THE INFLUENCE OF A BOTANICAL GARDEN EXPERIENCE ON HUMAN HEALTH

by

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B.A., Austin College, 1968

A THESIS

Submitted in partial fulfillment

of the requirements for the degree

MASTER OF SCIENCE

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and Recreation Resources
College of Agriculture

KANSAS STATE UNIVERSITY

Manhattan, Kansas

1994

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ABSTRACT

Physiological and psychological measurements of 127 visitors to a botanical garden were collected to determine the influence of a garden environment. Physiological measurements were recorded before and after participants visited the gardens. A pre-visit survey identified emotional expectations of the garden visit. Post-visit surveys ascertained participants' emotional impressions. Length of visit, ambient air temperature, and participants' health related data were recorded. Participants' average systolic blood pressure measurements decreased significantly on three of the four days studied. Participants' mood state before and after visiting the gardens were significantly influenced. Self-reports of participants as well as physiological measurements indicate both physiological and psychological benefits of visiting a botanical garden.

ACKNOWLEDGMENTS

This research required the cooperative effort and the generous support of many people and organizations. Credit must be given to Dr. Richard Mattson, who originally suggested the idea for this project and the other members of my graduate committee, Dr. Mary Albrecht and Dr. Mary McElroy. Special thanks are due to Dr. Ruth Hassanein, Ph.D., of the Kansas University Medical Center faculty and her staff for their indispensable help with the statistics. Gratitude is extended to Robert Proctor, MD, who helped develop the medication list and reviewed this study.

Without the gardens of Botanica, this research would not have been possible. Special thanks is offered to the staff, donors and volunteers, as well as the City of Wichita, who sustain this "green" refuge encircled by the bustling sounds, smells and intensity of downtown Wichita. This research required the participation of Butler County Community College nursing students and faculty, Dr. Mattson, friends, family, and the Botanica visitors who participated in this study.

The results of this study were presented, in July of 1991, at the annual meeting of the American Horticultural Therapy Association in Philadelphia where I first met Charles Lewis. At the conclusion of my presentation Charlie came forward, hugged me and exclaimed that he had been waiting for 25 years for this type of research to be

undertaken. Since then Charlie has been an endearing source of support. Because of his support, it was my privilege to participate in a panel presentation in June, 1992 at the American Association of Botanical Gardens and Arboreta annual meeting held at Ohio State University. The panel, moderated by Charlie, included Rachel and Stephen Kaplan and Herb Schroeder. This research was also presented at the People-Plant Council Conference in New Jersey in the spring of 1992, and the People-Plant Council Research Symposium at UC Davis in March, 1994.

Some of us are fortunate enough to be reared in homes surrounded by plants and learn to appreciate and respect nature from our families. One of my greatest supporters throughout graduate school was my father. In May of 1992, while working in a flower bed in his yard, my father had a heart attack and died. My grandmother, who is 95, could not come to Arlington National Cemetery for the funeral. Earlier that week, she had slipped and fallen while working in the greenhouse attached to the back of her home. This research effort would not have been possible without the encouragement, assistance, and love of all of my family, particularly Gerald, Aimee, Charles, Maggie and Dad.

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FORMAT EXPLANATION

In the forward to the 1990 edition of Awakenings, Oliver Sacks explains that every clinical experience has the potential for two books. One of these books would be purely "medical", an objective description. The other account would be more existential and would enter into the world of people on a personal level.

Rather than a traditional "five chapter" thesis, two journal articles have been prepared for possible publication. The first article is a short objective description, formatted for Science. The second article describes the information gathered from the study and relates the information to recent research being conducted within a variety of settings. The second article is formatted for Environment and Behavior. These articles are written in the styles specified by the two journals.

Botanical Garden Environment Decreases Blood Pressure

Abstract. Physiological and psychological measurements of 127 visitors to a botanical garden were collected to determine the influence of the garden experience on their health. Blood pressure and pulse were measured before and after participants visited the gardens. Other information gathered included length of visit, ambient air temperature and participants' health related data. Participants' average systolic blood pressure measurements decreased significantly on three days of the four days studied. Diastolic blood pressure decreases were recorded on the same three days as the systolic decreases, and were significant on two days. On the day no significant changes were noted in systolic or diastolic blood pressure measurements, heart rate increased significantly.

Limited research documents the human health benefits of a natural environment. Past research of the impact of nature upon health has focused upon passive visual perception. Cholecystectomy patients in hospital rooms with a view of trees required fewer medications and were discharged sooner than those patients with a view of a brick wall (1). Inmates of prisons with cell windows that afforded scenic views of nature requested fewer stress related medical services than prisoners with other

views (2). Most people prefer viewing scenes with elements of nature more than urban scenes (3). Studies of people who viewed nature or urban scenes report that viewing nature scenes reduces stress more than the urban scenes (4, 5).

Passive viewing of slides of nature does not conclusively prove that natural landscapes can reduce stress. The need exists to measure physiologically the restorative effects of nature in an outdoor environment. However, research conducted outside a laboratory setting presents unique challenges because nature, rather than man, manipulates the environment. This study examined the influence of a botanical garden environment on human blood pressure and heart rate.

A botanical garden is an outdoor environment landscaped with a variety of trees, shrubs, flowers or other plant life. The environmental design provides a milieu of the sounds, sights and smells of nature. It is a unique outdoor setting, that lends itself to research into the relationship of humans with nature, because access can be controlled and monitored. As humans experience a garden environment by walking leisurely among the plants, their blood pressure should drop and the aerobic exercise should increase their heart rate.

During four September and October Sunday afternoons

in 1990, visitors to a botanical garden were greeted by a sign stating "We need your help for a health and environment survey." They were offered a descriptive sheet explaining the research project and given an opportunity to ask questions. Participants read and signed two informed consent forms before they were escorted into a room where blood pressure and heart rate were measured with an automated blood pressure cuff programed to measure both blood pressure and pulse at one minute intervals. The study was limited to people whose upper arm circumference was within the size range of a standard adult blood pressure cuff (6). Three sets of physiological measurements were recorded for each participant, who also completed a pre-visit survey form that evaluated expectations of the visit. Following this procedure, participants left the building and entered the gardens.

After visiting the gardens, participants were asked to return to the main building where blood pressure and heart rate were measured again. The same measurement protocol was followed before and after the visit. Participants completed a post-visit survey form that included evaluations of the visit and were offered a copy of their pre-visit and post-visit blood pressure measurements.

