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Concise Communication

Antimicrobial utilization data: Does point prevalence data correlate with defined daily doses?

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Abstract

We correlated antibiotic consumption measured by point prevalence survey with defined daily doses (DDD) across multiple hospitals. Point prevalence survey had a higher correlation (1) with monthly DDDs than annual DDDs, (2) in nonsurgical versus surgical wards, and (3) on high- versus low-utilization wards. Findings may be hospital specific due to hospital differences.

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Antimicrobial resistance and the slow development of new drugs is a significant problem, making effective antimicrobial stewardship programs a priority.[1] Antibiotic utilization is a key quantitative metric of stewardship. In particular, days of therapy (DOT) and daily defined dose (DDD) are commonly accepted and used metrics.[2] Point prevalence survey (PPS) of antibiotic use is a relatively short but resource-intensive metric used for cross-facility comparison[3] in worldwide projects such as the Global Point Prevalence Survey of Antimicrobial Consumption and Resistance (Global PPS).[4] To the best of our knowledge, no study has compared PPS to the well-accepted DDD or DOT in acute-care hospitals. Hence, we aimed to assess the correlation between PPS and DDD.

Methods

In this study, 5 hospitals with a total of 48 wards conducted a Global PPS in 2017: 2 tertiary-care hospitals in Hamilton, Ontario (May 17 and August 1, 2017, respectively), and 3 hospitals in Montreal, Quebec (June 6, 2017).[4] We included a wide range of services such as medicine, surgery, intensive care, bone marrow transplantation, and solid organ transplantation. Emergency room and pediatric units were excluded.

Global PPS entails collection of data on a given day for all hospitalized patients on systemic anti-infectives: antifungal, antiviral, and antibacterial with the exception of nystatin and sulfasalazine. We calculated the point prevalence by dividing the number of patients on any anti-infective by the number of patients on a specific ward. The proportion calculated can be >1.0 if the average patient received >1 anti-infective. Dispensed antibiotics in DDD per 1,000 patient days were routinely collected at all sites using standard definitions and analyzed in monthly and annual groups.[5]

Using the 48 wards as the unit of observation and with Pearson's correlation (Microsoft Excel 2016, Redmond, WA), we assessed the association between the proportion of patients on antibiotics on the day of the PPS and the DDD per 1,000 patient days in the corresponding month of the PPS as well as the DDDs for the entire calendar year.[6] Finally, we conducted exploratory subgroup analyses based on hospital site, and type of ward. We grouped the wards into the bottom third, middle third, and highest third of utilization based on DDDs hypothesizing that wards with higher utilization have a stronger correlation due to less relative variance.

Results

Of 1,228 patients, 473 (39%) were on systemic anti-infectives across all sites (n = 138, 46%): 111 (33%) at the Hamilton sites, and 17 (27%), and 145 (44%) and 62 (35%) at the Montreal sites, respectively. The proportion of patients on anti-infectives by ward ranged from 0 to 100%. The DDD per 1,000 patient days ranged from 94.8 to 1,699.1 for the corresponding month of the PPS and from 160.6 to 1,700.8 for the annual consumption.

The correlation coefficient (R) comparing PPS to the DDD per 1,000 patient days in the month of the PPS was 0.62 (Fig. 1a). The correlation coefficient was lower (R = 0.56) than the DDD per 1,000 patient days in the calendar year of the PPS (Fig. 1b). Most outliers were surgical units. When separated into surgical and medical units, nonsurgical units correlated with an R of 0.63 for monthly and 0.57 for annual DDD, respectively, whereas surgical units had Rs of 0.57 and 0.52, respectively. The most extreme outliers were in Montreal: When surgical units were excluded at the 3 Montreal sites, the correlation coefficient was 0.29. At one of the Montreal hospitals, a surgical unit closed and surgical patients had been offloaded onto a medical unit, which likely explains this low R value. When we excluded this unit, the correlation coefficient increased to R = 0.57. The largest correlation coefficient was found at Hamilton sites in nonsurgical wards (R = 0.79). The volume of anti-infective use had a gradual effect on the correlation coefficient: Rs were 0.54

