# Health Benefits of Gardens in Hospitals

Paper for conference, *Plants for People*

International Exhibition Floriade 2002

## Health Benefits of Gardens in Hospitals

Roger S. Ulrich, Ph.D.

Center for Health Systems and Design

Colleges of Architecture and Medicine

Texas A & M University

College State, TX 77843

**INTRODUCTION**

This paper selectively reviews scientific research on the influences of gardens and plants in hospitals and other healthcare settings. The discussion concentrates mainly on health-related benefits that patients realize by simply *looking* at gardens and plants, or in other ways passively experiencing healthcare surroundings where plants are prominent. The review also briefly addresses other advantages of gardens and plants in hospitals, such as lowering the costs of delivering healthcare and improving staff satisfaction.

It might be asked at the outset: why is worthwhile to focus exclusively on gardens located in hospitals and other healthcare facilities? One important reason is linked to the fact that extraordinary amounts of money are spent internationally for construction of healthcare environments. This funding for hospitals potentially represents a major source of resources for gardens, plants, and related features such as atriums. Consider the example of only one large medical complex in the United States, the Texas Medical Center in Houston, which plans to spend about $1.8 billion on new construction during the next two years. In the State of California alone, new spending for hospital buildings will be upwards of $14 billion by 2010. Even individual buildings can be extremely costly — Northwestern University's recently opened main hospital in Chicago cost $687 million. Spending in the United

States for new hospitals has averaged about $15 billion annually during the last decade. The United Kingdom plans to spend at least $4 billion on new hospital construction within the next three years or so. When substantial additional spending is considered for the many other types of healthcare environments – for example, nursing homes, primary care clinics, rehabilitation facilities — it becomes even clearer that healthcare design and construction directly accounts for vast amounts of money. This reality implies great opportunities for funding and creating new gardens to enrich and improve the lives of patients and the environments of hundreds, if not thousands, of existing medical facilities.

**Background: Gardens and Hospital Design**

The belief that plants and gardens are beneficial for patients in healthcare environments is more than one thousand years old, and appears prominently in Asian and Western cultures (Ulrich and Parsons, 1992). During the Middle Ages in Europe, for example, monasteries created elaborate gardens to bring pleasant, soothing distraction to the ill (Gierlach-Spriggs et al., 1998). European and American hospitals in the 1800s commonly contained gardens and plants as prominent features (Nightingale, 1860).

Gardens became less prevalent in hospitals during the early decades of the 1900s, however, as major advances in medical science caused hospital administrators and architects to concentrate on creating healthcare buildings that would reduce infection risk and serve as functionally efficient settings for new medical technology. The strong emphasis on infection reduction, together with the priority given to functional efficiency, shaped the design of hundreds of major hospitals internationally — that are now considered starkly institutional, unacceptably stressful, and unsuited to the emotional needs of patients, their families, and even healthcare staff (Ulrich, 1991; Horsburgh, 1995). Despite the intense stress often caused by illness, pain, and traumatic hospital experiences, little attention was given to creating environments that would calm patients or otherwise address emotional needs (Ulrich, 2001).

A growing awareness has developed in recent years in the healthcare community of the need to create functionally efficient and hygienic environments that also have pleasant, stress reducing characteristics. An important impetus for this awareness has been the major progress achieved in mind-body medical science. A substantial body of research has now demonstrated that stress and psychosocial factors can significantly affect patient health outcomes. This knowledge strongly implies that the psychological or emotional needs of patients be given high priority along with traditional concerns, including infection risk exposure and functional efficiency, in governing the design of hospitals (Ulrich, 2001). It also follows that conditions or experiences shown by medical researchers to be stress reducing and healthful, such as pleasant soothing distractions and social support, must become important considerations in creating new healthcare facilities. The fact that there is limited but growing scientific evidence that viewing gardens can measurably reduce patient stress and improve health outcomes has been a key factor in the major resurgence in interest internationally in providing gardens in hospitals and other healthcare facilities.

**Importance of Health Outcomes Evidence**

Healthcare administrators everywhere are under strong pressures to control or reduce costs yet increase care quality. Faced with imperative demands such as paying for costly new medical technology, administrators may often consider gardens as desirable but nonessential. Convincing the medical community to assign priority and resources usually requires providing credible evidence that gardens or plants produce benefits yet are cost-effective compared to alternatives, including not providing gardens/plants.

