1 Introduction

Hospital noise is an ongoing issue. With high amounts of activity and equipment, many hospitals are producing noise levels that can impede patient healing and affect staff [1, 2]. Therefore, it is to little surprise that noise is a commonly low-performing category in patient satisfaction surveys.

In the United States, with the enactment of the Patient Protection and Affordable Care Act in 2010, Federal reimbursements to hospitals are dependent, in part, upon the performance of the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) patient satisfaction survey. This survey accounts for patients’ perception of the noise level in terms of the area around their room being, “quiet at night” which has historically shown poor performance [3].

Because of the widespread use and importance of the HCAHPS system in the United States, it was of interest to compare patient satisfaction scores with their associated noise levels. Acoustics By Design (ABD) has performed several comprehensive noise assessments of healthcare facilities and gathered the associated patient satisfaction data. The purpose of this session is to explain the HCAHPS survey, describe the hospital noise survey methodology developed by ABD, and compare selected results of ABD’s noise surveys with the facilities’ patient satisfaction scores.

2 HCAHPS

The Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) is a powerful comparative tool within the United States because it serves as a nationally standardized and publically available hospital rating system. It was developed in part by the Centers for Medicare & Medicaid Services (CMS) and the Agency for Healthcare Research and Quality (AHRQ). It was first implemented in 2006 with the first public result reporting period in 2008 [4].

Relevant to hospital noise the HCAHPS survey asks, “During this hospital stay, how often was the area around your room quiet at night?” which is answered as “never”, “usually”, “sometimes” and “always.” The data is presented to the public as the percentage of patients, “who reported that the area around their room was, ‘Always’ quiet at night”. Recent findings show that less than 60% of respondents indicated “pay for performance” issues as the main reason to reduce noise [3].

3 Hospital Noise Survey Methodology

Acoustics By Design (ABD) has developed a comprehensive hospital noise survey methodology that has been conducted in multiple hospitals across the Midwest region of the United States.

3.1 Measurements

ABD has integrated multiple techniques in performing hospital noise surveys that consist of both a long term measurement session (to capture the broadband sound level and describe the overall noise over time and in different locations) and a short term measurement session (to characterize disturbing singular noise source events).

Measurement locations are chosen in an interdepartmental planning session with hospital staff to ensure measurements are collected in representative locations. This helps to gather information on which areas are perceived as to be quieter or louder and other operational factors such as cleaning/food service schedules, where staff tend to congregate, and the patient room door policy. Typically, measurement locations are at several representative locations including corridors, nurse’s stations, private patient rooms, semi-private patient rooms and unoccupied patient rooms.

Long Term Noise Monitoring

In congruence with the methodology of similar current research [5–7], ABD has chosen to perform long-term broadband measurements with Larson Davis 703 and 706RC dosimeters. The meters are programmed for slow response and 1-second sampling of \( L_{eq} \), \( L_{max} \), \( L_{min} \), and \( L_n \). 1-second data is used to evaluate how much the sound level varies and how quickly. It is also used for correlation with the short term noise source data (described below).

Long-term measurements are conducted over a 48-hour period and typically cover one weekend day and one weekday to attempt to account for variations in census counts. In an effort to reduce staff behavioral changes, installation typically occurs several days prior to the actual measurement session and the staff is not informed on when the meters begin measuring.

Short Term Noise Monitoring

In addition to the long-term broadband noise monitoring described above, short term measurements are collected during
the long term measurement period in order to characterize the level and frequency content of many identified disturbing singular noise source events.

These measurements collect short-term (typically about 30 seconds to 1 minute in duration) octave band sound level data acquired at a normalized distance of 1 meter from each source using a Larson Davis 824 sound level meter. The selected noise sources are based on observations during hospital tours as well as staff surveys. Common sources include patient bed alarms, cart noise, the prescription delivery system, the paging system, and EVS equipment.

4 Results

The following describes the noise survey results and patient satisfaction scores of one facility in the Midwestern United States conducted before and after implementation of ABD’s noise mitigation recommendations. Table 1 below shows the $L_{eq}$ and patient satisfaction scores of the different departments of the facility before and after mitigation. The satisfaction scores are reported as the percentage of patients who perceived the noise in and around their room to be “favorable” which is assumed to be similar to the HCAHPS survey question metric.

<table>
<thead>
<tr>
<th>Unit</th>
<th>$L_{eq}$ before (dBA)</th>
<th>Satisfaction before (%) favorable</th>
<th>$L_{eq}$ after (dBA)</th>
<th>Satisfaction after (%) favorable</th>
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<tr>
<td>A</td>
<td>57</td>
<td>66</td>
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Table 1: $L_{eq}$ and patient satisfaction scores (percent of patients that described the noise in and around their room as “favorable”) before and after implementation of noise mitigation. [8]

According to Table 1, before mitigation, the average noise levels within the different departments ranged from 56-59 dBA over a 48-hour period. For comparison, a common hospital design reference, the FGI Guidelines (2014 cycle), recommends a maximum background noise level of 45 dBA within patient rooms (produced by the building mechanical system). However, because it was not feasible to reduce noise levels to those levels, recommendations given to the client were designed to minimize the overall background noise level along with reducing the frequency and level of disturbing impulsive noises, with the end goal of achieving better “acoustic comfort”.

After mitigation, the decrease in overall $L_{eq}$ ranged from 3-6 dBA. While the level of the “after” measurements are still higher than what is recommended by the FGI guidelines, the patient satisfaction scores in the departments of interest increased from 4-15%. In addition, anecdotally, the hospital reported that, overall, patients changed their perception of the treated spaces from being “noisy” to being “quiet”. These data suggest a preliminary relationship between the decrease of hospital noise level with the increase of patient satisfaction scores [8].

5 Conclusions

The Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) patient satisfaction survey provides a standardized reporting method across the United States whose results include a category for the perception of hospital noise. Because federal reimbursements to many hospitals across the United States are now dependent on the performance of the HCAHPS survey and because hospital noise is one of the poorest performing categories, it is expected that there will be an increase of interest in hospital acoustics studies.

Acoustics By Design (ABD) has performed multiple hospital noise studies across the United States and have developed a comprehensive and cost effective methodology. One particular study involved performing identical measurements before and after the implementation of noise mitigation techniques. The results from this study show that after mitigation the background noise level was reduced by 3-6 dBA, while patient satisfaction scores of the “noise in and around the room” increased from 4-15% favorable. This preliminary evidence seems to indicate a relationship between increasing patient satisfaction by reducing noise levels.

References