A Survey of Temperatures of Adult Medical and Surgical Patients

Marie Ardith Smeltzer

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LOMA LINDA UNIVERSITY
Graduate School

A SURVEY OF TEMPERATURES OF ADULT MEDICAL
AND SURGICAL PATIENTS

by
Marie Ardith Smeltzer

A Thesis in Partial Fulfillment
of the Requirements for the Degree
Master of Science in the Field of Nursing

January 1968

142318
Each person whose signature appears below certifies that she has read this thesis and that in her opinion it is adequate, in scope and quality, as a thesis for the degree Master of Science.

Chairman
L. Lucile Lewis, Associate Professor of Nursing

Gertrude L. Haussler, Assistant Director of Nursing Service

Bessie Wat, Assistant Director of Nursing Service for Staffing
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Marie Ardith Smeltzer
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CHAPTER I

INTRODUCTION

Today temperature taking is considered a common procedure in the care of the sick. It has not always been so. Although fever has been recognized since Old Testament times, it was not until the late sixteenth century that the first thermometer was invented. Then it took about three hundred years for it to be perfected and come into common usage. In the past there was little specific treatment for fevers, so they were treated symptomatically and frequent checks of temperature were important. Today there are many medications specific to disease. Also many of the causes of fever have been almost eliminated.

Many hospitals have a routine of checking each patient's temperature twice a day or four times a day. In the event the patient is very ill his temperature may be taken every four hours, every two hours, every hour, or even every half hour. In this day and age, when there are so many diagnostic measures that can be used, is the routine checking of the patient's temperature as important as it was in the past?

Phyllis J. Verhonick and Harriet H. Werley wrote in 1963:

Taking oral temperatures has become so routinized as a nursing procedure that the nurses' observations are accepted without question. In fact, temperatures frequently are taken and recorded by non-professional personnel on the nursing team; even then, the accuracy of the reading is rarely questioned.²

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²Phyllis J. Verhonick and Harriet H. Werley, "Experimentation in
Virginia H. Walker and Eugene D. Selmanoff have questioned whether the routine taking of temperature, pulse, and respiration is a less meaningful activity for nursing personnel than it was in the past.  

Some have written that temperature taking may be done with indifference and thus become a meaningless routine. But Jean C. Barbata has written: "Accurate temperature taking is a valuable diagnostic and therapeutic aid. Like all other procedures, it should be individualized and never become routine."  

I. THE PROBLEM

Statement of the Problem

At present temperatures are checked routinely four times a day at the selected hospital. Is it safe to reduce the frequency of checking temperatures on adult medical and surgical patients?

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Other phases of this problem which were investigated for this study include: (1) At which time of day does the highest temperature most frequently occur? (2) Does the highest temperature occur at different times of day for different age groups? (3) Is there a difference between the sexes as to when the highest temperature occurs? (4) Do patients with some diagnoses have more elevated temperatures than those with other diagnoses? (5) Is there an elevation of temperature following a diagnostic procedure or therapeutic procedure? (6) What other signs indicate the need for frequent temperature checks? (7) Over what period of time do most elevations of temperature occur?

Purpose of the Study

The purposes of this study were: (1) to find out if it is necessary to check temperatures of adult medical and surgical patients as frequently as it is being done at present in the selected hospital; and (2) to show that factors of beginning elevations can be identified without checking patients' temperatures more than once a day routinely.

The Need for the Study

Observations made by the researcher have led to the conclusion that many patients in the hospital have normal temperatures. If these temperatures are unnecessarily checked several times a day, it seems that this time might be used to better advantage in caring for other needs of patients. A doctor in England wrote that "he would not care to calculate the number of hours spent annually in taking and recording the temperatures of hospitalized patients--most of which are normal
anyway.\(^8\)

In a study conducted by Marie A. Schmidt, over 90 percent of the temperatures recorded were normal.\(^9\) In a similar study Victoria Canetto found that over 97 percent of the temperatures were normal.\(^10\) A study conducted in the selected hospital by Marilyn Pinder reported that 95 percent of the temperatures were normal.\(^11\) These studies recommended a once daily recording of temperatures for the majority of patients.

At present, in the selected hospital, temperatures of adult medical and surgical patients are taken four times daily— at 8 a.m., 12 noon, 4 p.m. and 8 p.m. Discussions with some of the nursing personnel revealed that some of them do not see the importance of checking the patients' temperatures so frequently.

Pinder's study at the selected hospital included only medical patients and also included only 8 p.m. temperatures; therefore it was decided that further study was needed to include both medical and surgical patients and the range of their temperatures for the entire day.

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\(^9\)Marie A. Schmidt, "Are All TPR's Necessary?" American Journal of Nursing, 58:559, April, 1958.

\(^10\)Victoria Canetto, "T.P.R. q. 4h. ad infinitum?" American Journal of Nursing, 64:132, November, 1964.

II. THE METHOD OF STUDY

The descriptive method of study was chosen for this study. Adult medical and surgical patients, who had oral temperatures taken, were selected as they were admitted to the selected hospital. It was hoped to have approximately fifty medical and fifty surgical patients. A ten day survey was conducted of the temperatures recorded at 8 a.m., 12 noon, 4 p.m., and 8 p.m. Those patients with beginning elevations of temperature were seen by the researcher to determine factors or symptoms that might be used by nursing personnel as indications that the patient may have a fever and should have his temperature checked more frequently than a once-daily routine check.

Scope and Limitations of Study

The following include the scope and limitations of the study:

1. Fifty-nine adult medical patients and forty adult surgical patients were included in the study.
2. Patients who had their temperatures taken orally were included in the study.
3. The study was limited to a two and a half week period.
4. Each patient was followed from the time he was admitted until he was discharged or for the first ten days.
5. The survey was conducted in the fall of the year.
6. Patients with elevated temperatures were seen at the time of the first elevation.
7. A different thermometer was used each time the patient's temperature was checked.

Hypothesis

The hypothesis for this study was that a once daily recording of
temperature is sufficient for most hospitalized patients.

Sub-hypotheses

The sub-hypotheses for this study were:

1. The patient's highest temperature occurs in the evening.
2. If a medical patient does not have an elevated temperature on the day of admission, he will not have an elevated temperature during the course of his hospitalization.
3. If a surgical patient does not have an elevated temperature on the day after surgery, he will not have an elevated temperature during the course of his hospitalization.
4. Factors causing an elevation of temperature can be identified.

Assumptions of Study

It was assumed that the temperatures as taken and recorded on the patients' charts at the selected hospital were reasonably accurate.

Steps of Study

Steps taken to do this study were:

1. Obtaining permission from the Research Advisory Committee at the selected hospital.
2. Obtaining permission from the Director of Nursing Service at the selected hospital.
3. Developing a data sheet and observation guide.
4. Reviewing literature pertinent to the subject.
5. Doing a pilot study to refine the data gathering sheet and observation guide for beginning elevations and to develop proficiency
in gathering data.

6. Gathering, assembling, and analyzing data.

7. Summarizing, drawing conclusions, and making recommendations.

III. DEFINITION OF TERMS

The following terms are defined as they were used in this study:

**Normal Temperature**

Any temperature between 97 degrees Fahrenheit and 99.5 degrees Fahrenheit was considered a normal temperature.

**Elevated Temperature**

Any temperature above 99.5 degrees Fahrenheit was considered an elevated temperature.

**Beginning Elevation**

A temperature above 99.5 degrees Fahrenheit was considered a beginning elevation the first time it occurred for each patient.

IV. SUMMARY

It was thought that once daily checks of the temperatures of medical and surgical patients would indicate the presence of fever. This study was conducted to determine whether it was necessary to check adult medical and surgical patients' temperatures as frequently as it was being done. Another reason was to determine if factors which point out the need for more frequent checks of temperature can be easily recognized. This is a report of a survey of temperatures of adult medical and surgical patients during their stay in the selected hospital.
Literature related to this study was reviewed in the areas of:

(1) temperature regulation in the body, (2) causes and significance of fever, (3) causes for temperature elevation other than disease, and (4) previous studies regarding the time and frequency of temperature taking.

I. TEMPERATURE REGULATION IN THE BODY

Normal Body Temperature

Temperature can be defined as "a measurement of heat expressed in degrees."\(^1\) Body temperature represents the balance between the amount of heat produced by the body and that lost by the body.\(^2\)

The temperature of the body does not remain the same all of the time. Also, the temperature is not the same in all parts of the body. Many authors have stated that 98.6 degrees Fahrenheit is the "normal" temperature or the average or mean temperature as taken orally in adults.\(^3,4,5,6\) Other authors have said that the "normal temperature

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\(^4\) Charles Herbert Best and Norman Burke Taylor, *The Physiological
is not an exact figure, but falls in a range of 97 to 99 or 100 degrees Fahrenheit. Because a person's temperature does not remain the same all of the time it is recommended that the body temperature be thought of in terms of a range of figures rather than a set figure.

