UNIVERSITY OF CINCINNATI

FEBRUARY 10, 2004

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hereby submit this as part of the requirements for the degree of:

MASTER OF SCIENCE

in HEALTH PLANNING/ADMINISTRATION *in the* SCHOOL OF PLANNING

It is entitled: COST-MINIMIZATION: COMPARING TREATMENTS FOR LENTIGO MALIGNA

Approved by:

COST-MINIMIZATION: COMPARING TREATMENTS FOR LENTIGO MALIGNA

A thesis submitted to the

Division of Research and Advanced Studies

of the University of Cincinnati

in fulfillment of the
requirements for the degree of

MASTER OF SCIENCE

in the School of Planning
of the College of Design, Architecture, Art
and Planning

2004

by

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Wright State University 1993

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ABSTRACT

This research is a critical analysis of a cost-minimization approach that compares two treatments used in the control of lentigo maligna. The two treatments are radiation (grenz rays) and surgery (Mohr's micrographic surgery). It was found that Mohr's micrographic surgery cost less than grenz ray treatment. A critical analysis of the cost-minimization process was performed. A number of areas were identified that should be carefully assessed when using a cost-minimization analysis. These areas include: data access; sample size; complete and specific center data; changes in current procedural terminology (CPT) codes; and elapsed time between data collection and analysis.

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INTRODUCTION

This research is a critical analysis of a cost-minimization approach that compares two treatments used in the control of lentigo maligna. The two treatments are radiation (grenz rays) and surgery (Mohr's micrographic surgery). Bucky rays and the Mischer technique are different names for grenz rays (Kompf, 1976: 115). Mohr's micrographic surgery has many different names including chemosurgery, microscopically controlled excision, and surgery with excision (Arndt, 1996: 1403).

A cost-minimization analysis is used to determine the differences between the costs of the two medical procedures. The primary interest would be the cost of the procedure and how the cost is derived. A second interest is to identify possible problems in getting all the necessary information for use in a cost-minimization analysis. This is achieved by performing a critical analysis. A critical analysis breaks down a problem into smaller parts and then examines the parts to discover the "rich complexity" of the whole (College of Saint Benedict and Saint Johns University: 2003).

The study took place at a university-affiliated research hospital that, for purposes of this research, will be called South Side University Hospital. South Side University Hospital is located in a city that will be called River City. South Side Hospital, founded in 1870, is a 490-bed institution with a yearly occupancy rate of 72.3% (Hand, 1997: 1). In 1993, South Side Hospital had 21,781 admissions, had 192,214 outpatient visits, and conducted 1,240,259 laboratory procedures (Hand, 1997: 1).

Physicians have given lentigo maligna many different names including Hutchinson's melanotic freckle, junctional nevus, melanoblastoma, and malignant melanoma in situ (Cohen, 1995: 923). Lentigo maligna, a brown patch that may occur on the face, usually occurs in the elderly and has the possibility of becoming lethal if left untreated (Tsang, 1994: 1008).

Lentigo maligna, as with other melanomas in situ, affects workers who have occupations in which there is long term exposure to the sun (Cochran, 1995: 810). The common and effective treatment of lentigo maligna in Europe has been the Miescher treatment, which is the use of grenz rays to destroy the lesion (Dancuart, 1980: 2279; Harwood, 1983: 1020). The grenz rays technique uses low energy radiation and is considered safe (Edwards, 1990: 18). In North America, by contrast, the conventional treatment for lentigo maligna has been the use of surgery with excision (Dancuart, 1980: 2279; Harwood, 1983: 1020). One form of surgery with excision is Mohr's micrographic surgery. Mohr's micrographic surgery conserves non-cancerous cells and scarring is kept to a minimum (Mikhail, 1991: 25).

According to Hayman, the cost-minimization analysis looks at the cost of two or more procedures, in which the researcher will consider the outcomes as equal, in order to select the procedure with the least cost. (Hayman, 1996: 828-829). Expenses of the two procedures were compared. The summation of the physician and hospital charges will show which procedure is the most economical. This study intends to develop a process for determining which procedure has maximum value, and outcome with the lowest cost.

The research is the first known study of its type to gain insight from a cost-minimization analysis comparing two specified treatments of lentigo maligna. An increase of the occurrence of melanoma, and lentigo maligna , is expected because of the ozone layer depletion (Cochran, 1995: 810). The need for a better treatment will be crucial due to the aging of the population, and the rationing of health care. It is hoped that this analysis will provide general practioners, dermatologists, hospital administrators, health policy makers, and third party payers with objective information regarding the economic value of grenz rays versus Mohr's micrographic surgery.

The thesis chapters first include a statement of the problem. The methodology section discusses cost-minimization analysis of radiation and surgery and explains how the information was obtained and how the analysis was performed. The data section

describes charges of using grenz rays versus those of employing Mohr's micrographic surgery. The analysis section is a critical examination of the data. The last section is the conclusion.

STATEMENT OF THE PROBLEM

The purpose of this research is to decide, by a cost-minimization analysis, the most cost-effectiveness treatment (grenz rays or Mohr's micrographic surgery) of lentigo maligna. This section contains the following subsections: cost-minimization; procedures in use at South Side University Hospital; lentigo maligna and lentigo maligna melanoma; detection of lentigo maligna and/or lentigo maligna melanoma; history and rationale for surgery; problems with Mohr's micrographic surgery; history and rationale for grenz ray treatment; alternative non-surgical treatments; and health expenditures as a factor influencing the medical decision making process.

Cost Minimization

According to Hayman (1996: 828-830), one method of financial analysis to analyze data is cost-minimization analysis. Other names for cost-minimization analysis include cost analysis and cost identification. The cost-minimization method involves comparing the cost of two or more treatments and stating which treatment has the lowest cost, assuming that the outcomes (consequences) are the same (Hayman, 1996: 828-830). Cost-minimization is commonly done by comparing a standard procedure with a new procedure or different procedure (Hayman, 1996: 828-830). Cost is defined as the summation of departmental expenses (which are incurred to produce the treatment) and the hospital overhead expenses (that are needed to be allocated as well) (Berman, 1989: 111). The procedure with the lowest cost is the one recommended, and considered to be most cost-effective (Jonasson, 1995: 1-3).

Procedures in Use at South Side Hospital

The preferred treatment in use at South Side Hospital is Mohr's micrographic surgery. South Side Hospital became interested in an alternative approach when a patient diagnosed with a benign lesion, who was concerned about the chance of damage caused by surgery, wanted an alternative form of treatment. In the late 1990s, physicians and administrators looked for an alternative, less invasive method, that was much safer than the use of high powered radiation treatments. A possible solution was the use of grenz rays treatment, an approach that was performed in Europe. Grenz rays were reported to be successful in the destruction of a lesion. South Side Hospital then decided, on a trial basis, to use grenz rays to treat patients with lentigo maligna.[1]

Lentigo Maligna and Lentigo Maligna Melanoma

Lentigo maligna was first discovered by Hutchinson in 1890 (Cohen, 1995: 923; Dancuart, 1980: 2279; Harwood, 1981: 271). Lentigo maligna and lentigo maligna melanoma, different phases of a lesion, affect three in every one-thousand persons who is over the age of fifty (Robinson, 1994: 59). The difference between lentigo maligna and lentigo maligna melanoma is the progression of growth and malignancy. Lentigo maligna, which does not metastasize to invade other tissue, is a lesion that has the potential, if left untreated, of becoming the lethal lentigo maligna melanoma. Growth of lentigo maligna occurs horizontally (contained in the epidermis) in contrast to the growth of lentigo maligna melanoma, which occurs vertically (dermis invasion)

[1] At Southside Hospital, there were patients who were interested in an alternative treatment to surgery.

(Cochran, 1995: 810, 813; Harwood, 1981: 271). Lentigo maligna melanoma could metastasize in 33% to 50% of the patients diagnosed with lentigo maligna (Harwood, 1983: 1019). Histological, dermal invasion (the precursor of metastasis disease from melanoma) occurs when abnormal melanocyte are apparent in the basal layer, and the junction of the dermis (Tsang, 1994: 1008). In a normal melanoma free cell, melanocyte are located primarily in the epidermis (Tsang, 1994: 1008).

The three factors that influence the transformation of lentigo maligna into lentigo maligna melanoma are environment, culture, and occupation. The onset of melanoma is attributed to the skin's long-term exposure (random overexposure) to ultra-violet light radiation (Autier, 1994: 1-5; American Cancer Society, 1991: 12; Cohen, 1995: 924). In addition, Cohen stated that ionized radiation, the use of hair dye, and the hormones estrogen and progesterone are agents that can increase the likelihood of the development of lentigo maligna melanoma (Cohen, 95: 923-924).

