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## Reanalysis of Tendon Data: Availability of Dilated Eye Exams by Optometrists

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REANALYSIS OF *TENDON* DATA:  
AVAILABILITY OF DILATED EYE EXAMS BY OPTOMETRISTS

By

Patrice Conrad

A THESIS

Submitted to  
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1997

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Brian Curry, Ph.D

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## **ABSTRACT**

### **REANALYSIS OF *TENDON* DATA:**

#### **AVAILABILITY OF DILATED EYE EXAMS BY OPTOMETRISTS**

**By**

**Patrice Conrad**

Diabetic retinopathy is the leading cause of new blindness among adults. Dilated fundusoscopic eye exams are necessary to screen for this complication of diabetes. It is often asymptomatic in the earliest stages when it is the most treatable. Nurses often need to refer people with diabetes for these screens.

Data were collected by *TENDON* through a survey of optometrists and were reexamined. The *TENDON* region includes ten counties in Western and Central Michigan. The original survey was sent to optometrists in the ten counties to gather information to print a survey used by nurses and others making referrals for screening.

This thesis, based on Neuman's System model (1995) asked the following of the data: a) the number of respondents by county; b) the approximate number of people with diabetes seen yearly; c) how often screens are recommended; d) the charge for a dilated fundusoscopic eye exam; e) patient education; f) and contraindications for examination?

Optometrists from each of the ten counties in the *TENDON* region responded to the survey. Most respondents recommend exams at least annually. The mean cost was \$50.65, the mode was the category of \$51-\$60. All respondents educate patients, most both verbally and written. Contraindications varied, the most frequent was narrow/closed angle glaucoma.

I dedicate this thesis to Kristin, Cassie and Zachary.  
I hope I can make their world a little better.

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My friends who have tirelessly, and without complaining, listened to me discuss (at great length) this thesis, and how I felt about doing it.

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## CHAPTER ONE

### INTRODUCTION

#### Background

The American Diabetes Association (ADA) Clinical Practice Recommendations (1996) state, “Diabetic retinopathy is a highly specific vascular complication of both insulin dependent (Type I) and non insulin dependent (Type II) diabetes mellitus” (p. S20). Type I diabetes is an autoimmune disease. Pancreatic islet (insulin producing) cells have been destroyed by the patient’s immune system. These patients are dependent on injected insulin for survival.

Patients with Type II diabetes may have one or more problems which cause the elevated blood sugars. They usually are resistant to insulin, which means that they make a sufficient amount of insulin, but their cells do not properly use the insulin. In the early stages of the disease, they may make a greater amount of insulin than a person without diabetes to compensate for the insulin resistance. Later in the disease, pancreatic ability to continue the overproduction is usually diminished, and they may require injected insulin for glycemic control. They are still considered Type II since they still have some pancreatic function. They may also have some problems with overproduction and/or release of glucose from the liver.

The ADA Clinical Practice Recommendations (1996) further state that the prevalence of retinopathy is strongly related to the duration of diabetes. After 20 years of

diabetes, nearly all patients with Type I, and >60% of patients with Type II, have some degree of retinopathy. Overall, diabetic retinopathy is estimated to be the most frequent cause of new cases of blindness among adults aged 20-74 yrs. Abstracts of Clinical Care Guidelines from the Joint Commission Newsletter (1995), state that 80% of blindness in persons aged 20-74 years is related to diabetic retinopathy.

The ADA recommendations (1996) explain that the progression of retinopathy advances from mild background abnormalities, including increased vascular permeability, to preproliferative retinopathy which is characterized by vascular closure. Murphy (1995) further described the nonproliferative stage to include intra-retinal microaneurysms, hemorrhages, and other retinal problems. The final stage is proliferative retinopathy, characterized by the growth of new blood vessels on the retina and posterior surface of the vitreous body. Central vision loss with diabetic retinopathy results from macular edema or capillary nonperfusion. The new blood vessels of proliferative retinopathy and contraction of the accompanying fibrous tissue can distort the retina and lead to retinal detachment which produces severe and often irreversible vision loss. New blood vessels may bleed, adding further complications of preretinal or vitreous hemorrhage. The Abstracts of Clinical Care Guidelines (1995) demonstrated a correlation between duration of diabetes and presence of eye disease (see Table 1).

#### Need for Dilated Eye Exam

The effects of diabetes, in particular hyperglycemia, on the retina are not totally preventable. The progression to blindness is, at best, preventable, and even when it cannot be totally prevented it can be delayed, giving the person more years of usable sight. Early detection of retinopathy and macular edema using dilated funduscopy eye

Table 1

Correlation Between Duration of Diabetes and the Presence of Eye Disease\*

| Duration of diabetes | Eye disease   |
|----------------------|---|
| Type I               |   |
| <5 years             | Possible ocular manifestations                      |
| >10 years            | 60% will have some retinopathy                      |
| >15 years            | Nearly 100% will have some degree<br>of retinopathy |
| >20 years            | 50% progress to proliferative retinopathy           |
| Type II              |   |
| At diagnosis         | 20% have some retinopathy                           |
| >4 years             | 5% progress to proliferative retinopathy            |
| >15 years            | Up to 20% progress to proliferative<br>retinopathy  |

\*From The Abstracts of Clinical Care Guidelines (1995)

exams can increase the use of laser therapy to reduce the rate of blindness from diabetes by an estimated 50-60% (Center for Disease Control, US Dept of Health and Human Services, et al., 1991). The lasers are used to photocoagulate damaged blood vessels in macular edema. They are also used to prevent the growth of, or destroy new blood vessels in advanced retinopathy. These new, fragile blood vessels which often grow in response to retinal damage, frequently hemorrhage. They can also cause retinal detachment or membrane formation. Laser burns are used to destroy these vessels and prevent the sight threatening complications. (Kohner, 1993). If treatments are delivered as recommended in the clinical trials, the financial savings would be \$966 annually for every person whose vision was saved from proliferative retinopathy and \$1 120 annually for each whose central acuity was saved from macular edema. In addition, if all Type I patients received eye care at federal expense, the predicted savings would exceed \$167 million and 79,236 total additional years of sight. The American Academy of Ophthalmology Preferred Practice Pattern (1993) points out that this is less than the cost of a year of Social Security disability payments for those disabled by vision loss. The treatment yields a substantial savings compared to the direct cost to society of the person who has not had an annual dilated funduscopy eye exam, and whose retinal damage was detected in a later and less treatable stage.

The American Academy of Ophthalmology Preferred Practice Pattern (1993), the American Diabetes Association Clinical Practice Recommendations (1996), and the American Optometric Association Consensus Panel on Diabetes (1995) all agree on the overwhelming need for dilated funduscopy eye exam beginning five years after diagnosis for the Type I patient and as soon as possible after diagnosis for the Type II. The

recommendations are for a minimum of annual dilated funduscopy eye exams if no problems are detected.

The American Optometric Association Clinical Practice Guidelines for Care of the Patient with Diabetes Mellitus (1994) states the following guidelines for a dilated funduscopy eye exam for patients with diabetes; a) patients with Type I diabetes who are age 12-30 should have dilated funduscopy eye exams after five years duration of diabetes and follow-up exams should be yearly after that, b) patients with Type II should have dilated funduscopy eye exams at diagnosis and then annually thereafter, c) any patient with proteinuria or poorly controlled diabetes should have dilated funduscopy eye exams annually, and d) patients with macular edema, moderate to severe nonproliferative retinopathy, or proliferative retinopathy should be referred to a retinal specialist.

Duenas (1993), in his article designed to help meet the needs of people with diabetes, recommends an annual dilated funduscopy eye exam. He states that early detection and proper management of patients with diabetes will ultimately lead to fewer complications, and a reduced burden to patients, their families, and society. He further recommends stressing the importance of the annual dilated funduscopy eye exams to patients.

### Referral to Optometrists

Optometrists have been trained to perform dilated funduscopy eye exams in New York since 1983 and nationally since 1989 (American Optometric Association's Statute Definitions Information Exchange, 1992). The study by Kleinstein, Roseman, Herman, Holcombe, and Louv (1987) showed that optometrists who performed dilated funduscopy eye exams were able to make appropriate referrals based on their findings

and correctly diagnosed diabetic retinopathy in 77% of the eyes examined. The optometrists correctly diagnosed the type and severity of retinopathy in 57% of the eyes examined, compared with 52% for general practice ophthalmologists and 39% for primary care physicians. Foster, Wylie-Rosett, and Walker (1996) found that dilated funduscopy eye exams were available at a relatively modest cost from optometrists, and the optometrists were educating their patients about the need for the exams. The optometrists stated that less than one fourth of the patients with diabetes that they had seen originally knew about dilated funduscopy eye exams and the need for screening. In the poorer South Bronx area, only 2% of the patients with diabetes were informed about the need for dilated funduscopy eye exams. They also found that optometrists were more readily available to the outlying areas and more affordable for the lower income patients. Dilated funduscopy eye exams should be accessible to all at a reasonable rate.