The "Thermostat" of the Body

Located just about in the center of the brain is the hypothalamus, which is considered to be the "thermostat" of the body. There are two parts of the hypothalamus that are concerned with the regulation of temperature. The anterior hypothalamus responds to excessive body heat and causes loss of body heat through mechanisms such as vasodilation, sweating,

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11McClain, op. cit., p. 208.

and increased respiration. The posterior hypothalamus is stimulated by a lowering of the body temperature and causes reactions which produce heat such as vasoconstriction and shivering.

**Production of Heat**

There are many methods by which the body may gain heat. Metabolic reactions within the body produce heat. Physical activity can produce a large amount of heat. Involuntary muscle activity is increased with shivering and also produces heat. An increase in the heat of the environment may cause an increase in the heat gained by the body. El-Attar has said that an adult man of average size produces about 70 calories of heat per hour in a basal condition. The combustion of food within the body is an oxidation process which produces heat. The specific dynamic action of food, especially protein, causes an increase in heat production. Specific dynamic action is the increased heat production as the result of the breakdown of foods, especially when protein is not used for growth of new tissue. Exciting emotions can also cause an increase in heat production. The liver and kidneys produce large amounts of heat because

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of numerous chemical reactions which are performed.\textsuperscript{18} Wakim and others also say that a low environmental temperature causes heat production because it stimulates metabolism.\textsuperscript{19}

Related to heat production is heat conservation which includes vasoconstriction in the skin, pilo-erection (gooseflesh), and abolition of sweating.

Heat production is also increased when thyroxine output is increased. The hypothalamus also stimulates the sympathetic nervous system which in turn stimulates heat production.\textsuperscript{20} An increased secretion of the hormone, adrenalin may increase heat production by increasing metabolism. During rest, abdominal organs, particularly the liver, produce about one-half of the body heat; but during strenuous muscular activity the muscles produce a much larger share of the heat.\textsuperscript{21}

Loss of Heat

There are several mechanisms used to rid the body of heat. An increase in the temperature of the blood stimulates the hypothalamus to initiate homeostatic mechanisms to rid the body of excess heat. The circulation of the blood plays an important part in the loss of heat from the skin. If much heat must be lost the superficial vessels dilate.


\textsuperscript{19}\textit{Ibid.}

\textsuperscript{20}Guyton, \textit{op. cit.}, pp. 994-995.

This allows a greater flow through them bringing warm blood to the surface where it can be conducted away from the body. This increased circulation facilitates loss of heat by perspiration, respiration, conduction, convection, and radiation.

Perspiration is an important method of losing body heat. During evaporation of perspiration a large amount of heat is absorbed by the water as it has a latent heat of vaporization of 0.58 kilocalories per gram. The body normally perspires all of the time although it usually is not noticeable. In the event the temperature of the body has risen and there is much excess heat to get rid of, the perspiration increases and a larger amount of heat is lost by evaporation.

Another important method of heat loss is the process of respiration. During this process the inhaled air is warmed and moistened so that on exhalation the air is much warmer. The processes of perspiration and respiration use evaporation to transfer heat from the liquid to the gaseous form of water.

Other methods of heat loss are conduction, convection, and radiation. More heat is lost by convection and radiation than by conduction. By conduction is meant the transfer of heat to an object which the body directly contacts, such as immersion in water. Convection involves the removal of heat from the body surface by moving currents of air which pass over the body, such as fanning or a blowing breeze. Radiation is a method by which heat leaves the body in the form of waves or rays if

22 Ruch, op. cit., p. 1054.
the environment is cooler.\textsuperscript{23, 24}

Radiation, convection, and conduction are largely dependent upon environmental conditions. In the event the temperature of the environment is in the high 90's on the Fahrenheit scale, none of these three methods will work very well, so the main method of heat loss would have to be by evaporation of moisture from the surface of the skin.\textsuperscript{25} When the humidity of the air is high the methods of convection, radiation, and conduction are not very efficient and neither is evaporation. Convection is decreased because moist air does not circulate as well as dry air. Radiation is cut down because moist air is more opaque to radiant energy. Evaporation can not be effective in a humid environment because the air is already saturated with water.\textsuperscript{26}

Other methods of losing small amounts of heat are through the urine and feces\textsuperscript{27} and by warming ingested food and fluids.\textsuperscript{28} These are actually methods of conduction.

According to Memmler more than 80 percent of the heat loss occurs through the skin and 15 to 20 percent is through respiration and urine

\begin{itemize}
\item \textsuperscript{24}Memmler, \textit{op. cit.}, pp. 317-318.
\item \textsuperscript{25}Wakim, \textit{op. cit.}, pp. 81-82.
\item \textsuperscript{26}Ibid.
\item \textsuperscript{28}MacBryde, \textit{op. cit.}, p. 442.
\end{itemize}
and feces. MacBryde has said that 60 percent of the body heat is eliminated through radiation, about 20 to 27 percent through vaporization, and 12 to 15 percent through convection.

**Diurnal Variations in Temperature**

The body temperature does not remain the same all of the time. It seems generally understood that usually the temperature of a healthy person is lowest in the morning and highest in the evening. This difference in temperature at different times of the day is caused by a diurnal, or circadian, (24-hour) cycle and "is related to the influence of the daily routine of work, meals, rest, and sleep" according to a study of ten subjects by Kleitman and Ramsaroop. Others have said that the temperature rhythm is due to endogenous or hormone mechanisms. The diurnal temperature is thought to originate in infancy and varies with each individual. It is thought by some that on reversing the activity or work schedule that the low and high temperatures will occur at opposite times of the day. Others believe that the diurnal

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33 Ibid., p. 16.
curve can be modified some, but that the diurnal curve remains essentially the same. Kleitman has written that there are "two distinct types of body-temperature and efficiency curves." Morning persons have their highest temperature earlier in the day than evening persons. He also said that morning persons can work more efficiently in the early part of the day and evening persons work more efficiently later in the day.38

There may be a difference of as much as 2 to 3 degrees Fahrenheit between the low temperature and the high temperature of the day.39

According to Keele and Neil the lowest temperature occurs between the hours of 2 to 6 a.m.40 Harrison and others have said the minimum temperature occurs 2 to 4 a.m.41 Best and Taylor and Kimber and others stated that the minimum temperature occurs between 3 and 5 a.m.42,43 MacBryde said that the lowest temperature is usually reached between 4 and 6 a.m.44

The maximum temperature is reached about 4 p.m. according to

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37 Kleitman, op. cit., p. 18.


39 Best, The Physiological Basis of Medical Practice, loc. cit.

40 Keele, op. cit., p. 206.


42 Best, The Physiological Basis of Medical Practice, loc. cit.

43 Kimber, op. cit., p. 655.

44 MacBryde, op. cit., p. 447.
Kimber and associates.\textsuperscript{45} Harrison and associates gave 6 to 10 p.m. as the hours when the highest temperature is most likely to occur.\textsuperscript{46} Tuttle and Schottelius have given 8 to 10 p.m. as the hours of the highest temperature.\textsuperscript{47} MacBryde has given 8 to 11 p.m. as the hours of the highest temperature.\textsuperscript{48} Other authors have said that the highest temperature occurs in the early evening, late evening, late afternoon or evening.

A study by Mellette and co-workers of eleven males and eleven females reported that the highest temperature for males occurred about 8:49 p.m. and for females at about 10:49 p.m. The lowest temperature for males occurred at about 6:04 a.m. and for females about 4:49 a.m.\textsuperscript{49}

II. CAUSES AND SIGNIFICANCE OF FEVER

Etiology of Fever

One definition of fever is: "an elevation in body temperature resulting from disease."\textsuperscript{50} Atkins has written that "fever is perhaps

\textsuperscript{45} Kimber, \textit{loc. cit.}

\textsuperscript{46} Harrison, \textit{loc. cit.}


\textsuperscript{48} MacBryde, \textit{loc. cit.}


\textsuperscript{50} Ivan L. Bennett, Jr., and Anthony Nicastrì, "Fever as a Mechanism of Resistance," \textit{Bacteriological Reviews}, 24:17, March, 1960.
the commonest and most widely known manifestation of illness."\(^51\) Fever used to be thought of as a disease. It was thought that each disease had its own type of fever. This explains the fact that many illnesses are named as a fever, for instance--typhoid fever and rheumatic fever. Today we know that fever is a manifestation or symptom of disease.

