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EFFECT OF NASAL OXYGEN ON ORAL TEMPERATURES
OF FEBRILE AND AFEBRILE ADULTS

by
Christina Louise Stanton

A Thesis Submitted to the Faculty of the
COLLEGE OF NURSING
In Partial Fulfillment of the Requirements
For the Degree of
MASTER OF SCIENCE
In the Graduate College
THE UNIVERSITY OF ARIZONA

1984
STATEMENT BY AUTHOR

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This thesis has been approved on the date shown below:

JOYCE A. VERRAN, RN, Ph.D.
Assistant Professor of Nursing
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ABSTRACT

A quasi-experimental study was conducted to examine the effect of nasal oxygen on the oral temperatures of febrile and afebrile adults. The sample consisted of 21 patients age 60 years or older at a southwestern private hospital. Eleven of the patients had pre oxygen temperatures of less than or equal to 98°F and 10 had pre oxygen oral temperatures of greater than or equal to 100°F. Oral to rectal temperature ratios pre and post oxygen were determined.

Using a paired t-test, the oral to rectal temperature ratios pre and post oxygen therapy were compared. There were no significant differences between the ratios.

Implications for nursing practice were drawn from the results. They included the need for actual practice to begin to reflect the findings of current research.
CHAPTER 1

INTRODUCTION

Although taking a patient's temperature is considered a basic nursing skill, obtaining an accurate measurement is not a simple matter. Temperature readings are known to vary depending on the site used, the environment of the immediate area, and the ability of the patient to cooperate with the procedure.

The site used to take a temperature is chosen based on nursing assessment of the patient's condition and current status. Nurses continue to vary the site selected for a single patient depending on the treatments in progress at that particular time. Basic nursing texts as recent as 1980 continue to recommend changing to rectal temperatures in the presence of oxygen administration via nasal prongs (Juneau, 1980).

Most alert adult patients view rectal temperatures as embarrassing and an unnecessary invasion of privacy. Even when care is taken to provide for privacy and lubricant is used to minimize discomfort, patients think the ordeal psychologically, and at times, physically, stressful.

Nursing personnel consider rectal temperatures to be more time consuming than oral temperatures (Lim-Levy, 1982). A patient must be properly positioned, the temperature obtained, and then the patient repositioned for comfort. The advent of electronic thermometers has
decreased the time required for the temperature to register but patient care activities have remained the same.

The patient temperature is one measure for following the course of disease and recovery. Therefore, there is a need for the temperature to be measured and recorded as accurately as possible. While "normal" temperatures are difficult, if impossible, to define (Horvath, Menduke, & Piersol, 1950), consistency of the route used with each patient will lend more meaning to the measurement (Erickson, 1973). Accuracy will also be improved by the elimination of possible sources of error such as ingestion of hot or cold liquids, smoking, excessive patient movement, and improper probe placement (Erickson, 1980). Historically, nurses have added oxygen therapy via nasal prongs as a source of error for oral temperatures (Felton, 1978).

**Statement of the Problem**

The problem in this study was the effect of nasal oxygen on the oral temperatures of both febrile and afebrile adult patients. An elevated temperature may be the first indicator of a disease process. Treatment regimens are begun and discontinued based on the presence or absence of fever states in patients.

On general nursing units, there are three sites commonly available for taking temperatures--oral, axillary, and rectal. Although the possibility for error in measurement exists at each site, oral temperatures are the route of choice based on patient comfort and the relative ease required to obtain the reading.
Oxygen delivery via nasal prongs is an often used mode for the administration of supplemental oxygen. Patient comfort, cost, and compliance all add to the frequency of physicians ordering nasal prong oxygen.

Although past literature has cited nasal oxygen as a source of error in oral temperatures, no concrete research is available to support the assumption. Therefore, if oral temperature is not influenced by the presence of oxygen administration by nasal prongs, the oral cavity is the site of choice in taking temperatures in view of patient comfort, nursing time, and the consistency of site selection.

**Purpose of the Study**

The purpose of this study was to determine if oral temperatures are influenced by nasal oxygen administration in febrile and afebrile hospitalized adults. Oral temperatures were compared to rectal temperatures in each patient before and after initiation of oxygen therapy via nasal prongs. Both febrile and afebrile adult patients were used to determine the effect of fever on the results.

Rectal temperature was used to help evaluate oral temperature since rectal temperatures are not influenced by nasal oxygen delivery (Erickson & Storlie, 1973) and therefore reflect temperature changes which may occur due to causes other than oxygen therapy. Specifically, the study examined any changes in the oral-rectal temperature ratio which may result from the initiation of nasal prong oxygen. Use of this ratio should control for any individual differences between oral and rectal temperature.
Hypotheses

1. There will be no significant difference between the oral-rectal temperature ratio pre and post delivery of oxygen via nasal prongs in a group of afebrile patients.

2. There will be no significant difference between the oral-rectal temperature ratio pre and post oxygen therapy in a group of febrile patients.

Definitions of Terms

For the purpose of this study, specific terms were defined as follows:

1. Afebrile: Oral temperature reading of less than or equal to 98°F before oxygen therapy. Since the sample population were age 60 years of age or older due to the patients available, a temperature lower than "normal" of 98.6°F was used to indicate an afebrile state (Higgins, 1983; Thatcher, 1983).

