

Using wasted time: How a portable culture device can reduce the impact of transportation times in antimicrobial susceptibility testing

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Background

Timely antimicrobial therapy is paramount to improve sepsis patient outcomes and reduce costs. Extremely resistant Gram-negative species are strongly associated with mortality^{1,2}. It is recommended that patients receive antibiotic treatment within one hour of admission³. Transportation time is the main factor that delays the detection of bacterial pathogens in blood cultures⁴. Figure 1 shows time until the blood samples were loaded in incubation cabinets from sampling, in a hub and spoke hospital system in Scandinavia.

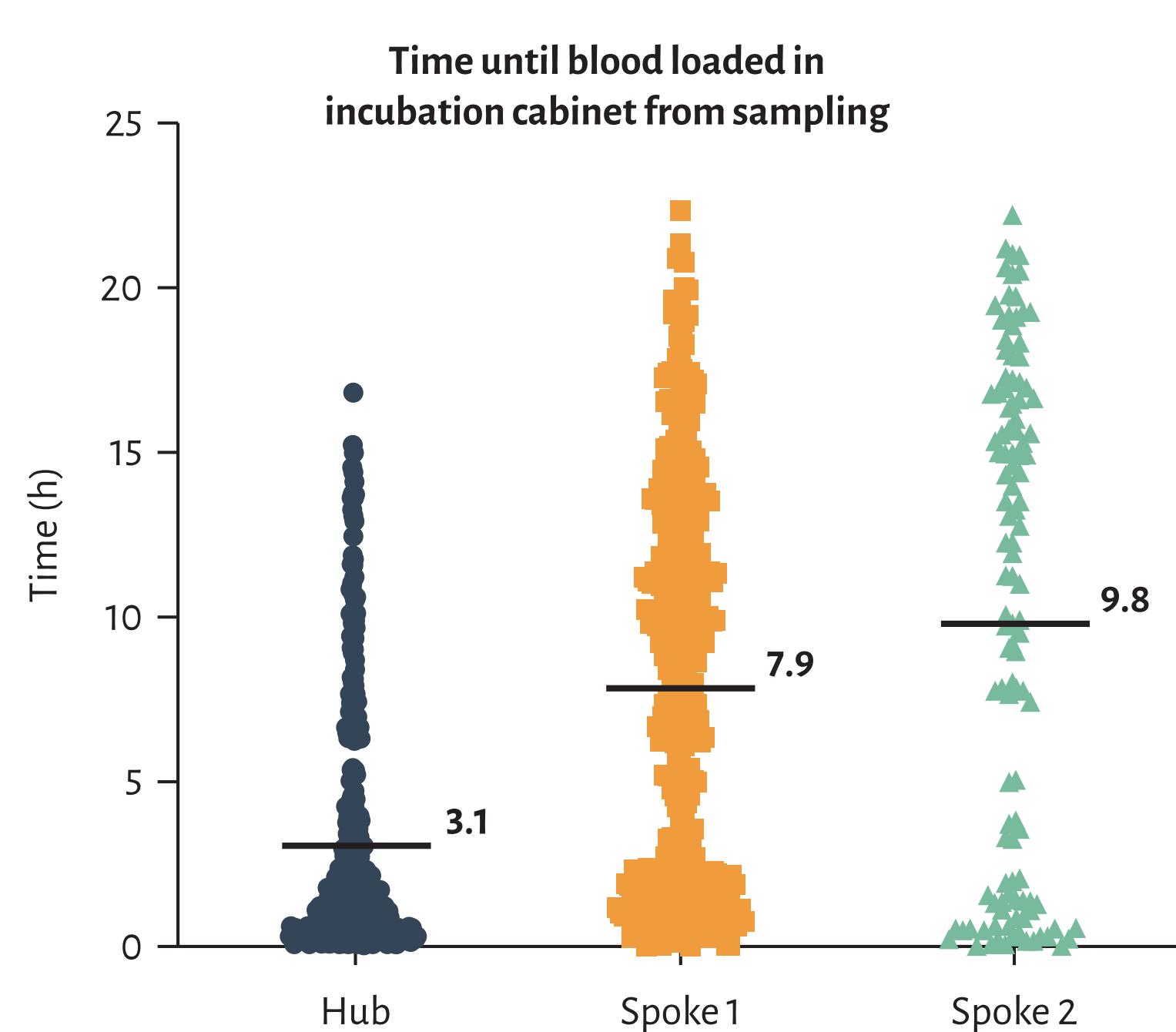


Fig 1. Data showing time until blood loaded in incubation cabinet from sampling for a hub and spoke hospital system. Average time was 3 hours for the hub hospital, and 8 and 10 hours for the two spoke hospitals. 43% of all samples had a sampling-to-load time greater than 6 hours, and 28% of all samples had a sampling-to-load time greater than 10 hours. 2 hours was removed from the values to represent order to sampling time.