There are many causes of fever. One that is commonly thought of is invasion by disease-producing microorganisms. The microorganism produces toxins that can be dangerous to the body. So the body produces antitoxins and starts the process of phagocytosis. The temperature rises because mechanisms are stimulated primarily to decrease heat loss and secondarily to produce heat.\(^52\) Trauma to tissues in the body such as that caused by surgery or accidental injury causes an elevation of temperature because of increased protein breakdown, or catabolism. This is apparently caused by toxins liberated by the injured tissues. Patients having a myocardial infarction may have an elevation of temperature due to tissue injury. Injuries to the nervous system, especially in the area of the third ventricle, internal capsule, medulla, or upper part of the spinal cord, can cause fever because of damage to the hypothalamus. Dehydration, especially in young children, can cause fever because of a reduction in the amount of fluid in the blood (anhydremia) which means that heat can not be lost easily when circulation is markedly reduced by the lowered fluid content in the circulatory system.

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\(^52\) MacBryde, *op. cit.*, p. 446.
Sometimes drugs or other chemical substances can cause a fever by their action on the hypothalamus, by increasing metabolism, or by inhibiting the sweating mechanism. Belladonna derivatives are examples of drugs which inhibit the sweating mechanism, thereby elevating the temperature.\(^{53}\)

**Temperature Regulation During Fever**

The hypothalamus is considered the heat-regulating center or "thermostat" of the body. During most fevers it functions only at a higher level as though it were turned up.

At the beginning of a fever the individual acts cold. This is because the body temperature as sensed by the thermoreceptors is too low. Vasoconstriction, chills and other methods of heat production and heat conservation are initiated to bring the body temperature up to the new level set by the "thermostat." Best and Taylor have written that heat conservation is a stronger force than heat production in the rise of temperature in fever.\(^{54}\)

When the cause for the fever is removed the thermoreceptors can react in their normal manner. At this time the body temperature is too high as sensed by the thermoreceptors, so mechanisms are put into effect to rid the body of excess heat. Often this reduction in temperature occurs very rapidly. The individual perspires profusely, throws

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\(^{53}\) Best, *The Physiological Basis of Medical Practice*, p. 1423.

\(^{54}\) Ibid., p. 1424.
off his covers, and feels very hot. This rapid drop in temperature is often referred to as the "crisis." If the temperature drops slowly over a day or two it is referred to as dropping by "lysis."56

Postoperative Temperatures

"Anesthesia depresses and renders inefficient the temperature regulating mechanisms of the body."57 The usual alteration in temperatures postoperatively is a reduction, but a rise may also occur.58 Fever may develop over a period of hours and is usually caused by having large areas of infection stirred up by operative intervention. Also fever may be seen after certain intracranial procedures such as infratentorial operations or those in the area of the hypothalamus.59,60,61,62

Because of increased protein catabolism postoperatively, heat production is higher than heat loss, thus causing a temperature eleva-
Kinney and Roe have written that "a low grade fever may occur in the immediate postoperative period without any evidence of bacterial infection." This is probably due to an increase in heat production when heat loss is diminished because of cutaneous vasodilation. In a study by Kinney and Roe they found that the maximum temperature in almost all of the postoperative patients occurred during the night after the operation or on the first postoperative day.

If the patient's temperature has been subnormal because of hypothermia an "overshoot" may occur because of the rewarming process.

**Signs Associated with Fever**

According to Pickering there are three phases of a fever. The first phase is that of the rising temperature. The second phase is that of steady pyrexia, or elevated temperature. The third phase is that of the falling temperature. Each phase has characteristic symptoms.


65 Ibid.


During the first phase the individual feels cold and may shiver or have gooseflesh. He looks pale. He wants extra clothing and bedding.

In the second phase, when the temperature is up and is remaining there, the skin appears flushed and is hot and dry.

The third phase is that of the falling temperature and is characterized by profuse sweating. The individual feels hot and throws his covers off. 69

Other symptoms of fever include: anorexia, headache, thirst, nausea or vomiting, constipation or diarrhea, generalized aching, tachycardia, 70,71 rapid breathing, drowsiness or restlessness. 72 In severe or prolonged fever there may be delirium, convulsions, coma, or scant urine.73,74,75

Clinical Significance of Fever

Harrison and others have written that fever is a "sensitive and reliable indicator of the presence of disease." This probably makes thermometry the commonest clinical procedure. 76 Determination of body

69 Guyton, op. cit., pp. 997-998.


71 McClain, op. cit., p. 209.

72 Kampmeier, op. cit., p. 135.

73 Taber, loc. cit.

74 McClain, loc. cit.


76 Harrison, op. cit., p. 50.
temperature assists in estimating the severity of an illness, its course and duration, and the effect of therapy. Chaffee and Greisheimer stated that because the "optimum" body temperature has such a narrow range, the close observation of the temperatures of all individuals who are sick is most important.

Modell wrote that the fever curve is not indispensable because there are "other good guides to the patient's condition." He also indicated that the chart can have negative usefulness if it is given emphasis out of proportion. Today, because of drugs and antibiotics that arrest disease or fever so quickly, the temperature record has lost much of its importance. Improved laboratory methods can more than compensate for this loss of importance of the fever chart.

When the body temperature is elevated, the rate of metabolism is higher. This causes the heart to work harder and the cardiac output increases. In cases of patients with myocardial infarction or other heart conditions, the higher rate of cardiac work may be dangerous.

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77 Ibid., p. 54.


79 Modell, op. cit., p. 321.


81 McClain, op. cit., p. 209.

When the patient's temperature is rising, he may often shiver. In some instances this shivering is undesirable because it increases the metabolism to a dangerously high level if he has a low respiratory or cardiac reserve. These patients should have their temperatures checked frequently and carefully.83

Fever weakens the patient and may dull his judgment probably because of congestion.84 He may become severely dehydrated and lose weight rapidly. His mouth and nasal passages may become dry and cracked. There may be temporary or permanent brain damage depending on the severity of the fever because of damage to the parenchyma of the cells especially those in the brain.85 Temperatures above 105 degrees Fahrenheit can cause brain damage.86,87 As the temperature of the body increases it stimulates heat production. It also is much more difficult to dissipate the heat that is produced. "Consequently, a high temperature tends to produce a still higher temperature."88,89 The body can not endure temperatures above 112 degrees Fahrenheit because of irreversible damage

83Stephen, op. cit., pp. 797-798.
85Guyton, op. cit., pp. 998-999.
87Guyton, loc. cit.
89Guyton, op. cit., p. 987.
to body tissues, so measures must be taken to reduce the temperature as rapidly as possible.\textsuperscript{90,91} It is imperative that those patients with rising temperatures be observed closely because changes can occur very rapidly.

III. CAUSES FOR TEMPERATURE ELEVATION OTHER THAN DISEASE

\textbf{Muscular Activity}

During strenuous muscular exercise the temperature of the body may rise several degrees. This is because heat is produced faster than it is eliminated.\textsuperscript{92} During heavy muscular activity heat production may be increased twenty times the normal level.\textsuperscript{93} Grollman said that severe exertion can cause an increase in the body temperature of as much as 5 to 7 degrees Fahrenheit.\textsuperscript{94} Best and Taylor were more conservative by saying that a temporary rise of 1 to 4 degrees or more may occur. They cited a report of a temperature of 104 degrees Fahrenheit during exercise.\textsuperscript{95} MacBryde reported that trained athletes have been observed to have rectal temperatures as high as 106 degrees Fahrenheit. The temperature falls to normal about 30 minutes after the activity is

\begin{itemize}
\item \textsuperscript{90} Memmler, op. cit., p. 321.
\item \textsuperscript{91} Guyton, op. cit., p. 998-999.
\item \textsuperscript{92} McClain, op. cit., p. 208.
\item \textsuperscript{93} Selkurt, op. cit., p. 620.
\item \textsuperscript{95} Best, \textit{The Physiological Basis of Medical Practice}, p. 1413.
\end{itemize}
During exercise the rectal temperature rises before the oral temperature rises according to Keele.  "Chewing-gum fever" was mentioned by MacBryde. He said that after vigorous chewing for a few minutes the temperature has been raised as much as 1 degree Fahrenheit. Brim and Chandler also stated that forty of fifty individuals that chewed gum had rises of their oral temperatures. At the end of twenty minutes nineteen had returned to the control level and twenty-one were still above.