As the ozone layer (the layer in the earth's atmosphere that blocks ultra-violet B radiation) thins it is expected that the rate of occurrence of melanoma will probably increase, since the exposure of ultra-violet B light radiation will increase (Autier, 1994: 5; Cochran, 1995: 810). The group of people that will be at greatest risk of melanoma are ones of Celtic origin (Cochran, 1995: 810), and ones who have light complexion with blond or red hair, and freckles (Autier, 1994: 2). People living closer to the equator have an increased risk of acquiring melanoma (Cochran, 1995: 810). The occupations that are of greatest risk for melanoma are those that have a high exposure to ultra-violet radiation and the sun which include farmers, fisher persons, and construction workers (Cochran, 1995: 810).

The Detection of Lentigo Maligna and/or Lentigo Maligna Melanoma

A. Physical detection

Melanoma can be defined by early warning signs that an easy self-exam can detect. The American Cancer Society uses the "A B C D" approach where as "A' stands for asymmetry, "B" stands for border, "C" stands for color, and "D" stands for diameter (American Cancer Society, 1991: 12; American Cancer Society, 1999b: 2). These signs include many changes in morphological features. Two features are asymmetry and border (American Cancer Society, 1991: 12; American Cancer Society, 1999b: 2). If a lesion does not have symmetry, and/or the border between the pigmented skin and non-pigmented skin can not be detected, then it is recommended to consult a physician (American Cancer Society, 1991: 12; American Cancer Society, 1999b: 2). Two other important features of a suspicious lesion are color and large diameter (American Cancer Society, 1991: 12; American Cancer Society, 1999b: 2). If the color of a lesion is varied, for instance, with many different shades of darkness in the pigmented area, and/or the diameter is larger than 6mm, it is considered a warning sign of potential malignancy development (American Cancer Society, 1991: 12; American Cancer Society, 1999b: 2) . Other characteristics of an ominous lesion include scaling, bleeding, and oozing (American Cancer Society, 1991: 12; American Cancer Society, 1999b: 2).

B. Staging

The extent of malignant progression (proximal to distal locations) in the body is referred to as **staging** (Bair, 1990: 285; American Cancer Society, 1999b: 4). Different forms of staging include **microstaging** and **pathological staging**. Microstaging is the malignant progression in a localized area such as the skin. Pathological staging is the

staging of malignancy from a localized area (the skin) and the body by the mode of metastasis. The forms of staging are simple to complex. The two systems of microstaging are the Breslow classification system and the Clark classification system (Bair, 1990: 284; American Cancer Society, 1999b: 4).

The **Breslow classification system** was developed by Alexander Breslow and his findings were published in 1970 (Cochran, 1988: 822). Breslow discovered that the thicker a melanoma lesion, by use of an ocular micrometer, the greater the chance that it will metastasize (Bair, 1990: 280 & 284; Cochran, 1995: 814). If the lesion is thinner than .75 mm, there is approximately a 100% chance of survival of life (Bair, 1990: 285; Cochran, 1995: 285). A lesion that is equal to or greater than 4.0 mm means the individual has a survival rate of less than 20% (Bair, 1990: 285).

In 1969, a classification system similar to Breslow's was introduced and is known as the **Clark Classification System.** It was named after the developer, Wallace Clark, Jr. (Bair, 1990: 285). Clark discovered a correlation between survival rate and malignancy invasion (Bair, 1990: 285). According to Bair (1990: 285), the Clark system uses a five-level approach for the migration of the malignancy through the layers of localized invasion (the skin). Clark's level one (I) is when the lesion is localized and has not spread (Bair, 1990: 283). The second level of invasion is Clark's level two (II), when the malignancy has spread to the papillary dermis (third layer of the dermis) (Bair, 1990: 285). Clark's level three (III) is when the malignancy spreads through the papillary dermis and reaches the reticular dermis, the fourth layer of the dermis (Bair, 1990: 285). If the malignancy spreads into the reticular dermis, then it has reached Clark's level four (IV) (Bair, 1990: 285). The level of classification with the greatest chance of metastasis

is Clark's level five (V), in which the malignant cells venture out into the fascia and subcutaneous tissues (Bair, 1990: 285).

Another System of staging is **The International Union Against Cancer Classification (UICC).** The UICC is the simplest and most commonly used for classification. According to Cochran (1995: 814-815) , the first stage of UICC (Stage I) is a lesion with other lesions located within a 5 cm boundary of the primary lesion and is considered in situ. The second stage (Stage II) is diagnosed when the lymph nodes are involved with the localized malignancy (1995: 814-815). The third stage (III) is when the malignancy has spread from the localized section, in this case the skin, and spread to the lymph nodes closest to the skin and then progressed to the vital organs (1995: 814-815).

According to Cochran (1995: 814-815), the **M.D. Anderson Hospital Classification System** begins at stage 0 and ends at stage IV. At stage 0, the lesion is considered benign. Stage one (I) is considered a non-malignant stage that contains three sub-stages. The three sub-stage descriptions involve tumor containment, excision, and number. The second stage of the M.D. Anderson Classification System is when there has been a redevelopment of a malignant lesion within 3 cm of the original site. The difference between the second stage and the third stage is that in stage III when the redeveloped malignant lesions are greater than 3 cm. Stage three includes three sub-stages indicating (a) the malignancy is moving, (b) the malignancy is located in the lymph nodes closer to the original lesion, and (c) (a combination of a and b) the malignancy is moving and is located in the lymph nodes closest to the lesion. The final stage of the M.D. Anderson system is stage four (IV) and is apparent when the malignancy has spread to distant organs. Stage four (IV) has four sub-stages which include [a] the malignancy

has reappeared in the dermis, [b] it has spread to vital organs, [c] it has spread to the lymph nodes and is apparent, and it has all of the characteristic sub-stages [a],[b], and [c].

The **American Joint Commission on Cancer** uses the **T.N.M.**, which stands for T-tumor thickness, N-degree of malignancy involved with the lymph node, and M-distant metastasis (Miller, 1998: 304; Cochran, 1995: 816; American Cancer Society, 1999b: 4). The sub-stage of T-tumor thickness includes a range from "can not be assessed" to a "tumor with greater than 4mm of thickness with corresponding lesions within 2cm of the original lesion" (Miller, 1998: 304; Cochran, 1995: 816; American Cancer Society, 1999b: 4). Subclasses of the "N-degree of malignancy of lymph node" include "can not be assessed (nx)" to a mass greater the 3 cm in the lymph node closest to the original lesion and that the malignancy is spreading (Miller, 1998: 304; Cochran, 1995: 816). The last subclass of "M-Distant Metastasis" includes a range beginning at (mx) "can not be assessed" to (m0) there are no malignancies that have spread, to (m1) the malignancy has spread to distant organs (Miller, 1998: 304; Cochran, 1995: 816).

C. Biopsy

The staging of a lesion, for the detection of the level of malignancy progression, requires the use of a special procedure that is know as a biopsy. A biopsy detects malignancy progression by extraction and then microscopic examination of tissue, of and around the suspected lesion. There are five different types of biopsies: shave, punch, incisional, excisional, and setinel node.

The extraction of tissue from the top layer of a lesion is known as a **shave biopsy** (American Cancer Society, 1999b: 3; Cochran, 1995: 813). An area that is considered ominous is first anesthetized by a local anesthetic, then a physician takes a sharp scalpel

to "shave" the top level of the lesion (American Cancer Society, 1999b: 3). The tissue than is sent for evaluation by a pathologist. Cochran stated that this form of biopsy is not preferred since it only detects changes (malignancies) in the top layer of the lesion, and does not detect any changes in the lower layers of the dermis (Cochran, 1995: 813; American Cancer Society, 1999b: 3).

A **punch biopsy** differs from a shave biopsy in that a punch biopsy also includes the lower tissue layers and a punch device is used (American Cancer Society, 1999b: 3). One of the punch devices used is 3 millimeters in diameter. After the area of biopsy is treated with a local anesthetic, a physician than turns the biopsy tool - which the American Cancer Society (1999b: 3) said resembles a cookie cutter- until all of the layers of the dermis are extracted. The extracted tissues are then evaluated by a pathologist.

Another form of biopsy is the **incisional biopsy**. After the area is treated with a local anesthetic, the incisional biopsy is performed by a physician who uses a scalpel to make an incision to take out part of the tumor for evaluation (American Cancer Society, 1999b: 3). An incisional biopsy is recommended for lesions over 2 centimeters in diameter. The whole tumor is not taken out.

In the **excisional biopsy**, the whole tumor is extracted, and then evaluated by a pathologist (American Cancer Society, 1999b: 3) . A form of excisional biopsy is Mohr's Micrographic Surgery, in which the tumor is excised, mapped, and then evaluated under a microscope by a pathologist.