2. Febrile: Oral temperature reading of greater than or equal to 100°F before oxygen therapy. Febrile readings were considered to begin at 100°F to allow for a more distinct difference between febrile and afebrile groups (Erickson, 1976). The temperature range of 98.1°F to 99.9°F was not categorized into either the febrile or afebrile group. This range is a "gray area" when considering the presence of
fever. Based on Erickson's work (1976), the lowest reading for febrile was $100^\circ F$.

3. Posterior sublingual pocket: Where the base of the tongue joins the floor of the mouth on either side of the frenulum.

4. Adult: Persons of either sex, 60 years of age or older.

Theoretical Framework

The theoretical framework represents the model of currently accepted nursing practice in regards to oral temperatures and nasal oxygen therapy (Figure 1). In the figure, the concepts of air current, oxygen flow, and nasal oxygen are related to temperature, body temperature, and oral tissue temperature. At the empirical level, oxygen delivery at less than or equal to six liters per minute via nasal prongs is related to the oral-rectal temperature ratio. It is at the level of nasal oxygen and its effect on oral temperature that this study begins to question the currently accepted relationships. The following sections describe the major theoretical concepts and their relationships to each other as they appear in Figure 1.

Relation Between Air Current and Temperature

Air currents influence the rate of convection and evaporation from surfaces (Selle, 1952). Alterations in either convection or evaporation produce a lowering of the temperature of the surface. Studies have been conducted exposing nude men to varying air temperatures
FIGURE 1: Theoretical Framework for Study
and wind velocities. The resultant change was a lowering in recorded
temperature (Lomax & Schonbaum, 1979; Selle, 1952).

Relation Between Oxygen Flow and
Body Tissue Temperature

Oxygen flow is a type of air current. In the hospital setting, oxygen is supplied in patient rooms most often through wall outlets. Nasal oxygen is connected to the wall outlet via a flow meter to adjust the rate of oxygen flow to the patient. Internal body tissues are normally moist. It would be expected that as the cool gas oxygen flows over the moist body tissues, evaporation of the moisture and convection causes the temperature of the tissues to be lowered (Selle, 1952). This has been shown to occur also when specific body parts are exposed to varying temperatures in studies by DuBois (1951), Gerbrandy, Snell, and Cranston (1954), and McCaffery, Cook, and Wurster (1975).

Relation Between Nasal Oxygen Flow
and Oral Tissue Temperature

For reasons of cost and patient compliance, nasal prongs are frequently chosen as the means to deliver low-flow oxygen. Since the nasal passages connect to the oral cavity at the posterior pharynx, the gas flowing into the nose cools the moist tissues of the mouth (Juneau, 1980). This is the basis for the nursing practice of taking rectal temperatures in the presence of nasal oxygen (Juneau, 1980; Levine, 1973; Lewis, 1976). Recent studies by Erickson (1979) and Lim-Levv (1982) support oral temperatures as accurate measurements when the posterior sublingual pocket is the site of thermometer placement. It is
therefore, at this level in the framework that this study begins to question the basis for current nursing practice concerning rectal temperatures when nasal oxygen is in use.

Empirical Measures

In this study, subjects were administered nasal prong oxygen at a rate determined by physician order at six liters or less per minute. According to Lim-Levy (1982), flow rates of six liters or less per minute were found not to alter the oral temperatures in 100 healthy adult subjects. Oral temperatures are reflective of general body temperature. When the oral thermometer is placed in the posterior sublingual pocket, it is in close proximity to a rich vascular supply (Erickson, 1979; Tate, Gohrke, & Mansfield, 1970). Although there is possibly no "normal" temperature that is the same for all adults (Horvath et al., 1950), there is a relationship between the oral and rectal temperature of an individual. This ratio varies over the course of a 24 hour period but would not be expected to change in a 15 minute time span. For this reason, oral and rectal temperatures were taken immediately after each other in this study. Rectal tissue, since not directly exposed to the oxygen flow, served as a reference point while changes in oral temperature were considered to be due to the effect of the nasal oxygen (Cranston, 1966; Gerbrandy et al., 1954).
Summary

The theoretical framework for this study has its basis in currently accepted nursing practice. At the level where nasal oxygen is currently viewed as a contraindication for oral temperatures due to the cooling effect of the gas on the oral tissues, this study begins to question the legitimacy of the currently accepted conceptual relationships. The purpose of this study is to support current research showing oral temperatures to be an appropriate site choice in the presence of nasal oxygen therapy.
CHAPTER 2

REVIEW OF THE LITERATURE

Literature pertaining to the relationship among oral, rectal, and axillary temperatures was reviewed. Studies were reviewed describing the effect of various external factors on oral and rectal temperature. The literature is limited on the subject of oral temperature changes during the administration of oxygen by any means including the administration of oxygen by any means including aerosol mask, venti mask, nasal catheter, oxygen tent, and nasal prongs. Although the literature reveals no significant effect of oxygen therapy on oral temperature, no study has looked at the relationship of nasal prong oxygen administration on oral temperatures in the presence of fever. The final section of this chapter reviews the subject of "normal" temperature in the elderly.