**Food**

Hot drinks can cause a fallacious temperature reading. Brim and Chandler did a study in which they found that none of the patients' temperatures returned to normal twenty minutes after receiving hot drinks. It took some of the patients as long as eighty minutes for their temperatures to return to normal. Verhonick and Werley concluded that the ingestion of hot and cold liquids makes "a significant difference in the degree of oral temperatures of afebrile patients" after an unstated length of time.

MacBryde said that elevations of 0.2 to 0.5 degrees

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98 MacBryde, *loc. cit.*
Fahrenheit have been recorded after the ingestion of a meal. The elevation began twenty to thirty minutes after the meal and reached its peak in about ninety minutes.  

Woodman, Parry, and Simms conducted a study of the effects of ice water on the oral temperatures of twenty-two nonhospitalized males. After comparing the results with a control group of twenty-two nonhospitalized males they concluded that ice water has a significant lowering effect on the oral temperature.

**Environment**

The increased temperature of the environment can cause an increase in body temperature. The body can pick up heat by direct radiation from the sun or by reflected radiation. It also can pick up heat from the immediate surroundings. MacBryde stated that the average temperatures of people rise when they move from a temperate to a tropical climate. Exposure to cold can raise the temperature by causing shivering to occur which in turn raises the body temperature.

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102 MacBryde, *loc. cit.*


104 Keele, *op. cit.*, p. 204.

105 MacBryde, *loc. cit.*

Hot Baths

Hot baths can cause a transient rise in body temperature. Cold or warm baths are thought to have a greater influence on body temperature than air of the same temperature. This is because water can absorb and hold more heat for a longer period of time than air.

Emotions

Exciting emotions can cause an increase in temperature because of their effect on some endocrine glands, such as the adrenal and thyroid glands, whose activity is greatly increased thus increasing metabolism. Von Euler stated that a rise of up to 2 degrees Fahrenheit has been reported due to emotions. This is because of vasoconstriction, increased muscle tonus, and shivering.

The stress of final examinations can cause an elevation of temperature as reported by Benjamin. Kleitman and Ramsaroop cited an

107 Best, The Physiological Basis of Medical Practice, p. 1422.
108 Harrison, op. cit., p. 51.
109 Tuttle, op. cit., p. 343.
112 McClain, op. cit., p. 208.
example of temperatures rising during movies. They said it might be possible for certain types of radio broadcasts or stimulating books to have the same effect.115

Hormones and Drugs

Stimulation of the adrenal and thyroid glands causes an increase in the metabolism. This in turn causes an increase in temperature because more heat is produced. Large doses of adrenalin or thyroxin or similar drugs may cause an elevation in the body temperature.116,117 Patients with thyrotoxicosis have slightly elevated temperatures.118,119

The menstrual cycle in women shows a rhythmic variation in body temperature. At the time of ovulation there is a rise of 0.5 to 0.75 degrees Fahrenheit. In women who have a fever from another cause, the temperature can be exaggerated because of the rise in temperature at the time of ovulation.120,121

Atropine or other belladonna derivatives can cause an elevation


116McClain, loc. cit.


118Harrison, op. cit., p. 53.


120MacBryde, op. cit., p. 449.

121Keele, op. cit., p. 206.
of temperature. Atropine blocks the sweating mechanism thus causing the body temperature to rise.\(^\text{122,123}\) This is considered one of the side effects of atropine. A fever can be caused by an overdose of atropine or other belladonna derivatives. Postoperatively a patient may have an elevated temperature which is caused by the administration of a belladonna derivative in the preoperative medication.\(^\text{124}\)

An allergic reaction to a drug or blood transfusion can also cause an elevation of temperature.\(^\text{125}\)

**Smoking**

In a study by Brim and Chandler, twenty-eight of fifty individuals who smoked had elevated temperatures. After a twenty-minute period eighteen did not return to the control level.\(^\text{126}\) Verhonick and Werley concluded from their study that cigarette smoking did not have a significant effect on the oral temperatures of afebrile patients.\(^\text{127}\) Woodman, Parry, and Simms found that there was only a minute change in the oral temperatures of subjects after smoking for two minutes. They


\(^{123}\)Krantz, *op. cit.*, p. 930.


\(^{125}\)Stephen, *op. cit.*, p. 797.

\(^{126}\)Brim, *op. cit.*, p. 773.

\(^{127}\)Verhonick, *loc. cit.*
considered it to be not clinically significant.\footnote{128}

Talking

In a study by Norma Eldridge on the effects of talking on the oral temperature reading, which she conducted on sixty-one individuals, she concluded that continuous talking for ten minutes may significantly lower the temperature. She also said that people do not usually talk as continually as those who were in her study. Furthermore, patients are unlikely to talk uninterrupted for ten minutes.\footnote{129}

Patients who have difficulty breathing, thus making them breathe through their mouths, also may have lowering of their temperatures.\footnote{130} Patients receiving oxygen often have difficulty breathing which causes them to breathe through their mouths.

IV. PREVIOUS STUDIES REGARDING TIME AND FREQUENCY OF TEMPERATURE CHECKING

Opinions of Authors Regarding Frequency of Temperature Checks

In 1955 Harmer and Henderson wrote that as long as a patient is in the hospital or in a home, his temperature is checked at least twice a day although this may be meaningless and unjustifiable.\footnote{131} In 1959

\footnote{128}Woodman, \textit{loc. cit.}


\footnote{131}Harmer, \textit{op. cit.}, p. 269.
Price wrote that the temperature, pulse, and respiration are of major importance in the observation of a patient. She wrote that they should be checked and recorded at least twice a day and if there is any variation from the normal they should be checked more frequently. Barbata, Jensen, and Patterson wrote that temperature taking is a "valuable diagnostic and therapeutic aid," but that "it should be individualized and never become routine." Walker and Selmanoff have written that they felt that the temperature, pulse, and respiration procedure is a less meaningful activity for nursing personnel than it was in the past. Reasons they gave were that fewer elevations are seen today because of prophylactic treatment and nursing is not as challenged by caring for patients with fevers because of all of the methods used today to treat disease.

Related Studies

In 1957 Dr. Kory reported a study of the routine measurement of the respiratory rate. The routine measurement of the respiratory rate was important for less than 5 percent of the patients. Dr. Kory said


many errors occurred because of the indifference on the part of the nursing personnel. He said:

Nevertheless the tradition has been firmly established, and hospital patients continue to have their respiratory rate recorded, as a matter of routine along with the body temperature and pulse rate.136

A temperature study was conducted by Marie A. Schmidt for three weeks on surgical, medical, and neurosurgical wards. It was found that of a total of 1,876 temperatures 1,744, or over 90 percent, were normal. There were 132 elevated temperatures, of which only 53 were over 99.4 degrees Fahrenheit. The elevated temperatures were mainly on preoperative and postoperative patients, those newly admitted, and those who had upper respiratory infections. Prior to the study, temperatures were checked at 6 a.m. and 2 p.m. After the study the temperatures were checked twice daily on newly admitted patients for two or three days, seriously ill patients, postoperative patients for ten days, patients who had a temperature elevation in the previous twenty-four hours, cardiac patients, and those on antibiotics. Other patients had their temperatures checked once daily at 2 p.m. The report was made two years later and there seemed to be no problems with the procedure.137

In a similar study by Victoria Canetto 101 ambulatory patients' temperatures were studied. There were 2,290 temperatures recorded of which 2,234 (over 97 percent) were in the normal range. Only 56

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137Marie A. Schmidt, "Are All TPR's Necessary?" American Journal of Nursing, 58:559, April, 1958.
temperatures were considered elevated and 36 of these occurred in four patients. At the time of the study 49 percent of the patients had their temperatures checked four or more times a day. The others had their temperatures checked twice a day. Most of the patients (forty-six) had their highest temperatures at 6 p.m. The next largest number (thirty-three) had their highest temperature at 10 p.m. Recommendations of this study were that newly admitted ambulatory patients should have their temperatures checked twice a day for two or three days. Then if there is no elevation they should be checked once daily at 6 p.m.  

It was recommended in a study by Sims that temperatures be taken at 7 p.m. because this is the time that the temperature peak usually occurs. He also suggested that temperatures be taken at 7 a.m., 2 p.m., and 7 p.m. for sick patients. A 2 a.m. temperature could be taken if desired. 

