prostate, clicking it will take you to the first page of the chapter.

Finally, know that by using this tutor you will learn more about prostate cancer. It will not, and is not designed to, answer all the questions you might have. Learn what you can here, then move forward.

WHAT IS CANCER?

The blueprint for our cells comes from the molecule DNA. Under normal circumstances, the DNA do a good job of controlling cellular growth and division. But factors such as genetics, the environment, and smoking can lead to abnormal changes in the blueprint, resulting in a change in the cellular makeup.
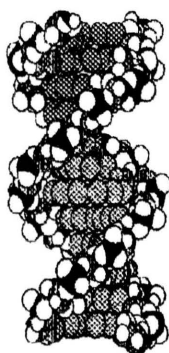
These new abnormal cells may then develop into a tumor, which because they are different, can't be controlled by the bodies normal regulatory processes. These new cancerous cells procede to grow and live off the body.
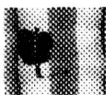
WHAT IS THE PROSTATE GLAND?

The prostate is a small gland that is part of the male reproductive system. It aids in the production of semen, the fluid that carries sperm. It is located under the bladder and above the rectum. The

Rectum — Bladder — Prostate — Urethra
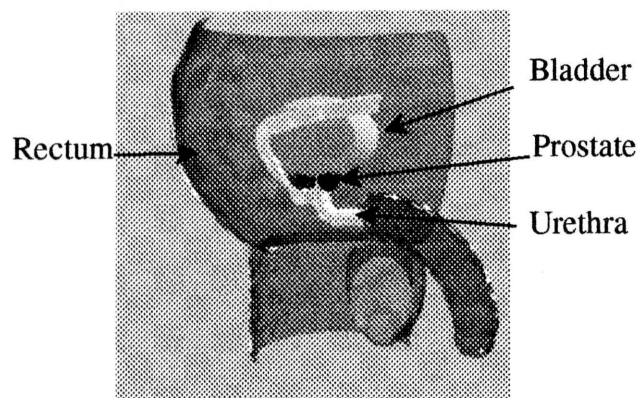
urethra is surrounded by the prostate, which can cause problems as the prostate gland enlarges. The prostate is about the size of a
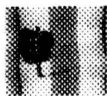
chestnut and weighs only about one ounce. There are a number of large blood vessels located close to the prostate. This is usually not a problem, unless you have prostate cancer. These vessels and the nerves in the area might be at risk if you undergo surgery.

The gland grows to its normal size during puberty and it remains about the same size until you reach your 50's. It then begins to enlarge again. The reasons for this are not really known, although your age and male hormones are believed to be factors. A condition known as Benign Prostatic Enlargement (BPH) can result. This is **not** the same as prostate cancer.

Problems associated with BPH include difficulty urinating and need to urinate frequently. The Digital Rectal Exam (DRE) can detect BPH. Surgery that removes part of the prostate is a common treatment. But because only part of the prostate is removed, this does not eliminate the chance of developing prostate cancer.
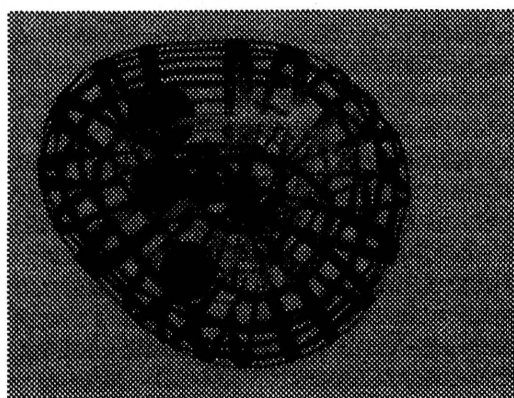
STAGES

There are not any set standards for classifying the different stages of prostate cancer, but almost all classification models are developed around the following four stage system. There are also subclassifications for each stage.

STAGE A

In Stage A the cancer is usually confined to one small area within the prostate gland. If you have Stage A prostate cancer you probably wouldn't know it. You won't notice any symptoms and most likely
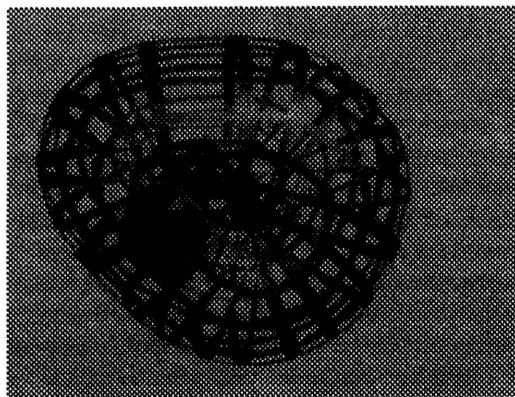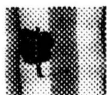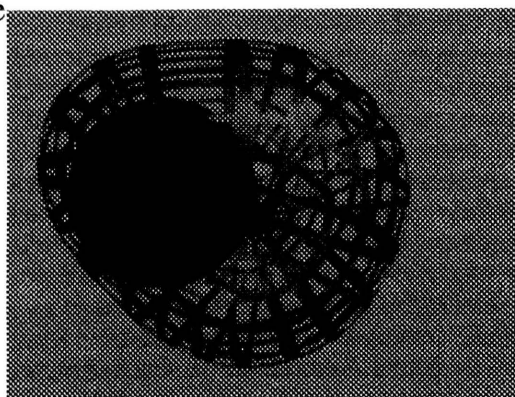
the cancer is too small to be detected during a Digital Rectal Exam (DRE). The best exams for detection of a Stage A tumor have been Transurethral Ultrasound (TRUS) and the Prostate Specific Antigen (PSA).