According to the University of Iowa Virtual Hospital (2002), the **sentinel node biopsy**, involves a radioisotope, an agent that has radioactivity and is injected into the lesion. Using a gamma camera, the radioisotope is traced to the lymph node that drains the suspected area (lesion). The patient than is transported into surgery, where a surgeon injects a blue dye into the suspected area, than dissects the potential diseased lymph node for evaluation. This method conserves lymph nodes since the only one that is removed is the one that is "connected" to the suspected site.

The History and Rationale for Surgery

A. History of Mohr's micrographic surgery

Frederic Mohr, a physician, (Goodman, 1999: 1-2), developed Mohr's micrographic surgery, a technique used to excise the lesion to control cancer. Mohr first described the technique in 1941 (Mikhail, 1991: 1; Arndt, 1996: 1403). The technique involves excision of the lesion, and the use of a microscope, to examine the excised piece of tissue, layer by layer, thereby reducing damage to non-cancerous cells, and by focusing repeated excisions in areas that contain possible malignancies (Mikhail, 1991: 11). Mohr accidentally developed a process of preserving a tissue using 20% zinc oxide and a unique horizontal section method (Arndt, 1996: 1403; Goodman, 1999: 1-2). In 1970, Theodore Tromovitch modified Mohr's process by developing the freeze tissue technique that eliminated the painful side effects of the zinc oxide thus using live tissue without the use of fixation (Arndt, 1996: 1403).

B. Rationale for surgery

If the lentigo maligna lesion is considered to be malignant (Harwood, 1983: 1019), then there is a need for the lesion to be biopsied. The process involves two 3-mm punch biopsies taken from different parts of the lesion to detect malignancy (Mascaro, 1986: 92). If the physician determines a need for surgery, then she/he recommends surgery with excision (Mascaro, 1986: 92). In the United States, the preferred treatment for lentigo maligna is Mohr's micrographic surgery (Dancuart, 1980: 2279).

C. Mohr's micrographic surgery procedure

Mohr's micrographic surgery encompasses a two-step invasive approach. Before this approach is put in place, the patient is advised that the week before surgery she/he will have to stop taking any blood-thinning medication, including over-the-counter analgesics like aspirin, to prevent any excessive hemorrhages during surgery (Larson, 1991: 193).

The two-step approach described by Arndt (1996: 1403-1405) begins on the day of surgery. The first step is that the surgeon uses a surgical pen to mark a one-millimeter to three-millimeter margin around the lesion. The actual scalpel lines will follow the penned margin. After the area has been marked, the surgeon than injects a local anesthetic to numb the site. Next, the site is debulked by use of a curette and then excised by use of a scalpel at an angle between 30 - 45 degrees. Excess bleeding is controlled by cautery, There are two types of cautery - electrodessication and chemicals. Electrodessication is the use of an electric probe that burns the tissue. Chemicals that are used for cautery include aluminum chloride. When the margin has been completely excised, and a dressing has been applied, the patient is asked to wait in the waiting room, between 30 and 60 minutes, while the tissue is microscopically examined.

According to MacDonald (1998:1), the second step involves the sectioning and microscopic examination of the excised tissue. First, the tissue sample must be identified as coming from an exact surgical excision site and then labeled. The tissue sample is then encased in a plastic or a paraffin media. By use of a cryomicrotome, the tissue is cut

in four nanometer frozen sections and then added to slides. The slides then go through a staining process.

Problems with Mohr's Micrographic Surgery

In comparison to non-surgical treatments, Mohr's micrographic surgery produces a greater chance for complications such as "scarring, bleeding, damage to the nerves, and graft failure" (Larson, 1991: 193-206). Mikhail (1991: 184-192) directly relates the preceding complications to the excised lesion. Since the Mohr procedure is a type of surgery, there is a potential for medical complications as well. The medical complications include cardiopulmonary problems, anaphylaxis shock, uticaric and angioedema, and death. Harwood, in his 1982 article in the *Journal of the American Academy of Dermatology*, stated that Mohr's micrographic surgery causes more trauma than other treatments (Harwood, 1982: 315).

History and Rationale for Grenz Ray Treatment

A. History

In 1910, Schultz developed an apparatus that produced longer wave x-rays that he called the "soft-ray" apparatus (Cipollaro, 1967: 183). One year later, Lindeman used a lithium borate window on the same apparatus to absorb the short-wave rays while letting the long-wave rays go through (Cipollaro 1967: 183). In 1923, Gustav Bucky first produced "ultrasoft" long wave x-rays, also called grenz rays or Bucky rays (Edwards, 1990: 17; Lindelof, 1991: 155). The name "grenz," in German, means borderline, that is,

grenz rays are between x-rays and ultraviolet light in the electromagnetic spectrum and are considered low powered and, therefore, less invasive (Cipollaro, 1967: 184; Edwards, 1990: 17; Lindelof, 1991: 155). Grenz rays are produced using an x-ray tube with a lithium borate window and power ratios of 10-20 kilovolts and 25 milliamperes (Braun-Falco, 1976: 35). Today grenz rays are produced by using a beryllium window and power ratios of 8-17 kilovolts (Petratos, 1972: 189; Lindelof, 1991: 155). The grenz rays' generator is the same generator that a standard x-ray machine uses for diagnostic imaging (Cipollaro, 1967: 184).

In recent years, there has been an increased interest in the use of grenz rays therapy. The use of low energy radiation, or grenz rays, has proven successful in the treatment of lentigo maligna in Europe (Dancuart, 1980: 2279). The use of grenz rays in the United States has been infrequent because dermatologists have been fearful of government regulations, and the public has been misinformed about radiation treatments (Edwards, 1990: 18). There was a belief in North America that melanomas as a whole, including lentigo maligna and lentigo maligna melanomas, were resistant to all types of radiation treatments (Harwood, 1983: 1019).

B. Rationale and problems with grenz rays

Grenz rays, is a treatment in which (soft-ray) radiation is used. The common complications with the grenz ray treatment are erythema (redness of the skin) and hyper-pigmentation (Braun-Falco, 1976: 101-102; Cipoloaro, 1967: 186-187). The European literature surveyed recommends X-ray therapy (grenz rays) as the most effective control of lentigo maligna since it is safer and causes less trauma than the other treatments (Kopf,

1976: 806-807; Tsang, 1994: 1008; Harwood, 1983: 1019, 1982: 315).

Alternative Non-surgical Treatments

Several other methods have been described for the treatment of lentigo maligna. Treatments that are used to remove the lentigo maligna lesion include carbon dioxide laser treatments, cryotherapy, azelaic acid treatments and immunological therapy. Other treatments includes those for advanced stage lentigo maligna melanoma progression.

A. Laser

According to Kopera (1995: 735-736), the theory behind the use of carbon dioxide laser treatments is that the lesion, being highly water based, absorbs the laser and begins to heat up at temperatures around 300°C . The use of a laser at this magnitude creates a need for a local anesthetic such as a lidocaine injection. Hydrogen peroxide is then used to remove any carbonized debris. After the treatment, the patient has to wear an antibacterial non-stick gauze dressing for three days. When a laser is used, there is a sample available for examination.

B. Cryotherapy

Cryotherapy, freezing the tissue, is another form of treatment for lentigo maligna scarring. This approach destroys melanocyte at temperatures between -4 degrees and -7 degrees Celsius (Cohen, 1995: 931) by use of liquid nitrogen (American Cancer Society, 1999a: 1). The treated skin area may be flaky and blistery (American Cancer Society, 1999a: 2). Cryotherapy is not recommended for lentigo maligna since the treatment could

prevent the diagnosis of lentigo maligna melanoma.

C. Azelaic Acid

According to Cohen (1995: 931), azelaic acid treatment, Carbon 9-dicarboxylic acid, is another method to remove the lentigo maligna lesion. The azelaic acid treatment was discovered by Nazzaro-Porro in 1979. The acid destroys the abnormal melanocyte (by blocking DNA synthesis of melanocytes) that cause lentigo maligna and must be applied twice a day for two to forty-eight weeks. This topical approach is a less expensive form of treatment.

D. Five-Fluorouracil

Another topical treatment for skin malignancies, as described by the American Cancer Society (1999a), is five-fluorouracil. Five-fluorouracil is a topical "chemotherapeutic cream" that destroys cancerous cells in the skin (American Cancer Society, 1999a: 2). One benefit of this form of therapy is that it affects the surface layer without affecting the deeper layers of the skin (American Cancer Society, 1999a: 2). One weakness associated with this form of treatment is that the applied area is very sensitive to sun light (American Cancer Society, 1999b: 2).

