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SOME INFLUENCES OF HORTICULTURAL AND SOCIAL ACTIVITIES  
ON BLOOD PRESSURE OF ELDERLY PEOPLE

by

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## INTRODUCTION

Horticultural therapy is currently being used with elderly people for reality orientation, leisure activity, skill maintenance, and physical rehabilitation. Involvement in gardening gives people a sense of pride and self-worth. Along with these attributes, gardening provides physical activity that is often lacking in older people's schedules.

Physical activity is essential to maintaining an older person's physiological functioning. Gardening is one of the most popular physical activities among the elderly and is useful to maintain health.

This research measured the influence of horticulture and other types of activity on blood pressure of elderly people. When more is known of horticulture's physiological effect on people, horticultural therapy will be more readily used as part of the medical treatment plan.

Results concerning effects of horticultural activities on cardiovascular health are being submitted to Science, a publication of the American Association for the Advancement of Science. Other results on types of activity and models for intervention will be submitted to the Journal of Horticultural Therapy, published by the American Horticultural Therapy Association.

## LITERATURE REVIEW

### Life Satisfaction and Leisure Activities

Gerontologists consider life-satisfaction to be a measurement of how well our social system is working to provide beneficial opportunities and environments for the aging (Ragheb and Griffith 1982; Rosenberg 1986). Ragheb and Griffith (1982) examined the interrelationships among leisure satisfaction, leisure participation, and other variables such as satisfaction with family, health, and standard of living of 565 persons 55 years and older. Their analysis showed that leisure satisfaction made the greatest contribution (20%) to life-satisfaction. Their study also showed that people who participated more frequently in leisure activities had a higher degree of life-satisfaction.

To study the problem of maintaining life-satisfaction in older people, Wilcox (1979) compared the involvement of residents in a skilled nursing home in a gardening or discussion group to a control group that was not involved in either activity. Each participants' level of life-satisfaction was measured using the Life-Satisfaction Index (LSI) administered before the project and eight weeks later. Residents in the garden and discussion groups had maintained life-satisfaction over the length of the study. Those who were not involved in either

activity showed a significant decline in level of life-satisfaction. Wilcox also noted that although the LSI scores of the garden and discussion groups were similar, the gardening appeared to have a greater influence on its members. Gardeners developed pride in their work and planned to garden again the next year, whereas the discussion group decided to reduce the amount of time they spent in the group and expressed no interest in repeating the group.

When choosing activities with the purpose of enhancing life-satisfaction of an elderly population, Achtley (1977) noted it is important to choose those activities that are currently or were previously meaningful to the group. Further, older people tend to retain the pattern of leisure held in their youth.

#### Outdoor Activity Preferences

Ragheb and Griffith (1982) showed that outdoor and sports activities had the highest correlation with total leisure satisfaction. They found social, outdoor, and sports activities correlated highest with total life-satisfaction for the elderly.

Of the outdoor activities fishing, gardening, and walking were universally perceived as important among black and white elderly in the 1982-83 National Recreation Survey (McGuire et al. 1987). Several other studies of overall activity preferences of elderly people

determined that gardening was the most mentioned vigorous activity (Hill and Relf 1982; MacAvoy 1979). Gardening ranked fourth after socializing, watching television, and reading (MacAvoy 1979).

In his preference study MacAvoy (1979) also sought the reasons motivating elderly people to participate in chosen activities and found them to be: 1) socializing; 2) self-fulfillment; 3) feeling close to nature; 4) physical exercise; and 5) learning. MacAvoy (1977) explained that although current activity programs take care of several of these needs, contact with the natural environment that could be met by gardening was not being addressed in nursing homes and senior centers. Not surprisingly, all five of the reasons elderly people gave for participation in activities are benefits that can be gained through gardening programs (Relf 1981).

#### Activity Therapy and Reality Orientation

Professionals in gerontology who agree with the activity theory of aging are often concerned with reality orientation and engagement of elderly persons. Reality orientation can be successful if carried out in the outdoor garden or in the greenhouse. In either location, people can experience the passage of sun time, changes in the seasons, and changes in plant growth (Griffiths 1976; MacAvoy 1977; McBey 1985).

Along with reality orientation, gerontologists are concerned with improving engagement. Lack of activity is connected with reduced life-satisfaction and morale, as reported by elderly residents themselves. In addition, lack of activity leads to physiological problems and skill atrophy (Powell et al. 1979). Powell et al. (1979) reported increased engagement using an indoor plant activity. They chose gardening because it was an activity that residents had previously enjoyed. Their participants were chosen from a group of nursing home residents who spent most of their time sitting in a lounge and, as a result, showed a low level of engagement. The study compared levels of engagement during garden session days versus days when no activity was planned. Results showed that engagement of residents at garden sessions averaged 90 percent whereas engagement on those days the garden session was not attended averaged 30 percent.

#### Physical Activity and Aging

Another area of study in gerontology is in the level of people's physical activity. Rosenberg (1986) notes that there is a reduction in physical activity in later life. Ahtley (1977) stated that time spent sitting can be positive in that it allows time for inner reflection and this may increase self-confidence through resolving inner questions and conflicts. Rosenberg (1986) questioned

whether the decline of physical ability with age was innate or induced through compliance with societal views that people should be less active as they grow older. Rosenberg stated "The difference between physical ability decline with age and decline due to societally induced withdrawal and consequent skill atrophy must be made clear, as must the potential for re-engagement and skill recovery with appropriate support" (p.51).