#### Problem and Purpose

Kohner (1993) states that once retinopathy is present it may advance. Laser treatments are most effective when applied early, before there is any visual loss and before the complications of new vessels. She states that since early retinopathy is symptomless, and effective treatment for retinopathy has shown the greatest improvement in the earliest stages, screening is necessary. She recommends all people with diabetes receive screening, including a dilated funduscopy eye exam by an ophthalmologist but recognizes that this is not always possible. A properly trained optometrist can do the screening, and refer people with retinopathy to an ophthalmologist. She recommends screening be done yearly.

Dilated funduscopy eye exams by ophthalmologists can be expensive. One

clinic, run by ophthalmology residents charges about \$100 for an exam (personal communication with Metropolitan Hospital's Ophthalmology Clinic, March 31, 1997). An ophthalmologist office (private practice) stated the charge is \$115 (personal communication with receptionist at Dr. Kunkle's office, March 31, 1997).

Nurses involved in caring for people with diabetes need information to make appropriate referrals for the annual dilated funduscopy eye exam screening. The purpose of this study was to examine available data about optometrists who perform dilated funduscopy eye exams to determine accessibility. The availability of this information can be utilized by nurses in all settings to assist in working with other disciplines to provide holistic, accessible, and more affordable health care. This will promote health and wellness, and ultimately save money and contribute to an improved quality of life for people with diabetes. The financial burden on society of social security disability payments may also be reduced. This will be explored further in the literature review.

## CHAPTER TWO

### LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

#### Conceptual Framework

The Neuman Systems Model (1995) focuses on a holistic approach to protect and promote client welfare. This model represents an open system which identifies repeated cycles of input, process and output for further growth and survival of the organism (person). There is a focus on defining the appropriate action of the client in a stress-related situation. Neuman (1995) defines health and wellness as the condition or degree of system stability. The action taken in a stress-related situation is directed toward maintaining or regaining that stability, thereby promoting wellness. Neuman also encourages care giving which cooperates with other disciplines to help the person achieve and/or maintain this wellness.

Neuman (1995) suggests that a tendency exists within any system to maintain a steady state or balance among the forces that may disrupt it, thereby maintaining stability and wellness. The model identifies the first line of defense against a stressor as the flexible line of defense (see Figure 1), the model was adapted with permission of Dr. Neuman (Appendix A). The flexible line of defense determines whether or not a reaction is likely to take place. This line is flexible and accordion-like. The greater the distance from the normal line of defense, which is the next line of defense, the greater the protective ability. The ideal is to strengthen this protective mechanism, preventing or

## The Neuman's System Model Applied to the Patient with Diabetes Needing a Dilated Funduscopy Eye Exam

NOTE: Physiological, psychological, sociocultural, developmental, and spiritual variables are considered simultaneously in each concentric circle

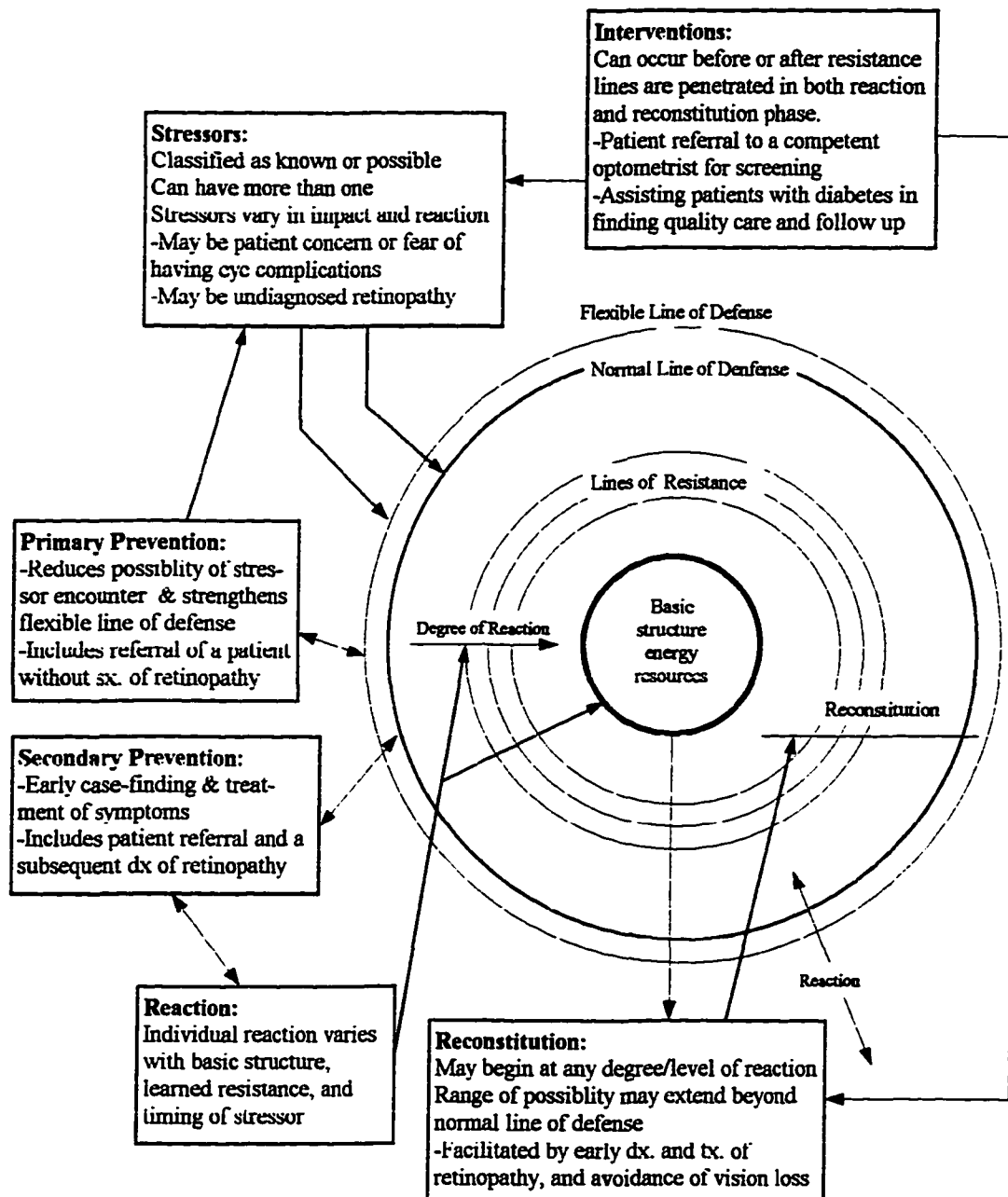


Figure 1. Adapted from The Neuman Systems Model, by B. Neuman, Norwalk, CT: Appleton & Lange. Copyright 1995 by B. Neuman. Adapted with permission by Dr. Neuman.

reducing a possible stressor reaction and maintaining a steady state. This stability preserves the character of the system.

The next layer of stress protection is called the normal line of defense and is an adaptational level of health which is developed over time (Neuman, 1995). This is behavior or system function which is considered normal for that person. It is the standard for determining wellness. Ideally, the individual's flexible line of defense limits the number of stressors which cause the need for the organism to change and adapt. Those stressors which do penetrate the flexible lines of defense necessitate an adaptation process within the normal lines of defense.

Within the normal line of defense are the lines of resistance (Neuman, 1995). These are defined as protection factors that are activated when stressors have penetrated the normal line of defense, causing symptoms. These lines protect the basic structure and facilitate reconstitution or rehabilitation toward wellness. Following treatment for a stressor, the stressor is reduced, client resistance is increased and this layer becomes the primary driving force toward stability.

This is done to protect the basic structure which includes the client survival factors and unique individual characteristics (Neuman, 1995). The basic structure represents the system energy resources. The basic structure includes normal temperature range, genetic structure, response pattern, organ strength or weakness, ego structure and knowns or commonalities. If the stressor is allowed to penetrate to the basic structure, depletion of this structure causes severe and often life-threatening illness or injury. Reconstitution at this level is often involved, lengthy and difficult.

It is viewed as critical to the Systems Model (Neuman, 1995) that the stressors.

real or potential, be identified as early as possible. Certainly retinal damage, real or potential, is a stressor to the stability of the organism. This is particularly true if that person goes on to develop severe visual problems and blindness. Identification of the stressors can be positive because it gives the person the potential for beneficial change (Neuman, 1995). The model describes the goals of nursing practice for the client. The goal for the client is to retain, attain, or maintain optimal client system wellness and stability. Nursing education of the client for the need for annual dilated funduscopy eye exams gives the client the opportunity to obtain early intervention and retain usable vision, thereby maintaining system integrity.

The use of optometrists for this function allows a more accessible and affordable “tool” for the client to use to identify a stressor. If retinopathy is discovered, it allows the client to engage in avoidance of further stressors and secure a referral to an ophthalmologist for the recommended vision saving therapy. This strengthens the flexible line of defense, and prevents the stressor from becoming more severe, and threatening the systems innermost layers and core. This helps maintain system structure and stability (Neuman, 1995).