Now the for the two subclasses: A1 and A2.

A1 tumors are found within one small area.

A2 tumors are found in more than one section of the prostate gland. Because the cancer has been found in multiple areas, the chance of the cancer "behaving aggressively" is increased.

To see the difference between A1 and A2, go back a page and move the mouse in and out of the image of the prostate gland.

STAGES

There are not any set standards for classifying the different stages of prostate cancer, but almost all classification models are developed around the following four stage system. There are also subclassifications for each stage.

STAGE A

In Stage A the cancer is usually confined to one small area within the prostate gland. If you have Stage A prostate cancer you probably wouldn't know it. You won't notice any symptoms and most likely

STAGE B

The Digital Rectal Exam (DRE) can find a Stage B tumor. You still might not have any symptoms. Therefore, your annual exam is very important. The tumor is still within the confines of the prostate gland, so surgery and radiation are available treatment options.

Stage B1

A Stage B1 tumor is more developed than a stage A1 tumor. It is still confined to one lobe of the prostate gland. For a look at B2, scan the image with the mouse.
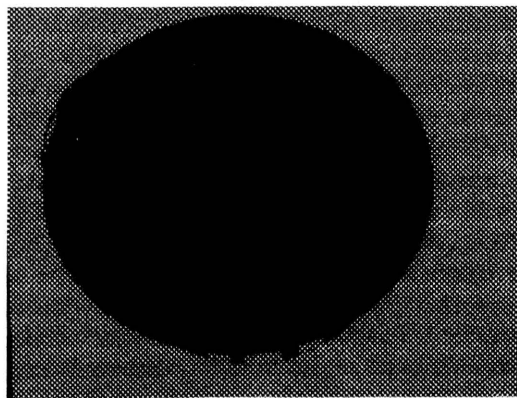
STAGE B

The Digital Rectal Exam (DRE) can find a Stage B tumor. You still might not have any symptoms. Therefore, your annual exam is very important. The tumor is still within the confines of the prostate gland, so surgery and radiation are available treatment options.

Stage B1

A Stage B1 tumor is more developed than a stage A1 tumor. It is still confined to one lobe of the prostate gland. For a look at B2, scan the image with the mouse.
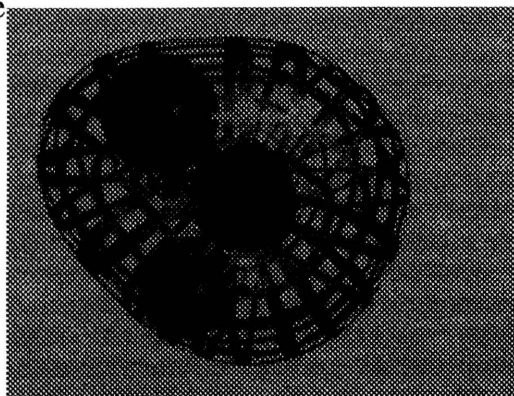
Stage B2

Like A2, stage B2 cancer is present in more than one lobe. It is now more than 2 centimeters in size.

STAGE C

Symptoms such as difficulty urinating are evident for Stage C prostate cancer. The cancer has now spread beyond the confines of the prostate and the prostate gland is rock-hard. Because the cancer has spread outside the prostate, your treatment options are usually limited.

STAGE D

The cancer has spread to other areas of the body (metastasized).
The lymph nodes and bones are the areas to where the cancer first
spreads.   Treatment, such as hormone therapy, is used to help slow
the growth of the cancer and relieve any associated pain.
Unfortunately, the life expectancy for a Stage D cancer patient is
only about 3 years.