Materials and methods

Benchmarking was performed against BACT/ALERT[®]3D[®] and with immediate loading following inoculation and delayed entry testing was performed to reflect delays caused by transportation time against BACT/ALERT VIRTUO[®]. The total time to positivity (tTTP), the time between inoculation of bottles and positivity was examined. In this study, BACT/ALERT FAN[®] PLUS bottles were inoculated with common sepsis-causing pathogens at clinically relevant inoculum and 9 ml of human blood. Bottles were loaded with no delay in Podler and BACT/ALERT 3D upon inoculation. For BACT/ALERT VIRTUO, inoculated bottles were stored at 20°C to 23°C for 6 hours or 10 hours before loading. Delays in loading were used to simulate the transportation time.

References

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Podler[®] – the world's first portable blood culture device

Podler is a portable culture device (PCD), capable of incubation, agitation, and continuous detection of bacteria in blood samples, developed by Q-linea. The device is currently in the prototype stage of development. With the use of Podler, incubation can begin immediately following blood draw. Podler utilises wasted transportation time to be used incubating the sample, therefore reducing the time taken for a result. The Podler Unit is shown to the right.

The workflow of Podler versus standard of care is shown in Figure 2.

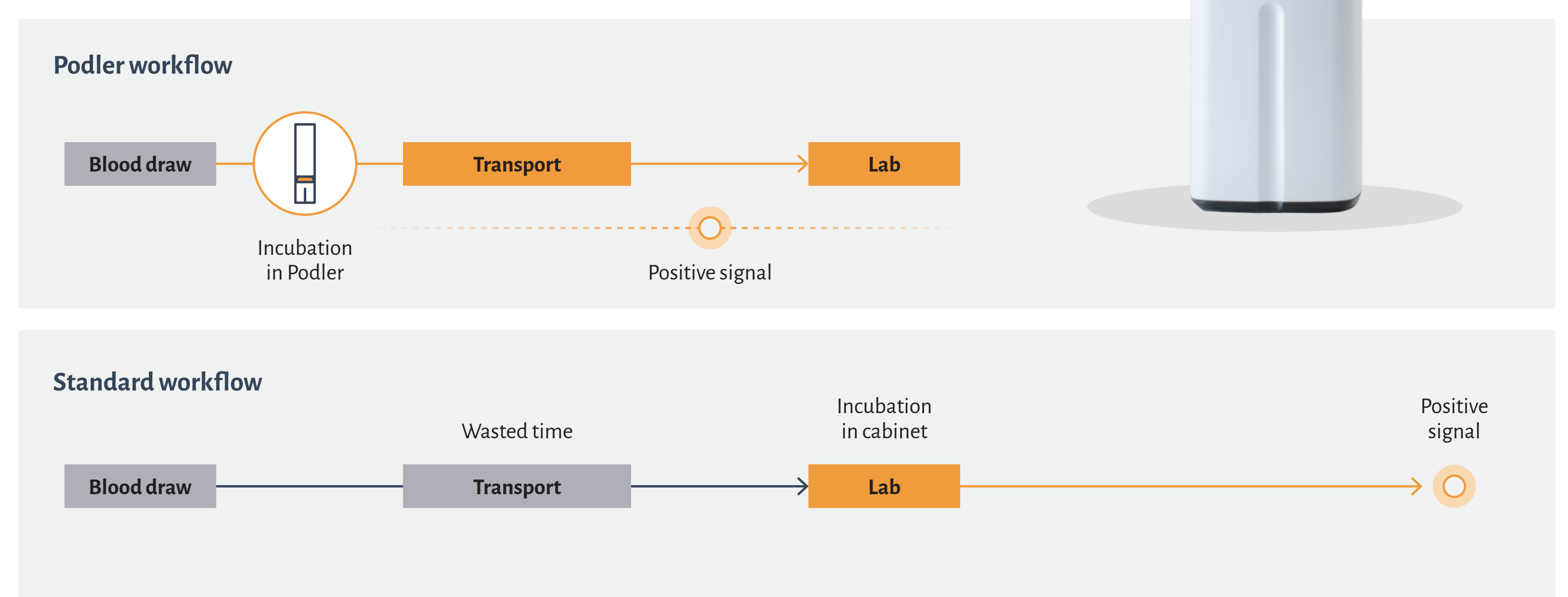


Fig 2. Podler vs standard of practice workflow.

Results

Benchmarking showed a set of Gram-negative and Gram-positive bacteria had on-par tTTP in the Podler compared with BACT/ALERT 3D. With a 6-hour delayed entry in BACT/ALERT VIRTUO, Podler demonstrated lower tTTP, signalling positive more than 3 hours earlier. At 10-hour delayed entry in BACT/ALERT VIRTUO, Podler had a tTTP of more than 6 hours faster. Results for delayed entry in VIRTUO are shown in Figure 3.

