

LETTERS TO THE EDITOR

Education-Based Intervention to Prevent Catheter-Associated Bloodstream Infection

TO THE EDITOR—In their recent article, Warren and colleagues¹ have described a multicenter, education-based intervention to prevent catheter-associated blood stream infections. We are concerned that the conclusions may not be warranted given the way the data were presented and analyzed.

The authors conceded that the preintervention-postintervention design may be limited because of other unmeasured factors that may have accounted for the changes in outcome. Use of this type of study is reasonable in circumstances in which randomization is not possible,² but the data presentation and analysis were not optimal in this study. Data in each time period were aggregated, which does not allow an assessment of the natural history of the outcomes, particularly in the preintervention period. For example, rates of catheter-related blood stream infections may have been decreasing anyway because of some other factor, and the intervention may have been coincidental in this decline. Analysis using segmented regression of interrupted time series, which gives an indication of whether there is a difference in the preintervention and postintervention slopes of the outcome, may have provided more information.³ Graphic representation of the rates or proportions of each outcome per time period (for example, month or quarter) or an analysis for trend would have allowed the reader to assess the pattern of the outcome before and after the intervention. Figure 1 in the article by Warren et al.¹ presents data per time period for the postintervention period. The fact that the reduction in catheter-associated blood stream infections was not significant until later in the postintervention phase may have reflected the time it took to change healthcare workers' behavior, as suggested by the authors, but may also have reflected a natural fluctuation of rates. A similar breakdown of rates in the preintervention period may have helped to assess this. It is not clear in the Methods section whether any of the intervention went beyond the initial 3 month period or whether this was merely the time required for its full implementation.

We are also concerned about the correlation presented in Figure 2 in the article by Warren et al.¹ Was it repeated without the outliers? In addition, there seems to have been no adjustment made for other factors that may have influenced these correlations. For example, was the proportion of healthcare workers who completed the self-study module associated with the level of perceived degree of support?

We understand that studies such as these are difficult to undertake and very labor intensive, but we believe that ap-

propriate data analysis is crucial to ensure that results are meaningful and useful to the reader.

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Reply to Marshall and Black

TO THE EDITOR—We appreciate the comments of Marshall and Black¹ regarding the presentation of data in our recent article. There are several reasons the data were displayed in this format. Displaying all of the individual study units' rates over time resulted in an uninterpretable figure, hence Figure 1 in the article² summarizes the data within the space limitations. The format highlights our observation of a lag between the beginning of the intervention and a decrease in rates. To address the concern that the infection rate may have been already decreasing in the preintervention period, and that the intervention was coincidental with that decrease, we offer here an alternative graph that shows the overall monthly rate of catheter-associated bloodstream infection for all of the units (Figure). From this graph, it can be seen that the overall catheter-associated bloodstream infection rate for the study units was not decreasing prior to the beginning of the intervention. It can also be noted that the rate appeared to be increasing slightly during the last 3 months of the post-