Available online at www.sciencedirect.com
ScienceDirect
Preventive Medicine 47 (2008) 279–283
Preventive Medicine
www.elsevier.com/locate/ypmed

Stress-reducing effects of indoor plants in the built healthcare environment: The mediating role of perceived attractiveness

K. Dijkstra [a,*], M.E. Pieterse [b], A. Pruyn [a]

[a] Faculty of Behavioural Sciences, Department of Marketing Communication and Consumer Psychology, University of Twente, The Netherlands
[b] Faculty of Behavioural Sciences, Department of Psychology & Communication of Health & Risk, University of Twente, The Netherlands

Available online 26 January 2008

Abstract

Objective. Natural elements in the built healthcare environment have shown to hold potential stress-reducing properties. In order to shed light on the underlying mechanism of stress-reducing effects of nature, the present study investigates whether the stress-reducing effects of indoor plants occur because such an environment is perceived as being more attractive.

Method. A single-factor between-subjects experimental design (nature: indoor plants vs. no plants) was used in which participants ($n=77$) were presented with a scenario describing hospitalization with a possible legionella diagnosis. The study was conducted from March to May 2007 in the Netherlands. Subsequently, they were exposed to a photo of a hospital room. In this room were either indoor plants, or there was a painting of an urban environment on the wall. Afterwards, perceived stress and the perceived attractiveness of the hospital room were measured.

Results. Participants exposed to the hospital room with indoor plants reported less stress than those in the control condition. Mediation analysis confirmed that indoor plants in a hospital room reduce feelings of stress through the perceived attractiveness of the room.

Conclusion. This study confirms the stress-reducing properties of natural elements in the built healthcare environment. It also sheds light on the underlying mechanism causing this stress-reduction.

Keywords: Healing environments; Evidence-based design; Facility design and construction; Interior design and furnishings; Stress; Indoor plants; Affect; Experimental design

Introduction

Traditionally, healthcare facilities were built with the emphasis on the functional delivery of health care (Ulrich, 1995). However, since research supports the idea of the built healthcare environment having an impact the health and well-being of patients, more attention is being paid to the psychological consequences of architectural choices (Ulrich et al., 2004; Dijkstra et al., 2006). Such 'psychologically supportive' healthcare environments are also referred to as *healing environments*. This concept suggests that the physical environment of healthcare settings 'can make a difference in how quickly the patient recovers or adapts to specific acute and chronic conditions' (Stichler, 2001, p2).

Three dimensions of the physical healthcare environment that can have effects on health and well-being have been distinguished (Harris et al., 2002): architectural features (e.g., spatial layout, room size), ambient features (e.g., lighting, odors), and interior design features (e.g., color, artwork, indoor plants). Interior design variables provide relatively easy and inexpensive opportunities to alter the atmosphere of healthcare environments. This applies especially to facilities that have already been built, but may also be scheduled for renovation. The review from Dijkstra et al. (2006) concluded that effects of interior design variables appear to be highly inconsistent. The knowledge of specific environmental stimuli and their effects on health and well-being may facilitate atmospheric changes in an environment. In addition, understanding the underlying processes causing these effects may help us to design healing environments more

* Corresponding author. University of Twente, Faculty of Behavioural Sciences, Department of Marketing Communication and Consumer Psychology, P.O. Box 217, 7500 AE Enschede, The Netherlands. Fax: +31 53 489 4259.
E-mail address: k.dijkstra@gw.utwente.nl (K. Dijkstra).

0091-7435/$ - see front matter © 2008 Elsevier Inc. All rights reserved.
doi:10.1016/j.ypmed.2008.01.013

efficiently. A clearer understanding of the exact mechanisms involved is necessary before we can implement such designs on a larger scale.

Being hospitalized is generally associated with feelings of fear, uncertainty, and anxiety (Mason et al., 1965; Pride, 1968). These feelings of stress and anxiety may affect the healing process. Research shows for example, that such psychological stress impairs wound healing in patients (Kiecolt-Glaser et al., 1995; Broadbent et al., 2003). With regard to the idea of healing environments, aspects of the built healthcare environment that can reduce this stress may therefore have beneficial effects on health-related outcomes.

Natural elements

Research on restorative environments suggests that certain environments are capable of promoting recovery from stress, and shows that especially natural settings have these restorative effects (Hartig et al., 1996). Considering the potential healing properties of nature (Ulrich 1984; Lohr and Pearson-Mims, 2000), exposing patients to natural elements may be an effective way of reducing stress associated with hospitalization. However, most healthcare facilities have been built in urban environments and thus lack natural resources that patients can be exposed to. Bringing nature into the hospital might be a good alternative to reduce stress in patients and in turn aid their recovery.

Ulrich et al. (1991) studied the effects of exposure to nature on stress recovery. Participants watched a videotape that induced feelings of stress, and were afterwards exposed to a tape with either a natural or an urban environment. Results demonstrated that individuals recover sooner from stress when exposed to the former (natural) than the latter (urban). A trial by Diette et al. (2003) studied the effects of natural murals and sounds on patients undergoing flexible bronchoscopy. It was found that pain control was better for patients exposed to nature. Lohr and Pearson-Mims (2000) studied whether the presence of indoor plants would increase pain tolerance. Participants were either placed in a room with plants, a room with non-plant objects (as visually distractive as the plants), or a control room (no objects). Results showed that a significantly larger proportion of respondents in the room with plants were able to keep their hand in the ice water for 5 minutes as compared to the other conditions, suggesting increased pain tolerance by exposure to indoor plants. They also showed that the room with plants was rated more positively (e.g., cheerful, calming, pleasant) than either of the control rooms. The results of these studies support the idea that indoor plants may have beneficial effects on the health and well-being of people.

Natural elements in the built environment have clearly shown stress-reducing properties, but it is still unclear which underlying mechanism causes this stress-reduction. A potential explanation lies in the theories by Kaplan (1987) and Ulrich (1983), which state that people have a tendency to prefer natural settings to built environments. Although these two theories have some important differences (see Hartig et al. (1996) for a discussion), both are based on the same evolutionary assumptions. The preferences for natural settings are assumed to have an evolutionary base; people are to some extent biologically adapted to natural as opposed to built environments. Secondly, it might be argued that nature may be processed more easily and efficiently because the brain and sensory systems evolved in natural environments (Wohlwill, 1983). As a result, humans have an innate tendency to pay attention and respond positively to natural elements (Ulrich et al., 1991). This predisposition to prefer natural elements to man-made objects may be the explanation of the stress-reducing effects of nature. It might thus be hypothesized that natural elements affect feelings of stress through the perceived attractiveness of an environment.

The purpose of this experiment was thus to investigate whether the stress-reducing effects of indoor plants occur because an environment with indoor plants is perceived as being more attractive. The following hypotheses will be tested:

H1: The presence of indoor plants in a hospital room leads to reduced feelings of stress in patients.
H2: The perceived attractiveness of the hospital room mediates this relation between plants and stress.

Methods

Design and procedure

The experiment employed a single-factor between-subjects design (indoor plants vs. no plants) with participants being exposed to a scenario and a photo of a hospital room. This procedure has been shown to accurately simulate real environments

Fig. 1. The photos of the hospital room (plants vs. no plants) used in the experiment conducted from March to May 2007 in the Netherlands.