Neuman (1995) sees a great need to clarify and make explicit those variables related to ambulatory and evolving high risk groups. Ambulatory patients are those who are currently maintaining system stability. People who are at risk for encountering stressors which threaten system stability are considered evolving high risk. Certainly people with diabetes are a high risk group for the development of retinopathy, as described earlier. People with existing vision problems or known retinopathy should be referred to an ophthalmologist for intervention and treatment options.

Neuman (1995) describes prevention as a nursing intervention and sets identification of the stressors as the first priority. Primary prevention is defined as reducing the possibility of encounter with stressors which strengthens the flexible lines of defense described earlier. Primary prevention in recommending dilated fundoscopic exams on all clients with diabetes before symptoms occur is vital in maintaining system integrity.

People who have the dilated fundoscopic eye exams done and have no retinopathy would be strengthening the flexible lines of defense with this primary prevention (Neuman, 1995). The flexible lines of defense are strengthened by the reassurance of health and wellness which result from knowing the retinas are disease free. Stress and anxiety tend to raise blood sugars, and the reassurance that the retinas are unaffected may reduce stress and thereby help in maintaining glycemic control, which promotes system stability.

Recommending dilated exams to people may also be an example of secondary prevention (Neuman, 1995). This occurs when a stressor has begun to penetrate the normal line of defense. The goal of secondary prevention is early case-finding and treatment. This prevents further intrusion of the stressor into the system. In those patients who have early retinopathy and have no symptoms, the dilated fundoscopic eye exam would include secondary prevention in the treatment of the retinopathy before any vision loss had occurred.

Neuman (1995) states tertiary prevention involves reeducation and adaptation following a stressor. The goal of this study was to review available data to identify optometrists who were willing and able to provide adequate screening to people with

diabetes. The providers must be affordable and accessible. This information, passed on to nursing for patient teaching, can help strengthen the flexible line of defense in those without retinal disease. It can also help strengthen the normal lines of defense for those with retinal disease, in cooperation with other health care disciplines.

### Literature Review

The literature reviewed was obtained from Medline and Spirs. There were 75 sources identified, which were reviewed. Many of the articles were not appropriate for this study. They did not discuss the need for screening, but rather other areas of retinopathy not discussed here. Some were not research based. No studies were identified which used Neuman's Systems Model (1995) as the basis for diabetes research. Neuman stated she did not know of anyone who used her model for diabetes research (personal conversation, March 29, 1997). Appropriate research studies are included in this review.

### Research Based Literature

As cited in the review by Cavallerano (1990), the Early Treatment Diabetic Retinopathy Study (ETDRS, 1987) demonstrated the need for annual dilated funduscopy eye exams. The ETDRS was cited by many of the research articles reviewed. Two of the questions posed by the ETDRS were: 1) Is laser treatment effective in treating diabetic macular edema? and 2) When in the course of the disease is the best time to initiate panretinal photocoagulation by laser for diabetic retinopathy?

To determine the answers to these questions the ETDRS (1987) research group established 23 clinical centers across the United States and Puerto Rico. Enrollment was 3,711 patients. People considered eligible for the study had macular edema and/or

preproliferative or early proliferative diabetic retinopathy. The patients with retinopathy had one eye which was treated early with laser treatments. The other eye had treatment deferred until high risk characteristics developed, but was carefully screened including, dilated funduscopy eye exams, and watched. Patients with macular edema had the same treatment assigned to each eye.

The ETDRS (1987) group found that focal laser treatment for clinically significant macular edema reduced the risk of vision loss by 50% or more. They also found an increased chance of vision improvement, decreased retinal thickening, and there were no major adverse effects noted. Focal treatment for macular edema was so helpful in reducing the risk of vision loss that the ETDRS group changed the treatment plan for the eye which did not receive immediate treatment.

The need for maintaining careful follow up was stressed. They did find that there was no advantage in beginning laser treatment until the disease was in the high risk stage. A strong recommendation for careful monitoring patients with mild to moderate disease was given. Overall rates of severe vision loss were very low for the ETDRS (1987) group. This study is cited by many authors as underscoring the need for early detection so that timely laser treatments can be done. Annual dilated funduscopy eye exams are recommended for screening. More frequent examinations are needed if any retinopathy is found.

Javitt et al., (1994) wanted to determine if there was a cost-saving benefit in early detection and treatment of people with Type II diabetes. Their purpose was to estimate the current and potential federal savings resulting from screening and treatment of retinopathy in these patients. The authors used the PROPHET (PROspective Population

Health Event Tabulation) Modeling System (as cited in Javitt et al., 1994). This is an epidemiology-based network simulation program designed for modeling the progression of a chronic irreversible disease. The program analyzes events and costs incurred during the lifetime course of an irreversible chronic disease while considering each patient as a separate individual. The simulation begins with a theoretical cohort representing all Americans within a given age group who develop Type II diabetes within a year. Data on incidence of diabetes, treatment with insulin, progression of diabetic eye disease, and vision loss are drawn from cross-sectional and longitudinal studies. Outcomes of laser treatments are based on published clinical trials. Each individual is assessed for disease progression and mortality in an age specific, disease duration specific, and disease severity specific manner. Individuals undergoing dilated funduscopy eye exams are assessed for the presence of retinopathy using published sensitivities for eye examination. Treatment failures are determined, net costs and benefits during the cycle are tabulated and the cycle repeats itself at two month intervals throughout the lifetime of the patient.

Costs of screening and treatment are derived from the average Medicare charges in 1990 (PROPHET, as cited in Javitt et al., 1994). Costs per year of blindness include: a) \$7,024 for disability and Social Security payments, b) \$3,358 in tax losses and expenditures and, c) \$3,914 in Medicare and Medicaid payments. A total annual federal expenditure of \$14,296 is predicted for each patient with blindness caused by diabetes who is younger than 65 years old. These estimates do not include the additional costs associated with rehabilitation, welfare, and any other state or local expenses.

It has been cited an estimate which estimated that adequate eye care would mean screening approximately 60% of patients with Type II diabetes (Javitt et al., 1994). This

is an improvement over current practice, which was based on other studies that estimated 40-50% of the patients receive dilated fundusoscopic eye exams. Various strategies for exams were devised, with dilated fundusoscopic eye exams occurring from six months to every two to four years. The number of patients whose vision was saved was based on national screening studies.

Javitt et al., (1994) reported results which indicated an annual savings of \$247.9 million to the federal budget, and 53,986 person-years of sight (the total number of years of sight by all people who would have lost vision). This estimate was based on the substandard rate of 60% of patients with diabetes being screened. If all patients with Type II diabetes were to receive the recommended eye care, the cost savings would be \$472.1 million, and 94,304 per-years of sight. This savings is dramatic, and calls for a greater number of dilated fundusoscopic eye exams to promote quality of life and the saving of vision. It would also result in large federal savings.

Javitt, Aiello, Bassi, Chaing, and Canner (1991) previously applied this formula to patients with Type I diabetes and predicted annual savings of \$101 million and 47,374 years of sight per person if screening were applied to 60% of people with this type of diabetes. They found an additional savings of \$9,571 per person annually if the newly diagnosed are properly screened, and do not wait the recommended five years.

Vander et al., (1991), assessed the relationship between early response to laser surgery for retinopathy, as described by the patient. They also reported the long term visual outcome in 59 eyes of 59 consecutive patients who developed proliferative diabetic retinopathy. The hypothesis was that successful treatment of retinopathy would result in long term visual improvements. This was a prospective study which followed patients

who initially presented with background or preproliferative diabetic retinopathy. None of the patients had prior laser surgery. Snellen visual acuity, slit-lamp examination and other tests were used to measure acuity.

Patients who were studied were those who went on to develop proliferative retinopathy in at least one eye (Vander et al., 1991). These patients were treated with laser photocoagulation. Follow-up examinations were performed at three weeks, three months, and every four to six months thereafter. Treatment was continued as warranted by the examinations performed. A successful initial response to the laser surgery was defined by regression of the proliferative vessels, or at least a regression in the size of at least one third of the proliferative area.

In the study by Vander et al., (1991) there were 32 men and 27 women who were studied. This group had 35 patients who had a successful response to the laser surgery, as defined above. Overall, 42 patients had visual acuity of 20/40 or better before the laser surgery, and none had acuity worse than 20/200, the acuity for legal blindness. Follow-up averaged 48 months, with a range of 7 to 101 months. Eleven patients were followed for less than two years and only five were followed less than one year.

The final visual acuity results found that 59 patients with 20/200 or better in the eye which had the laser surgery at the time of the last examination (Vander et al., 1991). There were 41 patients who had visual acuity of 20/49 or better, and 20 patients who had visual acuity of 20/20 or better at the last examination. Recurrent visual hemorrhage did not occur, or involved only one vessel in all but one of the patients studied.

