Recovery Periods After Bathing Activity in Ten Post-Laminectomy Patients

A Thesis

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Chapter One

Introduction

Some basic assumptions of life: we all need to sleep, rest, to have activity, human interaction, and food. These are all confirmed by observation of our everyday life. Perhaps less obvious is our need for a balance in all things. We are all familiar with the admonition to eat a balanced diet; fewer of us heed it.

The role of balancing the input and output of daily life has not escaped the attention of nurse theorists. The dynamic balance of life is implicit in Rogers' Science of Unitary Man (1970, 1980). Levine (1967) defines the role of the nurse to be one of facilitating the balance of patients' needs and abilities. Watson (1979) identifies the activity-inactivity need as basic and fundamental to human existence. Rest is included as a form of inactivity in Watson's conceptualization and is seen as a means of replenishment of energy. The balance of energy expenditure and energy restoration is the essence of the activity-inactivity need.

A basic assumption in nursing is that human needs change during illness or injury. According to Watson, "the major function of the practice [of nursing] is dependent on the success or failure of helping others in their efforts to gratify their human needs" (p. 106). In order to assist in gratification of basic needs, the nurse must have an understanding of what those needs are, what activities are encompassed by them, and what actions external to the patient (in the environment) will facilitate their fulfillment.

Nursing research has as its mission the development of a scientifically based body of knowledge which can be utilized during the practice of nursing. The translation of research findings of nursing and of other disciplines (e.g. physiology, psychology) into practice relevant principles for nursing is a part of this overall mission. This research project has as its goal the identification of specific recovery periods exhibited by patients after performance of particular activities of daily living.

The long term goal of this investigative program, to be achieved through a series of future studies, is the development of a research-based protocol for a progressive activity program for use in inpatient acute care settings. This protocol will provide guidelines for the staff nurse who is responsible for monitoring and advising patients regarding their activity and rest needs during the immediate post-acute phase of illness, injury, or surgery. The progressive nature of the protocol will allow for activity and rest recommendations to be made for the time span beginning with hospitalization and including post-hospitalization recovery.

One factor which is not included for consideration in the present study is the influence of psychological variables on a person's need for rest and activity. It is anticipated that future work in this research program will include the influence of psychological variables on a person's need for rest and activity and that the final protocol will involve assessment of such parameters prior to activity and rest recommendations.

Statement of the Problem

The lack of patient activity on many acute care nursing units is clear to even the casual observer. Once patients are self sufficient with their activities of daily living and are physiologically stable, they are often left on their own in favor of those who are in greater need. There are no standardized activity schedules in the literature to guide nursing practice in activity management. Patient activity levels are occasionally ordered by the physician but are more often left to the discretion of the nurse or patient.

In order to provide an understanding of the basic need for energy expenditure and energy restoration, a review of the literature regarding the physiological effects of bedrest, energy requirements for specific activities, and rest periods and activity programs will be presented. The following chapters include a description of the methods and design of the study followed by data analysis procedures, results and discussion.

Complete data for each subject and the forms used during during data collection are included in the appendices.

Review of the Literature

Physiological Effects of Bedrest

Early work.

The physiological effects of bedrest have been identified in the nursing and medical literature for over forty years (Deitrick, Whedon, and Schorr, 1948; Dock, 1945; Greenleaf & Kozlawski, 1982; Leithauser, Gregory, and Miller, 1966; Olson, 1967; Rubin, 1988; Wenger, 1984b). The negative impact of bedrest and immobility on the cardiovascular, respiratory, and musculo-skeletal systems includes decrease in performance in all areas of functioning. Overall muscle wasting and bone demineralization, alterations in cardiac functioning, the formation of thrombi, decreases in lung volumes, and the inability of the body to adapt to activity demands are only some of the clearly identified sequelae of bedrest (Bonner, 1969; Browse, 1965, Chobanian, Lille, Tercyak, & Blevins, 1974; Deitrick et al., 1948; Greenleaf, 1984; Kottke, 1966; Saltin, et al., 1968).

Staying in bed beyond the period required for restoration of energy and relief from simple fatigue is not generally a health enhancing behavior. Moreno and Lyons (1961) identified an immediate effect of lying flat in bed as being a decrease in lung volumes. Tyler (1984) correlates the decrease in lung volumes with the drop of mean arterial oxygen tension (PaO_2) (103 to 94) that Cardus (1967) found in his study of seven normal young men put to bed for ten days. This drop in oxygen tension is clinically insignificant in a healthy person but could be a serious complication in an ill person with already low oxygen saturation levels (SaO_2). In a now classic study, Saltin et al., (1968) examined the effects of 20 days of bed rest and subsequent training on a sample of five healthy young men. These researchers reported related findings of a 28% decrease in mean maximal oxygen uptake (VO_2max). They also reported mean decreases in total blood volume, cardiac output, stroke volume, and lean body mass. The most significant documentation provided by this study was, however, the clearly identifiable decrease in work (exercise) performance by all subjects at the end of the period of bedrest.

The aged and those with heart failure suffer decreased respiratory compliance when assuming a supine position (Browse, 1965; Light, 1984). According to Browse, the diameter of the bronchioles is reduced when supine. The layer of mucous lining thickens, ciliary action is detrimentally affected and the potential for pneumonia increases.

Kottke (1966) quantified strength lost with immobility stating that it was lost at a rate of 3% per day in the inactive muscle. He identified correct balance and posture as an important factor in maintaining mobility and emphasized that without use physiological functions fail.

In an early study using urinary mineral excretion as an estimator of calcium lost from bone during bedrest, Issekutz, Blizzard, Birkhead, and Rodahl, (1966) reported that a daily exposure to gravitational stress of three hours seemed to prevent calcium loss in a group of young normal subjects. Krolner and Toft in 1983 used dual photon absorptiometry to document significant (1% per week) vertebral bone mineral loss in their patient population placed on simple bedrest for a mean of 27 days. These patients were hospitalized for conservative (bed-rest) treatment of low backache due to protrusion of a lumbar intervertebral disc. It is interesting that during this study patients were allowed bathroom privileges and they performed supine exercises. Neither the bathroom privileges nor the supine exercises halted the bone mineral loss. Re-ambulation reversed the decline in bone mineral loss again supporting the thesis that gravitational stress was the main factor in preventing disuse osteopenia (Krolner & Toft, 1983).

Fareeduddin and Abelman (1969) found impaired orthostatic tolerance in post myocardial infarction (MI) patients on strict bedrest for 9 to 24 days. Patients on a regimen of modified bedrest did not exhibit orthostatic intolerance in this study. Modified bedrest was defined as performing active leg exercises in bed, use of the bedside commode, and sitting at the edge of the bed. It should be noted that the patients following the modified bedrest regimen experienced gravitational stress on their long bones due to weight bearing several times per day. Impaired orthostatic tolerance in a sample of normal men placed on bedrest had previously been described by Deitrick et al., (1948). Deitrick also documented calcium and nitrogen excreted in significant quantities by his subjects during immobilization.

The space age.

With the onset of human space travel, scientists realized that space travellers suffer symptoms similar to those exhibited by people who had been on prolonged bedrest. By the 1970's, research related to zero gravity adaptations of the body and work done regarding the effects of bedrest and prolonged immobility were complimenting one another. The mechanisms of the cardiovascular symptoms (orthostatic intolerance, tachycardia, and decreased VO_2 max, with related decrease in work performance) were being sought not only for the benefit of patients but to further our potential in space.

In a study with broad scope, Chobanian et al. (1974) examined the effect of two to three weeks of bedrest on electrolyte and fluid balance, renin - aldosterone activity, catecholamine metabolism, vascular reactivity, and cardiovascular hemodynamics in six normal adult men. Among the findings were tachycardia, decreased ventricular ejection time, reductions in central blood volume, decreased stroke volume, and increased peripheral resistance with a 70° tilt at the end of the period of bedrest. Renin-aldosterone activity and catecholamine metabolism were essentially unchanged and normal during the study. These findings pointed away from nervous system involvement in the hemodynamic changes now commonly found upon reambulation after bedrest.

By 1979 data were building which indicated that at least some of the well documented cardiovascular responses resulting from both bedrest and exposure to zero gravity were related to fluid shifts from the periphery to the trunk. Nixon et al. (1979) determined that the cardiovascular adaptations to zero gravity conditions were essentially established by the end of six hours. They documented a rise in central venous pressure (CVP), a significant central fluid shift with a decrease in leg fluid volumes, reduction in total blood volume, reduction in mean VO_2 max and the now typical decreased work (exercise) performance post bedrest.

In a study designed to distinguish between the influence of two factors of prolonged bedrest (physical inactivity and lack of exposure to upright gravitational stress) Convertino, Hung, Goldwater, and DeBusk (1982) examined the cardiovascular responses of 12 middle aged men after 10 days of bedrest. Their conclusions, based on the subjects' response to upright and supine exercise testing, were that the typical response of decreased exercise performance was due primarily to orthostatic factors and not to the reduction of physical activity. These orthostatic factors were isolated to cardiac underfilling by the same researchers (Hung et al., 1983) using echocardiography. Further studies have supported the hypothesis that the cardiovascular aspects of the phenomenon of bedrest deconditioning are primarily the result of the body adapting to the central fluid shift resulting from the assumption of the supine posture (Convertino, Goldwater, & Sandler, 1984; Convertino, Sandler, Webb, & Annis, 1982; Gaffney et al., 1985).

A clear limitation to many of the above studies is the fact that they were performed with young, healthy subjects. In attempts to further the understanding of these phenomena related to physiological responses to bedrest, several investigators have undertaken studies with middle aged subjects (Bloch, Maeder, Haissly, Felix, & Blackburn, 1974; Convertino, Hung, Goldwater, & DeBusk, 1982; Gaffney et al., 1985). Findings of these studies point to a more rapid deterioration of cardiovascular responses in the older population. Other changes with aging have already been mentioned.

The differences in physiological responses between men and women is another area which has received minimal attention from researchers. In one of the few studies examining the responses of both men and women to exercise after prolonged bedrest, Convertino, Stremel, Bernauer, and Greenleaf (1977) found an increase in the variability of cardiovascular response in female subjects when compared to the responses of the male subjects. One limitation of the study is the different group size, eight young women versus fifteen young men. Another which must be considered, given that fluid volume shifts are being implicated in altered cardiovascular responses to prolonged bedrest, is the role of hormonal and menstrual cycles in the response of women. Women have served as subjects in some of the studies described below examining oxygen consumption and energy requirements during certain activities.

Energy Requirements for Specific Activities

Nurses and allied health personnel have been involved in examining the amount of energy consumed by patients and normal control subjects during certain activities of daily living (ADLs). In an early study, McCarthy (1968) found that the energy expenditure of five normal, healthy female subjects did not differ significantly when measured in five different body positions. She examined parameters of oxygen uptake, heart rate, and respiratory function values and concluded that the energy requirement for any of the studied positions need not be a consideration in positioning a patient. In 1975 McCarthy again examined energy expenditure using oxygen uptake as a primary measurement. In this study the activity analyzed was range of motion (ROM) exercises. Her subjects were eleven normal young (20 - 33) women. She found a significantly greater amount of energy expended by subjects during active ROM when compared to passive (assisted) ROM. She reported a linear relationship between heart rate and oxygen uptake, pointing the way for further studies to determine the consistancy and reliability of this relationship.

In their descriptive study with male MI patients as subjects, Halpenny and Wills (1977) examined oxygen uptake and cardiovascular responses to dressing and walking. The walking was done in two three minute bouts on a treadmill at a steady speed. The dressing was done from hospital garb to street clothes. Standard metabolic equivalent term (MET) levels for both activities were calculated for this population from the data. The calculated values were found to be very close to the values given in the literature and were all less than three MET's, indicating very low level activity. One MET is defined as the basal oxygen requirement of the body at rest, equal to 3.5 ml per kg per minute (Greer, Weber, Dimick, and Ratliff, 1980). Standard MET levels for various activities continue to be determined and documented (Exercise Equivalents, n.d.).

Jackson and Kinney (1978) contributed to the developing database of energy expenditure in relation to the assumption of common patient positions and modes of patient transfer. They used oxygen consumption as an indicator of energy expenditure and documented a correlation between oxygen consumption and heart rate and blood pressure measurements. Their subjects were 34 normal, young to middle aged (21-46 yrs) women. Based on the variability of their results, Jackson and Kinney questioned whether heart rate and blood pressure were sufficient parameters to assess patient response to activity. It was their position that expenditure of energy needed to be included in the assessment. This is supported by the recommendations of Amundsen (1979), who suggested that knowledge of the MET level of a particular activity be utilized in addition to the patients' physiological responses when assessing a person's activity tolerance. The variability found in the results documented by Jackson and Kinney also supports the work by Convertino et al, (1977) mentioned earlier in which the variability of results for female subjects was greater than that of the male subjects.

Geden (1982), using a sample of 14 healthy female nursing students, examined the energy expended during various modes of lifting and transferring. She used parameters of oxygen consumption, heart rate, blood pressure, and respiratory rate. She found that a variety of assisted transfer modes actually required more energy expenditure on the part of the subject when compared to self transfer.

In examining the responses of normal control subjects and acute MI patients to various modes of bathing, Winslow, Lane, and Gaffney (1985) determined that the physiologic cost of tub, basin, or shower bathing was similar for both male and female control and patient groups. They also concluded that differences in responses to bathing were a function of subject variability and not bath type. They recommended further studies to identify patient groups at high risk for excessive responses to the various modes of bathing.

Determining energy expenditure during a variety of exercises is also within the domain of the physical therapists. Amundsen (1979), DiCarlo and Leonardo (1983), and Greer, et al. (1980) have suggested using heart rate, blood pressure, and physiological responses as well as a knowledge of the MET level of the activity in determining a safe level of exercise for patients. MET's have enjoyed increasing use as a measure of oxygen consumption. Activities of daily living are commonly rated at between one and three METs.

Rest Periods and Activity Programs

Activity and deconditioning.

There is a distinct lack of activity guidelines in the literature for all patients except those hospitalized with an acute MI. The area of cardiac rehabilitation has extended itself into the acute and critical care areas. In many facilities, patients are begun on rehabilitation protocols within 24 hours of admission. Much of the literature cited in this study regarding the hazards of bedrest and the benefits of early ambulation was originally directed at the cardiac population.

During the early 1970's several controlled studies were done to examine the comparative benefits of early activity and early ambulation for the cardiac patient. Without exception, the results pointed to experimental groups with decreased disability, both physical and psychological, at the end of hospitalization and after discharge (Bloch, Maeder, Haissly, Felix, & Blackburn, 1974; DeBusk, Spivack, van Kessel, Graham, & Harrison, 1971). By the late 1970's, early ambulation was accepted as a component in the standard treatment of MI patients (Wenger, 1984a, 1984b).

The nursing literature has had scattered recommendations urging staff nurses to provide activity-exercises for their patients to decrease the sequelae of immobility (Kelly, 1966; Winslow & Weber, 1980; Ziegler, 1980). Nowhere to be found is an adaptable, progressive activity protocol based on researched knowledge suitable for use with the general patient population.

A 'Geriatric Program' using a multidisciplinary team approach was described by Rogers (1983). The focus of the program was the "prevention of deconditioning, improvement of motivation and endurance..." (Rogers, 1983). A significantly decreased length of stay and an increase in the number of patients able to return to their pre-hospitalization living situations was noted.

In an attempt to determine whether exercise conditioning was more effective than simple resumption of activities in restoring functional capacity after bed rest, DeBusk, Convertino, Hung, and Goldwater (1983) studied the responses of 12 healthy middle aged men who had been confined to bed for 10 days. They determined that restoration of functional capacity was a factor of exposure to usual activities and the accompanying orthostatic stress and that increased levels of activities of an exercise program were not advantageous.

Rest prescriptions after activity.

An area of study which needs further documentation before a research based protocol can be developed is the area of rest prescriptions after activity. The physiological basis of the need for rest after strenuous activity was first documented by Müller (1953). In an attempt to determine the physiologic response to work with varying length work-rest periods, Patterson, Pearson, and Fisher (1985) had young, normal, male and female subjects perform work in 30 second, two minute, and six minute bouts with equal length rest periods interspersed. They found work done at the same metabolic work load (i.e. 80% of VO_2 max) in short (30 sec) bouts resulted in significantly lower heart rate (HR) and blood pressure (BP) than work done for longer periods (six minutes). The implication of these findings is that cardiac work load can be substantially reduced by performing work in short bouts with short rest periods. This is one of the few studies examining work rest periods with short bursts of work interspersed with rest. Further substantiation of the findings with a larger subject group as well as with non-normal subjects is needed.

Observing severely injured neurological patients, Mitchell and Mauss (1978) found that a period of time was required after nurse patient activity before the patient's intracranial pressure (ICP) returned to baseline. They suggested that nurses allow patients a rest period after single activities and not cluster activities in order to keep ICP levels from peaking dangerously. In a study published in 1981, Mitchell, Ozuna, and Lipe found a cumulative increase in ICP with activities spaced fifteen minutes apart. There was no cumulative rise in ICP with activities spaced one hour apart. They recommended consideration of these findings when planning care for severely ill patients.

Bruya (1981) also studied periods of rest after nursing activities with severely compromised neurological patients. With a design that allowed for 10 minute rest periods in between nursing care activities, she found no difference between the ICP level of the experimental and control (no planned rest periods) groups. One possible explanation offered by Bruya was that the 10 minutes was an insufficient rest period; patients may require longer times to recover from activities. Another explanation involved the definition of rest used in the study. It was proposed that merely leaving patients unattended was not sufficient to provide for their rest.

Working with male post myocardial infarction patients, Alteri (1984) identified recovery periods after shower, walk, and stair climb activity. Using measurement parameters of heart rate and blood pressure, she found definite trends in recovery time, with the recovery time after shower being the longest at approximately 25 minutes. She recommended that these recovery periods serve as guidelines in prescribing rest periods after activity for the post MI patient.

A definition of rest is difficult to find in the literature. Bruya (1981) provided one of the few conceptual examinations of rest found in the research literature. She pointed to the lack of distinction usually made between sleep and rest, and that most of the research which has been done has focused on sleep. Other factors which have prevented the study of rest include the multifarious ways in which people rest. To some, rest is gardening, to others it is reading, and to others only sleep qualifies as rest.

That rest is difficult to obtain while in the hospital is not usually considered by hospital workers. Holmes and Winch (1984), themselves hospital administrators, wrote a letter regarding the difficult time one of them had in obtaining 'rest' while hospitalized. While they did not offer a definition of rest, they did mention some of what they perceived as deterrents to rest. These included long waking hours, intrusions of others into their personal space (the private room), and multiple visits from medical and nursing personnel.

In an early attempt to urge nurses to consider the patients' perceptions of rest, Narrow (1967) reviewed various components of and attitudes toward rest. These included feeling cared for, a sense of peace and order, familiar routines and belongings, being in control, particular activities including naps and sleeping late, and freedom from embarrassment. It can be seen that being in the hospital is not generally conducive to the attainment of these states.

In a recent study to determine the effect of napping on mood when compared to quiet awake resting, Daiss, Bertelson, and Benjamin (1986) found that both napping and resting improved subjects' mood when compared to the control group. These researchers made no attempt at a formal definition of rest other than 'lying quietly'.

As was mentioned in the introduction, one of the few nurse educators/theorists to consider the topic of rest is Watson. In her work Nursing: The Philosophy and Science of Caring, she classifies the activity-inactivity need as a lower order psychophysical need (Watson, 1979, Ch.7). Both activity and inactivity are necessary to a balanced existence. Inactivity manifests itself in a variety of ways; of these, rest is only one. Others mentioned by Watson are relaxation, sleep, meditation, and reading. Nurses are urged to pay attention to verbal and non-verbal cues when assessing a person's need for activity and inactivity. They are also urged to work with their patients to determine what is restful or need fulfilling for them. Watson presented the following definition of rest: "a de-accelerated state of physical and mental activity in which there is less energy utilization because there is less energy output and input. During rest, energy is conserved and restored" (Watson, 1979, p.160).

As has been mentioned previously, certain researchers have begun to examine the concept of physiological recovery periods after activities (Alteri, 1984; Bruya, 1981; Patterson et al., 1985). Alteri (1984) defined an adequate rest period after each particular activity to be the amount of time needed for a return of vital signs to baseline values for 90% of her subject population. With the establishment of such values for large populations of patients with varying diagnoses and varying activities, the determination of appropriate activity-rest prescriptions should be possible.

An understated priority in nursing has been the supervision of appropriate activity-rest patterns in recovering patients. The balance of activity-rest in humans is subject to multiple variables. It is well known that the body's need for rest changes with illness and exposure to stress. Rest and activity needs are observed to change with age. With further research, determination of physiological recovery periods in different populations will facilitate the development of guidelines for activity and rest in hospitalized and recovering adults.

Tables 1 and 2 which follow list the most pertinent research studies reviewed earlier.

Table 1

Activity / Inactivity: Related Research Findings

1948	Deitrick, Whedon, & Schorr document impaired orthostatic tolerance, increased calcium (and other mineral) excretion, and decreased "fitness levels" after six weeks of bedrest.
1961	Moreno & Lyons report decreased lung volumes on assuming the supine position after studying the changes in lung volumes resulting from the assumption of various postures.
1966	Issekutz, Blizzard, Birkhead, & Rodahl document increased Ca^{++} excretion with prolonged bedrest prevented by daily three hour exposure to gravitational stress (experienced when standin and walking).
1968	Saltin et al., document increased Ca^{++} excretion, decreased lung volumes, and decreased mean maximal oxygen uptake (leading to decreased exercise performance) during and after prolonged bedrest.

Table 1 (cont.)

Activity / Inactivity: Related Research Findings

1969	Fareeduddin & Ablemann document orthostatic intolerance in 18 subjects on complete bedrest, no orthostatic intolerance in eight subjects following a modified bedrest regimen.
1982	Convertino, et al., isolate the factor primarily accounting for the decrease in mean maximal oxygen uptake to orthostatic factors (particularly cardiac underfilling) with the decrease in physical activity playing a lesser role.
1985	Gaffney, et al., determine that the cardiovascular deconditioning (orthostatic intolerance, tachycardia, decreased mean maximal oxygen uptake) after bedrest is primarily the result of the central fluid shift that occurs when assuming a supine position.

Table 2

Rest Needs: Related Research Findings

1954	Muller documents the need for rest periods during heavy work.
1978	Mitchell & Mauss (working with severely compromised neurological patients) document that a period of time is required after (ICP) nurse-patient activity before a patient's intracranial pressure returns to baseline levels.
1981	Mitchell, Ozuna, & Lipe document a cumulative rise in ICP during nurse-patient activities spaced 15 minutes apart, no cumulative rise in activities spaced an hour apart.
1984	Alteri documents the occurrence of periods of elevated vital signs after three different activities in post myocardial infarction patients.
1985	Patterson, Pearson, & Fisher find that short (30 sec.) periods of work interspersed with short periods of rest results in significantly lower heart rate and blood pressure than same intensity work for longer (six min.) periods with longer rest periods.

Chapter Two

Conceptual Framework

The model supporting the long term research program of which this project is a first step is based on the need for balance between activity and rest, particularly in persons recovering from acute illness, surgery, and other forms of stress (Fig. 1). The determination of adequate rest periods for recovering patients is a necessary prerequisite to the development of an activity-rest protocol adaptable to acute care patients. The use of low (metabolic) level activities such as activities of daily living will form the basis of the activity prescriptions. Walking will be used as a progressive activity which provides gravitational stress as well as mild cardiovascular conditioning.

Rest requirements are seen as being the same as the recovery time from activity experienced by patients. As overall activity level decreases, deconditioning results and recovery time and rest needs increase. As overall activity levels increase and the person becomes more physically fit, recovery times and rest needs decrease. Illness, injury, and surgery are identified as events which decrease a person's overall activity level and lead to deconditioning. These same events may increase a person's rest needs regardless of the effect they have on overall deconditioning.

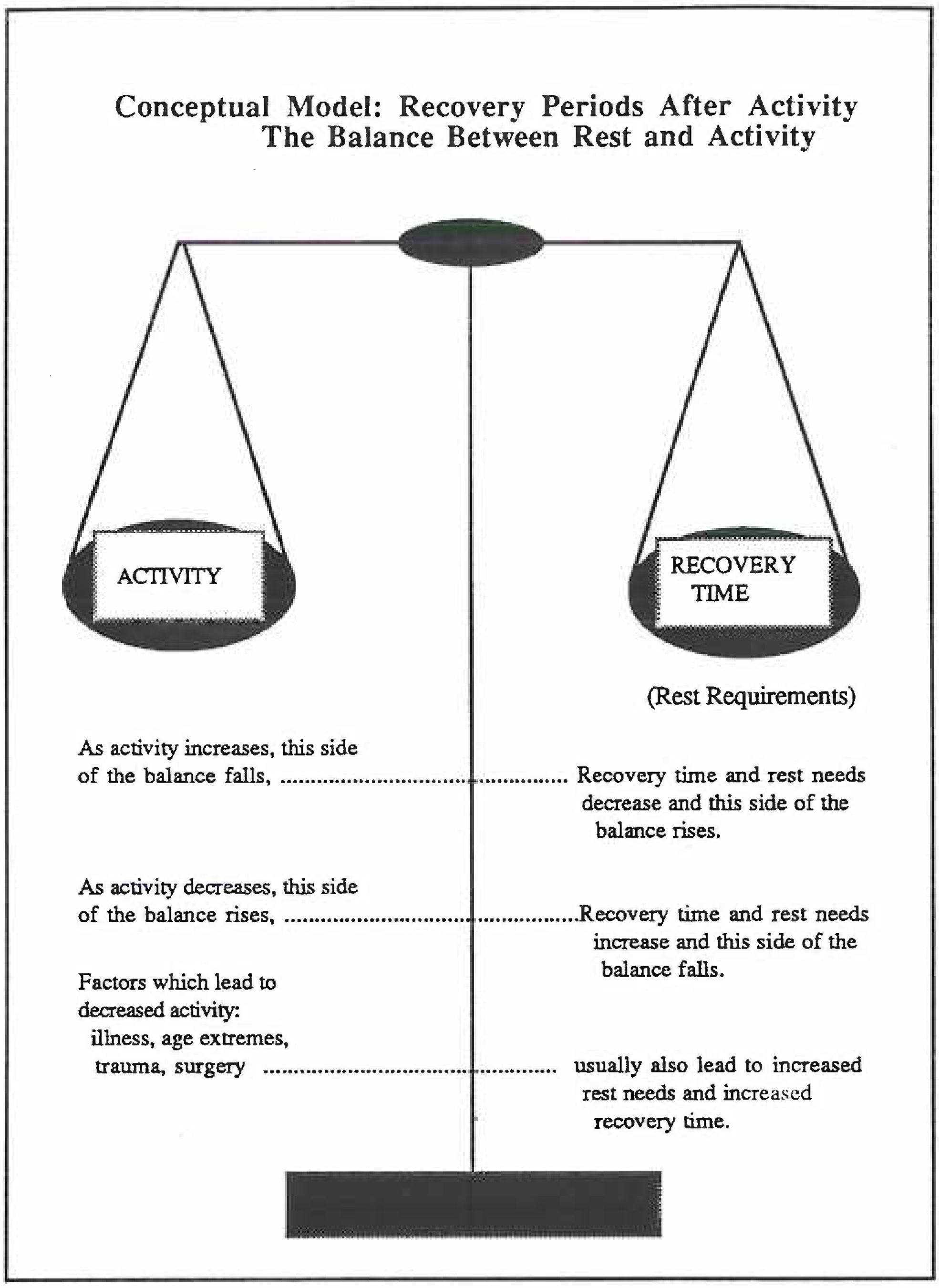


Figure 1.

Conceptual Model: The Balance between Rest and Activity

Definitions

For the purposes of this study, the following definitions are being used:

- Activity is defined as active participation in any task.
- Rest is defined as quiet sitting or lying with minimal external stimulation.
- Recovery period is defined as the period of time after performance of an activity during which the vital signs return to baseline values while the patient is sitting or lying quietly.
- Pressure rate product (PRP) is defined as systolic blood pressure times heart rate. PRP is used as the statistical parameter indicating the level of myocardial oxygen consumption in order to compare the findings of the present study to previous work by other researchers.
- Recovery point in the clinical area is defined as the point at which the subject's vital signs return to baseline values or level out.

Hypotheses

1. Post surgical laminectomy patients will exhibit a difference in recovery time after bathing activity on each of the three postoperative mornings.

2. The number of days after admission will be positively correlated with the length of recovery time on each of the three postoperative mornings.

Chapter Three

Methods

Subjects and Setting

The setting for this study was a neurological unit of a 300 bed private hospital and medical center in the Pacific Northwest. This setting was chosen because the principal investigator had been invited to conduct the study on the neurosurgical nursing unit by the unit's head nurse.

Nonprobability convenience sampling was used to obtain ten patient volunteer subjects. Inclusion criteria were:

- adult between the ages of 30 and 60,
- within the first three days postoperative after laminectomy surgery,
- temperature less than 102° Fahrenheit (F) (38.9° C) at the time of testing,
- without febrile illness for the 48 hours prior to testing,
- not on β-blocker medication.

In order to control for physiological circadian differences, only subjects who usually bathed and were active in the morning were included in this study.

The study included ten subjects. There were five men and five women in the study. The age range was from 27 to 57 years old; the mean age was 44.5 ± 9.3 (s.d.). The mean age for the male subjects was 43.4 ± 7.3 (s.d). The mean age for the female subjects was 45.6 ± 11.8 (s.d.).

All subjects had lumbar laminectomies. Four subjects had surgery on their first hospitalized day. Four subjects had surgery on their second hospitalized day and two had surgery on their third hospitalized day. Those subjects who had surgery on hospital days two or three had diagnostic studies, usually myelograms, on the pre-surgery days. The mean length of time under anesthesia was 1.94 ± 0.56 hours. Individual subject data is summarized in Table 3. All subjects received a 24 hour course of antibiotics immediately after surgery and pain medication on an as needed basis. No patient was on maintenance medication prior to or during hospitalization.

Review and approval was obtained from the Committee on Human Research of Oregon Health Sciences University, the Institutional Review Board and the Nursing Research Committee of the hospital. Oral presentations were made to the attending neurosurgeons and to the staff nurses working on the unit on which the study took place. The surgeons signed permission statements granting the investigator permission to approach their patients for inclusion in the study. A copy of this form is included in Appendix A along with the consent form signed by the subjects. The subjects gave informed consent. Verbal consent was obtained on the second and

Table 3

Individual Subject Data

SUBJECT	GENDER	AGE	SURGERY ON WHICH DAY OF HOSPITALIZATION	TIME UNDER ANESTHESIA (in decimal hours)
1	Male	45	1	2.00
2	Female	49	1	2.75
3	Female	57	1	1.50
4	Male	55	2	2.25
5	Female	53	3	2.33
6	Male	36	2	1.25
7	Female	42	3	1.50
8	Male	42	2	2.83
9	Female	27	2	1.50
10	Male	39	1	1.50
mean		44.5		1.94
		± 9.3		± 0.56
median			2	

third days of testing by each data collector. One subject declined to participate on the second and third day of testing.

Design and Procedures

The design of this study was descriptive. A descriptive design was chosen based on the lack of previously published data directly relating to the study question. As was indicated previously, there is little published research examining the physiological responses of patients to activity. The influence of surgery, acute or critical illness, or trauma on a person's need for rest has not been documented.

The data collection forms are included in Appendix B. Data other than the vital sign measurement were primarily narrative in nature. An ongoing account of the patient's activity was kept. Documentation was kept regarding who interacted with the patient and for how long. Periods of inactivity were also documented. It was the aim of this study to document patient response to standard nursing practice. It was the intention of the investigator that manipulation of the usual morning activities not occur. It became evident through the course of the study that the staff nurses were altering their activity somewhat in order to "not keep the data collectors hanging around all morning." The physiological consequences on the patient of this change in pattern could not be assessed.

Data collection protocol.

The subjects were approached by the principal investigator between 0700 and 0730 on the morning of their first postoperative day. The study was explained to them and their participation was requested. If they expressed interest in participating in the study at that point, a consent form was left with them for approximately fifteen minutes while the principal investigator reviewed their chart. [An alternate situation arose in approximately one third of the situations. All of the subjects were asked if they would prefer to read the consent form themselves or have it read to them. Approximately one third asked to have the form read to them and this was done by the principal investigator. All potential subjects were left alone for approximately fifteen minutes prior to being asked to sign the consent form in order to provide them with time to consider their decision.] If they agreed to participate and signed the consent form, they were tested that morning and on the two following mornings. Once the subject agreed to participate in the study, the principal investigator contacted the data collector for that morning who then came to the hospital.

The subject's primary nurse was informed by the principal investigator when the nurse finished with morning report of the subject's agreement to participate in the study. Prior to the onset of any activity for the day, the data collector obtained a baseline set of vital signs, including heart rate (HR), respiratory rate (RR), blood pressure (BP), and temperature (T) and the time was documented. If the time lapse between the onset of activity and baseline vital sign determination was greater than 20 minutes, a repeat observation set was taken immediately prior to the patient beginning his or her bath.

