INTRODUCTION
Needlefree connectors (NC) have been implicated as a source of catheter-related bloodstream infection (CRBSI). Primary risk factors are attributed to differences in connector type, design, assembly, device management, and frequency of connector exchange. The 2011 CDC Guidelines for the Prevention of Intravascular Catheter-Related Infections advise to exchange needlefree connectors no more than 72 hours after insertion. The recommendation, little evidence exists to address this issue.

Constant exposure of the external surfaces of access sites to the patients’ skin and environmental contamination requires scrutiny of the NC septum with a disinfectant prior to access.1 Equally important is the disinfection of the internal lumen and external threads of the catheter hub. Until recently, effective technology designed specifically for this purpose was lacking. In addition, compliance with disinfection protocols by clinicians has been poor.

In the absence of effective disinfection, significant differences in bacterial transfer rate among the various NC designs have been observed2. The connector and catheter assembly provides a continuous internal flow path with direct access to the bloodstream. Microorganisms entering the system are either flushed through the catheter (Problem 1) or attach to the intraluminal components during infusion or locking. Attached microorganisms can transform the connector into a biofilm (Problem 2) that eventually disperses planktonic bacteria that are then flushed into the bloodstream (Problem 3). The contribution of biofilm formation in connector vs. the hub, vs. the catheter lumen is unknown.

The current CDC recommendation (Category II) states that a split septum valve may be preferred over some mechanical valves due to increased infection risk with the mechanical valves.1 This recommendation is based on a particular design feature but can this feature be used to predict infection risk with vascular access devices?

METHODS
The purpose of this study was to compare six needlefree connectors with respect to the transfer of bacteria through the connector-catheter system and to compare biofilm formation within the connectors, catheter hub and catheter lumen.

RESULTS
Research Question: Is there a difference among the connectors in biofilm formation through the catheter lumen?

The mean log density of bacteria in the hub was significantly smaller for MicroClave compared to any other connector except for ClearLink (Figure 5).

Clinical relevance: The risk of bacterial biofilm formation on the hub of the connector may be dependent on the type of connector used. The MicroClave had a significantly lower bacterial transfer rate than all other connectors.

Research Question: Can biofilm formation within the connector, catheter hub or catheter lumen predict the bacterial transfer rate into the bloodstream?

The log density of bacteria in the connector was the only significant predictor of the log density of bacteria in the flush (p=0.038).

Clinical relevance: This question addresses Problem 3 in intraluminal pathogenesis: planktonic bacteria shed from the biofilm are flushed into the bloodstream with infusion. Given that the connector is the best predictor of the bacterial burden flushed into the bloodstream, the choice of connector becomes a critical decision point in the prevention of catheter-related bloodstream infection. It also points to the importance of frequency of exchange of the connector to prevent hub and catheter lumen biofilm formation.

CONCLUSIONS
• The risk of transfer of bacteria from a contaminated connector surface through the hub and catheter lumen and into the bloodstream is dependent on the type of connector used. The MicroClave had a significantly lower bacterial transfer rate than all other connectors.
• Biofilm formation in the hub and internal lumen can result from bacteria transferred through a needleless connector.
• Biofilm formation within the connector is the best predictor of the number of bacteria flushed into the bloodstream.
• The frequency of connector exchange may be dependent on the bacterial transfer potential of each design.
• The common classification of split septum and mechanical valve is an oversimplification and an unreliable approach for device selection based on infection risk.

REFERENCES