Vander et al., (1991) concluded that for patients who develop high-risk characteristics and are treated early, most had a favorable response, and the visual

prognosis was excellent. The probability of recurrent hemorrhage was also reduced. This study supports the need for dilated funduscopy eye exams and early detection of diabetic retinopathy, so that the laser surgery can be performed as soon as it is detected.

The research by Constantinides and Fourdrignier (1996) attempted to discover the reasons for late diagnosis of severe retinopathies. The study used 30 people with diabetes who had severe retinopathy upon initial examination. They analyzed the quality of blood sugar control and the number of dilated funduscopy eye exams. The results indicated that sixteen patients (53%) had no dilated funduscopy eye exam since the diagnosis of their diabetes; 100% of the people were greater than 15% overweight; 100% had no strict control of their blood sugar; and 90% had high blood pressure. The conclusion was that the prevention of diabetic retinopathy is dependent on the maintenance of strict glycemic control and funduscopy examinations every year. One of the drawbacks of this study was the small number of patients who were studied. Despite the small sample size, the study does support the need for regular dilated funduscopy eye exams by indicating that the people who did not have them had disastrous results. Further study with a larger number of subjects would add credibility to this research.

Another study examined hospital admission rates and bed utilization rates in the North Western Region from 1980/81 to 1990/91, with diabetes as the principal cause. Williams, Anthony, Young and Tomlinson, (1994) looked at data about hospital admissions from 1980/81 - 1986-87 and 1988/89 - 1990/91. Admission rates for all combined categories of diabetes showed little change until 1986/87 after which they rose progressively each year. Hospital bed utilization rates fell progressively from 1986/87 onward with the number of bed days from diabetes falling from 1.9% to 0.8% of the total

for all causes.

Most of the rise in admission rates from 1988/89 onwards was attributable to diabetes with ophthalmic complications (Williams et al., 1994). This was heavily influenced by the number of day cases (patients who were admitted but did not spend the night) in the Regional Information System. It is significant to note that while admissions from other types of complications from diabetes are falling, ophthalmic complications, which are largely preventable, are on the rise. This contributes to the already high cost on society of diabetes and reinforces the need for early dilated funduscopy eye exams.

The above study, when reviewed in conjunction with the study by Zhang et al., (1992), supports the premise that people with diabetes should have dilated funduscopy eye exams earlier and more frequently to prevent the progression to more severe and less treatable forms of retinopathy. Zhang et al., looked at 662 cases of diabetes and found that the prevalence of diabetic retinopathy was 51.3%, of which 7.6% were preproliferative and 7% proliferative. It showed that when the disease progressed to the preproliferative and proliferative stages of retinopathy, laser photocoagulation was the treatment of choice in salvaging vision.

Kohner (1993) discussed the various mechanisms which contribute to the development of diabetic retinopathy. She stated,

Of all the long term complications of diabetes, retinopathy raises the most interest and the most arguments. This is not only because it is a common cause of visual loss in patients of working age. It is also because, although the clinical course is well understood, the pathogenic mechanisms responsible for the lesions and visual loss are not clearly defined (p. 1195).

The author discussed the clinical course of diabetic retinopathy in great detail and also stated that laser surgery for new vessels was shown to be effective as long ago as 1977.

Kohner (1993) concluded that once retinopathy is present, it may advance.

Photocoagulation is most effective when applied early, before there is any visual loss and before there is the complication of new vessel growth. She states that since early retinopathy is symptomless, and since effective treatment for retinopathy has shown the greatest improvement in the earliest stages, that dilated funduscopy eye exams are necessary. She recommended that all people with diabetes have the dilated funduscopy eye exams from an ophthalmologist but recognizes that this is not always possible. Therefore, an optometrist can do the screening, and then refer people with retinopathy to an ophthalmologist. She further recommended that dilated funduscopy eye exams be done yearly.

Brechner et al., (1993) assessed whether adults with diagnosed diabetes in the United States were receiving dilated funduscopy eye exams for the detection of diabetic retinopathy. They surveyed the U.S. population based on the 1989 National Health Interview Survey (as cited in Brechner et al., 1993). A probability sampling identified 84,572 persons. A questionnaire was sent to all subjects with diagnosed diabetes. Their outcome measure was the receipt of a dilated funduscopy eye exam in the last year. The study found that 57% of people with Type I, 55% of people with insulin treated Type II and 44% of people with non-insulin treated Type II had received a dilated funduscopy eye exam in the last year. Only 61% of people with diabetes who had a high risk of vision loss because of previously diagnosed retinopathy, and 57% of people who had a long duration of diabetes, were found to have received timely dilated funduscopy eye

exams. They also found that people who had been educated about diabetes and those with a high socio-economic status were more likely to have had an exam. They conclude that about half of the adults with diabetes have yearly dilated funduscopy eye exams. They state there is a need for greater patient and professional education to ensure that patients who are not receiving appropriate eye care have an annual dilated funduscopy eye exam to detect retinopathy and prevent loss.

Gatling, Howard, and Hill (1995) stated that in many cases, blindness due to diabetic retinopathy can be prevented if treatment with laser photocoagulation is used at the proper time. They contend that a screening program, including a dilated funduscopy eye exam, is required to identify cases of sight threatening retinopathy. The authors discussed their approach to this need. An optometrist was hired to perform the examinations on patients with diabetes in their regions of Dorset and Poole in the United Kingdom. The findings were then recorded on a coded form and sent to the hospital diabetologist. The diabetologist recalled patients with positive findings for follow up examinations. Seventy six practices joined the program. A total of 3,224 patients were seen in the first six months. A total of 129 patients were recalled in the six months. After three additional months 59 patients were recommended for further recall. Of these 59 patients, referral to the ophthalmologist was made in 15 cases for potentially sight threatening retinopathy. The clinic for patients with diabetes followed 14 cases for significant background retinopathy. Annual screening, including dilated funduscopy eye exams, was recommended for 24 cases in the optical practices. There were six patients who did not follow up. The authors felt that the optical screening program had been successful with a large number of patients. They strongly recommended that dilated

funduscopy eye exams be performed for all patients with diabetes.

Porta et al., (1995) described the implementation of a dilated funduscopy eye exam screening for retinopathy in Italy. They evaluated the 4,549 people in the north-west city of Turin between 1967 and 1991. They examined the cause of blindness, and found that diabetic retinopathy was the second cause of bilateral blindness. Diabetic retinopathy was the leading cause of visual loss in the 20 to 70 age group. The incidence of diabetic retinopathy related blindness did not show any decrease over the 25 years investigated. The study concluded that despite the widespread availability of facilities for assessment and treatment, diabetic retinopathy remains a leading cause of blindness in north west Italy. The researchers stated this justifies the implementation of dilated funduscopy eye exam screening programs and efficient referral chains for the early detection and prompt treatment of diabetic retinopathy.

#### Theoretical Based Literature

Search of the literature identified several articles which were relevant to this study but were not research based. Murphy (1995) stated that all people with diabetes are at risk of retinal complications. The two stages of retinopathy were discussed; first the nonproliferative stage, second the proliferative stage. It is clear that in order to detect the often symptomless preproliferative retinopathy, so that the timely laser treatments can be done, early screening and detection are necessary. The author stated that regular dilated funduscopy eye examinations may result in properly timed laser treatments which can markedly reduce the risk of vision loss.

Cavallerano (1990) made the following statement: "Regular eye examinations through dilated pupils are important for all people with diabetes. Early detection and

appropriate treatment of diabetic retinopathy is the best way to maintain good vision” (p. 8). He went on to clarify the need for a minimum of annual examinations for all people with diabetes. He also urged proper and timely referral to a retinal specialist when necessary.

Tierney (1992) discussed the need for early detection and screening including dilated funduscopy eye exams for retinopathy. It was stated that diabetic retinopathy is a treatable condition, which is currently managed with aggressive therapy. The article further discussed that early recognition of the condition can protect the patient against blindness, and sometimes restore visual acuity. It was recommended that from the first dilated funduscopy eye exam, the patient should be placed on a program of watchful follow-up, treatment, and referral to ophthalmologists when warranted by the detection of early problems. This article was written for primary care physicians, but clearly applies to all those who are involved in the care of people with diabetes.

Dunbar (1994) stated that co-management of the person with diabetes requires interdisciplinary care involving optometry, ophthalmology, and the patient’s other care givers. The optometrist needs to communicate the ocular health of the patient’s eyes to the physician and others involved. Dunbar also stressed the need for regular dilated funduscopy eye exams and patient education. It was also indicated that timely and appropriate referrals to the ophthalmologist are also important based on the patient’s current eye status and the need for further intervention.

Hurwitz and Yudkin (1992) discussed recommendations for those who are responsible for the care of people with diabetes to improve the quality of that care. One of these is the need for a competent funduscopyist who can perform screening. They listed

several sources of professionals who could do the screening and included optometrists. They emphasized the need for dilated funduscopy eye exams. They also encouraged frequent and appropriate education about all aspects of self care.