When the cancer spreads
to the bones, it usually
goes to (in order
of frequency):

3. Ribs

2. Spine

4. Femur

1. Pelvic Area
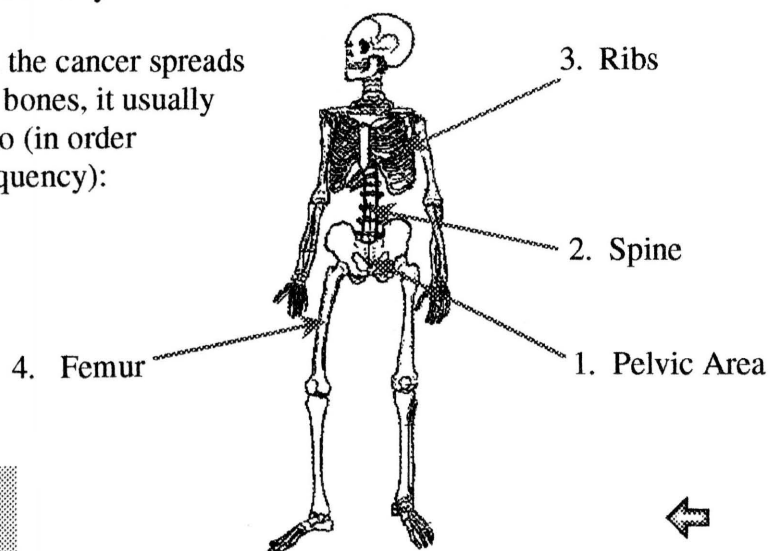
ASSESSING YOUR SITUATION

What causes prostate cancer is not yet clear. Studies linking occupations, cigarette smoking, and the environment to the disease have not been conclusive. What is known is that family history and diet may be factors. Also certain ethnic groups are more susceptible than others. For example, the chart below shows the death rates from prostate cancer in different ethnic groups in the State of Texas.

DEATH RATES FOR TEXANS
PER 1000 MEN
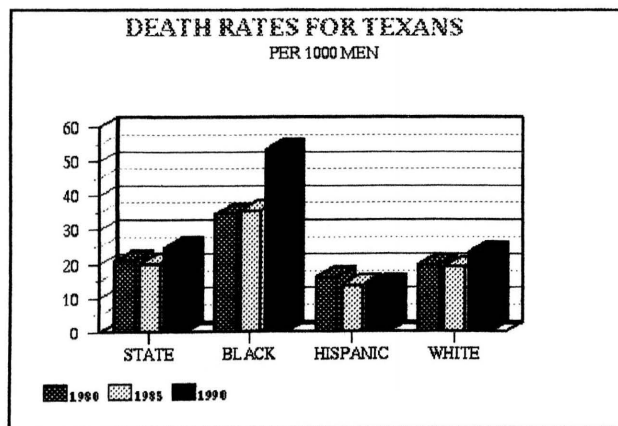
RISK FACTORS

AGE

Only about 1% of the detected prostate cancers occur in men under the age of 50. This doesn't mean that men under 50 don't develop it. This is only the percentage of detected cases. For men between the ages of 50 and 64, the percentage increases to 16%. The remaining 83% are detected in men over the age of 65.
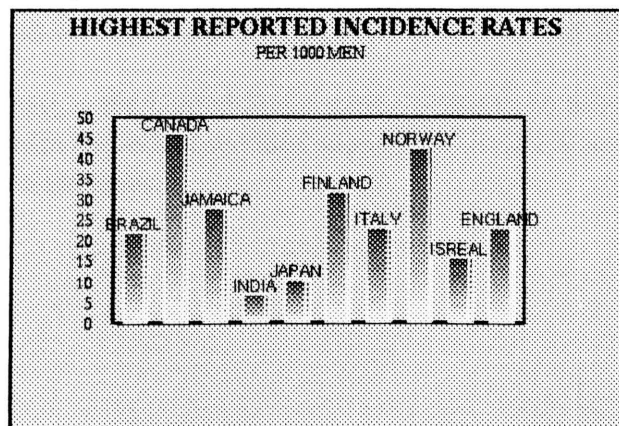
TEXAS PROSTATE CANCER DEATHS
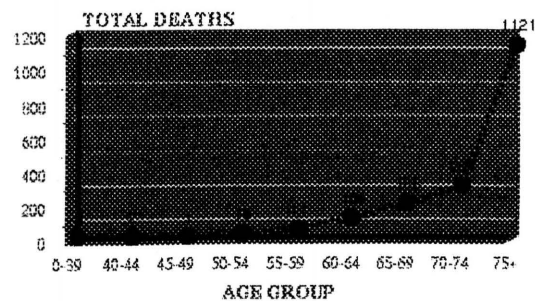
ETHNIC GROUP

For African-American men, the risk of developing prostate cancer is 40% higher than for Caucasian men. It is the highest rate in the world. The reasons for the increased risk are not known.

Prostate cancer is more common in Northwest Europe and North America. The incidence rate is lower in Africa, Central America, South America, and the Near East.

HIGHEST REPORTED INCIDENCE RATES
PER 1000 MEN

A bar chart showing incidence rates per 1000 men with a y-axis scale from 0 to 50 (in increments of 5), for the following countries: BRAZIL, CANADA, JAMAICA, INDIA, JAPAN, FINLAND, ITALY, NORWAY, ISREAL, ENGLAND.

