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A Holistic Approach

Staff at all levels must expand their ability to work together to produce the kinds of results that will ensure their success and will carry out the mission of their healthcare system.

BY MICHAEL D. TOPF, M.A.

There is an ongoing concern within the healthcare field about the number of errors, accidents and incidents that occur in the delivery of all aspects of healthcare services. This includes medical, surgical, nursing, pharmaceutical, laboratory and testing errors as well as patient care errors that result in accidents, injuries and incidents for patients and healthcare personnel. This concern extends to the levels of awareness and attitudes and behaviors that can lead to these types of incidents. The nature of the extremely responsible and demanding positions in this field calls for individuals who are highly trained, capable and aware. Each person must be able to think and respond quickly to all situations and circumstances effectively, make proper decisions, function well under pressure and work effectively in a team.

Regardless of their position or level of experience, everyone working in the healthcare field must work optimally, with the least chance for error.

Because of the strategic role of

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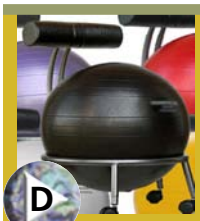

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New Beginnings

Spring is here and for many, especially those living on the East Coast, it could not have come soon enough. With spring comes a sense of renewal and new beginnings. Let's hope this year's new beginnings include some economic recovery.

Mark Shirley
CSP, REA

I suspect all of us have experienced a reduction of resources, including staffing cuts for many. As everyone is forced to do more with less, it will be interesting to see whether injury, accident and illness rates increase along with our workload. As we look for possible changes in rates, we should also be on the lookout for staff experiencing emotional distress from work and personal issues. This is especially important in organizations experiencing layoffs. In these organizations, it is a good idea to think about improving security, training managers and supervisors to be more aware of the signs and symptoms of aggressive behavior, and ensuring that counseling for those employees experiencing survivor's guilt is available. Additionally, an increased emphasis on wellness programs should help minimize any increase in injury and illness rates.

The Healthcare Practice Specialty (HPS) has been busy. In March, we partnered with the Institute of Industrial Engineers to bring you several webinar sessions from the Allied Ergonomics Conference in Reno, NV. I hope you were able to take advantage of this opportunity. We continue to pursue similar opportunities with other professional organizations dedicated to healthcare safety. Stay tuned!

ASSE's new year is just around the corner and we have an important HPS officer opening. Our longtime *HealthBeat* editor, Mary Vorndran, is stepping down. She has done a tremendous job for many years. Please let me know if you are interested in this position or if you would like to submit an article to *HealthBeat*.

Finally, it is not too late to register for Safety 2009 in San Antonio, TX. This year's conference will feature several exciting sessions related to healthcare, including a technical tour of Baptist Health Hospital, a healthcare issues roundtable and an HPS networking meeting. I hope to see you there! ✪

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By **Joyce A. Overman Dube,** M.S., RN, et al.

Environmental Noise Sources: A Tale of Two Hospitals

Noise has been shown to interfere with the healing process and can disrupt the patient's experience. This study assesses patients' and staff's perceptions of noise levels and sources in the hospital environment and identifies interventions to reduce the noise level. The interventions significantly reduced noise as perceived by patients and staff. Identification of a structured process to identify noise sources and standardization of noise measurement methods can improve the patient hospital experience.

Periodic assessment of hospital noise levels can help identify new noises and reinforce interventions that have been put in place to maintain a quiet environment.

The process of delivering patient care in a hospital often generates noise. Examples include discussions of patient care or treatment requirements among healthcare team members, carts delivering food or supplies, equipment alarms on pumps and monitors, industrial floor cleaners and even footsteps from persons wearing hard-soled footwear.

Although certain sources and levels of noise are necessary, the hospital setting has many noise-related activities that disrupt patients' experience and interfere with the healing process (Wysocki, 1996). Increased noise has been linked to stress reaction, sleep disturbance and increased heart rate, blood pressure and muscle tension, which affects multiple disciplines and departments in the provision of hospital care.

While conducting a quality improvement project, nurses working the night shift on a patient care unit (PCU) found that unsolicited comments from patients alerted them of noises that were disruptive to patients' sleep (Cmiel, Karr, Gasser, et al., 2004). Further investigation revealed that noises perceived by patients as bothersome occurred throughout the day and night. Implementation of several interventions indicated that noise could be successfully reduced on that PCU. Based on the impact of noise reduction interventions on patients' perceptions of the environment, the authors chose to replicate the project across all PCUs in two hospitals.

Study Aims

The purposes of this study are to identify noise sources and implement noise reduction interventions with an outcome aimed at controlling noise levels at two Mayo Clinic Hospitals.

The following specific study aims focused on assessments of noise on PCUs before and after implementation of noise control interventions:

- identify the time of day and noises that were most bothersome in the hospital environment as reported by patients, nursing staff and nursing leadership;
- describe noise control interventions implemented;
- describe the level of noise on PCUs as identified by patients and nursing staff;
- compare decibel readings before and after noise-reduction interventions were implemented on selected PCUs;
- identify noise control interventions that could be easily replicated across diverse PCU environments;
- explore differences and similarities in noise readings between two noise measurement devices.

Literature Review

Much of the literature addressing the measurement of noise and impact of change in acute care settings was published in the mid- to late-1990s. More recent publications indicate that issues of environmental noise continue to exist and practitioners seek to find solutions that positively affect patients' hospital experience. The authors highlight some of the older literature because of its value in supporting the importance of reducing hospital noise.

Evidence exists that noise can produce many damaging psycho-physiological effects, including sleep disturbances, stress reactions, increased vital sign parameters (blood pressure, heart rate, respiratory rate, body temperature) and acute drops in SaO2 (Topf & Thompson, 2001; Freedman, Gazendam, Levan, et al., 2001; Zahr & Balian, 1995; Morrison, Haas, Shaffner, et al., 2003; Fogari, Zopppi, Corradi, et al., 2001; Katz, Fogelman, Attias, et al., 2001). In addition, noise exposure has been demonstrated to delay wound healing, decrease weight gain and impair immune function and hearing (Wysocki, 1996; Redwine, Hauger, Gillin, et al., 2000; NIH, 1990). Changes in behavior and muscle tension were noted both during the exposure to loud noise and sustained after the exposure ended (Trapanotto, 2004).

Sources of loud noise in the hospital environment can be identified by self-report (patient and staff questionnaires or surveys), directly assessing noise levels with a dosimeter or polysomnography (Freedman, et al., 2001; Richards, O'Sullivan & Phillips, 2000; Doğan, Ertekin & Dogan, 2005; Tijunelis, Fitzsullivan & Henderson, 2005; Christensen, 2005; Gabor, Cooper, Crombach, et al., 2003). Both subjective and objective data are valuable in

identifying sources, defining a threshold for disruption and assisting in decision making for implementation of noise control interventions and/or environmental modification.

Prior studies of modifying noise levels in hospital environments exist. Sleep enhancement protocols have been shown to be a successful intervention to reduce noise levels and increase patient sleep (Walder, Francioli, Meyer, et al., 2000; Johnson, 2003; Lower, Bonsack & Guion, 2003). Patient and staff in postanesthesia recovery areas perceived decreased noise levels when ambient music was played (Thorgaard, 2005).

Although it has been demonstrated that noise can have many detrimental effects, evidence also exists that reductions in noise levels can be obtained through combinations of staff education, environmental modification of physical surroundings and behavioral modification (Cmiel, et al., 2004; Topf & Thompson, 2001; Elander & Hellstrom, 2005; Ulrich & Zimring, 2004; Johnson & Thornhill, 2006; Nightingale, 1860; Bremmer, Byers & Kiehl, 2003; Kahn, Cook, Carlisle, et al., 1998; Monsen & Edell-Gustafsson, 2005). Many studies have evaluated interventions on individual PCUs; however, none were found that evaluated the implementation of noise control measures throughout an entire hospital. The authors attempted to identify, measure and reduce noise levels across an entire hospital environment.

Methods

Design

A mixed-method research design (quantitative and descriptive qualitative) was used to expand the methodology of an earlier quality improvement project implemented at the study setting on 1 PCU (Cmiel, et al., 2004). Baseline noise levels were measured objectively using noise dosimeters and subjectively by both patient and staff perceptions. Once sources and levels were identified, noise reduction interventions were implemented. Both subjective and objective data were again collected one month after implementation of noise reduction interventions and six months from preintervention data.

Setting & Sample

The study was conducted at two hospitals affiliated with the Mayo Clinic, a large Midwestern quaternary care and referral-based system. Fifty-seven PCUs of varying size with a wide range of clinical foci were included. No patient surveys were obtained from the two preoperative waiting areas. A convenience sample of 30 patients from each of 55 PCUs (n = 1650) was planned for both the pre- and postnoise assessments, with an actual response rate of 47% (n = 775) and 43% (n = 704), respectively. Inclusion criteria for the patient participants included the ability to read and write in English, self-reported unimpaired hearing ability, identified by nursing staff as alert, oriented and on the unit for a minimum of 12 hours prior to data collection. No patient surveys were obtained from the two preoperative waiting areas. Staff response rates were 53% (2,016/3,830) and 43% (1,652/3,847) and included registered nurses, licensed practical nurses, patient care assistants and unit secretaries working on the PCUs and preoperative waiting areas.

Instruments

Patient or Staff Surveys & Unit Environmental Noise Assessment

The survey and assessment instruments developed by the investigators were based on existing noise literature and previous experience. Face and content validity were established for both the patient and staff surveys through review provided by both industrial hygiene and nursing experts. Input from PCU nursing staff, nurse researchers and the nursing leadership group (nurse manager, clinical nurse specialist and nursing education specialist) was also obtained. Both patient and staff survey instruments used a five-point Likert response scale of very quiet to very loud for rating noise levels during four separate periods of a day—morning (7 a.m. to noon), afternoon (noon to 5 p.m.), evening (5 p.m. to 10 p.m.) or night (10 p.m. to 7 a.m.). The survey also asked the respondent to identify a noisiest time of the day.

Evidence exists that noise can produce many damaging psychophysiological effects.

Bothersome noises were identified using a pick-list with the opportunity for multiple choices and participants could also write about other noises not addressed on the pick-list. Comments, including suggestions for controlling bothersome noises, were solicited on the survey. All noise control interventions implemented on the PCU prior to the start of the study were also identified. Patient surveys were in a pen-and-paper format. Staff surveys were sent electronically through individual intranet e-mail distribution lists.

Noise Dosimeter & Sound-Level Meter

Dosimeters and sound-level meters measure environmental noise. The two devices measure noise differently and both were used to illustrate differences in measurement and the importance of consistency in noise-level measurement. Three general field work type II noise dosimeters (Quest Technologies, Q300, Oconomowoc, WI) were used to collect pre-and post-intervention noise levels measured in decibels (dB) on 31 PCUs (12 randomly selected and 19 voluntary units). The dosimeter measurements were obtained by industrial hygienists according to OSHA standard methods [29 CFR 1910.95, 80 dB Threshold, 5 dB Exchange and A-weighted filter noted as dB(A)]. In addition, a general field work type II sound-level meter (Quest Technologies, 2900, Oconomowoc, WI)

was used on four PCUs to log additional noise measurement parameters for post-intervention comparisons. All instruments were calibrated prior to each use using the manufacturer's procedures and equipment (Quest Technologies, QC-10, Calibrator, 114 dB at 1,000 Hz).