Physical and occupational therapists appreciate the use of horticulture in re-engagement and skill recovery because it employs a wide range of fine motor and gross motor skills (Cole-Adams 1972; McBey 1985; Sullivan 1979). Gardening can be used as a means of assessing and rehabilitating physical abilities (McBey 1985; Sullivan 1979).

#### Cardiovascular Effects

Additional studies explore the benefit of gardening in the improvement of the cardiovascular system. Regular light exercise, such as walking, cycling, or gardening, reduced the number of acute coronary events in people 35 to 69 who suffered from acute myocardial infarction (Magnus et al. 1979). The effects of exercise were reduced only a few weeks after discontinuing activity and suggests that an activity such as gardening, if done only seasonally, will not produce positive results.

This exercise study supports the idea that a gardening program should run year-round. Many of the warmer climates are suited for gardening year-round, but even cooler areas can incorporate gardening throughout the winter months by working with plants indoors or in a greenhouse (Rothert and Daubert 1981; White 1973).

Another aspect of cardiovascular health is blood pressure. Smith and Gilligan (1984) explained that blood pressure tends to increase as people get older. Between the ages of 39 and 70, average blood pressure increases by 10 to 40mm Hg systolic and 5 to 10mm Hg diastolic due to the aging process. Lack of exercise is in part responsible for this increase in blood pressure. The elderly may fear injury and as a result avoid exercise, but as Smith and Gilligan point out, "Inactivity itself is dangerous to the heart; physical activity programs can be designed to prevent injury and strengthen the cardiovascular system" (p.94). Increase in blood pressure is considered normal in the United States because it is so prevalent, but since many people do not experience increased blood pressure with age, changes in blood pressure may be attributed to lifestyle and inactivity (Smith and Gilligan 1984).

### Stress Reduction

Increase in blood pressure is often associated with stress. A number of researchers have reported that

gardening promotes relaxation and reduces stress (Doxon et al. 1987; Relf 1981). In a study of developmentally disabled adults, Doxon et al. (1987) showed that a plant environment was less stressful than a non-plant environment. Doxon used five physiological measures of stress: pulse, systolic blood pressure, diastolic blood pressure, electrodermal response, and skin temperature. Participants were involved in a vocational training program and spent half the program working with plants in a greenhouse and the other half sorting clothing patterns in a training center. A comparison of the biological measurements for stress showed that average systolic and diastolic blood pressures were significantly lower and electrodermal response was significantly higher in the greenhouse versus the training center. Skin temperatures were lower in the greenhouse, but this was probably influenced by participants placing their hands in cool water while washing pots, an activity that was not believed to increase stress. Lower diastolic and systolic blood pressures and higher electrodermal response and skin temperature reflect a reduction in stress (Doxon et al. 1987).

Henry (1985) supported Doxon's finding in a more global sense by a study of blood pressure of 50 to 60 year old men in societies with different economies. The lowest blood pressure existed among men who were involved in

subsistence agriculture and did not grow food for sale. Blood pressure was several points lower for these agriculturists than for hunter-gatherers or hunters, none of whom produce products for sale. As agriculture grew to involve selling and other trade and industry occupations became more apparent, blood pressures also rose. Traditional agriculture and agriculture that involved economic competition affected blood pressures differently. This research suggests that to achieve a lower blood pressure, activities that resemble traditional agriculture, such as small-scale or home horticulture, might be most beneficial.

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## INTRODUCTION

Important to the well-being of older people are meaningful activities and cardiovascular health. Choosing appropriate physical and leisure activities contributes to maintaining health. The main reasons elderly people give for participating in chosen activities are socializing, self-fulfillment, feeling close to nature, physical exercise, and learning (1). Many current activity programs meet these needs with the exception of contact with the natural environment (2). Group gardening may serve as an ideal activity since it incorporates all these needs (3).

Older people tend to become sedentary as they age due to fear of injury. However, complications of inactivity are skill atrophy and physiological problems (4). Even as older people incorporate more reading and television into their activities, many maintain an interest in plants. Gardening remains the most preferred physical activity among elderly people (1,5).

As an activity of choice, gardening gives its older participants many benefits. The garden or greenhouse setting is used for reality orientation and increasing engagement because it allows people to experience the passage of sun time, changes in season, and changes in plant growth (2,6,7). Gardening uses a wide range of fine and gross motor skills so it is often used to assess

and rehabilitate people's physical abilities (7,8). Working with plants helps people maintain their satisfaction with life and in so doing gives them a sense of pride and a desire to plan for future seasons of gardening (9). As evidenced by a reduction in blood pressure of developmentally disabled adults working in a greenhouse versus a training center, working with plants also reduces stress (10). When done as a year-round light physical activity, gardening was effective in reducing heart attacks in people suffering from coronary heart disease (11).

The number one variable in cardiovascular health is blood pressure. Blood pressure does tend to increase with age, but this does not mean that age-associated hypertension is benign. In fact, the Framingham Heart Study shows that the risk gradient for coronary heart disease increases with age (12). Control of even minor elevations in blood pressure (i.e. a 90-104 range in diastolic pressure) is important in reducing risk of cardiovascular complications (13).

Involving older people in physical activities they prefer may be beneficial to improving their cardiovascular health while providing meaningful activity. This research compares elderly people's frequency of and preference for doing activities and investigates how participation in different types of activity may influence their blood pressure.

