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Wearable Respiratory Sensor for the Detection of Opioid-Induced Respiratory Depression

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How It Works

RESPMETER is a wireless biosensor worn on the chest that monitors breathing and detects when the wearer is experiencing opioid-induced respiratory depression.[1] The manufacturer states that RESPMETER is 1 of the smallest biosensors available, but it is unclear, based on the information available, what the dimensions of the device are.[2] The device monitors and analyzes the respiratory patterns of the wearer and when it detects opioid-induced respiratory depression, an alert is sent to designated first responders who can then intervene and administer naloxone.[1] The device can transmit data to a real-time monitoring platform using a smartphone.[2] This platform uses artificial intelligence to detect and be alerted to breathing problems.[2]

Who Might Benefit?

Opioids are potent respiratory depressants and overdose resulting in respiratory depression is a leading cause of death among people who use opioids.[3] Opioid use disorder is a chronic, relapsing condition that has been a major contributor to the increase in opioid-related morbidity and mortality in Canada.[4] There were 1,705 apparent opioid toxicity deaths in Canada between July and September 2020.[5] This is a 120% increase in the number of apparent opioid toxicity deaths during the same time frame in 2019 (776 deaths).[5] Most apparent opioid toxicity deaths in 2020 (January to September) occurred among males and those aged 20 to 49 years.[5] People with opioid dependence are the most likely to experience an overdose.[3] Due to lowered tolerance, people who use opioids are at an increased risk of overdose following a period of abstinence from opioids (e.g., following detoxification, cessation of drug dependence treatment, release from incarceration).[3] Devices that detect opioid-induced respiratory depression could be of benefit to people who use opioids during these high-risk periods.

In Canada, there was a 74% increase in apparent opioid toxicity deaths in the 6 months following the implementation of COVID-19 prevention measures (April to September 2020; 3,351 deaths) compared to the prior 6 months (October 2019 to March 2020; 1,923 deaths).[5] Factors that may have contributed to this increase in overdose deaths include the increasingly toxic drug supply; increased feelings of isolation, stress, and anxiety; and limited availability or accessibility of services for people who use drugs.[5]

Availability in Canada

RESPMETER received FDA breakthrough device status in 2020 but is not yet approved by the FDA.[1] The device is not currently approved for use in Canada. It is not clear, at the time of publication, when and if the manufacturer intends on entering the Canadian market.

What Does It Cost?

Information on the cost of RESPMETER was not found. It is unknown whether device users or the health care system will cover the cost of the device. The device may require the use of a smartphone, which would be a cost incurred by the device user. There could be additional costs to the health care system because of first responders who intervene after receiving an alert from the device.

Current Practice

The 2018 Canadian Research Initiative in Substance Misuse (or CRISM) guidelines recommend opioid agonist treatment (e.g., buprenorphine-naloxone, methadone) as the first- and second-line treatment options for opioid use disorder.[4] Withdrawal management alone is not recommended, as it has been associated with an increased risk of relapse and overdose death.[4] As part of standard care for opioid use disorder, the guidelines recommend that information and referrals to take-home naloxone programs and other harms reduction services should be routinely provided.[4] Current harms reduction strategies do not include devices that monitor for overdose. Devices that detect opioid-induced respiratory depression such as RESPMETER would represent a novel addition to harms reduction interventions for opioid use disorder in Canada.

For the treatment of opioid overdose, WHO recommends the administration of naloxone, which is an opioid antagonist that can rapidly reverse the effects of opioids within minutes.[3] In addition to naloxone, airway management and assisting resuscitation (e.g., assisting ventilation and rescue breathing) are recommended for the management of opioid overdose.[3] WHO also recommends that after naloxone has been administered and the individual has been successfully resuscitated, their breathing and level of consciousness should be closely monitored until they have fully recovered.[3]

What Is the Evidence?

No published evidence for the use of RESPMETER to detect opioid-induced respiratory depression was identified.

Safety

No evidence on the safety of RESPMETER has been identified in the literature.

Issues to Consider

Devices that detect opioid-induced respiratory depression such as RESPMETER could help to prevent opioid overdose deaths by alerting first responders so that they can intervene earlier and administer naloxone. However, the willingness of people who use opioids to wear these devices is an important consideration. A patient preference study conducted in Vancouver found that among the 1,061 adults who use illicit drugs surveyed, 576 (54.1%) said they were willing to wear an overdose detection device.[6] The study found that factors that were positively associated with willingness were previous overdose, current methadone treatment, female gender, and history of chronic pain.[6] Understanding factors that impact the acceptability of wearable overdose detection devices for people who use opioids could help to ensure the uptake of these devices. Devices that are small and can be worn under clothing or that look similar to other commonly worn devices could help to limit the stigma that may be associated with wearing overdose detection devices. Another factor to consider is the requirement for access to a smartphone. Overdose detection devices that require the use of a smartphone could pose a barrier to individuals without smartphone access.

Related Developments

Automatic Antidote Delivery Device

A prototype of a minimally invasive automatic antidote delivery device for opioid overdose has been developed and tested in an animal model.[7] The device is designed to be placed under the skin and can deliver naloxone when activated by a wearable magnetic field generator.[7] The device is still in early development, but the researchers intend to conduct further studies that integrate a wireless respiratory monitor to detect overdose.[7]

RESPMETER in COVID-19 Patients

A digital platform is being developed that will be used in combination with RESPMETER to help clinicians continuously monitor and predict respiratory failure in COVID-19 patients.[8] To support the development of this platform, RESPMETER is currently being studied in a prospective study in patients with respiratory failure.[9] The aim of the study is to develop a machine-learning model that can predict clinically significant deterioration in patients.[9]

Looking Ahead

RESPMETER, or devices like it, could play a role in opioid overdose management. However, information on its effectiveness and safety for detecting opioid-induced respiratory depression is needed. Information on the cost of this device would help to determine its potential place in current practice. Further research on design features and other factors that influence the acceptability of overdose detection devices could help to ensure their uptake and identify people who are most likely to benefit from their use.

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