At the selected hospital a study was previously done by Marilyn Pinder. She conducted a survey of 500 8 p.m. temperatures of adult medical patients. Ninety-five percent of these were normal. Approximately 75 percent of the 170 patients had no elevations. The total of 113 elevated temperatures occurred on approximately forty patients. It


was recommended that temperatures be checked once daily at 8 p.m. on adult medical patients unless they did not have normal temperatures or the doctor or nurse felt that an elevation might occur later. Another recommendation was to follow medical patients who were admitted with elevated temperatures to find out if the temperature taking could be reduced after the temperatures returned to normal. She also recommended that a larger number of patients with beginning elevations be observed to find out how to identify them. Other recommendations were to study postoperative patients to see how soon temperature taking could be reduced to once daily; and a study of fever in disease categories to find out how long the temperature stays elevated.

V. SUMMARY

The "normal" temperature of the body falls in a range of about 97 to 100 degrees Fahrenheit. The temperature is regulated by the hypothalamus. The anterior section controls loss of heat and the posterior section controls heat production and heat conservation. The highest temperature usually occurs in the late afternoon or evening.

Fever is considered an elevation of temperature as a result of disease. Symptoms of fever include: chills, skin flushed, hot and dry, profuse perspiration, anorexia, headache, nausea or vomiting, rapid pulse and respiration, thirst, drowsiness or restlessness. Fever is important because body tissues break down if there is prolonged extreme temperature.

Temperature elevations can occur that are not related to disease.
Strenuous muscular exercise, eating hot food and drink, an increased temperature of the environment, hot baths, exciting emotions, and certain hormones and drugs have been known to increase the body temperature.

Several authors have written in recent years that temperature checking has become routine and meaningless. Two studies reported in nursing literature and a previous study done at the selected hospital showed that 90 to 97 percent of the temperatures taken were normal. One recommendation of these studies was to have temperatures checked only one time daily. It has been recommended that a once daily temperature should be checked in the evening.
CHAPTER III

METHOD OF STUDY

The purposes of this study were to find out if it is necessary to check temperatures of adult medical and surgical patients as frequently as it is being done at present in the selected hospital; and to show that factors of beginning elevations can be identified without checking patients' temperatures more than once a day.

I. METHOD OF APPROACH

Selection of Method

The descriptive method of study was chosen for this study. It was hoped that by determining the incidence of elevated temperatures among hospitalized medical and surgical patients and the times that they occurred that it could be shown that after several days of hospitalization the patient does not need his temperature checked as frequently as it has been done. Those patients with beginning elevations were to be seen personally by the researcher to find out if they had recognizable symptoms or factors which might be used by nursing personnel as indications that they should have their temperatures checked more than once a day.

The tools developed for this study and refined in the pilot study were: a data gathering sheet and an observation guide for beginning elevations. The data gathering sheet was used for each patient included in the study and the observation guide for beginning
Selection of Facilities and Patients

The hospital selected for this study was a general hospital operated as a university medical center. Patients were selected from the medical and surgical units as they were admitted. Criteria for selection were that they be twenty-one years of age or older and that their temperatures be taken orally.

Permission to conduct this study was obtained from the Research Advisory Committee for Human Experimentation and the Director of Nursing Service of the selected hospital.

II. THE PILOT STUDY

Purpose

The purpose of the pilot study was to refine the tools used in this study and to familiarize the researcher with their use.

Method and Selection of Patients

There were twenty patients included in the pilot study, which was conducted for four days. Of these patients, eleven were medical patients and nine were surgical patients. All of the surgical patients and ten of the medical patients were studied for one to four days after admittance to the selected hospital. One medical patient had been hospitalized for eight days prior to the time the pilot study was started. This patient was included because she had her first elevated elevations was used for a more detailed study of those patients with beginning elevations of temperature.
temperature since her admission during the time the pilot study was conducted.

The temperatures of each patient were recorded four times a day on a data gathering sheet (Appendix A). One patient had her temperature checked only twice a day routinely, so her temperature was recorded only twice a day. Those who had beginning elevations were seen by the researcher to find out what other signs suggesting temperature elevations could be identified. This was done to refine the observation guide for beginning elevations (Appendix B).

Findings of Pilot Study

Of the total 277 temperatures recorded 249, or 89.9 percent, were normal and 28, or 10.1 percent, were elevated. There was a total of eight patients who had one or more elevations. Two of the patients had seven elevations each and one had five.

Of the 161 recorded temperatures of medical patients 148, or 92 percent, were normal and 13, or 8 percent, were elevated. Three patients had elevated temperatures, one of which had seven, another five, and the last had one. The patient with seven elevated temperatures had her first elevated temperature on the tenth day after admission. It was recorded at 6:45 a.m. after the patient woke up with a headache and after having a restless night. This occurred on a nursing unit where temperatures were routinely taken only twice a day. Treatment was initiated and the temperature of this patient was checked four times a day for two days.

There were 116 recorded temperatures for the surgical patients
of which 101, or 87.1 percent, were normal and 15, or 12.9 percent, were elevated. One patient had seven elevations and four of the patients had variations of from one to three elevations.

Two of the medical patients who had elevated temperatures were admitted to the hospital with elevated temperatures. The third patient had the first elevation ten days after she was admitted. One patient who was admitted with an elevated temperature had no more elevations during the course of the pilot study. The other patient had elevated temperatures for two days after admission.

Of the surgical patients who had elevated temperatures, one had the first elevation on the day of admission. (This patient did not have surgery.) Another patient had the first elevation two days after surgery; and three patients had beginning elevations on the first postoperative day.

Two medical patients and four surgical patients, who had beginning elevations, were seen by the researcher to try out the observation guide for beginning elevations.

The pilot study included a larger number of temperature elevations than normally seen because the researcher chose some patients specifically because they had temperature elevations. This was done for the purpose of testing the observation guide for beginning elevations.

Conclusions from Pilot Study

It appeared from the pilot study that more surgical patients than medical patients had temperature elevations. Because of this, the
researcher concluded that the surgical units should be checked first for patients with fever during the main study. This would make it easier to visit patients if they had beginning elevations.

Changes were made in the data gathering sheet (Appendix A). They included allowing space for a room number, a column for dates the patient was in the hospital, and a column for postoperative days.

The observation guide for beginning elevations (Appendix B) had a Yes-No check column added to it to make it simpler to use. Also lines were added to the right of the factors listed for pertinent comments.

III. DATA COLLECTION

The refined data gathering sheet was used to record the temperatures of sixty-three adult medical patients and fifty-one adult surgical patients who had their temperatures taken orally. Diagnostic and therapeutic procedures which the patient experienced also were recorded along with the time they occurred. The patients were followed after admission until they were discharged or until ten days after admission. The data were gathered during the last two and a half weeks of October, 1967.

Four of the medical patients and eleven of the surgical patients were deleted from the findings of the study because they did not meet all of the criteria. This left fifty-nine medical patients and forty surgical patients to be included in the findings of the study. Twenty-five patients with beginning elevations were seen by the researcher and studied in more detail. These patients were seen only once--after the first elevated temperature was recorded. The observation guide for beginning elevations
was used for recording observations of those with beginning elevations.

The data were tabulated and an analysis and interpretation are included in Chapter IV. A summary with appropriate conclusions and recommendations comprise Chapter V.
CHAPTER IV

ANALYSIS AND INTERPRETATION OF DATA

Oral temperatures of fifty-nine adult medical patients and forty surgical patients were studied from the time they were admitted to the selected hospital until they were discharged or until ten days after admission.

I. PRESENTATION AND ANALYSIS OF FINDINGS

A total of 2,484 oral temperatures of medical and surgical patients were obtained. They were classified according to the time of day of the highest temperature as a group and according to sex and age. They were also classified according to the number of elevated temperatures as a group or according to whether the patient was a medical or surgical patient. The temperatures were also classified according to the number of elevated temperatures in different disease categories. They were also classified according to different diagnostic and therapeutic procedures performed on the patients and according to the symptoms and factors associated with temperature elevations.

The Time of the Highest Temperature

Of the temperatures of the entire group that were recorded at 8 p.m., 31 percent were the highest temperatures of the day compared to 21 percent at 4 p.m., 14 percent at noon, and 11 percent at 8 a.m. (See Table I.) Twenty-nine percent of the temperatures of the medical patients that were recorded at 8 p.m. were the highest temperatures of
TABLE I

PERCENTAGE OF RECORDED TEMPERATURES THAT WERE HIGHEST AT 8 A.M., NOON, 4 P.M., AND 8 P.M. LISTED ACCORDING TO SEX AND MEDICAL AND SURGICAL SERVICE

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of Patients</th>
<th>8 a.m.</th>
<th>12 Noon</th>
<th>4 p.m.</th>
<th>8 p.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>36</td>
<td>8</td>
<td>11</td>
<td>24</td>
<td>34</td>
</tr>
<tr>
<td>Female</td>
<td>63</td>
<td>13</td>
<td>16</td>
<td>20</td>
<td>29</td>
</tr>
<tr>
<td>Medical</td>
<td>59</td>
<td>12</td>
<td>16</td>
<td>22</td>
<td>29</td>
</tr>
<tr>
<td>Surgical</td>
<td>40</td>
<td>10</td>
<td>11</td>
<td>20</td>
<td>34</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>11</td>
<td>14</td>
<td>21</td>
<td>31</td>
</tr>
</tbody>
</table>
the day, while 22 percent was the figure for 4 p.m., 16 percent for noon, and 12 percent at 8 a.m. The temperatures that were recorded at 8 p.m. for the surgical patients showed 34 percent as the highest temperatures of the day. Twenty percent were highest at 4 p.m., 11 percent at noon, and 10 percent at 8 p.m.