## MATERIALS AND METHODS

Participants were 53 older adults randomly selected from two nursing homes and two senior centers in a small midwestern city. They ranged in age from 45 to 99 with 75% between 68 and 88, and were demographically representative of older adults from independent to dependent living conditions. The overall ratio of men to women was 1:4 with males equally distributed among sites. One senior center with 17 participants represented middle income; the second senior center had 19 participants and was a low income nutrition site. Total population of the two centers was approximately 250. Seventeen participants were selected from the two nursing homes with an average bed capacity of 60 each.

Data were collected using a three page questionnaire developed by the researcher. A medical chart was used to collect participants' blood pressure records. Participants were read advised consent statements explaining the researcher's request that they fill out a questionnaire and release their blood pressure records. This consent statement assured participants their confidentiality and stressed the volunteer nature of their participation. After signing these statements, participants responded in writing or verbally to questions dealing with frequency of and preference for doing activities in the previous year (14), and also with diet,

health, and other demographics. The majority of questionnaires were completed in less than one hour; one subject required over six hours.

Monthly blood pressure records taken over a two year period by nursing home medical staff and/or health department nurses were released by participants. From these records, one year of reading from March 1987 through February 1988 were used for analysis. Forty-seven out of the 53 participants released blood pressure records. These systolic (SBP) and diastolic (DBP) readings were organized into seasonal means (15). Fifty-three percent of participants had missing data for seasonal means. Scarpelli et al. (1984) showed that blood pressures fluctuate seasonally, so readings from the same month of the previous or following year were substituted. Twenty-six of the 47 participants (55%) had a complete set of four means each for SBP and DBP without any substitution. Including substitutions, each subject had at least two seasonal means from which was calculated an annual mean for SBP and DBP.

#### Data Analysis

A general linear model (GLM) program in the Statistical Analysis System (SAS) was used. Analysis of variance was conducted on the variables SBP, DBP, and frequency and preference of activity. Sources of variance were gender,

location, and type of activity. For the sake of analysis, participant responses from the two nursing homes were compared. Participants from the two nursing homes did not give contrasting responses, so they were combined into a single location group noted as "Nursing Home."

Analysis of activity frequency and preference involved categorizing the questionnaire activities into social, horticultural, and other, with twelve items per activity. Total activity scores as well as activity component scores were analyzed.

A multiple analysis of variance procedure was used to show correlations between SBP, DBP, age, and frequencies of horticultural, social, and other activities.

## RESULTS AND DISCUSSION

The frequency of older adults' activities decreased significantly ( $F=18.8$ ;  $p=.0001$ ) from the senior center (23.3), to the nutrition site (21.1) and on to the nursing home (19.1). In contrast, older adults' preference for activity increased significantly ( $F=13.7$ ;  $p=.0001$ ) from the nutrition site (26.0) to the senior center (27.5), with the highest preference scores at the nursing home (29.4). The wide difference between nursing home residents' frequency of doing activities and

preference for doing activities suggests a wishful desire to participate in activities they may no longer be able or may not be given the opportunity to do. This gives evidence for the need to adapt more activities to the skill levels of older people. Through use of specialized tools and accessible garden areas, traditional gardening becomes "adaptive gardening," which is both safe and mentally and physically stimulating (18).

Participants from the three locations did participate in horticultural, social, and other activities at different rates and at different levels of preference, but these differences were not significant. These scores are enumerated in Table 1. As one group, however, participants did show a significant difference ( $F=10.19$ ;  $p=.0001$ ) in preference for activity. Social activities ranked highest, horticultural activities were second, and other activities were the least preferred. Also note that the greatest disparity between preference and frequency scores occurs for horticultural activities. Elderly people may not have the opportunity to be involved in the areas of horticulture and nature as much as they would like.

#### Fluctuation of Blood Pressure Readings

Individuals' seasonal SBP and DBP means fluctuated widely: SBP readings ranged 102-180 and the DBP readings

Table 1.  
Frequency and Preference of Activity Compared by Location

Activity Type	Location										Mean
	Nursing Home		Nutrition Site		Senior Center						
	F <sup>z</sup>	P <sup>z</sup>	F	P	F	P	F	P	F	P	
Horticultural	18.7	29.6	21.0	25.6	22.2	27.8	20.7	27.7 <sup>by</sup>			
Social	20.7	30.6	21.3	27.6	24.9	29.0	22.3	29.1 <sup>a</sup>			
Other	17.9	27.7	21.0	24.9	22.9	25.6	20.6	26.1 <sup>c</sup>			

<sup>z</sup> F = Frequency of activity; score range = 12 - 36.

P = Preference for activity; score range = 12 - 36.

<sup>y</sup> Means followed by the same letter in any one column do not differ significantly ( $p < .0001$ ).

ranged 46-104. Means for the nursing home, nutrition site, and senior center were 129.6/69.8, 130.1/79.4, and 136.0/75.5, respectively.

Participants from the three locations did not have significant contrasts in seasonal blood pressure readings. Senior adults from the nursing home had stable SBP and DBP readings over the four seasons when compared with the rest of the participants. At the nursing home, SBP and DBP readings fluctuated only 1.0 and 2.2 points, respectively, over the four seasonal means. In contrast, the nutrition site and senior center averaged fluctuations of 10.6 points systolic and 4.9 points diastolic. Perhaps through medication and management of activities and diet, blood pressure is more highly controlled throughout the year for residents of the nursing home. This data suggests a need for continuing blood pressure monitoring and education in senior centers and nutrition sites as a means of encouraging older people who are still independent to control their blood pressure.