Classe (1992) stated that the optometric management of patients with hypertension and diabetes is determined by clinical and legal requirements. The most common cause of litigation is failure to recognize retinal changes requiring treatment, and then a failure to refer. The author suggested that optometrists should comply with appropriate standards of care. Classe defined the standards of care as performing a thorough eye examination, including a dilated funduscopy eye exam; patient education about the risks of diabetes and retinal disease; and the need for periodic assessment. He recommended further referral if sight threatening retinal changes are found.

#### Accessibility of Dilated Funduscopy Eye Exams

Foster et al. (1996) published a study which was a survey of optometrists who performed dilated funduscopy eye exams for patients with diabetes. Their study most closely resembles the information collected for this thesis. They mailed letters to the 31 optometric practices listed in the Bronx NYNEX Yellow Pages requesting participation in a telephone survey about eye exams for patients with diabetes. Practices not listed in the yellow pages were not contacted. Each practice was contacted by telephone two to four weeks later to determine the policies and procedures used by the practice. Training, procedures for dilated funduscopy eye exams, referrals, perception of contraindications, billing practices and charges and the number of patients with diabetes examined monthly were assessed for each optometrist.

The telephone interviews were conducted with 23 (74.2%) of the 31 optometry

practices listed in the Bronx NYNEX Yellow Pages (Foster et al. 1996). Of the eight optometrists who were not surveyed, five declined to participate in the survey, two were no longer in practice, and one could not be reached by telephone. Dilated funduscopy eye exams were performed in 13 (56.5%) of the 23 practices surveyed. Billing charges ranged from \$12 to \$55. The charge for a dilated funduscopy eye exam ranged from no additional charge to \$27 in addition to the regular exam fee. The optometrists reported the perception that the patients with diabetes who were aware of the need for dilated funduscopy eye exams represented 2-25% of their practices. The article stated that among the optometrists who had graduated from optometry school before 1964, five (38.5%) stated that they performed dilated funduscopy eye exams. This contrasts with the four (67%) out of six who graduated between 1964 and 1983, and all (100%) four of the optometrists who graduated after 1984. All the optometrists reported that they made referrals to general practice or retinal specialist ophthalmologists.

Foster et al., (1996) concluded that dilated funduscopy eye exams were available at a relatively modest cost in over half of the optometry practices listed in the phone book yellow pages. The authors stated that in a managed care system, optometrists are likely to become “the gatekeepers” of eye care with a specialty referral being required for examination by an ophthalmologist. The information gathered was especially important since some of the areas surveyed were considered to be areas of very few medical resources.

The authors suggested that a more in-depth assessment of how to provide patient education be explored particularly because patients were mostly unaware of the need for dilated funduscopy eye exam, as well as other aspects of diabetes self-care (Foster et al.,

1996) . They encouraged yearly dilated funduscopy eye exams for all persons with diabetes, as well as information about other eye related diseases. The study by Wylie-Rosett, et al. in 1995 (as cited in Foster, 1996) found in a chart study that less than 5% of patients in primary care clinics in medically under served areas of New York City included referrals for dilated funduscopy eye exams.

Olsen, Gerber and Kassoff (1991) wanted to learn about the involvement of optometrists in the eye care of people with diabetes in New York. They also wanted to collect baseline data for planning intervention programs in diabetic eye disease. Their study was a mail survey which was sent to 2,270 optometrists in New York who could be identified through state sources. The results of the survey are shown in Table 2. Three follow-up mailings were conducted for those who did not respond to the original survey. They had a response rate of 86%. Olsen et al., (1991) concluded that optometrists as a group see many patients with diabetes. They recommend that intervention strategies should include increased emphasis on the use of dilated funduscopy eye exams at least annually in caring for these patients.

Alexander and Duenas (1994) wanted to determine the accessibility of eye care and the similarities and differences in the practice pattern of optometrists and ophthalmologists for patients with diabetes. They analyzed the results of two surveys sent to the Florida Society of Ophthalmology and the Florida Optometric Association by the Florida Diabetes Retinopathy Task Force (as cited in Alexander and Duenas, 1994). They stated that the results indicated better accessibility of people with diabetes to optometrists because there were optometrists in 81% of the counties, whereas ophthalmologists were found in only 55% of the counties. The results also showed strong

Table 2

Responses of Optometrist by Olsen et al. (1991)

| Survey Questions   | Percentage of Positive Responses |
|--|----------------------------------|
| Do you see patients with diabetes?                       | 87%                              |
| Do you provide routine retinal examinations?             | 68%                              |
| Of these, how many perform dilated funduscopy eye exams? | 60%                              |
| Do you provide follow up?                                | 15%                              |
| Of these, how many perform dilated funduscopy eye exams? | 90%                              |
| Do you refer to an ophthalmologist?                      | 25%                              |
| Do you recommend an annual eye exam?                     | 91%                              |
| Do you recommend an annual dilated funduscopy eye exam?  | 68%                              |

Note. Optometrists who dilated pupils were significantly more likely to recommend annual dilated funduscopy eye exams.

similarities in practice patterns between the two professions. They concluded that poor utilization of the primary care optometrist creates a gap in health care delivery for the person with diabetes and may contribute to the increase in complications of retinopathy.

### Implications For the Study

It is clear from the identified research that there is a need for people with diabetes to have a dilated funduscopy eye exam. Neuman's (1995) description of nursing's first priority of identification of stressors and prevention clearly defines nursing's role in patient referral for eye screening. The recommendations of Foster (1996) for increased patient education fits this model of nursing. If information about people providing this service can be gathered and then distributed to nurses, one can hope for an increase in the number of patients who are screened. Optometrists certified in dilated funduscopy eye exams are appropriate for referral since they can be more affordable and accessible. It was clearly stated earlier that lower socio-economic status is linked to fewer dilated funduscopy eye exams, making the need for lower cost and more accessibility even greater.

### Research Question

The focus of this study was to review data gathered by *TENDON*, a ten county Diabetes Outreach Network, in Western and Central Michigan. The counties include Allegan, Barry, Clinton, Eaton, Gratiot, Ingham, Ionia, Kent, Montcalm, and Ottawa. They wanted to determine how many optometrists provide a dilated funduscopy eye exam and were willing to be included in a brochure designed for nurses.

The research questions were; a) what is the number of respondents by each county, b) what is the approximate number of people with diabetes seen each year in each

of the ten counties in the *TENDON* region, c) how often are dilated funduscopy eye exams recommended, d) what is the charge for the exams, e) is patient education provided, f) is the education verbal, written or both, and g) what do the optometrists see as contraindications to performing the exams?

### Definition of Terms

Dilated funduscopy eye exam. This describes an eye exam in which the patient is given a myopic drug to dilate the pupils which then allows greater visualization of the fundus of the retina.

Optometrists. Independent primary health care providers who examine, diagnose, treat and manage disease and disorders of the visual system, the eye, and associated structures as well as diagnose related systemic conditions (American Optometric Association Consensus Panel on Diabetes, 1995).

Ophthalmologist. An MD or DO who has completed a residency in eye disease.

## CHAPTER THREE

### METHODOLOGY

#### Design

This study reanalyzed data already available from *TENDON* which is one of six Diabetes Outreach Networks. “*TEN*” stands for the ten counties in the region including central and western Michigan. These counties include: Allegan, Barry, Clinton, Eaton, Gratiot, Ingham, Ionia, Kent, Montcalm, and Ottawa. *TENDON*’s goal was to provide a brochure listing optometrists who perform dilated funduscopy eye exams for their counties, and encourage appropriate referrals to be made. The original questionnaire was developed by *TIPDON*, and was available to *TENDON*. *TIPDON* is another diabetes outreach network which services the counties in the “tip” of the lower peninsula of Michigan. *TENDON* adapted the *TIPDON* questionnaire which was then sent to every optometrist in these ten counties. A copy of the survey is included in Appendix B.

*TENDON* also included a letter (in Appendix C) to the optometrists explaining that being listed in the brochure meant they were willing to take some low/no pay clients. Permission was given by *TENDON* Project Director, Julie Lundvick, to use the data which was gathered for this project. (See Appendix D.)

#### Population and Sample

The sample was the data set which was available from *TENDON*. Surveys were sent to all 159 optometrists who were certified to perform dilated funduscopy eye exams

in the ten county area described above. This list was purchased from the Michigan Department of Commerce and was complete as of the running date, August 28, 1995. All ten counties in the *TENDON* area were represented on this list.

This study was a reanalysis of the data that resulted when the optometrists returned the above survey. The sample consisted of optometrists in the *TENDON* region who returned the survey. A total of 40 surveys were returned. The population consisted of all optometrists doing business in the *TENDON* region.