The final form, that each participant completed, was

a health survey. It described the participant's physical characteristics and contained pertinent questions for a study with physiological parameters. Part of this survey included a medication list. Participants were thanked for their participation in the study, and literature was available for them about blood pressure, heart rate, and healthy life styles.

This study involved 127 participants whose average age was 46. The 57 men and 70 women spent an average of 51 minutes in the gardens. The median time since they had last eaten was 2 hours and 43 minutes.

Analysis of the means of participants' systolic blood pressure measurements before and after visiting the gardens indicated significant decreases ($P < 0.01$), on three days of the study (Table 1). The greatest decrease in systolic blood pressure of 6.67 mm Hg occurred on the first day of the study. Participants on the third day had decreases in blood pressure after visiting the gardens of 5.87 mm Hg. Decreases of 5.94 mm Hg were measured on the fourth day.

Participants' diastolic blood pressure means decreased on the same three days as the systolic decreases were recorded (Table 2). On the first day participants' diastolic blood pressure means decrease was 3.17 mm Hg ($P < 0.01$), and on the fourth day participants'

diastolic blood pressure means decrease was 6.07 mm Hg ($P < 0.01$). These were two of the days that significant systolic blood pressure means decreases were recorded as well.

On the first three days of the study, analysis of the means of participants' heart rate measurements before and after visiting the gardens registered increases (Table 3). The heart rate measurement means increased by 4.09 beats per minute (bpm) and were statistically significant ($P < 0.05$) on only one day, the second day (Table 3). The changes on the second day in heart rate and blood pressure are contrary to the changes on the other three days of the study. Two factors that could account for the differences on the second day are the ambient air temperature and the sample size. The high temperature for the second day of the study was 37.2 degrees C at 3:30 pm while the study was in progress (Table 4). As a comparison, on the fourth day of the study, the ambient temperature was 21.7 degrees C at 3:30 pm (Table 4). Because of the heat and humidity on the second day, only 57 people visited the garden and 15 people participated in the study (Table 4).

The impact of weather and climate on health poses many unanswered questions. The difficulty lies in the complexity of weather and the intricate functioning of the human body (7). An outdoor environment with an

ambient temperature of 37.2 degrees C could cause heat stress; and heart rate may increase linearly with heat stress (8).

Scientists are beginning to recognize the role of nonpharmacologic therapy in the treatment of hypertension (9, 11, 12, 13). A recent study found two nonpharmacologic interventions to be significant in the reduction of high blood pressure (9). Weight reduction produced a decrease in systolic blood pressure of 2.9 mm Hg ($P < 0.01$) and sodium reduction produced a systolic pressure decrease of 1.7 mm Hg ($P < 0.01$) (9). A drop of approximately 6 mm Hg in the systolic blood pressure means occurred for participants on 3 days of this study (Table 1). The ability to decrease blood pressure consistently, even 1 to 2 mm Hg, in an at-risk group could potentially be a very positive health benefit (10). That "at-risk" group includes 30 percent of the adult population in the United States who have hypertension or are already receiving antihypertensive drug treatment (9).

The possibility of treating hypertension with nonpharmacologic measures presents a challenge and opens a new horizon to scientific research (11). Many pharmacologic treatments of hypertension are expensive and frequently accompanied by side effects (12). Adding

plants to environments considered stressful for people would be a potential nonpharmacologic intervention with few contraindications. The knowledge acquired, as science continues to analyze the human body, may serve as a reminder of humanity's dependence upon nature and plants.

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Table 1. Mean systolic blood pressure changes were measured before participants visited the gardens in a room with high windows that did not afford a view of the gardens (1). After participants visited the gardens, their blood pressure was measured in a room with a view of the gardens. The same measurement protocol was followed before and after the visit. Statistical treatments were performed at Kansas University Medical Center using the Biomedical Computer Programs, P-Series from the University of California Press in Berkeley (Version 1988). On three days of the study participants' systolic blood pressure significantly decreased.

Week	Pre-Visit (mm Hg)	Post-Visit (mm Hg)	Change (mm Hg)
1	119.46	112.79	6.67*
2	112.19	113.30	1.11
3	126.79	120.92	5.87*
4	128.59	122.65	5.94*

*Significance $P < 0.01$.

Table 2. Mean diastolic blood pressure changes were measured at the same time as systolic measurements. On two days of the study participants' diastolic blood pressure decreased significantly.

Week	Pre-Visit (mm Hg)	Post-Visit (mm Hg)	Changes (mm Hg)
1	70.66	67.50	3.16*
2	66.42	67.37	0.95
3	71.16	70.91	0.25
4	77.36	71.29	6.07*

* Significance $P < 0.01$.

Table 3. Mean heart rate changes were measured at the same time as systolic and diastolic blood pressure measurements. On one day of the study participants' heart rate significantly increased.

Week	Pre-Visit (bpm)	Post-Visit (bpm)	Change (bpm)
1	71.49	72.43	0.94
2	69.99	74.08	4.09*
3	70.64	71.70	1.06
4	76.76	75.40	1.36

* Significance $P < 0.05$.

Table 4. Ambient air temperatures were recorded between 3 and 4 pm while study was in progress. Table includes number of visitors and study participants for each day.

Week	Temperature (degrees C)	Number of visitors	Number in study
1	35.6	71	18
2	37.2	56	15
3	26.7	134	41
4	21.7	255	53

THE INFLUENCE OF A BOTANICAL GARDEN EXPERIENCE ON HUMAN HEALTH

Journal Article II

"...The products of scientific horticulture will finally be judged by their impact on the quality of everyday life of the people who plant and see them." Charles Lewis

Although people have intuitively believed in the restorative value of contact with nature, research documenting the effects on humans of natural environments is limited. Research conducted outdoors allows nature rather than the research team to control the "laboratory". Despite the inherent challenges of conducting research outdoors, the need remains to study humans within "green" environments.

A botanical garden is an outdoor environment landscaped with a variety of trees, shrubs, flowers and/or other plants. This environmental design provides a milieu of the sounds, sights and smells of nature. It is a unique outdoor setting, that lends itself to research, because access can be controlled and monitored. For these reasons, a botanical garden was selected as an appropriate site to conduct research into the relationship of people and nature.

This study investigated the influence of a botanical garden experience on humans as measured by physiological and psychological instruments. Participants evaluated their expectations of the garden visit via a pre-visit survey. After their garden experience, participants described their feelings with a post-visit survey. Blood

pressure and heart rate were measured before and after the garden experience. Participants also completed a health survey after visiting the garden. Although there was no previous research design that was followed, a review of the literature influenced the design developed for this study.

