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Exhibit 10

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As noise rises, so do the dangers

The constant clatter in hospitals stresses both patients and staff.

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Special to The Times

November 28, 2005

Even Florence Nightingale thought that all the noise in hospitals was harmful.

"Unnecessary noise is the most cruel abuse of care which can be inflicted on either the sick or the well," she wrote in her 1859 book, "Notes on Nursing."

Victorian hospitals are now museums, but a new study has found that Nightingale's observation is even more accurate for the high-tech hospitals of today. As the decibel levels in hospitals have steadily increased during the last five decades, so has the suffering of patients and staff.

Researchers from Johns Hopkins University took a look at the problem of noise in hospitals and found that the contemporary version of the "cruel abuse of care" translates into stressed workers, raises the risk of medical errors because instructions aren't properly heard, and can even interfere with healing and recovery.

Add to these problems the results of two other recent studies that link excessive noise to a higher risk of heart attacks and high blood pressure, and our cacophonous environment begins to look like a serious public health problem.

The study began when a vice president at the Johns Hopkins Hospital in Baltimore asked Eileen Busch-Vishniac and James West — not medical doctors but acoustics experts — to evaluate the noise levels in the pediatric intensive care unit and make recommendations to address the problem.

Their investigation then broadened to look at the levels throughout the hospital. The team made 24-hour sound measurements of every area, including operating rooms and patient waiting rooms, and developed a "sound picture" of the environment.

The picture was almost deafening. The Johns Hopkins researchers first performed an analysis of all the previous research on the subject and found that in 1995 the World Health Organization had issued noise guidelines for hospitals that put the preferable noise levels in patients' rooms at 35 decibels. They learned that few, if any, hospitals achieve that level of peace.

Johns Hopkins was consistent with the average noise levels in hospitals everywhere, which have risen dramatically since 1960, from 57 decibels to 72; evening levels have similarly soared from 42 decibels to 60.

Busch-Vishniac, a professor of mechanical engineering at Hopkins, points out that the problem is epidemic. "Whether you are in Islamabad, Athens, Nairobi or all over the U.S., we found the measurements were the same everywhere," she says.

But where was all this clamor coming from?

The researchers began at the pediatric ICU. Each bed was surrounded by beeping instruments with intrusive pumps or blasts of warning signals. Overhead, the sound of doctors and nurses being paged added to the ambient noise, not

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to mention the ongoing conversation among doctors, nurses, patients, families, orderlies and other staff members — each trying to speak just a little bit louder to be heard.

Busch-Vishniac describes the phenomenon as the "cocktail party effect," in which everyone incrementally speaks more loudly to be heard as the noise level around them increases.

Her colleague West, professor of electrical and computer engineering, says that this process of gradually talking louder is exhausting for speaker and listener alike. "Having to talk louder and having to be more attentive just to listen to others is considered one of the reasons that hospital staff suffers from fatigue," he says.

Blood pressure rises

Patients simply longing for a decent night of sleep suffer as well. Even though fewer people populate the hospital's halls at night, the combination of the powerful hospital ventilation system and alarm-laden electronic devices throughout still makes a hospital bear more resemblance to a 24-hour shopping mall than a quiet place where people can heal.

The serious and specific health risks of noise were examined in two other studies published this month. A University of Michigan study in the Archives of Environmental Health suggests that working in loud places can increase blood pressure levels. And another study of more than 4,000 cardiac patients, published in the European Heart Journal — Europe's leading cardiac journal — linked exposure to chronic noise with an increased risk of heart attacks.

In the blood pressure study, Michigan researchers studied workers in a Midwest auto assembly plant and looked at different types of noise in the factory setting. Continuous or "usual" noise was recorded at between 42 and 103 decibels. Elevated noise ranged between 46 and 124 decibels, and spikes in instantaneous loud noises went from 113 to 145 decibels.

The researchers gave factory workers mobile monitors that took blood pressure readings every 10 minutes and recorded noise levels every minute throughout the day.

Each time the average noise exposure increased by 10 decibels, systolic blood pressure crept up an average of 2 millimeters of mercury — which is how blood pressure is measured. When the noise increased by 13 decibels, diastolic blood pressure also rose by an average of 2 millimeters.

The European study involved all 32 hospitals in Berlin between 1998 and 2001 and was designed to look at the association between the annoyance that chronic noise triggers in people and its effect on heart attacks in men and women.

When the body experiences annoyance, a whole set of physiological changes occur, such as increased levels of adrenaline and noradrenaline, which are associated with increased blood pressure and inflammatory responses that are implicated in heart disease and heart attacks. If noise triggers those responses, then it could be considered a real risk factor for cardiac problems.

The team found that the general noise in the environment, like traffic or airplanes, affected both genders and increased the overall risk of a heart attack by nearly 50% for men and 75% for women.

Then there was workplace din, which was a problem for men, increasing their risk by nearly a third, but which did not seem to affect women.

Quieter halls

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The Johns Hopkins researchers came up with two sophisticated solutions to the hospital problem. They found that the hospital did not have acoustical ceiling tiles, which can harbor infectious organisms, becoming in effect acoustical petri dishes. But the researchers came up with a substitute: By wrapping fiberglass insulation inside an antibacterial fabric, they created sound absorbers, which they then attached to the ceiling and walls of an oncology unit, muffling some of the sounds that used to bounce freely in the area.

To lessen the blasts from the pages announced over loudspeakers, the pediatric ICU staff was given small, hands-free personal communicators. The system cut the frequency of overheard pages from one every minute or so to about one an hour.

The simplest solution, however, may be decidedly low-tech — one that even Florence Nightingale could have prescribed.

If you go to the hospital, says Busch-Vishniac, "I would strongly recommend wearing earplugs."