Participants from the senior center had significantly higher ( $F=21.2$ ,  $p=.0001$ ) annual means for SBP (136.3) than participants from the nutrition site (130.1) or the nursing homes (129.6). Annual means for DBP were also significantly different ( $F=4.53$ ,  $p=.013$ ) and ranked lowest to highest from the nursing home (69.8) to the senior center (75.5), to the nutrition site (79.4).

As with seasonal differences, higher annual blood pressures at the independent site may be accounted for by fluctuations in diets, activities, and medication. Correlations show some relationships of blood pressure to activity frequencies. For this sample, diastolic and systolic blood pressure were significantly positively correlated ( $r=0.54$ ,  $p=.0005$ ), which lends support to trends affecting either parameter. Except for frequency of social activity with systolic blood pressure, ( $r= -.031$ ;  $p=0.057$ ), frequency of all three types of activity were not significantly correlated with blood pressure. Participants who were more frequently involved in social activities tended to have lower readings for blood pressure. Horticultural activities were not highly correlated, but findings on analysis of variance (Table 1) showed that participants were not doing this type of activity as much as they would like.

In summary, frequency of activity decreases while preference for activity increases as people reach the later developmental stages, as shown by the scores of nursing home residents. As compared to the senior center and nutrition site, blood pressures were more stable at the nursing home, which points to a need to encourage regular blood pressure monitoring and treatment for elderly people in the independent stages of life.

Systolic blood pressures were negatively correlated with frequency of social activities. This finding suggests that participation in activity may be useful in decreasing blood pressure. An activity that combines social interaction with opportunities to work independently in a natural setting may be the key to maintaining high life-satisfaction and good cardiovascular health. Adaptive gardening is such an activity. While gardening directly enhances people's health, it also creates a serene setting that can be used as a backdrop for many more healthful activities.

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14. Frequency of activity in the past year was scored with 1 point=never, 2 points=1-4 times, and 3 points=more than 4 times. Preference for activity was scored with 1 point= dislike, 2 points=neutral, and 3 points=like very much.

15. Seasons were: Spring=March 1-May 31, 1987; Summer=June 1-August 31, 1987; Fall=September 1-November 30, 1987; Winter=December 1, 1987-February 29, 1988.

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17. Social activities required interaction with people directly or indirectly (i.e. writing a letter to a friend). Horticultural activities involved interaction with plants, animals, or natural physical phenomena. Other activities were those that did not require interaction with nature or people.

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GARDENING MAY REDUCE BLOOD PRESSURE OF  
ELDERLY PEOPLE: ACTIVITY SUGGESTIONS  
AND MODELS FOR INTERVENTION

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Abstract: Activity questionnaires and blood pressure records were compared for 53 people aged 45-99 from two nursing homes and two senior centers. Participants were most often involved in activities requiring clerical and social skills. Participants' frequency of and preference for horticultural, social, and other activities differed by location. Contrasts between preference and frequency scores were greatest for horticultural activities. Participants' systolic and diastolic blood pressures were related to their blood pressure medication, frequency of activity, age, and diet.

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## INTRODUCTION

Wilcox (1979) showed the value of horticultural therapy in maintaining life-satisfaction of elderly people. Others have used horticulture successfully in reality orientation (Griffiths and Griffiths 1976; MacAvoy 1977; McBey 1985) and physical rehabilitation (Cole-Adams 1972; Sullivan 1979; McBey 1985). Doxon et al. (1987) demonstrated that adults with developmental disabilities had lower blood pressures in a plant environment as compared with a non-plant environment. Doxon's conclusion that horticulture could positively influence human physiology was also verified by Magnus et al. (1979). Magnus found that gardening done as regular light exercise lowered the number of heart attacks in patients suffering from heart disease.

High blood pressure increases the risk of heart problems, especially as people age. Elderly peoples' hypertension can be partially explained by inactivity. Older people may avoid physical activity because they fear injury, but inactivity itself is dangerous to the heart (Smith and Gilligan 1984). Gardening is the most popular physical activity among older people (Hill and Relf 1982; MacAvoy 1979) and should be encouraged for maintaining and even improving health.

More studies are needed to confirm the physiological benefits of horticulture and further encourage the use of

horticultural therapy in senior centers and nursing homes. To help with this concern, the following study examines the effect of horticulture and other types of activity on blood pressure of elderly people.

#### **MATERIALS AND METHODS**

Participants in this study were 53 older adults randomly selected from two nursing homes and two senior centers in a small midwestern city. Participants ranged in age from 45-99 with 75% between 68 and 88, and were representative of older adults from independent to dependent living conditions. One senior center with 17 participants represented middle income; the second senior center had 19 participants and was a low income nutrition site. A total of approximately 250 people regularly visited the two centers. Seventeen participants were selected from the two nursing homes with an average bed capacity of 60 each.

Data were collected using a 3-page questionnaire developed by the researcher (Appendix A). The questionnaire identified six types of activities as follows:

- 1) artistic; 2) commercial/political; 3) clerical;
- 4) constructive; 5) scientific; and 6) social. Six activities were listed in each category (Table 1).