A few notes on the chart from the preceding page. One, the rates illustrated are based on the figures reported up to 1987. Second, each rate is for the highest reported rate in that particular country. For example the highest reported rate for the United States was for African American men in Alameda County, California. The reported incidence rate was 100.2 per 1000 men. The lowest incidence rate in the United States was for Japanese-American men in the Bay area of California. Their rate was 12.7/1000 men. Finally, some areas of the world do a more thorough job of collecting data, so the incidence rates illustrated on the chart might be for the whole nation or just a local area.

Immigration into the United States appears also to be a factor. The incidence rates for Japanese emigrants to the United States are higher than for men in Japan.

DIET

There is more evidence that diet may be a risk factor. Recent studies have found that men who have diets high in animal fats were 2.5 times more likely to develop prostate cancer. Foods generally included were beef, pork, lamb, and chicken with the skin.

Remember, not all dietary fats are alike. For example, vegetable oils don't appear to be a risk factor.

Why animal fats? Researchers believe that a link exists between the level of alpha-linolenic acid and prostate cancer. Whether there is a direct link or not has not yet been proven.

FAMILY HISTORY

If you have an immediate relative who has had prostate cancer, your chances of developing it are doubled. If you have three relatives who have developed prostate cancer, you are eleven times more likely than normal to develop it.

Considering that normally about 1 in 11 men will develop prostate cancer, any family history of the disease should serve a warning to get your exams early and on a regular basis.

SYMPTOMS

In the initial stages, the cancer usually develops without any noticeable symptoms. The early symptoms are usually similar to Benign Prostatic Hypertrophy (BPH) symtoms. One of the first noticeable symptoms is difficulty urinating, which is caused by the growth of the prostate gland around the urethra. Other symptoms include the following:

Frequent need to urinate--especially during the night;
Painful urination;
Blood in the urine;
Pain during ejaculating:
Pain in the lower back, hips, or thighs;
Fatigue or anemia.

HOW IS PROSTATE CANCER DETECTED?

There is no "sure proof" exam for prostate cancer detection, but there are a number of different tests available. The three main screening tools are the:

Prostate-Specific Antigen (PSA)
Digital Rectal Exam (DRE)
Transurethral Ultrasound (TRUS)

If the findings from these exams indicate a chance of prostate cancer, a biopsy will be administered. Individually each has limits. Studies have shown that a single exam can fail to detect cancer up to 45% of the time. But when combined, the detection rates are much better. For the:

PSA + DRE: Positive Prediction Value is from 60% to 75%
PSA + DRE + TRUS: Positive Prediction Value of 71% to 77%
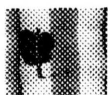
THE PSA EXAM

The recently developed Prostate Specific Antigen is a blood test that measures the level of PSA in the blood. PSA is a normally produced substance in the prostate gland. The level of PSA is measured in nanograms in a milliliter of blood (ng\ml).

It has been assumed that a good reading for PSA in the blood should be between 0 and 4 ng/ml, but recently new guidelines have been suggested based on age. For men 41 to 50 years old, a normal reading should be 2.5 ng\ml. Men in the 50 to 70 age range should "normally" have a PSA level from 3.5 to 4.5 ng\ml. Over the age of 70, a reading of 6.5 ng\ml would fall within the normal range.

As with all the prostate cancer exams, the PSA exam has limits. The exam may reveal normal levels (0 to 4 ng\ml) of PSA in up to 30% of men with localized prostate cancer. For men with PSA levels between 4 and 10 ng\ml, cancer may be present. Readings in this range should serve as an incentive for further testing with one of the other prostate cancer screening exams. Above 10, there is a very good chance that cancer is present.
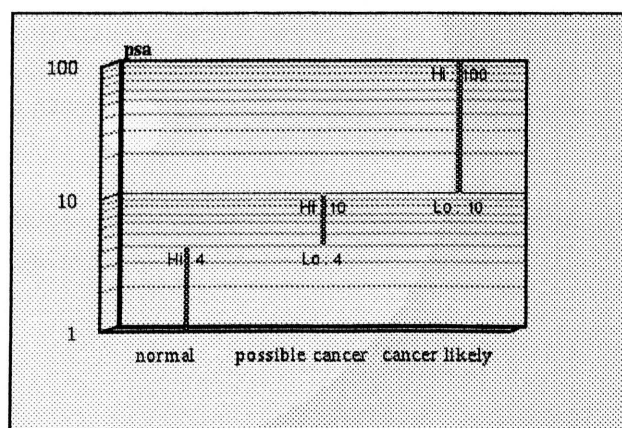
The exam can also show high PSA levels in men without the disease. This is the case in about 16% of the tests.

