Antimicrobial Stewardship News

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Antibiotic Use in Small Community Hospitals

Introduction

Antibiotic stewardship programs are tasked with measuring and improving antibiotic use (AU). Measuring antimicrobial use (AU) is difficult because volume does not necessarily reflect "appropriate" use. Therefore, hospitals often benchmark AU rates with facilities that are similar in composition. Despite the fact that the majority of US hospitals have < 200 beds, little data are available describing AU rates in facilities such as these.

A recent study by Stenehjem et al. described AU rates among a network of small and large community hospitals.[1] Of note, the methods used for calculating AU rates as well as the characteristics of hospitals included differed substantially from DASON. Therefore, this newsletter will review the findings of this study and discuss benchmarking AU data with available literature in the context of participating in the DASON network.

Methods

Stenehjem et al. compared AU rates among 15 small community hospitals (SCH) and 4 large community hospitals (LCH) in Utah using data from the CDC's National Healthcare Safety Network (NHSN) AU option. The NHSN AU option is a secure, standardized internet-based surveillance system used to collect AU data that are generated monthly and manually uploaded.[2] AU rates were expressed as days of therapy per 1000 days present (DOT/1000 days present). Days of therapy (numerator) were obtained from a locally developed eMAR system and days present (denominator) were obtained from patient location data. Hospital units were categorized as intensive care (ICU), medical/surgical, pediatric, or miscellaneous. The miscellaneous unit category was developed to include those with historically low AU rates (e.g., well-baby nursery, psychiatry). Using NHSN AU data from January 2011 through December 2013, monthly and 3-year AU rates for each facility, unit type, and antibiotic category were calculated.

Results

The characteristics of hospitals included are summarized and compared with DASON in **Table 1**. The median size of SCHs included was 25 beds, and the majority (11 of 15) of SCHs had less than 50 beds. Note that DASON hospitals are generally larger than those in the SCH group and smaller than those included in the LCH group.

Table 1. Characteristics of SCHs and LCHs Compared with DASON Network Hospitals

Characteristic	SCHs N=15	LCHs N=4	DASON Hospitals[a] N=17
Licensed beds, median (IQR)	25 (18-71)	352 (261-453)	199 (140-233)
Active ICU, No (%)	7 (47)	4 (100)	17 (100)

[a]Data reported represents N=17 DASON hospitals reporting data in calendar year 2015

Facility-level AU rates varied widely among SCHs (median 436 DOT/1000 days present, range 134-671) and were similar to those in LCHs despite having lower case mix indexes (CMI) (**Table 2**). Among the 15 SCHs included, AU rates were highest in ICUs (median, 881 DOT/1000 days present) and lowest in miscellaneous units (median, 54 DOT/1000 days present) (**Table 3**). Of note, the contribution of days present coming from miscellaneous units varied substantially between SCHs and had a large impact on facility-level data. Therefore, excluding the miscellaneous units in facility-level AU rate calculations resulted in significant changes in hospital rank.

Index of Key Abbreviations

AU = antimicrobial use
CMI = case mix index
SCH = small community hospital
LCH= large community hospital

Table 2. Total AU Rates & Case Mix Index at SCHs and LCHs

Metric	SCHs N=15	LCHs N=4
Total antibiotic use rate, median (range)[a] DOT/1000 days present	436 (134-671)	509 (406-597)
CMI, median (IQR)[b]	1.05 (1.0-1.62)	1.59 (1.5-1.62)

[a]Data reported as days of therapy/1000 days present
[b]CMI, case mix index

Table 3. Antibiotic Use Rates by Unit Type at 15 Small Community Hospitals

Hospital Unit Type	Antibiotic Use Rates Median (IQR) DOT/1000 days present
Intensive Care (ICU)	881 (755-1041)
Adult Medical-Surgical	607 (452-715)
Pediatric Medical-Surgical	491 (426-582)
Miscellaneous	54 (24-108)
Overall	500 (111-715)

The authors conclude that there is considerable variability among total antibiotic usage at SCHs, but that overall antibiotic prescribing patterns are similar to LCHs. In addition, they outline the inherent limitations of comparing these data with antibiotic use rates at other SCHs.

Can This Study Serve as a Benchmark for Comparison with DASON Hospitals?

