## **Opioid Overdose Monitoring**

The rise of misused opioids which led to overdoses has greatly increased the number of deaths in Canada since 2016. An opioid overdose occurs when an opioid user unintentionally poisons themselves. Often fatal, it is due to decreasing oxygen levels in the blood, which ultimately leads to respiratory failure. With the development of an opioid overdose detector, we hope to protect users from the fatal outcomes of overdosing. We recognize and understand that opioid users have very valid purposes for exercising the use of drugs, and therefore our aim is to create a device that can provide security and protection during times of use. We plan to accomplish these goals by minimizing the user's exposure to stigma, providing convenient day-to-day use of the device, ensuring accurate detection of an overdose, and accurately alerting a third party of the user condition and location.

The device needs to accurately detect when the oxygen concentration is below 90% and/or when the respiratory rate is less than 10 breaths per minute. When the appropriate psychological symptoms have been detected, the gadget needs to send an alert, with the precise location of the user, immediately to an ambulance or loved one so that naloxone can be administered in under 3 minutes. If the device does not accurately measure the oxygen concentration and/or respiratory rate it could either, cause a potential death due to no assistance, or send help when it is not needed which would result in mistrust. Therefore, it is very important that the measurements be accurate. Another feature that would improve this gadget, but is not essential is making it customizable for users with disorders that would affect their oxygen concentration/respiratory rate so that the alert would only be sent when it is dangerous for that specific individual.

The product must be convenient for day-to-day use. If it is difficult to use or interferes with the use of drugs, the user won't wear it. Since a pulse oximeter, *(an instrument that measures the proportion of oxygenated hemoglobin)* is usually placed on the finger to measure the concentration of oxygen in the blood which will interfere with drug use, we will have to find an alternative part of the body to measure. The device needs to be durable and have at least one day's battery life. It would be beneficial for the product to be light-weight and compact enough to be carried during the entire day.

Stigma and discrimination can cause disparity and shame for drug users. Feeling targeted, individuals may choose to isolate themselves from accessing any assistance for safe drug use. In an attempt to protect drug users from this vulnerability, the subtlety of the device is an important feature. Users are less likely to fear judgement if their personal choices on drug use are not obviously displayed to those around them.

This product cannot be intrusive. It is not practical, reliable or safe to use the arterial blood gas test method to detect the concentration of oxygen in the blood. Although that method is slightly more accurate we can not ask the user to continuously draw blood to check their oxygen concentration. The device also cannot use a needle to inject naloxone into the user. Injecting naloxone immediately would be the best way to save a

person from overdosing but if the naloxone injection failed and wasn't administered to the user and the user overdosed there would be an issue of liability.

The cost must be a significant consideration for the product to realistically reach the intended audience. The target price for this project is \$100. The majority of users are those in harm reduction or safe consumption sites, people using the drugs alone at home, or single men in the trades. The cost must be realistically based on the average budget, or it won't be effective in reaching the audience.

We have researched several products that satisfy some or all of the criteria listed above as a method of benchmarking. One prototype device found was developed by Carnegie Mellon University. Though it is still a prototype, it is in the form of a wearable smartwatch. It functions by using pulse oximetry to measure a light reflected from the user's skin back to its sensors. In the event of an overdose, the user's blood oxygen level drops. When the device has detected this to occur for up to 30 seconds, it triggers the alarms which calls for immediate assistance and also contacts the user's emergency contact. This device meets the client's needs such as the device being non-intrusive, useful when the user is alone, activates alarms to call for help, can be worn daily, measure oxygen levels, does not inhibit drug use and is discrete. Another product that was found was developed is called the Oxalert EPO device. Described as a wrist-worn, battery-powered pulse oximeter and arousal device that restores control of breathing to help in life-saving. The device detects hypoxemia(low blood oxygen) and verbally reminds the user to breathe. In the case where the patient is deaf or sedated, it gives escalating safe but arousing electrical stimuli through electrodes in contact with the user's wrist to encourage breathing or to wake up if necessary to self-medicate or get help. This device although it satisfies a number of the client's needs, it is however not small or discrete and inhibits drug use.

In conclusion, the opioid epidemic is one with an undeniable effect on our society. With the increasing number of deaths involving opioids, we aim to develop an opioid overdose monitoring device that would help reduce and control the number of deaths due to opioid overdose. This durable device, which would be convenient for daily use, would accurately, measure the appropriate physiological factors, and notify first respondents while minimizing the user exposition to stigma. In addition, we plan to make sure the device isn't intrusive and accurately signals the user location to a third- party. We recognize and understand that users have valid purposes, as a result, our goal is to provide security and protection during times of use.

Problem Statement: Design a product that accurately detects when a person is overdosing and sends an alert for help and the location of the user in under three minutes so that naloxone can be administered. The device must be discreet, have one day's battery life, not interfere with drug use .

## References

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