When the sample was divided according to sex, the percentages of the highest temperatures for the four times of the day were very similar to the above figures. (See Table I.) In the male group 34 percent of the temperatures recorded at 8 p.m. were the highest temperatures of the day with 24 percent at 4 p.m. Twenty-nine percent of the temperatures recorded at 8 p.m. for the females were highest at that time and 20 percent of those at 4 p.m. were highest.

Age seemed to have some effect on when the highest temperature occurred. The highest percentage of the highest temperatures of the day occurred at noon for those in the age group 41-50 years and at 4 p.m. for those in the age group 51-60 years. (See Table II.) The other age groups appeared to follow the pattern of the entire group.

The Elevated Temperatures

There were thirty-one patients who had temperatures above 99.5 degrees Fahrenheit. Of these, twenty were surgical patients and eleven were medical patients. The surgical patients had a total of 147 elevations and the medical patients had 43 elevations making a total of 190 elevations. Of the total number of temperatures studied, only 8 percent were elevated. Of the temperatures recorded for medical patients, only 3 percent were elevated while 17 percent of the temperatures recorded for
### TABLE II

PERCENTAGE OF RECORDED TEMPERATURES THAT WERE HIGHEST AT 8 A.M., NOON, 4 P.M., AND 8 P.M. LISTED ACCORDING TO AGE OF PATIENT

<table>
<thead>
<tr>
<th>Age in Years</th>
<th>Number of Patients</th>
<th>Percentage 8 a.m.</th>
<th>Percentage 12 Noon</th>
<th>Percentage 4 p.m.</th>
<th>Percentage 8 p.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-30</td>
<td>6</td>
<td>18</td>
<td>0</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>31-40</td>
<td>8</td>
<td>13</td>
<td>11</td>
<td>9</td>
<td>17</td>
</tr>
<tr>
<td>41-50</td>
<td>14</td>
<td>16</td>
<td>24</td>
<td>22</td>
<td>20</td>
</tr>
<tr>
<td>51-60</td>
<td>17</td>
<td>7</td>
<td>14</td>
<td>31</td>
<td>27</td>
</tr>
<tr>
<td>61-70</td>
<td>35</td>
<td>10</td>
<td>13</td>
<td>21</td>
<td>38</td>
</tr>
<tr>
<td>71 &amp; above</td>
<td>19</td>
<td>12</td>
<td>10</td>
<td>20</td>
<td>32</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td></td>
<td><strong>11</strong></td>
<td><strong>14</strong></td>
<td><strong>21</strong></td>
<td><strong>31</strong></td>
</tr>
</tbody>
</table>
surgical patients were elevated.

Seventeen percent of the total elevations of the entire group occurred at approximately 8 a.m. Sixteen percent occurred at noon, 26 percent at 4 p.m., and 41 percent at 8 p.m. The surgical patients had 19 percent of their elevated temperatures at approximately 8 a.m., 15 percent at noon, 24 percent at 4 p.m., and 41 percent at 8 p.m. The medical patients had 9 percent of their elevated temperatures at approximately 8 a.m., 19 percent at noon, 33 percent at 4 p.m., and 40 percent at 8 p.m. It appears that about two-fifths of the elevated temperatures occurred at 8 p.m.

Table III indicates that about half of the patients had their first elevations at 8 p.m. Of the thirty-one patients having elevated temperatures sixteen occurred at approximately 8 p.m. Fifteen patients had their first elevation at another time of day. Nine of these also had an elevated temperature at 8 p.m., while six patients, or 19 percent, had no elevation at 8 p.m. Four of the six patients had only one elevated temperature that was not above 100 degrees Fahrenheit. The other two patients had their first elevated temperatures shortly after receiving a blood transfusion or at the time of the first temperature check following surgery.

For convenience the diagnoses of the patients were divided into ten categories. Table IV shows the elevated temperatures listed according to disease categories. The medical patients in the cardiovascular and gastro-intestinal categories and the surgical patients in the gastro-intestinal and musculoskeletal categories had more temperature elevations
TABLE III

NUMBER OF FIRST ELEVATIONS THAT OCCURRED AT 8 P.M. AND OTHER TIMES OF DAY LISTED ACCORDING TO MEDICAL AND SURGICAL PATIENTS

<table>
<thead>
<tr>
<th>Group</th>
<th>8 p.m.</th>
<th>Other Time</th>
<th>Both Times*</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Surgical</td>
<td>11</td>
<td>2</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>6</td>
<td>9</td>
<td>31</td>
</tr>
</tbody>
</table>

*The patient's first elevation occurred at another time but the patient also had an elevated temperature at 8 p.m. on that day.
### TABLE IV

NUMBER OF ELEVATED TEMPERATURES LISTED ACCORDING TO DISEASE CATEGORIES FOR THIRTY-ONE ADULT MEDICAL AND SURGICAL PATIENTS HAVING ELEVATED TEMPERATURES

<table>
<thead>
<tr>
<th>Disease Category</th>
<th>Number of Patients</th>
<th>Medical Patients</th>
<th>Elevations</th>
<th>Surgical Patients</th>
<th>Elevations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cardiovascular</td>
<td>18</td>
<td>3</td>
<td>22</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2. Respiratory</td>
<td>9</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3. Gastrointestinal</td>
<td>24</td>
<td>4</td>
<td>13</td>
<td>7</td>
<td>76</td>
</tr>
<tr>
<td>4. Genitourinary</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>5. Gynecology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>6. Eye and ear</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>7. Musculoskeletal</td>
<td>13</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>44</td>
</tr>
<tr>
<td>8. Dermatology</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>9. Neurology</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10. Endocrine</td>
<td>6</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Totals</td>
<td>99</td>
<td>11</td>
<td>43</td>
<td>20</td>
<td>147</td>
</tr>
</tbody>
</table>
than those in the other groups. It should be noted that there were more patients in these categories than there were in the other groups so there was not as much chance that the smaller groups would have temperature elevations.

Temperature Elevations Following Diagnostic or Therapeutic Procedures

The diagnostic procedures and therapeutic procedures that were done for each patient were recorded on the data gathering sheet and later analyzed.

Two medical patients (M-10 and M-42) had elevations after receiving blood transfusions. Otherwise no diagnostic or therapeutic procedure could be credited with causing an elevation of temperature.

The surgical patients had more elevated temperatures than the medical patients. One patient (S-8) had elevated temperatures after receiving Sitz baths. Her first elevated temperature occurred about two hours after a Sitz bath. This also was thirty-one hours after surgery. One patient had a second elevation after he was catheterized. But at this time he had been having elevated temperatures for twenty hours and his first elevation had begun six hours after surgery.

It appears from analyzing findings that of the patients seen, administering blood to two medical patients caused them to have elevated temperatures. The trauma of surgery is apparently the main cause of elevated temperatures of surgical patients.

The Period of Time Over Which Elevated Temperatures Occurred for Medical Patients

The mean time for the first elevated temperature to occur for the
medical patients was 47 hours after admission. The time the first
elevation occurred ranged from zero, or on admission, to 125 hours after
admission. The mean time for the last elevation to occur was 113 hours
after admission and ranged from 16 to 245 hours after admission.

Because the mean time of the last elevation was 113 hours after
admission it was thought that most of the patients would not have ele-
vated temperatures after five days. Table V illustrates this.

Because the median length of time of the period of elevated
temperatures for medical patients was 52 hours, it was decided to com-
pare the first three days' elevated temperatures with the first five
days' elevated temperatures. (See Table V.) Although more elevated
temperatures occurred after three days than after five days, the ele-
vated temperatures involved the same patients. Both M-6 and M-26 had
temperatures that were below 100 degrees Fahrenheit. One patient (M-10)
had elevated temperatures after receiving blood. Another patient (M-34)
developed phlebitis after being given some intravenous fluids. The last
patient (M-42) who had elevated temperatures after three days following
admission had elevated temperatures during much of his hospitalization
and also received blood.