It should be emphasized here that most healthcare administrators and especially physicians consider evidence from *health outcomes* research to provide the most sound and persuasive basis for assessing whether a particular medical treatment or service (here providing a garden or plants) is medically beneficial and financially sensible. (Ulrich, 1999, 2002).

Health outcomes are numerous and varied, but most refer to measures of a patient's medical condition or to indicators of healthcare quality. These measures include (1) observable clinical signs or medical measures, (2) subjective measures such as reported satisfaction, and (2) economic measures (Ulrich, 2002).

• Clinical indicators that are observable signs and symptoms relating to patients' conditions. (Examples: length of stay, blood pressure, intake of pain drugs)

• Patient/staff reported outcomes. (Examples: patient reports of satisfaction with healthcare services, staff reported satisfaction with working conditions)

• Economic outcomes. (Examples: cost of patient care, recruitment or hiring costs due to staff turnover)

Clinical and economic outcomes data traditionally have carried the greatest weight in decisions, but in recent years evidence regarding effects of treatments or services on patient *satisfaction* has gained much importance as healthcare providers in the United States and Europe have faced mounting pressures to become more patient or consumer oriented.

**STRESS REDUCING EFFECTS OF VIEWING PLANTS AND NATURE**

Several studies of nonpatient groups (such as university students) as well as patients have consistently shown that simply looking at environments dominated by greenery, flowers, or water — as compared to built scenes lacking nature (rooms, buildings, towns) — is significantly more effective in promoting recovery or restoration from stress. (See Ulrich, 1999, for a survey of studies.) A limited amount of research suggests that viewing settings with plants or other nature for a few minutes can promote measurable restoration even in hospital patients who are acutely stressed.

There is considerable evidence that restorative effects of nature scenes are manifested within only three to five minutes as a combination of psychological/emotional and physiological changes. Concerning the first, psychological/emotional, many views of vegetation or garden-like features elevate levels of positive feelings (pleasantness, calm), and reduce negatively toned emotions such as fear, anger, and sadness. Certain nature scenes effectively sustain interest and attention, and accordingly can serve as pleasant distractions that may diminish stressful thoughts. Regarding physiological manifestations of stress recovery, laboratory and clinical investigations have found that viewing nature settings can produce significant restoration within less than five

minutes as indicated by positive changes, for instance, in blood pressure, heart activity, muscle tension, and brain electrical activity (Ulrich, 1981; Ulrich et al., 1991).

One controlled experiment, for example, measured a battery of physiological responses in 120 stressed persons (non-patients) who were randomly assigned to a recovery period consisting of one of six different videotapes of either nature settings (vegetation or vegetation with water) or built settings lacking nature (Ulrich et al., 1991). Findings from four continuously recorded physiological measures (blood pressure, heart rate, skin conductance, muscle tension) were consistent in indicating that recuperation from stress was faster and much more complete when individuals were exposed to the nature settings rather than any of the built environments. The quickness of nature-induced restoration was manifested as significant changes in all physiological measures within about three minutes. The pattern of physiological data further supported the interpretation that nature, compared to the built settings, more effectively lowered activity in the sympathetic nervous system. (Heightened sympathetic nervous system activity involves energy consuming mobilization or arousal and is central in stress responding.) Moreover, data from self-reports of feelings indicated that the nature environments likewise produced substantially more recuperation in the psychological component of stress. Persons exposed to the settings with plants and other nature, in contrast to the built environments, had lower levels of fear and anger, and reported far higher levels of positive feelings (Ulrich et al., 1991).

Hartig (1991) also used both physiological and psychological measures to study restoration in non-patient subjects who were stressed because they either had driven an automobile through urban traffic or completed a series of difficult tests. His findings were broadly similar to those described above — more specifically, blood pressure data and emotional self-reports converged to indicate that recovery was appreciably greater if persons looked at a nature setting dominated by vegetation rather than a built environment without nature (Hartig, 1991).