Health Expenditures as a Factor Influencing the Medical Decision Making Process

As was emphasized before, the purpose of a cost-minimization analysis is to consider the cost of two or more procedures and to select the procedure with the lowest cost (Hayman, 1996: 828-829). Health care institutions are interested in cost analysis,

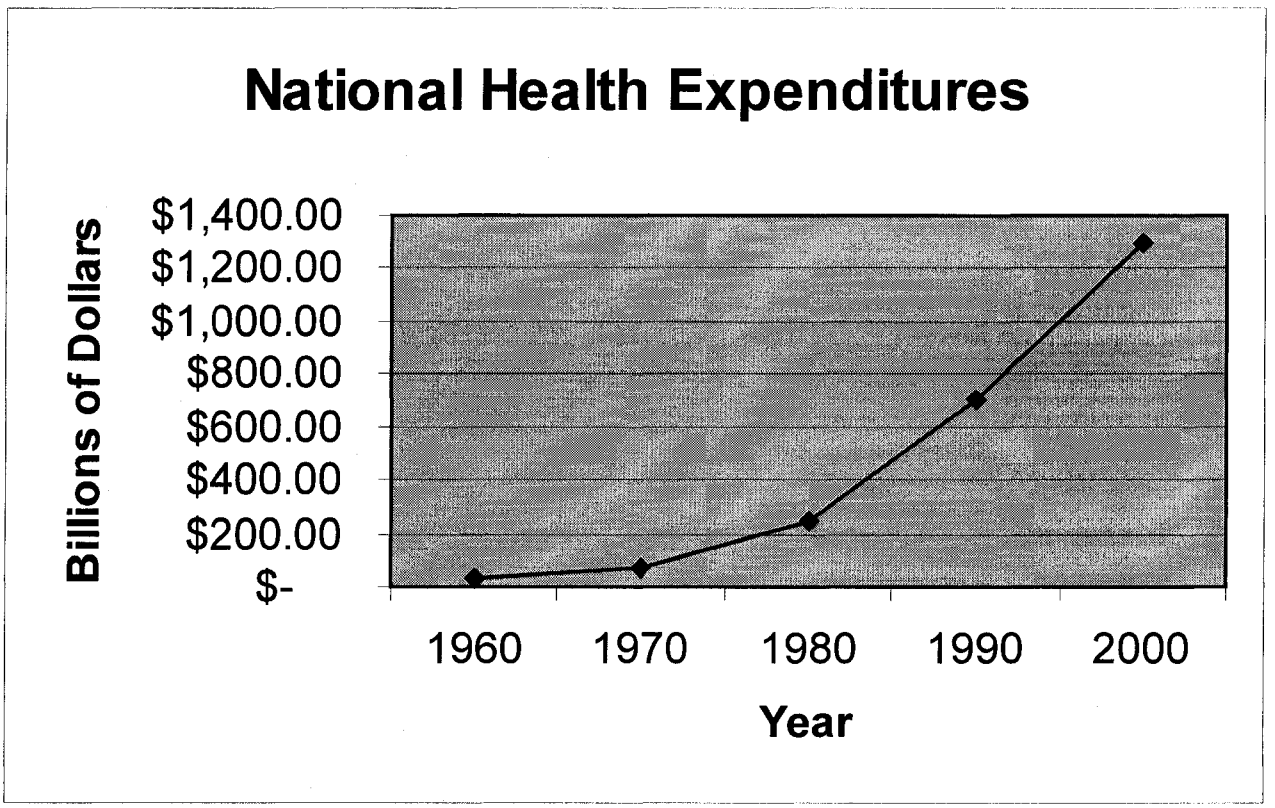
like the cost-minimization analysis, partly because of the public concern about the cost and the quality of healthcare (Haymen, 1996: 828-829). The public is interested in the best health care at an affordable cost (Lashof, 1994: 69) and the hospital is interested in making a profit (Berman, 1989: 83-84).

The third party payer, such as the managed care organization, is the predominate source of revenue for a hospital, or other health care entity (Berman, 1989: 84). Managed care organizations (health maintenance organizations and preferred providers organizations) decide the best care for the patient at the least cost by intervening in the medical decision process (Feldstein, 1994: 161). According to Feldstein (1994:20), one way to reduce cost is the utilization review. A utilization review is a cost controlling method in which a managed care employee, physician and/or nurse, get involved with the type of care, and the importance for such care (Cleverley, 1997: 51). The federal government also uses utilization review for it's Medicare and Medicaid program (Jacobs, 1994: 321). Information obtained from a cost analysis like a cost-minimization analysis would be used to help determine the appropriate form of treatment.

One reason that there is so much emphasis on controlling costs in the United States is the dramatic growth of health expenditures. In the United States, health expenditures have been increasing since the 1960s (See Graph 1). According to the U.S. Health Care Financing Administration, U.S. health expenditures in 1960 were 26.7 billion dollars (Health Care Financing Administration, 2003: Table 1). In 2000, the United States spent 1,300.0 billion dollars on health care (Center for Medicare and Medicaid Services,

2003: Table 1)[2]. In a 40-year period, health expenditures have climbed 1,273.3 billion dollars. Due to the increases in health expenditures, health care providers have been pressured to decrease costs for services from health insurance companies, consumers, and consumers' employers (Cleverly, 1997: 49-50).

Graph 1: National Health Expenditure



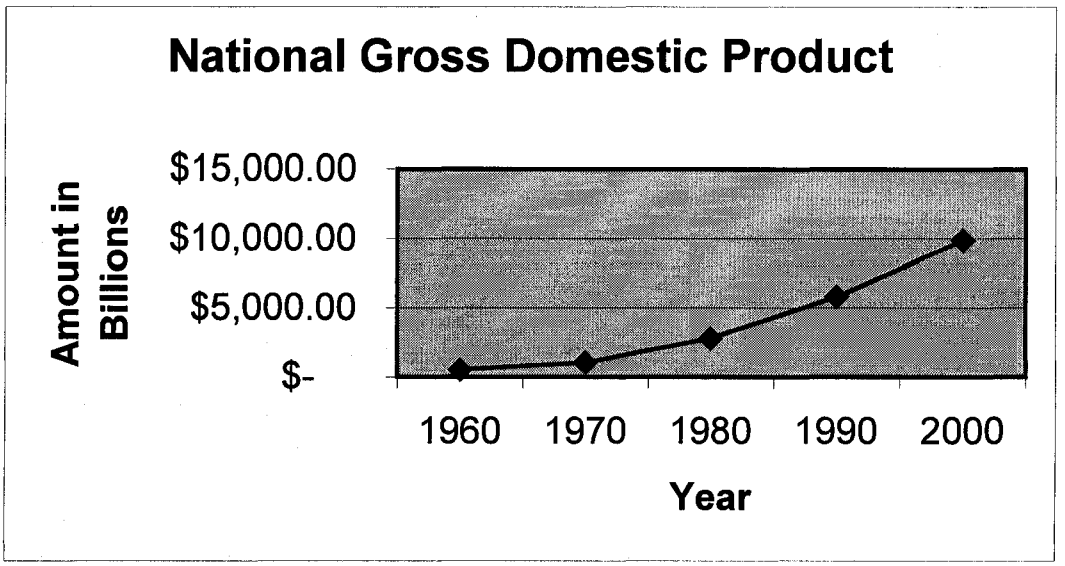
(Health Care Financing Administration, 2000: Table 1; Center for Medicare and Medicaid Services, 2003: Table 1)

One might argue that the health expenditures are increasing due to an increase in the population and/or an increase in the gross domestic product. The population in 1960

[2] On June 14, 2001, The Health Care Financing Administration (www.hcfa.gov) name was changed to Centers for Medicare and Medicaid Services (www.cms.hhs.gov).