Temperature determinations were made using the oral route with the probe of an electronic thermometer placed in the posterior sublingual pocket at the base of the tongue. A digital pulse rate monitor was used in data collection with the first three subjects. At that point the pulse rate monitor became erratic and its use was discontinued. Pulse measurements were made using the radial pulse with final seven subjects. Pulse and respirations were counted by the data collector for 15 seconds and the result multiplied by four to obtain approximate values for one minute. Blood pressure was taken with a cuff sphygmomanometer placed one to one and a half inches above the antecubital space. Consistancy of limb use was maintained throughout a given morning with each patient. That is, if vital sign determinations were begun using the right arm, that arm was used throughout the session. All determinations were done in the following order: pulse, respirations, blood pressure.

Activities of the patient were documented from approximately 8:00 a.m. until 10:30 a.m. on the first three postoperative mornings. The type of bath was not a discriminating factor in subject inclusion. Winslow, et al, (1985) reported that energy consumption during three types of baths (basin, tub, and shower) is not significantly different.

Once the bathing activity had begun, the patient was not interrupted by the data collector. An observation set consisted of HR, RR, and BP. Observation sets were taken at any point during which the activity stopped for more than five minutes and the time and length of any breaks in activity were documented. Once the activity ceased, observation sets were taken every two minutes until the values returned to baseline. An effort to maintain each subject in a consistent posture was made during all observation set determinations. When this was not possible, posture changes were noted by most of the data collectors.

In addition to vital signs, documented data included amount of independent activity, where the bath took place (i.e. bed, sink, shower), time and duration of non-activity, movement away from the site of the bath (i.e. if the bath was done at the bedside, did the patient then get up and go to the sink to brush her/his teeth), bath related activity undertaken by the nurse, and other events and timing that were pertinent to the bathing activity and rest periods. If, in the usual routine, the patient was assisted by the nurse to sit in a chair after the bath, this was documented by the data collector and included in the data collection record.

In cases in which baseline values of vital signs were not achieved, data collection stopped when the data collectors obtained vital sign values within a designated range for five successive vital sign determinations. The designated range of acceptable variation for blood pressure was ± 2 mmHg. The designated range of acceptable variation for heart rate was ± 2 beats per minute.

Data collection instruments.

Data was collected by the principal investigator and four other data collectors. The first three patients were tested by the principal investigator. Subsequent subjects were tested by the four data collectors due to the principal investigator's inability to continue with the data collection.

Interrater reliability for vital sign determinations was based on the data collectors' repeated vital sign measurement of a trial volunteer subject. The data collectors gathered on a single occasion. Repeated simultaneous heart rate and respiratory rate measurements were taken for 15 second intervals. Radial pulse measurements were taken simultaneously by two of the data collectors for five repeated 15 second trials. If, at the end of the five trials there was any discrepancy, the five trials were repeated. All combinations of data collectors were tested. This procedure was repeated for respiratory rate measurements with all four data collectors participating in each trial. Each data collector took five consecutive blood pressure measurements two minutes apart. Trials were repeated until all blood pressure determinations within each set varied by no more than ± 2 mmHg. Each data collector practiced thermometer probe placement twice; eight successive temperature determinations were made with each data collector documenting her results without discussion. There was consistancy of temperature documentation among all data collectors. Overall interrater reliability for all measurements was calculated at 0.91 using the formula: number of identical recordings divided by the number of attempts. Interrater reliability for diary (narrative) data was not determined.

Data collection instruments included an initial subject screening form and a flow sheet to document vital signs, type and duration of independent activity, duration and timing of rest periods, and subject's physiological signs and symptoms. Copies of both forms are included in Appendix B.

Blood pressure was measured using a Propper aneroid sphygmomanometer and a Littman 'cardiac' stethoscope. The cuff sphygmomanometer was certified calibrated by the factory as long as the dial reads within certain visual parameters. This calibration was checked each day prior to the onset of data collection. The accuracy of the cuff sphygmomanometer was checked against a certified mercury manometer subsequent to data collection and was found to be accurate to within ± 4 mmHg.

Temperature was determined with an IVAC TempPlus Model 2000 electronic thermometer. The thermometer was calibrated using an IVAC 828A calibration plug each morning prior to the onset of data collection for that day. Calibration of the thermometer was also checked using a well stirred heated water bath and a certified thermometer prior to any data collection and after all data was collected. The thermometer was accurate to ± 0.1°F both prior to and after data collection.

Pulse rate was monitored on the first three subjects using a Model CT-1600 digital pulse rate monitor (IBS Corporation). Calibration of this machine was checked prior to the onset of data collection for each day using an 80-beats per minutes Cardiotach calibrator. Accuracy of the pulse rate monitor was guaranteed to ± 2% or 1 digit. This machine became non-functional after the third subject and subsequent subjects were measured using radial pulse determinations.

Recovery points were determined from the graphed data. Recovery time was determined by subtracting the time at the end of the bath from the time at the point of recovery. Analysis of variance was used to compare time to recovery on the three post-operative days. Pearson's Correlation Coefficient was used to identify a relationship between day of hospitalization and time to recovery. Statistical testing was performed using the statistical computer package CRUNCH.

Chapter Four

Results

Complete data were obtained on eight of the subjects. The first subject developed an ileus on the first postoperative morning. Data collection ceased on that first morning when the subject began vomiting. Data was collected uneventfully on the second day and data collection was completed on the third day without incident. The final subject declined to participate in the study on the second and third mornings. Reasons were not requested of the subject but he stated he "had too much pain."

Blood Pressure, Heart Rate, and Recovery Points

Vital sign data were collected on a total of 28 days. Postbath systolic blood pressure (SBP) increased on 24 and decreased on four of the 28 test days when compared to prebath values. Six subjects exhibited an increase in postbath SBP over prebath SBP on all of the three test days. The remaining three subjects exhibited variability in their SBP response after bathing, their postbath values increasing on some days and decreasing on others.

The range of postbath SBP increase over prebath SBP was two to 40 mmHg. The range of postbath SBP decrease from prebath SBP was from four to 32 mmHg. Postbath SBP increased over prebath SBP a mean of 10.7 ± 15.5 mmHg overall. Day one mean postbath SBP increased 7.8 ± 21 mmHg over prebath SBP. Day two mean postbath

SBP increased 9.1 ± 6.2 mmHg over prebath SBP. Day three mean postbath SBP increased 15.6 ± 15.5 mmHg over prebath values.

There were five test days on which subjects exhibited changes in postbath SBP greater than 20 mmHg. The subject with the largest drop in SBP after bathing (occurred on day one) was the same subject (#2) with the largest increase in SBP after bathing (occurred on day three). Examination of diary data describing those time periods revealed that on day one the subject received intravenous morphine sulfate five minutes after the baseline vital signs were taken. Twenty-five minutes elapsed after medication administration before the second set of vital signs were taken. It was this set, taken after the pain medication, which indicated the substantial drop in the subject's SBP. On day three this subject exhibited a 40 mmHg increase in SBP after bathing. Examination of diary data revealed that the baseline set of vital signs was taken with the subject lying in bed. The subject then showered independently and the immediate postbath vital signs were taken with her sitting on the side of the bed. It was this measurement with the subject sitting on the side of the bed which indicated the increase of 40 mmHg over the prebath measurement. The second postbath set indicated a 20 mmHg drop in SBP occurring immediately following a position change to the supine position.

Subject #1 exhibited a 28 mmHg increase in postbath SBP over the prebath value on day one. The postbath set of vital signs was taken immediately prior to the onset of vomiting by the subject. Subject #1 was the person who developed an ileus during the first day of testing. The seventh subject also exhibited a dramatic increase in postbath SBP (40 mmHg) on the first postoperative day immediately prior to the onset of vomiting.

The only other subject to exhibit an increase in postbath SBP greater than 20 mmHg over the prebath value was subject #4 on the third day of testing. Review of diary data in this case contained no information that contributed to an understanding of the change.

Postbath diastolic blood pressure (DBP) increased on 20, decreased on three and remained stable on five of the 28 test days when compared to prebath values. Three subjects exhibited an increase in postbath DBP over prebath DBP on all of the three test days. The remaining six subjects exhibited variability in their DBP response after bathing, their postbath values increased on some days, decreased or remained stable on others.

The range of postbath DBP increase was 2 to 20 mmHg. The range of postbath DBP decrease was from 8 to 24 mmHg. There was no discernible pattern in the postbath responses of diastolic blood pressure either across subjects or across days. Postbath DBP increased over prebath values a mean 6.1 ± 10.2 mmHg overall. Mean postbath DBP on day one increased 5.6 ± 14.2 mmHg over prebath DBP. Mean postbath DBP on day two increased 7.3 ± 5.7 mmHg over prebath values. Mean postbath DBP on day three increased 6.0 ± 9.4 mmHg over prebath values.

Subject #2 (mentioned in the presentation of SBP results) exhibited the largest drop in postbath DBP (24 mmHg) on postoperative day one following the administration of medication. This drop in DBP coincided with a dramatic drop in SBP reported above.

Examination of prebath and postbath heart rate (HR) values reveals that postbath HR increased on 19 out of 28 days, remained the same on six out of the 28 days and decreased on three of the 28 days. Three subjects exhibited an increase in HR on each of the three testing days. The remaining subjects exhibited variability in their HR response over the three testing days. Review of diary data revealed no contributing or common factors related to HR response.

The range of postbath HR increase was from two to 28 beats per minute. The range of postbath HR decrease was from eight to 14 beats per minute. Postbath heart rate increased over prebath HR values a mean 6.7 ± 10 beats per minute overall. The mean postbath heart rate on day one increased 7.2 ± 13.3 beats per minute over the mean prebath HR. The mean postbath heart rate on day two increased 6.7 ± 7.6 beats per minute over the mean prebath HR. The mean postbath heart rate on day three increased 6.1 ± 9.1 beats per minute over the mean prebath HR.

Subject #6 had the largest increase of postbath HR over prebath HR (28 bpm on day one). Examination of diary data in this case revealed no information that contributed to an understanding of the change in heart rate.

Postbath pressure rate product (PRP) increased on 26 and decreased on two of the 28 test days when compared to prebath values. Seven subjects exhibited an increase in postbath PRP over prebath PRP on all of the three test days. The remaining two subjects had increases in their PRP values on some days and decreases on others.

The range of postbath PRP increase over prebath PRP was 304 to 7200. The range of postbath PRP decrease was from 1632 to 4672. There was no discernible pattern in the postbath responses of pressure rate product either across subjects or across days. Postbath PRP increased over prebath values a mean 1945 ± 2255 overall. Mean postbath PRP on day one increased 2071 ± 3119 over mean prebath PRP. Mean postbath PRP on day two increased 1598 ± 1227 over mean prebath PRP. Mean postbath PRP on day three increased 2153 ± 2123 over mean prebath PRP. The sample means for prebath and postbath PRP are listed in Table 4.

Table 4.

Sample (Group) Means by Day

DAY	BASELINE TEMPERATURE	PREBATH PRP	POSTBATH PRP	TIME TO RECOVERY	
1	99.1°F	11674	13483	0.30	
	± 1.4	± 2171	± 4191	± 0.12	(s.d.)
	(37.3°C				
	± .8)				
2	98.5°F	10264	11619	0.33	
	± 1.1	± 2739	± 2452	± 0.17	(s.d.)
	(37.0°C				
	± .6)				
3	97.9°F	9816	11969	0.22	
	± 0.6	± 3026	± 3595	± 0.06	(s.d.)
	(36.6°C				
	± 0.3)				

Note: Time is reported in decimal hours.

Recovery point was determined during data collection to be the time at which the subject's vital signs returned to baseline values. In situations in which this did not happen, recovery was determined to have occurred at the point at which the data collector recorded five consecutive vital sign measurements within a designated range as outlined in the Data Collection Protocol. Recovery point for data analysis purposes was originally defined to be the point at which a given subject's PRP returned to baseline values. The difference between this definition and the definition used during data collection became problematic during data analysis. On seven out of 27 total data collection days, the PRP returned to baseline values and was used to determine the recovery point. On the remaining 20 days, PRP did not return to baseline and the original vital signs were referred to in order to determine recovery point. In all but two of those 20 days, when the original vital signs were examined, the recovery point based on the raw vital sign data was clear. In two cases, SBP returning to baseline values was used as the indicator of recovery as neither the PRP nor HR returned to baseline values.

Complete individual subject data for all subjects is included in Appendix C. Data for two subjects chosen as representative will now be reviewed.

Figure 2 is a graphic representation of the vital sign data of Subject #3 on her first post-operative day. Figure 3 is a plot of the calculated PRP for that same subject and day. The postbath SBP, DBP, HR, and PRP all increase over prebath values. The variability in the values for SBP and HR (Figure 2) during the recovery period is evident. The resultant variation in PRP is clearly seen in Figure 3. The recovery point (PRP = 6656) chosen in this case is very close to the baseline value (PRP = 6864). Examination of the data listing for the day reveals that the recovery point SBP and DBP were at baseline values and the recovery point HR was within two beats per minute of the baseline values (see Table 5). There is some question in this investigator's mind as to whether recovery was actually reached due to the wide fluctuations observed up to the point that data collection stopped.

The data from Subject 8 on postoperative day two is graphed in Figures 4 and 5. The postbath SBP, DBP, HR, and PRP all increase over prebath values. The SBP and HR decrease steadily as the time after the bath increases. The vital signs clearly come to a levelling off point. The recovery point is clearly identifiable although it is substantially below the baseline values. The recovery point is chosen at the point at which the PRP levels out. The vital signs for post-op day two for this subject are given in Table 6.

Table 5
Subject 3: Vital Signs and Pressure Rate Product, Post-op Day 1

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
8.47	96.4	(35.8)	66	20	104	60	6864
8.82	-	-	70	20	116	80	8120
8.85	-	-	68	16	116	80	7888
8.88	-	-	67	20	108	72	7236
8.92	-	-	66	16	110	74	7260
8.95	-	-	65	14	100	80	6500
9.03	-	-	64	16	100	80	6400
9.07	-	-	57	20	108	72	6156
9.10	-	-	58	16	108	72	6264
9.13	-	-	59	16	104	70	6136
9.17	-	-	64	16	98	70	6272
9.20	-	-	64	16	110	70	7040
9.23	-	-	54	12	102	64	5508
9.27	-	-	54	16	104	60	5616
9.30	-	-	64	16	104	60	6656

Note: TIME is documented in decimal hours (8.75 = 8:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure 2.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 3: Vital Signs versus Time, Post-op Day #1.

Figure 3.

Note: B = baseline, before bath

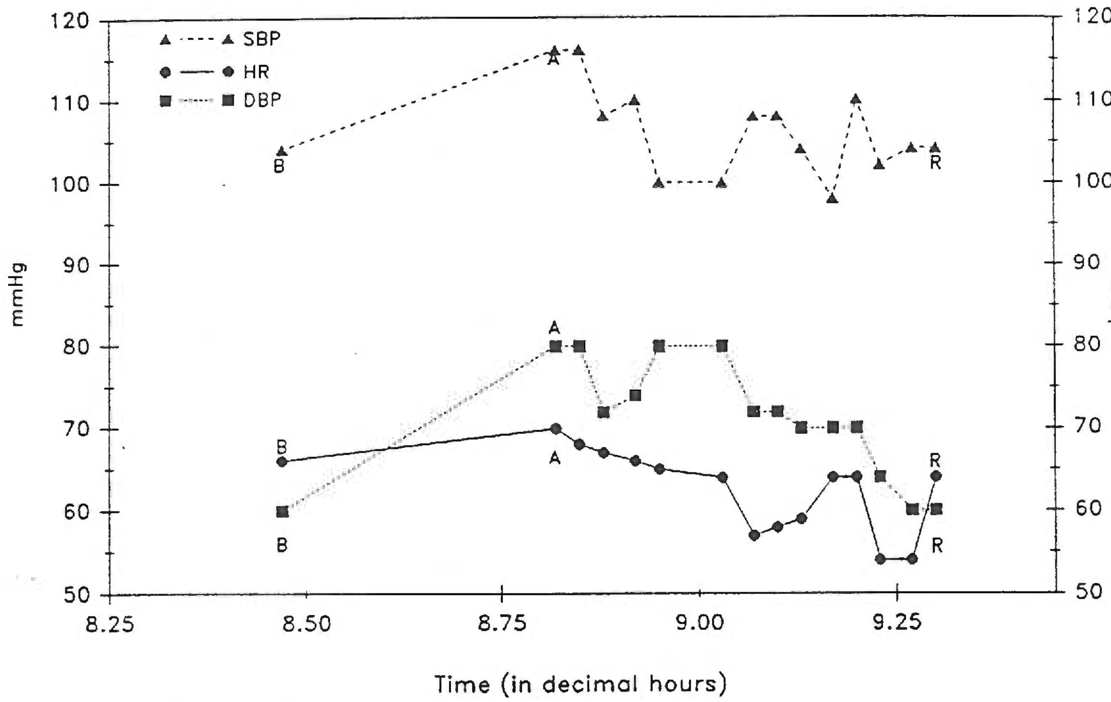
A = immediately after bath

R = recovery point

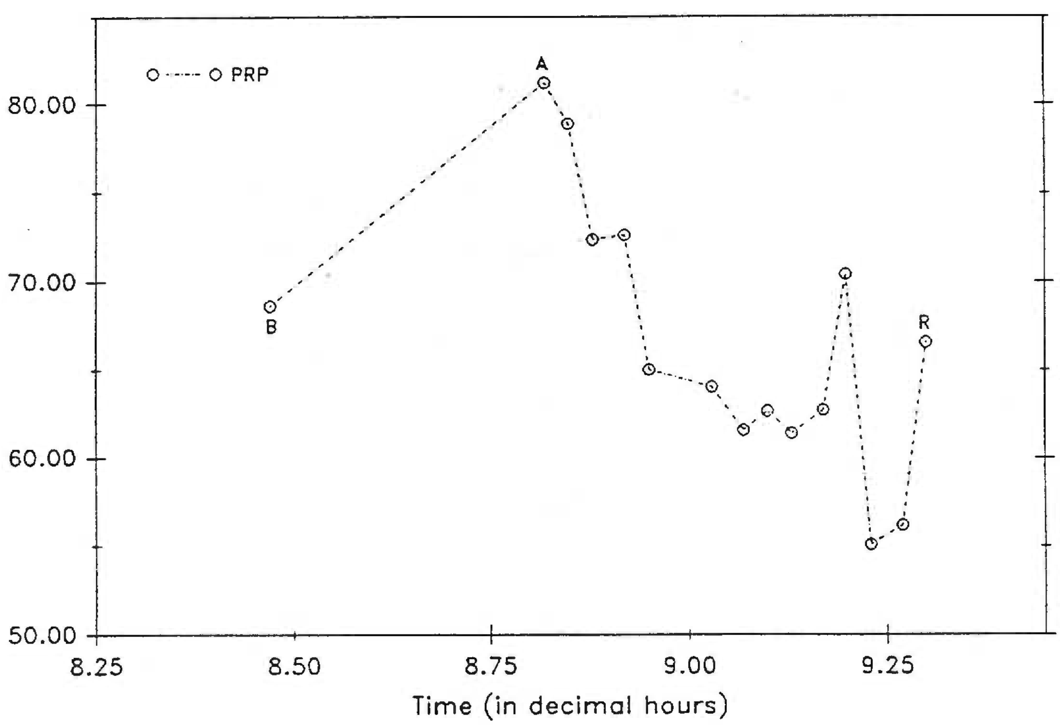
PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 3: Pressure Rate Product versus Time, Post-op Day #1.



SBP
HR
DBP
mmHg
bpm
120
110
100
90
80
70
60
50
8.25
8.50
8.75
9.00
9.25
Time (in decimal hours)



PRP
80.00
70.00
60.00
50.00
8.25
8.50
8.75
9.00
9.25
Time (in decimal hours)

Table 6

Subject 8: Vital Signs and Pressure Rate Product, Post-op Day 2

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
9.10	98.8	(37.1)	76	24	142	78	10792
9.70	-	-	78	24	150	80	11700
9.73	-	-	82	24	150	80	12300
9.77	-	-	76	20	144	80	10944
9.80	-	-	76	20	142	78	10792
9.83	-	-	72	20	140	80	10080
9.87	-	-	68	16	138	80	9384
9.90	-	-	64	16	138	80	8832
9.93	-	-	64	16	138	80	8832
9.97	-	-	64	16	138	82	8832
10.00	-	-	64	16	138	82	8832

Note: TIME is documented in decimal hours (9.75 = 9:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure 4.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 8: Vital Signs versus Time, Post-op Day #2.

Figure 5.

Note: B = baseline, before bath

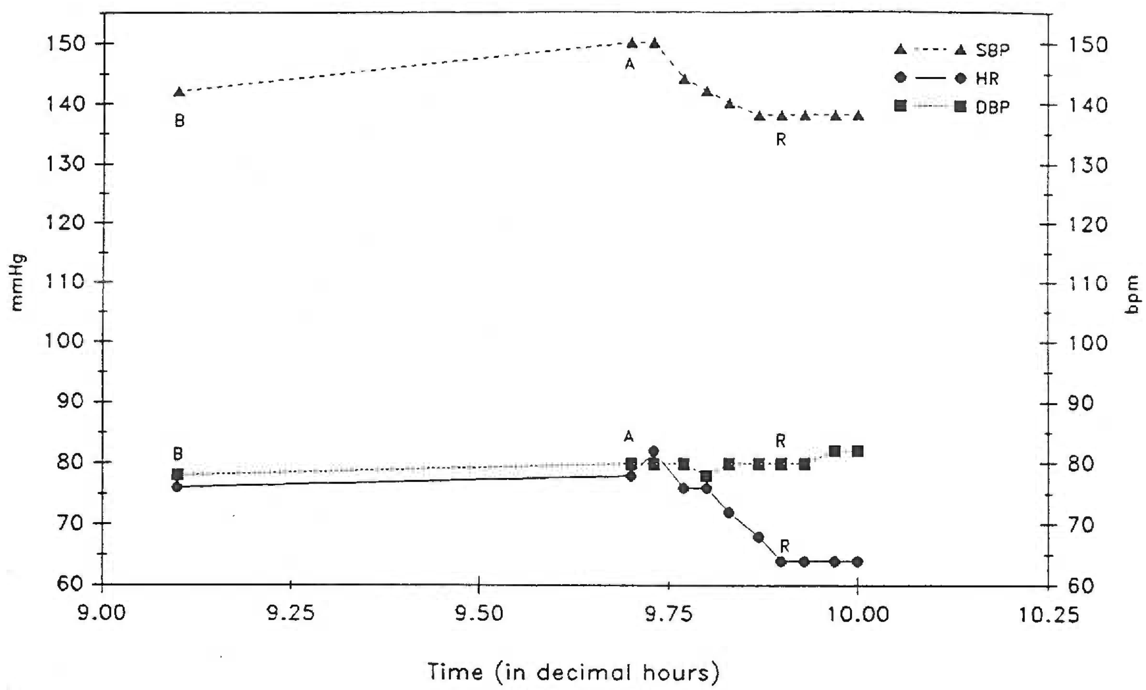
A = immediately after bath

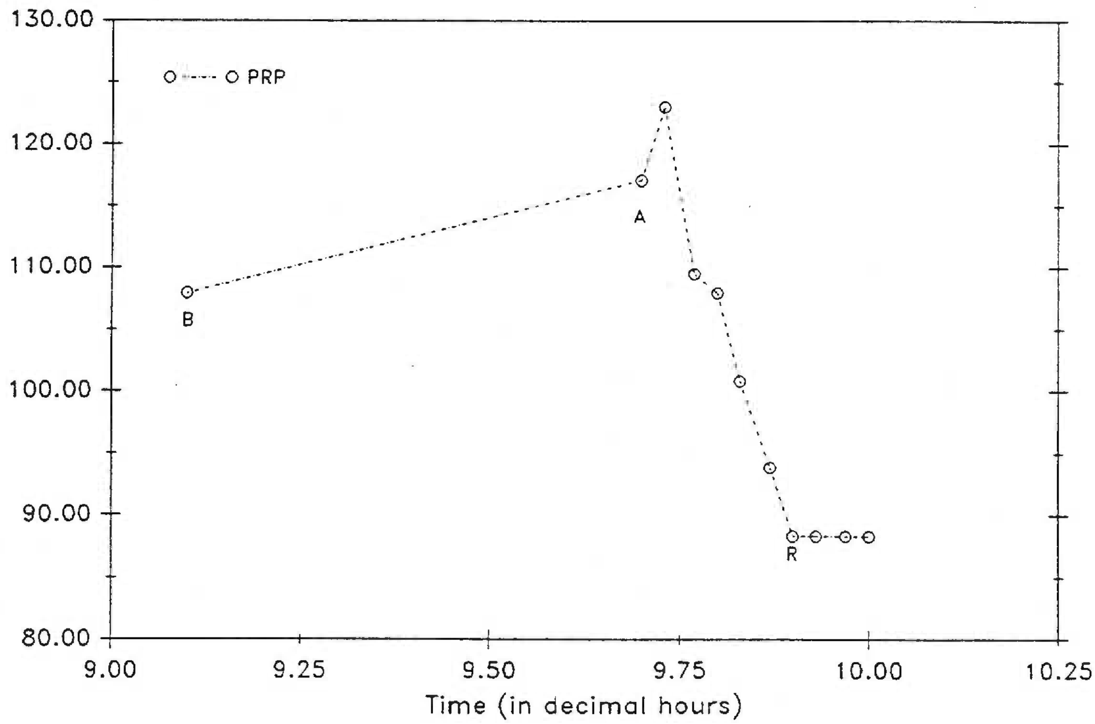
R = recovery point

PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 8: Pressure Rate Product versus Time, Post-op Day #2.


SBP
HR
DBP
mmHg
bpm
B
A
R
Time (in decimal hours)


PRP
B
A
R
Time (in decimal hours)

Time to Recovery

Time to recovery was determined by subtracting the time at the recovery point from the time at which the bath ended. The examination of the data for Subject 3 done earlier gives the reader an idea of the possible imprecision in the determination of time to recovery in some cases.

The mean time to recovery on day one was 0.30 ± 0.12 hours. The mean time to recovery on day two was slightly higher at 0.33 ± 0.17 hours. The mean time to recovery on day three decreased to 0.22 ± 0.06 hours. The sample group means for time to recovery are reported in Table 4.

Time to recovery on day two increased for four subjects over their time to recovery on day one with a mean increase for this subgroup of 0.11 ± 0.08 hours. A second subgroup of four subjects exhibited decreased time to recovery on day two over their time on day one with a mean decrease of 0.10 ± 0.06 hours.

Seven subjects exhibited shorter time to recovery on day three when compared with the day two value. The mean decrease in recovery time on day three over day two was 0.15 ± 0.12 hours. One subject had a longer time to recovery on day three than on day two and one subject's time to recovery was the same on day two and three.

Comparing day three recovery time with day one recovery time for each subject reveals that six subjects had a decrease in recovery time on day three over their time to recovery on day one. One subject had a longer time to recovery on day three than on day one. One subject had the same time to recovery on day three as on day one. Individual subject values for time to recovery are reported in Table 7.

Repeated measures analysis of variance (ANOVA) was performed on the recovery time data. The ANOVA data is presented in Table 8. The $\underline{F}(7, 16) = 3.290$ is not significant with $\underline{p} = .0869$ and α set at .05. The first study hypothesis: Subjects will exhibit a difference in recovery time on each of the first three post operative mornings, was not supported. Post hoc testing using the Newman-Keuls Test identified that a non-statistically significant difference did occur between the mean recovery time on day two and the mean recovery time on day three with recovery time being shorter on day three. The test also indicates that the mean recovery time on day one was greater than on day three.

The Pearson Product Moment Correlation Coefficient (r) was used to examine the relationship between the number of days after admission and time to recovery on each of the three post-operative days. The second study hypothesis: The number of days after admission will be positively correlated with the length of recovery time, was not supported. Time to recovery on day one was

Table 7

Individual Subject Data Across Days

SUBJECT	BASELINE TEMPERATURE		PRESSURE RATE PRODUCT PREBATH	PRESSURE RATE PRODUCT POSTBATH	TIME TO RECOVERY
	°F	°C	DAY 1		
1	101.8	(38.8)	15264	19296	-
2	99.8	(37.7)	13312	8640	0.30
3	96.4	(35.8)	6864	8120	0.48
4	99.0	(37.2)	12480	16800	0.17
5	97.8	(36.6)	12096	13176	0.13
6	99.7	(37.6)	10912	12760	0.32
7	100.0	(37.8)	12000	19200	0.38
8	99.0	(37.2)	12320	16000	0.25
9	97.9	(36.6)	10912	11564	0.43
10	99.4	(37.4)	10584	9272	0.21
mean	99.1	(37.3)	11674	13483	0.30
	± 1.4	(± 0.8)	± 2171	± 4191	± 0.12

Note: Time is reported in decimal hours.

Table 7 (cont).

Individual Subject Data Across Days

SUBJECT	BASELINE TEMPERATURE		PRESSURE RATE PRODUCT PREBATH	PRESSURE RATE PRODUCT POSTBATH	TIME TO RECOVERY
	°F	°C	DAY 2		
1	99.2	(37.3)	15210	15210	0.47
2	99.5	(37.5)	7154	10974	0.32
3	100.2	(37.9)	7296	9000	0.68
4	96.6	(35.9)	11600	13392	0.32
5	97.3	(36.3)	10320	13400	0.18
6	98.4	(36.9)	8664	8784	0.13
7	98.2	(36.8)	13132	13600	0.28
8	98.8	(37.1)	10792	11700	0.20
9	98.2	(36.8)	8208	8512	0.37
10	-		-	-	-
mean	98.5	(37.0)	10264	11619	0.33
	± 1.1	(± 0.6)	± 2739	± 2452	± 0.17

Table 7 (cont).

Individual Subject Data Across Days

SUBJECT	BASELINE TEMPERATURE		PRESSURE RATE PRODUCT PREBATH	PRESSURE RATE PRODUCT POSTBATH	TIME TO RECOVERY
	°F	°C	DAY 3		
1	98.9	(37.2)	16320	17640	0.23
2	98.1	(36.7)	6750	11700	0.17
3	98.6	(37.0)	6240	8800	0.30
4	98.6	(37.0)	11520	16640	0.20
5	97.2	(36.2)	9360	11840	0.13
6	97.5	(36.4)	8496	9424	0.20
7	97.7	(36.5)	11088	14016	0.25
8	97.8	(36.6)	10224	10944	0.20
9	97.5	(36.4)	8352	6720	0.30
10	-		-	-	-
mean	97.9	(36.6)	9816	11969	0.22
	± 0.6	(± 0.3)	± 3026	± 3595	± 0.06

Table 8.

Analysis of Variance and Post Hoc Testing, Dependent Variable: Time to Recovery (TTR)

Source	df	SS	MS	F	P	P(E-Adj)
Between Subjects	7	0.2403				
Within Subjects	16	0.1394				
TTR	2	0.0446	0.0223	3.290	0.0669	0.0869
Error	14	0.0948	0.0068			

Post Hoc Test for Time to Recovery

Level	Mean
1 = Time to Recovery, Day 1	0.308
2 = Time to Recovery, Day 2	0.311
3 = Time to Recovery, Day 3	0.218

Comparison	Newman-Keuls
1 < 2	> 0.1000
1 > 3	0.1000
2 > 3	0.1000

negatively correlated to the number of days after admission, $r = -.4093$, $p = .3136$. The correlation was not significant with α set at .05. Time to recovery on day two was also negatively correlated to the number of days after admission, $r = -.5927$, $p = .1216$. Similarly, time to recovery on day three was negatively correlated to the number of days after admission, $r = -.2709$, $p = .5158$.

Other Findings

The mean baseline temperature decreased over the three study days approximately 0.5°F (0.3°C) per day. The sample means for daily baseline temperature are reported in Table 4. Repeated measures ANOVA was used to test whether the difference over the three days was statistically significant. With α set at .05, this difference was determined not to be statistically significant ($F = 2.118$, $p = .1516$). The ANOVA table for this test is given in Table 9.

Review of individual subject data for temperature reported in Table 7 reveals that two subjects had an increase in their baseline temperatures on day two over day one values. Both of these subjects' temperature decreased on day three. One subject had a higher temperature on day three than on day two.

Examination of Table 4 shows that mean prebath PRP decreased over the three study days. Repeated measures ANOVA was used to determine whether the prebath PRP means were significantly different on each of the three study days. ANOVA test results indicate that there was a significant difference in the mean values measured over the three days, with $F = 5.931$, $p = .0291$. The ANOVA table for prebath PRP is presented in Table 10. Post hoc testing using the Newman-Keuls Test indicates that prebath PRP was significantly higher on day one than on days two or three.

Examination of Table 4 shows that mean postbath PRP decreased on days two and three when compared day one. Repeated measures ANOVA was used to determine whether there was a significant difference in mean postbath PRP over the course of the three study days. ANOVA test results indicate that there was a significant difference in the mean values measured over the three days, with $F = 4.309$, $p = .0498$ and α set at .05. The ANOVA table for postbath PRP is presented in Table 11. Post hoc testing using the Newman-Keuls Test isolated the difference, indicating that postbath PRP was significantly higher on day one than on days two or three.