### Instrument

The tool for this study was designed to answer the research questions. See Appendix E for the data collection tool. The tool included, a) the number of people with diabetes seen by the respondents to the survey by county; b) the approximate number of people with diabetes seen by the optometrists (the *TENDON* data was compared with data available from the Michigan Department of Community Health, 1996 which described the number of people with diabetes in each of the ten counties and the total region); c) the charge for a dilated funduscopy eye exam was identified (this is often a prohibitive factor for many people, particularly in practicing prevention, since many insurance companies don't cover this type of service); d) patient education was achieved, since patient education is vital for continued health, and how the education was done was also examined; e) contraindications perceived to be prohibitive to the optometrists were examined, to help determine appropriateness of referrals.

### Method of Obtaining the Data Set

*TENDON* determined a need for a brochure listing the optometrists who are certified to perform dilated funduscopy eye exams. This brochure was needed for those

agencies, clinics, hospitals and all others involved with *TENDON*, so that appropriate referrals could be made. Referring patients for dilated funduscopy eye exams is one of *TENDON*'s goals, and providing a brochure is one way of facilitating these referrals.

A list was purchased from the Michigan Department of Commerce and was complete as of August 28, 1995. All ten counties in the *TENDON* area were represented on this list. The list included all optometrists certified to perform dilated funduscopy eye exams. A total of 159 survey forms were distributed. They were sent to each of the individual optometrists on the list. The number of surveys sent out per county were: Allegan (7), Barry (4), Clinton (5), Eaton (13), Gratiot (4), Ingham (36), Ionia (6), Kent (54), Montcalm (6), and Ottawa (24). Optometrists who practice in a group setting were not identified, since each individual optometrist was sent a questionnaire, and therefore were not included in the mailing. A letter was included which explained the survey, and detailed the need for acceptance of low/no pay patients by anyone who would be listed on the brochure. A self-addressed envelope was included to facilitate return. These envelopes were not stamped, since the survey and subsequent brochure were seen as free advertising for the optometrists and this would represent a significant cost to *TENDON*. Respondents were given several weeks to return the surveys. The surveys included an area which indicated agreement to be included in the brochure. The approximate numbers of patients diagnosed with diabetes was requested, since records of numbers of patients with diabetes was not likely to be readily available. It was assumed that the optometrists would not be willing to look at all their charts for the last year to discover the exact number of patients with the diagnosis of diabetes.

There were 42 surveys returned. One survey was returned with "address

unknown”. A call to telephone information service determined that this optometrist was no longer in the area, and this name was deleted from the list. Four of the surveys were returned “no longer forwarding”, the addresses were obtained by telephone information, and the surveys were sent to the current address. The data were not compiled until two weeks after the stated deadline, to insure inclusion of any late responses.

No attempt was made to contact any people who did not respond. Since inclusion in the brochure was voluntary, and meant accepting low/no pay patients, anyone who did not return the survey may not have been willing to have their name published, or to accept indigent patients. It was assumed that contacting them again would not change their decision.

One of the optometrists had offices in two different counties. The offices in both counties were listed separately. Some of the respondents listed a group practice, and the responses were listed individually, except the numbers of patients seen. Two of the respondents were from counties not included in the *TENDON* area, and this information was sent to the appropriate Diabetes Outreach Network. These responses were not used in this study.

### Procedure

The data set was obtained from *TENDON*, and permission for this was given by Julie Lundvick, project director (see Appendix D). The respondents were then divided by county. Responses were then tallied for each county. The responses were then totaled for the entire region.

## CHAPTER FOUR

### RESULTS

The total number of surveys returned was 40, which was 25.3% of the total number of surveys which were sent to the *TENDON* region. One of the optometrists had a practice in two of the counties, therefore there is a total of 41 responses by county. The data was tallied and compiled using the data collection tool.

Question one asked for the number of respondents by county. The three counties with the highest return were Barry, Ionia and Montcalm, each with a 50% return. See Table 3 for the number of respondents by county, and the percentage of the total number of surveys sent out to each county.

Question two asked for the total number of patients with diabetes seen by each of the respondents. The respondents stated that the total number of people with diabetes seen annually was 13,225. The total number of people with diabetes in the ten county region (estimate by the Michigan Department of Community Health, 1996) is approximately 50,200. This indicates that 26.3% of the total number of people with diabetes are being seen by these optometrists. See Table 4 for the number of patients seen and the percentage of the total number of patients with diabetes, by county.

The question of how often dilated funduscopy eye exams are recommended for patients with diabetes was answered “annually”, with 40 out of the 40 respondents stating they recommended at least an annual exam. One respondent from Ingham county

Table 3

Number of Respondents, by County

| County   | Respondents | Percentage of Surveys<br>Returned |
|----------|-------------|-----------------------------------|
| Allegan  | 3           | 42.8%                             |
| Barry    | 2           | 50.0%                             |
| Clinton  | 1           | 20.0%                             |
| Eaton    | 5           | 38.5%                             |
| Gratiot  | 1           | 25.0%                             |
| Ingham   | 9           | 25.0%                             |
| Ionia    | 3           | 50.0%                             |
| Kent     | 9           | 16.7%                             |
| Montcalm | 3           | 50.0%                             |
| Ottawa   | 5           | 20.8%                             |

Table 4

Number of Patients Seen, by County

| County   | Patients seen by<br>Optometrists | Number of People<br>with Diabetes* | Percentage<br>of Pts. Seen |
|----------|----------------------------------|------------------------------------|----------------------------|
| Allegan  | 2,970                            | 3,370                              | 88.1%                      |
| Barry    | 200                              | 1,940                              | 10.3%                      |
| Clinton  | 75                               | 2,100                              | 3.6%                       |
| Eaton    | 2,650                            | 3,470                              | 76.4%                      |
| Gratiot  | 1,000                            | 1,530                              | 65.4%                      |
| Ingham   | 930                              | 9,100                              | 10.2%                      |
| Ionia    | 200                              | 1,920                              | 10.4%                      |
| Kent     | 840                              | 17,860                             | 5.0%                       |
| Montcalm | 2,100                            | 2,030                              | 103.4%                     |
| Ottawa   | 2,260                            | 6,730                              | 33.6%                      |

\*Michigan Department of Community Health (1996)

recommends semi-annual exams for patients with Type I diabetes. A respondent (from Ionia county) recommends a dilated funduscopy eye exam every two years for patients who have been diagnosed with diabetes for less than 8 years, and then after 8 years annually is recommended. One respondent (from Montcalm county) recommends exams every 6 months to one year. Some of the respondents gave several answers to that question, so results are more than the number of respondents. (See Appendix F.)

One of the respondents in Ingham county stated that for most patients an annual exam was adequate but, for Type I diabetes, twice a year exams were recommended. It was not stated what defined the differences in length of time recommended. Most of the optometrists added the stipulation that more frequent examinations were recommended if problems were noted.

The charge for an examination ranged from a low of \$38 to a high of \$70. The mean cost of an exam was \$50.65. Three of the respondents gave a range or no answer at all. Some of the respondents stated that the higher amounts were used for new patients. Since the purpose of this study was to compile data for new referrals, the higher amount was used to determine the mean. The mode was the category of \$51-60.

Question five asked if patients were educated about eye care. All the respondents stated they educated their patients about eye care. Two of the respondents (5%) answered that they use only verbal instruction for patient education in response to the question requesting how patients were educated. The remaining 38 (95%) stated they gave both verbal instruction and written handouts. The respondent who had offices in both counties uses both verbal and written instruction, and was counted only once in this section. None of the optometrists use only written handouts for instruction.

Contraindications to dilated funduscopy eye exams was the final question asked. By far the most commonly stated contraindication to performing a dilated eye exam was narrow/closed angle glaucoma (67.5%). Narrow/closed angles are characterized by a shallow anterior chamber and a narrow angle, in which filtration is compromised as a result of the iris blocking the angle. An acute episode can be precipitated by myopic dilation of the pupil (Friel, 1974). This is very painful for the patient and requires immediate treatment. Laser surgery is used by an ophthalmologist to reopen the angles. The painful nature of this condition, and therefore the need for timely intervention would necessitate an ophthalmologist referral for these patients for the recommended dilated funduscopy eye exam. Twenty-seven of the respondents (67.5%) stated this would prevent them from performing dilated funduscopy eye exams. High intraocular pressure was determined to be cause for deferring an exam for five (12.5%) of the optometrists and lens implants was cited by twenty (50%) of the respondents. Allergies to the medication used to dilate the pupils was stated by eleven (27.5%) of the respondents. Six (15%) of the optometrists had other responses which included “prediagnostic conditions”, “light sensitivity”, “decreased VA with slight decreased distance VA” (the meaning of this phrase is unclear, and an ophthalmology clinic and ophthalmologist’s office were also unable to define what it could be), and patient refusal. The optometrist who has offices in two counties did not list any contraindications, and was counted only once.

## CHAPTER FIVE

### DISCUSSION AND APPLICATION OF FINDINGS

The purpose of this study was to gather information from an available data set about the availability of optometrists who perform dilated funduscopy eye exams. The number of respondents by county (question one) demonstrated that there are optometrists available in each county who are able and willing to see patients with diabetes. Response to the original survey by *TENDON* indicated that they are willing to see low/no pay patients. While this information is useful for nurses who see patients with diabetes in these counties, so that appropriate referrals can be made, there is still a concern about the ability of the respondents to fulfill the needs of all the patients requiring screening. This is of greatest concern in the counties with a small number of respondents where there is a large population. These counties include Kent, Ingham, and Ottawa.