The Period of Time Over Which Elevated Temperatures Occurred for Surgical
Patients

The mean time for the first elevated temperature to occur for
surgical patients was 16 hours after surgery. The time the first ele-
vation occurred ranged from zero hours after surgery to 32 hours after
surgery. The mean time for the last elevation to occur was 95 hours
<table>
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<tr>
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<td><strong>Totals</strong></td>
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<td><strong>18</strong></td>
<td><strong>15</strong></td>
<td><strong>28</strong></td>
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</tbody>
</table>
after surgery, and ranged from 8 to 208 hours after surgery. Table VI shows the number of elevated temperatures each surgical patient had during the first four postoperative days compared to the following days. This is then compared to the first three postoperative days and the following days.

There is not much difference between the total number of elevations that occurred during the first four days and those that occurred during the first three days. Seven patients had elevations after the fourth postoperative day and nine patients had elevations after the third postoperative day. The two additional patients (S-4 and S-13) who had elevations had continuous temperature elevations. Several other patients (S-1, S-10, S-25, and S-31) also had continuous elevations. Two patients had temperature elevations after several days of normal temperatures, but the temperatures stayed below 100 degrees Fahrenheit. One patient (S-46) began having elevated temperatures after starting radiation therapy.

**Signs of Fever Manifested by Patients**

Of the eleven medical patients who had elevated temperatures, seven were seen by the researcher after their first elevation to determine what signs of fever they manifested and what factors caused the elevations. The patients that were not seen had only one elevated temperature which was above 99.5 degrees but below 100 degrees Fahrenheit. They were not recorded soon enough for the researcher to see the patients.

Four other patients also had temperature elevations that were
TABLE VI
COMPARISON OF ELEVATED TEMPERATURES OF SURGICAL PATIENTS DURING AND AFTER THE FIRST THREE AND THE FIRST FOUR POSTOPERATIVE DAYS

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<td>16</td>
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<td>15</td>
<td>3</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>S-28</td>
<td>5</td>
<td>5</td>
<td></td>
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<td>2</td>
<td></td>
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<tr>
<td>S-31</td>
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<td>7</td>
<td>3</td>
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</tr>
<tr>
<td>Totals</td>
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<td>101</td>
<td>46</td>
</tr>
</tbody>
</table>
above 99.5 degrees Fahrenheit but below 100 degrees. One of these patients did not have any symptoms or other factors thought to produce fever. Another patient complained of a headache, but said she had one all of the time. She also complained of pain in her knee. Her diagnosis was synovitis of the knee. Another patient complained of pain, warmth, and redness of her arm caused by phlebitis. She also complained of anorexia and a headache. The fourth patient was admitted with coronary artery disease. She had a temperature elevation about 23 hours later. Her symptoms were chills, rapid pulse, headache, anorexia, and slight thirst. No other factors could be identified.

Three medical patients had temperatures that were 100 degrees Fahrenheit or above. One patient had her first elevated temperature just prior to receiving a blood transfusion. The second elevation occurred while the blood was being administered. She had symptoms of thirst and drowsiness and also complained of being cold, but said she did not have chills. The second patient had an elevated temperature when he was admitted. His chief complaint was vomiting. Symptoms which he manifested were: thirst, headache, restlessness, and nausea. The third patient had his first elevated temperature about an hour after a blood transfusion was discontinued. He showed symptoms of a rapid pulse, headache, nausea, restlessness, and anorexia.

There were twenty surgical patients who had elevated temperatures. Of these, the researcher saw eighteen. The other patients had only one elevated temperature that was not recorded soon enough for the researcher to see the patient. One of the two patients not seen did not have any
temperatures that were 100 degrees or above. The other patient had elevated temperatures above 100 degrees but which were not recorded soon enough so the researcher could visit the patient.

Three of the patients who were seen had temperatures above 99.5 degrees Fahrenheit but which did not go as high as 100 degrees. One patient had symptoms of pain in the operative site, thirst, and drowsiness. The only activity immediately prior to her first elevation was that she visited with her family. Her surgery had been performed the previous day. Another patient had his first elevation about 8 hours after a transurethral prostatectomy which necessitated a retention catheter. His symptoms were: pain, chills, flushed appearance, thirst, headache, generalized aching, and drowsiness. The third patient had her first elevated temperature about 7 hours after surgery. Her symptoms were: mild pain, rapid pulse, flushed appearance, and thirst. She had received scopolamine preoperatively which could have had an effect on her temperature.

Of the fifteen surgical patients who had temperatures of 100 degrees or above who were seen by the researcher, fourteen complained of pain. Seven were drowsy and three restless. Six complained of a headache, and five had a rapid pulse. Three had chills, six were flushed in appearance, five were perspiring, three had hot, dry skin, and two complained of being hot. Six patients complained of thirst, five complained of nausea or vomiting, and four had anorexia. One patient complained of a sore throat. Two of the patients had retention catheters. Four of the patients had received scopolamine or atropine preoperatively.
about 12 hours before the first elevation. One patient was possibly allergic to aspirin, but when given an empirin compound did not manifest any other symptoms of an allergic reaction.

Those patients with temperatures above 100 degrees seemed to have more symptoms of fever than those who had temperature elevations below 100 degrees Fahrenheit.

II. CLINICAL SIGNIFICANCE OF DATA

The entire group showed a higher percentage of highest temperatures at 8 p.m. than at the other times of the day. Both the males and the females showed this trend. Four of the age groups showed this trend, but two age groups did not. It appears that in general a higher percentage of the temperatures of the day as compared to the percentages recorded for the other three times of the day. This seems to agree with literature written on the subject although a more frequent check of temperatures would give more significant findings as to when the highest temperature most often occurs.

About 8 percent of the temperatures studied were elevated leaving 92 percent as normal. This agrees with other studies which showed 90 to 97 percent of the temperatures that were taken were normal. It also supports the findings of Marilyn Pinder's study which was done previously at the selected hospital.¹

About two-fifths of all of the elevated temperatures occurred at

8 p.m. which further supports the idea that the highest temperatures occur in the evening. Those patients who did not have an elevated temperature at 8 p.m. on the day of their first elevated temperature either did not have a temperature above 100 degrees Fahrenheit or had an obvious reason for a temperature elevation.

Surgical patients had many more elevated temperatures than did the medical patients although the number of patients in the surgical group (forty) was considerably less than those in the medical group (fifty-nine). One-half of the surgical patients had elevations, whereas one-fifth of the medical patients had elevation. This would seem to indicate that surgical patients have more elevated temperatures than medical patients do.

Diagnostic procedures and therapeutic procedures did not seem to cause many temperature elevations except in patients having surgery or receiving blood transfusions. One patient had a second elevation after receiving a Sitz bath. Patients often had a rise in temperature which did not go above normal following a diagnostic or therapeutic procedure. Because these procedures usually were done early in the day it was impossible to say if this rise was due to the procedure or to the normal rise in temperature as the day progressed.

Most of the elevated temperatures of the medical patients have been shown to occur during the first five days. (See Table V.) When compared to the elevations that occur during the first three days it is seen that the same patients had elevated temperatures after the third day that had them after the fifth day. A similar pattern is shown for
the surgical patients by comparing the first four days postoperatively with the first three days postoperatively. (See Table VI.)

Patients with temperature elevations that were below 100 degrees Fahrenheit showed fewer symptoms and less obvious symptoms than those manifested by patients who had temperatures that went up to 100 degrees or above. In general, the symptoms manifested by the patients were common and could be related to a specific factor which caused the temperature elevation.

III. SUMMARY

A survey was conducted of the temperatures recorded four times a day for ninety-nine adult patients. The patients' temperatures were classified according to sex, age, disease categories, and whether medical or surgical patients. Percentages of recorded temperatures that were the highest were obtained for 8 a.m., noon, 4 p.m., and 8 p.m. In general most of the highest temperatures occurred at 8 p.m.

Ninety-two percent of the 2,484 temperatures studied were normal. Findings of the study show that surgical patients have more elevated temperatures than medical patients do.

The temperatures were also studied to see if there was a relationship between diagnostic and therapeutic procedures and elevated temperatures. Patients who received blood and those who had surgery were the ones who most often had temperature elevations.

Three days after admission of the medical patient and three days after surgery for the surgical patient appears to be sufficient time to
include most of the temperature elevations of these patients.