Literature Review

Historical Perspective on Gardens and Civilizations

The words garden, grove, paradise, park, eden, savannah, landscape, and botanical garden elicit myriad images. The word paradise is from the Persian word pairidaeza meaning an enclosure. In Old Testament Hebrew the word changed to pardes signifying a garden or park enclosure. For the early Greeks, the word paradeisos meant a kingly or extravagant park (Thacker, 1979). Persian ceramics, dating around 4,000 B.C., depict scenes of the world as a chahar bagh, an Islamic garden plan of four gardens with a palace or pavilion in the center (Ruggles, 1987). In China a garden of medicinal plants was established by Emperor Sheng Nong in 2800 B.C. (Sheng-ji, 1984). Gardens have been an integral part of the civilization of many cultures.

Shepard (1967) explains that the garden is the perfect human habitat. Although plants and designs vary from one culture and geographic area to another, the

differences among gardens measure the unique experience of each society as it confronts nature (Shepard, 1967). For example, in the Koran, Moslems are told that after death they will go to Paradise, an enclosed garden (Blakstad, 1986). The geographical location of the origin of the Moslem faith is a dry and arid region. Consequently the description of Paradise as an enclosed garden creates a vision of an oasis of water, coolness and shade protected from the hostile outer environment (Thacker, 1979).

In earlier times, gardens were necessary for the food provided. Clarkson (1940) explains that as civilizations progressed, people no longer needed a garden to grow food to survive, and the appeal of the garden became spiritual. As well as the spiritual and utilitarian appeal of gardens, the desire to collect and study plants created another type of garden--the botanical garden. A botanical garden is a garden open to the public in which the plants are labelled (Sheng-ji, 1984). There are 1400 botanical gardens in the world (Haywood, Haywood, & Jackson, 1990). Over 58 million people annually visit the 365 gardens that belong to the American Association of Botanical Gardens and Arboreta (E. Sullivan, personal communication, July, 1993).

In early botanical gardens the primary objectives

were to classify and collect plants for scientific study; and garden design was a secondary issue (Thacker, 1979). In fact, Burckhardt (in Thacker, 1979) states that the design of early botanical gardens was a retarding influence in garden design. Uzzell and Lewand (1990) contend that landscape design decisions often are developed without evaluation procedures that address the full range of human response to place.

Conventional wisdom suggests that participating in the experience of an environment such as a garden or park can have positive psychological and stress reducing benefits. Gardens bring beauty, quiet, and repose to those seeking a retreat from the burdens of everyday life (Berrall, 1966). One benefit gained from visiting a garden may be that living plants provide a meaningful emotional experience because they are alive and participate in a life cycle. Stamm and Barber (1978) explain that most people make a direct and ready correlation between the life cycle of plants and the human life cycle.

History of Human/Nature Research

Throughout history, people of varied cultures and civilizations have recognized and eagerly shared their experiences with nature. These self-reports form the basis of the earliest recordings of the people and nature experience. Historical references to the benefits of

nature extend back to the early Greek philosophers. Aristotle (330 B.C./1952) stated that abundant information respecting perishable plants is available "living as we do in their midst, and ample data may be collected...if only we are willing to take sufficient pains" (p. 168).

Much of the research into the relation of humans and nature can be attributed to Rachel and Stephen Kaplan, psychologists, and Roger Ulrich, a geographer. Ulrich (1984b) studied the medical records of patients who had undergone the same surgical procedure, a cholecystectomy. He found that patients assigned to hospital rooms with a view of trees received fewer medications and were discharged sooner than patients with a view of a brick wall. A study by West (1986) documented the effects of viewing nature through windows for a prison population. Inmates with cell windows that afforded scenic views of nature requested fewer stress related medical services than prisoners with other views.

Slides and videotapes depicting scenes of nature and other environments have been shown to subjects in studies that measured the visual impact of nature upon man. The Kaplans reviewed these studies and suggested people prefer scenes with elements of nature more than slides of urban scenes (1989). Ulrich, Dimberg, and Driver (1990) reviewed studies in which subjects participated in a

stressful activity before viewing slides or videotapes of nature scenes and urban scenes. These studies suggest that nature scenes are more likely to reduce stress than urban scenes.

In a study by Honeyman (1987), slides of urban scenes with varying amounts of vegetation, as well as slides of urban scenes void of vegetation, were shown to different groups of participants. The participants who viewed urban scenes with vegetation showed decreases in their stress levels. Honeyman also found that the group of participants who viewed urban scenes void of vegetation, showed increased stress levels.

Studies of Human Response to Environments

Kastka and Noack (1987) measured the level of neighborhood noise in two towns in Germany and Switzerland. Residents were asked to evaluate their annoyance with the neighborhood noise. Their study compared the perception of neighborhood noise annoyance with the residents' perception of the visual attractiveness of their neighborhood. Kastka and Noack concluded that the aesthetic context of an environment can influence the perception of noise. Both neighborhoods had similar noise levels. However, the same amount of noise produced a higher degree of annoyance for residents living on streets perceived as less attractive than for people who perceived their

neighborhood as more attractive.

Although the Kaplans and Ulrich used slides in their earlier research designs, their more current work leads in different directions. The Kaplans' work focuses on the psychological effects of nature. Whereas Ulrich's research evaluates the physiological responses of humans to nature.

The Kaplans explain that the word "nature" can have a variety of definitions. There is the nature of a wilderness experience and the nature of a nearby neighborhood park. Though very different, both environments allow humans an opportunity to "be away" psychologically (Kaplan & Kaplan, 1989, p. 189). The ability of nature to allow humans to "be away" psychologically plays an important part in the Kaplans' premise that nature can aid in recovery from fatigue (1989, p. 198).

Two recent graduate studies expand on the Kaplans' psychological focus. Canin (1991) studied AIDS caregivers and examined their leisure time activities. Caregivers who spent time in "escapist" leisure activities had difficulty coping with the mental fatigue of their profession and experienced "burn out." "Escapist" activities involve high levels of distraction and little capacity for reflection. Caregivers whose after work activities included quiet nature activities,

that provided room for reflection, functioned in a more positive manner.

The second study involved breast cancer patients who were undergoing medical treatment. Cimprich (1990) found dealing with the stress of the breast cancer led these patients to display attentional capacity low enough to place their scores in the "brain-damaged" category. Participation in outdoor experiences led to steady improvement in the patients' attentional functioning abilities.