Nakamura and Fujii have carried out two studies in Japan (1990, 1992) that measured brain wave activity as unstressed persons (non-patients) looked either at plants or human-made objects. In an intriguing first experiment, the researchers analyzed alpha rhythm activity as subjects viewed: two types of potted plants, each with and without flowers (*Pelargonium* and *Begonia*); the same pots without plants; or a cylinder similar to the pots (Nakamura and Fujii, 1990). Results suggested that persons were most wakefully relaxed when they observed plants with flowers, and least relaxed when they looked at pots without plants. In the second study they recorded the electroencephalogram (EEG) while persons were seated in a real outdoor setting and viewed a hedge of greenery, a concrete fence with dimensions similar to the hedge, or a mixed condition consisting of part greenery and part concrete (Nakamura and Fujii, 1992). The EEG data supported the conclusion that the greenery elicited relaxation whereas the concrete had stressful influences.

**Benefits of Nature and Gardens in Healthcare Settings**

The research examples described above, all based on non-patient groups, indicate that visual exposure to plants and other nature lasting only a few minutes can foster considerable restoration or recovery from stress.

It is important to emphasize that broadly parallel findings have been obtained when stressed patients in healthcare settings have been visually exposed to nature. A study by Heerwagen and Orians, for instance, found that anxious patients in a dental fears clinic were less stressed on days when a large nature mural was hung on a wall of the waiting room in contrast to days when the wall was blank (Heerwagen, 1990). The restorative benefits of the nature scene were evident both in heart rate data and self reports of emotional states.

In the case of hospitals and other healthcare facilities, there is mounting evidence that gardens function are especially effective and beneficial settings with respect to fostering restoration for stressed patients, family members, and staff (Ulrich, 1999). Cooper-Marcus and Barnes (1995) used a combination of behavioral observation and interview methods to evaluate four hospital gardens in California. They found that restoration from stress, including improved mood, was by far the most important category of benefits derived by nearly all users of the gardens — patients, family, and employees. Likewise, a recent study of a garden in a children's hospital identified mood improvement and restoration from stress as primary benefits for users (Whitehouse et al., 2001). This conclusion was supported by convergent results from behavioral observations, interviews, and surveys. The fact that stress is a pervasive, well documented, and very important health-related problem in hospitals implies major significance for the finding that restoration is the key benefit motivating persons to use gardens in healthcare facilities (Ulrich, 1999).

Well-designed hospital gardens not only provide calming and pleasant nature views, but can also reduce stress and improve clinical outcomes through other mechanisms, for instance, fostering access to social support and privacy, and providing opportunities for escape from stressful clinical settings (Ulrich, 1999; Cooper-Marcus and Barnes, 1995). Concerning the last of these, escape, Cooper-Marcus and Barnes
(1995) concluded that many healthcare employees used gardens as an effective means for achieving a restorative pleasant escape from work stress and aversive conditions in the hospital. They also included in their report statements by several patients which suggested that the gardens fostered restoration in part by providing positive escape (and sense of control) with respect to stress. For example, a patient interviewed in a hospital garden commented: "It's a good escape from what they put me through. I come out here between appointments. . I feel much calmer, less stressed" (Cooper-Marcus and Barnes,
1995, p. 27).

In addition to ameliorating stress and improving mood, gardens and nature in hospitals can significantly heighten *satisfaction* with the healthcare provider and the overall quality of care. Evidence from studies of a number of different hospitals and diverse categories of patients (adults, children, and elderly patients; ambulatory or outpatient settings, inpatient acute care wards) strongly suggests that the presence of nature — indoor and outdoor gardens, plants, window views of nature — increases both patient and family satisfaction (Cooper-Marcus and Barnes, 1995; Whitehouse et al., 2001; Picker Institute and Center for Health Design, 1999). The capacity for gardens and plants to heighten satisfaction, as well as reduce stress, is attracting considerable attention from hospital administrators who, as noted earlier, are facing strong pressures to become more patient/consumer oriented and improve the consumer's healthcare experience. A nationally prominent hospital

administrator in the United States recently evaluated the role of gardens in the highly competitive marketplace of managed care, and endorsed their effectiveness for increasing care quality and patient/consumer satisfaction (Sadler, 2001). Further, the administrator advocated creating gardens as an effective means for helping hospitals and providers to achieve more positive market identities and thereby improve economic or financial outcomes (Sadler, 2001).