Twenty-five patients with beginning temperature elevations were seen. Those with temperature elevations that did not go up to 100 degrees Fahrenheit did not manifest as many symptoms as those who had temperatures of 100 degrees or more.
CHAPTER V
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

I. SUMMARY

A survey of temperatures of fifty-nine adult medical and forty adult surgical patients was conducted from the time they were admitted until they were discharged or until ten days after admission. It was done to determine if it is safe to reduce the frequency of checking temperatures of hospitalized patients. Other problems studied were: (1) to find the time of day the highest temperature most frequently occurs, (2) to find if patients in different age groups have their highest temperature at different times of the day, (3) to see if there is a difference between the sexes as to when the highest temperature occurs, (4) to find out if the primary diagnosis of the patient affects his temperature, and (5) to see if diagnostic or therapeutic procedures cause elevated temperatures.

The purposes of this study were: (1) to find out if it is necessary to check temperatures of adult medical and surgical patients as frequently as it has been done in the selected hospital; and (2) to show that factors of beginning elevations can be identified without checking patients' temperatures more than once a day routinely.

A review of literature was done on the regulation of body temperature, fever, causes for temperature elevation other than disease, and previous studies regarding the time and frequency of temperature checking.
A pilot study was done on twenty patients to refine the data gathering sheet (Appendix A) and the observation guide for beginning elevations (Appendix B).

Over a two and a half week period the temperatures of fifty-nine adult medical patients and forty adult surgical patients were studied. Thirty-one percent of the highest temperatures occurred at 8 p.m. with the other times of day having lower percentages. The males and females both followed this pattern. Two age groups (41-50 and 51-60) did not show this pattern.

Twenty surgical patients and eleven medical patients had elevated temperatures. Of the total of 2,484 temperatures only 190, or 8 percent were elevated. Forty percent of the elevated temperatures occurred at 8 p.m.

Surgery and blood transfusions appeared to be the main therapeutic procedures causing temperature elevations. One patient with phlebitis from intravenous infusions and another who received radiation therapy had temperature elevations. No diagnostic procedures could be credited with causing temperature elevations.

The mean time after admission for the first elevation to occur for medical patients was 47 hours. The mean time for the last elevation to occur was 113 hours after admission. Most of the elevated temperatures occurred in the first 5 days after admission although there was not much difference when compared to the first 3 days after admission.

Surgical patients had a mean time of 16 hours after surgery for the first elevation to occur. The mean time for the last elevation was
95 hours after surgery. Most of the elevated temperatures occurred during the first 4 days postoperatively, but when compared to the first three days postoperatively there was very little difference.

Seven medical patients and eighteen surgical patients with beginning elevations were seen to determine what symptoms of fever they had and also to determine what factors may have caused the temperature elevations. The patients who had temperature elevations below 100 degrees Fahrenheit did not have as many symptoms or as pronounced as those with temperature elevations above 100 degrees Fahrenheit.

II. CONCLUSIONS

Upon the basis of the findings of this study the hypothesis was accepted. That is, a once a day temperature is sufficient for most hospitalized patients. A review of literature brought out that most people have their highest temperature in the evening. Findings of this study agree with this. The sub-hypothesis stating that the patient's highest temperature occurs in the evening can be accepted. Thus it is suggested that a temperature taken at 8 p.m. would more likely show whether a patient had a fever than a temperature taken at another time of the day.

Only two of the eleven medical patients who had temperature elevations had them on the day of admission. Thus the sub-hypothesis stating that if a patient does not have an elevated temperature on the day of admission, he will not have an elevated temperature during the course of his hospitalization, must be rejected. Findings from this
study show that most temperature elevations occur during the first five days after admission.

Surgical patients who had elevated temperatures had them from 0 to 32 hours after surgery, so the hypothesis stating that if a surgical patient does not have an elevated temperature on the day after surgery, he will not have an elevated temperature during the course of his hospitalization, can be accepted.

The last sub-hypothesis states that factors of an elevation of temperature can be identified. Twenty-five patients with beginning temperature elevations were seen by the researcher. One medical patient did not have any signs of fever. All of the surgical patients seen had signs of fever. Those with temperature elevations below 100 degrees Fahrenheit had fewer and less obvious symptoms than those with temperatures of 100 degrees or above. Factors causing temperature elevations that were more easily observed were: surgery, blood transfusions, phlebitis, and radiation therapy. Thus it is concluded that factors which indicate the need for frequent temperature checks can be identified.

III. RECOMMENDATIONS

Based on the findings of this study it is recommended that:

1. Temperatures be checked four times daily on medical patients for three days after admission and then once daily at 8 p.m. unless the patient has had an elevation in the previous twenty-four hours or the physician and/or nurse decides that his temperature should be checked more frequently.
2. Temperatures be checked four times daily on surgical patients for three days after surgery and then once daily at 8 p.m. unless the patient has had an elevation in the previous twenty-four hours or the physician and/or nurse decides that his temperature should be checked more frequently.

3. Those who are responsible for caring for hospitalized medical and surgical patients be made aware of the importance of their observations of signs of fever the patients may have.

Further research could be done by:

1. Doing a similar study which includes a larger number of medical and surgical patients.

2. Studying the procedure of taking temperatures to find out how accurate the readings are.

3. Doing a similar study but limiting the population as to age and disease categories.

4. Studying why those patients in the age groups 41-50 and 51-60 had their highest temperatures at a time other than 8 p.m.

5. Determining whether the procedure of checking temperatures is considered to be important to nursing personnel.

6. Doing a study to determine how to identify patients who may have their highest temperature earlier in the day rather than in the evening.
BIBLIOGRAPHY

A. BOOKS


B. PERIODICALS


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Schmidt, Marie A. "Are All TPR's Necessary?" American Journal of Nursing, 58:559, April, 1958.


C. UNPUBLISHED MATERIALS


APPENDIXES
APPENDIX A

DATA GATHERING SHEET

Name ___________________________ Code Number ___________________

Age ___________ Sex ___________ Room Number ___________________

Diagnosis ________________________ Hospital Number ___________________

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Diagnostic Procedures ____________________________ Date ____________________________ Time ____________________________
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APPENDIX B

OBSERVATION GUIDE FOR BEGINNING ELEVATIONS

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<td></td>
<td>TV, radio, movie, exciting book</td>
</tr>
<tr>
<td></td>
<td>smoking</td>
</tr>
<tr>
<td></td>
<td>other</td>
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<tr>
<th></th>
<th>4. Medication given which might cause elevation</th>
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<tbody>
<tr>
<td></td>
<td>atropine</td>
</tr>
<tr>
<td></td>
<td>thyroid</td>
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<tr>
<td></td>
<td>epinephrine</td>
</tr>
<tr>
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<td>allergic reaction</td>
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<td>other</td>
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OBSERVATION GUIDE FOR BEGINNING ELEVATIONS (Continued)

Yes  No  5. Temperature of environment

            air conditioning working
LOMA LINDA UNIVERSITY
Graduate School

A SURVEY OF TEMPERATURES OF ADULT MEDICAL
AND SURGICAL PATIENTS

by
Marie Ardith Smeltzer

An Abstract of a Thesis
in Partial Fulfillment of the Requirements
for the Degree Master of Science
in the Field of Nursing

January 1968
ABSTRACT

The purposes of this study were: (1) to find out if it is necessary to check temperatures of adult medical and surgical patients as frequently as it has been done in the selected hospital; and (2) to show that factors of beginning elevations can be identified without checking patients' temperatures more than once daily.

A survey was conducted of fifty-nine adult medical and forty adult surgical patients' temperatures from the time they were admitted until they were discharged or for ten days. A total of 2,484 temperatures were studied. Most of the patients had their highest temperatures at 8 p.m.

Ninety-two percent of the temperatures were normal and 8 percent were elevated. Of the 190 elevated temperatures, 147 were those of surgical patients and 43 of medical patients, although the medical group was larger.

Most of the elevated temperatures for the medical patients occurred during the first three days after admission. The surgical patients had most of their elevated temperatures during the first three days after surgery.

Twenty-five patients who had beginning elevations of temperatures were seen. The patients with temperature elevations that did not go to 100 degrees Fahrenheit or above did not exhibit as many symptoms of fever as did those with temperatures of 100 degrees or more. Causative factors were more pronounced for those patients who had elevated
temperatures that went to 100 degrees or more. Surgery and blood transfusions seem to be the main therapeutic procedures causing elevations although patients with phlebitis after receiving intravenous fluids and after radiation therapy also exhibited symptoms of fever.

It was concluded that temperatures taken once daily at 8 p.m. would be sufficient except for the first three days after admission or surgery or if the patient's condition warranted its being taken more often.