Ulrich's work examines the physiological responses of humans to natural environments. Measurement of the physiological responses of humans to experiences in everyday settings has been neglected by researchers (Ulrich and Simons, 1986). Despite extensive literature that examines the relations between psychological variables and hypertension, little is known about the liaison of blood pressure, mood, and thought patterns of people in their everyday environment (Southard et al., 1986).

Many biological studies of environmental influences on human health use the traditional experimental paradigm. Variables are explored within a laboratory. The question, still unanswered, is "Do isolated, highly controlled reactions occur in the same way in the `real' world as they do in the lab?" (Evans, 1982, p. 3).

A recent "real world" study of men who had sedentary jobs supports the connection between job strain, hypertension and left ventricular mass index (Schnall et al., 1990). The men affected by job strain worked fast and hard with little control over the work process. They perceived their work allowed little job autonomy and limited use of skill discretion. Men exposed to job strain, as defined above, increased their odds of developing hypertension by 3 to 1. Their left ventricular mass was greater than in those men whose work place did not include the defined job strain. Schnall et al. (1990), believe this study is the first to relate hypertension and anatomic increases in heart mass to a psychosocial variable based on job characteristics.

The need exists to study the work place, as well as other environments, to understand their impact on humans. Rovner et al. (1991) studied depression and mortality rates of newly admitted residents to nursing homes. People entering nursing homes who were identified with depressive disorders were 59% more likely to die during their first year after entering a nursing home than those not suffering from identified depressive disorders. Possibly the most significant finding of this study is there were no differences in mortality rates between depressive disorder patients receiving antidepressants and those not receiving antidepressants. If

pharmacological treatment did not affect the mortality rate of the nursing home residents, perhaps nonpharmacological interventions should be considered.

A review of the literature suggests the Rovner et al. research (1991) is not the only study justifying the need to consider non-pharmacologic approaches to treatment (Blaufox, et al., 1992; Frasure-Smith, Lesperance, & Talajic, 1993; Ginsberg, et al., 1990; Moriguchi, Consoni & Hekman, 1990; Phillips & Smith, 1990; Pickering, 1992; Schnall et al., 1990; Trials of Hypertension Prevention Collaborative Research Group, 1992). The use of medication for mild hypertension is expensive, frequently accompanied by side effects, and minimally cost-effective (Pickering, 1992). The possibility of treating hypertension with nonpharmacologic measures presents a challenge and opens a new horizon to scientific research (Moriguchi et al. 1990).

A recent study reviewed the mortality rate of myocardial infarction survivors over a six month period (Frasure-Smith, Lesperance, & Talajic, 1993). Myocardial infarction survivors displaying symptoms of major depression had fivefold higher mortality rates than survivors not identified with symptoms of major depression. An editorial, commenting on the Frasure-Smith et al. study (1993), entitled "The Need for

Research on Interventions" states that it is now time to develop and evaluate interventions that improve the quality of life for patients (Williams & Chesney, 1993).

Recent Human/Nature Research

Ulrich et al. (1990) contend one reason to measure the physiological responses of people experiencing "green" environments is because there may be important beneficial consequences, not apparent to the participant, that can be documented scientifically. They state a priority need is for a study designed to cross check the results of verbally based methods with those obtained from physiological and behavioral measures. One physiological parameter suggested for study is blood pressure measurement.

A study in the Chang Jia Jie National Forest Park in China measured blood pressure and heart rate of people in six different locations within the forest. A major theme of this study is that the foliage of the forest provides social and economic benefits as well as several vital environmental functions. Lu et al., (1985) state pulse recovery improved by 30% and blood pressure decreased for the participants in the study.

An environmental effect study by Hartig, Mang and Evans (1991) involved 34 college students who participated in the study for course credit. The students were randomly assigned to walk through a park, walk

through a mixed residential and commercial area, or sit in a comfortable chair and quietly read magazines. There were no significant differences among groups for either blood pressure or heart rate. However, the final physiological measurements of the students were not recorded until approximately 50 minutes after completion of the various activities. Hartig et al. (1991) concede that the 50 minute delay could have affected their results.

Blood Pressure Monitoring Equipment

The ultimate choice of method to measure blood pressure depends on the information required in that particular circumstance (Littler and Komsouogiu, 1989). A sphygmomanometer is accepted by the American Heart Association for documentation of blood pressure (Frohlich et al., 1988). However, a quiet environment is required when measuring blood pressure with a sphygmomanometer to hear the Korotkoff sounds (Constant, 1987).

A botanical garden is not a laboratory environment, and the noise levels cannot be controlled. An automated blood pressure monitor was selected for this study because it does not require a quiet environment to accurately measure blood pressure. Another advantage of an automated blood pressure monitor is that it can measure heart rate as well as blood pressure.

To measure blood pressure accurately, the subject

must be fitted with a blood pressure cuff that correctly fits the arm of the subject. An undersized cuff can result in falsely high readings and an oversized cuff can result in falsely low readings (Manning, Kuchirka, & Kaminski, 1983). Automated blood pressure monitors are designed with a selection of cuffs of varying sizes.

Methodology

Participants

On three September and one October Sunday afternoons in 1990, visitors to a botanical garden were greeted by a sign stating "We need your help for a health and environment survey." A descriptive sheet explaining the research project was offered to visitors; and they were given an opportunity to ask questions. The visitors, who wished to participate, read and signed two informed consent forms before becoming part of the study. The study was limited to people whose upper arm circumference was within the size range of a standard adult blood pressure cuff.

During the four days of the study, 127 people participated. The 57 men and 70 women, whose average age was 46, received no remuneration for their involvement. Participants spent an average of 51 minutes in the gardens. The median time since they had last eaten was 2 hours and 43 minutes.

Design

After participants signed the informed consent forms, they were escorted into a room with high windows that did not afford a view of the gardens. Blood pressure and heart rate were measured with an automated blood pressure cuff programed to measure both blood pressure and pulse at one minute intervals. Three sets of physiological measurements were recorded for each participant, who also completed a pre-visit survey form that evaluated expectations of the visit. Following this procedure, participants left the building and entered the gardens. Participants were asked to return to the main building after visiting the gardens to have their blood pressure and heart rate measured again.

After participants visited the gardens, their blood pressure and heart rate were measured in a room with a view of the gardens. The same measurement protocol was followed before and after the visit. Participants completed a post-visit survey form that included evaluations of the visit, and were offered a copy of their pre-visit and post-visit blood pressure measurements.