Table 1  
Six Activity Categories

Constructive

Repot a plant  
Work with wood  
Repair garden tools  
Take a gardening course  
Mend clothing  
Knit a garment or blanket

Social

Write letters to friends  
Attend garden club meetings  
Attend a religious service  
Watch sports with friends  
Dance  
Visit with family

Scientific

Take geranium slips  
Bake a new bread  
Read a science magazine  
Make a seed order  
Learn about trees  
Feed and identify birds

Commercial/Political

Tour a historical site  
Vote in an election  
Serve as a club officer  
Sell plants  
Play bingo  
Participate in a group  
discussion

Artistic

Arrange Flowers  
Enjoy a sunset  
Sing or play an instrument  
Read poetry or fiction  
Take an art course  
Write poetry

Clerical

Plan things for the day  
Identify a plant  
Pay bills  
Groom and maintain a plant  
Organize personal papers  
Organize a photo album

Participants were read advised consent statements explaining the researcher's request that they complete a questionnaire and release their blood pressure records. This consent statement assured participants their confidentiality and stressed the volunteer nature of their participation. After signing these statements, participants responded in writing or verbally to questions dealing with frequency and preference for doing activities in the previous year, and also with diet, health, and demographics. The majority of questionnaires were completed in less than one hour; one subject required over six hours.

Monthly blood pressure records taken over a two year period by nursing home medical staff and/or health department nurses were released by participants. From these records, one year of readings from March 1987 through February 1988 were used for analysis. Forty-seven out of the 53 participants released blood pressure records. Their systolic (SBP) and diastolic (DBP) readings were organized into the following seasonal means:

Spring = March 1 - May 31, 1987

Summer = June 1 - August 31, 1987

Fall = September 1 - November 30, 1987

Winter = December 1, 1987 - February 29, 1988

Fifty-three percent of participants had missing data for

seasonal means. SBP and DBP readings of the same month of years directly preceding or succeeding the target year were used to fill in 21 seasonal means for 19 participants. With substitution, each subject had at least two seasonal means from which was calculated an annual mean for SBP and DBP. Twenty-six participants (55%) had a complete set of four means each for SBP and DBP without substitution.

#### Data Analysis

A general linear model (GLM) program in the Statistical Analysis System (SAS) was used. Analysis of variance was conducted on the variables SBP, DBP, and frequency and preference of activity. Sources of variance were gender, location, and type of activity.

A multiple regression analysis revealed relationships of SBP and DBP to gender, location, age, diet, activity types, activity frequency, and the presence or absence of regular exercise and anti-hypertensive medication.

Participants' diet scores were determined by adding points weighted for their weekly frequency of eating six foods, and whether they took calcium supplements or followed a low sodium diet. Based on the number of times a participant had done an activity in the past year, frequency of activity was scored with 1 point=never, 2 points=1-4 times, and 3 points= more than 4 times.

Preference for activity was scored with 1 point=dislike, 2 points=neutral, and 3 points=like very much. Participants scored two points if they exercised regularly; one point if not. Similarly, two points were given for taking blood pressure medication and one point in its absence.

For the sake of analysis, participant responses from the two nursing homes were compared. Participants from these homes did not give contrasting responses, so they were combined into a single location group noted as "Nursing Home." Participant number, gender, and age data are summarized in Table 2. Comparing the nursing home with the nutrition site and the senior center, note that percentage of males progressively declines with increasing mean age at the three locations.

## RESULTS AND DISCUSSION

Participants' involvement in activities was significantly more frequent in activities that required clerical and social skills (Table 3). When asked what they preferred to do, significantly more people chose clerical, social, artistic, and commercial/political activities. Differences between frequency and preference scores suggest that participants would like to do more activities, especially those that are scientific and

Table 2.  
Demographics of Older Adults by Location

Location	N	Males (%)	Females (%)	Age Range (Yrs.)	Mean Age (Yrs.)
Nursing Home	17	17.6	82.4	78-99	86.4 ± 6.4
Nutrition Site	19	21.2	78.9	63-84	74.3 ± 6.9
Senior Center	17	29.4	70.6	45-89	76.7 ± 12.1

Table 3.

Frequency and Preference Mean Scores<sup>z</sup> for Activity Types

Activity Type	Frequency	Preference	$\Delta$ P - F
Clerical	12.2 <sup>a</sup>	14.1 <sup>a</sup>	2.0
Social	11.8 <sup>a</sup>	14.6 <sup>a</sup>	2.8
Artistic	10.7 <sup>b</sup>	14.1 <sup>a</sup>	3.4
Commercial/Political	10.2 <sup>b</sup>	14.1 <sup>a</sup>	3.9
Constructive	9.6 <sup>c</sup>	12.8 <sup>b</sup>	3.2
Scientific	9.0 <sup>c</sup>	13.0 <sup>b</sup>	4.0
LSD	.74	.71	

<sup>z</sup> Range of scores = 6 - 18.<sup>y</sup> Means followed by the same letter in any one column do not differ significantly ( $p < .05$ ).

business related.

The six activity categories were further simplified into three types of activity. Analysis of variance for activity frequency and preference involved categorizing the items into social, horticultural, and other types of activity, with twelve activities in each grouping. Social activities were those requiring interaction with people directly or indirectly (i.e. writing a letter to a friend). Horticultural activities involved interaction mainly with plants, but also with other aspects of nature, such as animals and physical phenomena. Horticultural activities could be done without interacting with people. Other activities were those that do not require interaction with nature or people.