Table 1 Time of Day & Noises Most Bothersome

	Pre, n (%)	Post, n (%)
Staff	435 (36)	367 (40)
Patient	235 (41)	192 (40)
Time of day most bothersome	Morning	Morning
Bothersome noises[a]	n = 2016	n = 1652
Voices	660 (33)	556 (34)
Carts traveling in hall	347 (17)	269 (16)
Foot traffic in hall	329 (16)	257 (16)
Cardiac monitor alarms	253 (13)	172 (10)
Overhead pages	184 (9)	132 (8)
Pulse oximeter alarm	178 (9)	143 (9)
Other	162 (8)	135 (8)

[a]*Participants could choose more than one bothersome noise; therefore, the total percentage is greater than 100.*

Table 2 Noise Control Interventions Initiated on Patient Care Units

Interventions	Pre, %	Post, %
Close patient doors	64	66
Dim lights at night[a]	55	58
Limit overhead page	44	51
Lower speaking voices	43	51
Alarms turned down as far as safely possible	27	27
Ringers on phones turned down	26	31
Quiet signs posted	18	28
Other sounds controlled	13	17
Quiet carts[b]	10	11
White noise[c]	4	6

[a]*When lights are dimmed, people tend to talk in softer voices (Cmiel, et al., 2004; Walder, et al., 2000; Johnson, 2003).* [b]*Cart wheels.* [c]*Background noise.*

Procedures

Following institutional review board approval, preintervention data were collected. Unit-specific data were then shared with staff who used the data to identify and implement noise reduction interventions. Postintervention data were obtained 6 months after the preintervention data were collected. Data collection included all identified assessments as well as dosimeter measurements.

To maintain data confidentiality, data from the assessments were entered by an administrative assistant into a Microsoft Access database, then reviewed and analyzed by the research team. All paper documents were stored in a locked cabinet. Postintervention summary data were also sent to each PCU nursing leadership group for review.

Environmental Data Collection

The environmental noise pre- and postassessment tools to measure noise-related activities and issues were completed by the nursing leadership group. There also was an opportunity to describe any unit-based noise control activities that were already in progress, as some PCUs had already chosen noise control as a priority quality improvement project. The postintervention assessment was completed in the same manner and required leadership team responses regarding perceived success related to the PCU noise control interventions.

Staff Data Collection

Staff data were collected using a web-based survey link sent to employees through the use of unit-based e-mail distribution lists. Data were aggregated electronically at both the unit and departmental levels.

Patient Data Collection

Informed consent for each patient's participation in the study was obtained by unit staff members who had completed the institutional review board competency in protection of human subjects. Completed surveys were placed in a sealed envelope and sent to a central location.

Dosimeter & Sound-Level Meter Data Collection

Noise dosimeters were placed at a central desk location on 31 units and recorded readings over a 24-hour period. A journal accompanied the dosimeter with directions for staff to log any extenuating circumstances that may have occurred during the recording time period that may explain unusual readings. During the postintervention assessment period, a sound-level meter was placed adjacent to the noise dosimeter and data were collected simultaneously on four PCUs selected by the investigators for comparison standards.

Intervention Implementation Data Collection

After receiving the preintervention data, the unit nursing leadership groups were asked to identify and implement at least one noise control intervention within the next

2 to 4 weeks. The environmental noise education/ information tool served to guide the identification of unit-specific noise control interventions for implementation.

Data Analysis

Descriptive statistics were used to characterize the sample. Frequencies were calculated to answer the first three study aims. Differences between staff and patient responses related to time of day when noise was perceived as most bothersome were compared using the student test for unpaired means. Analyses were completed using SPSS, Inc. (Cary, NC) statistical software. P values < .05 were considered statistically significant.

Content analysis of patient and staff comments was completed by an experienced qualitative nurse researcher with theme analysis by investigators to ensure the trustworthiness of the data. Themes were identified using ATLAS software, a qualitative research software to help manage the large data set and to discern systematic patterns and interrelationships.

Analysis of the dosimeter data included a line graph developed for each of the 31 PCUs on the basis of the measured sound level from the noise dosimeter. This sound level, referred to as the slow max level, was calculated by recording the highest sampled sound levels during the dosimeter's run time (24 hours) and displaying them minute by minute.

Next, the average sound level measured from the noise dosimeter over the run time (24 hours) was compiled on a bar chart. This average, noted as Lavg, used the OSHA parameters specified in the Hearing Conservation Amendment, including an 80-dB threshold, 5-dB exchange rate and A-weighting filter noted as dB(A) (OSHA, 2007). As specified in the methods section, any sound below the threshold was not included in the average.

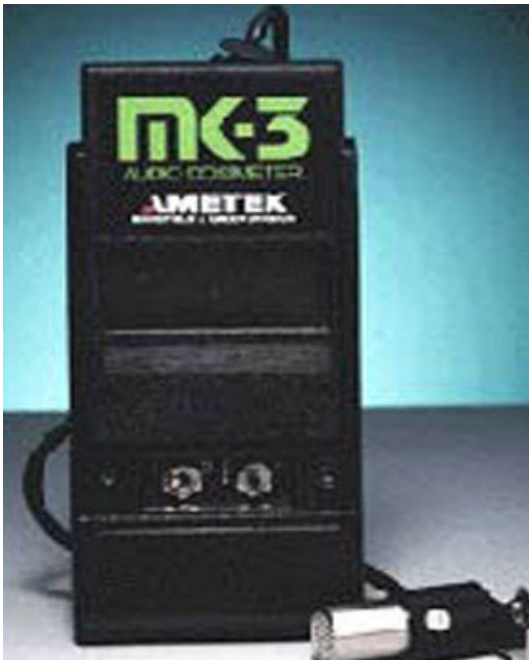
Results

Morning was identified as the most bothersome period of the day. Voices were perceived as the most bothersome by patients and staff (Table 1, p. 6). There were no differences in noises identified as most bothersome between staff and patients; therefore, the data were combined. The top six most bothersome noises are listed plus a cumulative value for other noises identified.

The qualitative data resulted in the emergence of four themes: 1) equipment: infrastructure (e.g., pagers, carts); 2) equipment: patient-related (e.g., monitors, pumps); 3) environment (e.g., activities at nurses station, door) and 4) human factors (e.g., voices, footwear and visitors). Noise control interventions initiated and identified by staff on PCUs are shown in Table 2, p. 6.

Noise was significantly reduced with interventions except on night shift (Table 3, p. 8). Patients' ratings of noise were significantly lower ($p < .001$) than staffs' at all time periods both pre-and postintervention.

Thirty-one of 57 PCUs comprised the sample of units where noise dosimeter measurements were taken. Staff received a comparison of pre- and postintervention dB(A) readings measured on their own unit as well as a departmental summary that allowed for comparison of their unit noise readings to other units. This provided an opportunity for staff to review how their noise reduction intervention(s) may have impacted their actual noise levels and how their unit noise reduction interventions compared with interventions initiated by other PCUs. Thirteen units had decibel readings averaged over the 4-hour period that decreased following noise control interventions and 18 had averaged readings that increased. Dosimeter data averaged across all of the 31 PCUs increased from 32 dB(A) during the preassessment to 36 dB(A) during the postassessment.



Dosimeters and sound-level meters measure environmental noise.

Noise control interventions that could be replicated across PCUs were identified. These interventions included padding chart holders, padding pneumatic tube drop-stations on PCUs and installing quieter paper towel dispensers. The team also created signage with the message "As a courtesy to patients, please limit use of this phone" and posted the signs near telephones proximal to patient rooms as reminders to staff. A second message, "To help promote a healing environment, please keep voices soft," has been approved for posting in visitor waiting areas. This message is currently under consideration for posting on electronic message boards throughout both hospitals.

The final aim was designed to compare sound-level readings from two different measurement devices (sound-level meter and noise dosimeter) placed on four selected PCUs. Although noise levels in dB(A) can be measured in several ways, all dB(A) measurements are not the same and may result in large differences in numerical dB(A) values. To illustrate this, the dB(A) values measured on one PCU include the 24-hour $L_{avg} = 31$, as measured by a noise dosimeter and four values measured with a sound level meter: $L_{eq} = 56$, $L_{dn} = 62$, $L_{10} = 59$ and maximum level = 84. All values were measured simultaneously and yet offer different dB(A) values. This presents problems when published studies offer dB(A) values yet do not completely describe the methodology. Readers may assume that all dB(A) values are the same.

Discussion

The delivery of patient care in hospitals involves a

certain amount of noise. Minimizing noise perceived as noxious or bothersome can improve the environment of care for both patients and staff. This is the only study known to the investigators that expanded noise reduction methodology across 57 PCUs in two hospitals.

Although somewhat expected, morning was identified as the time of day when noise was most bothersome. This may be explained by the observance of four of the five most bothersome noises common to the delivery of patient care: voices, carts, traffic and cardiac monitor alarms. The fifth most common noise was identified as overhead paging in the preintervention data collection period and pulse oximeter alarms for the postintervention data collection period. The authors' results were similar to those of other studies in the literature that defined noise sources using survey methods (Cmiel, et al., 2004; Richards, et al., 2000; Doğan, et al., 2005). Morning is typically when the most staff and visitors arrive on PCU, which may cause the increase in noise. In addition, scheduling of tests and morning care routines (e.g., bathing and changing bed linens) all contribute to sources and levels of noise.

Noise control intervention frequency increased pre- to postintervention in the authors' hospitals and were found to be common tasks, such as using soft voices, closing doors, dimming lights and limiting overhead paging. These modifications of environmental physical surroundings can be found in studies conducted on a single nursing unit as well as behavioral modifications (Ulrich & Zimring, 2004; Johnson & Thornhill, 2006; Nightingale, 1860; Bremmer, et al., 2003; Kahn, et al., 1998; Monsen & Edell-Gustafsson, 2005). Furthermore, the use of sleep enhancement protocols incorporates aspects of these items (Walder, et al., 2000; Johnson, 2003; Lower, et al., 2003). Awareness of environmental noise had an impact alone on the number of interventions used by staff.

A significant difference was noted between pre- and postmean noise ratings when combining staff and patient responses for three out of four periods of the day. The combined mean noise ratings decreased in all four time categories from pre- to postintervention assessment. Nighttime was not found to be statistically significant, as it was already identified as quiet. A reduction in rating of noise levels was noted after interventions were put in place. Furthermore, staff rated the noise in the morning as close to loud, whereas patients rated noise on the high side of quiet. Beyond statistical significance, this is an important finding clinically. The location of where noise is heard (hospital bed vs. in the hallway) may contribute to differing perceptions.

Objectively assessing noise with a dosimeter helped quantify actual noise, although considerations and context must be considered when using this equipment (Tijunelis, et al., 2005; Christensen, 2005). Actual noise level readings were higher after noise reduction interventions were implemented, but the perception of bothersome noise was reported to decrease by both patients and staff. The hospital patient census was higher during the postintervention measurement period, possibly accounting for the increase in actual noise-level readings. A dilution effect occurs when comparing the average level across 31 PCUs. Although individual units demonstrated changes, the averages across all units were difficult to realize. Finally, regardless of actual noise levels, the attention given to the issue of noise as part of the patient experience may have contributed to the overall perception of a quieter hospital environment.

