Abstract

Hospital in the home (HITH) refers to the provision of hospital healthcare services at the patient's home. The benefits of HITH include higher patient satisfaction, reduced nosocomial infections, improved cost effectiveness and increased hospital bed availability. HITH therapies include parenteral nutrition, palliative care, immunoglobulin therapy, chemotherapy and outpatient parenteral antimicrobial therapy (OPAT). The latter involves the administration of intravenous antimicrobials via an ambulatory infusion pump, which may be electronic or elastomeric. Electronic pumps have adjustable flow rate and volume and include additional safety features such as alarms, while elastomeric pumps are lightweight, silent, easy to operate and maintenance free and have fewer risks than electronic pumps because they are non-electrical. Given their advantages, elastomeric pumps are the most commonly used pumps for OPAT. However, they suffer from a fixed flow rate and volume and a lack of in-built safety features such as a flow sensor and alarm.

The aim of this thesis is to understand the problems related to the infusion pumps used in HITH services by studying pump performance and related adverse events. A review of the literature highlighted that research on adverse events related to infusion pumps is lacking. Therefore, we audited the case notes of adult and paediatric patients receiving OPAT at home and found that incomplete infusions are common. The flow rate of elastomeric infusion pumps has previously been examined in the laboratory setting only. Therefore, we conducted a clinical trial to investigate the performance of these pumps in a real-world setting. A flow sensor was used to measure the flow rate of the elastomeric pump and temperature of the fluid, and a temperature sensor was used to measure the skin temperature. A data logger was designed to measure and store the flow rate and temperature readings. Six patients were included in the trial and each patient used one of two different pumps (MobiFUSER or Surefuser). The results demonstrate that pump flow rates were consistently lower than the rate stated by both manufacturers and the relevant international standard, leading to incomplete emptying after 24 hours. As recommended by the manufacturer, some factors can affect the performance of the elastomeric pump, such as height difference between the pump and the restrictor and ambient temperature. Even after accounting for these factors, all six pumps' flow rates were still outside the tolerance levels. In addition to these factors, past studies have shown that the viscosity of the drug and the central venous pressure can affect the performance of the elastomeric pumps. Pump

manufacturers need to consider these factors when calibrating the pumps. Incorporating a flow sensor and alarm system to the elastomeric pumps as an attachment could be helpful in detecting the low flow and alert the clinicians and patients. Meanwhile, HITH and OPAT providers and clinicians should think about ways to improve the service. Proper patient education and training, creating guidelines and checklist, close monitoring and reporting, conducting regular audit, having feedback from patients may help to optimise the service and to overcome some of the issues identified.