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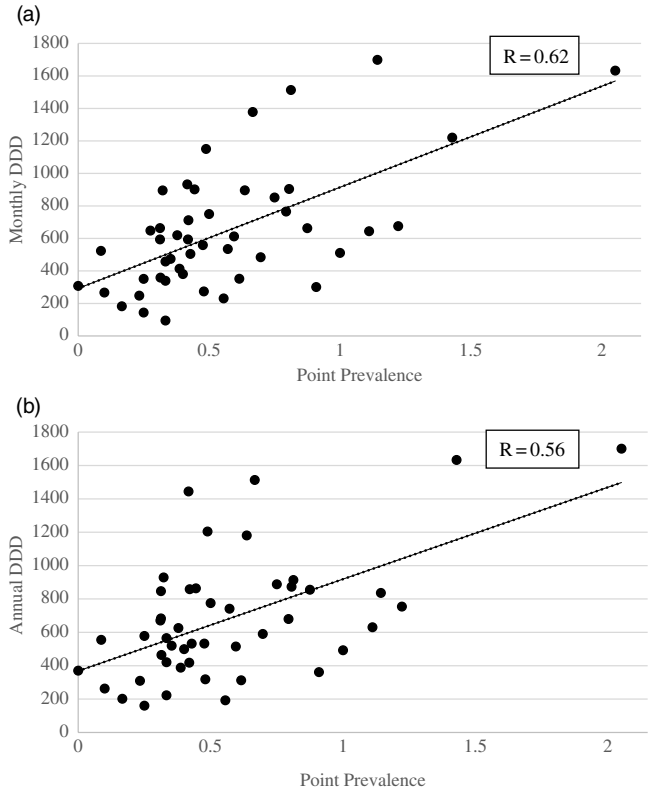

Fig. 1. (a) Overall correlation between point prevalence and defined daily doses per 1,000 patient days in the month of the point prevalence survey. (b) Overall correlation between point prevalence and defined daily doses per 1,000 patient days in the calendar year of the point prevalence survey.

annually and 0.65 monthly for the highest-usage wards; 0.40 annually and 0.48 monthly for the intermediate-usage wards; and 0.32 annually and 0.36 monthly for the lowest-usage group.

Discussion

Our study assessed the correlation between point prevalence and annual and monthly DDD per 1,000 patient days across 5 centers in 2 Canadian cities. The correlation with DDD per 1,000 patient days of the month of the PPS was stronger than the correlation between PPS and the annual DDD per 1,000 patient days. Surgical units and units with lower antibiotic utilization also showed weaker correlations.

In every analysis performed, point prevalence was more closely correlated to monthly DDD per 1,000 patient days than if compared to the annual average utilization. This highlights the variation in antibiotic utilization over 1 year, influenced by changes in patient population and seasonal trends. During the winter, a high rate of respiratory illnesses generally occurs,[7] and the volume of elective surgeries declines during summer,[8] both potentially resulting in seasonal variation in anti-infective use. Thus, PPS data from one season may not be comparable to PPS data from another facility during a different season. Also, physician practice may also influence usage; such factors include not only the accumulation of experience (eg, newly graduated and postgraduate physicians starting in July) but also physician turnover with different practices.[9]

Finally, surgical prophylaxis may vary from day to day based on surgical volume variation, which does not affect antibiotic utilization on nonsurgical wards. These factors can explain the more pronounced variation in surgical units and the higher correlation for nonsurgical versus surgical wards. Low-utilization units appear to be more prone to variation, which is illustrated by a gradient increase in the correlation coefficient from low-, to intermediate-, to high-utilization units.

Although these trends in correlation coefficient differences held true at all sites; we observed a difference in the level of correlation between Hamilton and Montreal. The higher volume of surgical patients in Montreal may explain the lower correlation coefficient at these sites. Thus, correlation may be site specific, probably driven by the aforementioned factors, which result in more variation in anti-infective use depending on patient population. Hence, the main limitation of our study is that the findings are not necessarily generalizable to any settings. However, our findings are consistent with another similar study we are aware of, which showed a correlation in nursing homes between DOT and weekly PPS. In our study, the latter was less prone to seasonal variation than a single PPS.[10]

Our data suggest that correlation between PPS and DDD per 1,000 patient days (1) is affected by seasonal variation in anti-infective use, (2) is stronger on nonsurgical units, and (3) can vary by site. These findings are important when interpreting the data and when using PPS data for interfacility comparison. Larger-scale studies are needed.

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