The reason for the inaccuracy is that in some cases the early stages of cancer do not raise the PSA level. On the other end, other noncancerous conditions associated with the prostate gland falsely raise the PSA to abnormal levels.

This is a popular test, which has been attributed to the 90,000 cases expected to be found in 1994. This would more than double the number of prostate cancer cases diagnosed in 1986.

The PSA is easy to administer, requiring only a blood sample. It usually costs between about $35, making it inexpensive.

DIGITAL RECTAL EXAM (DRE)

The position of the prostate provides for easy access by way of the rectum. With a finger inserted directly into the rectum, a physician can feel the prostate gland. The physician checks for gland enlargement and areas of abnormal growth.

While the exam can cause temporary discomfort, it is inexpensive, simple, and most important, can detect cancer.

The DRE does have limitations. The exam is operant-dependent. It is also difficult to detect prostate cancer in the early stages.

For men over the age of 40, an annual DRE is recommended by the American Cancer Society and the National Cancer Institute.

TRANSRECTAL ULTRASONOGRAPHY (TRUS)

Like the PSA, the TRUS is a recently developed exam. Like the DRE, this exam is administered through the rectum. In this case the physician inserts an ultrasound instrument that emits sound waves that echo off the prostate gland. The waves are converted to images that are then seen on a video screen.

As a screening test, TRUS is not commonly administered. Some studies have shown it to be more sensitive in diagnosing prostate cancer while other studies have found it to be less sensitive. It does require expensive equipment and it's reliability can be dependent on the operator's ability.

TRUS have proven to be an effective way to monitor confirmed cancer cases, men with an abnormal DRE, or an elevated PSA.

BIOPSY

If one of the prior exams indicate that there is a possibly of cancer, your physician will procede with a biopsy. This test will confirm whether or not cancer is present.

A biopsy involves the removal of a small portion of the prostate for evaluation. A urologist inserts a thin needle through the rectum that removes a very small portion of the gland. The procedure is painless and takes only about 10 minutes.

⇦ ⇨

WHAT SHOULD YOU DO?

The American Cancer Society and the National Cancer Institute both recommend that men begin getting an annual DRE at age 40. At age 50, you should get both a DRE and a PSA.

The TRUS should be administered if one of the first two tests is abnormal. Why? Because the availability of TRUS is limited.

If you are in an at-risk group, such as an African-American or have prostate cancer in your family history, these recommendations do not apply. Talk to your physician. You might want to have a bi-annual DRE or begin having both the DRE and the PSA at age 40.

Remember, by the time the symptoms begin to show the you could have at least a Stage B cancer, and your treatment options will be limited.

Mass screening for prostate cancer is controversial. A mass screening program would be expensive. Also some men can live with prostate cancer and not die from it. If it doesn't mastisize (stays confined) you can carry on with your life without undergoing any treatment.
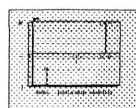
What is important is that screening exams are available--**use 'em. It's up to you to get your annual exam.**

For a summary in a chart-like form, click the image

DRE

normal   abnormal

psa <4   psa 4-10   psa >10   trus and biopsy

psa and dre   psa*   trus and biopsy

* if psa is between 4-10, test at 4 to 6 months intervals. Watch for changes in the values.
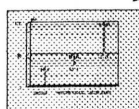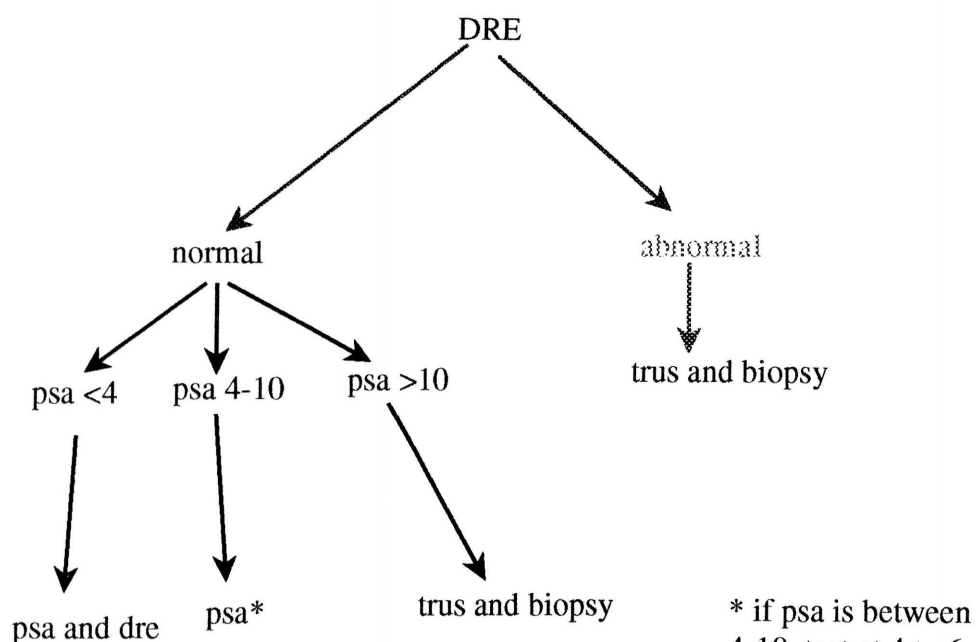
click the image to return to tutorial

