

GrindCap Medication Disposal System

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The misuse and abuse of prescription drugs is an increasingly prevalent problem in the United States, and reported overdoses and deaths have sharply risen in the past five years. Opioids are one class of prescribed medication that has seen a large increase in abuse. Due to the strength of their effect and addictive nature many people misuse them or experiment with stronger substitutes, most notably heroin. This recent trend in prescription opioid abuse presents a heavy economic burden for American society. Total US societal costs of prescription opioid abuse were estimated at \$55.7 billion in 2007. This burden has steadily increased since 2007, and shows no signs of slowing down. In fact, a recent report found that 16,917 deaths were caused by prescription opioids in 2011, an increase of 2% from the previous year. Two of the three most commonly prescribed drugs are the opiates hydrocodone and oxycodone. Since many people don't finish these prescriptions, the drugs are often left in medicine cabinets or other easy access places rather than being properly disposed of. National surveys have shown that about 60% of recreational pain killer users get their painkillers from family or friends who have a prescription, while only 17% of recreational users obtain their drugs directly from a physician's prescription. Appropriate drug disposal would go a long way towards alleviating opioid abuse in the United States. Of the methods currently available for drug disposal, most are insufficient for preventing subsequent abuse. Additionally, others simply require too much time or effort to motivate the average person to dispose of their medication. Many people throw unused medication away in the trash, but this method doesn't ensure that the drugs are in a state where they can't be found and utilized by an abuser. Flushing down a drain is also common practice, but this method introduces nontrivial amounts of opioid active ingredients into the water supply. One current method to dispose of prescription medications is to drop them into Medication disposal boxes located in police stations that transport them to large facilities for incineration. This method of disposal is inconvenient for people who don't live close to a police station, and the programs are largely unknown to the public. In an informal survey conducted with 20 college students, it was found that 55% do not dispose of their medication at all. When asked about medication drop boxes, 25% had heard of them, and only 5% knew where the closest drop box is located. Half of those surveyed said they would travel up to five miles to their nearest medication drop box. These findings lead to the conclusion that the current drop box medication disposal method is ineffective.

There are a few commercially available options for drug disposal, two of which include Medsaway and Cactus Smart Sink. Medsaway is an in-home medication disposal system which includes a sealable plastic bag lined with activated charcoal. When medicines and water are added to the pouch, the activated carbon attaches itself to the medicines, rendering them "inert". However there is no reliable evidence to document inactivation of the medication.. The Cactus Smart Sink is designed to dispose of medical wastes in a medical facility. However, it's too expensive (~\$500) and cumbersome (15.5" x 9.5" x 12.25") for at home use.

The GrindCap system facilitates the proper disposal of prescription opioids and other medications in a way that is inexpensive and easy to use, in an effort to encourage proper disposal in line with the FDA recommended procedure. Our design includes a custom designed grinder modified to fit onto the top of a pill bottle, and reduce the unused pills into powder. The system also includes predetermined amounts of polyethylene glycol (PEG) to create an excipient gel that traps the powder and hinders digestion, and sodium bentonite clay, which solidifies the resulting product and also absorbs some of the active ingredients. The intended process is to grind the medication into a pill bottle, then add amounts of PEG, sodium bentonite clay, and water based on the amount of powder obtained, then wait for the sample to solidify before disposing of in the trash. This design has the advantage of being compatible with the current method of drug distribution. It is an add-on that allows the patient to use the same pill bottle that is used for distribution as a vessel for safe disposal. The new grinder cap could be put on any pill bottle, and the sodium bentonite clay and PEG could also be provided with prescriptions. Therefore when people picked up their prescription they would also be given everything they need to dispose of the medication. Any pharmacy that uses traditional pill bottles could purchase this system and include it with their prescriptions. Finally, this system is versatile, and can be modified to include inactivation agents specific to other target drugs as needed. Given the increasing prevalence of opioid-related issues that have become a socioeconomic burden across the country, GrindCap offers a simplistic and effective solution to an otherwise ineffectually dealt with problem.