Table 9

Analysis of Variance, Dependent Variable: Baseline Temperature

Source	df	SS	MS	F	P	P(E-Adj)
Between Subjects	8	12.9251				
Within Subjects	18	23.9734				
TEMP	2	5.0186	2.5093	2.118	.1516	.1695
Error	16	18.9548	1.1847			

Table 10

Analysis of Variance and Post Hoc Testing, Dependent Variable: Prebath Pressure Rate Product (PRP)

Source	df	SS	MS	F	P	P(E-Adj)
Between Subjects	8	148235536				
Within Subjects	18	45531920				
PRP	2	19385312	9692656	5.931	.0117	.0291
Error	16	26146574	1634161			

Post Hoc Test for Prebath Pressure Rate Product

Level	Mean
1 = Prebath Pressure Rate Product, Day 1	11796
2 = Prebath Pressure Rate Product, Day 2	10264
3 = Prebath Pressure Rate Product, Day 3	9817

Comparison	Newman-Keuls
1 > 2	.05
1 > 3	.05
2 > 3	

Table 11

Analysis of Variance and Post Hoc Testing

Dependent Variable: Postbath Pressure Rate Product (PRP)

Source	df	SS	MS	F	P	P(E-Adj)
Between Subjects	8	259307376				
Within Subjects	18	72465904				
PRP	2	25366192	12683096	4.309	0.0316	0.0498
Error	16	47099720	2943732			

Post Hoc Test for Postbath Pressure Rate Product

Level	Mean
1 = Postbath Pressure Rate Product, Day 1	13951
2 = Postbath Pressure Rate Product, Day 2	11827
3 = Postbath Pressure Rate Product, Day 3	11969

Comparison	Newman-Keuls
1 > 2	.05
1 > 3	.05
2 > 3	

Chapter Five

Discussion

Blood Pressure, Heart Rate, and Recovery Points

The variability in systolic blood pressure response to bathing in this sample of ten postoperative laminectomy subjects was surprising. The majority of subject SBP response (24 out of 28 test days) was exhibited as an increase after activity. The surprising result was in the range (two to 40 mmHg) and in the variability (10.7 mmHg ± 15.5) of the response. Future studies with larger sample size could investigate causes of this variation. Modification of the data collection forms to facilitate documentation of subjective responses such as pain, fatigue, or perception of exertion would be advantageous.

There were only five occurrences of a change in postbath SBP over prebath SBP greater than 20 mmHg as was reported in the Results section. Two of the occurrences were attributable to the same subject (#2) on different days (days one and three). Review of diary data revealed that two of the occurrences were related to subjects vomiting on their first postoperative day (subject #1 and subject #7). Review of diary data for the final occurrence (subject 4, day 3) revealed no contributing factors for the change in postbath SBP of 40 mmHg over prebath SBP. The lack of interrater reliability testing and the lack of refinement of the data collection tool for diary data was a serious problem in data analysis, especially when trying to determine possible reasons for individual idiosyncratic responses.

There was also variability in the heart rate response after bathing in this group of subjects. As indicated in the Results chapter, postbath HR increased on the majority of subject days (19 out of 28). The surprise came in that only three subjects exhibited consistent increase in their HR postbath over the three days. The other subjects had either decreased postbath HR on at least one of the days (occurred on three test days) or their HR remained at the same level postbath as it was prebath (occurred on six test days).

The overall mean change in postbath HR over prebath HR of 6.7 ± 10 beats per minute is similar to the after bath responses reported by Winslow, et al (1985). Winslow and her research group tested oxygen uptake and cardiovascular responses during bathing in 18 post myocardial infarction (MI) subjects (mean 9 ± 3 days post infarct) and 22 normal control subjects. They reported "heart rate recovery scores (before bath HR subtracted from after bath HR) for basin bath, tub bath, and shower for subjects were 9 bpm, 12 bpm, and 9 bpm respectively; and for controls, 3 bpm, 1 bpm, and 2 bpm..." (p. 166). While the comparison is hampered due to Winslow not reporting standard deviations, it can be seen that the subjects in the current study were more similar to the post MI subjects than to the normal control subjects in their HR response to bathing. A summary of the results from the current study contrasted with the results reported by Winslow and Alteri (1984) is presented in Table 12.

A substantial problem with the design of this study was in the definition of recovery point. During data collection, recovery point was defined as the point at which the subject's vital signs returned to baseline values or leveled out. For data analysis recovery point was defined as the point at which a subject's PRP value returned to baseline or leveled out. During data collection, it was frequently the case that a subject's vital signs varied by no more than ± 2 units (the typical limit of precision of the data collection tools) while the computation of PRP for data analysis on that same data resulted in a widely varying PRP. This discrepancy will have to be remedied in future studies. The study by Alteri (1984) was the only one in which the identification of recovery point after activity was attempted. Alteri made no mention of any difficulty in determining recovery point.

Time to Recovery

The finding that the mean time to recovery on post-op day three was less than the mean time to recovery on days one or two is not surprising, based on clinical experience with postoperative subjects. As the days after surgery increase, the subject is typically doing more for him or herself, often

Table 12

Comparison of Current Study Pressure Rate Product and Recovery Time Data With Data Reported by Alteri (1984) and Winslow, et al., (1985)

Current Study:

DAY	PREBATH PRP	POSTBATH PRP	TIME TO RECOVERY
1	11674	13483	18 minutes
2	10264	11619	19.8 minutes
3	9816	11969	13.2 minutes
Range:	6240 - 11630	6270 - 19296	

Overall mean (across days):

	PREBATH PRP	POSTBATH PRP
	10624	12397
	± 2679	± 3448

Alteri:

	PRESHOWER PRP	POSTSHOWER PRP	TIME TO RECOVERY
	8264	10376	20 minutes
	± 1185	± 2170	
Range:	6370 - 10450	7300 - 14400	

Winslow:

	PREBATH PRP	POSTBATH PRP
Range:	4600 - 13900	4500 - 20500
Mean (est):	8475	9267

requiring less nursing time and often is more active. Experienced nurses frequently plan their nursing care based on these expectations. This study provides research support for that expectation. Before these findings are disseminated and applied to practice situations, a comprehensive research project with a large sample size and more varied subjects is warranted.

A surprising finding was that the mean time to recovery did not decrease steadily over each of the three study days. As was reported in the Results section, four subjects had an increase in recovery time on day two as compared with recovery time on day one and four subjects had a decrease in recovery time. The mean increase and decrease were approximately the same and as a result the sample mean showed no change over the two days. The question arises as to whether this finding will be consistent in a larger more diverse sample.

Alteri (1984) tested the response of 10 post myocardial infarction subjects to bathing. Subjects were tested after bathing only once. They were a mean of 13.5 days past infarction. She reported a mean time to recovery of 20 minutes after bathing. The mean time to recovery on day one of the present study of 0.30 hours (18 minutes) is close to the mean recovery time for bathing found by Alteri. The mean time to recovery on day two of the current study of 0.33 hours (19.8 minutes) is almost exactly the value obtained by Alteri. By day three the subjects in the current study exhibited a shorter recovery period than did the subjects in Alteri's study (0.22 hours - 13.2 minutes compared to Alteri's reported mean of 20 minutes). A comparison of the data from Alteri's study and the current study is presented in Table 12.

The second study hypothesis: The number of days after admission will be positively correlated with the length of recovery time, was not supported by the statistical tests. Despite the lack of statistical significance, the test results using the Pearson Product Moment Correlation Coefficient (r) provide information on which to base several questions. The direction of relationship suggested by the $\underline{r}$ values is directly opposite to that which was expected by the investigator. The results obtained for day one: $\underline{r} = -.4093$ suggest that approximately 16.75% of the variance in the time to recovery values for day one is explained by differing values for number of days after admission. The surprise is in the direction of the suggested relationship: those who had surgery on their second and third days of hospitalization had generally shorter recovery times. This finding is supported by the $\underline{r}$ value for the time to recovery on the second study day. The $\underline{r} = -.5927$ suggests that approximately 35.17% of the variance in the time to recovery values for day two is explained by differing values for number of days after admission. The direction of the suggested relationship carries the same implications as the findings for the time to recovery on day one. By the third day the r = -.2709 suggests that only 7.34% of the variance in the time to recovery values for day three are explained by differing values for number of days after admission.

These curious findings point to the need for a better way to assess overall level of activity prior to surgery. A basic assumption held by the investigator prior to data analysis was that subjects who had been in the hospital for one or more days prior to surgery would have an overall lower level of activity and would therefore be more deconditioned than those who had surgery on the day of admission. This assumption was not supported by the findings. It is clear that there is a need for a tool to better assess level of activity and level of physical conditioning prior to surgery.

Other Findings

A trend identified in the mean baseline temperature was a decrease of approximately 0.5°F (0.3°C) per day. The ANOVA data for baseline temperature compared over the three days is presented in Table 7. This is another example of a finding that is not statistically significant but may have clinical implications and should be explored in future studies.

There have been no studies documenting temperature patterns in postoperative patients during the first few days postoperative. Freischlag and Busuttil (1983) retrospectively examined the efficacy of routine screening tests in the evaluation of postoperative fever. In their sample of 464 abdominal surgery patients, 15% were identified as febrile (two elevations above 38.5°C in eight hours), and 27% of those patients were diagnosed as having an infection. These findings supported results reported by Pien, Ho, and Fergusson (1982) regarding postcardiac surgery patients. This retrospective study reported a 25% rate of infection in febrile patients between the fourth and ninth day postoperative. The remainder of the febrile patients were classified as having "benign postoperative fever."

Examination of Table 5 reveals that only one subject on one morning had a baseline temperature greater than 101.3°F (38.5°C). None had persistent elevations in daily temperatures. Further research identifying normal temperature responses to surgery is warranted.

The mean prebath pressure rate product (PRP) decreased over the course of the three study days as was reported in the Results chapter. This follows what was expected as the result of undergoing the stress of surgery. The range of prebath PRP (6240 to 16320) is similar to the range reported by Winslow, et al (1985) (4600 to 13900) for her group of 40 subjects (both control and post MI included). The range of prebath PRP reported by Alteri in her study of cardiovascular responses to activity in 10 post MI subjects was narrower (6370 to 10450).

The means of the three studies appear to be different. The overall mean prebath PRP for the current study is 10624 ± 2679. Interpreting from the graphs presented by Winslow, et al., (1985) the reported mean prebath PRP is approximately 8475. This is very close to the mean prebath PRP reported by Alteri (1984) of 8264 ± 1185. An examination of the reported values reveals that the mean prebath PRP values for the current study are considerably higher than the values reported by Alteri and Winslow although by day three the trend in the values from the current study is approaching the values reported by the other authors. Alteri reported that none of her subjects was receiving cardiac depressant medications. Likewise, none of the subjects in the current study was receiving cardiac depressant medications. One explanation of the difference could be the stress the subjects in the current study experienced secondary to surgery.

The mean postbath PRP for the current study is significantly higher on day one than on day two or three as was reported in the Results chapter. It is surprising that there is no significant difference in the mean postbath PRP on days two and three. Future studies are warranted to determine whether this trend persists in larger, more varied samples. The question also arises: when in the postoperative recuperative phase does the postbath PRP decrease.

The range of postbath PRP is 6720 to 19296. The range of postbath PRP reported by Winslow, et al., (1985) is 4500 to 20500. The range reported by Alteri (1984) is 7300 to 14400. These ranges are similar with Alteri reporting a slightly narrower range (as with the prebath PRP). It should be remembered that the mean number of days past infarction for Winslow's 18 member experimental group was 9 ± 3, and that the values reported by Winslow, et al., include data on 22 normal control subjects as well. Alteri's ten subjects were a mean of 13.5 days post infarction. The smaller range reported by Alteri may well be due to her more homogeneous group.

The overall mean postbath PRP for the current study is 12397 ± 3488. Interpreting from the graphs presented by Winslow, et al., (1985) the reported mean postbath PRP is approximately 9267. The mean postbath PRP reported by Alteri is 10376 ± 2170. Given that the value for Winslow's study is approximate, the values for the two studies by Winslow and Alteri are fairly close. The overall mean for the current study is somewhat higher. When the mean postbath PRP for the current study is examined on day one, however, the difference between it and the other two study means is even greater (13483 ± 4191). The implication of this is that the subjects in the current study were expending considerably more energy immediately after their bath (and presumably during their bath) than were the subjects of the other studies.

Study Limitations and Implications for Future Work

This study has many areas which will need to be refined or revised in future work. The small sample size was a serious detriment to the identification of statistically significant differences in groups of data. A larger, more diverse sample needs to be used to examine recovery time and vital sign response to activity in postsurgical patients.

A major problem discussed earlier was the identification of recovery point. The identification of recovery point during data collection was defined as the point at which a subject's vital signs returned to baseline or levelled out for five consecutive measurements. There were instances when a subject's vital signs returned to baseline values for a single measurement and data collection was discontinued. Question must be raised as to whether this is a reliable measurement. There is no way to determine if those points represent true recovery points or merely transient occurrences.

Recovery point definition for data analysis was modeled after Alteri's work and was chosen as the point at which PRP returned to the baseline value. This discrepancy between the definition during data collection and data analysis lead to difficulty in assigning recovery point in some instances. Future research projects will be developed with a unified definition of recovery point.

Interrater reliability was not determined with diary (narrative) data. This was a serious problem. The data collected by some of the data collectors was detailed and the data collected by others was sparse. There was no consistency in the reporting of postural changes. The data collection tool used (contained in Appendix B) is evidence of the lack of refinement of the author in the development of such tools. It is anticipated that future work will include the refinement and testing of this tool. Interrater reliability with diary data will need to be determined in future studies.

The lack of evaluation of presurgical norms for subject vital signs and activity levels was another shortcoming of the study design. Future work will include such an evaluation. This would aid in the understanding of the patterns of postsurgical responses seen with individual and groups of subjects.

The influence of psychological variables is another area which will be included in future work. The current study did not consider the role of any psychological variables such as fear, anxiety, or comfort with the hospital surroundings or study protocol. It is doubtless that some or all of these factors have some influence on the vital sign responses of subjects. Future work to attempt to understand what effect these and other such variables have on patient response to surgery and activity is warranted.

Another problem arose during data collection related to the mechanical reliability of the data collection instruments. Both the thermometer and the pulse rate monitor malfunctioned during the course of the study. The thermometer probe malfunction was identified during a routine calibration check and was replaced prior to any further data collection. The pulse rate monitor became unable to be calibrated after the third subject and future subjects were tested with the data collectors using radial pulse measurements. As was mentioned in the report of interrater reliability, interrater reliability was determined with the radial pulse rate determinations, not with the pulse rate monitor.

Further investigation of the findings reported in this paper needs to be conducted with more subjects and a refined study design. One of the reasons for the lack of statistical significance is related to the low power of the statistical tests done on this data. This low power is directly related to the small sample size.

Final Comments

This study was an attempt to identify trends in subject vital sign response to bathing in the first three days after back surgery. Subjects were observed performing routine morning care activities. No attempt to alter the activities, periods of rest, or usual morning procedure of the unit was made.

This study provided data to test the hypotheses that:

1. Post surgical laminectomy patients will exhibit a difference in recovery time after bathing activity on each of the three postoperative mornings, and

2. The number of days after admission will be positively correlated with the length of recovery time on each of the three postoperative mornings.

The data obtained from the sample of ten subjects did not support either of the hypotheses. Further questions which arose as a result of the statistical testing were reviewed in the discussion.

The nonsignificance of the statistical tests points to the need for a full scale study examining the same issues with refined data collection tools and a larger sample size. Some suggested refinements have been mentioned previously. It is expected that future work in this area will contribute to the researched knowledge base for nursing practice.

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An Abstract of the Thesis of

Marianne Reith

For the Degree of Master of Science

Date of Receiving Degree: June 10, 1988

Title: Recovery Periods After Bathing Activity in Ten Post-Laminectomy Patients

Approved: [redacted]

Linda Felver, R.N., Ph.D.

Abstract

Increasing the research based knowledge in Nursing is one of the primary tasks of the next decade. The purpose of this study was to identify trends in vital sign response after bathing in ten postsurgical patients. The data did not support the study hypotheses: 1. Postsurgical laminectomy patients will exhibit a difference in recovery time after bathing activity on each of the three postoperative mornings; and 2. The number of days after admission will be positively correlated with the length of recovery time on each of the three postoperative mornings.

Non-probability convenience sampling was used to obtain a sample of ten post lumbar laminectomy patients. There were 5 men and 5 women in the sample. Their mean age was 44.5 ± 9.3. The subjects gave informed consent and were observed during their

morning bath on the first three postoperative days. Their vital signs were taken prior to the bath and then after the bath every two minutes until they reached the baseline values or levelled out.

Vital sign data was described using descriptive statistics and compared to similar research performed by Alteri (1984) and Winslow, et al. (1985). Data was analyzed using graphical analysis to determine recovery point. Repeated measures analysis of variance was used to test the first hypothesis (with $\alpha = .05$, $F = 3.290$, was nonsignificant, $p = .0869$). Pearson Correlation Coefficient (r) was used to test the second hypothesis. There was a non-significant negative relationship on all three days between time to recovery and number of days after admission. (Day 1, $r = -.4093$, $p = .3136$; Day 2: $r = -.5927$, $p = .1216$, Day 3: $r = -.2709$, $p = .5158$.) There was a non-significant decrease in the mean baseline temperature over the three mornings.

The small sample size was a serious limitation of this study. The trends identified in the data of a decrease in mean recovery time on the third postoperative day, a decrease in the mean baseline temperature over the three days and the elevated vital signs on the first day postoperative when compared to other studies (e.g. Winslow and Alteri) should be examined in an investigation with a larger, more varied sample.

Appendix A:

Consent Forms

Oregon Health Sciences University
in collaboration with
Good Samaritan Hospital & Medical Center
CONSENT FORM

Recovery Periods After Activities

You are invited to participate in a research study. The purpose of this study is to determine the length of time it takes people to recover from certain activities after they have been in the hospital for a few days. This research will be performed at Good Samaritan Hospital in Portland, Oregon by Marianne Reith, R.N. whose field of specialty is adult medical surgical nursing. Ms. Reith is a graduate student at Oregon Health Sciences University in the School of Nursing and is working towards a Master of Science degree in Adult Health and Illness. Ms. Reith, whose office telephone number is 279-7839, has agreed to answer any questions you may have.

Participation in this study will involve your performing routine morning activities and having your blood pressure, pulse, and breathing rate monitored on three consecutive mornings. You will be asked to bathe as you would usually do in the hospital, whether that is by using a basin at the side of the bed or using a sink or taking a shower. During this activity, the data collector will be sitting nearby, noting the extent of independent activity and keeping track of the time.

You will have your blood pressure, heart rate (pulse), and breathing rate measured before beginning your morning activities and then whenever you stop your activity for more than a short while. When you complete your bath, the data collector will check your blood pressure, heart rate, and breathing rate every two minutes until all of the measurements return to their original (before activity) values. If your nurse assists you to sit in a chair before the values return to their original level, the data collector will continue to monitor your blood pressure, heart rate and breathing rate after you are sitting. It is expected that this period of recovery time will range from five to fifteen minutes. Your temperature will be measured once prior to beginning any of the activities. There are no experimental or invasive procedures in this study.

It is highly unlikely that you will suffer any side effects or complications from participation in this study. You may find that you experience slight discomfort while your blood pressure is being checked.

The findings of this study when added to the future work anticipated in this research program will enable staff nurses of the future to recommend activity-rest schedules to their patients who are recovering from illness, injury, or surgery.

Your decision whether or not to participate in this study will not prejudice your nursing or medical care at Good Samaritan Hospital in any way. If you decide to participate, you are free to withdraw your consent and to discontinue your participation in this study at any time without prejudice to you or influence on your medical or nursing care. If you have any questions regarding the procedures involved in the study, please do not hesitate to ask Ms. Reith, telephone 279-7839.

If you decide to participate in this study, your medical record will be reviewed by Ms. Reith in order to record your present medications and normal ranges for your blood pressure, pulse, respirations, and temperature. All personal information collected will be kept strictly confidential. Neither your name nor your identity will be used for publication, publicity or any other purpose.

It is not the policy of Good Samaritan Hospital & Medical Center, or any other agency funding the research project in which you are participating, to compensate or provide medical treatment for human subjects in the event the research results in physical injury. You should further understand that should you suffer any injury from the research project, compensation will be available only if you establish that the injury occurred through the fault of Good Samaritan Hospital, its officers or employees or your physician. Further information regarding this policy may be obtained from the Office of Research Administration at 229-7218.

I have read and understand the foregoing and agree to participate in this study.

______________________	______________________
Signature of Witness	Signature of Participant
______________________	______________________
Date	Date

THE OREGON HEALTH SCIENCES UNIVERSITY
SCHOOL OF NURSING

Dear Dr. ____________________,

I am working on my Master's degree in nursing at Oregon Health Sciences University and it is necessary for me to conduct a research study. The study is entitled: "Recovery Periods After Activity." The Institutional Review Board of Good Samaritan Hospital, the Committee on Human Research of Oregon Health Sciences University, and my thesis committee in the School of Nursing have approved my research proposal and given me permission to proceed with data collection.

In the coming weeks I will be seeking 33 inpatients who have had laminectomies, craniotomies, or who have been hospitalized for evaluation of seizure disorders to participate in my study. The subjects will be asked to perform only routine activities of daily living and a short, self-paced walk. I have attached an abstract of my proposal, the inclusion criteria for the subjects, indications for cessation of activity, as well as the activity protocols that the patients will be asked to follow.

Before any approach is made to the patient, I would like to request your permission to use your patients in the study. If, after reviewing the enclosed information, you have any questions regarding the study, please do not hesitate to contact me at 225-7839.

I have enclosed a consent form indicating your agreement to allow your patients to participate in the study. If you agree to allow me to approach your patients and request their participation please sign the enclosed form and return it to me in the enclosed envelope by 2/6/87.

I will present an overview of my proposed research and be available to answer questions during the Neurosurgeon's monthly meeting on 2/6/87 at 0700 as arranged by Ms. Debbie Gaspar, R.N. H.N. of 6NW. I look foward to meeting you at that time.

Thank-you for your time and thoughtful consideration.

Sincerely yours,

Marianne Reith, R.N.

PHYSICIAN CONSENT FORM

THE OREGON HEALTH SCIENCES UNIVERSITY

SCHOOL OF NURSING

Title of Study: Rest Periods After Activity

I give permission to Marianne Reith, R.N., for my patients to participate in this study.

Signature

Printed Name

Date

Appendix B:

Data Collection Forms

Form 1.

Initial Subject Screening Form

Date:__________ Admit Date:__________ Surgery Date______________

Sex:__________ Age:____________ Patient Initials:____________

Physician:____________________________ Room Number:__________

Surgical Procedure:____

Length of Procedure:____

Medications: (no β-blockers)

[meds given in last 24°, dosage and time of administration]

Recent abnormal lab values? [K, PO_4, Mg]

(include date and value)

Form 2.

Data Collection Form

Subject: Room #: POD#: Date:

Time: Baseline VS: T- ,P- ,R- ,B/P

Type of bath:

Time:	Vitals:	Comments:

Appendix C:

Individual Subject Data

Table A-1.

Subject 1: Data for Post-op Day 1

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
7.75	101.8	(38.8)	120	27	140	90	16800
8.78	-	-	130	20	124	90	16120
9.08	99.3	(37.4)	140	20	116	92	16240
9.30	-	-	144	24	106	84	15264
9.50	-	-	144	20	134	90	19296

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)

TEMPERATURE is baseline temperature

HR = Heart Rate

RESP = Respiratory Rate

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

PRP = Pressure Rate Product

Figure A1.

Note: Data collection stopped immediately after bath due to subject vomiting.

B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 1: Vital Signs versus Time, Post-op Day #1.

Figure A2.

Note: Data collection stopped immediately after bath due to subject vomiting.

B = baseline, before bath

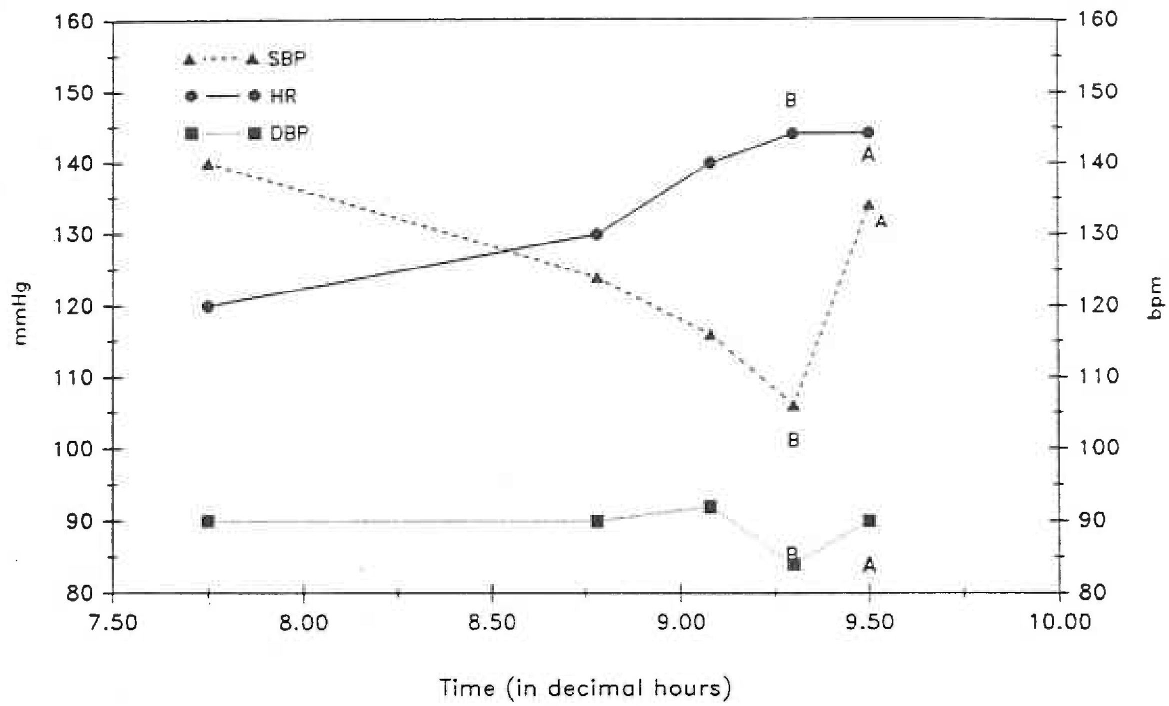
A = immediately after bath

R = recovery point

PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 1: Pressure Rate Product versus Time, Post-op Day #1.


160
150
140
130
120
110
100
90
80
mmHg
bpm
SBP
HR
DBP
A
B
7.50
8.00
8.50
9.00
9.50
10.00
Time (in decimal hours)

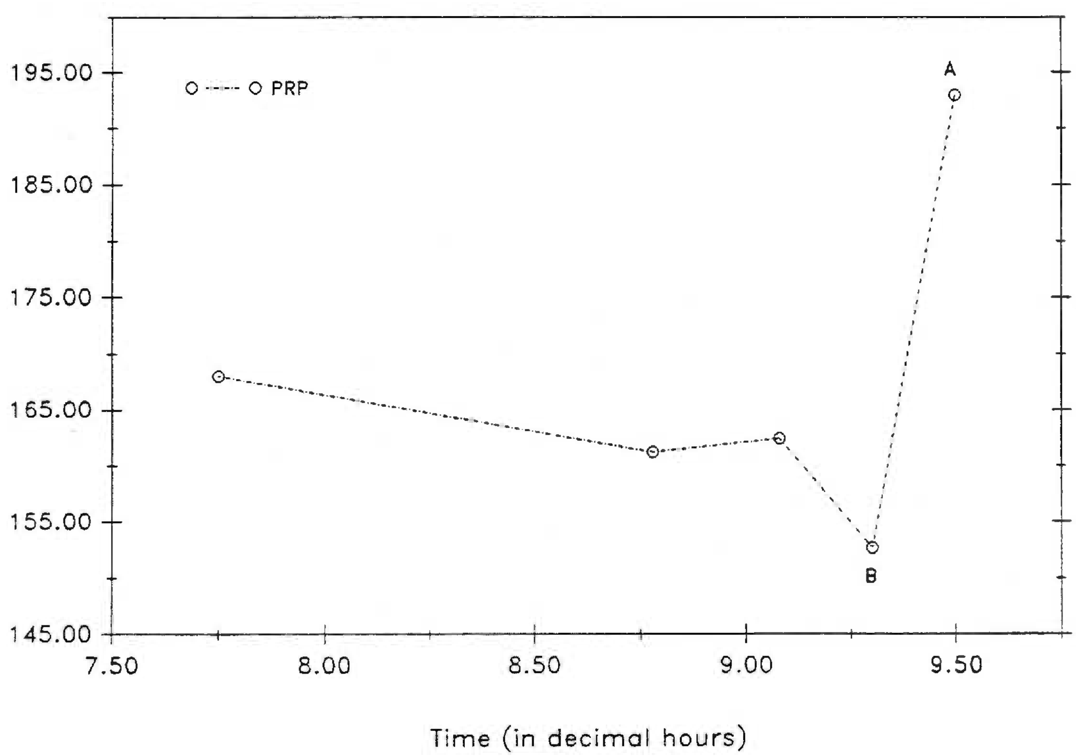

195.00
185.00
175.00
165.00
155.00
145.00
PRP
A
B
7.50
8.00
8.50
9.00
9.50
Time (in decimal hours)

Table A-2.

Subject 1: Data for Post-op Day 2

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
7.75	99.2	(37.3)	117	24	130	90	15210
7.88	-	-	117	24	130	90	15210
8.18	-	-	117	20	146	90	17082
8.21	-	-	115	16	144	94	16560
8.25	-	-	123	24	142	88	17466
8.28	-	-	132	20	142	88	18744
8.31	-	-	117	20	-	-	-
8.35	-	-	119	20	146	96	17374
8.38	-	-	114	20	138	86	15732
8.41	-	-	113	20	140	86	15820
8.45	-	-	116	24	142	90	16472
8.48	-	-	111	20	136	88	15096
8.51	-	-	113	20	130	90	14690
8.55	-	-	115	20	136	90	15640
8.58	-	-	112	20	134	90	15008
8.61	-	-	114	20	126	90	14364
8.65	-	-	114	20	130	90	14820
8.66	-	-	114	20	130	90	14820

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A3.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 1: Vital Signs versus Time, Post-op Day #2.

Figure A4.

Note: B = baseline, before bath

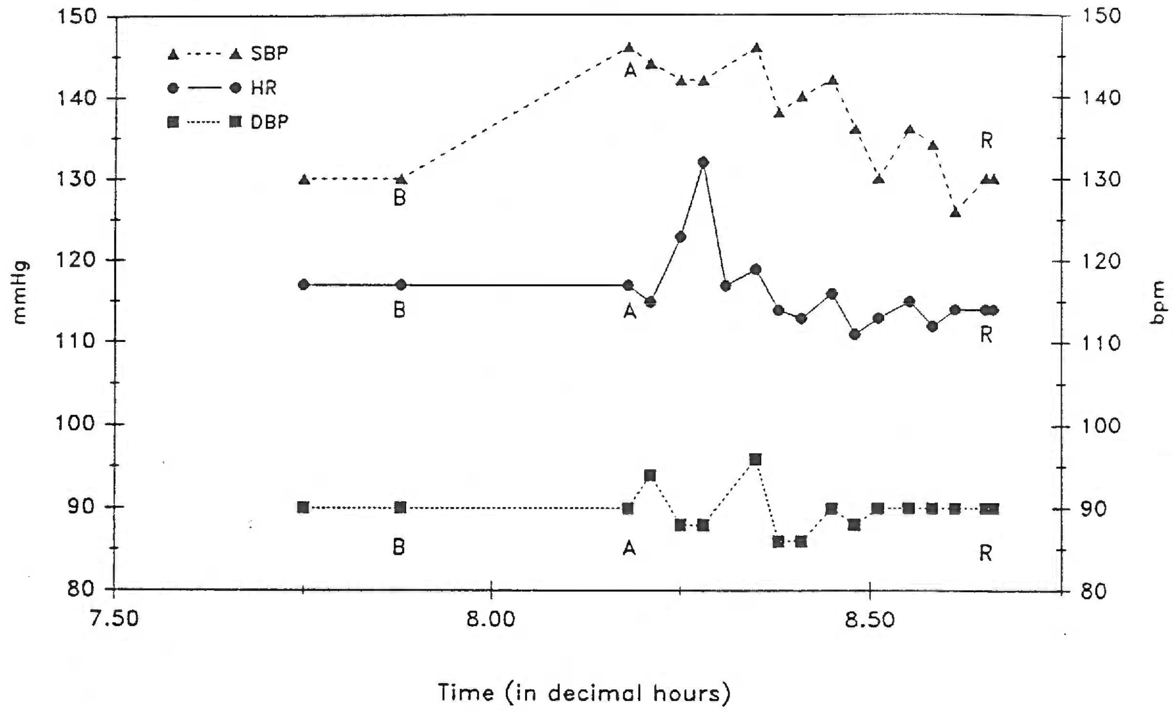
A = immediately after bath

R = recovery point

PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 1: Pressure Rate Product versus Time, Post-op Day #2.