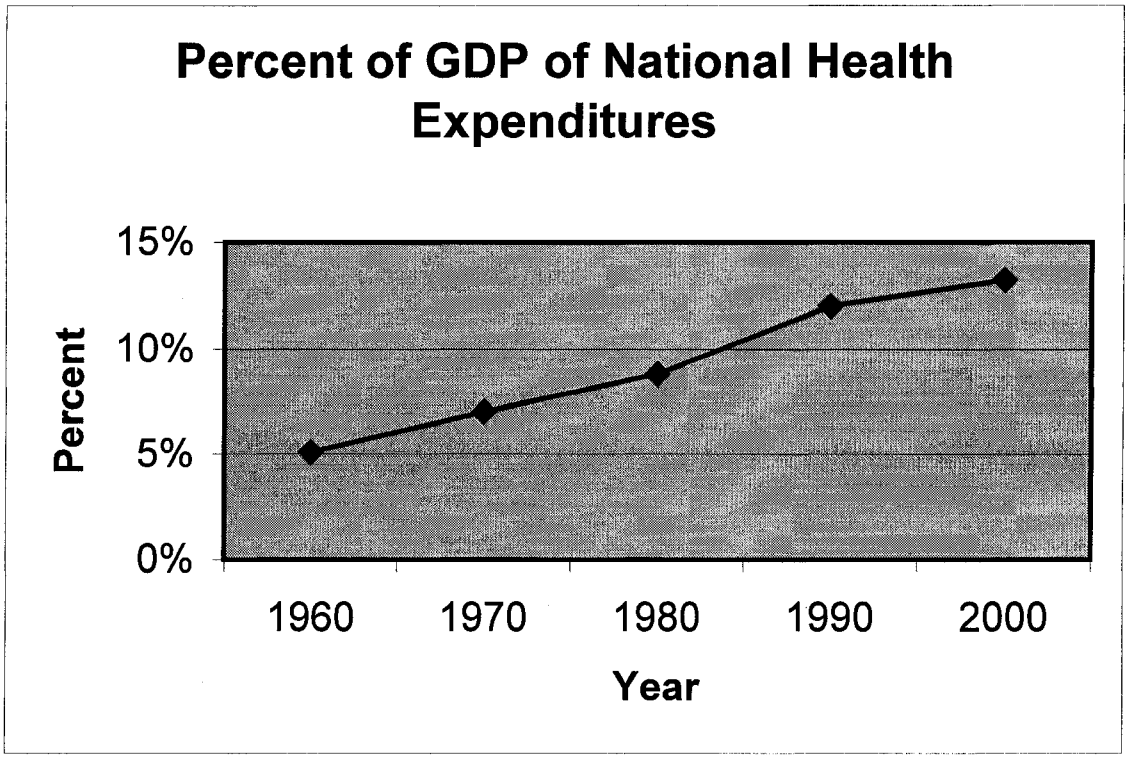
was 186 million people compared to 280 million people in 2000 (Health Care Financing Administration, 2000: Table 1; Center for Medicare and Medicaid Services, 2003: Table 1). The Gross Domestic Product (GDP), which is "the total value of good and services produced in a country for a period of time" (Gross Domestic Product, 2003), has been on the rise as well (see Graph 2). In 1960, the G.D.P. was 527 billion dollars compared to 9,873 billion dollars in 2000 (Health Care Financing Administration, 2000: Table 1; Center for Medicare and Medicaid Services, 2003: Table 1). The G.D.P. has increased a total of 9,346 billion dollars in 40 years. The next graph (Graph 3) explicitly shows health expenditure as a percentage of gross domestic products.

Graph 2: National Gross Domestic Product



(Health Care Financing Administration, 2000: Table 1; Center for Medicare and Medicaid Services, 2003: Table 1)

Graph 3: Percent of GDP of National Health Expenditures



(Health Care Financing Administration, 2000: Table 1; Center for Medicare and Medicaid Services, 2003: Table 1)

The health expenditures percentage of the gross domestic product in 1960 was 5.3 percent (Health Care Financing Administration, 2000). In 2000, the health expenditure percentage of the gross domestic product was 14.0 percent (Center for Medicare and Medicaid Services, 2003: Table 1). In a 40-year period, health expenditures have increased 8.7 percent of the gross domestic product, and health expenditures are expected to grow continue to grow.

METHODOLOGY

The basic research method used in this study is a critical analysis of a cost-minimization approach. This section will consist of a brief explanation of critical analysis followed by four additional subsections: subject review, data on costs, cost-minimization analysis, and researcher's interest in lentigo maligna.

Critical Analysis

According to the Writing Center of Saint Benedict and Saint Joseph University, a critical analysis is performed to uncover the truth by breaking down a problem into smaller parts (College of Saint Benedict and Saint Johns University, 2003: 1). After the problem is broken down into smaller parts, the researcher then describes the parts, details the function of the parts, and then looks at the relationships between the parts in order to "uncover the rich complexity of a work." (College of Saint Benedict and Saint Johns University, 2003: 1).

Subject Review

Information was received, in 1994, for five subjects from South Side Hospital's Dermatology Department. All of the subjects were diagnosed with lentigo maligna and lentigo maligna melanoma. The process in obtaining information from subjects was similar to the chart review method used by Harwood (1982: 310-311). Unlike Harwood,

whose focus was only radiological therapy, this project included subjects treated by Mohr's micrographic surgery.

The focus of the chart review was cost based rather than the radiation-dose based approach used by Harwood. Another contrast with the Harwood study was that grenz rays (low-power x-rays) were used in this research, not orthoradiotherapy (higher-power x-rays).

The subject data was obtained from South Side Hospital Dermatology Department. Subjects' names were encoded to preserve the confidentiality of the subjects. Data was separated from the subject's actual name. On one sheet (data sheet), there is a descriptive number, and information from the chart. South Side's subject information was reviewed for the period from January 1996 to January 1997.

South Side University Hospital has treated only two subjects with grenz rays[3], and three subjects with Mohr's micrographic surgery. An additional subject had Mohr's micrographic surgery first and then had the grenz ray treatment. Usually a subject diagnosed with lentigo maligna in North America, receives both treatments, grenz ray treatments and, months later, Mohr's micrographic surgery.

Five subjects' data were given to the researcher for this exploratory review. One of these subjects received both treatments and, for purposes of this research, was listed as two subjects. The data for the six cases, was broken down into a table format. This format can be found in Appendix A (data sheet).

[3] The grenz ray machine at Southside Hospital became inoperable, and was sent back to the manufacturer.

Data on Costs

The South Side Hospital dermatology group was the first to contribute cost information from subjects based on the subject data review. The Quantitative Management Department of South Side Hospital gave information on each subject relating to the cost of the procedure. For purposes of this research, the grenz rays treatment cost and the Mohr's micrographic surgery costs are the real costs. The costs have not been discounted as is frequently done by a third party payer like a health insurance company.

The first set of costs (charges) is the physician charges. Physician charges are the charges a physician submits to a third party payer and/or a patient for reimbursement. The physician charges are itemized by a Comprehensive Procedural Terminology (CPT) code. The CPT code shows what type of a procedure was performed by the physician (American Medical Association, 2003: 1).

The second form of costs that were received are the center charges. Center charges are the charges that are submitted to a third party payer and/or patient for reimbursement. Center charges are charged by a health care institution for use of the center's staffing, equipment, and facility.

Cost Analysis

A cost-minimization analysis is one method of deciding the costs of a medical procedure. Cost is a combination of direct costs - cost associated specifically with the procedure, and indirect costs that are not directly related to the medical procedure

(Sweetenham, 1999: 49). A cost may be fixed (not constantly changing) or it may be variable (in which it constantly changes) based on the volatility of the market price for the product in question (Heaney, 1999: 20). As mentioned earlier, the focus of this research is to emphasize cost rather than outcome and if the outcomes are equal, then the concentration can be placed on the cost. The outcome for purposes regarding this research will be considered "equal" even though the outcomes of cancer treatments are never really equal (Hayman, 1996: 828-829;Robinson, 1993: 793).

Below is a chart developed by Hayman (1996: 829) that explains cost-minimization analysis. A letter has been used, instead of a value, to show the arithmetic value of each the cost-minimization analysis.

Treatment	**Cost**
New	A
Standard	B

Cost Minimization: a very basic form of analysis.
If A>B, then B is the recommended treatment.
If A<B, then A is the recommended treatment.

Hayman (1996: 829)used the following example to illustrate his formula:

Treatment	**Cost**
Laser	$1,000.00
Surgery	$3,750.00

Since $1,000.00 < $3,750.00 and Laser treatment cost < the cost of Surgical treatment, then Laser treatment is recommended.

The cost-minimization analysis is one form of cost analysis. It was selected for use in this research project because of the emphasis on cost alone (rather than combining cost and outcomes) and because it is now widely used in health care settings.

This research is the first known project to compare Mohr's micrographic surgery and grenz rays treatments using cost-minimization analysis in an exploratory way. Cost-

minimization analysis is a first step in the development of other cost analyses (Hayman, 1996: 829).

As with other cost analyses, there are many strengths and weaknesses attributed to the cost-minimization analysis. A strength of the cost-minimization analysis is that it is widely used in health care settings. One reason for it's popularity is that it is the initial cost analysis performed in the execution of other cost analyses. The second reason for its popularity is that is focuses the emphasis on cost rather than outcomes. If outcome is a factor, as in a cost-effectiveness analysis, then the help of a physician is needed to assign a quantitative value to a specific outcome. A weakness is that such an analysis may encourage insurers to only consider economic factors.

Data was obtained from each subject's data sheet (Appendix A). The subject account number was submitted to South Side Hospital Decisions Support Services to gather cost data. The subject data sheet review provided a subject's name, subject account number, type of treatment, diagnosis, treatment type, location of lesion, date of birth and sex. The undiscounted cost indicated by the center (South Side Hospital) and the physicians' undiscounted cost were summed for each patient. Each subject was given a false name to protect his/her identity. The economic summations of the two treatments in question were to be analyzed and the one with the lowest value would be designated as the preferred treatment.