TREATMENT OPTIONS

You have a number of different options available for treatment of prostate cancer. Please note that treatment options vary depending on your situation.
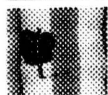
Click one of the buttons for information on a specific treatment.

| Delay Treatment | Hormone Therapy |

| Cryosurgical Ablation |

| Surgery | Radiation Therapy |

DELAY TREATMENT

One option you have is to wait. In many cases, while the cancer is localized, and you are without symptoms, immediate treatment may not be necessary. In other parts of the world, this is a common practice.

It is important to remember that you can not predict the rate of the cancerous growth or agressiveness. Therefore, closely monitoring the status of your situation is important.

The advantage of this option is that you can avoid any complications from any of the other treatment options.

The disadvantage is that the cancer is not cured.

RADIATION THERAPY

For men unable to withstand the rigors of radical surgery, or if you seek to prevent further spreading of the cancer, radiation is an option. The radiation can be applied using two different methods: Externally or by seed implantation. External Beam Therapy is administered 4-6 days a week for up to 8 weeks. The treatment is painless.

Seed Implantation (Brachtherpy) requires surgically implanting "seeds" directly on the prostate gland. The seeds emit rays for about a year, and afterwards will remain harmless inside your body. This treatment can not be repeated.

The disadvantages of radiation include frequent and painful urination, diarrhea, upset stomach, and impotence.

The advantages of radiation include the ability to function normally during treatment and avoidance of surgery.

HORMONE THERAPY

Hormone therapy is an effective treatment for slowing or stopping the growth of cancerous cells. Hormone treatments decrease the production of the testosterone, a male hormone (androgens) that contributes to the growth of the cancer cells. For cancer that has spread beyond the confines of the prostate gland, this is often the preferred treatment method. Also hormone therapy can be used prior to radiation or surgery. It is an effective way to decrease the size of the prostate gland.

The disadvantages of this therapy include hot flashes, a decrease in sex drive, and impotence.

The advantages of hormone therapy include avoiding, or decreasing, the effects of surgery or radiation treatments. For patients in the later stages of life, and with a short life expectancy, hormone treatments may help with living comfortably with prostate cancer.

CRYOSURGICAL ABLATION

Cryosurgical ablation is a procedure in which 5 "probes" are placed within the prostate gland that in effect, freeze it. The procedure is sometimes done under general anesthesia and is accomplished transperineally.
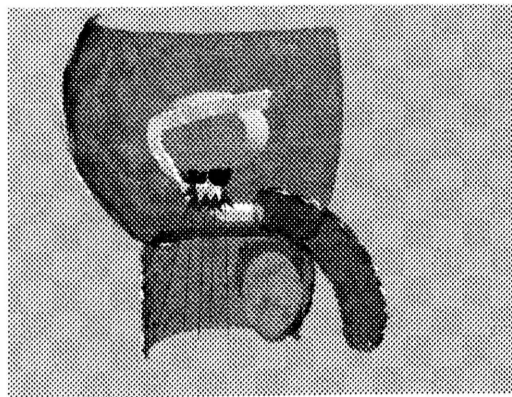
No radical incision is made, and the treatment is performed in 2 to 3 hours. A 1 day hospital stay is usually required. If you undergo this treatment you will be discharged with a catheter that is in place for 1 to 3 weeks, or until normal urination resumes.

The advantages of cryosurgery are: No radical surgery, no blood loss, minimal risk of incontinence and/or impotence, it can be repeated, and can be used along with other treatments.

The disadvantages are that: It is only applicable for the early stages of prostate cancer, and the treatment, although around for 25 years, is new to prostate cancer. Therefore, any long term side effects have not been determined. Also, at this time it has not been approved by Medicare for payment.

SURGERY

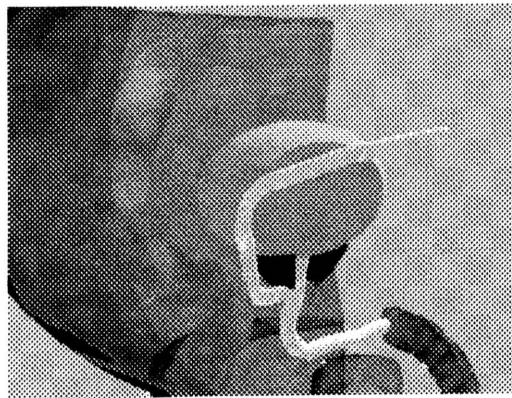There are three methods used for surgical removal of the prostate gland:

Perineal Prostatectomy
Retropubic Prostatectomy
Transurethral Resection

The term Radical Prostatectomy refers to both Retropubic and Perineal Prostatectomy. Transurethral Prostatectomy is not an invasive procedure.