**Oral, Axillary, and Rectal Temperatures**

Nichols, Ruskin, Glor, and Kelly (1966) recorded oral, axillary, and rectal temperatures on 10 "normal" male and 50 "normal" female subjects age 18 to 50 years old. Oral to axillary temperature differences ranged from 9 to 4.2°F. In only five percent of the subjects was axillary temperature 1°F less than oral temperature. Oral to rectal temperature difference ranged from 0 to 2.8°F with eight percent exactly 1°F higher rectally.
In a review of studies from 1845 through 1945, Horvath et al. (1950) stated "mean" oral temperature were found to range from 97.2°F to 99.0°F in afebrile subjects. While studying a group of 38 females and 16 male "well" people between the ages of 19 and 37 years, he found oral to rectal temperature differences to range from 0.7 to 1.2°F with a mean difference of 0.8°F. They concluded there was no single "normal" difference between oral and rectal temperatures for everyone but instead a normal difference for each individual.

Oral temperatures were more responsive than rectal temperatures during the administration of heated (45.4°C) saline infusions according to Gerbrandy et al. (1954). "Normal" subjects, 15 males and 2 females, were studied. Results indicated the closed-mouth method gave more accurate oral temperature.

Seventeen males and 14 female chronically ill patients aged 20 to 74 years who had non-specified "normal" temperatures at the beginning of the study were found to have oral and rectal temperatures respond in a similar manner to pyrogen injection (purified bacterial lipopoly-saccharide) to induce fever. There was a correlation of +0.925 between the slope of the oral and rectal temperature curves in response to the injections (Wendt, Snell, Goodale, and Cranston, 1956).

In a study of 10 healthy males between the ages of 18 and 24 years, Sellars and Yoder (1961) found oral temperatures to differ from rectal temperatures 0 to 5°F. The researchers stated oral temperatures
are more susceptible to factors which alter accurate measurement and therefore rectal temperature are less variable and more reflective of body temperature.

The research of Cranston (1966) revealed rectal temperature to respond little if at all to rapid temperature changes compared to oral temperatures when warm saline was infused intravascularly or when a limb was immersed in warm water. It was stated that oral temperatures are measured at a site which is proximal to a rich arterial blood supply. In slower temperature changes such as those that occur in the presence of fever, rectal temperature was found to respond the same as oral temperature. No specific demographics of the sample group were given.

Nichols and Glor (1968) stated rectal temperature to be the most accurate temperature available to nurses. In their study, optimum time placement for mercury thermometers was established to be two minutes rectally with a sample consisting of 146 afebrile male patients between the ages of 18 and 35 years. The basis for reliance in this study on rectal temperatures as the most accurate site is not stated.

Erickson and Storlie (1973) stated rectal temperatures were safer in children and unconscious patients as well as less likely to be influenced by environmental conditions. Rectal temperatures were found to be 0.7 to 1.4°F higher than oral temperatures in their summary of past studies.
Axillary temperatures appear to be taken only when neither oral or rectal sites are appropriate. Nichols, Ruskin, Glor, and Kelly (1966) found a 4.2°F range of variance between oral and axillary temperatures using a sample consisting of 10 males and 60 females age 18 to 50 years old.

### Factors Influencing Oral and Rectal Temperatures

Mellette (1950) and DuBois (1951) found exercise to influence temperatures. Mellette's study with three males age 24 to 26 years found rectal temperature to increase from 37°C to 38.3°C after 60 minutes of bicycle ergometry. DuBois stated two men (no given age) had a rectal temperature increase from 37.5°C to 39°C after 36 minutes of playing squash.

Cranston, Gerbrandy, and Snell (1954) studied the effect of body position on temperature. After 30 to 45 minutes in a horizontal position, there was a 0.21 to 0.63°C decrease in oral temperature and a 0.25 to 0.63°C decrease in rectal temperature. No specifics related to the sample tested were given.

Hypothermia can result from above sub-zero temperatures if there are additional factors present such as wind. The rectal temperature of a subject fell to 35.5°C while working in an environment 5°C with wet clothes and wind (Lomax, 1979).

In numerous studies, ingestion of iced water was found to significantly lower oral temperatures. Woodman, Parry, and Simms (1967)
stated oral temperature decreased 0.2 to 1.6°F for 22 healthy males age 18 to 52 years after drinking iced water. Forster, Adler, and Davis (1970) stated 30 seconds after ingestion of eight ounces of 32°F water, a mean lowering of 5.25°F occurred in 10 male patients age 26 to 50 years. Initially, the oral temperatures of the subjects were below 99°F. Brim and Chandler (1948) stated oral temperatures decreased 0.2 to 2.6°F immediately after drinking cold liquid for their study sample of 50 subjects. Verhonick and Werley (1963) found an unstated number of males age 20 to 30 years to have a decrease in oral temperature after ingestion of cold liquid.

Ingestion of hot liquid is followed by an increase in measured oral temperature. Lee and Atkins (1972) studied an unspecified number of subjects and stated that drinking "hot" liquids increased oral temperature from 2 to 3°F. Oral temperature increased from 0.6 to 4.8°F immediately after 50 subjects drank "hot" liquid in a study by Brim and Chandler (1948).

