

# Smart Pharmaceutical Solutions to Prevent Misuse And Abuse of Prescription Drugs

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## PROBLEM

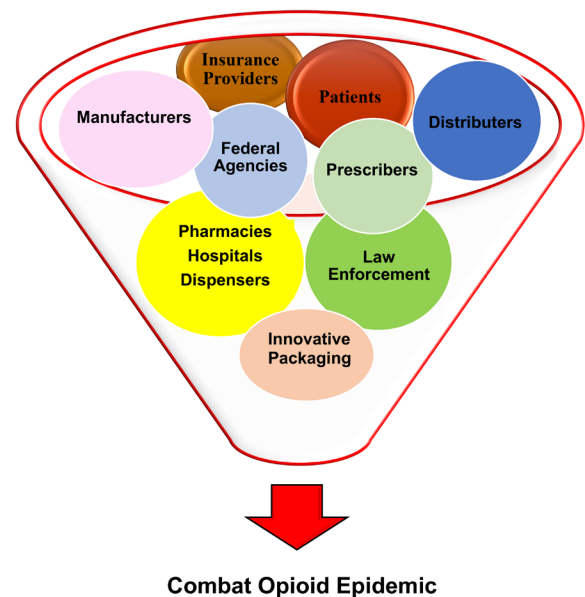


The misuse and abuse of prescription drugs such as opioids has developed into a serious national concern. Based on preliminary data published from the Centers for Disease Control and Prevention, more than 72,000 people in the U.S. have died from opioid (prescription pain medications, heroin, and illicitly manufactured fentanyl) overdoses in 2017. This represents nearly 200 fatalities per day and marks the worst year ever for overdose deaths in the U.S. Comprehensive solutions which consider the multifaceted nature of the problem must be developed to address this growing national crisis.

## OVERVIEW

Prescription drug misuse can be defined as seeking prescriptions from multiple prescribers, forging prescriptions, a preoccupation with obtaining more opioids despite evidence of adequate analgesia of pain, unsanctioned dose escalations, taking opioids from relatives or friends, and manipulating available prescribed drug packages.

Packaging, storage, and disposal solutions are part of a multi-layered approach aimed at enhancing the safety of legally prescribed opioids by preventing or deterring misuse. Smart solutions can: (1) make it easier to track the number of doses taken by the patient; (2) improve safe storage and thus reduce available supply to and risk of third-party access to the package; and (3) allow physicians and pharmacists to monitor the patient's use of the prescription drugs.



## CONTACT

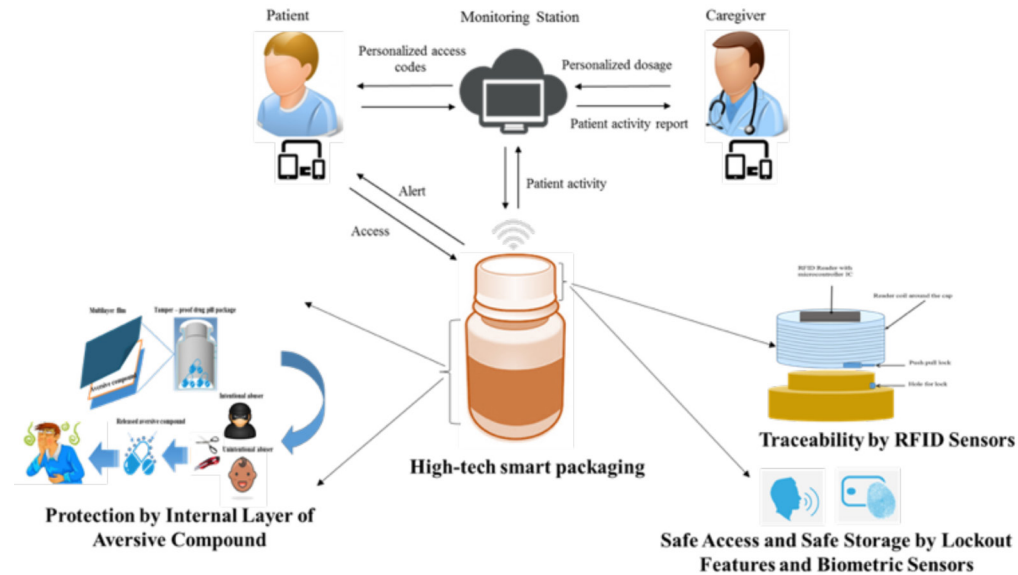
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## MORE INFORMATION

To learn more about Dr. Aliakbarian's research, visit her website at [www.broad.msu.edu/facultystaff/bahara/](http://www.broad.msu.edu/facultystaff/bahara/)

## APPROACH

**Smart Pill Package:** The goal of this project is to develop a cost-effective, smart packaging solution to reduce prescription drug abuse and misuse. We will integrate low-cost Radio Frequency Identification (RFID) and biometric authentication (fingerprint/voice) sensors into the cap of the pill bottle. This allows traceability and personalization. We will also integrate an internal protective layer that includes a natural compound with a disgusting flavor in the body of the pill bottle. If someone punctures the bottle to access pills, the protective layer will burst and the unpleasant compound will be released onto the pills. We will test the prototype clinically to evaluate safe and effective use, acceptance and usability by end users (e.g., patient, third party). The proposed solution offers traceability plus additional layers of protection in the form of two-factor authentication and use of an aversive compound. Such a multi-factor solution can be used not only in combatting the opioid epidemic, but could be expanded to other prescription drugs.



**Smart Traceable Pills:** The goal of this project is to develop a new generation of smart pill technology to track ingestion of medication and detect physiological metrics with the aim of rapid sharing of data with caregivers. To this end, we will develop miniaturized, digestible and cost-effective radio-frequency identification (RFID) sensors to be incorporated into pill medications. The ingestible sensors will be activated by gastric fluids and communicate unique identifying signatures to the body surface. This system will allow traceability, detect the realtime amount of ingested medicine, and alert healthcare providers in the case of abuse or overdose. The effective communication system will assist pharmacists and other caregivers to remotely monitor patients' drug intake behavior and to promote action in the case of overdosing.

## IMPACT

This research brings together a team of experts from US-based and international institutes in the fields of chemical, electrical and mechanical engineering; computer science; human medicine; pharmacology; and supply chain management. We will develop a next generation prescription monitoring system with enhanced supply chain item-level traceability. This research has the potential to prevent drug counterfeiting, diversion, abuse and theft. Research outcomes will impact multiple industries and organizations across the

extended pharmaceutical value chain including the lives of caregivers and patients.