In Perineal Prostatectomy, the prostate gland is reached by cutting in the space between the scrotum and the anus. Lymph nodes are not removed.

Retropubic Prostactetomy involves removal of the prostate gland by way of the abdomen. This operation often includes the removal of the prostate and the pelvic lymph nodes. The loss of the nerves necessary for erection and incontinence is less likely with Retropubic Prostatectomy.
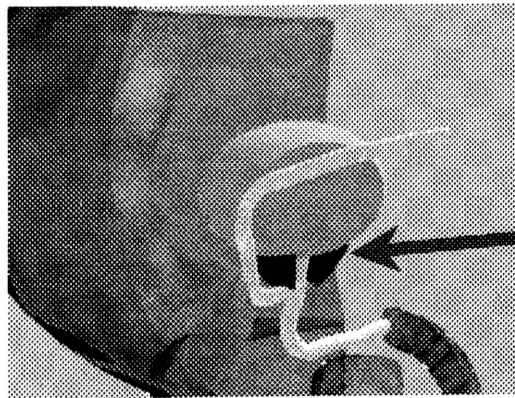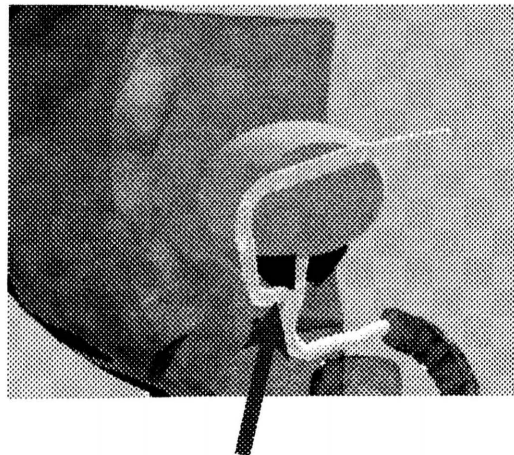

Click one

RETROPUBIC

PERINEAL

In Perineal Prostatectomy, the prostate gland is reached by cutting in the space between the scrotum and the anus. Lymph nodes are not removed.

Retropubic Prostactetomy involves removal of the prostate gland by way of the abdomen. This operation often includes the removal of the prostate and the pelvic lymph nodes. The loss of the nerves necessary for erection and incontinence is less likely with Retropubic Prostatectomy.

Click one

RETROPUBIC

PERINEAL

In Perineal Prostatectomy, the prostate gland is reached by cutting in the space between the scrotum and the anus. Lymph nodes are not removed.

Retropubic Prostactetomy involves removal of the prostate gland by way of the abdomen. This operation often includes the removal of the prostate and the pelvic lymph nodes. The loss of the nerves necessary for erection and incontinence is less likely with Retropubic Prostatectomy.
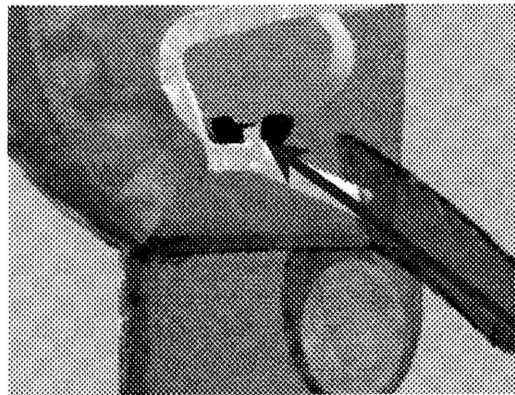

Click one

RETROPUBIC

PERINEAL

Transurethral Resection (TUR) involves removing the cancer
through the urethra. Only a portion of the prostate gland
is removed. This treatment is sometimes used for men needing
relief from the cancer symptoms, but because of age or illness are
not prospects for Radical Prostatectomy.

NOTES ON PROSTATECTOMY

You probably assume that Radical Prostatectomy would completely eliminate any possible reappearance of cancer. Not so. It is possible that the cancer has spread. Almost 25% of men who undergo surgery will have what are called "positive margins." Positive margins are microscopic cancers on the edges of the area removed surgically. Usually, a combination of the different tests will identify any remaining cancerous cells. But again, this is not always the case.

Your Options? It's your life and health that's at stake, so always monitor your situation. If more cancer is found an aggressive approach would be to undergo radiation therapy. If the cancer is still within the region, the radiation would eliminate any of the remaining cancerous cells. There is also hormone therapy. If you believe that possibly the cancer has spread to any of the outer regions, this might be a wise choice. Finally, surgery is rarely repeated, so this would not be a reasonable option.