The pre-visit and post-visit surveys included questions answered with a five point Likert scale (1). To determine the reliability of the emotional responses, two questions were used to evaluate each emotion. One

emotion evaluated with two questions was stress. The pre-visit questions were "Visiting the garden will be a stressful experience" and "My time in the garden will be relaxing."

The final form completed by each participant was a health survey. It described the participant's physical characteristics and contained appropriate questions for the physiological parameters of this study. Part of this survey included a medication list. Participants were thanked for their participation in the study, and literature was available for them about blood pressure, heart rate, and healthy life styles.

Design Integrity

A botanical garden is an outdoor environment, consequently divergent temperature and humidity levels cannot be controlled that may affect the participants. Blood pressure is the measurable result of a variety of physiological processes and represents a composite parameter (Linden, 1984). Therefore exposure to the botanical garden is not the only factor that determines participants' blood pressure levels. Because psychological factors other than the environment of the botanical garden contribute to the emotional state of visitors to the garden, the environment is not the only factor that determines participants' emotional attitudes. Despite these caveats, the need exists for empirical

research to understand the effects of "green" environments on human health. The integrity of this study required accurate scientific documentation. Consequently, the use of reliable instrumentation for measurement and interpretation of the findings were major design considerations of this study.

Results

Blood Pressure Measurements

Participants' mean systolic blood pressure measurements are presented before and after visiting the gardens in Table 1. Significant decreases ($p < 0.01$) in systolic blood pressure were recorded on three days of the study. The greatest decrease in systolic blood pressure of 6.67 millimeters of mercury (mm Hg) occurred on the first day of the study. On the second day, there was an increase of 1.11 mm Hg. Participants on the third day had decreases in systolic blood pressure of 5.87 mm Hg after visiting the gardens. Decreases of 5.93 mm Hg were measured on the fourth day.

As shown in Table 2, on the first and fourth days of the study, participants' diastolic blood pressure means decreased significantly ($p < 0.01$). These were two of the days that significant systolic blood pressure means decreases were recorded as well. On the first day participants' diastolic blood pressure means decrease was

3.17 mm Hg. On the fourth day the diastolic blood pressure means decrease was 6.07 mm Hg.

Heart Rate Measurements

On the first three days of the study, participants' heart rate measurements before and after visiting the gardens registered increases (See Table 3). On the second day of the study the heart rate measurement mean significantly increased by 4.09 beats per minute ($p < 0.05$). The second day was the only day of the study heart rate increased significantly.

Survey Results

One question on the pre-visit survey was "After my visit, I will be tired." Participants responded to this question with a five point Likert scale (1). The post-visit survey posed the question "I am tired." A Newman-Keuls Multiple Comparison Test of the pre-visit and post-visit questions regarding how tired the participants were reflect statistical significance ($p < 0.01$) on the second day of the study. In the pre-visit survey, participants' responses suggest that they did not expect to be tired after visiting the gardens. However, in the post-visit survey participants' responses imply that they were tired after the visit. The second day was the only day that the concept of tiredness indicates statistical significance. One other question on the pre-visit and post-visit surveys indicates statistical significance on

the second day. The concept of fragrance in the garden was statistically significant ($p < 0.01$) on the Newman-Keuls Multiple Comparison Test. Participants indicated on the post-visit survey, that they enjoyed the fragrances in the gardens on the second day less than they had anticipated, on the pre-visit survey.

The pre-visit survey asked participants to rate their mood on a Likert scale (1). One statement was "I am in a good mood today." Before visiting the gardens, 85 participants agreed that they were in a good mood. One participant disagreed with the good mood question. The rest of the participants' responses ranged from slight disagreement to slight agreement. On the post-visit survey none of the participants responded that they disagreed or disagreed slightly to the mood question; and 94 agreed that they were in a good mood. A Pearson correlation between pre-visit good mood and post-visit good mood indicates statistical significance of $p < .0001$.

Summary and Discussion

The changes on the second day in heart rate and blood pressure are different than changes on the other three days of the study. The only heart rate mean significant increase was on the second day when the heat index was 100. This was the only day of the study that systolic blood pressure did not decrease significantly.

The impact of weather and climate on health still

poses many unanswered questions. The difficulty lies in the complexity of both the weather and the intricate functioning of the human body (Landsberg, 1969). This is one problem of interdisciplinary research.

An outdoor environment with a heat index of 100, as was recorded on the second day, could cause heat stress; heart rate may increase linearly with heat stress (Bell & Greene, 1982). On the other three days of the study, heart rate measurements showed no statistical significance. Heart rate is more a measure of the response of the body to immediate physiological demands (Waters, Williamson, Bernard, Blouin, & Faulstich, 1987) such as coping with a heat index of 100, than a measure of emotional stress.

Stress is best understood by simultaneously considering a number of responses at several different levels (Baum, Singer, & Baum, 1982). While the environment of the gardens may have a positive impact on visitors on days with temperate weather conditions, some stressors, such as extremely high temperature, may produce debilitating reactions (Baum et al. 1982) and override the positive influence of the garden environment.

This study combined physiological measurements with self-reports and found correlations between people's physiological responses and their emotional responses.

On the second day with a heat index of 100, there was statistical significance to participants' responses to questions relating to tiredness, as well as significant increases in heart rate. On the other three days of the study, systolic blood pressure decreased significantly. During the four days of the study, none of the participants responded negatively to the good mood question, after spending time in the gardens. James, Yee, Harshfield, Blank, and Pickering (1986) explain that as the degree of happiness increases, systolic pressure decreases.

Sixty million Americans have high blood pressure that if left untreated can cause heart attack, kidney failure, or stroke. Thirty percent of the adult population in the United States have hypertension or are already receiving antihypertensive drug treatment (Trials of Hypertension Prevention Collaborative Research Group, 1992). The ability to decrease blood pressure consistently even 1 to 2 mm Hg in an at-risk group could potentially be a very positive health benefit; because the decrease in blood pressure of each mm Hg has a corresponding protective effect against cardiovascular dysfunction (Wilson, 1987). Decreases in participants' systolic blood pressure on three days of this study ranged from 5.87 mm Hg to 6.67 mm Hg.

