9th Annual MDDC Awards for Excellence in Biomedical Engineering Student Design & Innovation

Special Award for Need-Oriented Innovation in Medical Technology Award:

Need-Oriented Innovation ($10,000)

The MDDC awards competition welcomes all submissions according to the criteria given on the website https://mddc.org/ . In addition, for the 2022-2023 year, the MDDC has established this special award, with a $10,000 no-strings cash prize, for an innovation that meets an identified and unmet need in health and wellness. "No strings" means that all intellectual property and rights will remain with the entrants. Entrants will be expected to demonstrate a working prototype at the time of the finalist competition. Entrants in the Need-Orientated Innovation will also be considered within the other, general MDDC Awards.

The unmet need categories for the 2022-2023 year are given below. A solution in each area may have substantial healthcare and economic benefits and should have follow-on investment potential. Entrants may choose any of the following identified categories. Entries outside these categories, or entries that are not at a stage where a working prototype cannot be demonstrated, will not be considered for this Special Award (but will of course be eligible for consideration under the traditional criteria).

Entrants for the “Need Orientated Award” ($10,000) are also eligible the “Design & Innovation Awards” of Principal Award ($5,000), Innovation Award ($2,500), Distinction Award ($1,500).

1. **Cuffless blood pressure monitor, suitable for incorporation into a wearable and/or smartwatch**

   There is a high-priority unmet need for a cuffless blood pressure monitor that can be integrated into a wearable or smartwatch or eye-based apparatus. The measurements must be reasonably accurate relative to central BP measurements; current approaches such as those that make use of pulse wave transit time (PWTT) must be calibrated initially with a cuff-based system. A bonus goal would be to provide a cuffless device that can measure blood pressure during sleep, and an even bigger bonus goal would be to provide a device that can continuously monitor blood pressure. An example of a creative approach can be seen by visiting veyetals.com. Measurement of central blood pressure, (the pressure within the aorta) versus peripheral blood pressure (blood pressure in the arm or leg) is the optimum target.

2. **Alert system for personal distress and fall detection, suitable for overcoming the serious limitations of currently offered pendant solutions**

   Seniors living alone are at risk from falls, injuries, or other undetected distress. Current PERS (Personal Emergency Response Systems) require the wearing of a pendant or other device, which is not well accepted by seniors. There is a need for an unobtrusive, non-invasive and ubiquitous means for monitoring the homes of seniors to detect distress that does not require the senior to remember to wear a device, recharge it, or otherwise take positive action. An ideal solution will reliably detect and report distress, both automatically under appropriate conditions, and on demand when desired by the senior.

3. **Robotic system for substantially reducing staff injuries and ergonomic problems associated with performing shoulder ultrasound examinations**

   Sonographers suffer form a high rate of work-related repetitive strain injuries because the ultrasound transducer has to be held against the patient in positions that are often taxing for the user.

   Tele-ultrasound with robot assistance has been proposed in the past and demonstrated to be effective in several patient studies. However, there are difficulties in setting up and operating such a system, as it requires both a "console" and a "patient-side manipulator" or PSM.

   New robotic technology allows a more collaborative approach to PSM design and operation, opening up the possibility of the sonographer directly maneuvering the robot-held transducer, in a collaborative approach, with the PSM as a cobot.

   The design of such a cobot system may provide benefits to sonographers, patients and the healthcare system. In particular, there is a high incidence of injury for shoulder scans, and this may be a first application to be considered.

Details and reference to robot-assisted ultrasound can be found at https://ieeexplore.ieee.org/abstract/document/9756910

4. **Improving efficiencies of medical staff and health care workers to reduce costs.** Efficient healthcare delivery is top of mind to all healthcare administrators and innovation in their parlance is not introducing a new implantable device or cure for a disease, it is finding efficiencies, and avoidance of patient harm. These can be analogous to Lean Engineering practices. Recent award-winning innovations in Canadian healthcare include digitization of influenza vaccination clinics, improvement of cybersecurity for IOT devices, methods to shorten room cleaning time between procedures and a reusable N95 mask.

   Other examples (listed here to provide the scope of possibilities but not intended to be comprehensive) include:

   a. Developing methods to reduce hospitalization related infection. This can happen by changing the handling of catheters or tubes, documentation techniques, changes in how patients are housed or moved, ,etc.
   b. Reducing hospital waste or more efficient means of disposing of hospital packaging or
   c. Any innovation or process that improves nursing productivity.

   Healthcare administrators are now the gatekeepers of introduction of new ideas and innovations which solve their problems. These innovations are more likely to have a timely reception and can make immediate and significant improvements in patient welfare.