Comparing the three types of activity in Table 4, the difference between activity preference and frequency increases from the senior center, to the nutrition site, and on to the nursing home. The wide difference between nursing home residents' frequency and preference for doing activities suggests a wishful desire to participate in activities they may no longer be able or may not be given the opportunity to do. Large disparities also exist between preference and frequency of horticultural and social activities. Although elderly people may be familiar with gardening, activity directors may be inexperienced or unable to conduct appropriate garden

Table 4.

Differences of Activity Preference and  
Frequency Scores

Activity Type	Location <sup>z</sup>			$\bar{x}$
	NH	NS	SC	
Social	9.9	6.3	4.1	6.8
Horticultural	10.9	4.6	5.6	7.0
Other	9.8	3.9	2.7	5.5
$\bar{x}$	10.2	4.9	4.1	

<sup>z</sup>NH = Nursing Home; NS = Nutrition Site; SC = Senior Center.

activities.

As shown in Table 5, based on a point range of 12-36, males indicated a significantly greater preference for doing activities than females, although the frequency with which males did activities was similar to that of females. Looking at people's frequency and preference for doing horticultural, social, and other activities (Table 5), male and female scores were similar. Differences in males' and females' responses to questions about activity may be accounted for partially by the inclusion of activities that have been traditionally gender specific (for example, knitting or woodworking).

#### Fluctuation of Blood Pressure Readings

Forty-seven of the 53 participants released their blood pressure records for analysis. As shown in Table 6, seasonal SBP and DBP means fluctuated widely. Individual SBP readings ranged from 102-180 and the DBP readings ranged from 46-104.

Participants from the three locations did not have significant contrasts ( $p < .05$ ) in seasonal blood pressure readings (Table 6). Senior adults from the nursing home had stable SBP and DBP readings when compared with the rest of the participants. Systolic and diastolic blood pressures of nursing home residents were highly controlled in all four seasons, perhaps through medication

Table 5.

Frequency and Preference Mean Scores<sup>z</sup> by

Activity Type and Gender

Activity Type	Frequency		Preference	
	Male	Female	Male	Female
Social	22.0	21.0	29.9	28.3
Horticultural	20.9	20.4	28.3	27.0
Other	20.2	22.7	27.2	25.0
$\bar{X}$	21.0 <sup>NS</sup>	21.4 <sup>NS</sup>	28.5 <sup>*</sup>	26.8 <sup>*</sup>

<sup>z</sup> Range of scores = 12 - 36.

<sup>NS</sup> Not significant.

<sup>\*</sup>  $p < .05$ .

Table 6.

## Blood Pressure Seasonal and Annual Means by Location

Location	Seasonal Means				Annual Mean
	Spring	Summer	Fall	Winter	
	Systolic BP				
Nursing Home	129.5	129.1	129.8	130.1	129.6 <sup>b<sup>z</sup></sup>
Nutrition Site	126.9	126.7	137.0	129.7	130.2 <sup>b</sup>
Senior Center	142.0	131.1	136.4	129.7	136.3 <sup>a</sup>
$\bar{x}$	132.8	129.0	134.4	131.8	
	Diastolic BP				
Nursing Home	70.1	70.3	68.3	70.5	69.8 <sup>c</sup>
Nutrition Site	81.9	78.7	76.8	80.1	79.4 <sup>a</sup>
Senior Center	77.1	72.2	75.9	77.0	75.5 <sup>b</sup>
$\bar{x}$	76.4	73.7	73.7	75.9	

<sup>z</sup> Means followed by the same letter in any one column and heading do not differ significantly ( $p < .05$ ).

and management of activities and diet. For senior center and nutrition site participants, SBP and DBP readings fluctuated with season. Their lowest readings occurred during the summer gardening season and were generally higher in the winter and spring months. Annual mean systolic and diastolic blood pressures were lowest for nursing home residents and highest with the younger, more independent participants from the senior center. As with seasonal differences, higher annual blood pressures at the two independent sites may be accounted for by fluctuations in these people's diets, activities, and medication as compared with people in the dependent living situation.

#### Models for Intervention

Systolic and diastolic blood pressures of 46 participants aged 60-99 were compared with their frequency of horticultural, social, and other activities, diet, age, and whether or not they exercised regularly or took blood pressure medication. From this comparison, two models were developed.

The first model was produced by stepwise elimination of non-significant variables for systolic blood pressure. Participants' blood pressure medication ( $p=.0096$ ) and frequency of doing social activities ( $p=.1749$ ) were most significant. The model for SBP is shown by the following

equation:

$$SBP = 117.99 + 11.2 \text{ BP medication} - 0.65 \text{ social activity}$$

This model suggests that people with higher systolic blood pressure were much more likely to be taking blood pressure medication. Since anti-hypertensives do indeed lower blood pressure, people with high SBP reported taking blood pressure medication. These responses were clouded by the tendency of nursing home residents to be unable to recall the purpose of their medication. Nursing home residents' medical records did show the medications each was taking, but no conclusions could be drawn from this information. A typical resident's list of medication along with indications follows (AMA 1983):

Dulcolax --stimulates intestinal motility

Lanoxin--a cardiac glycoside for congestive heart failure

--also has a mild diuretic action

Lasix--emergency treatment of hypercalcemia

--rapid diuresis for treatment of hypertension

--treats edema caused by impaired renal function

Tylenol--for relief of pain and fever

Diuretics such as Lasix, which are often prescribed for hypertension, have more than one indication, so

participants' medication listings could not be used to confirm their responses on the questionnaire. In addition, participants were asked to respond simply yes or no, so no gradation of blood pressure medication was determined. Studies that include scores for blood pressure medication that are weighted on the basis of dosage and individuals' physical parameters may show a clearer relationship between systolic blood pressure and use of blood pressure medication.