Table 3 Rating Level of Noise: Staff & Patient[a]

	Pre		Post		Difference between pre & post, *P*
	n	Mean (SD)	n	Mean (SD)	
Morning (7AM to 12 noon)					
Staff	1204	3.83 (0.65)	902	3.85 (0.66)	
Patient	763	2.81 (0.90)	690	2.68 (0.89)	
Combined	1967	3.44 (0.91)	1592	3.34 (0.96)	.003
Afternoon (12 noon to 5 PM)					
Staff	1201	3.61 (0.66)	906	3.57 (0.65)	
Patient	728	2.77 (0.87)	661	2.68 (0.82)	
Combined	1929	3.29 (0.85)	1567	3.20 (0.84)	.001
Evening (5 PM to 10 PM)					
Staff	1205	3.31 (0.67)	908	3.28 (0.66)	
Patient	707	2.63 (0.90)	644	2.53 (0.84)	
Combined	1912	3.06 (0.83)	1552	2.97 (0.82)	.002
Night (10 PM to 7 AM)					
Staff	1157	2.74 (0.71)	892	2.72 (0.72)	
Patient	707	2.08 (0.98)	648	2.05 (0.96)	
Combined	1864	2.49 (0.88)	1540	2.44 (0.89)	.155

[a] *Response set values: 1 (very quiet), 2 (quiet), 3 (good/neutral), 4 (loud), 5 (very loud).*

Inconsistencies in noise data comparisons in the literature had been noted. Various articles describe noise in the healthcare environment but do not use the same or do not elaborate on the evaluation methods in their comparisons (Fogari, et al., 2001; Gabor, et al., 2003; Kim, Kil & White, 2001; Buelow, 2001). Complete sampling methodology was described in only five of the many articles reviewed (Morrison, et al., 2003; Tijunelis, et al., 2005; Walder, et al., 2000; Kahn, et al., 1998). Unless one fully understands the noise sampling method, it is easy to conclude that the sampling method and dB(A) levels are comparable from study to study. Findings from this study demonstrate how easily noise measurements can be misinterpreted and emphasize the need for consistency. Standardization of noise measurements would allow comparison across studies. A thorough understanding of the various methods used in conducting studies of environmental noise and when comparing results across studies in the literature, is warranted.

Limitations

In generalizing the results of this study, one should consider several limitations. The size and geographic location of this medical facility may limit comparison to other acute care settings. A convenience nonrandom sampling strategy to identify both patient and staff participants may have introduced bias. Since the pre- and postintervention data collection occurred nearly 6 months apart, different patients completed the surveys. To a certain extent, it is possible that different staff members may have provided the pre- and postdata on the basis of new hires and attrition.

In some PCUs, controlling noise had been prioritized as a quality improvement project and environmental changes had already been implemented. Although the data collection instruments were developed on the basis of the literature and piloted prior to use in the study, no psychometric properties are available for them beyond face and content validity. The study did not include control units, which may have allowed for randomization of units and a stronger study design. The authors did not collect unit census data nor did they collect data about the flooring for the units. Both of these factors may have influenced noise levels. Differences in perception of noise by patients and staff may have been influenced by the fact that patients are there 24 hours a day and nurses' shift is typically 8 to 12 hours.

Nevertheless, the results of this study highlight the similarities between patients' and staffs' identification of bothersome noises in the hospital environments and expand on current attempts to study and reduce noise in acute care hospitals. The importance of how one measures noise has been identified. A difference in perception of bothersome noise levels and actual noise level readings are worth noting.

Conclusions

A structured process can help healthcare institutions identify noise sources. Although many variables affect hospital environmental noise, there remains a lack of consensus on standards and methods used to assess a quiet environment or to identify actual levels of noise conducive for healing. This study contributes important information about the types of noise and perception of noise levels in a large, hospital environment. Furthermore, this study illustrates some pitfalls of noise assessment and interpretation. Standardization of noise measurement methods may allow better comparison and interpretation of noise studies. Interventions at the individual PCU level may have a greater impact to decrease noise in hospital environments. Periodic assessment of hospital noise levels can help identify new noises and reinforce interventions that have been put in place to maintain a quiet environment. ✪

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Six Sigma Strategies to Solve Noise Pollution

Professor S. Arun Vijay, a principal physiotherapist at KG Hospital and Post Graduate Medical Institute, offers these strategies—based on six sigma principles—for controlling noise pollution in a healthcare setting.

1) Establish stringent standards impacting patient safety.

2) Evaluate the current hospital noise through patient satisfaction surveys and by measuring the decibel levels.

3) Review the hospital's repair and maintenance policy and ensure it reflects the need for equipment to operate effectively and quietly.

4) Conduct an auditory impact query as part of every remodel and construction project, equipment purchase and staff event.

5) Change the ceiling tiles periodically from sound-reflecting to sound-absorbing tiles allowing patients to sleep better.

6) Convert a centralized nurse station to a decentralized nurse station.

7) Provide curtains in multi-bed rooms to provide both visual and auditory protection.

8) Use music therapy to replace noxious sounds with pleasant sounds—music improves restfulness and sleep, and induces relaxation.

9) Provide guidance and instruction during staff education and employee orientation sessions on the importance of maintaining appropriate noise levels.

10) Place appropriate signs and slogans throughout the hospital.

11) Use sound meters to record ambient noise level at periodic times throughout the day.

12) Reduce waiting time in the outpatient departments. Schedule consulting times for the patients and fix appointments with the physicians during registration. Reducing the waiting time in turn reduces noise in the outpatient departments.

Source: http://healthcare.isixsigma.com/library/content/c071205a.asp

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By **Tony Stewart,** CHMM, ASP, REA, CHSP, HEM, CHCM

An Ever-Changing Environment

The healthcare industry is poised for many changes under the new presidential administration, including the ability for hospitals to have an alternative accreditation option to The Joint Commission. In September 2008, the U.S. Centers for Medicare and Medicaid Services (CMS) announced its approval of Det Norske Veritas Healthcare (DNVHC) Inc. to become the first new hospital accreditation organization in more than 30 years.

The Joint Commission

Founded in 1951, The Joint Commission's mission is to continuously improve the safety and quality of care provided to the public through the provision of healthcare accreditation and related services that support performance improvement in healthcare organizations. Currently, The Joint Commission accredits and certifies more than 15,000 healthcare organizations in the U.S.

Det Norske Veritas (DNV)

DNV was founded in 1864 and has executed third-party evaluations in maritime, information technology and telecommunications, finance, automotive, food and beverage, aerospace, energy and healthcare industries. DNV has 50,000 clients worldwide with more than 85,000 certifications. DNV is the third largest certification body in the world. DNVHC Inc., a subsidiary of DNV, has worked closely with 60 hospitals over the course of the last 4 years and has accredited or scheduled 20 more hospitals since DNVHC received CMS deeming authority in September 2008.

Environment of Care Standards

As it relates to the scope of environmental health and safety and industrial hygiene, most healthcare organizations are surveyed to The Joint Commission environment of care standards. Historically, the environment of care standards consisted of seven management chapters: safety management, security management, hazardous materials and waste management, fire life safety management, emergency management, utilities management and medical equipment management. Recent revisions to the 2009 environment of care standards created standalone chapters for both the emergency management and life safety chapters.

Under the DNVHC scope, similar standards have been instituted for the physical environment with eight subsets of the physical environment chapter: facility, life safety management system, safety management system, security management system, hazardous material management system, emergency management system, medical equipment management system and utility management system.

Random environment of care inspection items are audited during the course of the week by The Joint Commission survey team.

Survey Process & Methodology

While both organizations have similar written standards for environmental health and safety and industrial hygiene healthcare professionals, the survey process and methodology are distinct.

The Joint Commission survey process is inspection-focused with the quantity of findings determining the outcome of the survey. An assigned administrative surveyor surveys to the environment of care standards by typically spending 2 to 4 hours in a document review session during the course of The Joint Commission survey. Random environment of care inspection items are audited during the course of the week by The Joint Commission survey team. These random environment of care items include dates on fire extinguisher tags, inspection dates on medical equipment, and staff knowledge of emergency and fire evacuation procedures.

Additionally, a separate life safety code specialist spends 1 to 2 days on site depending on the size of the healthcare organization to conduct a building tour and a document review pertaining to life safety-related items as required by NFPA life safety codes applicable to the healthcare organization. Specific attention is focused on firewall penetrations and random areas are selected to be physically inspected for penetrations during the fire life safety building tour.

In contrast, the survey process under DNVHC is outcomes-based, process-oriented and integrates the International Organization for Standardization (ISO) management system standards. ISO is the world's largest standards developing organization. In the last 62 years, ISO has published more than 17,500 international standards, ranging from standards for activities such as agriculture and construction, mechanical engineering, medical devices and the newest information technology developments. Under DNVHC, healthcare organizations also have the opportunity to align their accreditation with the integration

Management systems require organizations to say what they do, show what they do, prove it and improve it.

of ISO 9001 (quality management system), ISO 14001 (environmental management system) and OHSAS 18001 (safety management system). These management systems can ultimately lead to safer and more sustainable environments, reduced costs through better waste mitigation and efficient documentation techniques.

Management Systems

Management systems help organizations formulate quality, environmental and occupational safety and health policies and objectives. Management systems apply to any organization, large or small, regardless of business sector. Two basic concepts of management systems are continual improvement and regulatory compliance. As it pertains to environmental, health and safety and industrial hygiene management systems, several dimensions will be measured on factors such as the organization's environmental, industrial hygiene and occupational health and safety policies, the nature of its activities and conditions under which it operates.

For example, a successful safety management system should be based on an occupational health and safety policy appropriate for the organization; identification of occupational health and safety risks and legal requirements; objectives, targets and programs that ensure continual improvements; management activities that control the occupational health and safety risks; monitoring of the occupational health and safety system performance; and continual system reviews, evaluation and improvement.

DNVHC Surveyors

DNVHC physical environment surveyors stay for the entire duration of the survey and focus on the healthcare organization's processes that are in place. The number of findings does not determine the survey's outcome. DNVHC surveyors work with the facility staff to develop continual improvement objectives and targets and to assist in improving the overall process that works best for the organization.

For example, a DNVHC surveyor would not necessarily spend much time physically inspecting the facility for firewall penetrations. However, s/he would ensure that a policy and process were in place to control firewall penetrations. This might include verification of the organization's vendor control procedures to ensure that all vendors and contractors understood and adhered to the facility's requirements to control firewall penetrations.

On the compliance side, regulations such as OSHA 29 CFR 1910.1200 (hazard communication) and 29 CFR 1910.147 (lockout/tagout program requirements), will also likely be addressed during a DNVHC survey. Additionally, management review is in the scope of the requirements to ensure that senior leadership understands the management systems, processes and continual improvement activities implemented at the organization.

Conclusion

Management systems require organizations to say what they do, show what they do, prove it and improve it. This would be the path less traveled for healthcare, but sometimes the path less traveled can be the most beneficial. This article is not intended to advocate for either The Joint Commission or DNVHC accreditation process. Rather, the intent is to further educate healthcare environmental safetyand health and industrial hygiene professionals about the option to adopt management systems such as ISO 9001, ISO 14001 and OHSAS 18001, which have been proven successful worldwide in many other industries. ✪

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Preventing Injuries in Healthcare

As senior risk control specialist for PMA Companies, Christine Zichello draws from her extensive nursing experience to help clients better protect healthcare workers from occupational hazards and injuries. In this interview, Zichello provides her views on occupational safety among healthcare workers and explains how they can best make use of risk management to protect themselves from injury.

HealthBeat: ***Please provide a brief description of your professional background and of your role as senior risk control specialist for PMA Companies.***

Christine Zichello: I have 15 years' experience in critical care and emergency department (ED) nursing. I grew concerned with seeing so many worker injuries and decided to switch to occupational health nursing, which focuses on prevention of injuries, accidents and, where possible, elimination of work-related environmental hazards among healthcare workers. In my role as a senior risk control specialist, my major area of responsibility includes assessing clients' knowledge in relation to employee work-related hazards and potential exposures, advising clients on exposures, risk reduction and measures available to protect employee health and safety and assisting in the implementation of occupational and environmental safety and health education and training.