**Benefits of Healthcare Gardens for Staff**

Healthcare staffing problems are a critical issue in most European countries and North America. It has been known for decades that healthcare occupations such as nursing are stressful because they often involve overload from work demands, lack of control or authority over decisions, and stress from rotating shifts (Ulrich, 1991). Workloads and pressures have mounted further, however, as healthcare providers everywhere have been forced to control or cut costs (Ulrich, 2002). These conditions have in many locations lowered lower job satisfaction, increased absenteeism and turnover, contributed to shortages of qualified personnel, increased providers' operating costs, and eroded the quality of care that patients receive (Ulrich, 2002).

These serious staff related problems imply major importance for the aforementioned finding that healthcare staff heavily use gardens for positive escape from workplace pressures and to recuperate from stress. Additionally, it should be emphasized that evidence has begun to appear showing that hospital gardens increase staff satisfaction with the workplace, and may help hospital administrators in hiring and retaining qualified personnel (Whitehouse et al., 2001; Sadler, 2001; Cooper-Marcus and Barnes, 1995, 1999).

**Effects of Nature on Clinical Outcomes**

Findings from a few studies focusing on hospitals and other healthcare facilities suggest that views of nature can have important benefits in terms of improving patient clinical outcomes. At Uppsala University Hospital in Sweden, Outi Lundén, John Eltinge, and I (1993) investigated whether exposing heart surgery patients to simulated nature views would improve recovery outcomes. We assigned each 160 patients in intensive care to one of six visual stimulation conditions: two nature pictures (either a view of trees and water, or an enclosed forest scene); two abstract pictures; and two control conditions (either a white panel, or no picture or panel). Results suggested that patients who viewed the trees/water scene were significantly less anxious during the postoperative period than patients assigned to the other pictures and control conditions. Moreover, patients exposed to the trees/water view suffered less severe pain, as evidenced by the fact they shifted faster than other groups from strong narcotic pain drugs to moderate strength analgesics. By contrast, a rather surprising finding was that an abstract picture dominated by rectilinear forms produced higher patient anxiety than control conditions of no picture at all.

Another medical outcomes study compared the recovery records of gall bladder surgery patients who had a bedside window view of either trees or a brick building wall with no nature (Ulrich, 1984). To keep other factors constant that could affect outcomes, the methods ensured that the tree and wall view groups were equivalent, for example, in age, weight, tobacco use, and general medical history. The outcomes data showed that those with the nature view, compared to those who looked out at the wall, had shorter hospital stays and suffered

fewer minor post-surgical complications (such as persistent headache or nausea) (Ulrich, 1984). Further, patients with the view of trees more frequently received positive written comments from staff about their conditions in their medical records ("patient is in good spirits"). Those in the wall view group, however, had far more negative evaluative comments ("patient is upset," "needs much encouragement"). Another major difference was that persons with the view of trees, compared to the wall view patients, needed far fewer doses of strong narcotic pain drugs.

The above findings not only indicated that views of nature in hospitals could enhance clinical or medical outcomes; as well, the results suggested that nature could improve economic outcomes by reducing the costs of care. The findings clearly implied that by providing nature it would be possible to achieve cost savings, for instance, because length of hospital stays might be shortened, and some patients would have reduced need for costly injections of strong pain drugs.

**QUALITIES OF EFFECTIVE RESTORATIVE GARDENS**

Few studies have examined rigorously how different design approaches and specific environmental characteristics affect hospital garden performance with respect to fostering restoration from stress or improving medical outcomes. No well controlled experiment has investigated, for instance, whether designing flowers beds with curvilinear in contrast to rectilinear forms or edges influences a garden's effectiveness in producing stress recovery. Nonetheless, the studies described in earlier sections have yielded a few broad conclusions and general guidelines regarding design directions for creating successful healthcare gardens.

The limited evidence to date suggests that gardens will likely calm or ameliorate stress effectively if they contain verdant foliage, flowers, water (not tumultuous), congruent or harmonious nature sounds (birds, breezes, water), and visible wildlife (birds) (Ulrich, 1999, pp. 74-75). Additionally, nature settings with savanna-like or park-like qualities (grassy spaces with scattered trees) are known to foster restoration. In their study of users of four hospital gardens, Cooper-Marcus and Barnes (1995, p. 55) found that the most frequently mentioned positive garden qualities were visual nature elements, especially trees, greenery, flowers, and water. Respondents strongly associated these nature features with restorative influences on their moods.