Also affecting SBP were participants' frequency of doing social activities. People who had higher rates of doing social activities tended to have lower systolic blood pressures. Alternative activities done with the same frequency as social activities may show a similar relationship.

The second model relates diastolic blood pressure to these significant variables: diet ( $p=.0194$ ), frequency of other activity ( $p=.0554$ ), and age ( $p=.0929$ ). This relationship is shown in the following equation:

$$DBP = 95.88 + 1.12 \text{ diet} - 0.68 \text{ Other activity} - 0.29 \text{ age}$$

Participants with higher scores for diet tended to have higher diastolic blood pressures. Without considering other parameters, this suggests that overnutrition in this sample contributed to higher diastolic blood

pressures. High diet scores may represent overweight individuals, but this cannot be confirmed. Unfortunately, information for height and weight from which to calculate above normal weight levels was not available for the majority of participants.

In contrast to diet, older participants tended to have lower diastolic blood pressures. This decrease in DBP with increasing age may again point to more highly controlled blood pressures as people age and move to a nursing home. Diastolic blood pressures were also lower in those people who were more frequently involved in other activities. It is possible that the frequency of other activity, rather than selection of other activities has lowered DBP in this sample.

The researcher had hoped to find frequency of horticultural activity significantly linked with SBP or DBP. Since participants did horticultural activities with the least frequency, it is not surprising that social and other activities were better linked with blood pressure. The fact that two types of activity were separately linked to SBP and DBP suggests that participants' frequency of activity, rather than type of activity, was important in lowering their blood pressures.

## CONCLUSION

Elderly participants were involved most often in activities that were social and clerical. Nursing home residents had the lowest frequency of activity in this sample, but also the highest preference for activity. This finding suggests that older people do not disengage. Because they still are interested in activities of their past, they need to be allowed the opportunity to participate in familiar activities. Horticultural therapists can provide this opportunity by implementing garden programs specifically adapted to the abilities and needs of older people.

The two intervention models show that relationships exist between elderly people's blood pressure and their blood pressure medication, frequency of activity, ages, and diets. The sample number was not large enough to verify these models for systolic and diastolic blood pressure. However, the fact that social and other activities remained highly correlated after stepwise elimination is of value in suggesting future studies of people's participation in activities and its effect on their blood pressure. To further study the effect of horticultural activities, a longitudinal study comparing people's blood pressure records before and after participation in a newly implemented garden program would be of great value.

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# APPENDIX A



Code No. \_\_\_\_\_

## ACTIVITIES PREFERENCE QUESTIONNAIRE

Johanna Fliegél

Check the number of times you did each activity in the last year:

never   
  1-4 times   
  more than 4 times

Check how well you like to do each of the following activities:

Dislike   
  ? or Neutral   
  Like Very Much

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Repot a plant	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Take geranium slips	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Arrange flowers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Write letters to friends	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Tour a historical site	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Plan things to do for the day	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Work with wood	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Bake a new bread recipe	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Enjoy a sunset	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Attend garden club meetings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vote at an election	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Identify a plant	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Repair garden tools	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Read a popular science magazine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Sing or play a musical instrument	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Attend a religious service	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Serve as a club or church officer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Pay bills	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Take a gardening course	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Make a seed order	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Read poetry or fiction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Code No. \_\_\_\_\_

Check the number of times you did each activity in the last year:

never    1-4 times    more than 4 times

Check how well you like to do each of the following activities:

Dislike    ? or Neutral    Like Very Much

_____	_____	_____	Watch sports events with friends	_____	_____	_____
_____	_____	_____	Sell Plants	_____	_____	_____
_____	_____	_____	Groom and maintain a plant	_____	_____	_____
_____	_____	_____	Mend clothing	_____	_____	_____
_____	_____	_____	Learn about trees	_____	_____	_____
_____	_____	_____	Take an art course	_____	_____	_____
_____	_____	_____	Dance	_____	_____	_____
_____	_____	_____	Participate in a discussion group	_____	_____	_____
_____	_____	_____	Organize personal papers	_____	_____	_____
_____	_____	_____	Knit a garment or blanket	_____	_____	_____
_____	_____	_____	Feed and identify birds	_____	_____	_____
_____	_____	_____	Write poetry	_____	_____	_____
_____	_____	_____	Visit with family	_____	_____	_____
_____	_____	_____	Play bingo	_____	_____	_____
_____	_____	_____	Organize a photo album or scrap book	_____	_____	_____

Check how often you had the following foods in the past week:

Never    1-3 times    Once    Two or more  
per week    per day    times per day

_____	_____	_____	_____	Glass of milk
_____	_____	_____	_____	Green leafy salad
_____	_____	_____	_____	Cheese, cottage cheese, or yogurt
_____	_____	_____	_____	A banana
_____	_____	_____	_____	Red meat
_____	_____	_____	_____	Poultry or fish

Code No. \_\_\_\_\_

Please fill out a few items about yourself:

Gender  male Age \_\_\_\_\_ Race:  American Indian  
 female  Asian  
Jobs held prior to retirement:  Black  
\_\_\_\_\_  Hispanic  
\_\_\_\_\_  White  
\_\_\_\_\_  Other \_\_\_\_\_

Do you have any of the following: (Please check any that apply)

heart trouble  high blood pressure  
 emphysema  low blood pressure  
 arthritis  hypertension

Do you do any of the following: (Please check any that apply)

smoke  follow a low sodium diet  
 take blood pressure medication  take calcium supplements  
 take medication for hypertension  exercise regularly  
 take other medication  have trouble sleeping

How long have you lived in your current residence?  
\_\_\_\_\_

-----  
This portion will be detached and kept confidential

Your Name \_\_\_\_\_  
(Please print)

Code Number \_\_\_\_\_

THANK YOU FOR YOUR PARTICIPATION

APPENDIX B

INFORMED CONSENT STATEMENT

You have been asked to participate in a research project. The research will be done under guidelines established by Kansas State University. This research will help us understand whether people can reduce stress through doing activities. It may show that people experience less stress by not doing any activities. In addition, this research will help people learn about improving their health and longevity.