There is conflicting research as to the effect of cigarette smoking on oral temperature. Lee and Atkins (1972) generalized that smoking increases oral temperature. Woodman et al. (1967) found smoking to increase oral temperature 0.2°F using a sample of 22 males age 18 to 52 years. In their study of 50 subjects, Brim and Chandler (1948) stated oral temperatures changed by -0.6°F to +1.2°F immediately after smoking. Verhonick (1963) concluded that, based on her study of
a group of males age 20 to 30 years, smoking had no effect on oral temperatures.

Chewing gum has been found at times to increase and at other times to decrease oral temperatures according to Brim and Chandler (1948). Verhonick (1963) stated gum chewing had no influence on oral temperature.

Based on numerous studies, the posterior sublingual pocket measures the highest oral temperature (Erickson, 1976, 1980; Ferguson, Gohrke, and Mansfield, 1971; Hersh, Woodbury, and Bierman, 1943; Tate, Gohrke, and Mansfield, 1970). This area of the mouth records a high temperature due to its close proximity to the carotid arteries (Tate et al., 1970). Hersh et al. (1943) state mouth temperatures recorded on five persons at various sites in the mouth vary as much as 3.27°F. The coolest reading was 95°F in the area of the hard palate. The warmest temperature was 98.2°F recorded in the posterior sublingual pocket. Erickson (1980) found the temperature in the posterior sublingual pocket to be 0.3 to 0.4°F higher than the area in front of the tongue in 18 male and 82 female subjects age 18 to 80 years.

Blainey (1974) listed criteria to be assessed in the selection of a site for taking patient temperatures. Among the criteria were absence of local inflammation and proximity of the site to major arterial blood supply.
According to Lomas and Schonbaum (1979), antipyretics augment heat loss through the skin and thus lower the temperature during fever states. No change is caused by antipyretics on a normal temperature.

**Oral Temperatures and Oxygen Therapy**

Basic nursing texts continue to recommend that rectal temperatures be taken on patients receiving oxygen therapy (DuGas, 1977; Fuerst, Wolff, and Weitzel, 1974; Juneau, 1980; Kozier and Erb, 1979; Levine, 1973; Lewis, 1976; Moidel, Giblin, and Wagner, 1976). The support of research is not cited as the rationale. The theory supporting rectal temperatures during oxygen therapy appears to be based on past nursing practice.

Hyperventilation with dry cold oxygen lowered the peripheral temperature in dogs (Brock, 1977). Selle (1952) stated mouth temperature is affected by the temperature of the inspired air.

Kintzel (1966) studied the effect of high humidity oxygen tents and deep nasal catheter oxygen therapy on oral temperatures of 40 patients age 19 to 74 years. Oxygen administration by either method was not found to affect the measured oral temperature.

Nine "healthy" females 21 to 24 years of age were studied by Graas (1974). After administration of oxygen via nasal prongs for 15 minutes, there was no statistically significant difference in oral temperature at the .05 level. Rectal temperatures dropped slightly.
This rectal temperature decrease was stated to be due to lack of activity during the measurement period. There was no relationship determined between the oral and rectal temperatures.

Felton (1978) studied 390 post operative patients receiving oxygen via mask. Oxygen was discontinued to test the feasibility of stopping oxygen therapy while taking oral temperatures. Nine out of 10 patients experienced a marked drop in $pO_2$ after four minutes without supplemental oxygen. Five out of the nine patients did not return to baseline $pO_2$ even after 20 minutes of restored therapy. Based on these findings, Felton suggested taking rectal temperatures on all post operative patients receiving oxygen via mask.

Lim-Levy (1982) revealed no significant change in oral temperature after administering oxygen via nasal prongs to 100 health adults. Flow rate was varied at 2, 4, and 6 liters per minute. Oral temperatures were measured before and after oxygen administration.

No temperature difference was found after 15 minutes of oxygen therapy via nasal prongs, aerosol mask, or venti mask in a study by Hasler and Cohen (1982). Forty health males and females were used as subjects, serving as their own controls for pre and post oxygen therapy temperatures.

"Normal" Temperature

For the Elderly

The accepted "normal" of 98.6°F oral temperature does not appear to hold true in persons over the age of 60 years. Thatcher
(1983) studied two groups of 50 men and women age 60 years and older. She established an average oral temperature of 97.89°F with a range of 96.29°F to 99.23°F oral temperature.

A study using a sample of 60 "well" adults, 33 women and 27 men, age 65 to 90 years was conducted by Higgins (1983). She reported the mean oral temperature for this group at 97.9°F.

Summary

The temperature measured at various sites of the body may reflect error depending on environmental and patient conditions. The axilla are cited as not being the best choice for measuring temperature in any situation. Oral temperatures are influenced by various factors not including oxygen therapy in studies involving healthy afebrile subjects of varying ages. The population of persons age 60 years and older appear to have "normal" oral temperature of less than the accepted "normal" of 98.6°F.
CHAPTER 3

METHODOLOGY

A quasi-experimental design was used to study the effect of nasal prong oxygen on the oral temperature in febrile and afebrile adult patients age 60 or older on general medical-surgical units in a private hospital.

Sample

Twenty-one adult patients age 60 years or older on general medical-surgical units at a private southwestern hospital participated in this study. Criteria for subject selection were:

1. English speaking,
2. No known active disease or inflammation present in the mouth or rectum,
3. Not known to be a mouth breather,
4. A "prn" order for nasal prong oxygen at less than or equal to six liters per minute.

