Needleless connector UV-C disinfecting device

Overview
Contamination is a problem often encountered with IV connector sets. Moreover, the lack of a consistent disinfecting procedure when using these tubes exacerbates this serious issue. B. Braun Medical wishes to develop a device to better disinfect the IV sets using UV-C radiation, thereby establishing a consistent method to avoid the problem of opportunistic infections and contamination. This method will also avoid the mistakes and variability that arise from human factors.

Objectives
Our objective was to design and build a device that used UV-C light to disinfect needleless connectors effectively and quickly, achieving a 4-log reduction in bacterial growth in less than 30 seconds.

Approach
- Customer needs were identified by speaking to our sponsor and nurses at Mount Nittany Medical Center.
- We reviewed existing patents to ensure our device avoided patent infringement.
- Based on these needs, we developed 6 possible device designs.
- We used concept scoring matrices to select our final design to be pursued.
- We video conferenced with our sponsor weekly to ensure we remained on track with the project.
- We developed alpha, and beta prototypes prior to our final design. Rapid prototyping was used to manufacture all 3 device iterations.
- Heat simulation in COMSOL was used to ensure the UV-C LEDs did not pose a danger to the user, casing, or electronics.
- 3 rounds of bacterial testing were performed to examine the effectiveness of the LEDs in disinfecting the needleless connectors.
- In one instance, we achieved a 2-log (99%) reduction in bacterial growth on the connectors.

Outcomes
- Our device validates the concept of using UV-C disinfection to decontaminate needleless connectors.
- The UV-C LEDs used must be modified by the manufacturer to ensure they remain on at a consistent power while connected.