During the study, I will ask you questions about what activities you like to do and a few questions about your medical history. This will take no more than one hour of your time. All this information will be confidential. Your name will not be used in the research paper in any way.

Your participation in this research is voluntary. You will not be at any risk. You are free to decline to participate at any time without consequence.

If you have additional questions about this study, you may contact Johanna Fliegel at 532-5901 or 632-6170, or Dr. Richard Mattson at 532-6170.

If you would like to participate in this research project, Please sign below:

I \_\_\_\_\_ volunteer to participate in a research project to be conducted by Kansas State University.

Signature \_\_\_\_\_ Date \_\_\_\_\_

Please turn in one copy and keep the second copy for your records.

APPENDIX C

MEDICAL RECORDS RELEASE FORM

I \_\_\_\_\_ have read the informed consent statement and agree to release the following medical records: age, height, weight, blood pressure, and medication.

Signature \_\_\_\_\_ Date \_\_\_\_\_

Activity Director

Signature \_\_\_\_\_ Date \_\_\_\_\_

Please turn in one copy and keep the second copy for your records.

## Appendix D

### Horticultural, Social, and Other Activities

#### Horticultural Activities

Repot a plant  
Take geranium slips  
Arrange flowers  
Groom and maintain a plant  
Work with wood  
Enjoy a sunset  
Identify a plant  
Take a gardening course  
Make a seed order  
Feed and Identify birds  
Sell plants  
Learn about trees

#### Social Activities

Write letters to friends  
Tour a historical site  
Attend garden club  
meetings  
Sing or play an instrument  
Attend a religious service  
Serve as a club officer  
Watch sports with friends  
Dance  
Participate in a group  
discussion  
Visit with family  
Play bingo  
Organize a photo album

#### Other Activities

Plan things for the day  
Vote at an election  
Pay bills  
Mend clothing  
Organize personal papers  
Write poetry  
Bake a new bread recipe  
Read a science magazine  
Read poetry or fiction  
Take an art course  
Knit a garment or blanket  
Repair garden tools

## Appendix E

### Treatment of Missing Blood Pressure Data

For seasonal means of systolic blood pressure (SBP) and diastolic blood pressure (DBP), 53 percent of participants had missing data. Since blood pressures fluctuate seasonally, (Scarpelli et al. 1984) SBP and DBP readings of the same month of different years are more similar than those of adjacent months of the same year. This factor was used to substitute monthly readings from up to a year prior to the months of March 1987 to February 1988, or from March to April 1988, the months just after this target year.

This method of substituting monthly readings from the years directly preceding or succeeding the target year was used to fill in 21 seasonal means for 19 participants. Twenty means for 14 participants were left unfilled.

With substitution, each subject had at least two seasonal means from which was calculated an annual mean for SBP and DBP. Seven subjects (14.9%) had two means, six (12.8%) had three means, and 34 (72.0%) had four seasonal means. Without using substitution, 26 participants (55.0%) had a complete set of four means each for SBP and DBP.

Scarpelli, P. T. et al. 1984. Blood Pressure Waves in Malignant Hypertension. In Mechanisms of Blood Pressure Waves, ed. K. Miyakawa, H. P. Koepchen, and C. Polosa, 193-203. Tokyo: Japan Scientific Societies Press.

SOME INFLUENCES OF HORTICULTURAL AND SOCIAL ACTIVITIES  
ON BLOOD PRESSURE OF ELDERLY PEOPLE

by

Johanna Carol Fliegel

B.S., University of Illinois,  
Urbana, 1986

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AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the  
requirements for the degree

MASTER OF SCIENCE

Department of Horticulture

Kansas State University  
Manhattan, Kansas

1988

This study investigated the relationship between systolic and diastolic blood pressure and participation level in horticultural and other activities.

Participants were 53 people aged 45 to 99 from two skilled nursing homes and two senior centers.

Activity levels decreased and preference for activity increased when comparing the senior centers to the nursing homes. Participants most often did activities requiring social and clerical skills, but would also prefer to do activities that are artistic and commercial/political. Involvement in horticultural, social, or other activities was similar, but contrasts between preference and frequency scores were greatest for horticultural activities.

Models were developed that related participants' systolic and diastolic blood pressures to their blood pressure medication, frequency of activity, age, and diet. Participants with higher rates of participation in activities tended to have lower blood pressures. Blood pressures were lower and more controlled in the nursing homes as compared to the senior centers.

Desire for activity continued in all elderly age groups studied. Older people need the opportunity to participate in activities, such as adaptive gardening, which are tailored to their skill levels and preferences. Horticultural activities may lower blood pressures and improve cardiovascular health of elderly people.