By contrast, a characteristic that usually worsens garden effectiveness in reducing stress is predominance of hardscape (concrete, for example) or other starkly built content (Ulrich, 1999). Whitehouse and her associates (2001) found that users of a children's hospital garden disliked and avoided areas having a high percentage of concrete ground surface and/or starkly built features. Persons interviewed in this study consistently recommended that the garden should have "more greenery and flowers" and less concrete (Whitehouse et al., 2001). Based on this evidence the administration of the hospital directed that the garden be reconstructed to include many more plants and less hardscape, in order to become more effective in promoting restoration.

In addition to predominance of hardscape rather than vegetation, other garden qualities that can hamper recovery or even aggravate stress include: cigarette smoke; intrusive, incongruent urban or machine sounds (traffic, for example); crowding; perceived insecurity or risk; prominent litter; and abstract, ambiguous sculpture or other built features that can be interpreted in multiple ways (Ulrich, 1999). Regarding abstraction and

ambiguity, there is mounting evidence that designers of hospital gardens should exercise considerable caution before including abstract art works or ambiguous design features. It appears that acutely stressed patients may be vulnerable to having stressful rather than positive reactions to ambiguous art or design (Ulrich, 1991). Current evidence suggests that the safest, most consistently effective general strategy for designers of hospital gardens is simply to feature the restorative, unambiguously positive qualities of greenery, flowers, and most other nature content (Ulrich, 1999).

A documented example of adverse patient reactions to ambiguous features occurred when a major university hospital installed a large-scale series of sculptures and other artworks to form a "bird garden" in a rooftop space overlooked on all sides by rooms for cancer patients (Ulrich, 1999). Although called a "garden," the space actually contained no greenery, flowers, or other nature. Soon after this sculpture garden was installed, administrators and physicians began to receive many anecdotal reports of strong negative reactions by patients. Accordingly, a questionnaire study was conducted of patient reactions to the artwork (Hefferman et al., 1995). The study showed that more than 20% of the cancer patients reported having a negative emotional or psychological reaction to the "garden." Several patients had strongly negative responses, interpreting some rectilinear metal bird sculptures, for instance, as frightening predatory animals (Ulrich, 1999).

The administration and medical staff decided that the rate and intensity of negative effects on patient outcomes was too high, so the art installation was removed for medical reasons (Ulrich, 1999).

**SUMMARY**

Findings from several studies have converged in indicating that simply viewing certain types of nature and garden scenes significantly ameliorates stress within only five minutes or less. Further, a limited amount of research has found that viewing nature for longer periods not only helps to calm patients, but can also foster improvement in clinical outcomes — such as reducing pain medication intake and shortening hospital stays. Well-designed hospital gardens not only provide restorative and pleasant nature views, but also can reduce stress and improve clinical outcomes through other mechanisms such as increasing access to social support, and providing opportunities for positive escape from stressful clinical settings. As well, evidence from studies of a number of hospitals strongly suggests that gardens and other nature helps to heighten patient and family *satisfaction* with the healthcare provider and the overall quality of care. Research has begun to appear suggesting that hospital gardens also increase staff satisfaction with the workplace, and can be advantageous in hiring and retaining qualified personnel. The potential for hospital gardens to improve medical outcomes, satisfaction, and economic outcomes is notably increasing the attention and priority accorded to gardens, as administrators and providers everywhere face strong pressures to increase quality, become more consumer/patient oriented, control costs, and in some locations establish a positive market identify in the face of strong competition from other providers.

**REFERENCES**

Cooper-Marcus, C. and M. Barnes (1995). *Gardens in Healthcare Facilities: Uses, Therapeutic Benefits, and Design Recommendations.* Martinez, CA: The Center forHealth Design.

Cooper-Marcus, C. and M. Barnes (1999). *Healing Gardens: Therapeutic Benefits and Design Recommendations.* New York: John Wiley.