SBP
HR
DBP
mmHg
bpm
150
140
130
120
110
100
90
80
7.50
8.00
8.50
A
B
R
Time (in decimal hours)

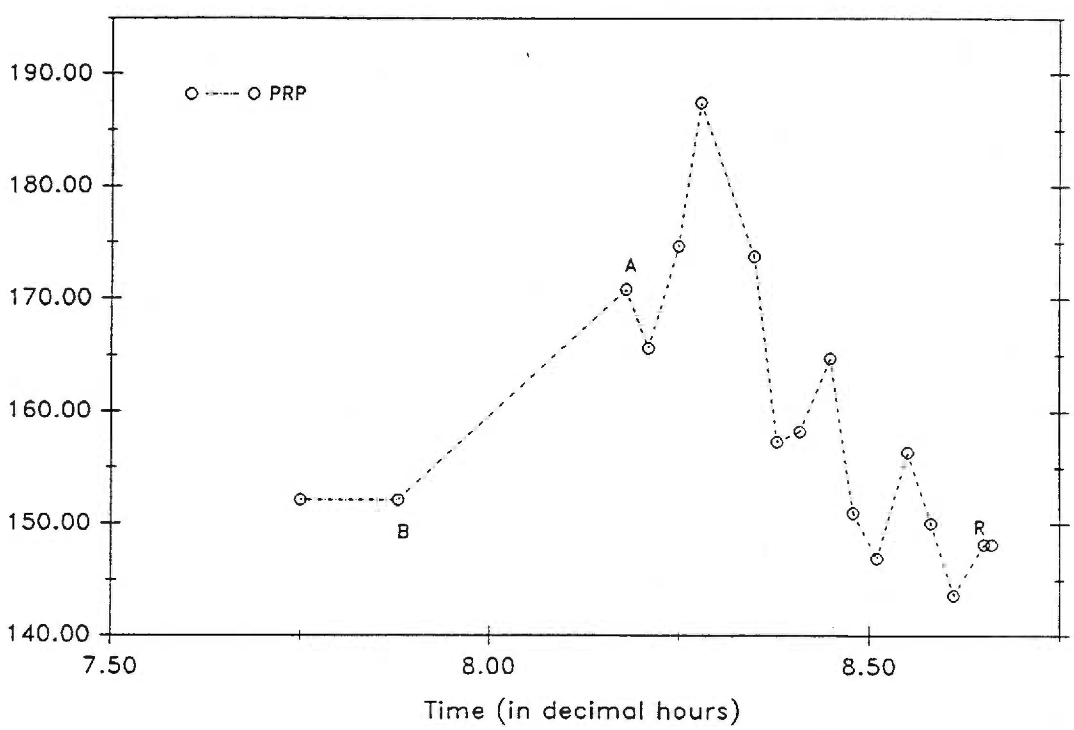

PRP
190.00
180.00
170.00
160.00
150.00
140.00
7.50
8.00
8.50
A
B
R
Time (in decimal hours)

Table A-3.

Subject 1: Data for Post-op Day 3

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
7.83	98.9	(37.2)	110	20	140	90	15400
8.45	-	-	136	24	120	100	16320
8.58	-	-	140	24	126	86	17640
8.70	-	-	141	24	122	90	17202
8.76	-	-	140	16	126	88	17640
8.80	-	-	136	20	138	88	18768
8.83	-	-	104	16	132	90	13728
8.86	-	-	130	20	130	80	16900
8.90	-	-	90	20	130	90	11700
8.93	-	-	108	24	126	86	13608
8.96	-	-	86	20	130	90	11180
9.00	-	-	110	20	130	90	14300

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A5.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 1: Vital Signs versus Time, Post-op Day #3.

Figure A6.

Note: B = baseline, before bath

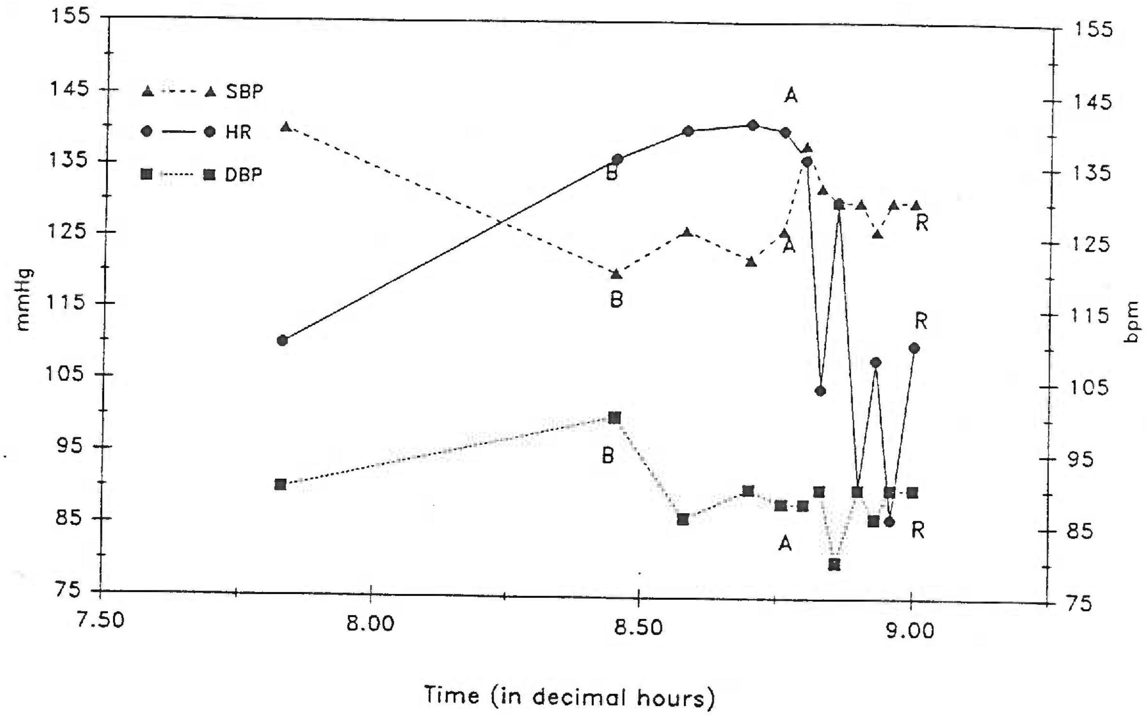
A = immediately after bath

R = recovery point

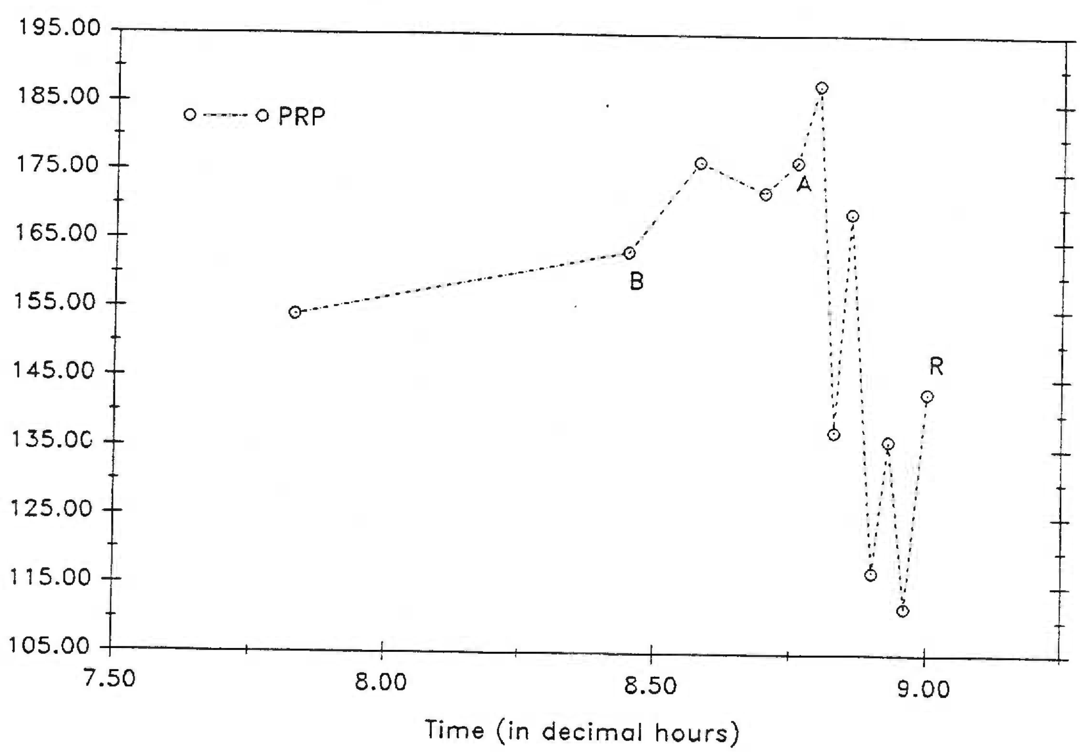
PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 1: Pressure Rate Product versus Time, Post-op Day #2.



155
145
135
125
115
105
95
85
75
mmHg
bpm
SBP
HR
DBP
A
B
R
7.50
8.00
8.50
9.00
Time (in decimal hours)



195.00
185.00
175.00
165.00
155.00
145.00
135.00
125.00
115.00
105.00
PRP
A
B
R
7.50
8.00
8.50
9.00
Time (in decimal hours)

Table A-4.

Subject 2: Data for Post-op Day 1

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
9.07	99.8	(37.7)	104	16	128	84	13312
9.55	-	-	90	16	96	60	8640
9.58	-	-	86	16	100	60	8600
9.62	-	-	90	16	98	60	8820
9.65	-	-	90	12	96	60	8640
9.68	-	-	89	12	100	60	8900
9.72	-	-	89	20	100	60	8900
9.75	-	-	92	16	108	60	9936
9.78	-	-	91	16	108	60	9828
9.82	-	-	90	16	106	60	9540
9.85	-	-	88	16	100	60	8800
9.88	-	-	90	16	100	60	9000

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A7.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 2: Vital Signs versus Time, Post-op Day #1.

Figure A8.

Note: B = baseline, before bath

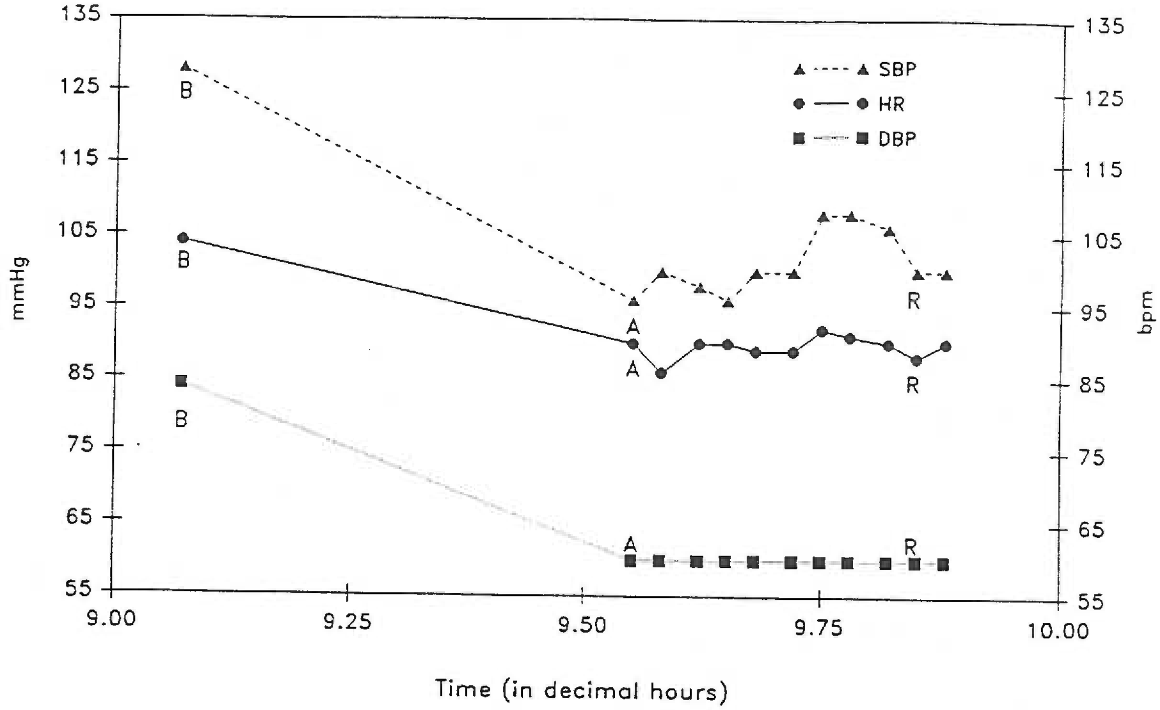
A = immediately after bath

R = recovery point

PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 2: Pressure Rate Product versus Time, Post-op Day #1.


135
125
115
105
95
85
75
65
55
mmHg
bpm
SBP
HR
DBP
B
A
R
9.00
9.25
9.50
9.75
10.00
Time (in decimal hours)

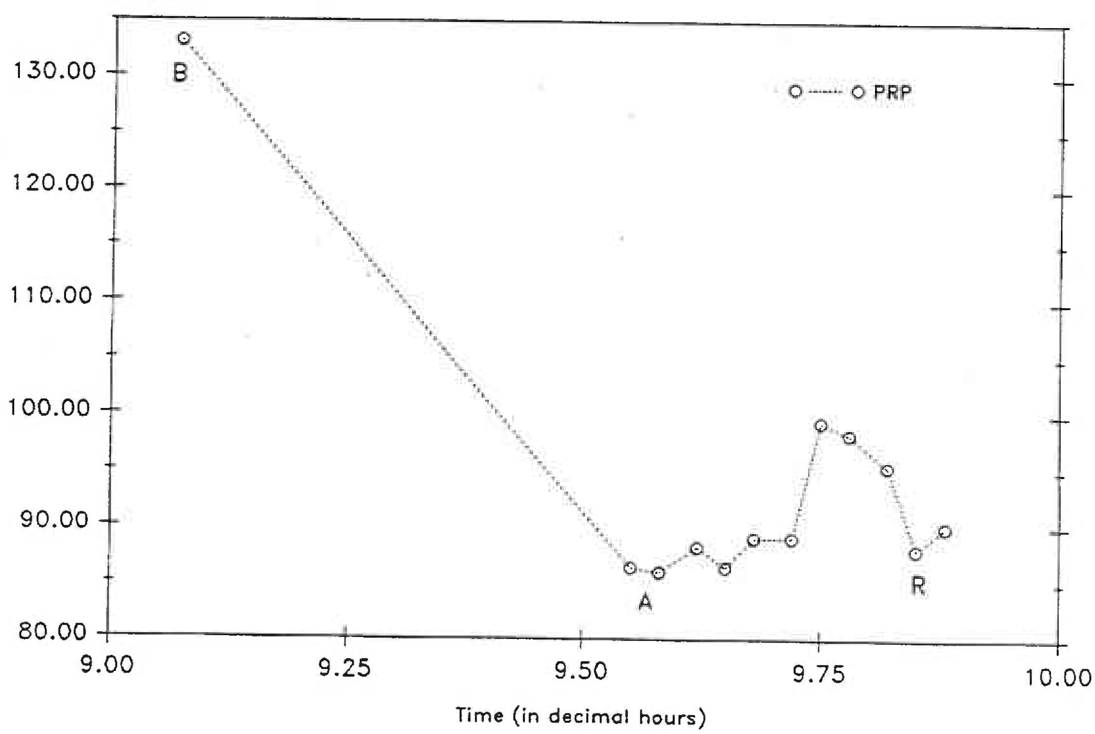

130.00
120.00
110.00
100.00
90.00
80.00
PRP
B
A
R
9.00
9.25
9.50
9.75
10.00
Time (in decimal hours)

Table A-5.

Subject 2: Data for Post-op Day 2

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
8.80	99.5	(37.5)	73	16	98	60	7154
9.25	-	-	90	20	120	94	10800
9.33	-	-	88	16	110	76	9680
9.48	-	-	93	20	118	78	10974
9.52	-	-	93	16	104	72	9672
9.55	-	-	88	16	120	74	10560
9.58	-	-	95	16	110	74	10450
9.62	-	-	90	16	110	70	9900
9.70	-	-	86	16	110	58	9460
9.73	-	-	84	16	104	60	8736
9.77	-	-	71	16	100	58	7100
9.80	-	-	69	16	96	60	6624
9.83	-	-	70	16	96	60	6720
9.87	-	-	72	16	96	60	6912

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A9.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 2: Vital Signs versus Time, Post-op Day #2.

Figure A10.

Note: B = baseline, before bath

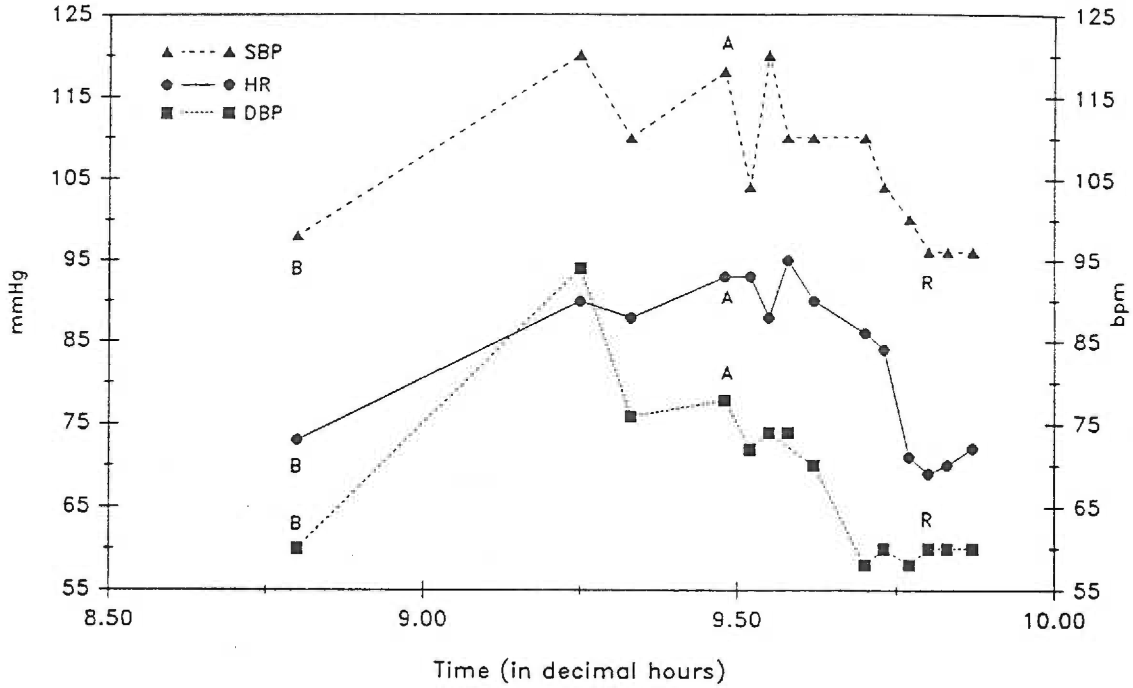
A = immediately after bath

R = recovery point

PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 2: Pressure Rate Product versus Time, Post-op Day #2.


125
115
105
95
85
75
65
55
mmHg
bpm
SBP
HR
DBP
A
B
R
8.50
9.00
9.50
10.00
Time (in decimal hours)

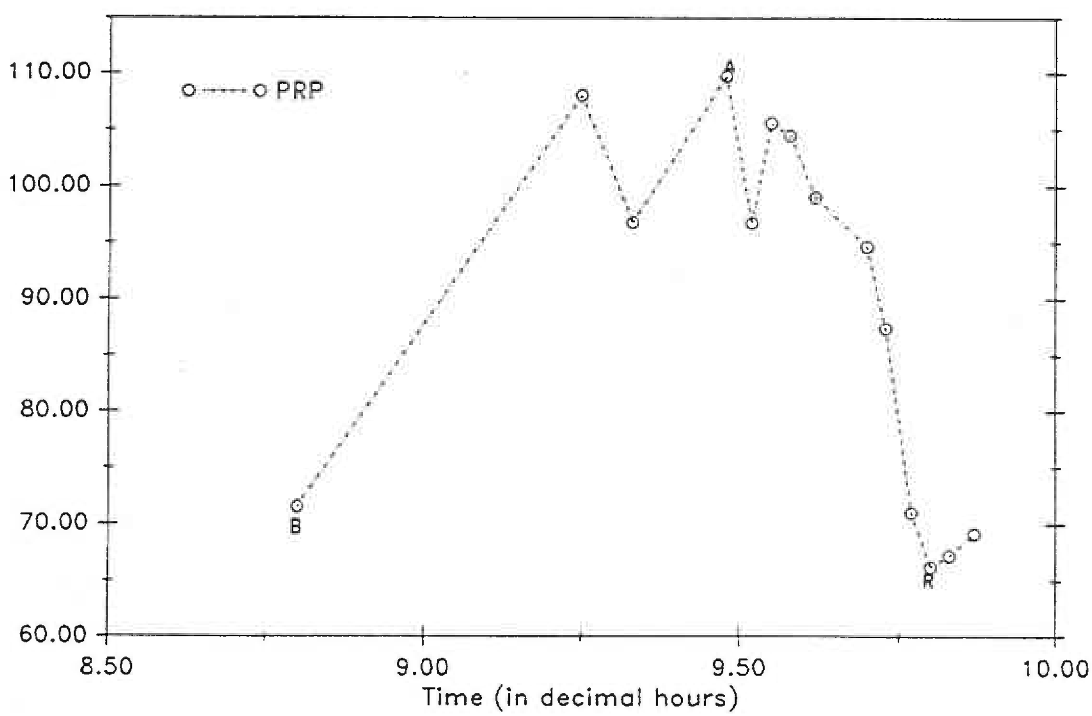

110.00
100.00
90.00
80.00
70.00
60.00
PRP
A
B
R
8.50
9.00
9.50
10.00
Time (in decimal hours)

Table A-6.

Subject 2: Data for Post-op Day 3

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
8.92	98.1	(36.7)	75	16	90	60	6750
9.42	–	–	90	20	130	80	11700
9.48	–	–	64	16	110	60	7040
9.52	–	–	63	16	106	60	6678
9.55	–	–	66	16	102	60	6732
9.58	–	–	68	20	100	60	6800
9.62	–	–	61	16	98	60	5978
9.65	–	–	72	16	98	58	7056
9.68	–	–	73	16	98	58	7154
9.72	–	–	63	16	96	60	6048
9.75	–	–	65	16	100	60	6500
9.78	–	–	66	16	110	70	7260
9.82	–	–	62	16	100	60	6200
9.85	–	–	63	16	104	60	6552
9.88	–	–	64	16	98	60	6272
9.92	–	–	60	16	96	60	5760
9.95	–	–	59	12	94	60	5546
9.98	–	–	60	12	96	60	5760
10.02	–	–	61	12	96	60	5856

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A11.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 2: Vital Signs versus Time, Post-op Day #3.

Figure A12.

Note: B = baseline, before bath

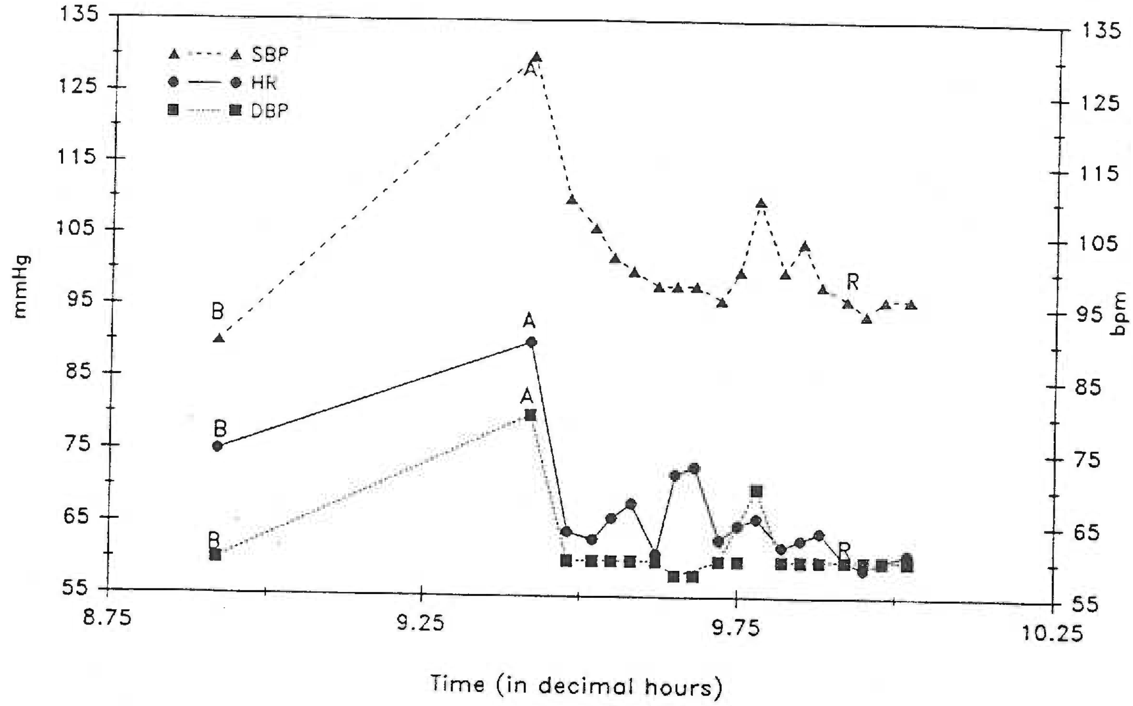
A = immediately after bath

R = recovery point

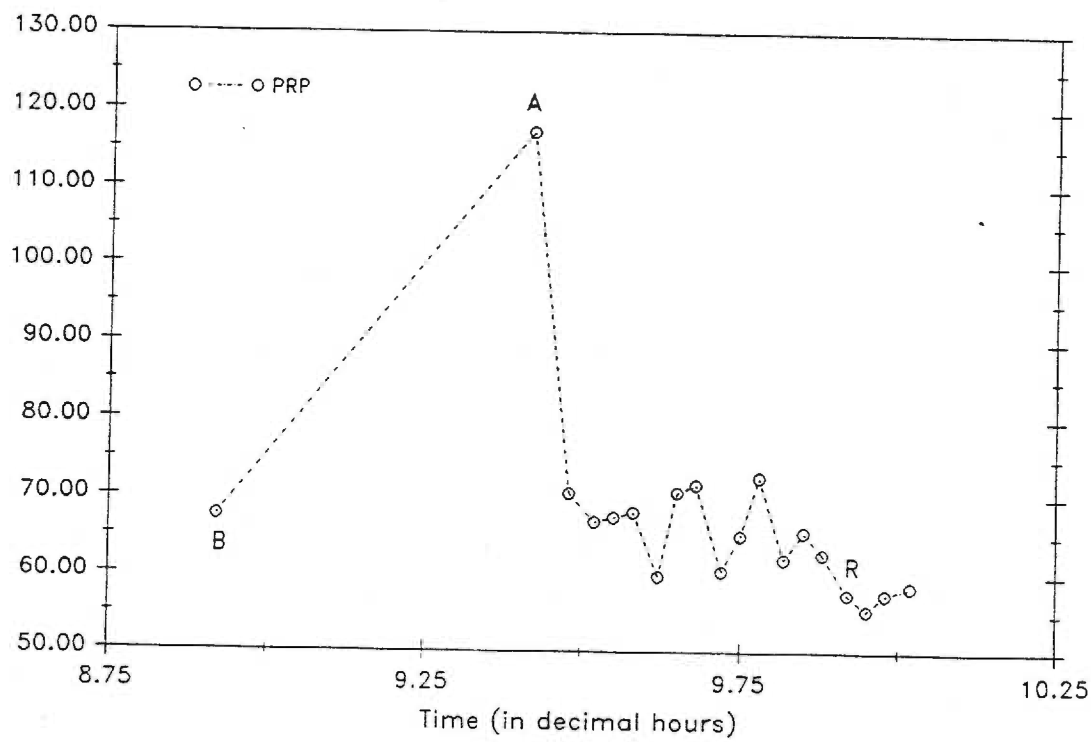
PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 2: Pressure Rate Product versus Time, Post-op Day #3.



135
125
115
105
95
85
75
65
55
SBP
HR
DBP
mmHg
bpm
B
A
R
8.75
9.25
9.75
10.25
Time (in decimal hours)



130.00
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
PRP
A
B
R
8.75
9.25
9.75
10.25
Time (in decimal hours)

Table A-7.

Subject 3: Data for Post-op Day 1

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
8.47	96.4	(35.8)	66	20	104	60	6864
8.82	-	-	70	20	116	80	8120
8.85	-	-	68	16	116	80	7888
8.88	-	-	67	20	108	72	7236
8.92	-	-	66	16	110	74	7260
8.95	-	-	65	14	100	80	6500
9.03	-	-	64	16	100	80	6400
9.07	-	-	57	20	108	72	6156
9.10	-	-	58	16	108	72	6264
9.13	-	-	59	16	104	70	6136
9.17	-	-	64	16	98	70	6272
9.20	-	-	64	16	110	70	7040
9.23	-	-	54	12	102	64	5508
9.27	-	-	54	16	104	60	5616
9.30	-	-	64	16	104	60	6656

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A13.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 3: Vital Signs versus Time, Post-op Day #1.

Figure A14.

Note: B = baseline, before bath

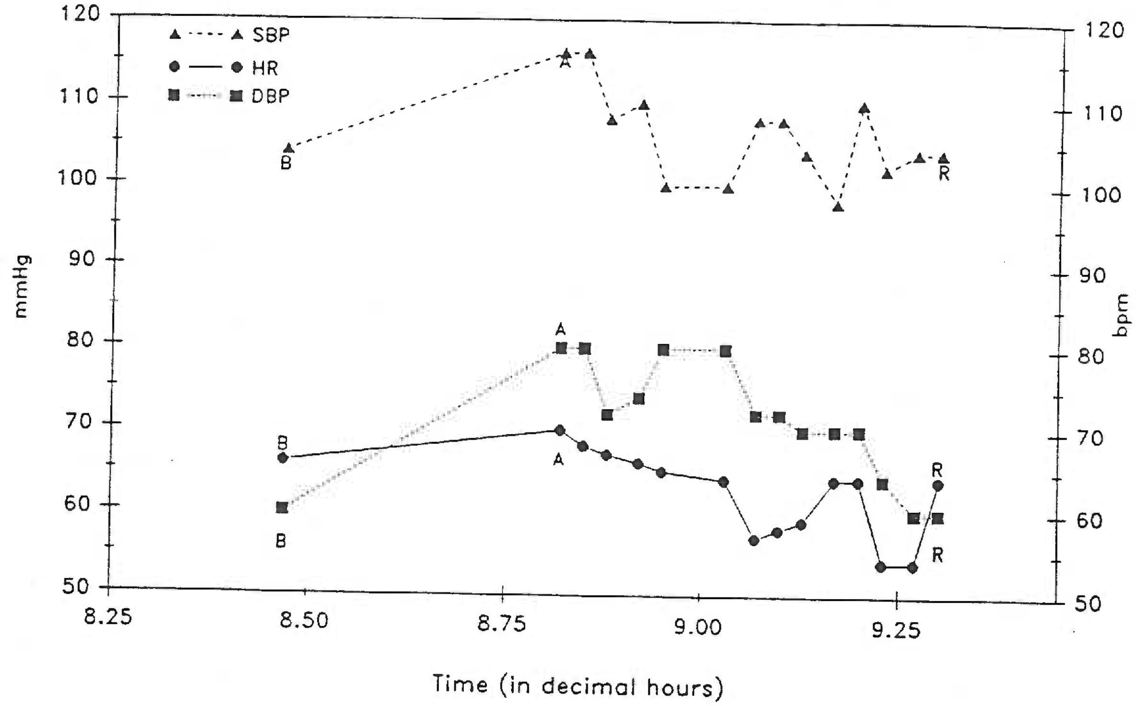
A = immediately after bath

R = recovery point

PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 3: Pressure Rate Product versus Time, Post-op Day #1.