HealthBeat: ***You have extensive nursing experience. What events in your career made you decide to get involved in the occupational safety of healthcare workers?***

Zichello: I saw work-related injuries that could have been prevented. The approach to treating an injured employee is a sport-medicine model. We want appropriate aggressive treatment so that the employee is back in the workplace as soon as possible with the best long-term outcomes. I saw a need to change the culture of the environment by preventing injuries and illnesses among employees, promoting health, safety and wellness in the workplace and establishing an environment with safety as a top priority.

HealthBeat: ***What are the greatest safety hazards facing healthcare workers today? How have these hazards changed over the years?***

Zichello: Healthcare employees face a wide range of hazards on the job, including needlestick injuries, back injuries, violence and stress. Although it is possible to prevent or reduce healthcare employee exposure to these hazards, healthcare workers actually experience increased numbers of occupational injuries and illnesses. It is imperative to function within the realm of a team to identify hazards, develop a program to prevent employee injuries and establish controls.

The emergence of unknown hazards and diseases, such as working with bariatric patients and newly identified diseases, is also a challenge.

Christine Zichello

HealthBeat: ***What services does PMA offer to protect healthcare workers?***

Zichello: Our greatest strength is our risk control department's ability to partner with organizations to make necessary safety improvements in their processes. Our consultants have the experience and knowledge to identify specific areas of risk within a healthcare organization, analyze the trends and work with the organization to develop a plan of action to address the key loss drivers. Our healthcare team is comprised of consultants with years of experience not only in nursing, but in healthcare safety. This is a major asset. This team is able to develop educational material not only internally, but for clients. Healthcare-specific web events are also held quarterly.

HealthBeat: ***What do you believe is the most challenging aspect of managing risk in the healthcare field?***

Zichello: Changing the mindset and eliminating old beliefs. We still hear from management and administration that an injured employee cannot return to work until "they are 100%." They say, "We cannot take the person back unless s/he can lift." Employees are hired for their knowledge, skills and education and in the current healthcare environment, equipment should be used to lift patients. We must instill in the management team that employees are their greatest asset and we must take necessary precautions to minimize their job-related injuries. We must look at the total job and not isolate down to one aspect of it. A nursing assistant has many skills to offer a healthcare organization other than lifting of patient/residents. If an assistant is injured, how can that person return to work? What can that person do?

This not only promotes the healing process, but offers better outcomes and the employee remains productive.

HealthBeat: ***How can healthcare workers best make use of risk management to protect themselves from injury? Of what should they be aware? What kinds of questions should they ask?***

Zichello: Healthcare organizations must look at losses, do trending and drill down to determine their key loss drivers. This can be done in partnership with their risk control consultant and by analyzing loss runs. Nursing is the largest department in healthcare, but we must evaluate other departments like radiology, housekeeping and dietary to determine what their exposures are and develop a plan to address those exposures. Risk management must be all-inclusive for all departments and employees. This includes off-shifts and input and involvement from all levels.

Healthcare organizations may want to ask how risk management/insurance companies can assist in developing a comprehensive safety plan. We can provide guidance, but the organization must establish a plan that is unique to their environment so it becomes "their" program.

HealthBeat: ***What do you consider your greatest professional accomplishment and what are your future ambitions?***

Zichello: I have worked for some phenomenal managers who promoted and mentored me. With their encouragement, I have obtained my certifications. My future ambition is to promote occupational health nursing. Most hospitals have an employee health nurse, but I do not see employee health nurses in manufacturing or other organizations. We must promote the knowledge and abilities of occupational health nurses through certification.

HealthBeat: ***What is your personal outlook for occupational safety among healthcare workers? What new measures are insurance companies and SH&E professionals taking to help reduce injuries and accidents among healthcare workers?***

Zichello: We must consider healthcare employees our greatest asset and put as much emphasis on their safety as we do on patient and resident safety. I would like to further promote wellness. We must have healthy and well employees—a correlation exists between fitness and lower accident rates. Promotion of wellness within the work environment will be a key factor. ✪

Christine Zichello, COHN-S, CSHM, ARM, FAAOHN, *is senior risk control specialist for PMA Companies. She has 15 years' experience in critical care and ED nursing and has held various leadership positions within the Tri-County New Jersey Association of Occupational Health Nurses and the American Association of Occupational Health Nurses (AAOHN). Her articles have appeared in previous issues of* HealthBeat *and in AAOHN publications. She volunteers regularly for the Caregivers Coalition of Morris County, Kinnelon Health Department and Health Promotion Advocates. Zichello holds a B.S. in Allied Health/Management from Montclair State College.*

New Book Examines Hazard Control in Institutional Settings

ASSE has released a new book, Hazard Recognition and Control in Institutional Settings—*A Guide for Hospitals, Universities and Nursing Homes,* coauthored by George Byrns, Ph.D., M.P.H., CIH, and other safety and health professionals with extensive institutional safety experience. The book provides vital information on a broad range of topics:

•laws and regulations regarding environmental management;

•emergency preparedness and incident command systems;

•building renovation and design;

•waste management;

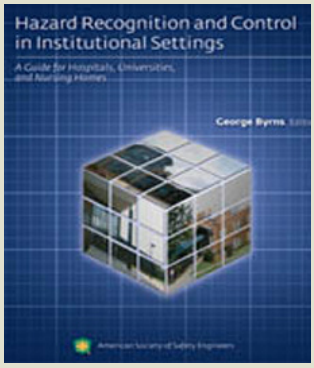
•hazard and risk assessment;

•indoor air quality;

•health surveys and surveillance;

•workplace violence;

•workers' compensation.



Areas of specific concern to hospital employees covered in the book include: healthcare accreditation standards; healthcare-specific occupational hazards; infection control; epidemiology; and ergonomic issues.

For nursing home employees, areas such as infection control and ergonomics are examined. For those in university and colleges settings, the book addresses hazards in dormitories, cafeteria and food services, student health services, science laboratories and also art studios, theaters and agricultural settings.

Byrns, the editor and main contributing author, is an associate professor of environmental health at Illinois State University. He holds a Ph.D. in Occupational and Environmental Health from The Johns Hopkins University, an M.P.H. in Environmental Health from the University of Minnesota and a B.S. in Environmental Health from Colorado State University.

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The book also features illustrations, a glossary and an index. An instructor's guide will be available to instructors. For more information, visit http://www.asse.org/cartpage.php?link=4420. ✪

By **Daniel S. Markiewicz,** M.S., CSP, CIH, CHMM

Workplace Reproductive & Developmental Hazards

Editor's Note: *ASSE is seeking to publish more occupational health-related articles in the coming year. Articles should address physical and psychological occupational health problems or best practices to eliminate them. In addition, articles on workplace violence, which may increase in the next year due to job and economic pressures, are welcomed. Please send articles or reprints (with permission granted) to the publication editor of your pertinent practice specialty or branch or to rheath@asse.org.*

In May 2007, nearly 200 leading international scientists in the fields of environmental health, chemistry, biology, epidemiology and paediatrics examined the human health effects of developmental exposure to chemicals in the environment. Their conclusions, in the form of a published statement (Nordic Pharmacological Society, 2007), is a strong "call to action" warning that human health effects of developmental exposure to chemicals in the environment are real, serious and require prompt attention in research and prevention.

According to the Faroes Statement, "Prevention should not await definitive evidence of causality when delays in decision-making would lead to the propagation of toxic exposures and their long-term, harmful consequences." The statement calls for a paradigm shift in science and public policy to encourage health interventions at the earliest stages of life where timing of chemical exposure is just as important as the magnitude of exposure.

The last decade has seen remarkable advances in the understanding of reproductive and developmental health. The National Research Council (NRC, 2000) reports that between 1995 and 2000, the number of new discoveries in the field of developmental biology and genomics were "staggering" and future discoveries were expected to be even more "explosive." These new advances now allow a man to measure the quantity of his sperm with a home test kit or a pregnant woman to clearly see the development of her unborn child with advanced 4-D ultrasound. New discoveries and understandings are altering how reproductive and developmental health hazards should be addressed in the workplace. This article explores whether U.S. safety and health professionals are ready, willing and able to take action.

For the purposes of this article, *reproductive* means the process where a man or woman is capable of producing a child. *Developmental* refers to the stages of child development from conception to adolescence.

Key Question

Should U.S. employers provide their workers with a risk assessment for workplace reproductive and developmental hazards? The answer to this question will have a profound impact on SH&E professionals who may be called on to conduct and communicate this risk assessment. The answer to the question is predicated upon answers to other questions. Is the assessment conducted to help protect the reproductive capacity of workers or to protect the developmental health of an unborn child (i.e., during pregnancy) or a worker's child (e.g., take-home toxics or breastfeeding)? Is there a regulatory obligation or legal duty to conduct the assessment? Is there a moral responsibility? Is there a business incentive? Have science and knowledge advanced sufficiently enough to perform a valuable assessment? And if the risk assessment is not conducted, what are the pitfalls? This article explores answers to these and other questions through the author's journey with this topic over the past decade.

All hazards, including chemical, biological, physical and psychological, may impact reproductive and developmental health.

Snapshot of Answers

A snapshot of answers to these questions is as follows. U.S. employers have a tort duty (as opposed to no legislative requirement) to conduct and communicate workplace developmental risk to employees. If this activity is not conducted, it is difficult for an employer to prove it performed due diligence if there is a negligence claim (and there is a growing possibility of this) for work-related prenatal injury. Workplace prenatal injury claims (for a single claim) have reached the $100 million level—big enough to get any company's attention.

The author has learned that the language in the introduction and the snapshot of answers above are contentious and controversial enough to warrant the following disclaimer: The author is not an attorney and the information in this article should not be viewed as legal advice. In all matters where workplace reproductive or developmental concerns are present, legal counsel competent in these matters should be sought.

Definition of Child

The limited scope of this article does not allow a thorough discussion of the various legal and social definitions of child. However, this article defers to two new risk assessment guidance reports that describe the scientific principles to be considered in assessing health risks to children. These reports are "*A Framework for Assessing Health Risk of Environmental Exposures to Children*," issued by

EPA in October 2006 and "*Principle for Evaluating Health Risks in Children Associated with Exposure to Chemicals*," released in July 2007 as Environmental Health Criteria 237 from the World Health Organization (WHO). Both EPA and WHO reports define *child* and *children* as life stages that begin at conception.

Demographics

The cited definition of child places a substantial burden on the workplace with regard to developmental exposures. While the concern for reproductive health of men is important, pregnancies hold a special concern because of its contribution to developmental health.

Over one-half of all U.S. children are born to working mothers and over 70% of U.S. women of reproductive age are in the workforce (McElhatton, 2003). However, all adult workers may now be considered to be of reproductive age due to advances in medical science and fertility treatments. For example, in recent years, a 90-year-old man fathered a child and a 66-year-old lady gave birth. Under the old concept, reproductive age is generally reported as between the age of 15 to 45 years for both men and women.

Approximately 4 million children are born annually in the U.S. Therefore, approximately 2 million of these children are born to working mothers. Due to pregnancies that were not carried to term, this number underestimates the number of women who may be pregnant while at work.