The goal of question two was to gather information that would give some indication of the number of people who are not being seen by these qualified optometrists. It is assumed that some of the optometrists did not understand the question. For example as shown in Table 4, in Montcalm county more patients are being treated than the total number of people with diabetes in the entire county. One explanation may be that the total number of patients seen by the individual or practice was given, not specifically the number of people with diabetes. The studies by Kleinstein et al., (1987), Javitt et al., (1994), Williams et al., (1994), and particularly Brechner et al., (1993) stated

that many people with diabetes are not receiving dilated funduscopy eye exams. This would support the supposition that the number of patients with diabetes actually seen by the respondents may not be as high as reported. Another explanation may be that there are actually more people diagnosed with diabetes than what was estimated by MDCH. Many of these patients may also be seen by ophthalmologists. The ability to make a conclusive statement from the data received in answer to question two is limited by the questionable nature of the responses to the number of patients actually seen with diabetes. The results from this question were used to compare with data which is available from the Michigan Department of Community Health (MDCH), 1996. The MDCH data were collected in 1994, the latest year this information is available. The surveys studied were sent out in 1996.

The question of how often dilated funduscopy eye exams are recommended was unanimously answered as at least annually. The only exception was one optometrist who recommends every two years for patients diagnosed with diabetes less than eight years. Annual examinations demonstrated support of the guidelines by the ADA (1996), the Center for Disease Control (1991), and the American Academy of Ophthalmologists Preferred Practice Pattern (1993). Nurses making patient referrals can have a high degree of confidence that the patients would be encouraged to return for annual examinations. This is very important for the continuation of the identification of potential stressors to the patient. The intervention of nurses referring patients to optometrists for screening supports Neuman's (1995) recommendation for interdisciplinary cooperation in providing quality patient care.

Many patients and primary care givers express concern about the financial ability

of a patient to receive quality care. The data gathered clearly shows that optometrists who provide dilated funduscopy eye exams are doing so at a reasonable cost. The average cost of \$50.65, with the mode being \$51-60 represents a cost which is comparable to the amount described in Foster et al (1996), who reported a cost of \$12-82 for an exam. The willingness of the optometrists to accept low/no pay patients should remove any financial barrier to patients obtaining eye examinations. The necessity of accepting low/no pay patients is clearly stated in the letter which was sent to the optometrists with the surveys (see Appendix C). This is especially helpful for the “working poor” who have inadequate or no health insurance, and limited funds to pay for the exams.

The continuation and reinforcement of patient education about eye disease is necessary for patients to understand their potential and real stressors. It is significant to note that all of the participants reported that they provide patient education. All but two of the optometrists stated they provide both verbal and written instruction. This is important to meet the needs of both the visual and auditory learner. It also helps to reinforce the verbal information with written instructions to which the patient can refer once they leave the optometrist’s office. This is reassuring to the nurse making the referral, and she/he can feel confident that the patients will continue to receive education about the identification of real and potential stressors.

The information about contraindications is important in the referral process. It would be a waste of the patient’s time and money to see a practitioner who felt that a proper examination was contraindicated for this patient. Referral to an ophthalmologist, probably a retinal specialist would then be appropriate. Patient education about the risks

of dilated funduscopy eye exams with each of these contraindications may also be necessary, so that the risks and benefits of referral can be appropriately weighed by the patient. This would assist the patient in the identification of real and potential stressors, as is supported by Neuman (1995). If the nurse is unfamiliar with contraindications, discussion with the optometrist may help the nurse understand the problem more clearly, which can facilitate patient education. This is also recommended by Neuman (1995) in her emphasis of interdisciplinary cooperation for patient care.

Primary and secondary prevention are both supported using this data (Neuman 1995). Patients who are referred appropriately for dilated funduscopy eye exams and who find that they have no existing eye disease are reassured of their health, which can reduce their stress level. Secondary prevention is accomplished in patients with positive findings of early retinal problems. These patients can be carefully monitored, or referred to an ophthalmologist for early treatment. Early treatment of retinopathy can prevent or delay blindness, which would reduce the probability of this stressor penetrating near the patient's basic structure.

### Limitations

The amount of data which could be gathered was limited by the lack of follow-up with people who did not respond to the original survey. The original purpose of the survey, was the printing of a brochure including only those optometrists who were willing to accept low/no pay patients, was prohibitive from a research standpoint. The number of respondents was limited. However the knowledge that patients could be referred, despite an inability to pay, is very helpful to nursing.

Using an "approximate" number of patients reduces the strength of the findings

regarding the “true” number of patients seen each year. It was assumed this information would not have been easily gathered, since it was assumed that accurate statistics on the number of patients with a specific disease would be difficult and time consuming to obtain. It would not have been feasible to determine a diagnosis on each patient seen in the previous year.

The knowledge that all of the optometrists who responded are providing patient education is encouraging and certainly helpful for referrals. This information is limited to the fact that education is provided. The volume, and more importantly the type and quality of education is unknown. Likewise the results and the education efforts are not evaluated.

Information about contraindications to dilated funduscopy eye exams leaves a question unanswered. What is done with patients who have been referred to the optometrist, but have contraindications not known before the referral was made? Is the patient referral made by the optometrist to an ophthalmologist?

### Recommendations

Several recommendations can be made based on the analysis.

1. Follow-up with those optometrists not responding to the original survey is recommended. This would eliminate the possibility that a survey may have been overlooked, or any reason other than lack of desire to participate could be ruled out. A telephone interview, or follow-up letter and another survey being sent may facilitate a better response. This would help increase the size of available optometrists for referral, and reduce the burden on those who did respond. This would be especially helpful in the counties with a large population.

2. It is highly recommended that future research using a survey which clearly states that only patients with diabetes are included. The question should be reworded, and the phrase “patients with diabetes” should be rewritten, and possibly placed in bold typeface and/or underlined. This would allow for the projected statistics and comparisons to be made. A request for actual counts for the number of patients with diabetes may be included since some offices may keep this data, or have it readily accessible.

3. Questions about the flexibility of payment options would be helpful. There are patients who may be able to pay for an exam, but unable to pay the full amount at the time of exam, who would benefit from a payment plan. How much of a “down payment” would be required? Are there any resources available to help patients who don’t have insurance coverage? These questions would also help facilitate referrals.

4. Specific topics of patient education should be asked. A list of various topics about eye disease in people with diabetes should be included, so that they can be checked off easily by the respondents. If the participant was willing, a copy of some of the educational materials could be requested.

5. Information about those patients for whom a dilated funduscopy eye exam is contraindicated would be useful. Treatment available for these patients is important for the nurse making the referral, so that she/he can determine the best recommendation. If an optometrist states that he/she would still see that patient, and do everything but the dilation, the patient should be referred to an ophthalmologist in order to complete the dilated funduscopy eye exam.

6. Future research to determine the availability of more optometrists is necessary for the proper referral, treatment and care of people with diabetes. Nurses in most health

care settings provide nursing care to people with diabetes. The literature clearly shows the need for timely treatment of retinopathy. The ability to recognize this often symptomless disease requires a dilated funduscopic eye exam. Annual referral to an eye care provider is vital for the prevention of blindness for people with diabetes. Nurses need information so that appropriate referrals can be made, and confidence in the abilities of these providers can be assured. The recommendations for modifications and information used in this study can also be applied to a research study involving ophthalmologists. This would provide an even greater number of eye care professionals for referral.

## APPENDICES

## APPENDIX A

Betty Neuman, RN, PhD  
Founder/Director, Neuman Systems Model  
Trustee Group, Inc.  
Beverly, Ohio  
Fax - 614-749-3322

Dear Dr. Neuman,

I am a graduate student at Grand Valley State University in Allendale/Grand Rapids, Michigan. I am in the final stages of completing my thesis: Reexamination of *TENDON* Data: Availability of Dilated Eye Exams by Optometrists. I am requesting your permission to use my adaptation of your diagram of your model. This will help explain the need for early dilated funduscopic eye exams. If you would prefer that I use an exact replica of your model, please indicate your permission for this by your signature below. Please let me know if you would like me to do any modification of my adaptation. Please know that University Microfilms, Incorporated may supply single copies of my thesis on demand.

I graduated from nursing school with a BSN in 1981 and have worked in many different areas of nursing. I have spent the last 7 years as a diabetes educator, obtaining my CDE in 1992. I hope to finish my thesis next month, which will fulfill my requirements for my MSN, CNS focus.

Please contact me with any questions, concerns, or anything else I can do or answer for you. Thank you for your time.