There are several important points to highlight in regards to comparing AU rates from this study with DASON community hospitals:

1. **Denominator Used in AU Rate Calculations**- AU rates were calculated with the denominator metric "days present" as opposed to "patient days." DASON currently uses patient days, which is the traditional denominator used for infection control surveillance. The two denominator metrics must be clearly distinguished. Days present is defined as the count of calendar days where a patient is present in that location for any portion of the day. Patient days is defined as a count of patients in the given location measured at the same time each day (e.g., midnight census). One of the main differences between these denominators is that days present will add a day to each patient stay when compared with patient days because admission day is included in days present. This is a particular concern on units housing patients with very short stays (less than 1 day) that do not cross the designated census time, because these patients will be missing from patient day counts but included in days present counts. Therefore, when AU rates are calculated using days present, the additional days included in the denominator result in LOWER total AU rates, especially in hospitals with units housing very short stays.[3] Overall, DASON-calculated AU rates are higher than those from this study in part because days present denominators result in substantially lower rates based on method of rate calculation alone.

2. **Hospital composition**- The SCHs in this study were substantially different from hospitals within the DASON network, specifically in regards to bed size, total patient days, and presence of active ICUs (Table 1). In this study, AU rates were highest in the ICU setting; however, less than half of the SCHs in this study had active ICUs, which may partially explain the low AU rates observed.

3. **Geographic location**- The SCHs evaluated in this study were located in Utah and Idaho (West census region). The DASON network includes hospitals from Virginia, North Carolina, South Carolina, Georgia, and Florida (South census region). Geographic location has a substantial impact on AU rates, for reasons that are not yet fully understood. A recent study demonstrated outpatient AU rates were significantly higher in the South census region than in the West (931 vs 647 prescriptions per 1000 persons, $p<0.001$).[4]

Are DASON Hospitals Currently Reporting Data to the NHSN AU Option?

At the present time, submission to the NHSN AU option is voluntary; however, the National Action Plan for Combating Antibiotic-Resistant Bacteria outlined a goal for it to become routine by 2020.[5]

DASON members benefit from a standardized data infrastructure that provides a streamlined process to participate in NHSN AU reporting. There are currently nine DASON hospitals reporting data to the AU option. These hospitals can access a new standardized metric for AU, the standardized antimicrobial administration ratio (SAAR), which is an observed to predicted ratio. The purpose of the SAAR is to summarize AU data and allow for inter-hospital comparison including some limited risk-adjustment for facility-level factors. The SAAR metrics include only AU data from adult and pediatric medical, surgical, and medical/surgical ICUs. Of note, no AU data from miscellaneous-type units are included in SAAR calculations. A high SAAR (above 1) may indicate excessive AU, whereas a low SAAR (below 1) may indicate antimicrobial under use. The intended use of the SAAR is to allow stewardship champions to quickly identify targets (e.g. hospital units or antimicrobial category) for further investigation.

Of note, the standard population of hospitals on which the SAAR is built includes 77 US hospitals reporting 2014 data. Nineteen of those 77 (25%) hospitals are the SCHs and LCHs described in Stenejhem's study above. Another 30-50% of hospitals used to develop the SAAR were Veteran's Affairs hospitals. Therefore, the comparator group used in the SAAR is different from DASON hospitals but may be a helpful second comparison in addition to DASON benchmarks. In all, we believe that more information can only help DASON hospitals who are looking to understand the needs of their hospitals and focus their stewardship efforts. Further, participation in NHSN AU option is a clear sign that hospitals are dedicated to tracking and responding to AU data, which is a regulatory requirement and Core Element for hospital stewardship programs.[6] Overall, the SAAR is a useful tool to compare AU estimates with a national sample of comparator hospitals. We expect the SAAR methodology and comparisons will become more meaningful as more facilities throughout the U.S. enroll in the AU option.

Take Home Message:

- Stenejhem's study demonstrated that antibiotic use rates vary widely among SCHs and are similar to rates in LCHs despite lower case mix index.
- Hospitals with a significant contribution of patient days from miscellaneous units (e.g., well-baby nurseries or labor and delivery wards) will have lower facility-level antibiotic use rates.
- AU rate estimates from this study are substantially lower than DASON hospital AU rates due to key differences in method of denominator calculation, hospital types, and geography.
- As more facilities enroll in the NHSN AU Option, the SAAR will become a more meaningful tool for hospital comparisons and identifying opportunities to improve antibiotic stewardship.

References

1. Stenehjem E, Hersh AL, Sheng X, et al. Antibiotic Use in Small Community Hospitals. *Clin Infect Dis.* 2016.
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6. Pollack LA, Srinivasan A. Core elements of hospital antibiotic stewardship programs from the Centers for Disease Control and Prevention. *Clin Infect Dis.* 2014;59 Suppl 3:S97-100.

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- Be on the lookout for your annual benchmark report during the first quarter of 2017!
- Please be sure to sign up for the upcoming DASON webinar on **Stewardship Challenges: Skin and Soft Tissue Infections**
  - Thursday, December 8, 12:30-1:30 pm
- Mark Your Calendars!!! Our next webinar will be on **Urinary Tract Infections** and is scheduled for February 2 and February 9.