Ulrich (1984a) stated that it seems possible health

cost savings as large as several hundred million dollars a year might be achieved if hospitals were designed to provide patients with attractive, stress-reducing views of nature. A recent editorial in the Journal of the American Medical Association explains that interventions for psychosocial factors could improve health as well as help control our spiraling health costs (Williams & Chesney, 1993). During the nine years between these two statements, very little research documenting the impact on humans of "green" environments has occurred. The value of this study may be that it indicates and justifies the need to evaluate the restorative value to people of plants and nature.

This research was, to the author's knowledge, the first attempt to measure physiological and psychological responses of people to a botanical garden environment. Throughout history, people have created gardens, environmental retreats surrounded by plants. Gardens require patience and respect for the balance of nature. People who work with plants as well as those who find refuge within "green" spaces recognize--if only for a moment--the restorative capacity of nature.

As we continue to lose the luxury of being surrounded by plants and replace vegetation with concrete and other man-made structures, are we creating a world that is physiologically and psychologically deleterious--

as well as environmentally unsound? When people express their desire to protect "natural areas" as diminutive as one tree or as vast as thousands of acres from destruction, part of their defense is the conviction that we must preserve the environment for future generations. The irony may be as we attempt to preserve the natural environment for future generations, we may be protecting our own quality of life in ways not yet fully understood.

NOTES

1. The Likert Scale ranged from 1--disagree, 2--disagree slightly, 3--neutral, 4--agree slightly, 5--agree.

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Table 1

Mean Systolic Blood Pressure Changes

Week	Pre-Visit mm Hg	Post-Visit mm Hg	Change mm Hg
1	119.46	112.79	(-) 6.67*
2	112.19	113.30	(+) 1.11
3	126.79	120.92	(-) 5.87*
4	128.59	122.65	(-) 5.94*

Note. mm Hg = millimeters of mercury

*Significance $p < .01$

Table 2

Mean Diastolic Blood Pressure Changes

Week	Pre-Visit mm Hg	Post-Visit mm Hg	Changes mm Hg
1	70.66	67.50	(-) 3.16*
2	66.42	67.37	(+) 0.95
3	71.16	70.91	(-) 0.25
4	77.36	71.29	(-) 6.07*

Note. mm Hg = millimeters of mercury

* Significance $p < .01$

Table 3

Mean Heart Rate Changes

Week	Pre-Visit bpm	Post-Visit bpm	Change bpm
1	71.49	72.43	(+) 0.94
2	69.99	74.08	(+) 4.09*
3	70.64	71.70	(+) 1.06
4	76.76	75.40	(-) 1.36

Note. bpm = beats per minute

* Significance $p < .05$

APPENDIX A

APPLICATION FOR APPROVAL TO USE HUMAN SUBJECTS
(One copy of both the application and the project proposal must be submitted for review.)

1. ACTIVITY OR PROJECT TITLE:

The Influence of a Botanical Garden Experience on Human Health

2. PROPOSED SPONSOR (IF ANY):

3. Richard H. Mattson (NAME (applicant must be faculty member)) | Horticulture (DEPARTMENT) | 532-6170 (PHONE)

4. RISK

A. Are there risks to human subjects? ____ yes X no

If yes, briefly describe. (See definition of risk, page 2 of the Handbook.)

B. Describe the benefits of the research

a) to the subjects:

Scientific documentation that exposure to a botanical garden could improve a person's health by a reduction of blood pressure and heart rate could help improve the life style of numerous sectors of our society.

b) to the discipline/profession:

Scientific documentation of landscaped environmental benefits would support the observations that plants promote human health and well being, thus advancing research efforts within the horticultural therapy discipline.

5. INFORMED CONSENT: General informed consent requirements are described on pages 3 and 4 of the Handbook. The written informed consent document must include the following: (1) a fair explanation of procedures to be followed, (2) description of discomforts and risks, (3) description of benefits, (4) disclosure of appropriate alternatives available, (5) an offer to answer inquiries, and (6) instructions that the subject is free to withdraw consent and participation at any time. Special informed consent policies relative to questionnaire/survey studies are described in the "Handbook Supplement" dated July, 1977.

On what page(s) of the proposal are your informed consent procedure and/or forms described? (If not a part of your proposal, the procedures and informed consent document must accompany this application.)

(OVER)

APPENDIX A

6. EMERGENCIES

A. Are any possible emergencies anticipated? _____ yes __X__ no

If yes, describe briefly or give the page of the proposal where these are described.

B. Describe procedures for dealing with emergencies, or give the page of the proposal on which these descriptions may be found.

7. PRIVACY: On what page of the proposal do you discuss procedures for keeping research data private? _____ This should include procedures for maintaining anonymity of subjects. Supplemental information concerning privacy of data may be discussed below. (See page 3 of the Handbook on "Safeguarding Information.")

Participants data forms will be coded as they enter the study. Participants names will not be used with any publication resulting from this study.

8. STATEMENT OF AGREEMENT: The below named individual certifies that he/she has read and is willing to conduct these activities in accordance with the Handbook for Research, Development, Demonstration, or other Activities Involving Human Subjects. Further, the below named individual certifies that any changes in procedures from those outlined above or in the attached proposal will be cleared through Committee 8290, The Committee on Research Involving Human Subjects.

Signed Patricia J. Owen (Applicant) Date May 4, 1990

Send applications to:

Dr. Robert P. Lowman
Associate Dean
Graduate School
103 Fairchild Hall

APPENDIX B

KSU
KANSAS
STATE
UNIVERSITY

Graduate School

Research and Sponsored Programs
Fairchild Hall
Manhattan, Kansas 66506
913-532-6195

TO: Richard H. Mattson
Horticulture
Waters Hall

Proposal Number: 642

FROM: Robert P. Lowman, Chair
Committee on Research Involving Human Subjects

DATE: May 30, 1990

RE: Committee Review of Your Proposal Titled "The Influence of a Botanical Garden Experience on Human Health"

The Committee on Research Involving Human Subjects has reviewed your proposal and has approved it with the stipulations indicated below and has determined that:

[x] There is no more than minimal risk to subjects.

[ ] There is greater than minimal risk to subjects.

This approval applies to this project only and only under the conditions and procedures described in the application. Any change in the protocol or conditions described in the proposal will require separate approval. This approval may be followed by a periodic review of the project and examination of records related to the project. Individual identification of human subjects in any publication is an "invasion of privacy" and requires a separately executed "informed consent."

Prior to involving human subjects, properly executed informed consent must be obtained from each subject or an authorized representative, and such forms must be retained on file for a minimum of three years after termination of the project. Each research subject must be furnished with a copy of the informed consent document for his or her personal records.