An exploratory research approach was used to analyze the data. Lin defines exploratory research as a way to give "the most general information about a research problem" (1976: 137). To investigate the information, one must have a method of obtaining and organizing the data.

Lin (1976: 137) stated that a type of exploratory study is case exploration. She indicated that case exploration is a "detailed examination of individual cases of involvement with the activities being studied" (Lin, 1976: 141) .

As mentioned before, this is a new approach for examining the costs of two procedures (grenz rays and Mohr's micrographic surgery) for the treatment of lentigo maligna. The research will explore the relationship between cost and treatment, by examining individual cases.

Interest in Lentigo Maligna

The researcher became interested in cancer research at an early age, since members of his family were diagnosed and eventually died of cancer. He became a volunteer in the medical imaging department at a 800+ bed hospital in a city located north of River City, in which he was exposed to the internal damage that cancer causes. In 1996, he found out that his dog was diagnosed with melanoma of the mandible and was given two months to live. His dog died four months later from a blood clot associated with the melanoma lesion.

The researcher has no affiliation with South Side Hospital, and/or any other organization that is connected to this project. The outcomes of this research will have no direct effect on the researcher or his family.

DATA

In order to look at subject costs, information was obtained from hospital data sheets. A total of five data sheets were reviewed for this research. The 13 categories of information extracted from the data sheets (i.e., date of initial treatment, CPT codes, diagnosis) is in the full list in Appendix A. Costs (physician and hospital charges) were obtained from the Quantative Analysis Department of South Side Hospital. Each subject's physician costs and the hospital costs were added together to achieve the total cost of treatment.

The physician cost data sheet information was organized by subject name, five-digit CPT code[4] and related charges. The Current Procedural Terminology (CPT) code is published by the American Medical Association. The 2002 edition of the Current Procedural Terminology codes was used to decipher the physician charge codes.[5] It is used by health care entities such as doctors, patients and insurers to describe the type of treatment that was performed and the charges that accompany such treatment. The codes are in numerical order starting with *anesthesia* and ending with *office visit.*

The center charges were received and organized by corresponding subject medical record number and date of service. Unlike the physician charges which were organized by CPT code, the center charges lacked an identifying code. Without an identifying code, it is difficult to elaborate on the exact type of center services that were rendered. The

[4] The CPT codes are found in the American Medical Association (2003). CPT (Current Procedural Terminology) Process. American Medical Association. 10 Aug 03. <http://www.ama-assn.org/ama/pub/category/3882.html>

[5] All of the explanations for the codes in this chapter comes from the volume edited by Tracy Gordy and produced by the American Medical Association in 2002. Since the research was obtained in 1997, there was no 1997 CPT code book when the data was analyzed in 2003, only the 2002 book was available.

researcher focused on the dates, regarding the center charge sheet, as a method of identifying of services connected to treatment. The following data, obtained from all sources, is organized here by subject.

Subject 1

The first subject (Subject 1) is a 94-year-old female and, in 1997, she was suffering from a lentigo maligna melanoma lesion on her right check. This lesion first appeared eight years earlier. Subject 1 was first treated with Mohr's micrographic surgery to remove the 1.6 cm X 1.5 cm lesion with a 10 mm margin. Fourteen days after the excision, she was given grenz rays treatment for 10 weeks for a total dosage of 10,000 cgy (1,000cgy /week). Six months after the grenz cycle of treatments, the lesions disappeared and, according to the dermatologist, her prognosis was good.

Subject 1 had two visits recorded based on the physician charge data. For the first visit, Subject 1 was charged an office consultation fee for a new patient (CPT code 99243) and the associated cost was $123.00. On the second visit, Subject 1 had four CPT codes listed. The first CPT code was 11642 for an excision of a malignant lesion diameter between 1.1 and 2.0 cm and the associated charge was $370.00. The second CPT code was 12052 for repair and closure and the associated charges was $300.00. The third code was for level 1 surgical pathology (CPT code 88305) and the associated charge was $72.00. The fourth code was for an unknown related procedure and the associated charge was $152.00.

Subject 1 has had center charges for four months of service. For the first month,

Subject 1 was charged for $37.00, which was for Mohr's micrographic surgery. On the second month the subject started grenz rays therapy and was charged $761.00. The third month there were one charge of $766.00 and a second charge of $705.00. The fourth month of service, Subject 1 was charged $118.00. Regarding the last month of service, the patient was charged $16.00.

Subject 2

The second subject (Subject 2) is a 70-year-old male who appeared at the dermatologist's office with a suspicious lesion on the right check. The dermatologist performed a punch biopsy. The results of the biopsy indicated melanoma (lentigo maligna melanoma). The patient underwent Mohr's micrographic surgery fourteen days after his initial office visit. The excised lesion was 4.5 cm X 5.5 cm with a 5 mm margin removed. A month after the initial visit, the patient went back to the operating room to remove a 4.8 cm X 6.6 cm area. A skin flap was used to seal the incision. Twenty-four days after the insertion of the skin flap, the patient went to see the dermatologist. The dermatologist diagnosed an infection of the skin flap, and prescribed an oral antibiotic. Two months later, the site of the incision was completely healed.

On the first visit, the subject was charged using three CPT related codes. The first code was for a biopsy of the skin (CPT code 11100) and the cost was $72.00. The second code was a level 1 surgical pathology (CPT code 88305) and the charge was $72.00. The last code for this visit was for an established office visit (CPT code 99212) and the charge was $31.00. On the second visit, the patient was charged using two codes. The first code was for the excision of a malignant lesion (CPT code 11646) and the cost was $670.00.

The second code was surgical pathology (level I) (CPT code 88305) and the charge was $72.00. During the last visit, the patient was charged for adjacent tissue transfer (flap) (CPT code 14300) and the cost was $1,600.00. As mentioned earlier, the flap is used to close up an unusually large defect in which a standard suture would not suffice. There were no center charges received for Subject 2.

Subject 3

The third subject was an 80-year-old female who was diagnosed with lentigo maligna on the right side of her nose. Subject underwent Mohr's micrographic surgery to remove the lesion. The lesion left a defect of 1.6 cm X 1.1 cm, and a flap was used from the ear to cover up the defect. Two weeks after surgery, the dermatologist noticed that necrosis was developing on a small piece of the graft. A month afterwards, the graft appeared to be healing well.

Subject 3 made five visits to the physician's office during the first year of treatment. On the first visit, the patient was charged for a biopsy of skin (CPT code 11100) and the cost was $70.00. The second code for the first visit was for the destruction of a benign, or pre-malignant lesion (CPT code 17000) and the charge was $85.00. In relation to the previous code, the patient was charged for one lesion (CPT code 17001) and the cost was $100.00. The fourth code was for a level 1 pathology (CPT code 88305) and the associated cost was $146.00. On the last visit, the patient was charged for an office visit (CPT code 99202) and was charged $46.00. Over a month

later, the subject went back to the physician's office. The subject was charged for a free[6] skin graft (CPT code 15260) and the cost was $1,200.00. The subject also was charged for Mohr's micrographic surgery (CPT code 17304), and the associated cost was $800.00. A couple of weeks later, the subject went back to the physician's office for a third visit and was charged for a surgery related visit (CPT code 99024) but the associated cost was $0.00. A week later, the subject saw the physician for a third time. The subject was charged for an office visit (CPT code 99212) and the cost was $31.00. The next year, the subject saw the physician three times. On the first visit, the subject was charged for level-1 pathology (CPT code 88305) and the fee was $146.00. On the second visit, the patient had three charges. The first charge was for a biopsy of skin (CPT code 11100) and cost was $70.00. The second charge was a level-1 pathology (CPT code 88305) and the cost was $72.00. The third charge was for an office visit (CPT code 99202) and the cost was $46.00. On the third and last visit, the subject was charged for an office visit (CPT code 99204) and the cost was $200.00.

There was only one center charge for Subject 3. That charge was $103.00.

Subject 4

The fourth subject was a 90-year-old female with lentigo maligna on the right side of the nose. The subject underwent grenz rays (1,000 cgy/week for 10 weeks for a total dose of 10,000 cgy). The patient suffered erythema after treatment.

The fourth subject was charged for three physician visits. On the first visit, the

[6] *Free* does not refer to financial matters. It means that the skin graft was removed from another location of the body and then relocated to the area of the defect.

patient had three charges. The first charge was a biopsy of the skin (CPT code 11100) and the cost was $72.00. The subject was charged for the codes 88305 (surgical pathology level I) and 99202 (office visit) and the costs were $72.00 and $58.00 respectively. On the next visit, the subject was charged for related services 985758 and was charged $130.00.The last visit, the subject was charged four times. The subject was charged for related services with the office's generic CPT codes[7] of 985624, 985661, 985737, and 985805 and was charged $57.00, $243.00, $270.00, and $98.00 respectively.