The length and type of exposures to pregnant workers have changed significantly over the past few decades. During 1961-1965, 35% of women worked within 1 month of giving birth. Latest census data (2008) shows that during 2001-2003, 64% of women worked within 1 month of giving birth. Women now hold jobs in all occupations—even those once thought of as the exclusive domain of men (BLS, 2007)—and 2.4 million women hold production jobs today. About 10% of construction workers are women. Three of every 10 manufacturing jobs are held by women. One in every 25 firefighters is a woman.

Concerns

Although most children are born healthy, there are concerns to having successful reproductive and developmental health outcomes. Concerns include (NRC, 2000):

- between 5% to 10% of couples are infertile;
- about 50% of all pregnancies are unsuccessful;
- major birth defects occur in 2% to 3% of newborns;
- minor developmental defects occur in 14% to 22% of newborns;
- autism spectrum disorders have shown a 10-fold increase over the last decade,
- preterm birth has increased 30% in the last 25 years;
- sperm counts are decreasing and male birth defects are on the rise;
- asthma, acute lymphocytic leukemia and brain cancer are also on the rise in children.

Hazards

All hazards, including chemical, biological, physical and psychological, may impact reproductive and developmental health. European guidelines on the assessment of the chemical, physical and biological agents and industrial processes considered hazardous for the safety or health of pregnant workers and workers who have recently given birth or are breastfeeding (Council Directive 92/85/EEC) include the following hazards and situations:

- mental and physical fatigue and working hours;
- postural problems connected with the activity of new or expectant mothers;
- working at heights;
- working alone;
- occupational stress;
- standing activities;
- sitting activities;
- lack of rest and welfare facilities;
- risk of infection or kidney disease as a result of inadequate hygiene facilities;
- hazards as a result of inappropriate nutrition;
- hazard due to unsuitable or absent facilities;
- shocks, vibration or movement;
- noise;
- ionizing radiation;
- nonionizing electromagnetic radiation;
- extremes of cold or heat;
- working in a hyperbaric atmosphere;
- biological agents;
- chemical agents.

Costs

The costs for reproductive and developmental problems are enormous. Preterm birth alone is estimated to cost the U.S. $26 billion a year in medical care and lost productivity.

Apportioning these costs to workplace exposures is a difficult challenge, but data are building in this regard. Consider, for example, the research article, "Work Activity in Pregnancy, Preventive Measures and the Risk of Delivering a Small-for-Gestational-Age Infant," which appeared in the May 2006 issue of the *American Journal of Public Health*. The research, conducted in Quebec, Canada, found that the occupational conditions of night hours, irregular or shift-work schedules, prolonged standing, lifting loads, noise and high psychological demand combined with low social support, increased the risk for having a low birth weight (LBW) infant. The research concluded that "Elimination of these conditions before 24 weeks of pregnancy reduced the risks close to those of unexposed women."

How much money may be saved if there was intervention to control the workplace conditions that increase the risk for an LBW infant? Costs of delivery and care for an LBW infant may range from $10,000 to $100,000 more when compared to costs for a child born of normal weight. LBW infants are more prone to mortality in their

first year of life. Chronic health conditions, including asthma, high blood pressure and poor cognitive development, have been associated with LBW infants. Chronic health problems can greatly increase a LBW infant's lifetime healthcare costs.

Tipping Points

The social and political landscape for protecting children's health in the U.S. has changed dramatically within recent years. New social and legislative activities focus on child health protections beginning at preconception. An example of these changes is CDC's April 2006 "Recommendations to Improve Preconception Health and Health Care—U.S." This report advises all women to treat themselves as pregnant even if they do not plan to conceive. The reasons for these changes are complex but include advancements in science along with changes in political and legal views.

The first significant tipping point experienced by this author was when a writer from *USA Today* contacted him. The writer was developing a front-page story titled "Workers take employer to court over birth defects" for the paper's Feb. 26, 2002, issue. The article described the growing tort liability for workplace prenatal injuries. This author contributed his views to the article in part saying that U.S. employers generally shy away from the topic. Tim Fisher of ASSE contributed to the article stating, "This is a huge issue that will continue to grow in importance as more women move into jobs traditionally the domain of men." William DeProspo, a plaintiff lawyer representing families who filed lawsuits, was quoted in the article saying, "This is a very, very serious problem and it is the tip of the iceberg." In March 2004, the employer being sued settled the $100 million claim (for one child) before it went to the jury.

The issue of children's health now includes workplace exposures to both parents prior to conception, exposures to the mother/unborn child during pregnancy and exposures during the early prenatal period when an infant is breastfed. The European Union (EU) issued guidelines for member states to develop legislation to address these exposures in 2000. Countries such as England now have clear laws in this regard. Government authorities in the U.S., such as NIOSH, have not issued any comparable guidelines. However, these exposures will be examined in the U.S. during the early stages of the National Children's Study (the study will examine environmental exposures to over 100,000 pregnant women and will follow their children to the age of 21) that received FY 2007 funding approval for implementation.

Global pressures are stimulating U.S. legislation to address reproductive and developmental health protection from workplace exposures. Legislative initiatives include the DOL's September 2006 ANPR for changes to the OSHA Hazard Communication standard to address global harmonization of chemical hazards. Expected changes to hazcom include lowering the threshold to 0.1% from 1% by product weight for reporting reproductive and mutagen hazards on safety data sheets (SDS) and include a new hazard category of "effects on or via lactation." Terms such as "may cause harm to the unborn child" or "may cause harm to breastfed babies" are expected to appear on U.S. SDS to conform to standardized risk phrases used internationally but predominantly used in the EU.

The issue of children's health now includes workplace exposures to both parents prior to conception, exposures to the mother/unborn child during pregnancy and exposures during the early prenatal period when an infant is breastfed.

The EU Registration, Evaluation and Authorization of Chemicals (REACH) legislation is expected to have a dramatic impact on U.S. chemical manufacturers. REACH identifies carcinogens, mutagens and reproductive toxicants (CMR) chemicals to be of "very high concern." Reproductive toxicants are defined within REACH as those that "interfere with normal human development, either before or after birth, resulting from exposures of either parent or exposure to the developing offspring to the time of sexual maturation." REACH's "precautionary principle" approach when dealing with CMR chemicals and persistent bioaccumulative toxicants (PBTs) (i.e., chemicals are not safe until proven otherwise) is already altering world markets.

Mothers are an integral part of a new emerging market model, more so than an at-risk population. Richard MacLean describes the emerging market model in the April 2007 issue of *Environmental Protection* as characterized "by increased global (vs. U.S.-dominated) public concern over long-term EHS social responsibility issues."

An example of the new emerging market is Wal-Mart's October 2006 implementation of its "Preferred Chemicals Principles" for product ingredients. Wal-Mart implemented the principles to drive the development of more sustainable products "for mother, child and the

environment." The principles call on Wal-Mart suppliers to screen chemical ingredients in their products with the intent to eliminate selected CMR chemicals and PBTs. If suppliers do not eliminate some chemicals from their products, the products will not be sold in Wal-Mart stores. Wal-Mart is not alone in taking this approach, but its huge presence (more than 6,600 stores worldwide) gives it the clout to fundamentally alter how business is conducted globally.

Mothers, children and the environment are central to the modern view of disease causation, which considers that children (beginning at conception) are more vulnerable to environmental exposures and early-in-life exposures to environmental hazards increase the risk of acute illness and chronic diseases. EPA's 2005 cancer risk guidelines (e.g., children under 2 years of age are 10 times more vulnerable to carcinogens than an adult, illustrates this new position).

Recent actions by market leaders such as Wal-Mart and EU legislation to take a precautionary approach with CMR and BPTs chemicals will change the role of mothers and fathers in addressing health concerns for new and future generations through greater transparency of chemical exposure risks at work or elsewhere. More than individual and industry action, however, is the monetary might of this issue. EU REACH is expected to have an enormous impact on the $2.5 trillion global chemical industry. Innovest Strategic Value Advisors' January 2007 report, "Cross-Cutting Effects of Chemical Liability from Products" clarifies the driving force of money. Innovest reports that shareholder resolutions on toxics in products reached an all-time high in 2006. Part of the drive includes actions of investing organizations representing over $22 billion in assets under management to seek better disclosure from companies regarding capital at risk to toxics, such as CMR chemicals, in products.

In 2005, the U.S. was next to last, just ahead of Latvia, for having the worst infant mortality rate among the world's 33 major industrialized nations, according to Save the Children, a global nongovernmental organization. There are many reasons why the U.S. fares so poorly in regard to infant mortality. One reason is that the U.S. healthcare system greatly favors treatment over prevention.

Social concerns for children are additional tipping points. In February 2007, the United Nations Children's Fund's (UNICEF) Innocenti Research Center released Report Card 7, "An overview of child well being in rich countries." The report card ranked child well being in six categories. In the health and safety category, the U.S. ranked at the very bottom among 25 rich countries. Components for the health and safety rank were child health at age 0-1, preventive heath services and safety (i.e., deaths from accidents and injuries).

The U.S. also fared poorly in other categories. In the behaviors and risks category, the U.S. was next to last. In the measurement of "relative income poverty" (i.e., percentage of children in households with income less than 50% of the median), the U.S. was so outside the norm for last place that it did not seem to belong at all with the ranking of rich countries. The poverty measurement was perplexing. The U.S. was ranked among the top five countries for having a child live with an employed parent. Did the measurement imply that some working parents in the U.S. had very meager incomes?

One of the stated purposes of UNICEF's report card is to "stimulate discussion and development of policies to improve children's lives." This raises the question, how does the U.S. measure up? The Institute for Health and Social Policy at McGill University addressed that very question in the February 2007 report, "The Work, Family and Equity Index." The report compared public policies for working families in 177 countries. A key finding of the report states, "When it comes to ensuring decent working conditions for families, the latest research shows many U.S. public policies still lag dramatically behind all high-income countries, as well as many middle-and low-come countries."

Lesotho, Liberia, Papua New Guinea and Swaziland—you may not be familiar with these countries but add the U.S. to the list. These are the only countries in the world that "do not guarantee any paid leave for mothers in any segment of the workforce," according to the McGill study. Other findings in the equity index report that may reflect poorly on U.S. social policies are:

•66 countries ensure that fathers either receive paid paternity/parental leave. The U.S. has no guarantees in this area.

•107 countries protect working women's right to breastfeed; in 73 of these countries, breaks are paid. The U.S. does not guarantee the right to breastfeed.

•137 countries mandate paid annual leave. The U.S. does not require employers to provide paid annual leave.

•134 countries have laws that fix the maximum length of the work week. The U.S. does not have a law for the maximum length of the work week or a limit on mandatory overtime per week.

•126 countries require employers to provide a mandatory day of rest each week. The U.S. does not guarantee workers this 24-hour break.

•145 countries provide paid sick days for short- or long-term illness. The U.S. provides only unpaid leave for serious illness through the Family and Medical Leave Act (FMLA), which does not apply to all workers.

The McGill report claims that lack of social policies, such as not providing paid leave for childbearing or no paid leave for illness and family care, eventually impacts the health and well being of children. This goes back to the UNICEF report, which indicates that the U.S. ranks last among rich countries in children's health and safety.

It is difficult to have policies without politics and the politics on these issues are heating up. Is the UNICEF report correct in ranking U.S. children's health and safety so low? The U.S.'s National Children's Study would answer this question. Former President George W.

Bush's proposed federal FY 2007 budget did not provide any funding for the study and, in an unusual move, went further to order that the study be shut down. There is general agreement among politicians that the budget process should avoid earmarking funds for any special projects, but in the final federal FY 2007 budget, NCS was earmarked to receive all funds for which it asked.