Any unanticipated problems involving risk to human subjects or others must be reported immediately to the Director of the Student Health Center and the Chairperson of the Committee on Research Involving Human Subjects.

Stipulations: See Attached Sheet.

The Committee on Research Involving Human Subjects has approved Proposal #642 with the stipulation that the informed consent statement include the following two paragraphs:

> "In the event of an injury or emergency resulting from my participation, or if I have any questions concerning this study, I understand that I can contact Richard H. Mattson, 222 Waters Hall (532-6170)."
>
> "If I have questions about my rights as a subject or about the manner in which this research was conducted, I may contact Robert P. Lowman, Chair, Committee on Research Involving Human Subjects, 103 Fairchild Hall (532-6195)."

Please submit revised consent form for final approval.

APPENDIX C

INFORMED CONSENT

I have been asked to participate in a research study being conducted by Pat Owen, a graduate student in Horticultural Therapy at Kansas State University. The purpose of this study is to measure emotional and physical changes that may occur during my visit to Botanica.

My blood pressure will be measured before I enter the garden area and before I leave the grounds. I will be asked to provide information, such as my age and weight. I will be asked to complete a questionnaire which describes my feelings about my visit to Botanica. All of the answers that I give will be held in confidence and my name will not be used in any way, except to identify my information from the pre-test and place it with my information from the post-test.

By participating in this study, I will be helping people better understand the impact of a visit to Botanica. In giving my consent, I acknowledge that my cooperation in this study is voluntary and that I may withdraw at any time. If I have any questions about this study, I will ask them and be comfortable with the answers before signing this form.

I have read the above statement and have been fully advised of the procedures to be used in this project. I understand the potential risks involved and I hereby assume them voluntarily.

In the event of an injury or emergency resulting from my participation, or if I have any questions concerning this study, I understand that I can contact Richard H. Mattson, 222 Waters Hall, Kansas State University (913 532-6170).

If I have questions about my rights as a subject or about the manner in which this research was conducted, I may contact Robert P. Lowman, Chair, Committee on Research Involving Human Subjects, 103 Fairchild Hall, Kansas State University (913 532-6195).

Date _____ Signature _____

APPENDIX D

KSU
KANSAS STATE UNIVERSITY

Graduate School

Research and Sponsored Programs
Fairchild Hall
Manhattan, Kansas 66506
913-532-6195

TO: Richard H. Mattson
Horticulture
Waters Hall

Proposal Number: 642

FROM: Robert P. Lowman, Chair
Committee on Research Involving Human Subjects

DATE: August 6, 1990

RE: Committee Review of Your Proposal Titled "The Influence of a Botanical Garden Experience on Human Health"

The Committee on Research Involving Human Subjects has reviewed the modifications which you made in your proposal in response to stipulations placed on its approval by the Committee. The Committee has accepted these modifications as fulfilling its stipulations and therefore grants full approval to your proposal, as modified. In granting this approval, the Committee has determined that:

[x] There is no more than minimal risk to subjects.

[ ] There is greater than minimal risk to subjects.

This approval applies to this project only and only under the conditions and procedures described in the application, as revised. Any change in the protocol or conditions described in the proposal, as revised, will require separate approval. This approval may be followed by a periodic review of the project and examination of records related to the project. Individual identification of human subjects in any publication is an "invasion of privacy" and requires a separately executed "informed consent."

Prior to involving human subjects, properly executed informed consent must be obtained from each subject or an authorized representative, and such forms must be retained on file for a minimum of three years after termination of the project. Each research subject must be furnished with a copy of the informed consent document for his or her personal records. Your informed consent statement, as approved by the Committee, is attached to this memorandum.

Any unanticipated problems involving risk to human subjects or others must be reported immediately to the Director of the Student Health Center and the Chairperson of the Committee on Research Involving Human Subjects.

APPENDIX E

PARTICIPANT CODE SHEET October 14, 1990

Code Number	Name of Participant

APPENDIX F

BOTANICA SURVEY

DIRECTIONS FOR TAKING PRE-VISIT BLOOD PRESSURE

1. Apply cuff to non-dominant arm.

2. Explain that 3 pressures will be taken, one minute apart. The first one will be tighter so that the machine can adjust to each individual.

3. Give the participant the survey. Tell them not to talk until after the third pressure. Tell them there are two sides to the survey.

4. After they start the survey, turn the machine from hold position to on.

5. Record MAP, BP and HR x 3, concealing the readings from the participant.

6. Explain that they will get BP results at the end of the tour.

7. Reset the machine by turning it off. Keep the right button on hold.

8. Check to see that you have filled in the right side of the card, and that the participant # and time and date are completed.

9. Thank the participant for participating, and remind him/her that there will be another blood pressure measurement and survey at the completion of the visit to the garden. There will be a sign in the garden directing participants to the other side of the auditorium for the concluding measurements.

APPENDIX G

BOTANICA SURVEY

DIRECTIONS FOR TAKING POST-VISIT BLOOD PRESSURE

1. Apply cuff to non-dominant arm.

2. Explain that 3 pressures will be taken, one minute apart. The first one will be tighter so that the machine can adjust to each individual.

3. Give the participant the survey. Tell them not to talk until after the third pressure. Tell them there are two sides to the survey.

4. After they start the survey, turn the machine from hold position to on.

5. Record MAP, BP and HR x 3, concealing the readings from the participant.

6. Reset the machine by turning it off. Keep the right button on hold.

7. Check to see that you have filled in the right side of the card, and that the participant # and time and date are completed.

9. Thank the participant for participating. If the person would like a record of blood pressure measurements, write down the highest reading from the post-test, and if requested the highest pre-test reading, on the Red Cross folder. Then request the participant to go to the health survey table.

#___ Previsit Time: ___

	MAP	BP	HR
1-			
2-			
3-			

Post visit Time: ___

	MAP	BP	HR
1-			
2-			
3-			

APPENDIX I

INFORMATION ABOUT THE HEALTH AND ENVIRONMENT SURVEY

This study is a research project being conducted by Pat Owen, a graduate student in Horticultural Therapy at Kansas State University. She is available to answer any questions.

You will be asked to read and sign an informed consent form before beginning the research project. Then you will complete a brief survey and have your blood pressure measured before visiting the gardens. After your garden visit, you will be asked to complete more survey information and have your blood pressure measured again. Blood pressure data will be made available to you upon completion of the second set of measurements. Your name will not be used in any report of this study. The information gathered will be compiled and results will be reported in Seedlings, a publication of Botanica.