The subjects were placed into one of two groups. Group I, the afebrile patients, were persons with oral temperatures less than or equal to 98°F immediately prior to initiation of oxygen therapy. Group II, the febrile group, consisted of patients with oral temperatures greater than or equal to 100°F prior to initiation of oxygen therapy.
Signed consents were not required due to the non-invasive nature of the study. Appendix A contains the memorandum from the Human Subjects Review Committee. Subjects were instructed they were free to withdraw from the study at any time without affecting the quality of their care. Confidentiality was maintained by assigning a number to each subject. The disclaimer used in this study appears in Appendix B.

Based on the reviewed research, the restrictions applied to all subjects in both groups were:

1. No ingestion of hot or cold liquids within 15 minutes prior to temperature measurement,
2. No talking during oral temperature taking,
3. Mouth closed during oral temperature taking,
4. No smoking or gum chewing within 15 minutes prior to oral temperature taking,
5. Bedrest for at least 30 minutes prior to and for the duration of temperature taking,
6. Not positioned in direct sunlight,
7. No ingestion of antipyretics within four hours prior to temperature measurements.

**Measurements**

In both groups of patients, oral temperature was taken immediately followed by rectal temperature prior to initiation of oxygen
therapy via nasal prongs at the liter flow rate specified by the physician. Fifteen minutes after beginning oxygen therapy, oral and rectal temperatures were obtained again in the same manner. All temperatures were measured with an IVAC electronic thermometer, Model #811. The IVAC #811 is a rechargeable electronic thermometer capable of measuring temperatures from 94°F to 108°F. Accuracy is ±0.2°F. An audible tone and red light signal when the computed temperature has been reached. Separate interchangeable probes are used for oral and rectal temperatures.

**Research Design**

Each subject served as his/her own control by having oral and rectal temperatures measured prior to and after initiation of oxygen therapy via nasal prongs. All patients had a current order for "prn" oxygen prior to consideration for participation in the study. Patients were assigned to one of two groups based on their initial oral temperature before receiving oxygen therapy. All subjects met the established criteria and restrictions for the study.

**Data Analysis**

A two-tailed paired t-test for the difference in the pre and post oxygen oral to rectal temperature ratios for each patient was used to test the hypotheses of this study. A significance level of .05 was selected for this analysis.
Descriptive statistics were used to analyze the demographic data. Age, sex, and principle diagnosis were examined to determine sample characteristics.

Protocol

A protocol was developed for data collection in this study (Appendix C). A pilot study of two subjects was done to test the protocol.

The investigator and two other registered nurses collecting data had been trained through hospital inservices in the correct use of the IVAC #811. Data collectors were given an overview of this study as well as a review of the manner in which the temperatures were to be taken (the protocol). Data were recorded on a data collection sheet as presented in Appendix D.

Summary

Data consisting of oral and rectal temperatures pre and post oxygen administration at less than or equal to six liters per minute via nasal prongs were collected in a consistent manner by nursing staff on 11 afebrile and 10 febrile adult patients age 60 years or older on a general medical-surgical. The data were analyzed utilizing a two tailed paired t-test with a significance level of 0.05. Demographic data were analyzed with descriptive statistics.
CHAPTER 4

PRESENTATION AND ANALYSIS OF DATA

This chapter presents the statistical analysis of the data collected. First, the demographic characteristics of the study sample are presented. This is followed by a discussion of the oral and rectal temperatures both pre and post oxygen delivery for the febrile and afebrile groups of patients.

Demographic Characteristics of the Sample

A total of 21 patients participated in the study. Group I consisted of 11 patients with oral temperatures prior to oxygen therapy of less than or equal to 98°F. Group II consisted of 10 patients with oral temperatures of greater than or equal to 100°F prior to oxygen therapy. Table 1 gives the summary statistics of subject age by group. In Group I, the minimum age was 62 years and the maximum age was 90 years with a mean age of 74.82 years. The standard deviation was 8.88 years from the mean. In Group II, the minimum age was 61 years and the maximum age was 74 years with a mean age of 67.40 years. The standard deviation was 4.33 years from the mean.

There were six males and five females in Group I. There were seven males and three females in Group II as presented in Table 1.
<table>
<thead>
<tr>
<th>GROUP</th>
<th>MINIMUM AGE</th>
<th>MAXIMUM AGE</th>
<th>MEAN</th>
<th>STANDARD DEVIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>62</td>
<td>90</td>
<td>74.82</td>
<td>8.88</td>
</tr>
<tr>
<td>(n=11)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group II</td>
<td>61</td>
<td>74</td>
<td>67.40</td>
<td>4.33</td>
</tr>
<tr>
<td>(n=10)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MALE</td>
<td>FEMALE</td>
<td>TOTAL</td>
<td></td>
</tr>
<tr>
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<td>--------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td>GROUP I (n=11)</td>
<td>6</td>
<td>5</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>GROUP II (n=10)</td>
<td>7</td>
<td>3</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>13</td>
<td>8</td>
<td>21</td>
<td></td>
</tr>
</tbody>
</table>
Table 3 presents the frequency of each primary diagnosis in each group. In Group I, two patients had pneumonia, two had asthma, three had chronic obstructive pulmonary disease, one had bronchitis, one had congestive heart failure, one had diabetes, and one had cor pulmonale. In Group II, two patients had pneumonia, two had asthma, three had chronic obstructive pulmonary disease, one had bronchiectasis, and two had bronchitis.