Gierlach-Spriggs, N. Kaufman, R. E., and S. B. Warner, Jr. (1998). *Restorative Garden: The Healing Landscape.* New Haven: Yale University Press.

Hefferman, M. L., Morstatt, M., Saltzman, K., and L. Strunc (1995). A Room with a View Art Survey: The Bird Garden at Duke University Hospital. Unpublished research report, Cultural Services Program and Management Fellows Program, Duke University Medical Center, Durham, NC.

Hartig, T. (1991). *Testing restorative environments theory.* Unpublished doctoral dissertation, Program in Social Ecology, University of California, Irvine.

Heerwagen, J. (1990). The psychological aspects of windows and window design. In K. H. Anthony, J. Choi, and B. Orland (Eds.), *Proceedings of 21st annual conference of the Environmental Design Research Association*. Oklahoma City: EDRA, 269-280.

Horsburgh, C. R. (1995). Healing by design. *New England Journal of Medicine,* 333: 735-740.

Nakamura, R. and E. Fujii (1990). Studies of the characteristics of the electroencephalogram when observing potted plants: *Pelargonium hortorum* "Sprinter Red" and *Begonia evansiana*. *Technical Bulletin of the Faculty of Horticulture of Chiba University,* 43: 177-183. (In Japanese with English summary)

Nakamura, R. and E. Fujii (1992). A comparative study of the characteristics of the electroencephalogram when observing a hedge and a concrete block fence. *Journal of the Japanese Institute of Landscape Architects,* 55: 139-144. (In Japanese with English summary.)

Nightingale, F. (1860) (1996). *Notes on Nursing (Revised with Additions).* London: Ballière Tindall.

Picker Institute and Center for Health Design (1999). *Assessing the Built Environment from the Patient and Family Perspective: Health Care Design Action Kit.* WalnutCreek, CA: The Center for Health Design (www.healthdesign.org)

Sadler, B. (2001). Design to Compete in Managed Healthcare. *Facilities Design & Management* (March).

Ulrich, R. S. (1981). Natural versus urban scenes: Some psychophysiological effects. *Environment and Behavior,* 13: 523-556.

Ulrich, R. S. (1984). View through a window may influence recovery from surgery. *Science*, 224: 42-421.

Ulrich, R. S. (1991). Effects of health facility interior design on wellness: Theory and recent scientific research. *Journal of Health Care Design*, 3: 97-109.

[Reprinted in: Marberry, S.O. (Ed.) 1995. *Innovations in Healthcare Design.* New York: Van Nostrand Reinhold, pp. 88-104.]

Ulrich, R. S. (1999). Effects of gardens on health outcomes: Theory and research. In C. Cooper-Marcus & M. Barnes (Eds.), *Healing Gardens: Therapeutic Benefits and Design Recommendations.* New York: John Wiley, pp. 27-86.

Ulrich, R. S. (2001). Effects of healthcare environmental design on medical outcomes. In A Dilani (Ed.) *Design and Health: Proceedings of the Second International Conference on Health and Design.* Stockholm, Sweden: Svensk Byggtjanst, 49-59.

Ulrich, R. S. (2002). Communicating with the healthcare community about plant benefits.

In C. Shoemaker (Ed.) *Proceedings of the Sixth International People Plant Symposium.* Chicago: Chicago Botanic Garden.

Ulrich, R. S., Lundén, O., and J. L. Eltinge (1993). "Effects of exposure to nature and abstract pictures on patients recovering from heart surgery." Paper presented at the Thirty-Third Meeting of the Society for Psychophysiological Research, Rottach-Egern, Germany. Abstract in *Psychophysiology,* 30 (Supplement 1, 1993): 7.

Ulrich, R. S. and R. Parsons (1992). Influences of passive experiences with plants on individual well-being and health. In D. Relf (Ed.), *The role of horticulture in human well-being and social development.* Portland, OR: Timber Press, pp. 93-105.

Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology*, 11: 201-230.

Whitehouse, S., Varni, J. W., Seid, M., Cooper-Marcus, C., Ensberg, M. J., Jacobs, J. J. and R. S. Mehlenbeck (2001). Evaluating a children's hospital garden environment: Utilization and consumer satisfaction. *Journal of Environmental Psychology,* 21: 301-314.

12-May-11 12:00 PM