Employed women with children or employed women who plan to have children are disproportionately affected by lack of social and private policies to address their needs as primary caregivers for their children. WHO's 2006 report, "Gender equality, work and health: A review of the evidence" is just one of many recent studies that supports this position.

"Mom's Mad—And She's Organized" is the title of an article that appeared in the Feb. 22, 2007, issue of *The New York Times*. This article indicates that U.S. mothers who hold jobs outside of the home are in larger numbers than ever before and they are not happy. They feel that there should be more social and private policies to address their special needs in the workplace. However, unlike years past, these moms are banding together and have considerable political clout.

MomsRising, established in May 2006, is one example. Membership in the group has been growing at over 10,000 per month. In September 2006, Ted Kennedy, Christopher Dodd, Hillary Clinton and Barack Obama spoke at an event in Washington to support Moms Rising's causes including promotion of the book and documentary film "The Motherhood Manifesto."

Ted Kennedy's proposed Healthy Families Act and proposed changes to FMLA from Christopher Dodd (who authored FMLA in 1993) are examples of new legislation geared toward fairer treatment of working mothers. Disease prevention and improving science to curb rising healthcare costs are also goals of the current administration. Given the demographics of workplace reproductive and developmental hazards, along with other information covered in this article, the workplace seems like a strong potential target for disease prevention.

Are SH&E Professionals Ready to Act?

U.S. employers have generally sidestepped directly addressing reproductive and developmental risks from workplace hazards. Part of the reluctance to address these risks was a misreading by most employers of the 1991 U.S. Supreme Court's decision in *UAW v. Johnson Controls* outlawing "fetal protection programs." The decision centered on employee discrimination concerns and never intended for employers to abdicate responsibility on workplace reproductive hazards, primarily to a pregnant employee or to employees planning a pregnancy.

A hands-off approach when dealing with pregnant employees can also be seen in the U.S.'s official response to the International Labor Organization's (ILO) Maternity Protection Convention (No. 183) and Recommendation (No. 191) of 2000, which calls for risk assessments for pregnant workers. The U.S. informed ILO that, in regard to maternity protection, "The (U.S.) government should not decide whether the (work) position held by a woman is prejudicial to her health or that of her child. That decision should be made by a woman in consultation with her physician. Additionally, a woman should not be prohibited from making her own decisions as to whether to work and when to work."

The U.S.'s approach to risks faced by pregnant employees goes against the tide of other nations' actions. As of June 2006, 92 countries around the globe, which include all countries in the European Union, have established legislative health protections for pregnant employees. Health protections include provisions on work time, breastfeeding and/or avoiding dangerous or unhealthy work. For example, in the U.K., legislative health protections for pregnant employees require employers to conduct and communicate a risk assessment for workplace pregnancy hazards before an employee is pregnant. If an employee voluntarily declares that she is pregnant, the employer then must tailor a risk assessment for that employee. Based on the findings of this risk assessment, the employee's physician may then provide specific guidance for a healthy pregnancy.

It is the author's opinion that in regard to workplace hazards, it is unreasonable to expect that pregnancy risk decisions should only be made by a woman in consultation with her physician, unless the physician conducts an on-site inspection of the workplace, which rarely happens. The employer, through its

Fetal Growth Studies

Many epidemiological studies have observed a significant effect of some occupational conditions on fetal growth, including long hours of work, shift work, prolonged standing, lifting loads and high psychosocial stress. However, some studies showed no effect. In a number of studies, limitations related to the measurement of exposure may have led to underestimation of the true effect. These limitations include having a reference group that includes moderately exposed workers, measuring occupational conditions on the basis of job title, and failing to take into account changes in occupational conditions that occur during pregnancy. The latter limitation is important because previous studies have suggested that workers most heavily exposed during early pregnancy are more likely to experience a reduction in exposure over the course of the pregnancy or to take earlier antenatal leave.

For more information, visit http://www.ajph.org/cgi/reprint/96/5/846.

superior knowledge of workplace hazards, is a critical interface between a pregnant employee and her health-care providers.

However, the effect of the *Johnson Controls* decision is that U.S. employers are believed to shy away from the issue, which has led to occupational safety and health practitioners in the U.S. not acquiring sufficient awareness or knowledge to successfully manage workplace reproductive and developmental hazards. It is hypothesized that these safety and health practitioners now have low self-efficacy in this regard. No qualified studies specifically measure this self-efficacy.

The author has conducted professional development conferences (PDCs) annually at the AIHce conferences since 2004 on "Implementing Reproductive and Developmental Health Programs." The experience is that participants have only a cursory understanding of the topic. Participant acceptances of the topic and issues presented in this article are high. The 2006 AIHce in Chicago ranked number two (out of 72 PDCs) and the 2007 AIHce in Philadelphia ranked number four (out of 69 PDCs).

Conclusion

U.S. safety and health professionals should complete a risk assessment for workplace reproductive and developmental hazards in advance of growing litigation, potential legislative rules or business imperatives. A major driving factor for business action is the threat of litigation that may occur if a child is born with prenatal injuries caused by workplace exposures. These tort claims are not covered by workers' compensation and may impose a multimillion dollar liability upon an employer. ✪

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Pandemic Planning

A workplace should keep informed, develop a plan and implement public health programs are some of the tips offered to businesses and members in an ASSE article, "Avian Flu: Infection Control Guidelines." While there is no one-size-fits-all solution, it is suggested that communities, workplaces and individuals should:

- develop and implement preparedness plans as one would for other public health emergencies;
- participate and promote state and community public health efforts and implement prevention and control actions recommended by public health officials and providers who can supply information about the signs and symptoms of a specific disease outbreak and to communicate this information with employees;
- participate in influenza vaccination programs annually;
- participate in annual health promotion programs to prevent airborne, bloodborne, waterborne, food borne and contact types of diseases and infections if you are a healthcare worker, school teacher, work in protecting public safety, prison population and an emergency responder;
- adopt business and school practices that encourage sick employees/students to stay home;
- anticipate how to function with a significant portion of the workforce/school population absent due to illness or caring for ill family members;
- practice good health habits;
- stay informed about pandemic influenza and be prepared to respond;
- use national and local pandemic hotlines that will be established in the event of a global influenza outbreak; and consult the White House web site for national and international information.

Additional Resources: Contact U.S. Centers for Disease Control and Prevention (CDC) at http://www.cdc.gov/flu/avian/index.htm; the World Health Organization, http://www.who.int/csr/disease/avian_influenza/en/; your state or local health department (http://www.cdc.gov/mmwr/international/relres.html) to notify them of any symptomatic employees or suspected exposure incidents. Also refer to the White House's web site, http://www.pandemicflu.gov; and OSHA's "Guidance for Protecting Workers Against Avian Flu" at http://www.osha.gov. For more information, visit www.asse.org/newsroom/safetytips/pandemic-flu.php.

A Holistic Approach

*continued from page **1***

the healthcare professional, including physicians, nurses, pharmacists, technicians, aides and related assistants and trainees, both salaried and volunteer, the importance of teamwork cannot be underestimated. Working independently does not contribute to the maximum effectiveness possible. Personnel must be able to understand the value and consequences of behaving as a team member. Everyone is a part of the greater team, including subteams and must have the skills to communicate, cooperate and support each other in both routine and emergency situations. They must experience the system in which they operate as supportive of themselves and their team members as a valued resource for assistance. People at all levels must know how to think as leaders and managers to lead and manage themselves and each other to achieve common goals and to produce their results in the most efficient and effective manner possible. Personnel at all levels and credentials must be willing to provide feedback and coaching to anyone regardless of their role or position, medical or nonmedical.

Training and development is needed to assist all levels of healthcare staff in developing an increased awareness and enhanced skills for individual and group excellence, which will empower them to carry out their daily activities and to prevent errors and related health and safety incidents. A holistic approach is essential to ensure that attitudes, thinking and behaviors help prevent errors and incidents.

A holistic approach intends to provide the awareness and skills that will enhance each person's ability to prevent errors in any aspect of their work. In doing so, they will contribute to the safety, health and well being of their organization's professional staff, employees and patients and will provide excellent service to whomever they serve. Staff at all levels must expand their ability to work together to produce the kinds of results that will ensure their success and will carry out the mission of their healthcare system.

Many factors can cause errors, which can result in untold human suffering as well as material and financial loss. SH&E incidents and resulting injuries, illnesses or fatalities offer a worst-case scenario. Patients receiving the wrong medication and treatment, improper medical or surgical procedures and damaged equipment hampering the delivery of services are only some of the possible results. The short- and long-range effects are unfathomable. Lawsuits and rising malpractice insurance rates are driving many doctors to give up their practices or to move to another location where rates may be lower.

Since 1983, we have studied and addressed the various human factors that cause errors, which can result in incidents and breakdowns related to the provision of healthcare services. This article addresses findings related to the cultural influences and human factors that cause errors and examines the awareness, skills and strategies needed to achieve excellence in all aspects of healthcare operations.

This article also describes the awareness and skills essential to error reduction and elimination. The result is potential improvement in the quality of the systems, products and services as well as the safety, health and well-being of employees, ancillary staff and patients. Regardless of their position or level of experience, everyone working in the healthcare field must work optimally, with the least chance for error. In this way, healthcare organizations and practices become more successful and better able to carry out their missions, minimizing negative consequences in a multitude of areas.

A Demanding Field

Preventing errors is a challenge in today's demanding and fast-paced healthcare climate. The nature of changes in this industry over the last 40 years have accelerated a highly competitive market as well as the need to deliver services in circumstances that require personnel who are highly trained, capable and aware. Across the board, medical and nonmedical employees must be able to recognize the importance of taking personal responsibility for their own performance and for the performance of others. They must be able to think in a multidimensional manner, focus and respond to changing situations, make good decisions and perform under pressure.

Medical personnel must be willing to transcend their egos and positions and must be clear and consistent in the expression of their commitment to excellence.

One of the most important hedges against errors is teamwork. Because of the complex roles and responsibilities that personnel have taken on (or have been handed) in the healthcare industry, the importance of teamwork cannot be underestimated. Working independently in most situations is an illusion and typically does not contribute to maximum effectiveness. Functioning as a team requires that medical and ancillary staff have the skills to communicate, cooperate and support each other in both routine and emergency situations. They need the peace of mind that the system in which they operate supports them as individuals and as team members.

Error Reduction Through Self-Management

An important strategy for error reduction is to increase employee proficiency in self-management, interpersonal, leadership and management skills. Honing these basic workplace skills can help prevent operational errors and the possibility of accidents, injuries and incidents. The strategy involves focusing on the underlying human mechanisms that cause errors in personal and team performance.

Communication is critical. Medical personnel must be

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willing to transcend their egos and positions and must be clear and consistent in the expression of their commitment to excellence. They must know how to elicit commitments from each other and their co-workers for what is required and they must know how to coach and counsel each other to achieve their results. This manner of being may be strange and unusual to some who are used to a more command-and-control type of management style. They must also be able and willing to communicate (speak and listen) with each other, laterally and vertically, and to operate as a team in which the risks and satisfactions from jobs well done are shared.

Simple methods to double-check what was heard against what was said can avoid misinterpretations that can lead to errors. One example outside the medical arena that pertains to this field is one we discovered while training control room operators for a major utility. We found that a common cause of errors occurred when people in the field automatically repeated back instructions they were given without fully understanding what actions the operator instructed them to take. Training in how to detect this simple parroting of their instructions detected and prevented errors that could have led to many potential incidents. Imagine a physician giving instructions to a nurse or technician in an emergency room, patient care area or in the operating room where this same type of situation can occur.