Group I (Afebrile):
Oral and Rectal Temperatures
Pre and Post Oxygen Delivery

Table 4 presents the pre and post oxygen delivery temperatures for Group I. The pre oxygen oral temperature was a minimum of 94.4°F and a maximum of 98.0°F with a mean of 97.1°F. The standard deviation was 1.06°F from the mean. Rectal temperature pre oxygen therapy was a minimum of 97.9°F to a maximum of 99.2°F with a mean of 98.8°F. The standard deviation was 0.47°F from the mean. By dividing the pre oxygen oral temperature by the pre oxygen rectal temperature for each patient, a pre oxygen ratio was determined. Pre oxygen ratio was a minimum of 0.9642 and a maximum of 0.9929 with a mean of 0.9838. The standard deviation was 0.0077 from the mean.

The post oxygen delivery oral temperature for Group I had a minimum of 94.6°F and a maximum of 98.1°F with a mean of 97.2°F. The standard deviation was 0.99°F from the mean. Rectal temperature post oxygen therapy ranged from a minimum of 97.4°F to a maximum of
<table>
<thead>
<tr>
<th>PRIMARY DIAGNOSIS</th>
<th>GROUP I</th>
<th>GROUP II</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumonia</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Asthma</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Chronic Obstructive Pulmonary Disease</td>
<td>3</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Bronchiectasis</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Bronchitis</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Congestive Heart Failure</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Cor Pulmonale</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>11</strong></td>
<td><strong>10</strong></td>
<td><strong>21</strong></td>
</tr>
<tr>
<td>Subject Number</td>
<td>PRE OXYGEN MEASURES</td>
<td>POST OXYGEN MEASURES</td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>---------------------</td>
<td>---------------------</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>ORAL</td>
<td>RECTAL</td>
<td>RATIO</td>
</tr>
<tr>
<td>1</td>
<td>97.6</td>
<td>99.2</td>
<td>.9839</td>
</tr>
<tr>
<td>2</td>
<td>97.8</td>
<td>99.0</td>
<td>.9879</td>
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<tr>
<td>6</td>
<td>94.4</td>
<td>97.9</td>
<td>.9642</td>
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<td>7</td>
<td>97.6</td>
<td>99.2</td>
<td>.9839</td>
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<td>8</td>
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<tr>
<td>11</td>
<td>96.9</td>
<td>99.1</td>
<td>.9778</td>
</tr>
<tr>
<td>Mean</td>
<td>97.1</td>
<td>98.8</td>
<td>.9833</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>1.06</td>
<td>0.47</td>
<td>0.0077</td>
</tr>
</tbody>
</table>

TABLE 4: GROUP I: AFEBRILE PATIENTS
ORAL AND RECTAL TEMPERATURES IN °F, PRE AND POST O₂ RATIOS
99.4°F with a mean of 98.8°F. The standard deviation was 0.60 from the mean. A post oxygen delivery ratio was determined for each patient by comparing the post oxygen oral temperature to the post oxygen rectal temperature. The post oxygen ratio had a minimum of 0.9713 and a maximum of 0.9908 with a mean of 0.9840. The standard deviation was 0.0061 from the mean. Four patients experienced an increase in oral temperature after initiation of oxygen therapy. The increase ranged from 0.1 to 0.3°F.

**Group II (Febrile): Oral and Rectal Temperatures Pre and Post Oxygen Delivery**

The temperature data for Group II is presented in Table 5. The pre oxygen delivery oral temperature had a minimum of 100.1°F and a maximum of 101.0°F with a mean of 100.6°F. The standard deviation was 0.33°F from the mean. The pre oxygen rectal temperature ranged from a minimum of 101.0°F to a maximum of 101.9°F with a mean of 101.6°F. The standard deviation was 0.32°F from the mean. The ratio of pre oxygen oral temperatures to pre oxygen rectal temperatures was a minimum of 0.9843 and a maximum of 0.9921 with a mean of 0.9903. The standard deviation was 0.0030 from the mean.

The post oxygen delivery temperatures for Group II are also presented in Table 5. The post oxygen oral temperatures were a minimum of 100.0°F to a maximum of 101.1°F with a mean of 100.5°F. The standard deviation was 0.39°F from the mean. The post oxygen
### TABLE 5: GROUP II: FEBRILE PATIENTS
ORAL AND RECTAL TEMPERATURES IN °F, PRE AND POST O₂ RATIOS