SBP
HR
DBP
mmHg
bpm
120
110
100
90
80
70
60
50
8.25
8.50
8.75
9.00
9.25
Time (in decimal hours)
A
B
R

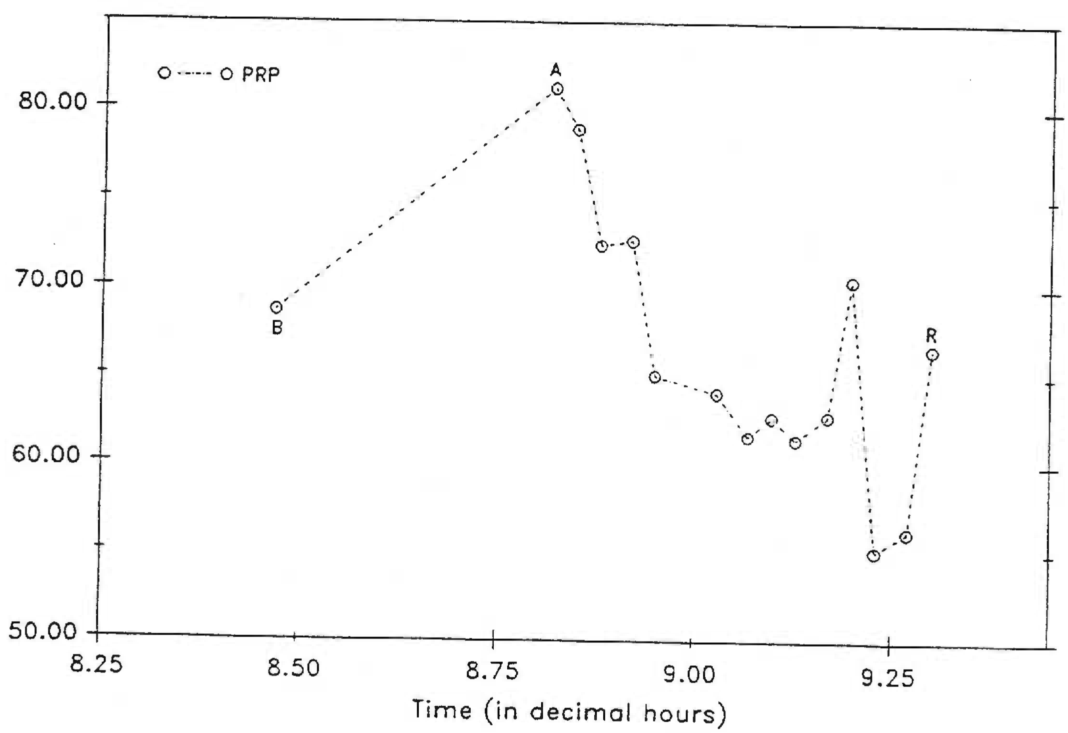

PRP
80.00
70.00
60.00
50.00
8.25
8.50
8.75
9.00
9.25
Time (in decimal hours)
A
B
R

Table A-8.

Subject 3: Data for Post-op Day 2

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
9.17	100.2	(37.9)	76	12	96	60	7296
9.47	–	–	90	18	100	68	9000
9.87	–	–	87	20	100	68	8700
9.90	–	–	83	20	92	64	7636
9.93	–	–	86	20	100	68	8600
9.88	–	–	74	16	96	64	7104
10.00	–	–	77	16	96	60	7392
10.03	–	–	75	20	90	60	6750
10.08	–	–	72	16	96	60	6912
10.12	–	–	72	16	96	60	6912
10.15	–	–	68	16	90	60	6120
10.18	–	–	68	16	90	58	6120

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A15.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 3: Vital Signs versus Time, Post-op Day #2.

Figure A16.

Note: B = baseline, before bath

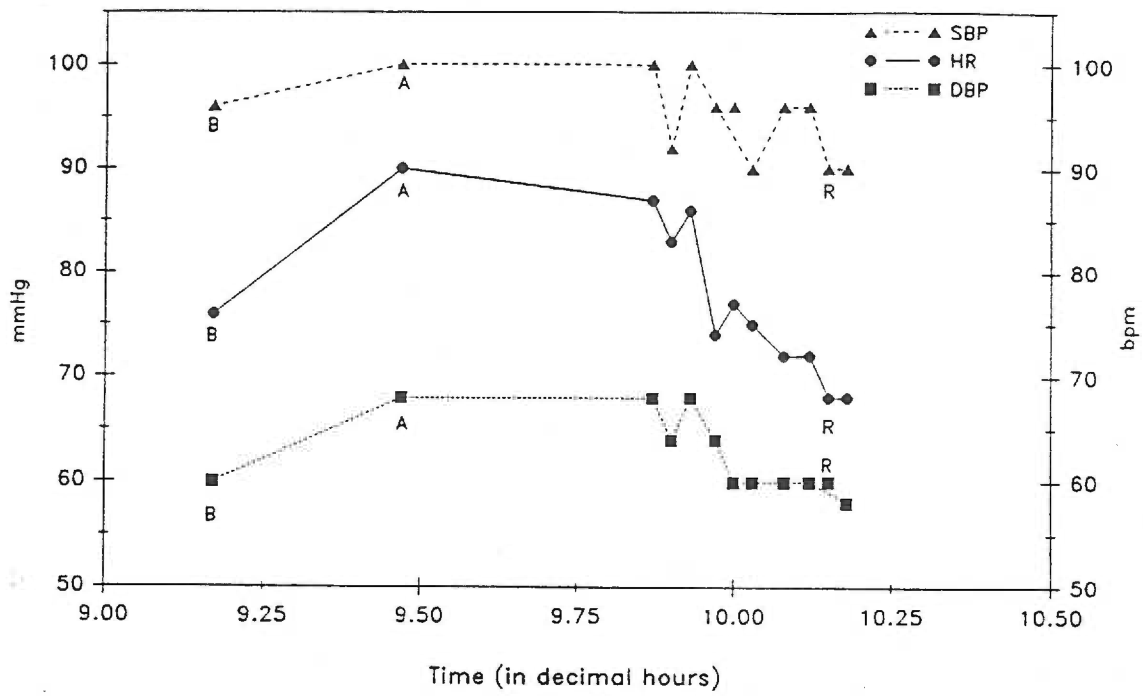
A = immediately after bath

R = recovery point

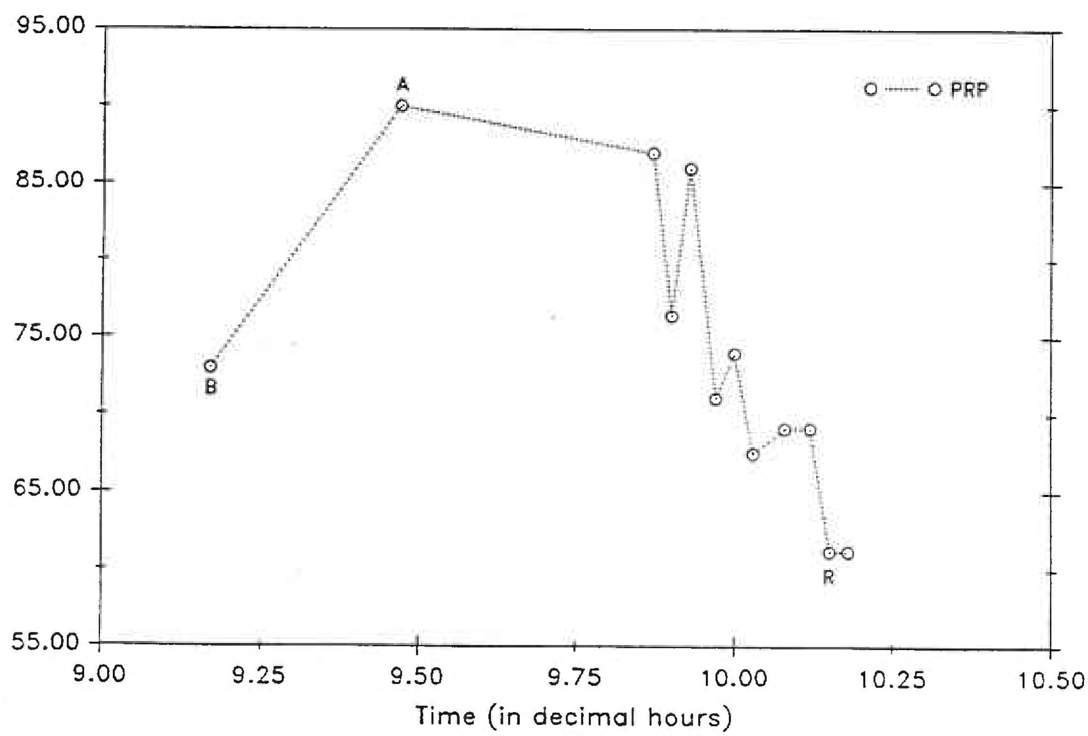
PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 3: Pressure Rate Product versus Time, Post-op Day #2.



SBP
HR
DBP
mmHg
bpm
B
A
R
100
90
80
70
60
50
9.00
9.25
9.50
9.75
10.00
10.25
10.50
Time (in decimal hours)



PRP
B
A
R
95.00
85.00
75.00
65.00
55.00
9.00
9.25
9.50
9.75
10.00
10.25
10.50
Time (in decimal hours)

Table A-9.

<u>Subject 3: Data for Post-op Day 3</u>

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
8.25	98.6	(37.0)	75	16	120	72	9000
9.20	-	-	60	12	104	60	6240
9.48	-	-	80	16	110	70	8800
9.52	-	-	76	12	110	70	8360
9.55	-	-	73	20	102	66	7446
9.58	-	-	76	20	102	72	7752
9.62	-	-	77	20	102	70	7854
9.65	-	-	76	20	108	68	8208
9.68	-	-	73	16	100	66	7300
9.67	-	-	75	16	104	70	7800
9.72	-	-	73	12	100	70	7300
9.75	-	-	73	16	104	70	7592
9.78	-	-	72	16	100	70	7200

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A17.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 3: Vital Signs versus Time, Post-op Day #3.

Figure A18.

Note: B = baseline, before bath

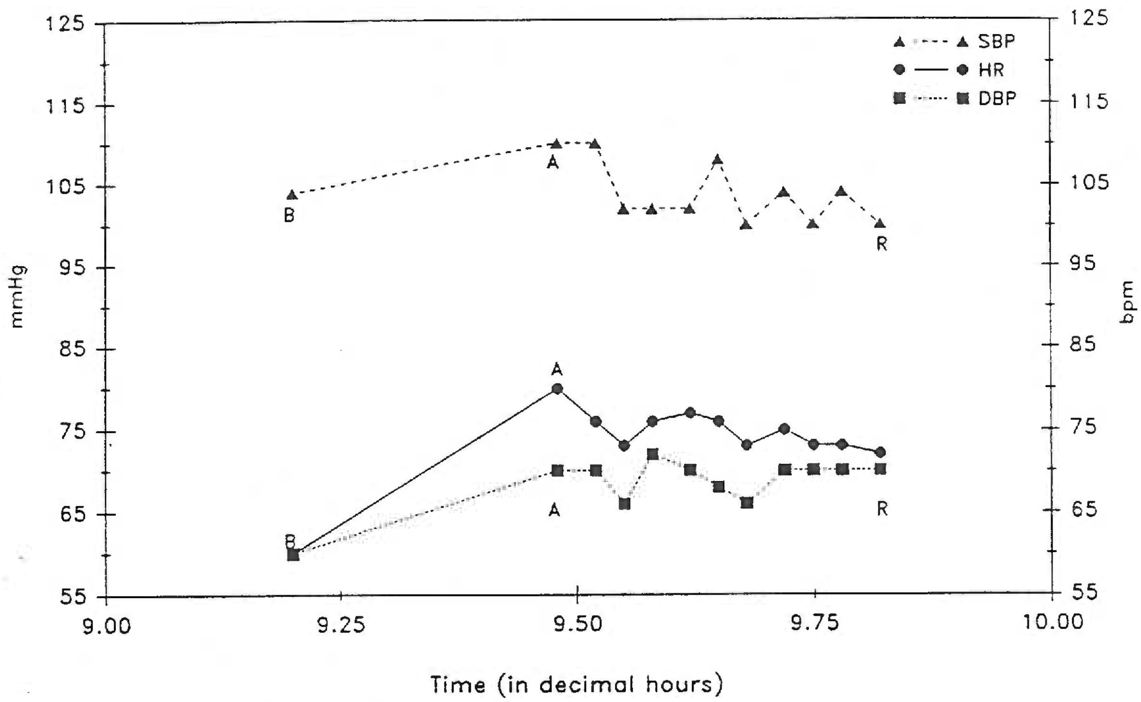
A = immediately after bath

R = recovery point

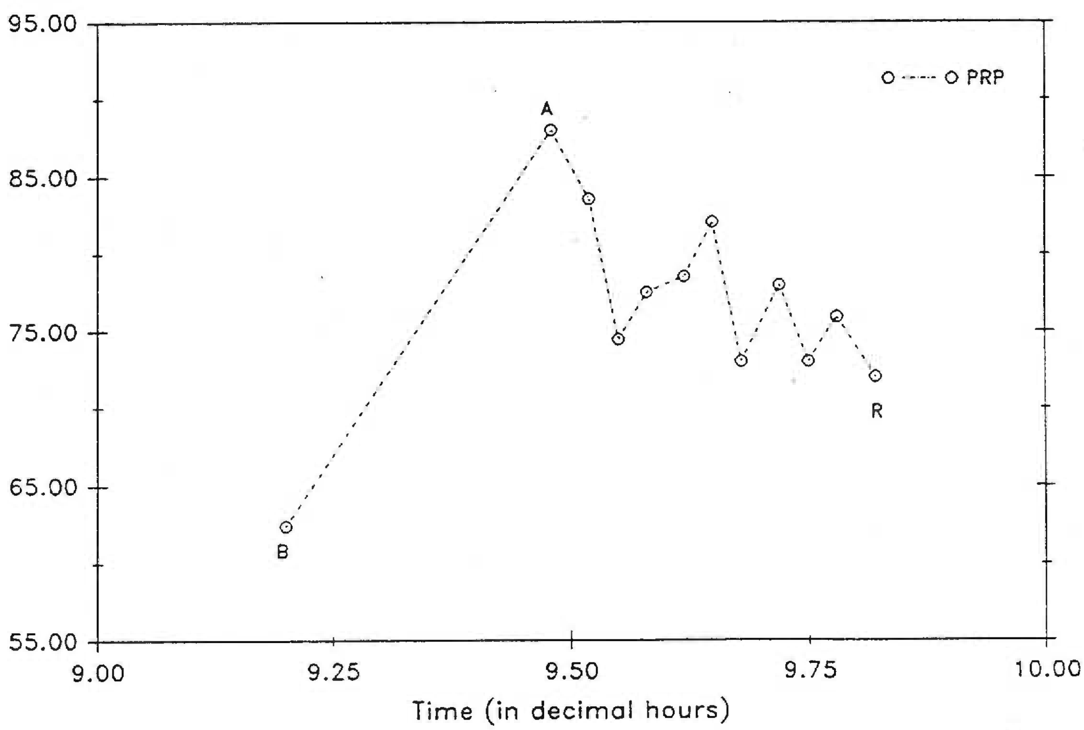
PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 3: Pressure Rate Product versus Time, Post-op Day #3.



SBP
HR
DBP
mmHg
bpm
125
115
105
95
85
75
65
55
9.00
9.25
9.50
9.75
10.00
A
B
R
Time (in decimal hours)



PRP
95.00
85.00
75.00
65.00
55.00
9.00
9.25
9.50
9.75
10.00
A
B
R
Time (in decimal hours)

Table A-10.

Subject 4: Data for Post-op Day 1

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
8.66	99.0	(37.2)	100	24	102	68	10200
8.87	-	-	140	24	120	72	16800
9.43	-	-	120	24	104	70	12480
9.75	-	-	140	32	120	80	16800
9.78	-	-	136	28	116	76	15776
9.82	-	-	130	26	108	76	14040
9.85	-	-	120	24	108	72	12960
9.88	-	-	116	24	106	70	12296
9.92	-	-	116	24	104	72	12064

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A19.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 4: Vital Signs versus Time, Post-op Day #1.

Figure A20.

Note: B = baseline, before bath

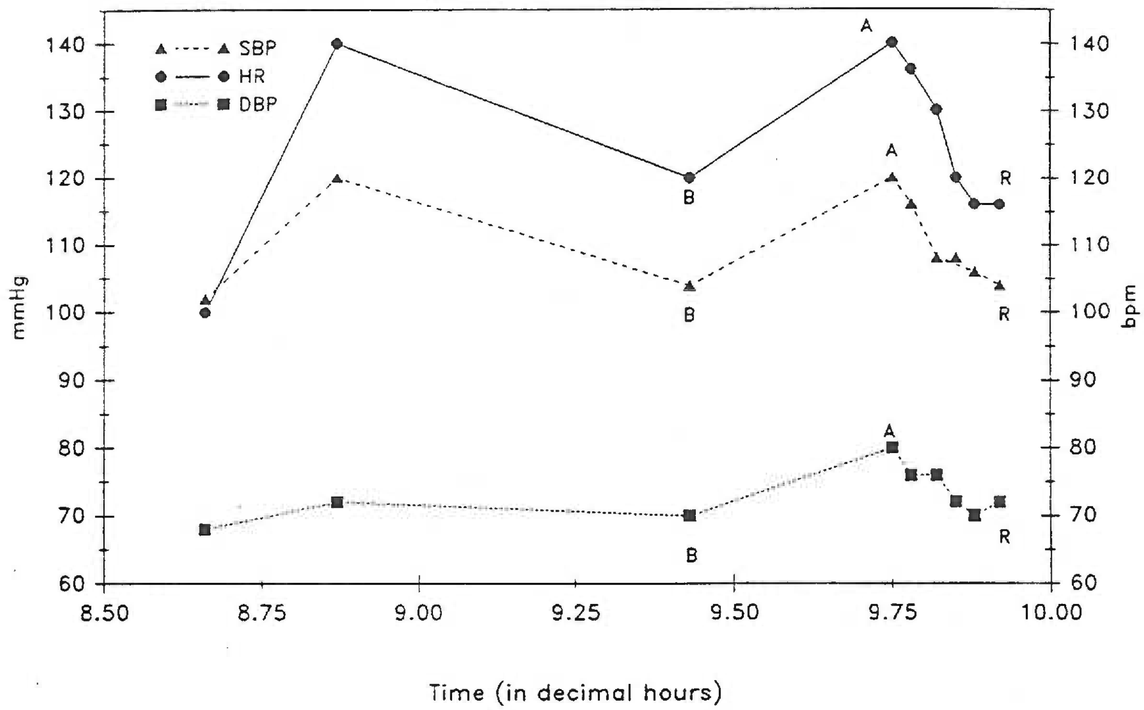
A = immediately after bath

R = recovery point

PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 4: Pressure Rate Product versus Time, Post-op Day #1.


SBP
HR
DBP
mmHg
bpm
A
B
R
140
130
120
110
100
90
80
70
60
8.50
8.75
9.00
9.25
9.50
9.75
10.00
Time (in decimal hours)

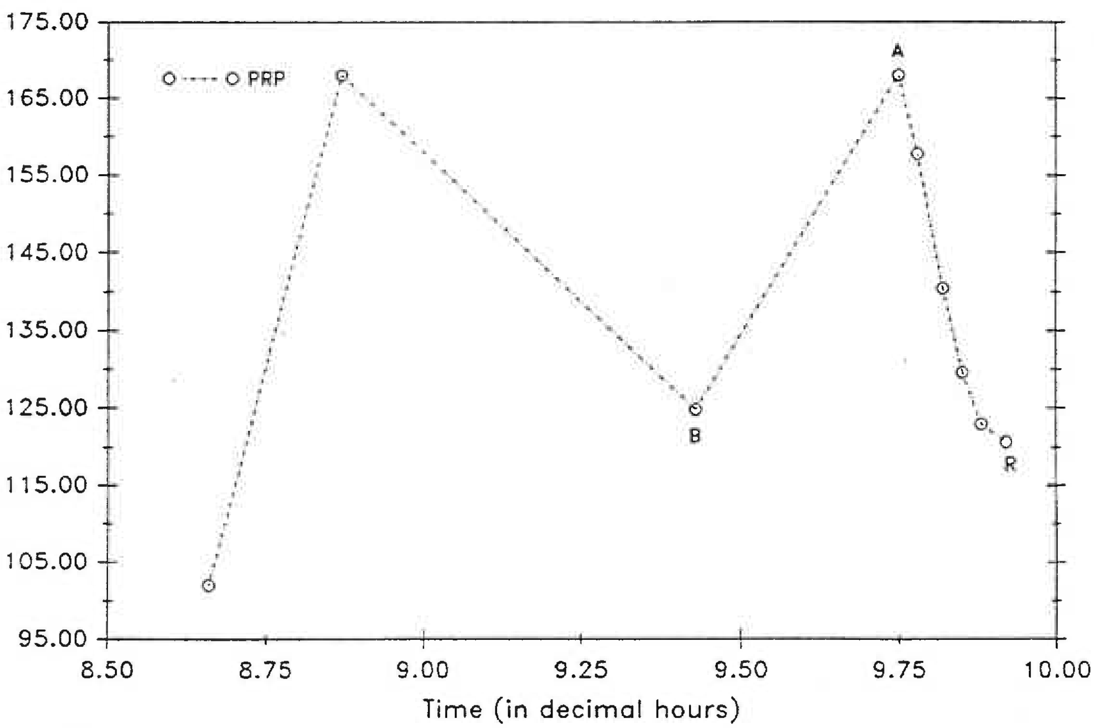

PRP
A
B
R
175.00
165.00
155.00
145.00
135.00
125.00
115.00
105.00
95.00
8.50
8.75
9.00
9.25
9.50
9.75
10.00
Time (in decimal hours)

Table A-11.

Subject 4: Data for Post-op Day 2

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
8.42	96.6	(35.9)	100	22	116	70	11600
8.78	-	-	104	22	120	80	12480
8.88	-	-	108	20	124	80	13392
8.92	-	-	104	20	120	78	12480
9.08	-	-	100	20	124	82	12400
9.12	-	-	100	22	124	80	12400
9.15	-	-	100	22	124	78	12400
9.20	-	-	102	20	122	80	12444

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A21.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 4: Vital Signs versus Time, Post-op Day #2.

Figure A22.

Note: B = baseline, before bath

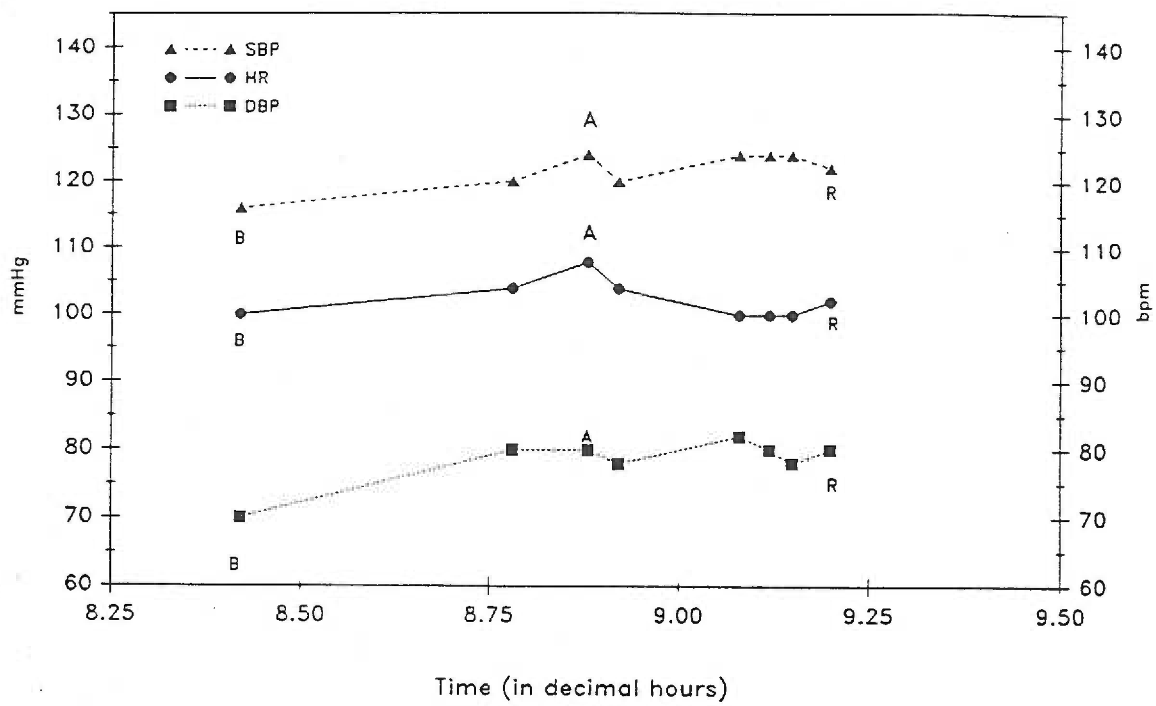
A = immediately after bath

R = recovery point

PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 4: Pressure Rate Product versus Time, Post-op Day #2.


SBP
HR
DBP
mmHg
bpm
A
B
R
140
130
120
110
100
90
80
70
60
8.25
8.50
8.75
9.00
9.25
9.50
Time (in decimal hours)

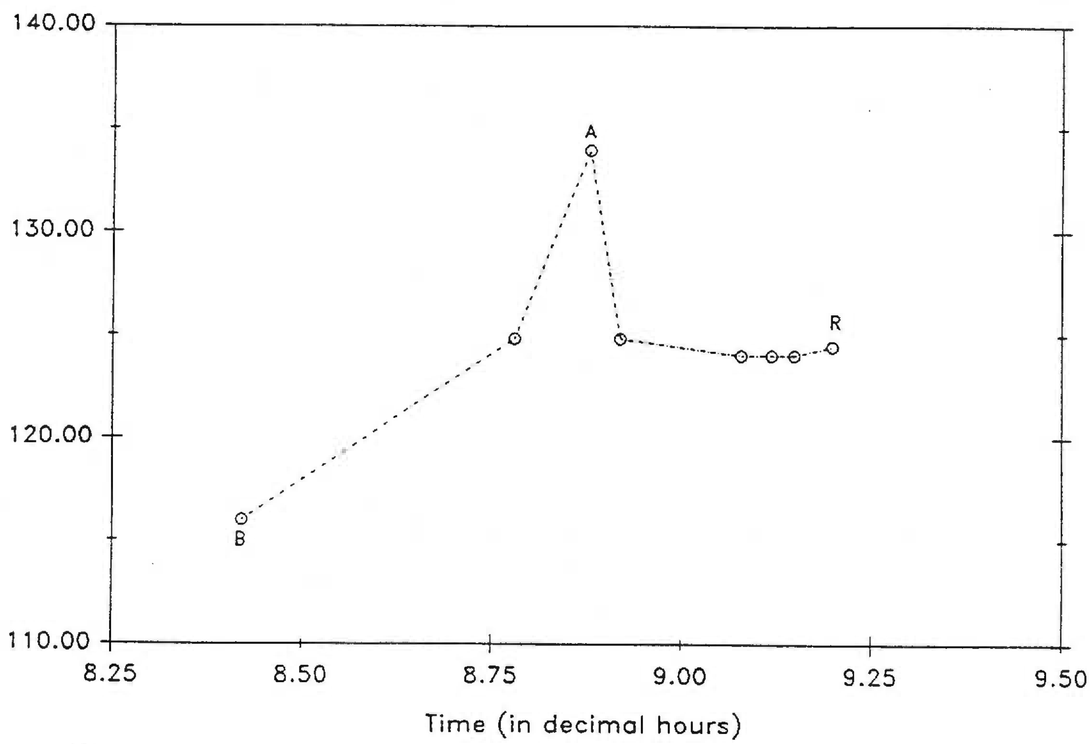

A
B
R
140.00
130.00
120.00
110.00
8.25
8.50
8.75
9.00
9.25
9.50
Time (in decimal hours)

Table A-12.

Subject 4: Data for Post-op Day 3

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
9.85	98.6	(37.0)	96	16	120	82	11520
10.07	-	-	104	20	160	94	16640
10.10	-	-	92	16	140	90	12880
10.13	-	-	92	16	138	90	12696
10.17	-	-	96	16	134	90	12864
10.20	-	-	96	16	136	90	13056
10.23	-	-	92	16	130	86	11960
10.27	-	-	88	16	128	82	11264
10.30	-	-	92	16	128	84	11776
10.33	-	-	88	16	128	82	11264
10.37	-	-	92	16	130	84	11960

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A23.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 4: Vital Signs versus Time, Post-op Day #3.

Figure A24.

Note: B = baseline, before bath

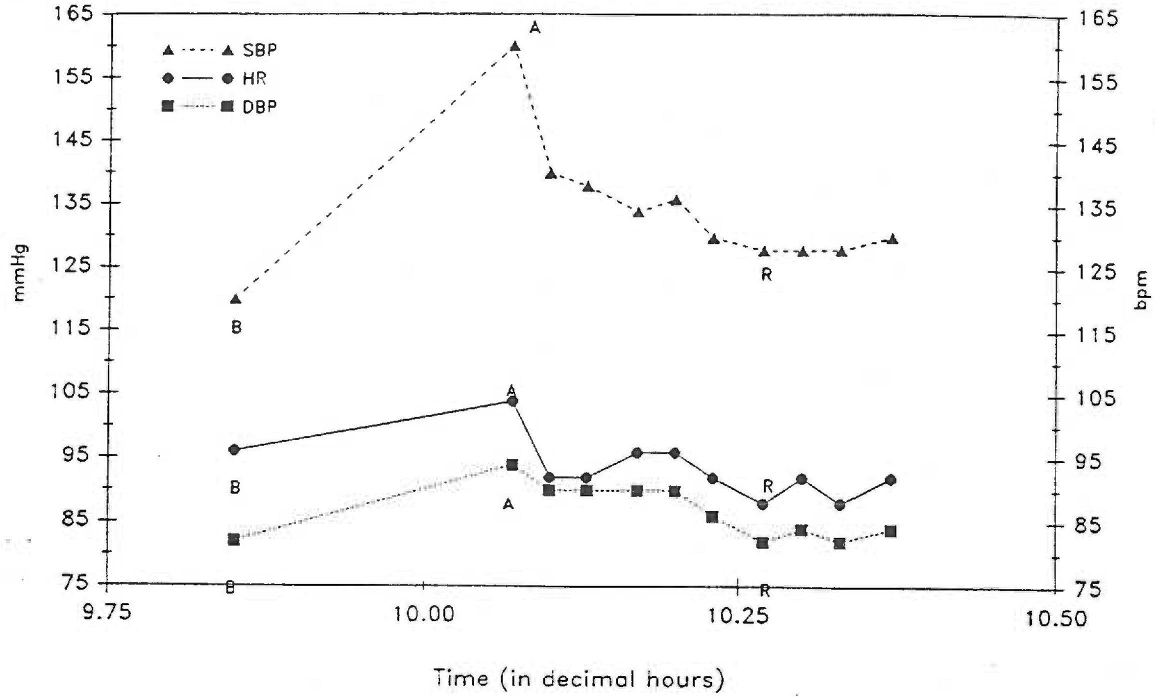
A = immediately after bath

R = recovery point

PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 4: Pressure Rate Product versus Time, Post-op Day #3.


165
155
145
135
125
115
105
95
85
75
mmHg
bpm
SBP
HR
DBP
A
B
R
9.75
10.00
10.25
10.50
Time (in decimal hours)

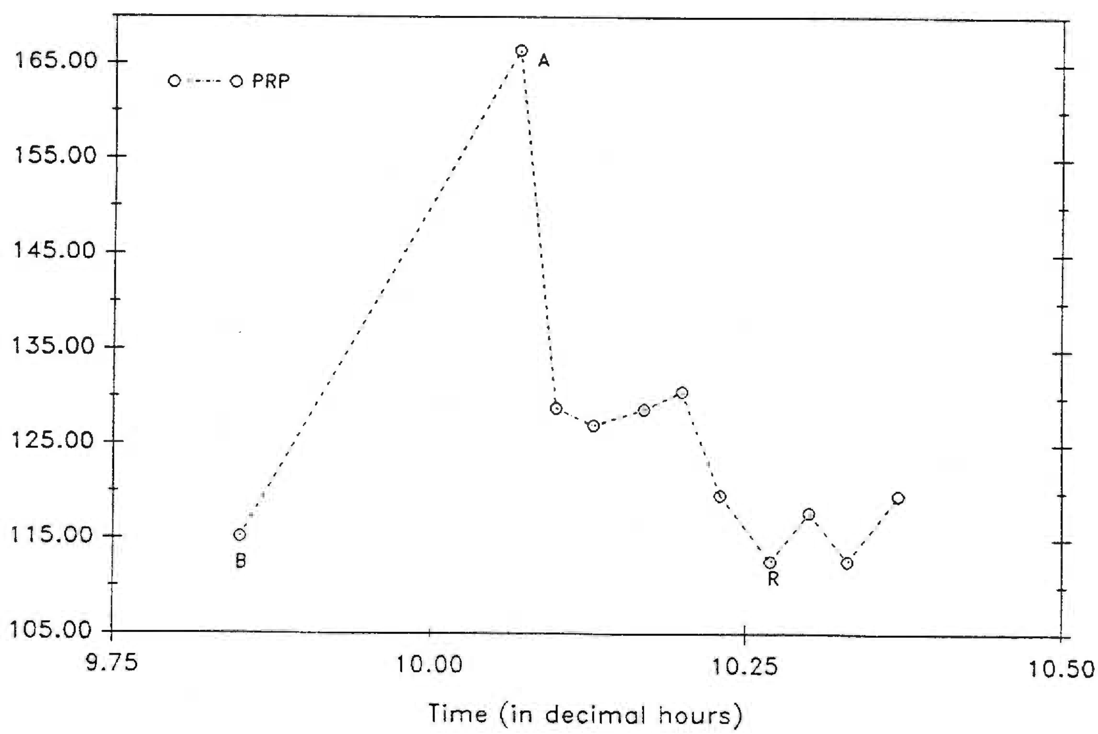

165.00
155.00
145.00
135.00
125.00
115.00
105.00
PRP
A
B
R
9.75
10.00
10.25
10.50
Time (in decimal hours)

Table A-13.