Organization-Based Confusion

Thus far, the 21st century has been characterized by near-constant organizational change and uncertainty in all industries, including healthcare. Flux in the form of mergers, acquisitions and reorganizations are the norm. Reductions in staff and efforts to economize have become top priorities.

Few industries are immune from this trend, with companies working nonstop to guarantee their futures by eliminating redundancies, waste and unnecessary costs. In their efforts to trim, too many healthcare organizations may have ignored the cost of errors in this equation. For many, the frenzy to rush to ensure their viability has compromised the effort to reduce error.

Levels of distraction and errors in judgment are compounded when employees are worried about their own and their company's future and their employment status. Stress, which we found to be a contributing factor in incident causation when first researching the causes of incidents for a major chemical company, is at record levels in many workplaces.

Having visited many hospitals in recent years to visit friends and relatives, I have observed that many employees, doctors, nurses, aides and volunteers are under tremendous amounts of stress. Emotional distress related to personal and organizational concerns can cause people to lose confidence and can feed into distrust of each other, including healthcare management. Stress can also erode employee and patient relations, communications, cooperation and teamwork, ultimately affecting the quality of their work. The likelihood of errors increases and SH&E performance can deteriorate.

However, it is not only negative changes that distract employees. Increased medical, regulatory, legal and other issues related to liabilities in today's litigation-crazy society, along with increased demands, new equipment, increased responsibilities, cross-training and other administrative initiatives also play a part.

When employees are worried about any aspect of their job, sidetracked by challenging new duties or concerned about problems at home, they do not bring a clear mind to the job. This diminished ability to focus can lead to an error and decreases employees' ability to manage their own performance and that of others.

The Error-Free Workplace

We approach the process in a manner that leaves no one out and involves all levels of medical and nonmedical employees to ensure that we are more likely to break free of the bonds of the old culture and the old way of doing things. We approach the process of performance improvement by creating a common vision for excellence. Creating and communicating a vision for excellence is key to producing breakthroughs in performance. Vision is defined as an ideal state, something seen in a dream.

Also, key to creating breakthroughs in performance is not only establishing and communicating a vision, but reiterating and recommunicating this vision at every possible occasion. We approach the process of creating an "error-free" environment and performance improvement from many levels:

Self-management level. Individuals must have skills to observe and must take personal responsibility to manage their own level of attention and focus as well as their own attitudes and behaviors on and off the job.

Peer/team support level. People must develop an attitude of mutual support and caring for what we do individually and collectively and a willingness to inter-

vene at any time to encourage excellence in coworkers. Skills are needed to do this constructively.

Leadership-management, supervisory and line level. All levels of medical and administrative leadership must be able to put aside political and business issues to create and maintain an environment in which everyone can work in an excellent and quality manner regardless of external or internal organizational circumstances.

Organizational level. Includes the culture and the norms, values, beliefs, attitudes and commitments of the organization and its employees. A commitment to excellence, including SH&E, must be a core value. Attitudes and behaviors that reflect these must be encouraged, supported and acknowledged.

Working with client organizations, we employ a holistic, integrated approach to prevent errors and subsequent incidents. It uses a variety of awareness, attitudinal and behavioral change methods that stress strategies for thinking, problem-solving and influencing perception and attention. Cognitive learning approaches employed involve restructuring knowledge to fit new circumstances. People learn strategies for paying attention to any task and the potential dangers of loss of focus.

Rather than being manipulated by the environment, the learner is taught to interact with the environment so that mental structures continue to develop over time and experience. Both memory and attention develop with cognitive training. People learn to "think excellence" and develop related skills to prevent errors that can be transferred from one environment or task to another.

In a follow-up review session we conducted in a research and development (R&D) facility, a chemist noted that he initially planned to make an adjustment to a process without shutting it down to save time in a competitive environment. Although this was a task he had performed many times before, he noted that he observed his thinking process and the belief or internal message that he could do this and pull it off without a problem. Recognizing that something could happen, even in a small likelihood, he stopped himself, followed protocol, shut down the process and made the adjustment without error and safely. Afterward, he reported that the extra time spent was worth it.

The cognitive approach was part of the strategy for organizational effectiveness training and consulting first championed by Topf Initiatives in 1980. In 1983 at a large R&D facility and pilot plant operation for a major chemical company, Topf associates found that errors and incidents occurred despite the fact that employees clearly knew what to do and what not to do. Where can you get a more highly trained group of people than the medical industry? Yet errors and incidents still occur.

We concluded that the most effective way to bring about lasting behavioral change is to start by raising people's awareness. The next step is to examine the core beliefs and attitudes that shape decisions in individuals and groups. These beliefs can directly influence and affect the results produced in any domain, including quality, SH&E, medical and patient care and service.

Our experience led us to explore many cognitive issues that can cause an employee to produce quality work or to commit errors. One is an understanding of how complacency sets in, placing medical staff and various service employees at risk of committing serious errors. The culprits include behaviors such as losing focus, not paying attention or taking shortcuts and bypassing protocols. The result is an open door to errors, injuries or incidents, even when people comply with requirements and follow prescribed procedures. Self-observation skills are a valuable tool in overcoming complacency and avoiding errors.

Other Factors

A primary cause of communication errors and misinterpretations is a loss of focus or inattention. Although no one wants errors, employees sometimes behave in what we call a deliberate or nondeliberate manner that causes mistakes to occur. Awareness wanes due to daydreaming, inattention, repetitive tasks, stress and distraction. Preoccupation with both positive and negative organizational issues, changes or personal issues can also lead to lack of focus and resulting errors.

The other culprit is conscious or premeditated behaviors. In these instances, an individual talks him/herself into taking shortcuts, such as not reading through a patients chart thoroughly, not understanding handwriting in a chart or not checking out exactly what was written before beginning a task. These premeditated risk behaviors tend to be supported by rationalizations and justifications and are often ascribed to factors such as time, comfort and convenience or the belief "I know what I am doing."

In other circumstances, errors occur because insufficiently trained personnel are placed in positions that require levels of experience and expertise beyond what they possess. Ingrained attitudes such as, "We cannot afford to spend the money or time on training people completely; we need to focus on providing services," contribute to errors.

Changing Attitudes & Beliefs

Raising awareness and addressing attitudes, beliefs and counterproductive circumstances are a proven means to reduce errors. Leaders set the stage by identifying and addressing the negative influences that shape employees' attitudes and behaviors. Leadership's attitudes and behaviors must also reflect the awareness and understanding that focus and attention on quality must be heightened in these times, not diminished. Essential resources necessary for proper education, training, equipment and resolution of performance issues must be allocated. To diminish resources from this area to "save money" can be far costlier in the long run. This cost can be in dollars or in human suffering.

Defining and tirelessly communicating desired values and commitments, then backing them with human, financial and material resources help convey quality and excellence in performance as esteemed values. The attitudes of employees at all levels must be examined and measured against the vision for the organization. The desired result is that each person exhibit responsibility for his/her performance and for the performance of others. When responsibility is perceived as an organizational and individual value, employees at all levels are less likely to take or overlook shortcuts and to make the compromises that result in error.

When a person is internally motivated by the value and benefit of excellence in performance for themselves and their organization, improvement tends to be more permanent. External motivational strategies are most effective when combined with internal motivation. Leaders must be skilled in coaching and counseling techniques to constructively lead and interact with employees regarding performance issues, attitudes and behaviors. This is especially true when you have medical and ancillary staff working side by side. Error-related costs can push a healthcare organization over the edge or seriously impair its viability. Legal issues related to the healthcare industry are causing many to reassess working in their field.

Optimum opportunities for breakthroughs in performance occur when employees reflect the values and beliefs in quality and performance excellence. Accomplishing this shift requires consistent and sustained effort. A genuine value for excellence will endure despite changing circumstances. Improving attitudes and behaviors around quality and performance yields improvements in attitudes and behaviors that impact all areas.

The Role of Employee Involvement

Employee involvement is another key feature in error prevention. With trimmer staffs in healthcare organizations, all team members must see themselves as leaders who proactively seek ways to identify and solve performance problems. Sometimes employees assume the posture of a victim around errors and performance issues. They may say the organization is too lax, other individuals are careless or the equipment is inadequate.

Some employees are like spectators at a game and passively observe. They may comment on how the game should be played, but they seldom take effective action to help others prevent errors and incidents. This often occurs because they may have had negative interactions in the past with coworkers or with leadership. Employees must be encouraged to participate and should be trained in improving interpersonal interactions.

Organizational systems and structures should encourage involvement, including identifying and solving problems and should receive feedback on progress. This is essential for continuous improvement. When employees are involved in organizational decision making, they tend to care more about the environment, their services and the image they project. That often means working more carefully and with fewer errors. Key areas to focus on are:

•experience a shared vision and purpose for themselves and their coworkers that is aligned with the purpose of their institution and/or department;

•understand the human mechanisms that contribute to errors, accidents and injuries;

•learn the principles and skills for preventing errors of all types;

•discover the elements necessary to be an effective self-manager and team manager;

•discover the elements of an effective team;

•learn the skills necessary to dissolve barriers to teamwork;

•discover the role of personal responsibility for error prevention;

•develop an increased sensitivity to others' points of view;

•understand the technology for effective communications;

•learn how to eliminate misinterpretations and to ensure your communications were understood as you meant it;

•know how to make effective requests to ensure error prevention;

•learn the principles of committed speaking and listening;

•learn how to communicate in a nondefensive and nonjudgmental manner;

•enhance personal ability to be supportive and cooperative with others;

•learn behavioral management concepts and techniques;

•learn to interface effectively with other personnel;

•increase their ability to respond to each situation effectively;

•learn to resolve problems and conflicts quickly;

•learn practical self-management skills and techniques to easily relieve workplace pressures;

•discover skills for constructive assertiveness;

•learn effective time and desktop management skills (organizing nursing stations, other work areas and managing paperwork flow);

•learn skills to minimize distractions and to control and manage work cycles;

•learn how to increase our ability to concentrate;

•learn how to set up a time management system to manage daily priorities;

•learn method to increase our attention span;

•learn the principles of effective decision making.

Do these ideas and skills apply to the healthcare industry? You bet. Most errors are the result of human factors and can be prevented. As such, the quality of service and care can be increased with greater patient and staff satisfaction, health and well-being. ✪

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By **K. Lamorris Waller**

Gulf War Syndrome

The Persian Gulf War, commonly known as the Gulf War, took place between August 1990 and February 1991 in Kuwait. The war was a military conflict between Iraq and a coalition of 34 nations attempting to remove Iraqi forces from Kuwait after Iraq's invasion and annexation of the country in August 1990.

Origins & Symptoms of Gulf War Syndrome

Although many nations were involved in the Gulf War, most soldiers consisted of U.S. and U.K. armed forces. Upon their return home, many thousands of veterans became ill and experienced symptoms such as persistent memory loss, chronic headaches, widespread pain, gastrointestinal issues, concentration problems and other chronic abnormalities. However, when these veterans sought treatment, doctors could not find the root cause of the illness and, therefore, could not properly treat the soldiers. After some time, more soldiers and those in constant contact with them became increasingly ill, so much so that many dubbed the illness "Gulf War Syndrome."

While many soldiers experience relatively the same symptoms, many experts and naysayers believe the illness stems from psychological issues or from contact with various forms of bacteria unrelated to the war. Nevertheless, a Dec. 8, 2008, report found that roughly one in four of the 697,000 U.S. Gulf War veterans suffer from this illness.