98

NOTES ON PROSTECTOMY (CONTINUED)

Complications are always a concern. With the more aggressive treatments, such as surgery or radiation, this is even more of a factor when considering a treatment. With surgery, there is a chance of death during the operation, of becoming impotent, and incontinence. What percentage of men experience one of these complications after undergoing surgery?
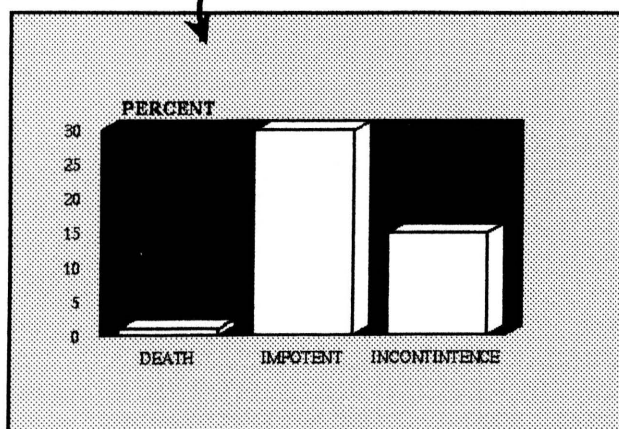
The chance of dying is less than 1 percent (.6); of becoming impotent between 30-50 percent, and suffering incontinence is 15 percent. Different studies have found different percentages, so gather as much information as you can and always discuss YOUR feelings with your physician.

With surgery you can expect to spend about 1 week in the hospital. The total recovery time lasts from 6 months to 2 years.

MIXING AND MATCHING STAGES AND TREATMENTS

Matching a treatment with a stage is not easy. **Working with your physician on the best treatment for you is critical.** The following is a closer look into matching the treatment options with the stages.

STAGES A1 AND A2

If you discover the cancer is at Stage A1, your age could be the determining factor in your treatment. If you are younger, removing the prostate with surgery or undergoing radiation are options for eliminating the cancer. If you are an older man, and without any of discomforts associated with symptoms, you may decide to wait while closely monitoring your situation. In many cases the cancer can remain localized and not inhibit your lifestyle. It is possible to live with the prostate cancer and not die from it.
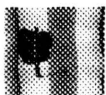
If the cancer is classified Stage A2 (not located in one area within the prostate gland) the approach to treatment is different. The options include external radiation, surgery, and waiting and watching. Surgery for Stage A2 requires the removal of the prostate gland and the lymph nodes. Radiation may follow to eradicate the remaining cancer.

STAGE B

The treatment options are almost the same as with Stages A1 and A2. In Stage B1, the tumor is still located in a single node of the prostate gland. Surgery is a frequent treatment, possibly along with radiation.

There are plenty of advocates for each type of treatment, so talk to as many different health care professionals as possible. But remember, the choice of treatment is up to you.

STAGE C

Up to 40% of all detected prostate cancers are at Stage C. Since the cancer is now beyond the prostate gland, the treatment goal is to limit the spread beyond the region.

In order to reduce the total number of malignant cells, you can have prostatectomy together with hormone or radiation treatment. Some physicians prefer only long term radiation therapy. The timing of when to begin hormone therapy is another question. Some doctors believe that treatment should begin immediately after surgery, while others advocate waiting until the result of the surgery is evaluated.

STAGE D

Because the cancer has spread to other parts of the body, curing cancer is not a goal. Controlling it is. By now the cancer can usually be found in the lymph nodes, bones, lungs and liver.

Hormone treatment is usually the treatment method.

A quick review. In this chapter there are 5 multiple choice questions. Each time you click a button, you will be told whether you're correct or not. There can be more than one correct answer.

???
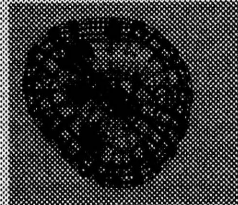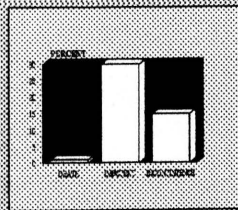
According to the American Cancer Society, at what age should you begin having a DRE exam?

1. Age 50

2. Whenever you want

3. Age 35

4. Age 40

Correct

What individuals and groups are more at risk for developing prostate cancer?

1. Coal Miners

2. Japanese

3. African-Americans

4. Men with a family history of prostate cancer

Try again

Forty percent of all detected prostate cancers are at Stage _____.

1. A2

2. C

3. B1

4. D1

Which treatment "freezes" the prostate gland?

1. Cryosurgical Ablation

2. Hormones

3. Surgery

4. Can not be done

What is considered to be within the "normal" range for the PSA exam?

1. 10 and 20

2. 0 and 10

3. 0 and 4

4. 4 and 10