Center charges were received for five non-consecutive months regarding Subject 4. During the first month, there was a center charge of $31.00. Six months after the first month, the patient was charged $1,154.00. The next month there was a charge of $547.00. The following two consecutive months, there were charges of $47.00 and $22.00 respectively.

Subject 5

The fifth subject was a 90-year-old male who underwent Mohr's micrographic surgery with the type of skin graft known as a flap. After the excision, there was a defect of 2.3 X 2.6 cm and a flap was used to close the defect.

The fifth subject was charged for four CPT codes, during three separate visits. The first code was for an established patient visit (CPT code 99212), and the cost was $31.00. On the second visit, the subject was charged for an established patient visit

[7] The researcher discovered six digit CPT codes that were not standard. The researcher talked with a representative of Southside Hospital Dermatology Clinic on 09/22/2003. The representative stated that these codes are the office's generic codes that relate to necessary cosmetic work of the defect.

(CPT code 99213), and the fee was $50.00. On the last visit, the subject was charged for the CPT code numbers of 11643 (excision of a malignant lesion 2.1 – 3.0 cm excised diameter) and 88305 (level 1 surgical pathology) and the respective charges were $430.00 and $72.00 respectively.

Center charges for Subject 5 were received. After reviewing the dates of center charges and the initial consultation date, it was decided to omit the data since the center cost dates were all before the date of initial consultation. The center charge data did not pertain to the research.

ANALYSIS

The two areas of central importance regarding this research are cost and the process of analyzing cost. This chapter consists, then, of two sections - cost and the critical analysis of cost analysis. The latter section includes general comments about the process as well as discusses the significant difficulties encountered in this exploratory project.

Cost

A. Comparison of all subjects including those with data missing

The cost data from South Side Hospital were entered into a spreadsheet program to generate the total costs. Cost data were not included if the cost and represented date of service was before date of initial consultation for treatment. As emphasized before, this preliminary research focuses on the costs of the procedures rather than the outcomes.

There were five subjects in this study but, there was one subject (Subject 1) that had Mohr's micrographic surgery and then grenz rays treatment. The data for both procedures were reviewed and then separated based on the treatment dates. This breakdown can be seen in Table 1.

TABLE 1: Itemization of Treatment for Subject 1

	Mohr's Micrographic Surgery	Grenz	Total
Physician	$1,017.00	$ -	$1,017.00
Center	$ 37.00	$2,366.00	$2,403.00
Total	$1,054.00	$2,366.00	

Table 1 shows higher total charges for grenz ray treatment contrasted to that of Mohr's micrographic surgery. Subject 1 had Mohr's micrographic surgery first, and then grenz rays treatment. As mentioned earlier, Subject 1 is listed as two cases, one as a person who received surgery (Mohr's micrographic surgery) [1A], and one as a person who received radiation (grenz rays treatments) [1B].

The table below (Table 2) shows each subject's physician charges, center charges, and total cost. There was no physician charge for the grenz rays treatment regarding Subject 1. Subject 2 did not have any recorded center charges, and Subject 5 had center charges predating the initial consultation.

TABLE 2: Charge Data by Subject and Charges

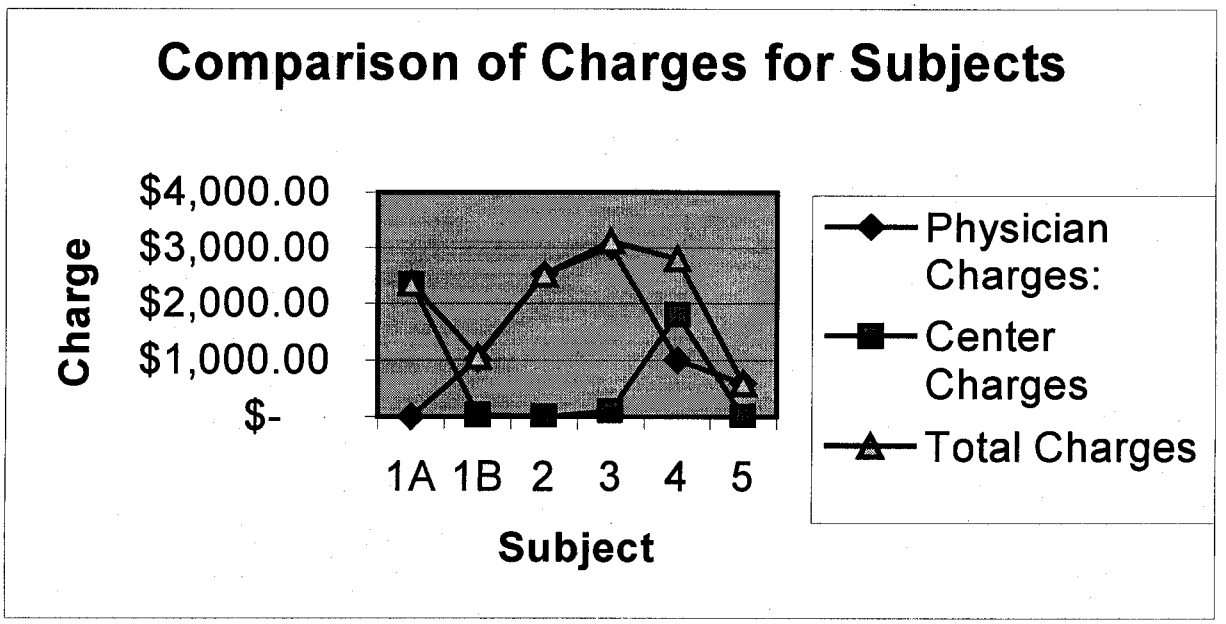
Subject	Physician Charges	Center Charges:	Total Charges:	Treatment
1A	$ -	$2,366.00	$2,366.00	GRENZ
1B	$1,017.00	$ 37.00	$1,054.00	MMS
2	$2,517.00	$ -	$2,517.00	MMS
3	$3,012.00	$ 103.00	$3,115.00	MMS
4	$1,000.00	$1,801.00	$2,801.00	GRENZ
5	$ 583.00	$ -	$ 583.00	MMS

The total for the subjects that had reportable physician charges are Subject 1B with a charge of $1,017.00, Subject 2 with a charge of $2,517.00, Subject 3 with a charge of $3,012.00, Subject 4 with a charge of $1,000.00, and Subject 5 with a charge of $583.00. The total charges for the physicians are $8,129.00. The total charges for the subjects that had reportable center charges include Subject 1A with the charge of $2,366.00, Subject 1B with the charge of $37.00, Subject 3 with the charge of $103.00 and Subject 4 with the charge of $1,801.00. The total center charge was $4,307.00. The total charges for the subjects who had Mohr's micrographic surgery are: Subject 1B with

$1,054.00, Subject 2 with $2,517.00, Subject 3 with $3,115.00, and Subject 5 with $583.00 . The summation of Subject 2, Subject 3, and Subject 5 is $6,215. One subject (Subject 4) received only grenz ray treatments and the charges were $1,000.00 for physician charges and $1,801.00 for center charges. The total charge was $2,801.00 .

The next graph (Graph 4) illustrates the charges in a line graph. As the graph indicates, Subject 3 had the highest total cost, while Subject 4, Subject 2, Subject 1A, and Subject 1B have the next highest total costs respectively. Subject 5 had the lowest total costs.

Graph 4: Comparison of charges for subjects



There appears to be a pattern in the reporting of charges. When one looks at TABLE 2 and GRAPH 4, one sees that the subjects that had grenz ray treatments have

lower to no physician charges, but the center charges are considerably more. One question that comes to mind: Are the physician charges for grenz ray treatments included in the center charges? If that is the case, then it would be recommended to get an itemized breakdown of center charges to see if physician charges are included in the center charges.

Referring to the subjects that received Mohr's micrographic surgery, the physician charges are considerably more than the center charges. This is the complete opposite of what was seen with the grenz ray treatment. This might be because the underlying tissue was exposed after Mohr's micrographic surgery so that the grenz rays were able to penetrate the potential cancerous tissue.

In order for the cost-minimization analysis to be used, the total charge average will be calculated for Mohr's micrographic surgery and grenz ray treatments. As emphasized before, Subject 1 treatments will be separated by type of treatment and then added to the respective group. The Cost Minimization Analysis formula that is used here was adapted from Hayman (1996: 829). This illustrates average total cost and a different treatment (1996: 829) as the "new" treatment.

The Cost Minimization Analysis

Treatment	Cost
New	A
Standard	B

Cost Minimization: a very basic form of analysis.
If A>B, then B is the recommended treatment.
If A<B, then A is the recommended treatment.