<table>
<thead>
<tr>
<th>Subject Number</th>
<th>PRE OXYGEN MEASURES</th>
<th>POST OXYGEN MEASURES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ORAL</td>
<td>RECTAL</td>
</tr>
<tr>
<td>1</td>
<td>101.0</td>
<td>101.8</td>
</tr>
<tr>
<td>2</td>
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<tr>
<td>3</td>
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<td>4</td>
<td>100.3</td>
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<tr>
<td>7</td>
<td>100.1</td>
<td>101.0</td>
</tr>
<tr>
<td>8</td>
<td>101.0</td>
<td>101.8</td>
</tr>
<tr>
<td>9</td>
<td>100.6</td>
<td>101.8</td>
</tr>
<tr>
<td>10</td>
<td>101.0</td>
<td>101.9</td>
</tr>
<tr>
<td>Mean</td>
<td>100.6</td>
<td>101.6</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.33</td>
<td>0.32</td>
</tr>
</tbody>
</table>
delivery rectal temperatures were a minimum of 100.9°F to a maximum of 102.0°F with a mean of 101.5°F. The standard deviation was 0.39°F from the mean. The ratio of post oxygen oral to rectal temperatures was a minimum of 0.9891 to a maximum of 0.9921 with a mean of 0.9906. The standard deviation was 0.0010 from the mean. As in Group I, four patients in Group II experienced an increase in oral temperature after initiation of oxygen therapy. This increase ranged from 0.1 to 0.3°F.

### Analysis of Oral to Rectal Temperature Ratios

The purpose of this study was to determine if oral temperatures are influenced by nasal oxygen administration in febrile and afebrile hospitalized adults. A paired t-test was done to evaluate the difference between the pre oxygen oral to rectal temperature ratio with the post oxygen oral to rectal temperature ratio. The specific hypotheses tested were:

1. There will be no significant difference between the oral to rectal temperature ratio pre and post delivery of oxygen via nasal prongs in a group of afebrile patients.

2. There will be no significant difference between the oral to rectal temperature ratio pre and post oxygen delivery via nasal prongs in a group of febrile patients.

Table 6 presents the results of the t-tests for both Groups I and II. Results for Group I were a t value of -0.897 at p> .05.
TABLE 6: PAIRED T-TEST RESULTS ON PRE TO POST $O_2$ RATIOS

<table>
<thead>
<tr>
<th>GROUP</th>
<th>t</th>
<th>df</th>
<th>SIGNIFICANCE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>-0.897</td>
<td>10</td>
<td>p $\geq .05$</td>
</tr>
<tr>
<td>Group II</td>
<td>-0.545</td>
<td>9</td>
<td>p $\geq .05$</td>
</tr>
</tbody>
</table>
For Group II, the t value was -0.545 at a p > .05. Overall, for both groups of patients, there was no significant difference between the oral to rectal temperature ratios pre and post oxygen delivery. Therefore, both hypotheses of the study were supported by the data.

**Summary**

In conclusion, pre and post oxygen therapy oral to rectal temperature ratios were compared in an afebrile and a febrile group of adult patients age 60 years and older. Using a paired two tailed t-test, the results indicated no significant difference between the ratios for either group of patients.
CHAPTER 5

CONCLUSIONS AND IMPLICATIONS

The results of the data analysis are presented in this chapter as well as conclusions drawn from the results. Implications for nursing practice are discussed. Finally, recommendations for future nursing research are outlined.

Conclusions

The specific hypotheses set forth in this study were:

1. There will be no significant difference between the oral to rectal temperature ratio pre and post delivery of oxygen via nasal prongs in a group of afebrile adults.

2. There will be no significant difference between the oral to rectal temperature ratios pre and post delivery of oxygen via nasal prongs in a group of febrile adults.

Both hypotheses were supported based on the results of the data analysis. There was no statistically significant difference between the oral to rectal temperature ratio pre oxygen administration at six liters or less per minute per nasal prongs and the ratio of
oral to rectal temperatures after 15 minutes of the oxygen therapy for each patient. Therefore, it can be concluded oxygen delivery via nasal prongs at liter flows of less than or equal to six per minute does not significantly alter oral temperatures in either febrile or afebrile patients age 60 years and older.

Lim-Levy (1982) found no significant change in oral temperature after administering oxygen at two, four, and six liters per minute per nasal prongs to 100 healthy adults. Hasler and Cohen (1982) also revealed no difference in pre and post oxygen therapy temperatures for 40 healthy adult males and females. Graas (1974) studied nine healthy females and found no significant decrease in oral temperatures after 15 minutes of oxygen per nasal prongs. This study supports the previous research as well as concluding patients with pre oxygen oral temperatures of greater than or equal to 100°F also experience no significant change in oral temperature after receiving nasal oxygen.

The theoretical framework for this study was based on currently accepted nursing practice which implies nasal oxygen decreases measured oral temperature. The results of the study do not support this relationship. Neither febrile nor afebrile patients had a significant decrease in oral temperature after receiving nasal oxygen.

**Implications for Nursing Practice**

There was no significant difference in oral temperature before compared to after nasal prong oxygen in either febrile or afebrile
adult patients. Currently, nasal prong oxygen is considered to be a contraindication for taking temperatures orally. This practice is set forth not only in the hospital utilized for the data collection but in recent nursing textbooks as well.

The investigator plans to present the findings of this study to the Professional Nurse Practice Committee and to the Procedure Committee at the hospital where the study was conducted. It will be proposed that the current policy for taking rectal temperatures in patients receiving nasal oxygen be changed to provide for using the oral site as also appropriate. This method of temperature taking is more esthetically pleasing to patients in addition to being a time saver for nurses.

A wider implication of this study is for nursing practice to reflect the current research findings in regards to their practice. There are several studies to support oral temperatures as appropriate in patients receiving nasal oxygen (Graas, 1974; Hasler & Cohen, 1982; Kintzel, 1966; Lim-Levy, 1982).