Sincerely,

[Redacted Signature]

Patrice Conrad, BSN, RN, CDE  
1913 Garret NE  
Grand Rapids, MI 49505  
616-364-1420 - home/evenings  
616-752-6259 - work/daytime  
616-732-3015 - fax

I give my permission for Patrice Conrad to use her adaptation of my systems model for her thesis: (Original systems model from my book *The Neuman Systems Model*, 3rd. Ed. 1995)

[Redacted Signature]

Date 3/31/97

I give my permission for Patrice Conrad to reproduce my systems model in her thesis. The diagram is from my book *The Neuman Systems Model*, 3rd. Ed. 1995, p. 17.

[Redacted Signature]

Date 3/31/97

## APPENDIX B

### **TENDON** **OPTOMETRIST QUESTIONNAIRE**

1. Do you provide exams and care to people with diabetes? Yes \_\_\_\_\_ No \_\_\_\_\_  
If yes, how many patients/year do you see \_\_\_\_\_
2. Are you certified for dilated eye exams? Yes \_\_\_\_\_ No \_\_\_\_\_
3. How often do you recommend that persons with diabetes have a dilated exam?  
annually \_\_\_\_\_ other \_\_\_\_\_
4. Are you a participating provider with: Medicare Part B Yes \_\_\_\_\_ No \_\_\_\_\_  
Medicaid Yes \_\_\_\_\_ No \_\_\_\_\_
5. Would you be interested in being listed in the *TENDON* brochure given to patients by  
home care, clinic and hospital nurses? Yes \_\_\_\_\_ No \_\_\_\_\_  
If yes, print your name as you would like it to appear:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
6. How much do you charge for a dilated eye exam? \_\_\_\_\_
7. How do you educate your patients about eye care? Verbally \_\_\_\_\_  
Handouts \_\_\_\_\_ Both verbal instructions and written handouts \_\_\_\_\_
8. What do you consider contraindications to dilated eye exams? \_\_\_\_\_  
\_\_\_\_\_
9. Would you be interested in speaking to consumers and/or professionals about eye  
disease in the patient with diabetes? Yes \_\_\_\_\_ No \_\_\_\_\_  
If yes, please list any areas of special expertise: \_\_\_\_\_  
\_\_\_\_\_

**Please return this form by January 15, 1997 to:**

Patrice Conrad, RN, CDE, *TENDON*  
260 Jefferson SE Suite 202  
Grand Rapids, MI 49503

**THANK YOU FOR PARTICIPATING IN IMPROVING PATIENT CARE!!**

## APPENDIX C

December 17, 1996

Dear Doctor,

The goal of the Diabetes Outreach is to reduce the morbidity and mortality from diabetes and its complications. We have enclosed a brochure about *TENDON*. This is accomplished through networking -- connecting the resources available with those who need them. You are well aware of the need for dilated funduscopy exams for people with diabetes to detect the presence of retinal damage in the earliest possible stages, long before symptoms occur.

Our plan is to print a brochure of optometrists to give to home health agencies, hospitals, clinics and doctor's offices. To be included in this brochure, you are stating that:

1. You are certified to perform dilated eye exams and then refer appropriately.
2. You are also agreeing to take some patients who may have limited ability to pay, or even no money or insurance.

It is our goal to distribute these low/no pay patients as evenly as we can among the participating optometrists. We will, of course, send you as many paying/insurance patients as possible.

Please fill out and return the survey by January 15th to be included in the optometrist brochure. If you would like to discuss any ideas or concerns, please feel free to contact us, and we will be happy to meet with you and/or your staff. If you prefer, you can also call us and we can talk about them by phone.

Thank you for your time and consideration.

Sincerely,

The *TENDON* staff:

Julie Lundvick, RN, BSN, CDE, Project Director

Pam Worst, Office Manager

Patrice Conrad, RN, BSN, CDE, Diabetes Educator



## APPENDIX D

January 6, 1997

To whom it may concern,

Patrice Conrad, BSN, RN, CDE has my permission to use the data collected by *TENDON* on the availability of optometrists who do dilated funduscopy retinal exams, in her master's thesis.

Sincerely,

A black rectangular box redacting the signature of Julie Lundvick.

Julie Lundvick, BSN, RN, CDE  
*TENDON* Project Director

## APPENDIX E

### OPTOMETRIST DATA QUESTIONNAIRE

1. What are the number of respondents by county?
2. What are the approximate number of people with diabetes seen each year?
3. How often are dilated eye exams recommended for people with diabetes?
4. What is the charge for a dilated funduscopy eye exam?
5. Are patients educated about eye care?
6. If patients are being educated, how is this done, verbally - written handouts, both?
7. What if any, are considered contraindications to performing a dilated funduscopy eye exams?

# APPENDIX F

| Data Collection Tool  | Alle-gan                            | Barry                               | Clin-ton                            | Eaton                               | Gra-tiot                            | Ing-ham                             | Ionia                               | Kent                                | Mont-calm                           | Ott-awa                             | Total                                  |
|---|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|--|
| Number of respondents? n %  | 3<br>42.8                           | 2<br>50                             | 1<br>20                             | 5<br>38.5                           | 1<br>25                             | 9<br>25                             | 3<br>50                             | 9<br>16.7                           | 3<br>50                             | 5<br>20.8                           | 41<br>25.3                             |
| What is the approx. number of patients seen annually?<br>n/a=no answer given by the respondent  | 2970                                | 200                                 | 75                                  | 4=2650<br>(1 n/a)                   | 1000                                | 6=930<br>(3 n/a)                    | 1=200<br>(2 n/a)                    | 7=840<br>(2 n/a)                    | 2=2100<br>(1 n/a)                   | 2260                                | 13,225                                 |
| How often are dilated exams recommended?<br>Y=Year(ly)<br>S=Semiannually  | Y=3                                 | Y=2                                 | Y=1                                 | Y=5                                 | Y=1                                 | Y=9<br>S=1<br>(Type 1)              | Y=3<br>q2Y if<br>dx<br><8yrs=1      | Y=9                                 | Y=2<br>1/2-<br>1Y=1                 | Y=5                                 | Y=40<br>S=1<br>q2Y=1<br>1/2-1Y=1       |
| What is the charge for a dilated eye exam?<br><\$40<br>\$40-50<br>\$51-60<br>>\$61<br>n/a or varied   | 0<br>2<br>0<br>0<br>1               | 0<br>0<br>2<br>0<br>0               | 0<br>0<br>1<br>0<br>0               | 0<br>0<br>5<br>0<br>0               | 0<br>0<br>1<br>0<br>0               | 1<br>2<br>5<br>1<br>0               | 0<br>3<br>0<br>0<br>0               | 0<br>1<br>5<br>1<br>2               | 1<br>0<br>2<br>0<br>0               | 1<br>2<br>2<br>0<br>0               | 3<br>10<br>23<br>2<br>3                |
| Educated about eye care?  | Yes=3                               | Yes=2                               | Yes=1                               | Yes=5                               | Yes=1                               | Yes=9                               | Yes=3                               | Yes = 9                             | Yes=3                               | Yes=5                               | Yes=41                                 |
| How are patients educated?<br>V=Verbal<br>W=Written   | V&W=3                               | V&W=2                               | V&W=1                               | V&W=5                               | V&W=1                               | V&W=9                               | V=1<br>V&W=2                        | V&W=9                               | V&W=3                               | V=1<br>V&W=4                        | V=2<br>V&W=39                          |
| What if any, are contra-indications to the eye exam?<br>N=Narrow/closed angles<br>P=High intraocular pressures<br>I=Lens implants<br>A=Allergies to exam meds | N=2<br>P=0<br>I=1<br>A=0<br>Other=0 | N=2<br>P=0<br>I=2<br>A=2<br>Other=0 | N=0<br>P=0<br>I=0<br>A=0<br>Other=0 | N=5<br>P=0<br>I=5<br>A=1<br>Other=1 | N=1<br>P=0<br>I=0<br>A=1<br>Other=0 | N=3<br>P=0<br>I=2<br>A=1<br>Other=2 | N=2<br>P=1<br>I=2<br>A=0<br>Other=2 | N=6<br>P=3<br>I=5<br>A=2<br>Other=0 | N=2<br>P=0<br>I=1<br>A=1<br>Other=0 | N=4<br>P=1<br>I=2<br>A=3<br>Other=1 | N=27<br>P=5<br>I=20<br>A=11<br>Other=6 |



## APPENDIX G

1 CAMPUS DRIVE • ALLENDALE MICHIGAN 49401-9403 • 616/895-6611

March 19, 1997

Patrice Conrad  
1913 Garret Dr. NE  
Grand Rapids, MI 49505

Dear Patrice:

Your proposed project entitled "*Reexamination of TENDON Data: Availability of Dilated Eye Exams by Optometrists*" has been reviewed. It has been approved as a study which is exempt from the regulations by section 46.101 of the Federal Register 46(16):8336, January 26, 1981.

Sincerely,

A black rectangular box redacting the signature of Paul Huizenga.

Paul Huizenga, Chair  
Human Research Review Committee

## LIST OF REFERENCES

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