Treatment	Total Cost	Number of Subjects	Average Total Cost
Grenz	$5,167.00	2 (1A & 4)	$2,583.50
Mohr's	$7,269.00	4 (1B, 2, 3, 5)	$1,817.25
Total	$12,436.00	6	$2,072.67

Grenz rays, at a cost of $2,583.50 was more than the $1,817.25 for Mohr's. It

was determined that grenz rays costs more than Mohr's micrographic surgery.

B. Comparison of subjects with no data missing

Data that is missing will affect the results given in section A. Because of this, an analysis was made using only those cases where complete information was provided. If one excludes the cases with missing data, it is possible to analyze the costs encountered in three cases.

Table 3: Charge Data by Case (Complete Data)

Case	Physician Charges	Center Charges	Total Charges	Treatment
1B	$1,017.00	$ 37.00	$ 1,054.00	MMS
3	$3,012.00	$ 103.00	$ 3,115.00	MMS
4	$1,000.00	$1,801.00	$ 2,801.00	GRENZ

The Cost Minimization Analysis

Treatment	Cost
New	A
Standard	B

Cost Minimization: a very basic form of analysis.
If A>B, then B is the recommended treatment.
If A<B, then A is the recommended treatment.

Treatment	Total Cost	Number of Subjects	Average Total Cost
Grenz	$2,801.00	1 (4)	$2,801.00
Mohr's	$4,169.00	2 (1B, 3,)	$2,084.50
Total	$6,970.00	3	$2,323.33

The cost of grenz rays was $2,801.00 where Mohr's micrographic surgery was found to be $2,084.50. It was determined that grenz costs more than Mohr's micrographic surgery. This analysis showed the same results as the one comparing subjects with missing data.

Critical analysis of a cost-minimization analysis

The costs reviewed here are based on available data. While conducting the cost-minimization analysis, it became apparent that a number of issues needed to be addressed as part of the critical analysis. The issues are discussed here in the following order: data access, sample size, standardization of center codes, changes in CPT codes, time from data collection to analysis and additional possible problems.

A. Data access

A number of questions came to mind while conducting this research. Among them: How were the data obtained? Were the data easy to acquire? As mentioned previously, the data were received from South Side Hospital's Quantative Analysis Department in 1996. The information was received in two ways. The information, on *physician charges*, included medical record number, subject's name, and date of service. A few weeks later, information was received about *center charges* for each subject.

Patient and center charges were reviewed. It was determined that certain information was missing. The researcher than made contact with the Quantative Analysis Department regarding the missing information. A few weeks later, most of the requested information was received.

In 2003, the data was thoroughly analyzed and questions came up regarding the data. In reviewing the center data, it was determined that in one instance, the cost was incurred before the data of initial consultation by the physician. This piece of data regarding Subject 5 became questionable, and was omitted from the study because a

patient can not undergo treatment before the actual initial consultation. It is believed that the data preceding the initial examination was for something else not related to the study. Because the analysis had been delayed, it now was no longer possible to check on this situation.

It would also have been helpful to have data from a variety of sources. Records of patient interviews, doctors' records, and insurance information would have been very valuable.

B. Sample size

In this study, a total of six cases were analyzed. Because of the small sample size, it is impossible to assess statistical relationships. If there were more subjects (at least 30), the researcher could have used statistical tests as part of the cost-minimization analysis.

In order for a test of significance to be used, a larger sample is needed. According to Strube (1999: 24), one important concept, in relation to research design, is sample size. As the number in a sample size declines, the statistical power of an analysis declines as well (Strube, 1999: 24). This causes one to attribute the lack of correlation within a data set, to the small sample size, rather characteristics of the sample population (Strube, 1999: 24). The emphasis of this study is not statistical in nature, rather it is to perform a critical analysis of the approach being used - cost-minimization.

C. Complete and specific center data

While reviewing the data, the researcher noted that the physician charges data

sheet was organized by a CPT (Current Procedural Terminology) code, and itemized by the type of procedure. The center charges, on the other hand, had no apparent organization or method of coding. There was information regarding patient names, and dates of service, but how does the researcher know that the center charges reflect the type of procedure? If a patient had multiple treatments and/or tests during the same day, how can the researcher obtain this information? As mentioned earlier, one subject's center charge data were not included here since the dates of center charges preceded the initial consultation that was listed on the physician charge sheet.

It would have been helpful if there had been a method of coding. There probably had been a classification of center charges at some point after the subjects' visits because department specific information is needed by insurance companies. This specific information, however, was not made available to the researcher.

D. Changes in Current Procedural Terminology (CPT) codes

The data were obtained in 1996 from South Side Hospital Quantative Analysis Department. Physician charge data was not reviewed until the data was analyzed in 2002. The physician charge data was broken down by CPT code. CPT codes are changed each year, as necessary, by the American Medical Association. Certain codes are combined, stay the same, or eliminated based on the use of the codes by practicing physicians. As previously mentioned, the CPT code book that was used was the 2002 version, and a researcher needs CPT codes for each year in which research is conducted.

E. Elapsed time from data collection and analysis

The center charge data and physician charge data was from 1996, and the data was analyzed in 2003. The elapsed of time of seven years caused a number of problems to occur. The first was the loss of the access to the original data. As time goes by, changes occur that inhibit the communication between the relevant departments and the researcher. This could occur due to staffing changes, logistical changes, and changes in technology. The second problem is that new questions may need to be answered. Unfortunately, due to the time lapse, it was impossible to gather the needed information.

F. Other possible problems

This kind of research requires the involvement of a number of individuals and departments. Without cooperation, this type of research would be very difficult, if not impossible. Cooperation in this project was difficult, as time went on, because the researcher had no connection to the institution or departments.

Even though the cost-minimization analysis is a simple form of financial analysis, the process is complex, and one should not perceive otherwise. Data access, sample size, changes in codes, and time are problems that were faced while working on this particular research.

CONCLUSION

In the course of this study, two cost-minimization analyses were performed. The first included all of the cases and the second included only those cases with complete data. Results of the first cost-minimization analysis showed that the new treatment (grenz rays) does cost more than the standard treatment (Mohr's micrographic surgery). The second analysis, of only those with complete data, also showed that the cost of the new treatment (grenz rays) was more than the standard treatment (Mohr's micrographic surgery).

After the cost-minimization analysis was performed, a critical analysis was undertaken. The points that were discussed include data collection, small sample size, standardizing of center codes, changes in CPT codes, and the time from data collection to analysis.

In this research, the cost of treatment of Mohr's micrographic surgery was being compared to the cost of treatment for grenz ray treatment. Using the small number of subjects, it was shown that grenz rays treatment, in regard to average total cost, does cost more that Mohr's micrographic surgery. It is recommended that more data be collected since there was such a small sample size. In addition, this study should go to the next level and become a cost-effectiveness analysis. A cost-effectiveness analysis takes into account the outcomes of the treatments. If the outcomes for the less costly treatment are favorable than, the less costly treatment would be the cost-effectiveness treatment.

Based on the research, then two points needs be discussed. They are outcomes and access.

Outcomes

A favorable outcome would be to eliminate the cancer risk while using a treatment that is less traumatic to the patient. With Mohr's micrographic surgery, the goal is to remove all the diseased tissue while maintaining as much healthy tissue as possible. The treatment is more traumatic to the patient than grenz rays.
As mentioned before, grenz rays should only be considered when the lentigo maligna is superficial, and should not be considered if the lentigo maligna has spread deeper in the dermis.

Cost-minimization analysis focuses on only the cost, and not outcomes. The formula does work but researchers are advised to increase the sample size and then do a cost-effectiveness analysis. By doing a cost-effectiveness analysis with a relatively large sample size, one can than bring the outcomes into the analysis, and determine if the treatment is worthy of changing a treatment protocol.

Access

Even though a cost-minimization analysis can be an easy analysis to perform, obtaining the data is a challenge. The researcher, who is working outside of the treatment centers will have to rely on other individuals for the data, due to access problems and knowledge of certain databases. When working on an analysis like this one, one needs to have direct access to all sources of data.

The way the information is kept may not meet the needs of the researcher. This type of research needs very precise and accurate information. Without this information, the results will not be meaningful.

Final Comment

It is important for health care entities to look at both the financial costs and quality-of-life outcomes of a new procedure versus a standard procedure. Financial analysis is becoming the norm in the improvement of better healthcare, and the reduction of costs in the healthcare sector. Financial analysis will only have the possibility of improving healthcare when it seriously considers outcomes.

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APPENDIX A

Data obtained from the subject data sheet:

SUBJECT NAME

MEDICAL RECORD NUMBER

DATE

DATE OF INITIAL TREATMENT

TREATMENT

CPT CODES

DIAGNOSIS

DATE OF TREATMENT

TREATMENT TYPE

LOCATION OF LESION

REFERENCE HOSPITAL

DATE OF BIRTH

SEX