**Recommendations**

Recommendations for future nursing research based on this study are:

1. Replication of the study using a larger sample,
2. Replication of this study with subjects of less than 60 years of age to determine if results are generalizable.
Summary

This study examined the difference between oral temperatures before and after the administration of nasal prong oxygen to febrile and afebrile patients. Eleven afebrile and 10 febrile adult patients age 60 years and older were the subjects. No significant difference was found to exist between the oral to rectal temperature ratio pre and post oxygen therapy. These findings are significant to the practice of nursing as they indicate oral temperatures to be acceptable even with patients receiving nasal prong oxygen. This method of measuring a patient's temperature is accurate, more comfortable and esthetically pleasing for the patient, and requires less nursing time than rectal temperatures while providing an accurate assessment of the patient's health status.
APPENDIX A

HUMAN SUBJECTS REVIEW
MEMORANDUM
THE UNIVERSITY OF ARIZONA COLLEGE OF NURSING

MEMORANDUM

TO: Christina L. Stanton, RN, BS, CCRN
3770 W. Horizon Hills Drive
Tucson, Arizona 85741

FROM: Ada Sue Hinshaw, R.N., Ph.D. Jan R. Atwood, R.N., Ph.D.
Director of Research Chairman, Research Committee

DATE: November 29, 1982

RE: Human Subjects Review: The Effects of nasal Oxygen Administration on Oral Temperatures in Febrile and Afebrile Adult Patients

Your project has been reviewed and approved as exempt from University review by the College of Nursing Ethical Review Sub-committee of the Research Committee, and the Director of Research. A consent form with subject signature is not required for projects exempt from full University review. Please use only a disclaimer format for subjects to read before giving their oral consent to the research. The Human Subjects Project Approval Form is filed in the office of the Director of Research, if you need access to it.

We wish you a valuable and stimulating experience with your research.

ASH: des
8/82
DISCLAIMER

Christina Stanton, R.N. is conducting a study to determine the relationship between oral temperature and nasal prong oxygen. The results of this study will help to evaluate the degree to which the oxygen delivery may alter the measured oral temperature.

To be considered for participation in this study you must be an adult age 60 years or older and have no active disease of the mouth or rectum. You must not be a "mouth breather". The nurse will take your oral temperature and then your rectal temperature. Immediately afterwards, the nurse will initiate your nasal oxygen at the flow rate ordered by your physician. The rectal temperature will serve as a reference since it should remain constant in the event the oral temperature is changed by the oxygen. Oral and rectal temperatures will be repeated 15 minutes after the oxygen in started.

Other information about you will be obtained from your chart. This will include your age, sex, and principle diagnosis. Your name will not be recorded. You will be assigned a number to protect your privacy. Only this number will be used to code information for analysis.

You are free to withdraw from the study at any time without affecting your nursing care or medical treatment. You are at no physical, psychological, or social risk through participation. The nurse will answer any questions you may have during the study.
The results of this study will be of no direct benefit to you. They may be useful in caring for patients receiving nasal oxygen in the future.

Data collected and analyzed for this study will become part of a Master's Thesis in Nursing. At some future time it may be published in nursing literature. Confidentiality will be maintained by grouping the data.

Your consent to participated in this study is implied by allowing the nurse to take your temperatures in the described manner.
APPENDIX C

PROTOCOL FOR DATA COLLECTION
PROTOCOL FOR DATA COLLECTION

For the purpose of this study, all patients used as subjects must meet the following criteria:

1. No ingestion of hot or cold liquids within 15 minutes of temperature taking,
2. No talking during oral temperature taking,
3. Mouth closed during oral temperature taking,
4. No smoking or chewing gum within 15 minutes of oral temperature taking,
5. Bedrest for at least 30 minutes prior to and for the duration of temperature taking,
6. Not positioned in direct sunlight,
7. No administration of antipyretics within four hours prior to temperature taking,
8. Age 60 years or older,
9. A current order for prn oxygen at less than or equal to six liters per minute.

Patients meeting the above criteria will have their temperature taken in the following manner according to hospital policy and procedure using the IVAC #811 electronic thermometer:

1. Explain the study to the patient,
2. Take the oral temperature and immediately enter the information on the data collection sheet,
3. Reposition the patient and take the rectal temperature. Enter the information on the data collection sheet,
4. Begin oxygen therapy via nasal prongs according to physician's orders.

5. After 15 minutes of therapy, retake the oral and rectal temperatures as outlined in steps 2 and 3.

6. The investigator will assign patients to either Group I or Group II based on the oral temperature immediately prior to initiation of oxygen therapy.
APPENDIX D

DATA COLLECTION SHEET
DATA COLLECTION SHEET

Subject Number: ____________________

Group: I _____ II _____

Age: ______________________________

Sex: __________________(M or F)

Principle Diagnosis: __________________

PRE OXYGEN THERAPY DATA

Oral Temperature _________ Time _________ Oral-Rectal Ratio_____
Rectal Temperature _________ Time _________ LPM O₂ Flow _________

POST OXYGEN THERAPY DATA

Oral Temperature _________ Time _________ Oral-Rectal Ratio_____
Rectal Temperature _________ Time _________ LPM O₂ Flow _________

Date: _______________________________
LIST OF REFERENCES