Subject 5: Data for Post-op Day 1

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
8.33	97.8	(36.6)	104	26	110	64	11440
8.83	-	-	100	24	114	60	11400
9.33	-	-	108	22	112	70	12096
9.57	-	-	108	22	122	70	13176
9.60	-	-	104	22	118	68	12272
9.63	-	-	104	22	118	68	12272
9.66	-	-	106	20	116	64	12296
9.70	-	-	104	20	110	60	11440
9.75	-	-	104	20	110	60	11440

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A25.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 5: Vital Signs versus Time, Post-op Day #1.

Figure A26.

Note: B = baseline, before bath

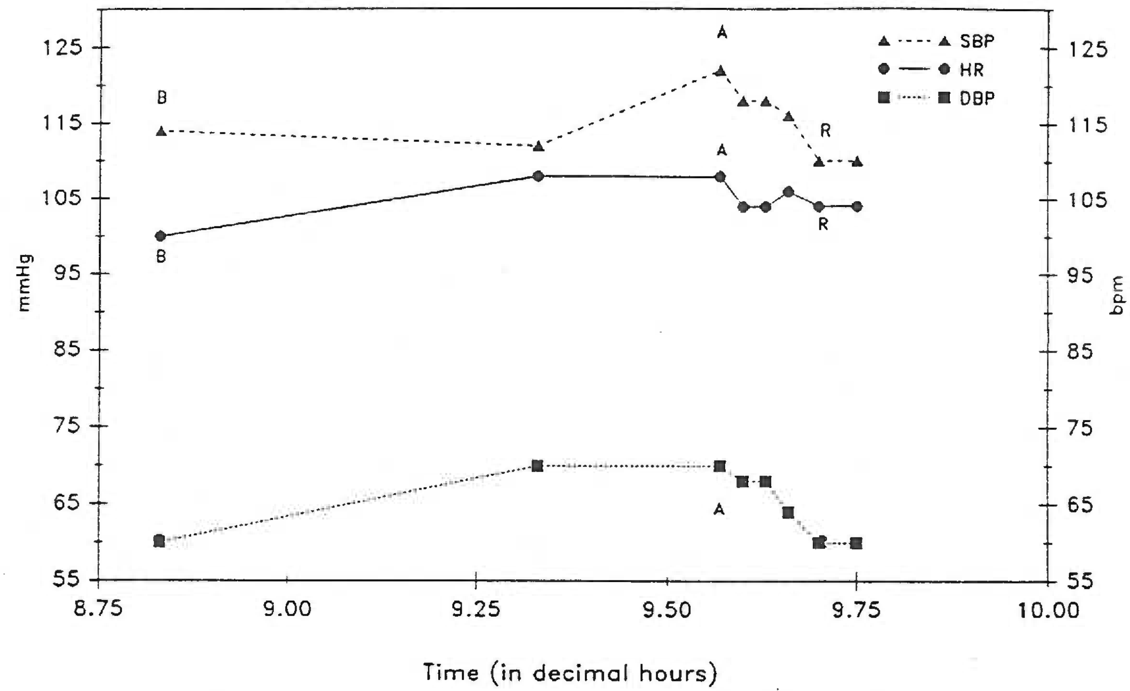
A = immediately after bath

R = recovery point

PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 5: Pressure Rate Product versus Time, Post-op Day #1.


125
115
105
95
85
75
65
55
mmHg
bpm
SBP
HR
DBP
A
B
R
8.75
9.00
9.25
9.50
9.75
10.00
Time (in decimal hours)

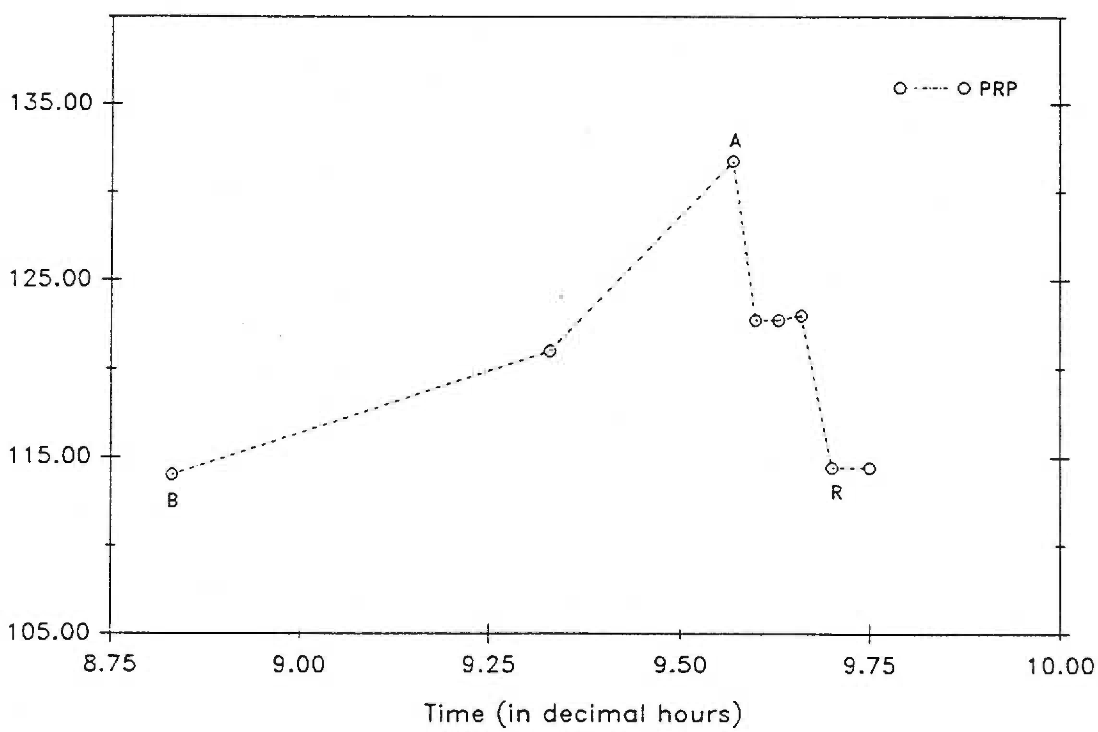

135.00
125.00
115.00
105.00
PRP
A
B
R
8.75
9.00
9.25
9.50
9.75
10.00
Time (in decimal hours)

Table A-14.

Subject 5: Data for Post-op Day 2

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
8.08	97.3	(36.3)	86	20	120	68	10320
8.42	-	-	86	20	116	64	9976
8.95	-	-	96	22	122	70	11712
9.27	-	-	100	22	134	80	13400
9.32	-	-	84	20	132	80	11088
9.37	-	-	84	20	124	72	10416
9.42	-	-	88	20	118	70	10384
9.45	-	-	80	20	116	68	9280
9.50	-	-	80	20	116	68	9280

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A27.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 5: Vital Signs versus Time, Post-op Day #2.

Figure A28.

Note: B = baseline, before bath

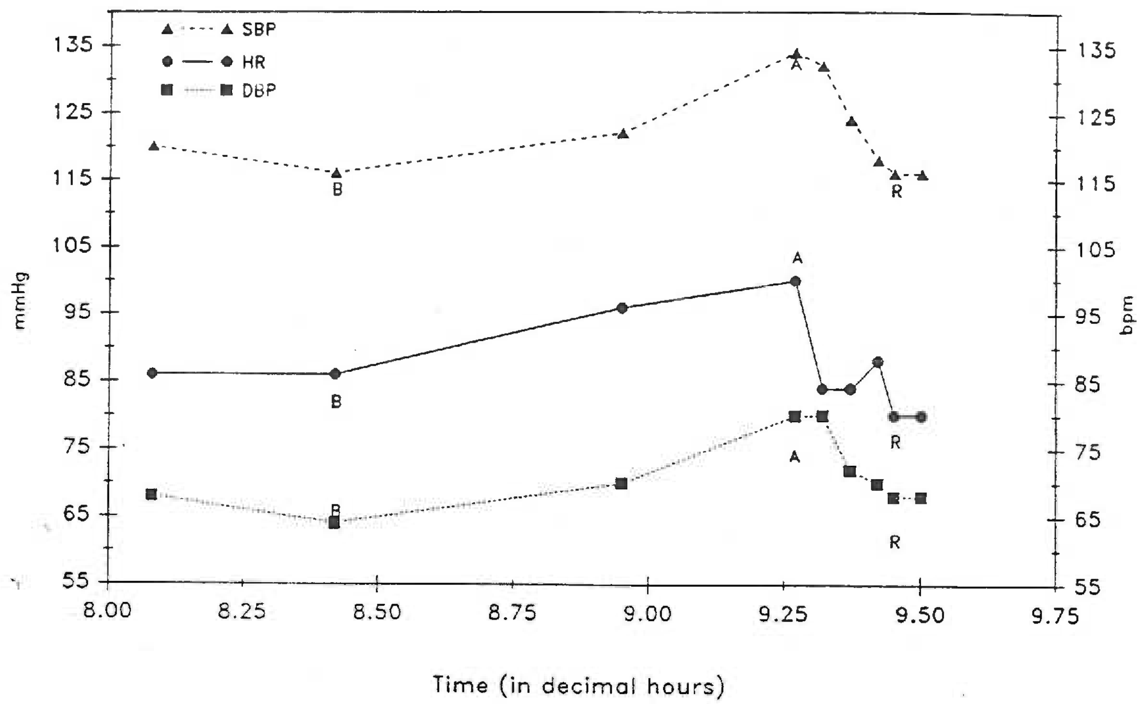
A = immediately after bath

R = recovery point

PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 5: Pressure Rate Product versus Time, Post-op Day #2.


SBP
HR
DBP
mmHg
bpm
135
125
115
105
95
85
75
65
55
8.00
8.25
8.50
8.75
9.00
9.25
9.50
9.75
A
B
R
Time (in decimal hours)

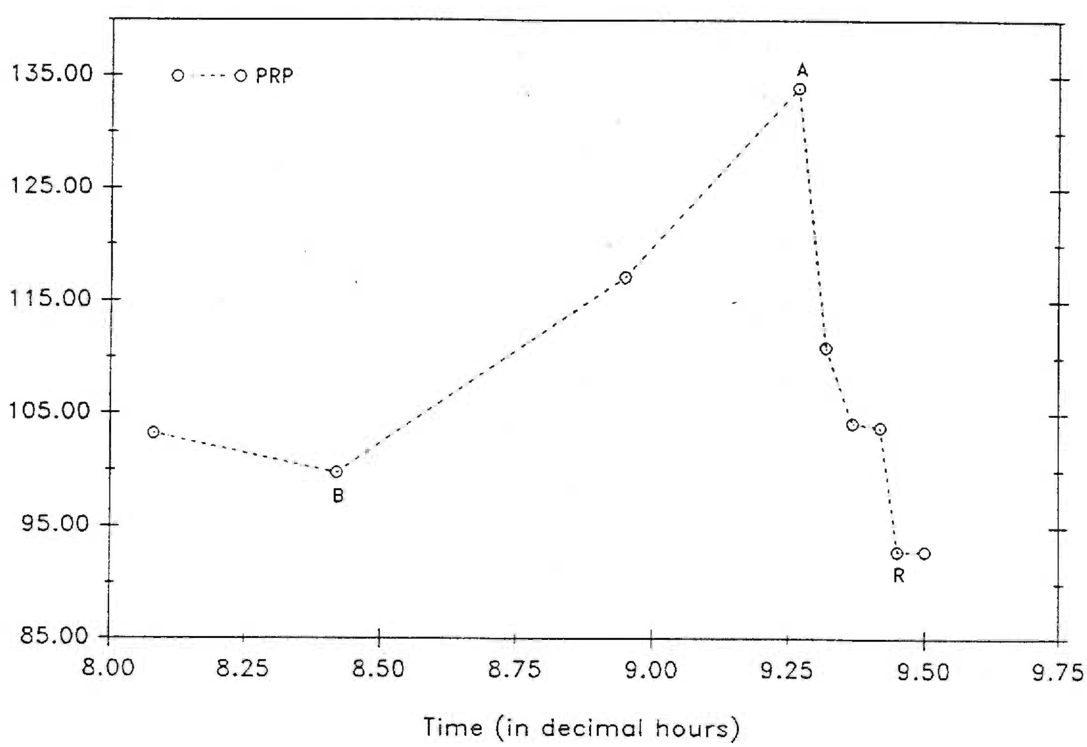

PRP
135.00
125.00
115.00
105.00
95.00
85.00
8.00
8.25
8.50
8.75
9.00
9.25
9.50
9.75
A
B
R
Time (in decimal hours)

Table A-15.

Subject 5: Data for Post-op Day 3

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
9.83	97.2	(36.2)	72	18	130	76	9360
10.15	-	-	80	20	148	82	11840
10.18	-	-	76	18	142	78	10792
10.22	-	-	76	18	138	78	10488
10.25	-	-	80	18	134	76	10720
10.28	-	-	76	18	132	76	10032

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A29

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 5: Vital Signs versus Time, Post-op Day #3.

Figure A30

Note: B = baseline, before bath

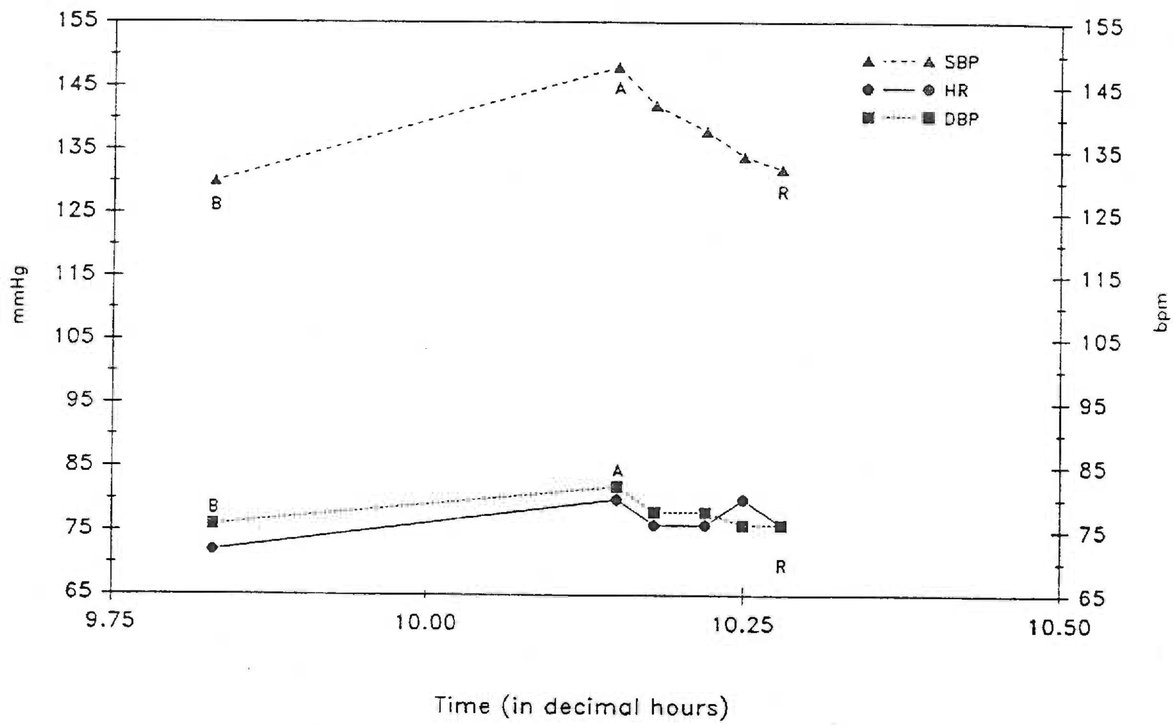
A = immediately after bath

R = recovery point

PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 5: Pressure Rate Product versus Time, Post-op Day #3.


155
145
135
125
115
105
95
85
75
65
mmHg
bpm
SBP
HR
DBP
B
A
R
9.75
10.00
10.25
10.50
Time (in decimal hours)

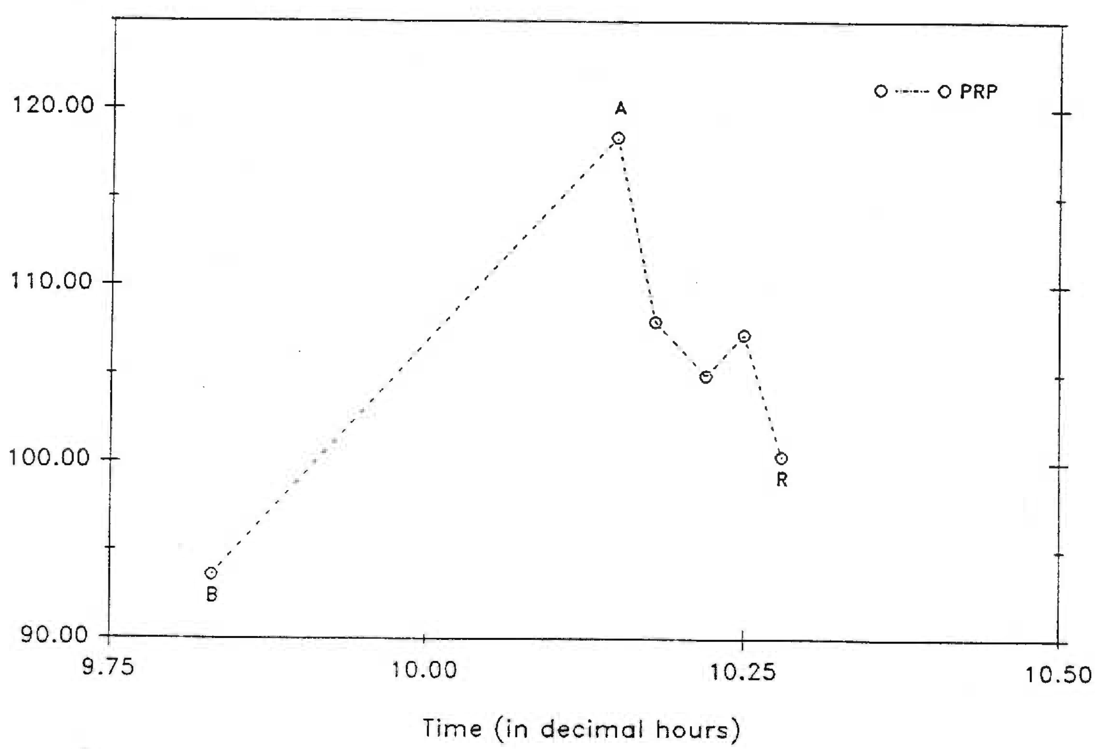

120.00
110.00
100.00
90.00
PRP
A
B
R
9.75
10.00
10.25
10.50
Time (in decimal hours)

Table A-16.

Subject 6: Data for Post-op Day 1

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
8.33	99.7	(37.6)	80	18	122	68	9760
8.88	-	-	88	20	124	68	10912
9.45	-	-	116	24	110	60	12760
9.50	-	-	96	20	100	60	9600
9.57	-	-	94	20	110	68	10340
9.60	-	-	88	20	114	68	10032
9.63	-	-	86	18	120	68	10320
9.67	-	-	88	18	122	68	10736
9.70	-	-	86	18	120	68	10320
9.73	-	-	88	18	120	68	10560
9.77	-	-	80	18	120	68	9600

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A31

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 6: Vital Signs versus Time, Post-op Day #1.

Figure A32

Note: B = baseline, before bath

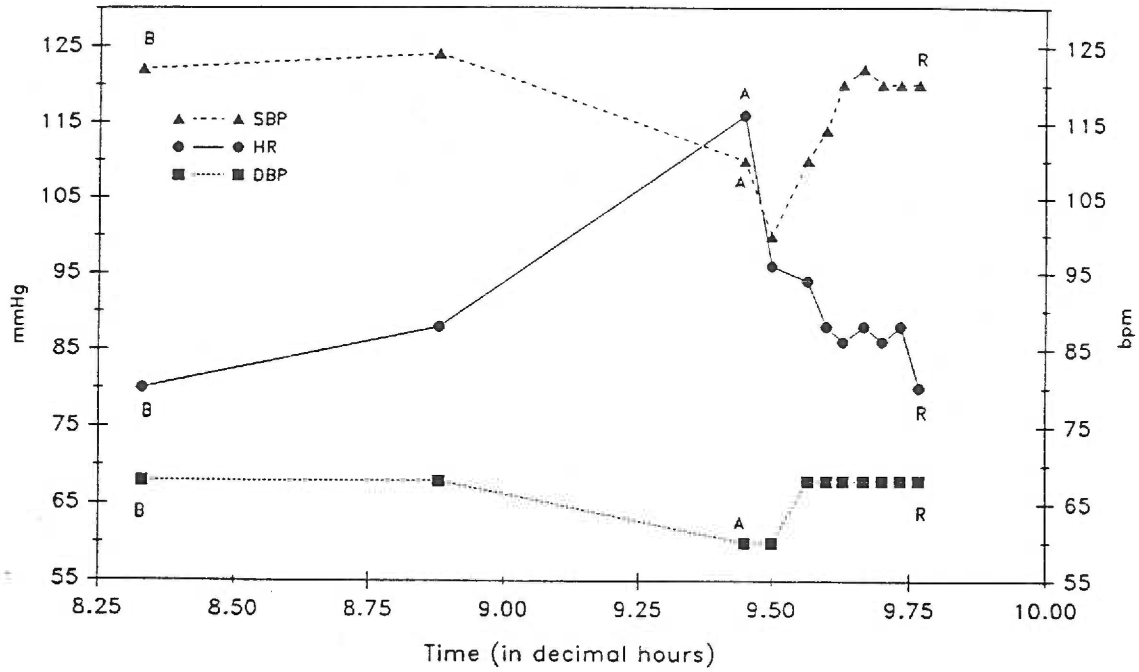
A = immediately after bath

R = recovery point

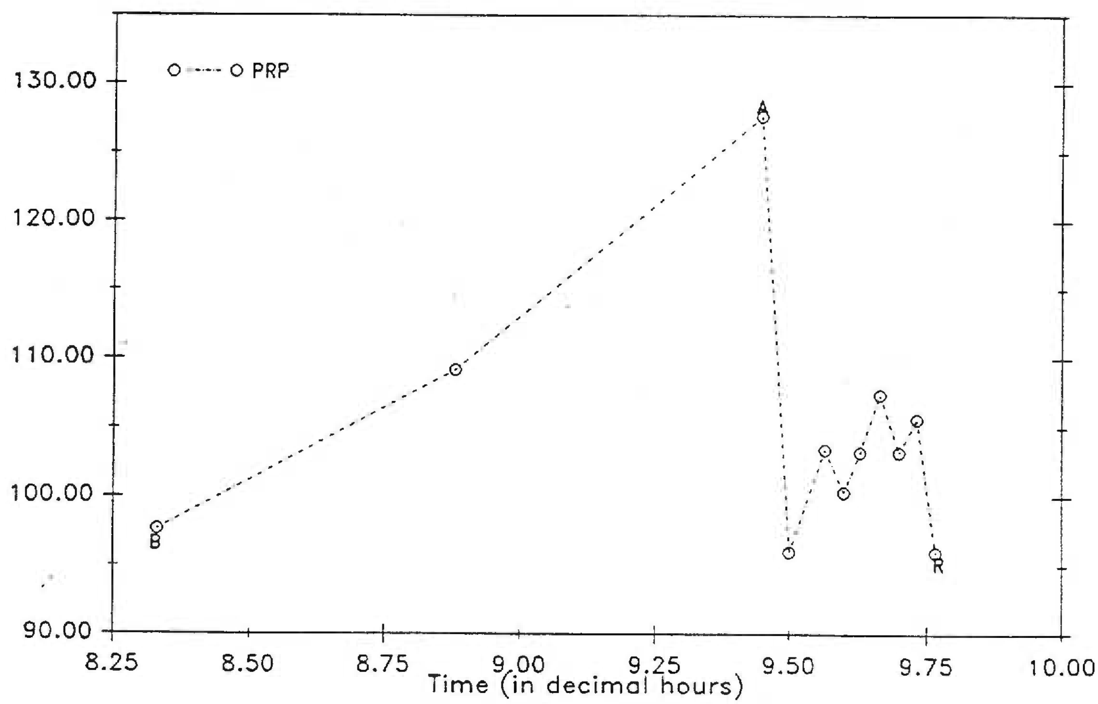
PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 6: Pressure Rate Product versus Time, Post-op Day #1.



SBP
HR
DBP
mmHg
bpm
B
A
R
125
115
105
95
85
75
65
55
8.25
8.50
8.75
9.00
9.25
9.50
9.75
10.00
Time (in decimal hours)



PRP
B
A
R
130.00
120.00
110.00
100.00
90.00
8.25
8.50
8.75
9.00
9.25
9.50
9.75
10.00
Time (in decimal hours)

Table A-17.

Subject 6: Data for Post-op Day 2

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
8.25	98.4	(36.9)	72	16	116	62	8352
8.58	–	–	80	16	116	62	9280
8.75	–	–	68	16	104	62	7072
9.50	–	–	76	16	114	62	8664
10.17	–	–	72	18	122	68	8784
10.20	–	–	76	16	118	62	8968
10.23	–	–	72	16	118	62	8496
10.27	–	–	74	16	116	62	8584
10.30	–	–	72	16	116	62	8352

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A33.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 6: Vital Signs versus Time, Post-op Day #2.

Figure A34.

Note: B = baseline, before bath

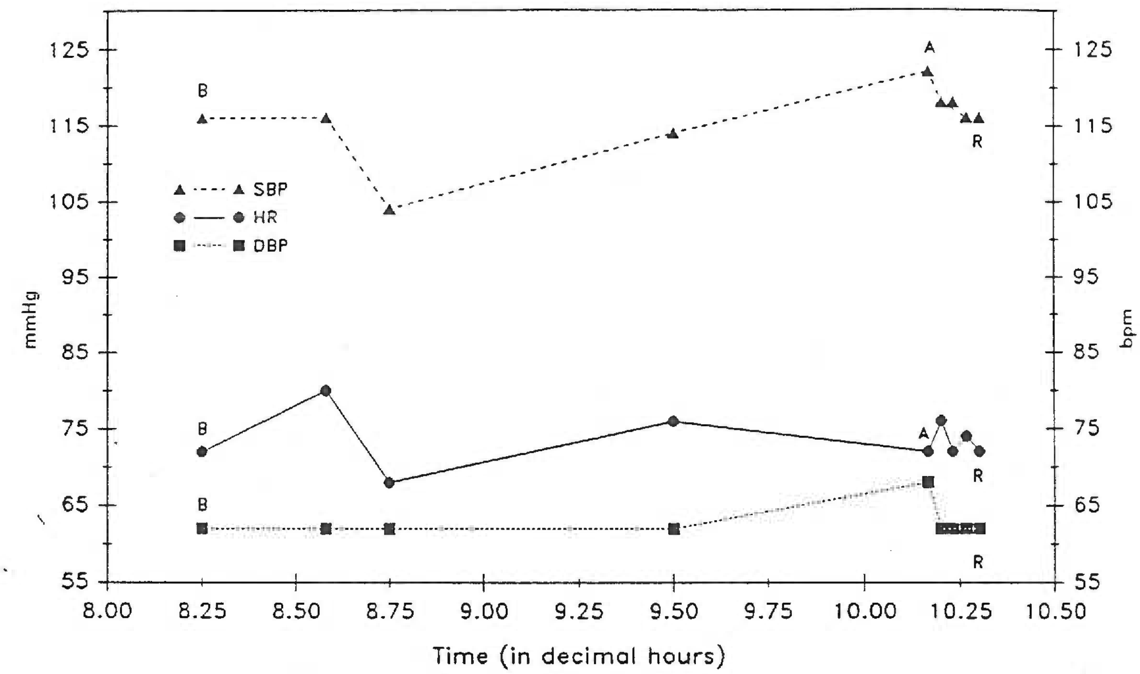
A = immediately after bath

R = recovery point

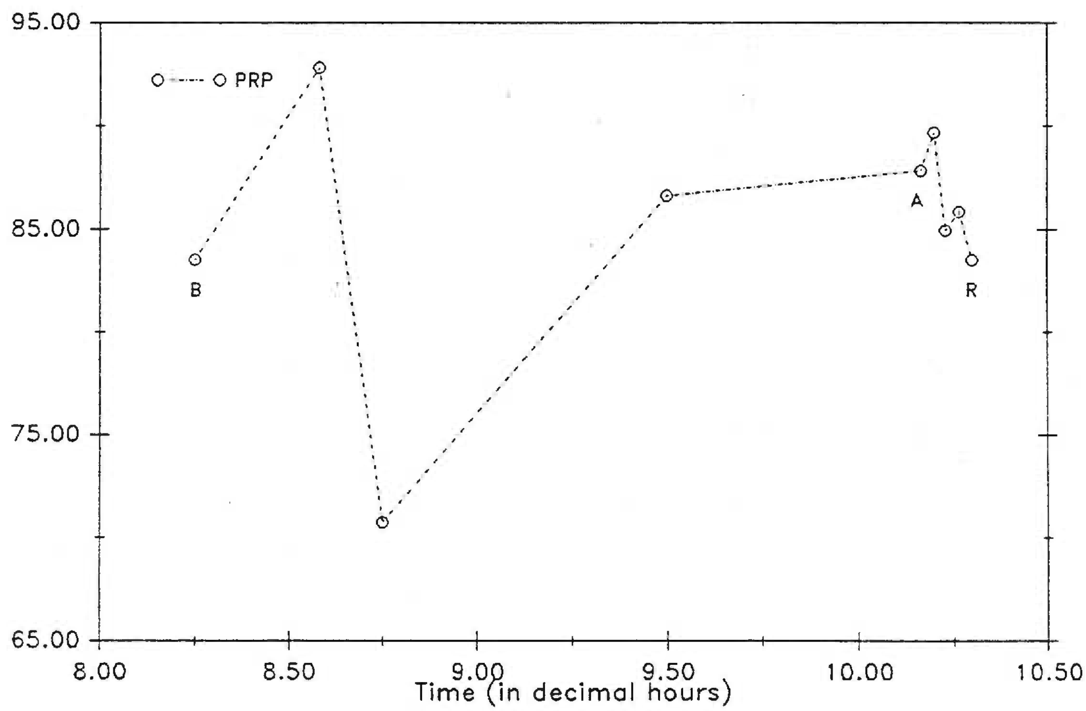
PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 6: Pressure Rate Product versus Time, Post-op Day #2.



SBP
HR
DBP
mmHg
bpm
B
A
R
125
115
105
95
85
75
65
55
8.00
8.25
8.50
8.75
9.00
9.25
9.50
9.75
10.00
10.25
10.50
Time (in decimal hours)



PRP
B
A
R
95.00
85.00
75.00
65.00
8.00
8.50
9.00
9.50
10.00
10.50
Time (in decimal hours)

Table A-18.

Subject 6: Data for Post-op Day 3

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
8.80	97.5	(36.4)	72	16	118	70	8496
9.30	-	-	76	16	124	74	9424
9.33	-	-	60	16	124	68	7440
9.37	-	-	80	16	120	72	9600
9.40	-	-	80	16	118	64	9440
9.43	-	-	76	16	116	64	8816
9.47	-	-	80	16	116	64	9280
9.50	-	-	80	16	118	64	9440

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A35.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 6: Vital Signs versus Time, Post-op Day #3.

Figure A36.

Note: B = baseline, before bath

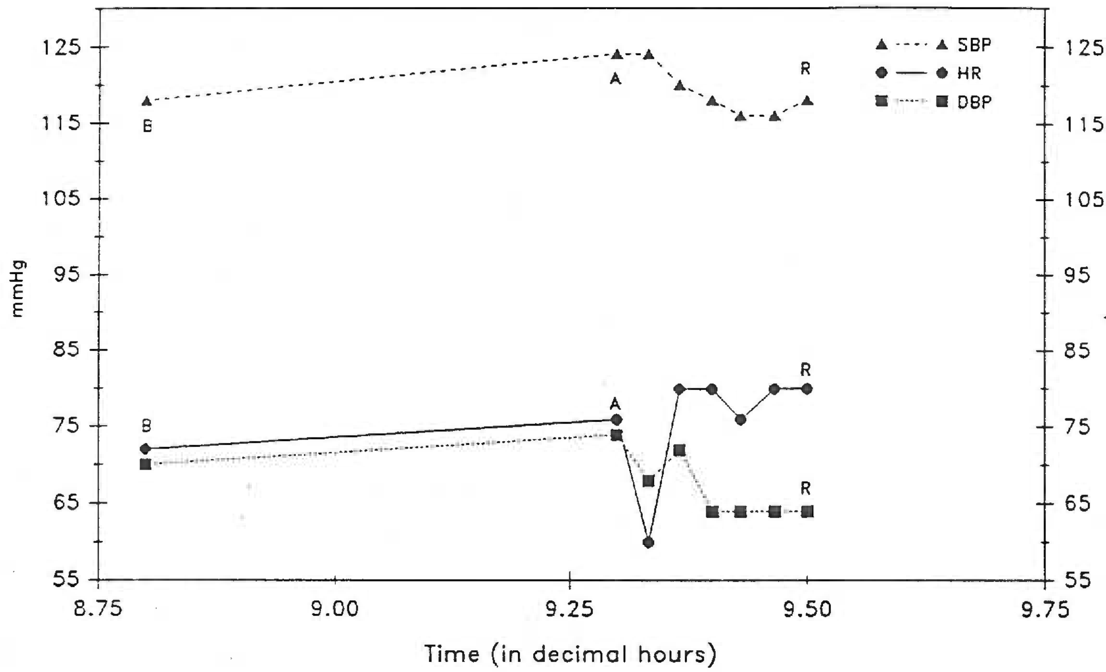
A = immediately after bath

R = recovery point

PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 6: Pressure Rate Product versus Time, Post-op Day #3.