APPENDIX J

BOTANICA HEALTH AND ENVIRONMENT SURVEY

Part I

Participant number_____

Date _____

For questions #1 and #2, please check the phrase(s) which best describes you.

1. How often do you visit Botanica?

   ____ my first visit ____ once a year

   ____ several times a year ____ several times a month

2. With whom are you visiting Botanica?

   ____ alone ____ with a group of people (club, class)

   ____ with my friend(s) ____ with my family

3. Do you know you can be a member of Botanica? Yes___No___

4. Are you a member of Botanica? Yes___ No___

5. Wichita zip code_____

   Or town_____

6. Please check all the phrases which describe your expectations for visiting Botanica today: It will...

   ____ help me forget my worries.

   ____ provide an opportunity to be with friend(s) and/or family.

   ____ be an educational experience.

   ____ be healthful exercise.

   ____ provide an opportunity to meet new people.

   ____ be an exciting adventure.

   ____ allow me an opportunity to enjoy viewing the beauty of the seasonal changes in the garden.

   ____ be a quiet and tranquil experience.

7. Please read all of the phrases and circle the number which best describes your expectations for your visit to Botanica. "1" means it does not describe how you feel. "5" means it is extremely descriptive of your feelings.

disagree	disagree slightly	neutral	agree slightly	agree	
1	2	3	4	5	Being in the garden will renew my energy level.
1	2	3	4	5	Today I feel sad.
1	2	3	4	5	I enjoy the fragrances of a garden.
1	2	3	4	5	Visiting the garden will be a stressful experience.
1	2	3	4	5	I look forward to visiting the gardens.
1	2	3	4	5	I am in a good mood today.
1	2	3	4	5	After my visit, I will be tired.
1	2	3	4	5	The garden brings me closer to nature.
1	2	3	4	5	I wish I were somewhere else.
1	2	3	4	5	My time in the garden will be relaxing.

8. When I think about Botanica, the features that I expect to see in the garden include:

____ shrubs	____ nature trail	____ water platters
____ trees	____ greenhouse	____ foliage plants
____ herbs	____ vegetables	____ theme gardens
____ flowers	____ rock gardens	____ fountains/ponds
____ grass	____ statues	____ xeriscape

Thank you for taking the time to answer these questions. When you are ready to leave, we ask that you participate in an exit survey and blood pressure measurement. At the completion of the exit survey, we will give you a copy of both sets of blood pressure measurements.

BOTANICA HEALTH AND ENVIRONMENT SURVEY

Part II

Participation number_____

Date_____

Thank you for continuing your participation in this study.

1. Please check the answers which describe your feelings. I ...

____ enjoy growing plants.

____ have access to a garden.

____ appreciate the landscaped gardens at Botanica.

____ have plants in my home/apartment.

____ enjoy the shrubs/trees surrounding my home/apartment.

____ enjoy fresh flowers.

____ consider myself to be in good health.

____ do not think I am very healthy.

2. Please check all the phrases which describe your visit to Botanica today. My visit to Botanica was...

____ an educational experience.

____ something I would like to do again.

____ a way to help me forget my worries.

____ healthful exercise.

____ a quiet and tranquil experience.

____ enjoyable because of the beauty of the seasonal changes in the garden.

____ an opportunity to be with friend(s) and/or family.

____ an opportunity to meet new people.

____ an exciting adventure.

3. Please read all of the phrases and circle the number which best describes your visit to Botanica. "1" means it does not describe how you felt. "5" means it is extremely descriptive of your feelings.

disagree	disagree slightly	neutral	agree slightly	agree	
1	2	3	4	5	My time in the garden was relaxing.
1	2	3	4	5	Being in the garden renewed my energy level.
1	2	3	4	5	Today I feel sad.
1	2	3	4	5	I am glad I visited Botanica today.
1	2	3	4	5	I am in a good mood today.
1	2	3	4	5	The garden brought me closer to nature.
1	2	3	4	5	I am tired.
1	2	3	4	5	Visiting the garden was a stressful experience.
1	2	3	4	5	My visit was disappointing.
1	2	3	4	5	I enjoyed the fragrances of the garden.

4. When I think about my visit, the five features that I enjoyed the most in the garden include:

____ nature trail	____ grass	____ trees
____ statues	____ herbs	____ foliage plants
____ theme gardens	____ vegetables	____ greenhouse
____ flowers	____ rock garden	____ fountains/ponds
____ water platters	____ shrubs	____ xeriscape

5. Please check the answer which best describes your visit to Botanica:

____ I would have enjoyed this visit more if I had not agreed to participate in this study.

____ I did not mind participating in this study.

APPENDIX L

BOTANICA HEALTH SURVEY

Please answer the following questions about yourself:

1. _____ Male _____ Female

2. _____ Smoker _____ Non-smoker

3. At what time did you last eat? _____

4. Age _____

5. Weight _____

6. Height _____feet _____inches

7. Please check all the responses which apply on the next question.

   I take the following medications:

   _____ diuretics (Lasix, Diuril, HCTZ, Dyazide, Lozol, Maxzide. etc.)

   _____ anti-hypertensives (Capoten, Tenormin, Lopressor, Aldomet, Zestril, etc.)

   _____ cardiac medication (Lanoxin, Digitalis, Nitroglycerin, Procardia, Quinidine, etc.)

   _____ beta blockers (Inderal, Propanol, Tenormin, Lopressor, etc.)

   _____ sedatives (Valium, Haldol, Ativan, etc.)

   _____ nerve pills (Elavil, Halcion, etc.)

   _____ others, reason for taking_____

   _____ none

Thank you for participating in this study. Results will be shared in a future issue of Seedlings.

APPENDIX M

Responses from participants to some of the statements on Survey Part I and Survey Part II

Pre-visit and post-visit responses

disagree	disagree slighty	neutral	agree slightly	agree	
5	3	40	33	39	Being in the garden will renew my energy level.
4	6	36	37	38	Being in the garden renewed my energy level.
1	0	8	20	90	I enjoy the fragrances of a garden.
4	4	20	20	71	I enjoyed the fragrances of the garden.
1	4	8	27	86	I am in a good mood today. (pre-visit)
0	0	9	22	92	I am in a good mood today. (post-visit)
1	0	5	19	100	The garden brings me closer to nature.
0	1	13	23	87	The garden brought me closer to nature.
1	0	5	16	103	My time in the garden will be relaxing.
1	2	9	11	100	My time in the garden was relaxing.