The report was compiled by a panel of scientific experts and veterans serving on a mandated research advisory committee on Gulf War veterans' illnesses, though they were unable to determine whether a cure existed. Additionally, few to no soldiers have recovered after developing symptoms. Michael Harbut, M.D., chief of the Center for Occupational and Environmental Medicine and diplomat for the American Board of Preventive Medicine and Occupational Medicine, says that in terms of the Gulf War, many were exposed to agents, which may have similar pathways in terms of the disease's manifestation and, therefore, make it difficult to pinpoint an exact condition.

"There may have been cases where soldiers were administered vaccines without knowing they were (being given them)," he says. "In fact, it has been reported that many who handled them did not know what they (vaccines) were."

Suspected Causes

When the U.S. first became involved in the war, Iraq boasted the world's fourth largest army with Saddam Hussein's famed Republican Guard at the forefront. It was widely speculated that Iraq used chemical weapons on its enemies, such as on Iran during the Iran-Iraq war and on the Kurds of northern Iraq to crush uprisings. Despite experiencing some damage from Iraqi SCUD missiles, when U.S. troops moved into Iraq and Kuwait from Saudi Arabia in the Gulf War, Hussein's army retreated out of Kuwait. After brief fighting, Kuwait was safely restored to its former government. Although troops were trained to deal with chemical and biological weapons, the war was brief and Iraq's army was dissolved without a major chemical incident.

Soldiers returned home victorious, which also resulted in former President George H.W. Bush's approval ratings being among the highest in history. However, concerns surfaced after veteran illnesses began to occur. A Gulf War veteran suddenly died without a known cause; a veteran's child was born severely disfigured; a veteran suddenly developed an enormous tumor without previous illness. These events caused panic and concern about the threats of chemical weapons that were widely reported in the media during the war. After some time, more veterans became ill with wide-ranging but similar symptoms. About 6% of Gulf War veterans have reported an ailment that they believe is linked to their service.

In 1996, Gulf War Syndrome came under scrutiny after some experts discovered that this illness could be a result of other circumstances. The *New England Journal of Medicine* claimed that many veterans' symptoms could be similar or linked to other illnesses such as multiple chemical sensitivity, modernly known as hypochondria, chronic fatigue syndrome or fibromyalgia, a disorder causing muscle and connective tissue pain.

Since the rise of these various symptoms, researchers have pursued dozens of different explanations as to a cause. Military doctors at Walter Reed Army Medical Center discovered sick soldiers suffering from Leishmania tropica, a parasite transmitted through bites of infected sand flies. Although it normally causes only skin lesions, these parasites invaded soldiers' bone marrow and internal organs, which then caused diarrhea and fever. University of Buffalo (UB) geneticist professors theorized that some veterans may have a genetic predisposition for developing the condition. Their research showed that affected veterans had an increased frequency of a nonbeneficial genetic variant in a gene involved with enzymes that help control blood pressure and electrolyte balance.

"The results of this study are somewhat controversial

because people do not necessarily want to accept the possibility of a genetic predisposition," says a UB professor involved in the research. They believe that external or environmental factors play a role in Gulf War Syndrome but likely as triggers in those with a genetic predisposition.

Another popular theory is that American soldiers were poisoned by their own weapons. Tanks and artillery shells were coated with depleted uranium, a byproduct of the material that fuels nuclear weapons. Although it is hard and helps protect tanks from enemy fire while also helping artillery pierce armor, upon impact, the byproduct is released and can be harmful to people.

Controversy & Conspiracy Theories

In a related theory, Captain Joyce Riley, who served on active-duty missions on a C-130 aircraft during the war, then became an organ transplant nurse in Houston, TX, believes that the American government, at some point, provided biological chemicals to Iraqis that were later used on American troops. In a January 1996 lecture given to the Natural Health and Longevity Resource Center, Riley described how soldiers were forced to take injected vaccinations without a clear explanation of their contents. She also said that although soldiers were made to believe they were immunized to withstand bacteria created in the Middle East, she later claimed the American government actually sold chemicals to the Iraqis.

"The basic fact is that biological agents, chemical agents and germ warfare were used on our troops," she said. "It was passed through the Centers for Disease Control and many other American companies, which was then passed on to Saddam."

However, at the time of Riley's research and accusations of a government cover-up, national publications such as *Time Magazine* and *The Los Angeles Times* reported that "there is no scientific or medical evidence that chemical or biological weapons were deployed at any level against us [America]."

In September 2006, *USA Today* also reported that the Institute of Medicine committee found no evidence of a "mystery illness known as Gulf War Syndrome, though veterans are more likely to be stricken with certain ailments than non-veterans." The institute, which is part of the independent National Academy of Sciences, arrived at these findings after reviewing 850 cases since the war ended in 1991.

Research Findings

In December 2008, a panel of scientific experts and veterans serving on the congressionally mandated Research Advisory Committee on Gulf War Veterans' Illnesses determined that one in four veterans of the Gulf War suffer from Gulf War Syndrome. According to the panel, the illness is a condition now determined as a result of exposure to toxic chemicals, including pesticides and a drug given to protect troops against nerve gas. The panel's 452-page report states that "scientific evidence leaves no question that Gulf War Syndrome illness is a real condition with real causes and serious consequences for affected veterans." It also notes that the illness has no cure and that many of its victims have not recovered over time.

Call for Research Funding

Although scientists still search for a cure to this controversial disorder, senior intelligence officers at the U.S. Department of Defense have recommended that funding be allocated to the Veterans Administration for better treatment. The administration also made clear that this issue is not a problem for current soldiers in the war on terror in the Middle East because the military no longer uses pyridostigmine bromide pills for protection against nerve gas or pesticides that led to the illness in 1990 and 1991.

Funding has declined significantly since 2001 and as such, the report calls for a "renewed federal research commitment to identify effective treatments for this and other priority Gulf War health issues." More specifically, the reports call for $60 million in new annual funding on research committed to improving the health of Gulf War veterans. ✪

Resources

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By **Sandra M. Woolley,** Ph.D., CPE

Use of Exercise Balls as a Workstation Chair

Do you spend 8 or more hours sitting at your desk glued to your computer monitor? Do work and other commitments prevent you from exercising or exercising as much as you would like? If so, you are not unlike the majority, or 78% of the American workforce (Day Timer Inc.). Wouldn't it be great if exercise sessions could be completed while working?

According to the Mayo Clinic, core exercises are an important part of any fitness program. Developing core strength or stability involves the muscles of the pelvis, lower back, hips and abdomen working in harmony. One piece of equipment used in developing core strength is the exercise ball.

The Swiss Ball or exercise ball was invented in Italy in 1963 as a toy. By the 1980s, the ball had found its way into North American physical therapy settings. A decade later, the exercise ball was used to develop core strength in the fitness industry. The next logical step would be to use the exercise ball as a substitute for an ergonomically designed office chair at a computer workstation. However, before buying an exercise ball to bring to work, read the following.

Review of Current Research

Exercise balls have been increasingly used in fitness and rehabilitation programs as an exercise tool (Merritt & Merritt, 2007). Their usage has focused on stabilization exercises, which is a term given to any exercise that "challenges the stability of the spine while training patterns of muscle activity and spine posture to ensure sufficient stabilization" (McGill, 2002). In other words, exercise balls can result in increased muscle activity that will subsequently increase core stability and strength, which is thought to be beneficial in reducing the incidence of low back pain (Gregory, Dunk & Callaghan, 2006). Some have suggested that *dynamic* or *active* sitting with frequent postural change is beneficial and have recommended sitting on the exercise ball. It is important to recognize that these studies have been conducted under the supervision of therapists and exercise specialists, whereas this would not be the case if the exercise balls were used as office furniture.

To date, little quantitative evidence supports the practice of exercise balls as an alternative to standard office chairs for prolonged sitting at computer workstations. Anecdotal evidence in a case study of two individuals with lower back pain suggested that "active sitting" obtained from using the exercise ball may be helpful in alleviating lower back pain in some patients (Merritt & Merritt, 2007). Several more quantitative studies comparing sitting on an exercise ball and a standard office chair found that no significant differences existed in the magnitudes of muscle activity, spine posture, spine loads and overall spine stability (Kavcic, Grenier & McGill,, 2004; Gregory, et al., 2006; McGill, Kavcic & Harvey, 2006). In other words, these studies failed to find any beneficial changes in spine stability or compression while sitting on the ball.

However, it was found that sitting on a ball appears to increase the

Top 7 reasons fitness balls should not be used as office chairs

1) You have a higher risk of falling when getting on and off or reaching from the ball.
2) You can't swivel or navigate your workspace while seated.
3) Your buttocks and thighs have insufficient support.
4) You don't have full seat or back support, making it difficult to maintain an upright posture.
5) You have minimal adjustability.
6) Your muscles are working excessively to maintain an upright posture.
7) You are literally exercising all day long, leading to increased fatigue.

Source: WorkSafe Magazine, July / August 2006, published by the Workers' Compensation Board of British Columbia. http://www.worksafebc.com/publications/newsletters/worksafe_magazine/Assets/PDF/wsm_jul_aug_2006.pdf.

Developing core strength or stability involves the muscles of the pelvis, lower back, hips and abdomen working in harmony.

seat-user interface, which increases contact area and can result in uncomfortable soft-tissue compression (McGill, et al., 2006; Gregory, et al., 2006). It was observed that when test subjects performed office tasks, they found sitting on the balls less comfortable over time than an office chair (Gregory, et al.). These authors also suggested that the use of the exercise ball for prolonged sitting may not be advantageous and suggested that potential safety issues may be associated with sitting on an unstable surface like the exercise ball.

Based on comments received through the Ergoweb e-mail list, it has been the consensus of ergonomic experts that exercise balls are not recommended as a substitute for workstation chairs. In addition to issues associated with muscle activation and spinal postures, the following are also a concern:

•The balls tend to roll out from under the person as s/he sits or stands, which can cause the person to lose balance or fall off the ball. This introduces a workplace safety hazard.

•Exercise balls are not height-adjustable and this can potentially result in poor upper-body postures.

Research suggests that exercise balls are not a good substitute for chairs for computer workstation usage. Exercise balls may best be left for exercising. ✪

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Setting Up Your Office Workstation

By Mike Wynn, CPE, Humantech

Whether you work from home or drive to the office each day, you probably spend a lot of time at your computer workstation. How you set up and use your computer workstation will shape your job performance. Follow these steps to optimize the 30-in. intersection between you and your work:

•If you can adjust the height of your keyboard surface, start at your feet.

1) Adjust your seat height so that you can sit with your feet flat on the floor, back against the back rest and knees bent approximately 90°.

2) Sit upright in your chair, with upper arms straight at your sides, forearms parallel to the floor and wrists straight.

3) Adjust the height of your keyboard surface so that your fingertips rest comfortably on the home row, with wrists still straight and fingers slightly bent in the typing position.

•If you cannot adjust the height of your keyboard surface, start at your hands.

1) If the keyboard surface won't adjust low enough, obtain a footrest to raise your feet, then start over with step 1 (placing your feet flat on the footrest). Place your fingertips comfortably on the home row, with wrists straight and fingers slightly bent in the typing position.

2) Adjust your seat height so that you can keep your fingertips comfortably on the home row with upper arms straight at your sides, forearms parallel to the floor and wrists straight.

3) If your feet are not flat on the floor with knees bent 90° and back against the backrest, obtain a footrest to raise your feet so that you can sit comfortably with your knees bent 90°.