SBP
HR
DBP
A
B
R
mmHg
bpm
125
115
105
95
85
75
65
55
8.75
9.00
9.25
9.50
9.75
Time (in decimal hours)

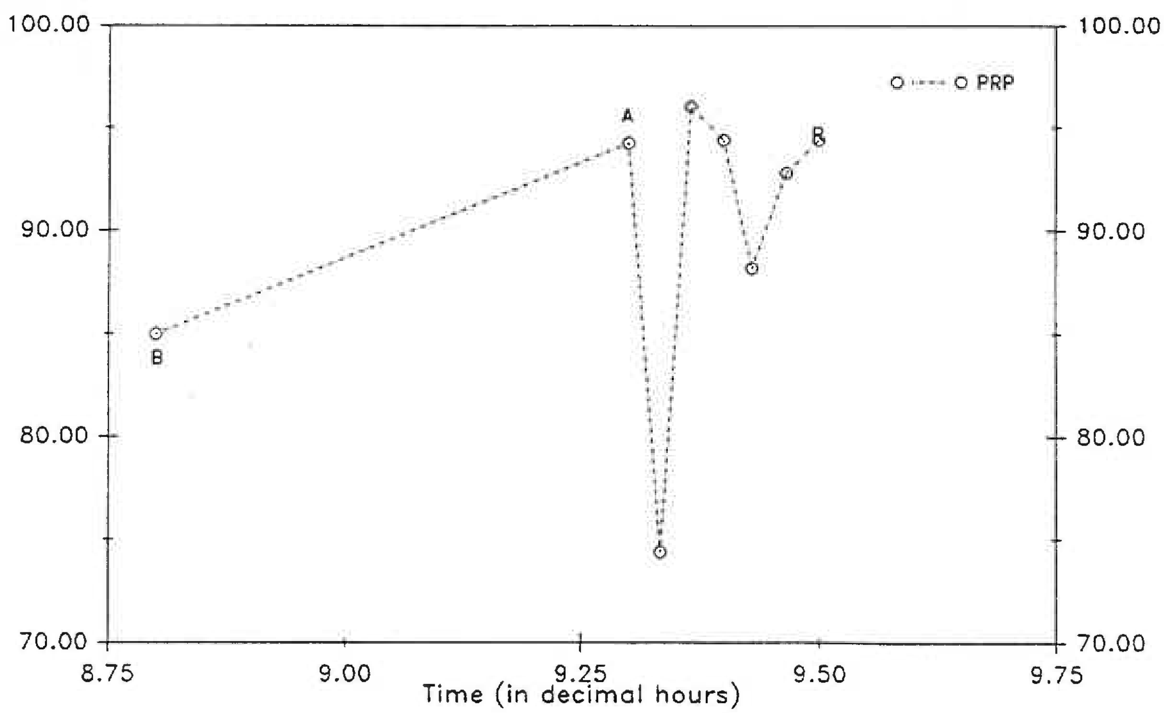

PRP
A
B
R
100.00
90.00
80.00
70.00
8.75
9.00
9.25
9.50
9.75
Time (in decimal hours)

Table A-19.

Subject 7: Data for Post-op Day 1

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
8.50	100.0	(37.8)	100	20	120	60	12000
9.48	-	-	120	26	160	80	19200
9.50	-	-	116	24	150	80	17400
9.53	-	-	114	24	148	76	16872
9.57	-	-	110	20	140	70	15400
9.60	-	-	112	20	140	70	15680
9.63	-	-	110	20	138	70	15180
9.67	-	-	100	20	134	70	13400
9.73	-	-	94	18	126	64	11844
9.77	-	-	88	18	118	62	10384
9.80	-	-	84	18	118	60	9912
9.83	-	-	84	18	120	60	10080
9.87	-	-	82	18	120	60	9840
9.90	-	-	82	18	120	60	9840
9.93	-	-	82	18	120	60	9840

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A37.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 7: Vital Signs versus Time, Post-op Day #1.

Figure A38.

Note: B = baseline, before bath

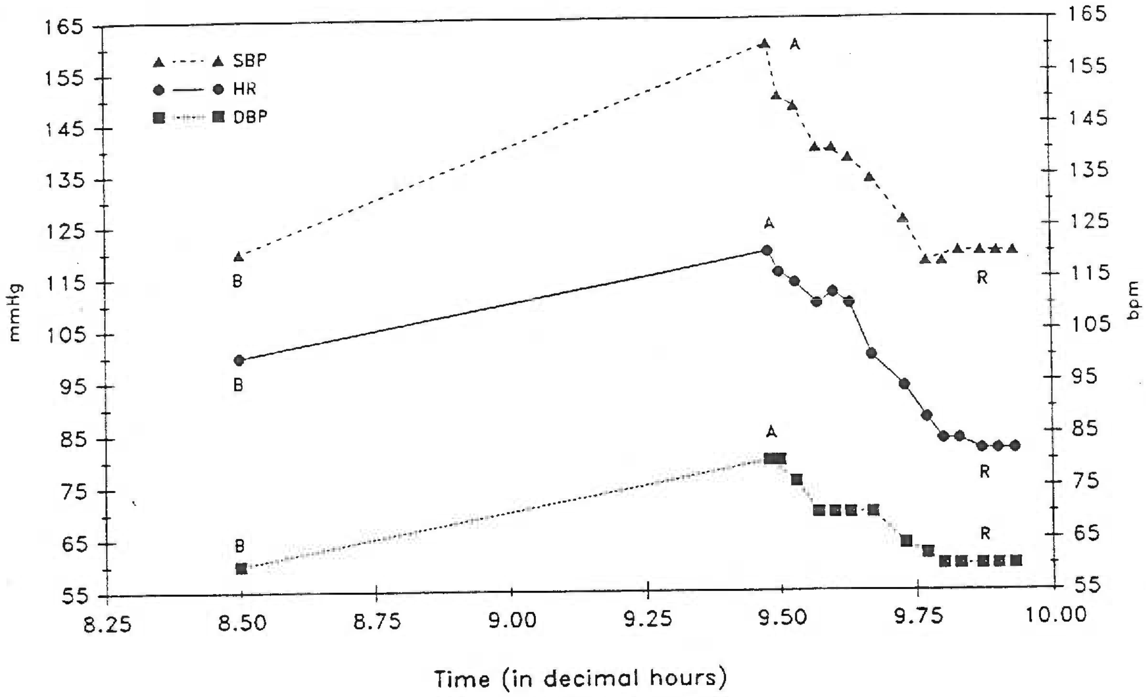
A = immediately after bath

R = recovery point

PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 7: Pressure Rate Product versus Time, Post-op Day #1.


SBP
HR
DBP
mmHg
bpm
A
B
R
165
155
145
135
125
115
105
95
85
75
65
55
8.25
8.50
8.75
9.00
9.25
9.50
9.75
10.00
Time (in decimal hours)

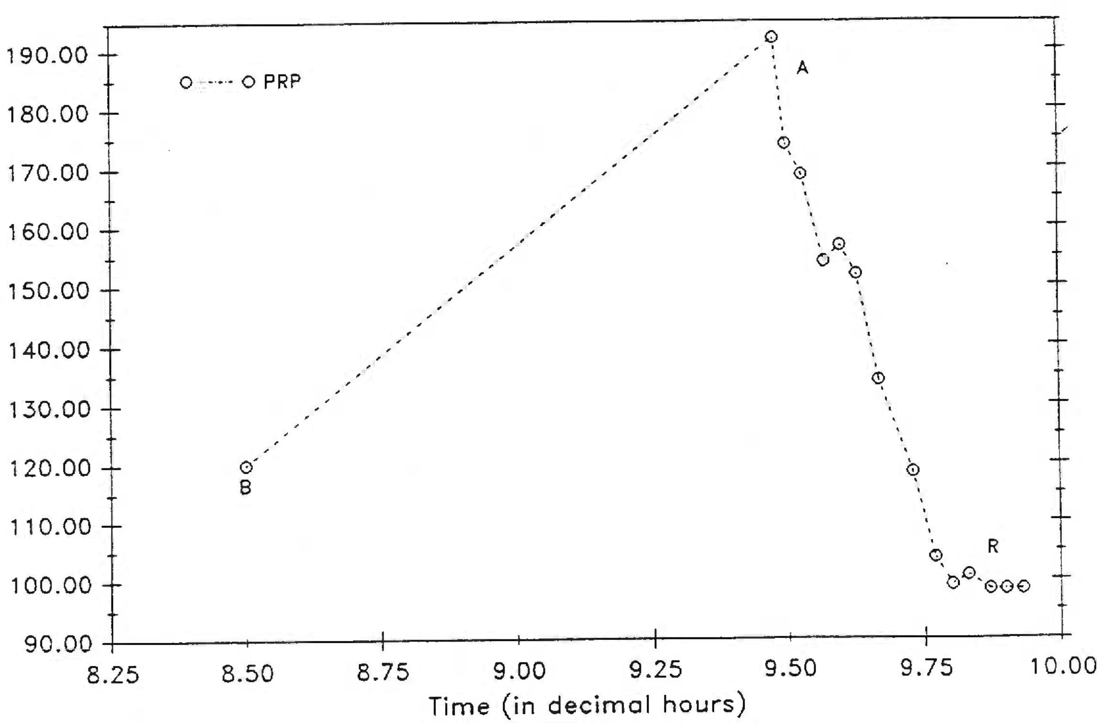

PRP
A
B
R
190.00
180.00
170.00
160.00
150.00
140.00
130.00
120.00
110.00
100.00
90.00
8.25
8.50
8.75
9.00
9.25
9.50
9.75
10.00
Time (in decimal hours)

Table A-20.

Subject 7: Data for Post-op Day 2

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
8.78	98.2	(36.8)	98	20	134	76	13132
9.30	-	-	100	28	130	76	13000
9.60	-	-	100	24	136	78	13600
9.68	-	-	100	24	130	78	13000
9.72	-	-	98	24	134	80	13132
9.75	-	-	98	-	132	80	12936
9.78	-	-	98	20	130	82	12740
9.82	-	-	96	20	132	80	12672
9.85	-	-	96	20	134	82	12864
9.88	-	-	88	20	134	80	11792
9.92	-	-	88	20	130	80	11440
9.95	-	-	88	18	134	78	11792
9.98	-	-	96	18	132	80	12672
10.02	-	-	96	20	132	80	12672
10.05	-	-	92	20	132	82	12144
10.08	-	-	88	18	134	82	11792

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A39.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 7: Vital Signs versus Time, Post-op Day #2.

Figure A40.

Note: B = baseline, before bath

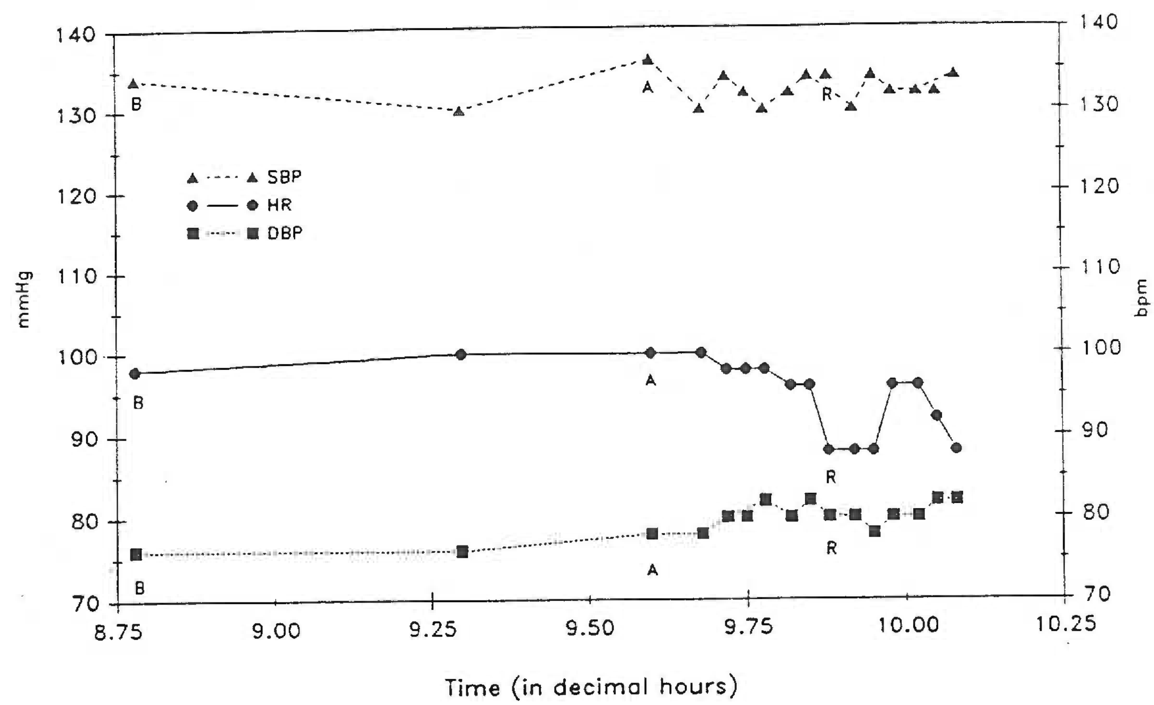
A = immediately after bath

R = recovery point

PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 7: Pressure Rate Product versus Time, Post-op Day #2.


140
130
120
110
100
90
80
70
mmHg
bpm
SBP
HR
DBP
B
A
R
8.75
9.00
9.25
9.50
9.75
10.00
10.25
Time (in decimal hours)

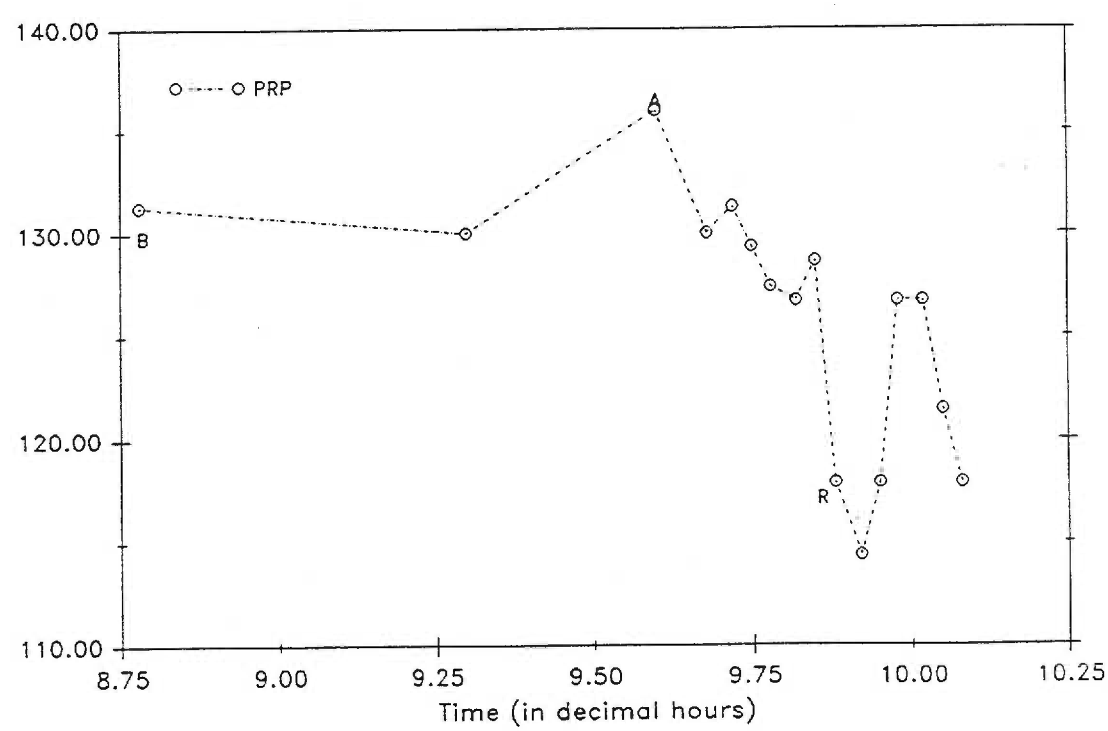

140.00
130.00
120.00
110.00
PRP
B
A
R
8.75
9.00
9.25
9.50
9.75
10.00
10.25
Time (in decimal hours)

Table A-21.

Subject 7: Data for Post-op Day 3

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
8.93	97.7	(36.5)	88	20	126	74	11088
9.25	–	–	96	24	146	88	14016
9.28	–	–	96	24	138	86	13248
9.32	–	–	88	20	136	86	11968
9.35	–	–	88	20	136	84	11968
9.38	–	–	88	20	136	80	11968
9.42	–	–	92	20	134	78	12328
9.45	–	–	88	20	130	78	11440
9.48	–	–	88	20	128	78	11264
9.52	–	–	88	20	130	78	11440
9.55	–	–	88	20	130	78	11440
9.58	–	–	88	20	130	76	11440

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A41.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 7: Vital Signs versus Time, Post-op Day #3.

Figure A42.

Note: B = baseline, before bath

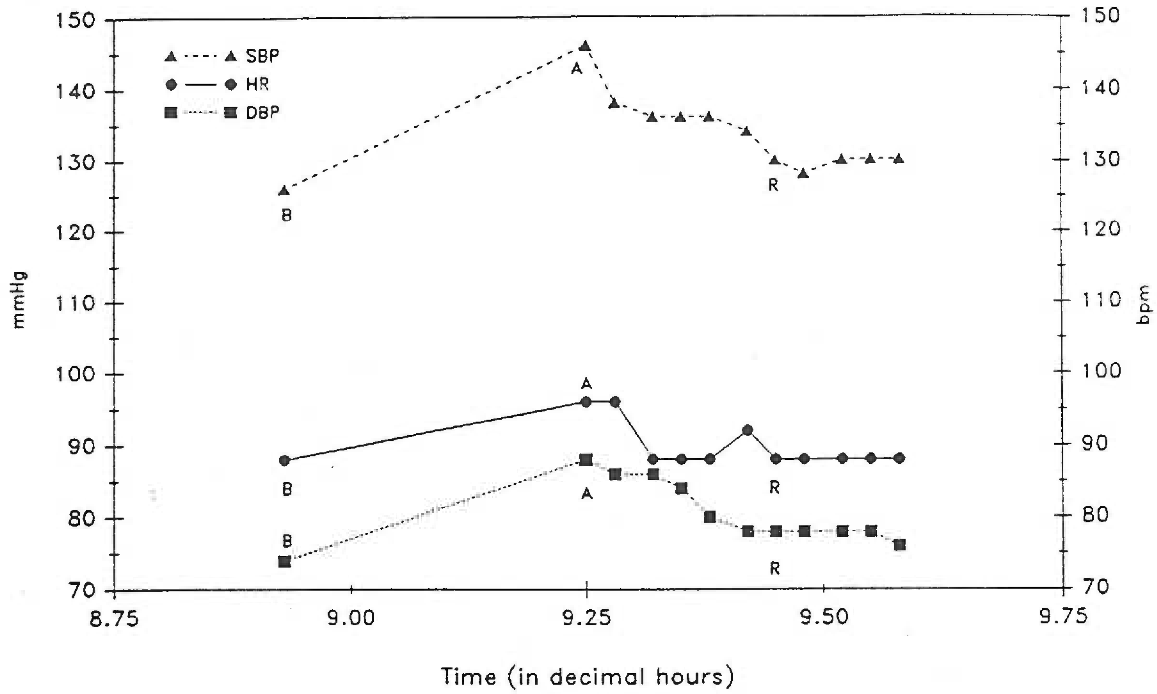
A = immediately after bath

R = recovery point

PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 7: Pressure Rate Product versus Time, Post-op Day #3.


150
140
130
120
110
100
90
80
70
mmHg
SBP
HR
DBP
A
B
R
150
140
130
120
110
100
90
80
70
bpm
8.75
9.00
9.25
9.50
9.75
Time (in decimal hours)

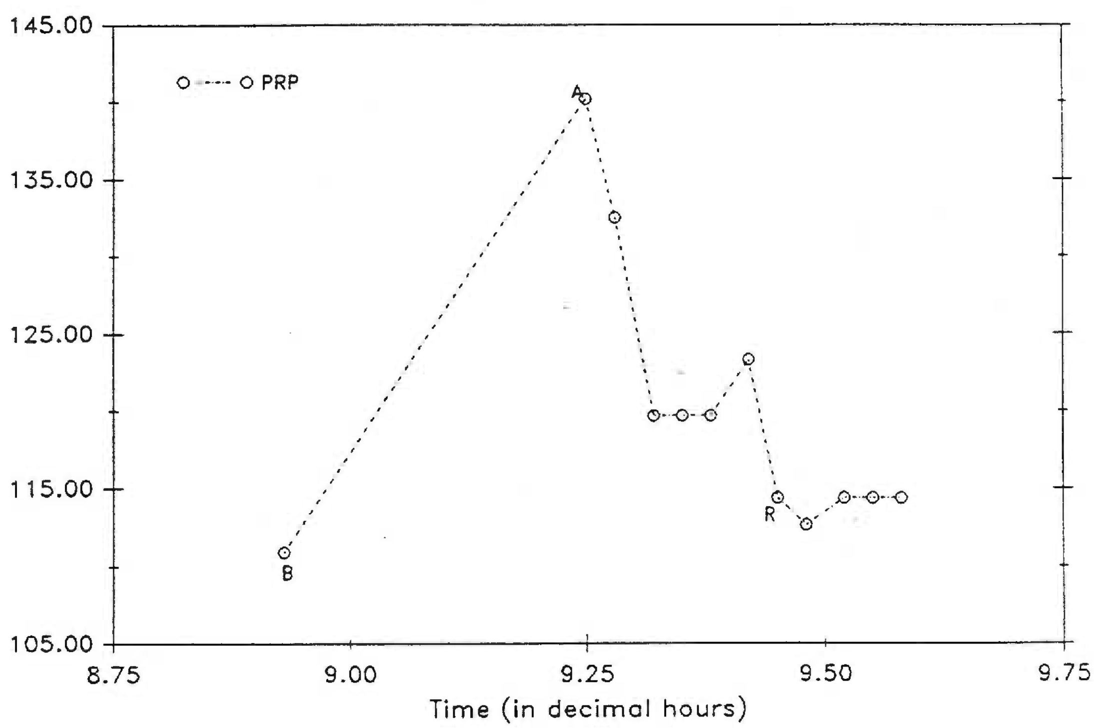

145.00
135.00
125.00
115.00
105.00
PRP
A
B
R
8.75
9.00
9.25
9.50
9.75
Time (in decimal hours)

Table A-22.

Subject 8: Data for Post-op Day 1

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
8.50	99.0	(37.2)	88	20	140	68	12320
9.33	-	-	100	24	160	80	16000
9.42	-	-	102	20	156	78	15912
9.45	-	-	98	20	150	76	14700
9.48	-	-	96	18	150	76	14400
9.53	-	-	96	18	148	74	14208
9.55	-	-	90	18	146	70	13140
9.58	-	-	88	18	140	68	12320
9.63	-	-	86	18	136	70	11696
9.65	-	-	88	18	140	70	12320
9.68	-	-	88	18	136	70	11968
9.73	-	-	86	18	140	70	12040
9.75	-	-	88	18	138	70	12144

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A43.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 8: Vital Signs versus Time, Post-op Day #1.

Figure A44.

Note: B = baseline, before bath

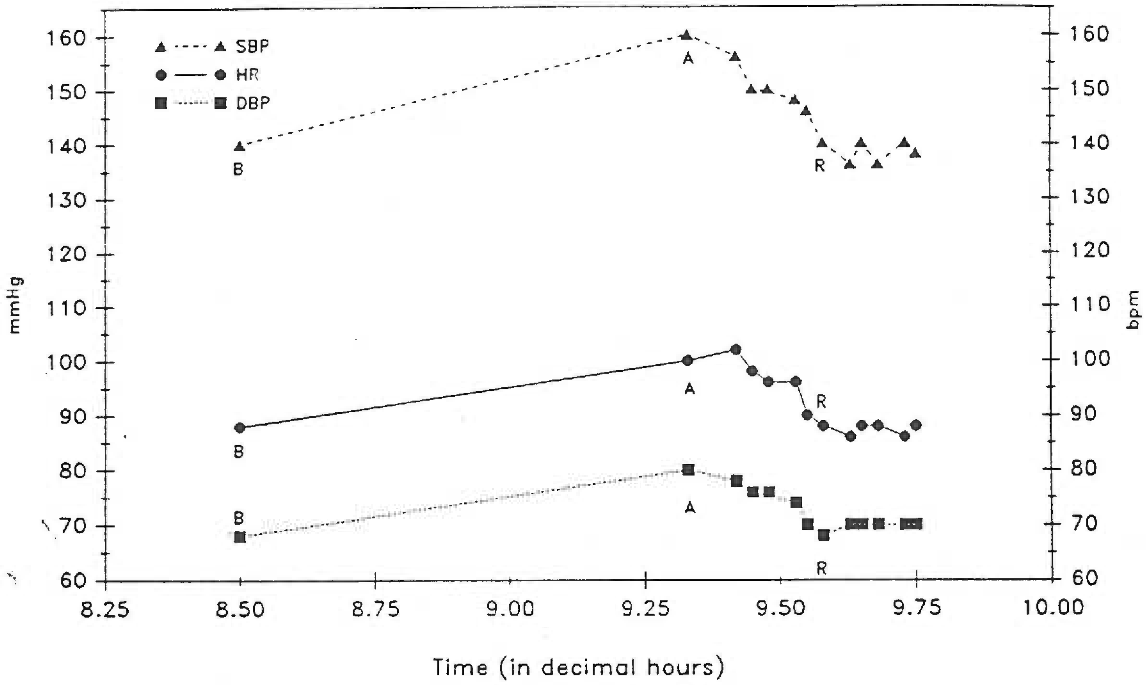
A = immediately after bath

R = recovery point

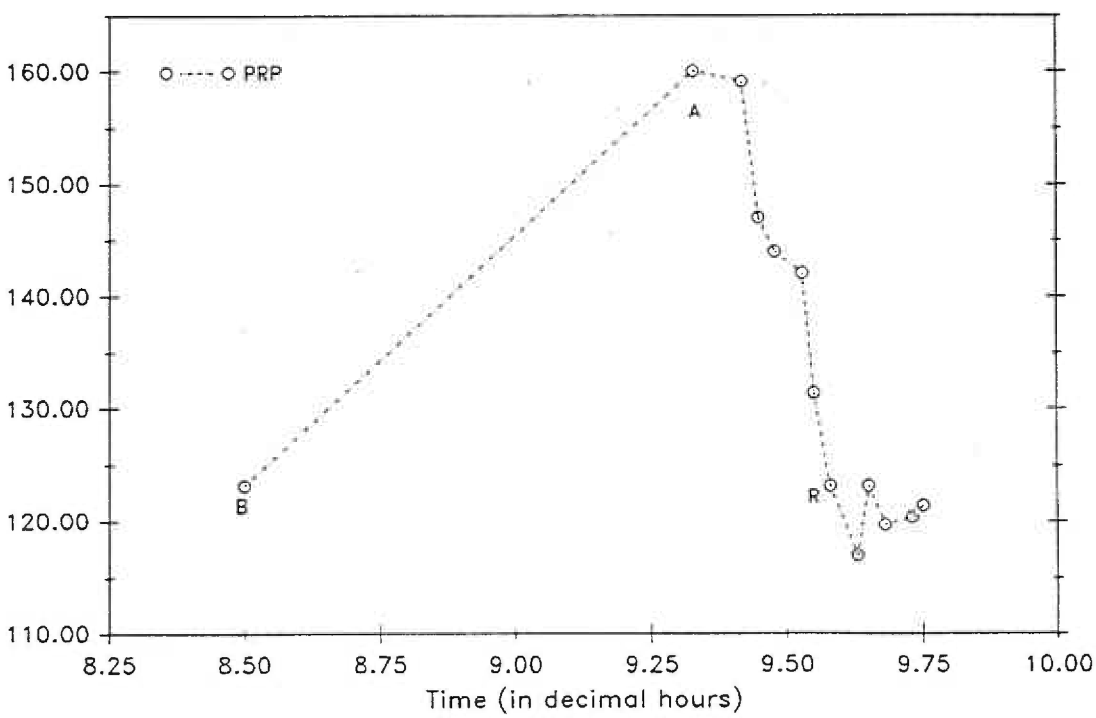
PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 8: Pressure Rate Product versus Time, Post-op Day #1.



SBP
HR
DBP
mmHg
bpm
A
B
R
160
150
140
130
120
110
100
90
80
70
60
8.25
8.50
8.75
9.00
9.25
9.50
9.75
10.00
Time (in decimal hours)



PRP
A
B
R
160.00
150.00
140.00
130.00
120.00
110.00
8.25
8.50
8.75
9.00
9.25
9.50
9.75
10.00
Time (in decimal hours)

Table A-23.

Subject 8: Data for Post-op Day 2

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
9.10	98.8	(37.1)	76	24	142	78	10792
9.70	-	-	78	24	150	80	11700
9.73	-	-	82	24	150	80	12300
9.77	-	-	76	20	144	80	10944
9.80	-	-	76	20	142	78	10792
9.83	-	-	72	20	140	80	10080
9.87	-	-	68	16	138	80	9384
9.90	-	-	64	16	138	80	8832
9.93	-	-	64	16	138	80	8832
9.97	-	-	64	16	138	82	8832
10.00	-	-	64	16	138	82	8832

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A45.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 8: Vital Signs versus Time, Post-op Day #2.

Figure A46.

Note: B = baseline, before bath

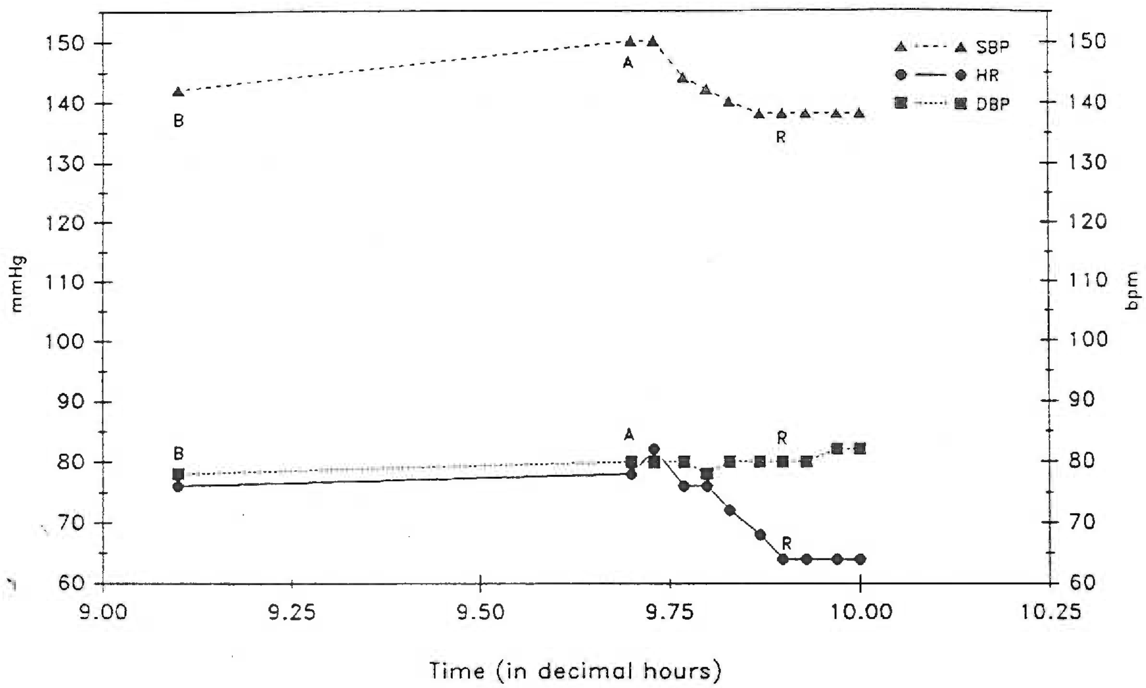
A = immediately after bath

R = recovery point

PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 8: Pressure Rate Product versus Time, Post-op Day #2.