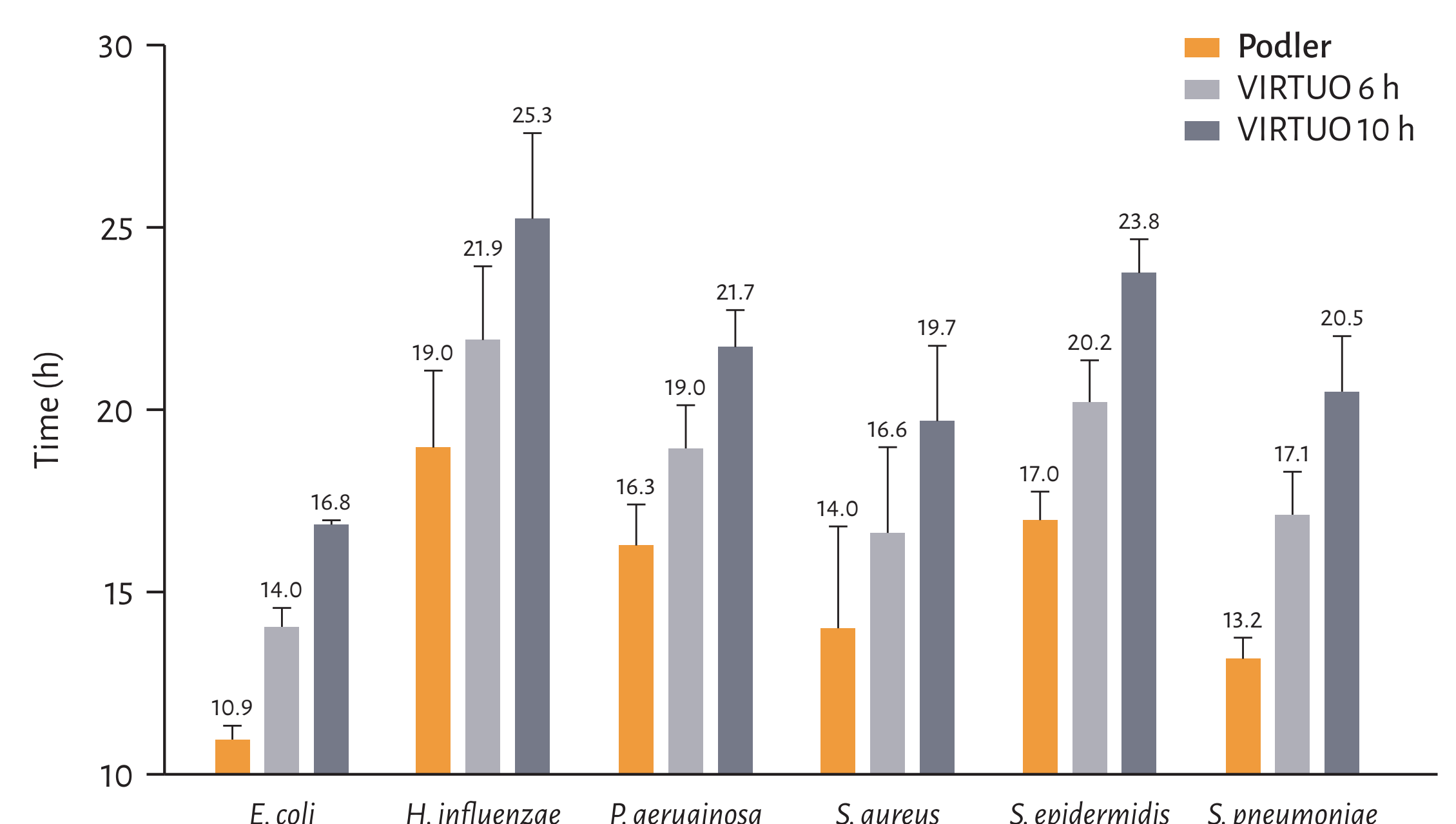


Fig 3. The effect of delayed entry on total time to positivity (tTTP) of six clinical pathogens. Blood cultures were directly incubated in Podler after inoculation or incubated in the VIRTUO cabinet with a delay of either 6 hours (VIRTUO 6h) or 10 hours (VIRTUO 10h). Flasks were stored in room temperature (20°C to 23°C) prior to incubation in the VIRTUO. Error bars represent standard deviation, a total of 192 flasks were included (n= 8 per pathogen and condition).

Conclusion

A long tTTP increases the time for patients to be administered optimal therapy. Transportation time has a major impact on tTTP. Podler had faster tTTP compared to BACT/ALERT VIRTUO when utilising a delayed entry to simulate transportation time, and on-par results for a set of bacteria with immediate loading. Reducing TTP has been shown to improve the clinical outcome of patients. Podler from Q-linea has the potential to reduce the negative impact of transportation time on tTTP and improve clinical outcomes.