Title of project

Simulation Training Program for Extracorporeal Membrane Oxygenation

Supervising team

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Background

Extracorporeal membrane oxygenation (ECMO) is an artificial heart-lung device which can support patients with severe cardiopulmonary failure when all traditional medical therapies have been exhausted. ECMO is a complex therapy involving a high level of decision-making skill and requiring an intimate understanding of the interactions between the device and different underlying patient physiologies. Skilful ongoing management of ECMO patients is important as ECMO treatment typically lasts around seven days, and continual one-to-one monitoring is required to ensure good patient outcomes and swift diagnosis of complications. Therefore, clinicians who provide ECMO treatment require a high level of initial training as well as ongoing training for skills retention for both the initiation and management of ECMO.

The Alfred Hospital is the largest adult ECMO centre in Australia and currently uses several methods of clinical training related to the initiation of ECMO therapy including ECMO team practice runs on a mannequin in the ICU and two-person simulations in a controlled simulation lab. These employed approaches primarily focus on ECMO initiation and do not give adequate training in the ongoing management of ECMO patients or the diagnosis of complications. Therefore, a training suite which can mimic established ECMO patients and simulate various complications in a clinically relevant manner would be a useful clinical tool.

This project outlines the clinical need for an ECMO training tool focusing on the management of ECMO patients and diagnosis of complications. Such a tool will supplement the training of new ECMO clinicians and improve skills retention at the Alfred Hospital and beyond. Alfred Hospital is a major ECMO training centre, training ECMO clinicians both nationally and internationally; therefore, successful outcomes from this project may be translated nationally and internationally and form the basis of a commercial product.

Short description of project

This project forms an important part of an extensive ECMO training suite being developed by Monash researchers and funded by Monash Institute of Medical Engineering. Previous work on the project has been done through the Monas HISS project which has produced an “interactive textbook” prototype. The interactive textbook contains several features including a *fully realised numerical model of the cardiovascular system,* a *scenario library* which allows

the simulation of various different patient adverse events at various difficulties, and an *examiner interface* which allows remote invigilation and examination through the software via Monash's existing eVigilation software. Currently, these features exist in separate solutions and the student's job would be to create a new integrated solution, leveraging the work done through the HISS program and the existing technologies in the Monash software environment (eVigilation and Moodle). This work will require a significant amount of algorithmic coding to properly integrate the cardiovascular simulator into the new solution and will nominally be developed in Unity. The student would benefit from having an interest or existing strength in mathematics and would benefit from some experience with the MATLAB/Simulink environment from which the prototype is currently embedded.

During this project, students will have the opportunity to work in a multidisciplinary cardio-respiratory research lab located at the Baker Heart and Diabetes Institute, at the Alfred hospital. The students will have access to clinicians from the Alfred hospital as well as Engineers from Monash for technical support. Because it is a simple software suite, the outcomes from this project may be translated in a short timeframe and distributed quickly throughout the Alfred hospital and beyond, with the potential to provide a significant improvement in ECMO training outcomes and therefore patient survival.