SBP
HR
DBP
mmHg
bpm
B
A
R
150
140
130
120
110
100
90
80
70
60
9.00
9.25
9.50
9.75
10.00
10.25
Time (in decimal hours)

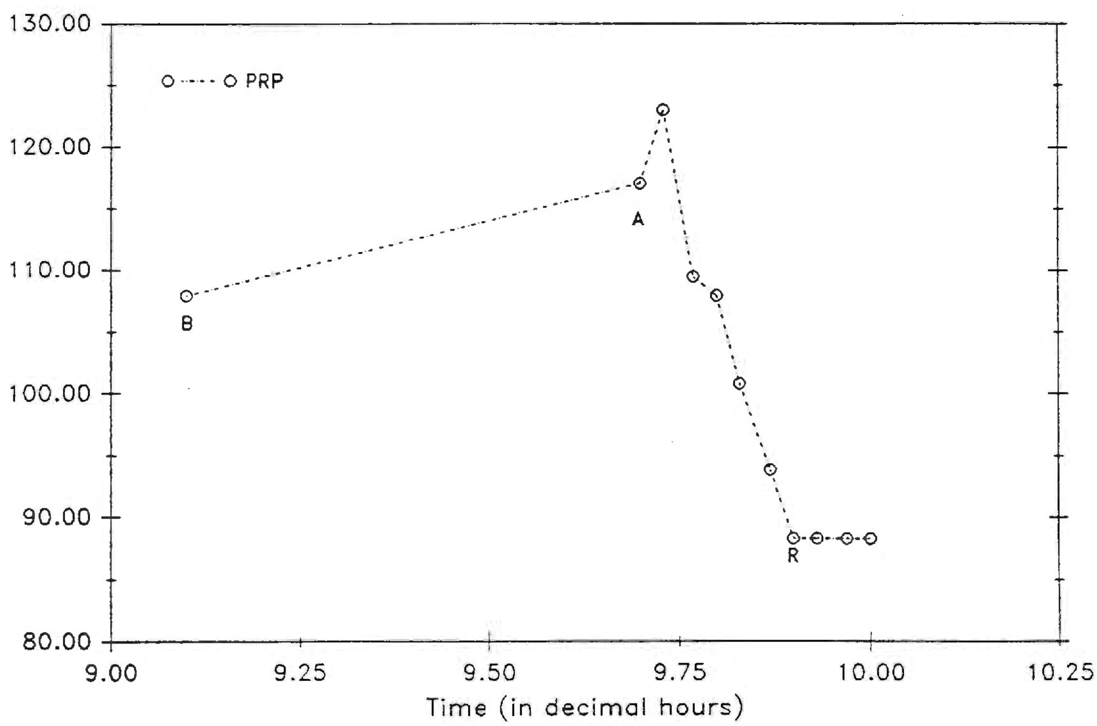

PRP
B
A
R
130.00
120.00
110.00
100.00
90.00
80.00
9.00
9.25
9.50
9.75
10.00
10.25
Time (in decimal hours)

Table A-24.

Subject 8: Data for Post-op Day 3

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
8.20	97.8	(36.6)	72	16	142	82	10224
8.62	-	-	72	16	152	82	10944
8.65	-	-	72	16	142	82	10224
8.68	-	-	76	20	162	90	12312
8.72	-	-	76	16	146	80	11096
8.75	-	-	76	16	140	82	10640
8.78	-	-	68	16	142	82	9656
8.82	-	-	72	16	142	80	10224
8.85	-	-	76	16	144	82	10944
8.88	-	-	72	12	142	82	10224

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A47.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 8: Vital Signs versus Time, Post-op Day #3.

Figure A48.

Note: B = baseline, before bath

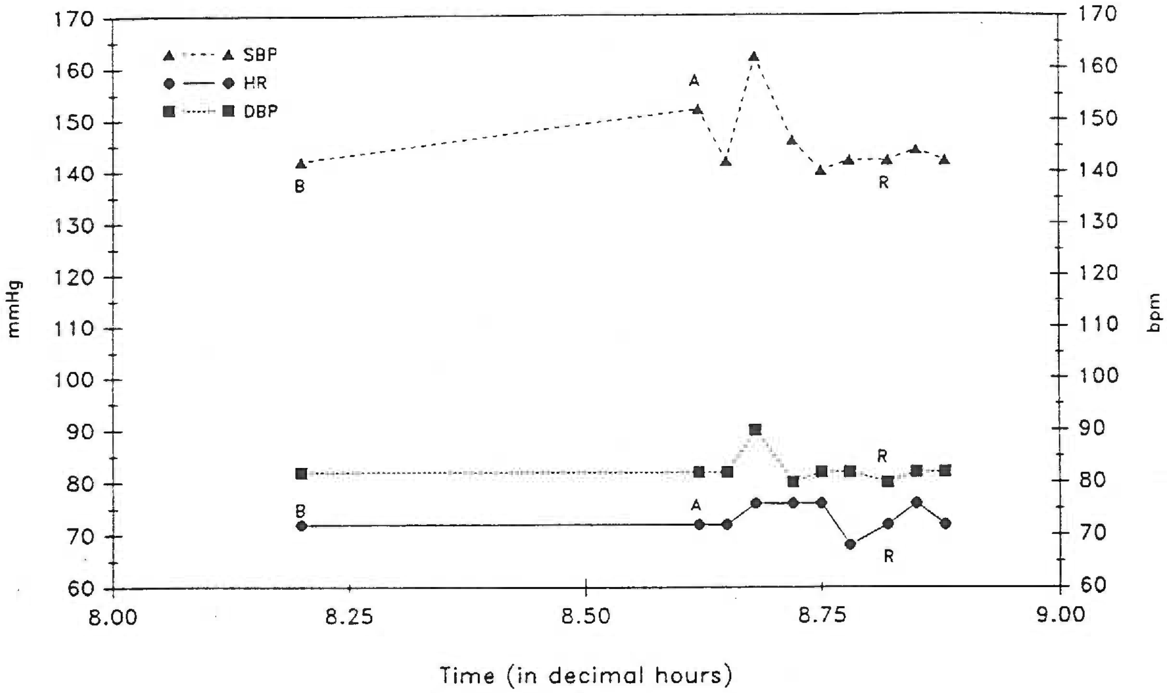
A = immediately after bath

R = recovery point

PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 8: Pressure Rate Product versus Time, Post-op Day #3.


SBP
HR
DBP
mmHg
bpm
A
B
R
Time (in decimal hours)

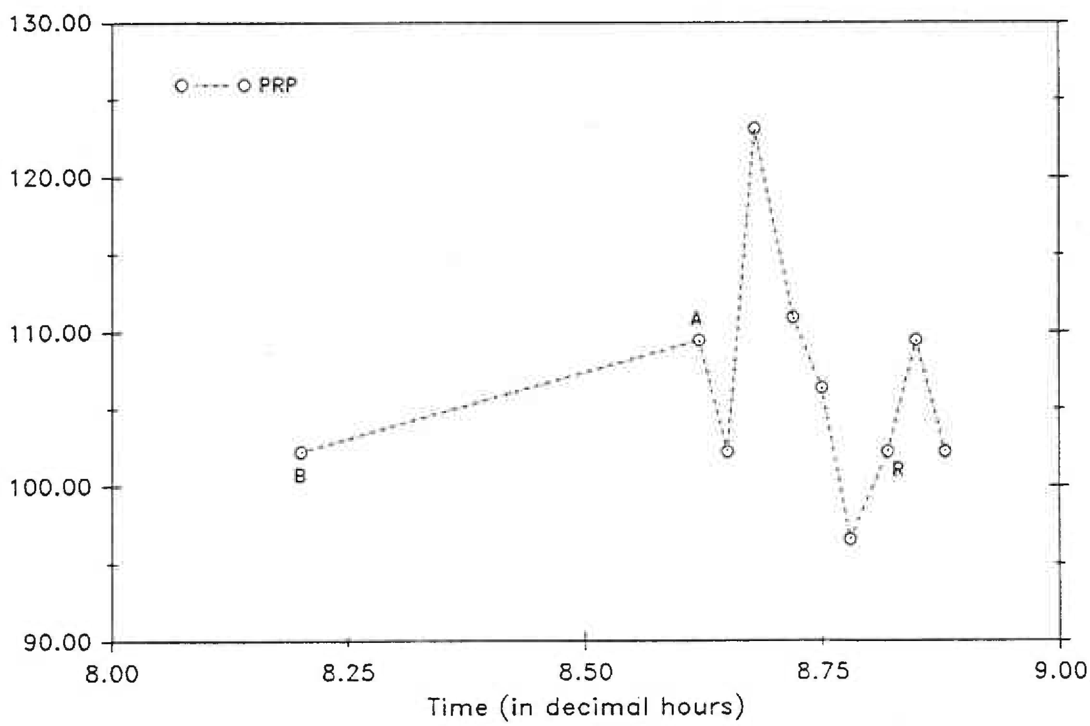

PRP
A
B
R
Time (in decimal hours)

Table A-25.

Subject 9: Data for Post-op Day 1

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
8.25	97.9	(36.6)	88	24	124	80	10912
8.77	-	-	98	28	118	60	11564
8.80	-	-	98	20	116	58	11368
8.83	-	-	96	22	110	64	10560
8.87	-	-	98	24	112	60	10976
8.90	-	-	92	24	118	64	10856
8.93	-	-	88	22	120	74	10560
8.97	-	-	88	22	122	70	10736
9.03	-	-	86	24	124	76	10664
9.07	-	-	88	22	120	78	10560
9.10	-	-	88	22	124	80	10912
9.13	-	-	88	22	124	80	10912
9.17	-	-	80	22	124	80	9920
9.20	-	-	86	22	124	80	10664
9.23	-	-	86	22	124	80	10664
9.27	-	-	86	22	124	80	10664
9.30	-	-	86	22	124	80	10664

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A49.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 9: Vital Signs versus Time, Post-op Day #1.

Figure A50.

Note: B = baseline, before bath

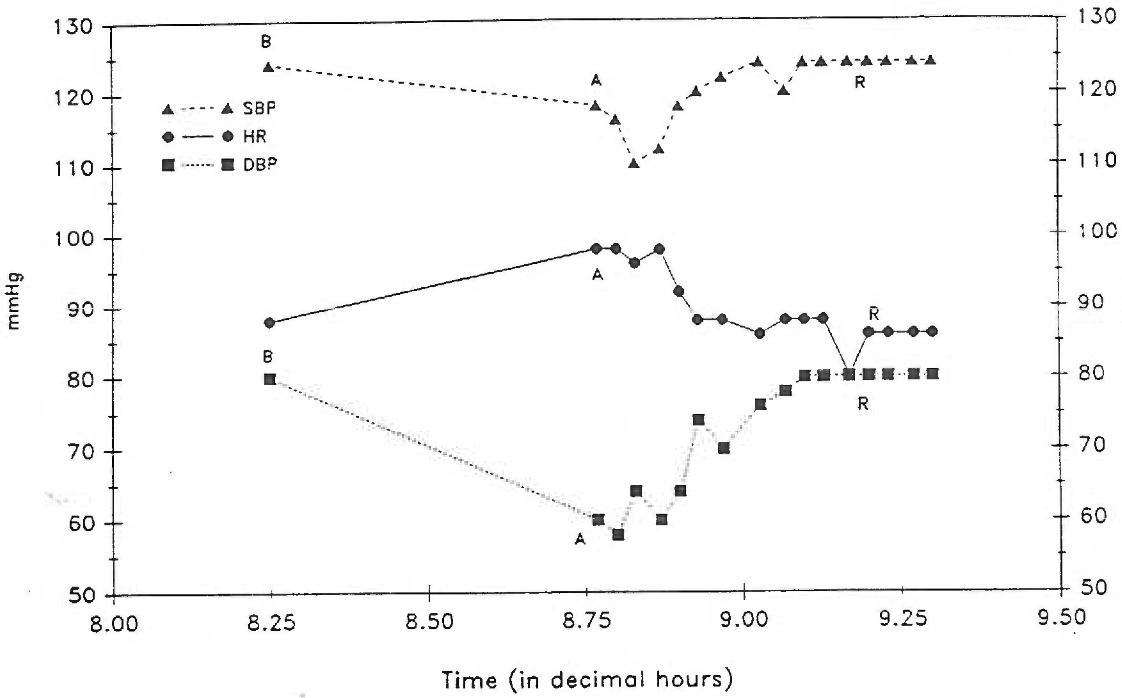
A = immediately after bath

R = recovery point

PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 9: Pressure Rate Product versus Time, Post-op Day #1.


SBP
HR
DBP
B
A
R
mmHg
bpm
130
120
110
100
90
80
70
60
50
8.00
8.25
8.50
8.75
9.00
9.25
9.50
Time (in decimal hours)

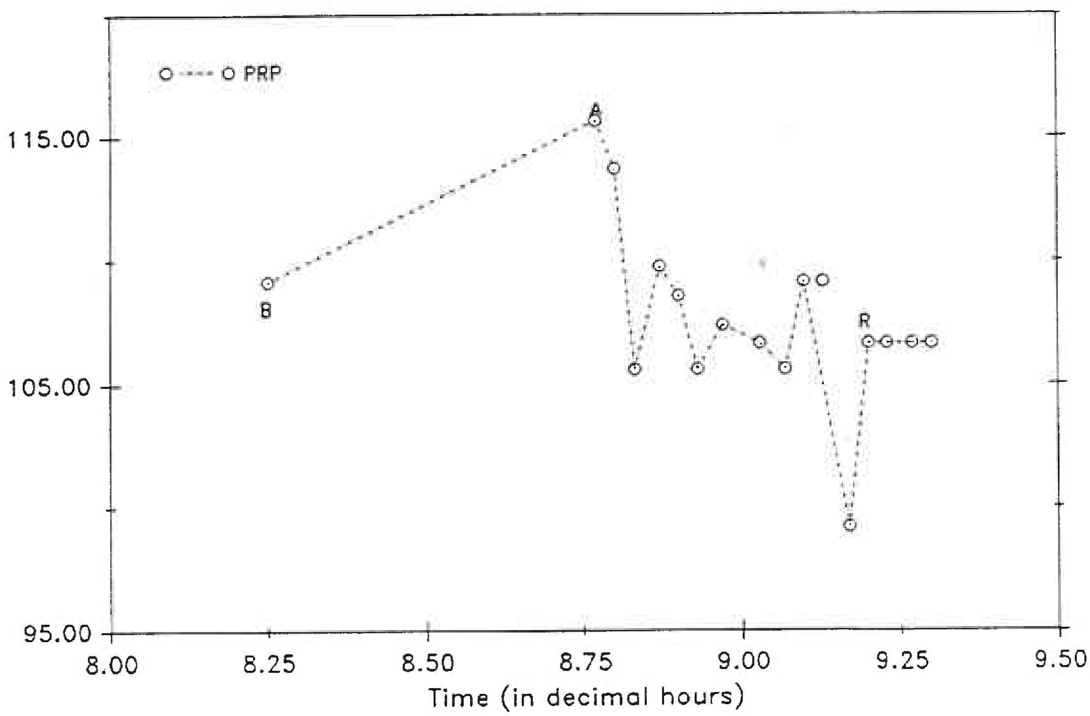

PRP
A
B
R
115.00
105.00
95.00
8.00
8.25
8.50
8.75
9.00
9.25
9.50
Time (in decimal hours)

Table A-26.

Subject 9: Data for Post-op Day 2

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
8.52	98.2	(36.8)	76	24	108	64	8208
8.88	-	-	76	28	112	68	8512
9.12	-	-	76	24	110	58	8360
9.15	-	-	68	20	98	56	6664
9.18	-	-	68	20	110	54	7480
9.22	-	-	68	20	110	56	7480
9.25	-	-	68	20	108	54	7344
9.28	-	-	64	20	108	54	6912
9.32	-	-	68	20	108	56	7344

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A51.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 9: Vital Signs versus Time, Post-op Day #2.

Figure A52.

Note: B = baseline, before bath

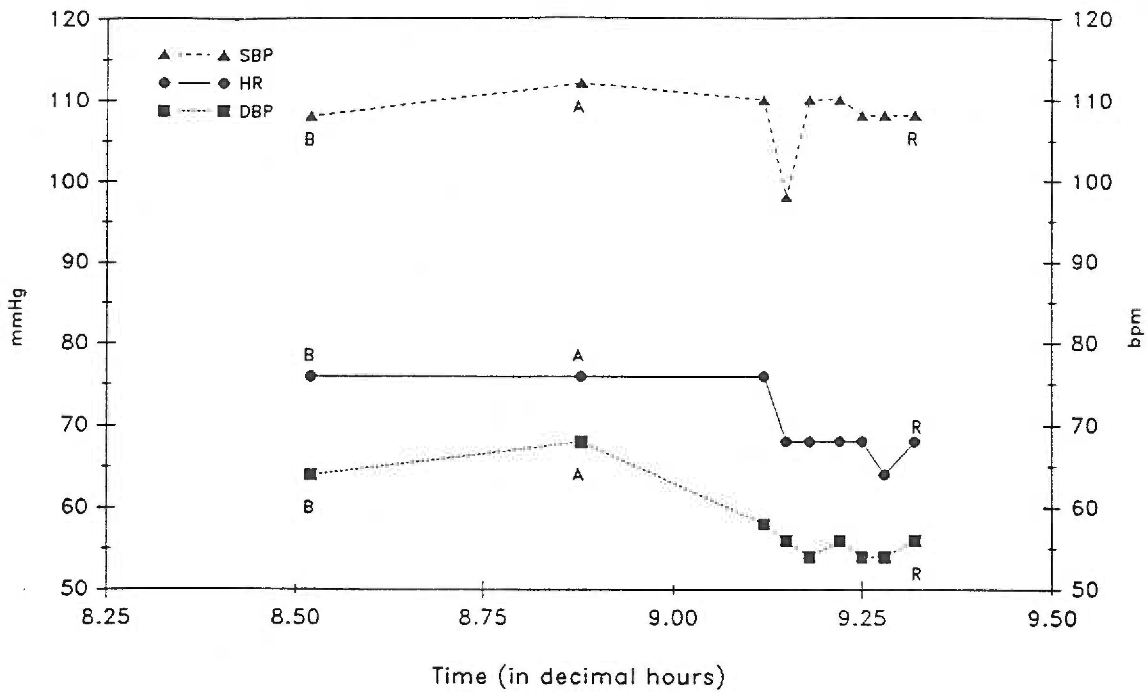
A = immediately after bath

R = recovery point

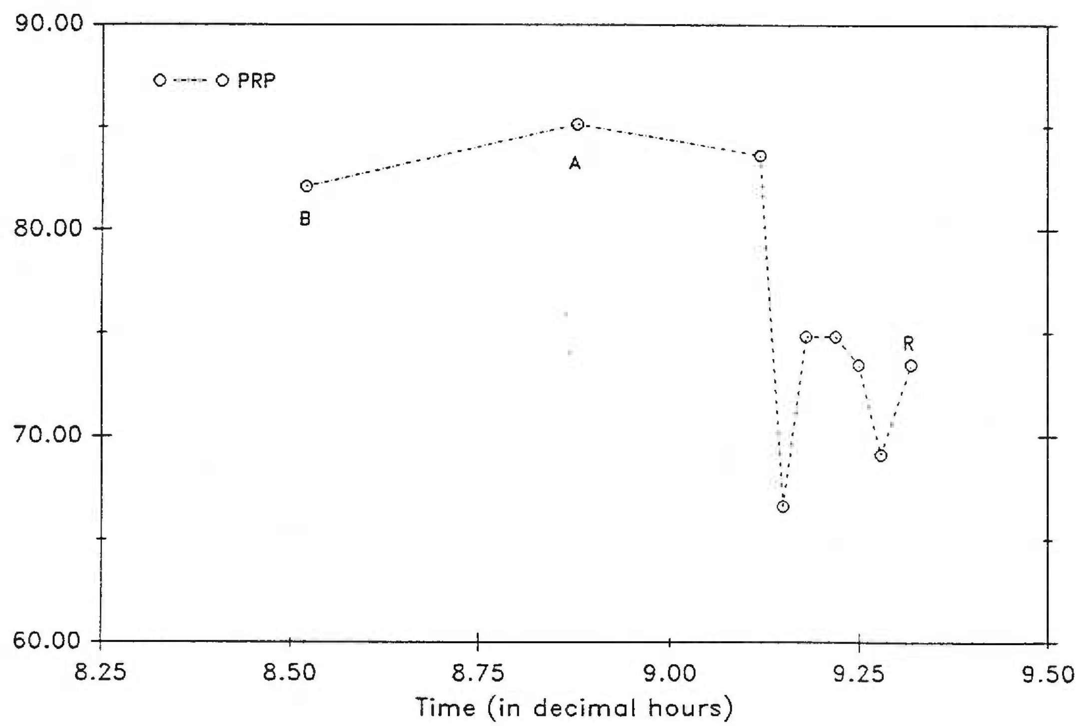
PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 9: Pressure Rate Product versus Time, Post-op Day #2.



SBP
HR
DBP
mmHg
bpm
B
A
R
120
110
100
90
80
70
60
50
8.25
8.50
8.75
9.00
9.25
9.50
Time (in decimal hours)



PRP
B
A
R
90.00
80.00
70.00
60.00
8.25
8.50
8.75
9.00
9.25
9.50
Time (in decimal hours)

Table A-27.

Subject 9: Data for Post-op Day 3

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
8.45	97.5	(36.4)	72	16	116	64	8352
8.62	-	-	60	16	112	64	6720
8.68	-	-	64	16	98	60	6272
8.75	-	-	64	16	106	64	6784
8.80	-	-	68	16	110	78	7480
8.83	-	-	68	16	114	76	7752
8.87	-	-	64	16	114	78	7296
8.92	-	-	64	16	116	78	7424
8.95	-	-	68	16	116	78	7888
8.97	-	-	64	16	116	78	7424

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A53.

Note: B = baseline, before bath

A = immediately after bath

R = recovery poin

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 9: Vital Signs versus Time, Post-op Day #3.

Figure A54.

Note: B = baseline, before bath

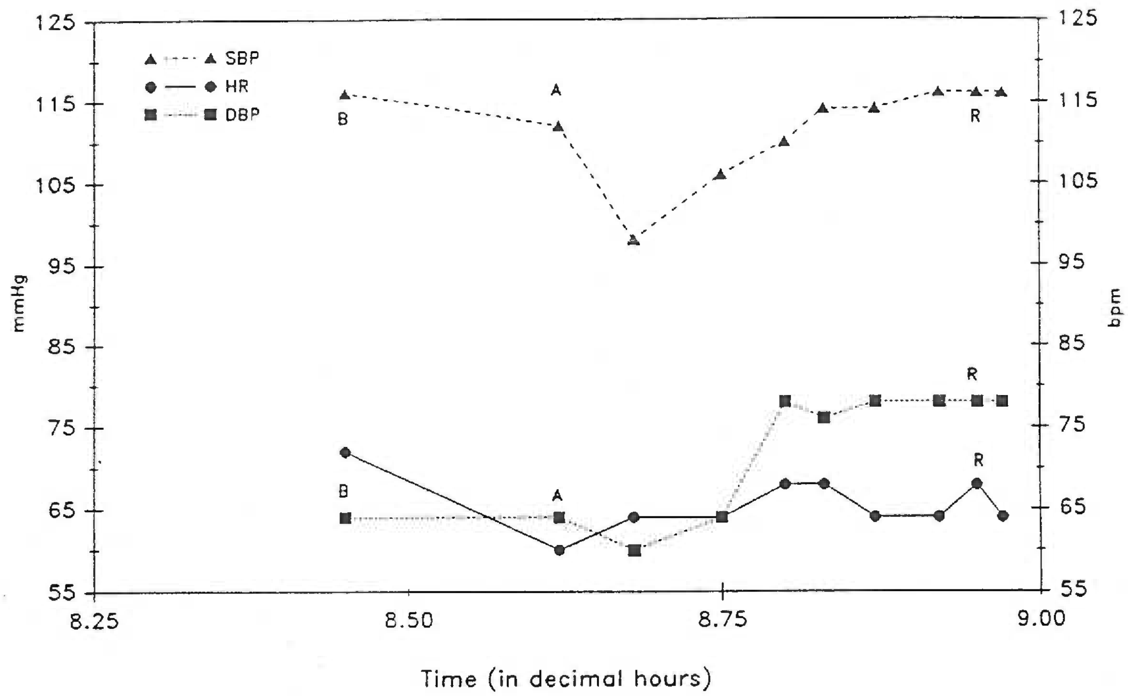
A = immediately after bath

R = recovery point

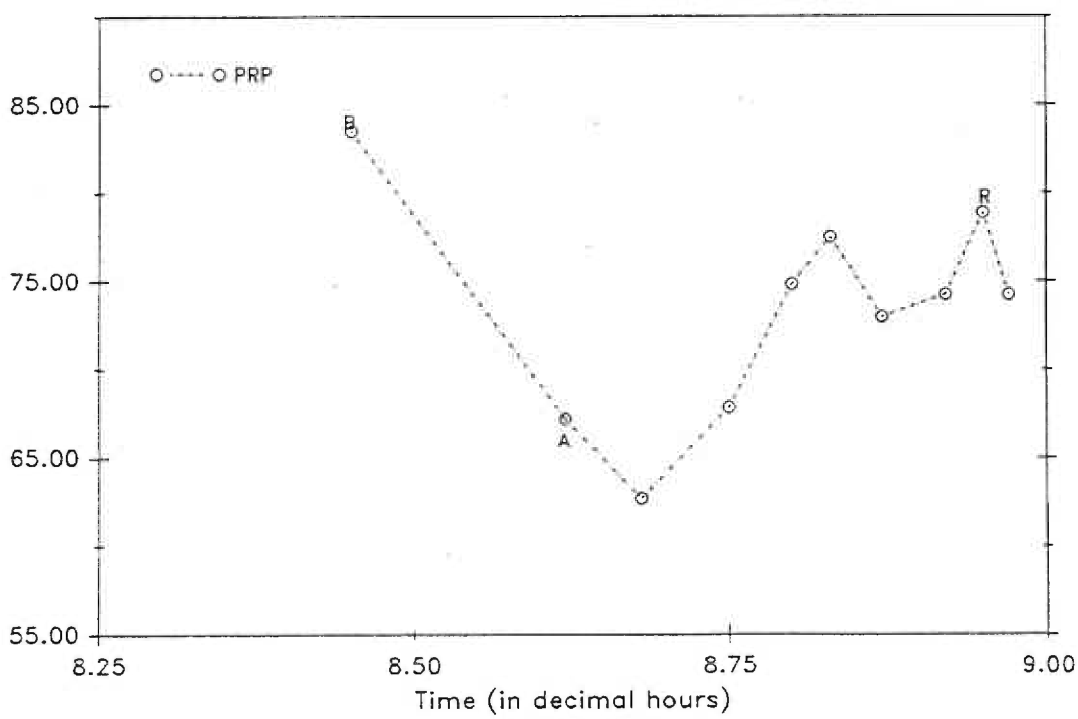
PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 9: Pressure Rate Product versus Time, Post-op Day #3.



SBP
HR
DBP
mmHg
bpm
B
A
R
125
115
105
95
85
75
65
55
8.25
8.50
8.75
9.00
Time (in decimal hours)



PRP
B
A
R
85.00
75.00
65.00
55.00
8.25
8.50
8.75
9.00
Time (in decimal hours)

Table A-28.

Subject 10: Data for Post-op Day 1

TIME	TEMPERATURE °F	°C	HR	RESP	SBP	DBP	PRP
9.13	99.4	(37.4)	84	16	126	78	10584
9.50	-	-	76	16	122	78	9272
9.55	-	-	76	20	120	80	9120
9.58	-	-	92	20	124	78	11408
9.62	-	-	92	20	128	80	11776
9.65	-	-	92	20	124	80	11408
9.68	-	-	92	20	124	80	11408
9.72	-	-	84	16	124	80	10416

Note: TIME is documented in decimal hours (7.75 = 7:45 a.m.)
TEMPERATURE is baseline temperature
HR = Heart Rate
RESP = Respiratory Rate
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
PRP = Pressure Rate Product

Figure A55.

Note: B = baseline, before bath

A = immediately after bath

R = recovery point

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

HR = Heart Rate

Subject 10: Vital Signs versus Time, Post-op Day #1.

Figure A56.

Note: B = baseline, before bath

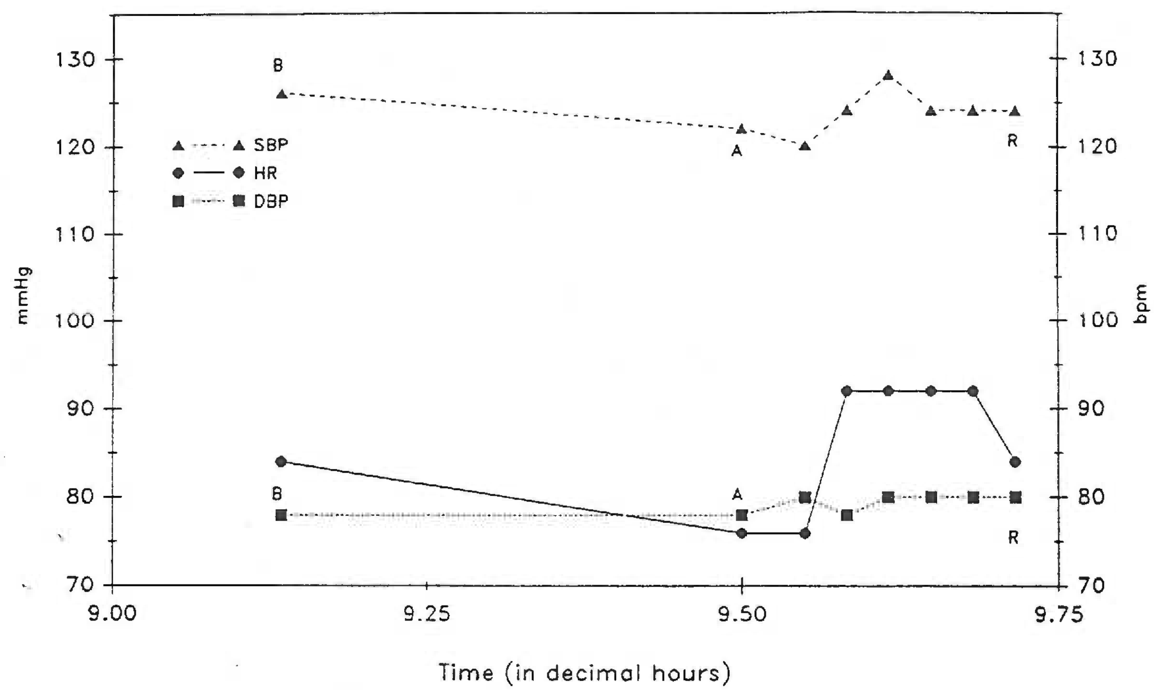
A = immediately after bath

R = recovery point

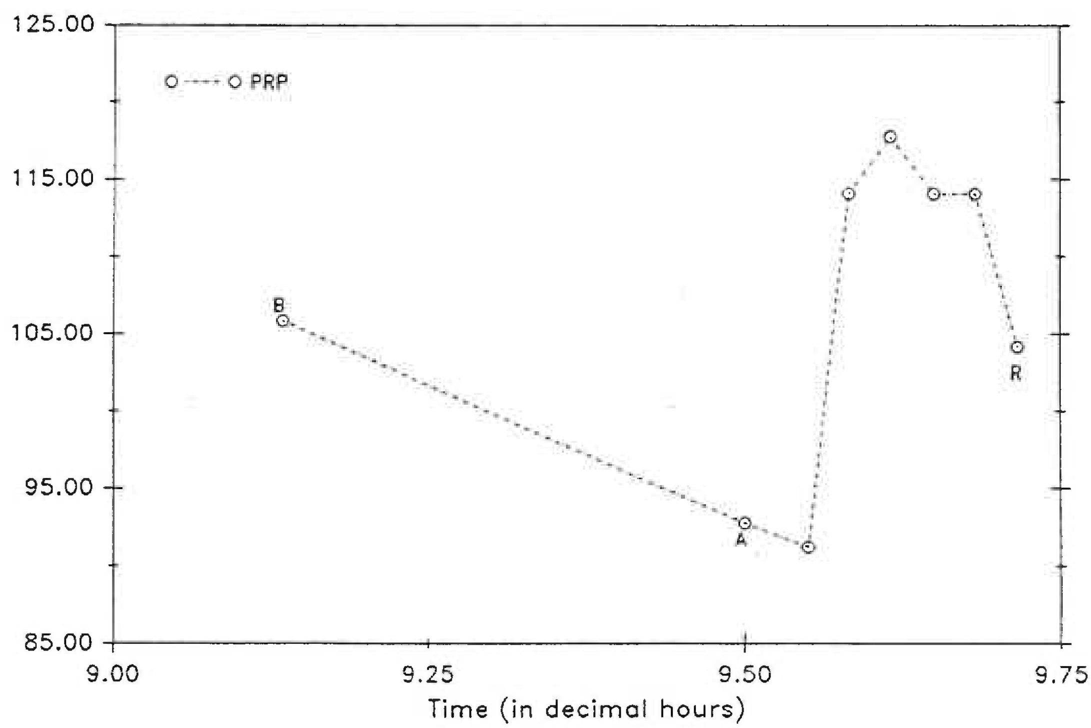
PRP = Pressure Rate Product = SBP * HR

Graph shows PRP * 10^{-2}

Subject 10: Pressure Rate Product versus Time, Post-op Day #1.



130
120
110
100
90
80
70
mmHg
bpm
B
A
R
SBP
HR
DBP
9.00
9.25
9.50
9.75
Time (in decimal hours)



125.00
115.00
105.00
95.00
85.00
PRP
B
A
R
9.00
9.25
9.50
9.75
Time (in decimal hours)