**A DANGEROUS DUO: ADVANCING TECHNOLOGIES AND STAGNANT MENTAL ILLNESS LEVELS**

**EXECUTIVE SUMMARY**

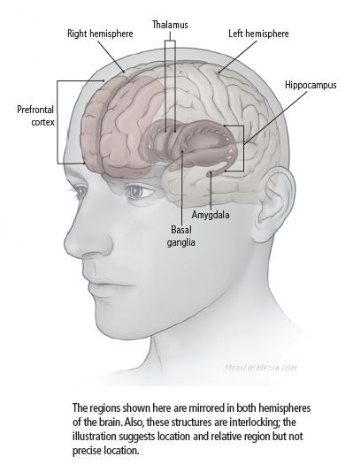
Humans are creating new technologies capable of mass destruction. These technologies are becoming cheaper, more accessible and easier to use.1, 4, 15, 19, 24, 31, 33 This combined with the current, inefficient “treatments” for mental illness (which merely manage symptoms rather than truly fix the underlying problem) poses a serious threat to the United States. All it will take is one seriously mentally ill person with violent tendencies getting their hands on these technologies to inflict mass casualty that will subsequently bring social, economic, military and government forces crumbling down.24 Since halting technological innovation is unrealistic, the United States must take steps to mitigate the toll mental illness imposes on society.4 This paper examines the current problematic situation where advancing technologies that can be used for sinister purposes is compounded by the lack of true progress made in treating mental illness. From there, it proposes a series of steps the United States can take to reduce the threat level and ultimately eradicate it.

**CAUSE FOR CONCERN: PREVALENCE OF VIOLENT, SERIOUSLY MENTALLY ILL REMAINS IDLE**

Any mental illness (AMI) arises from a complex interaction of one’s genes, environment and lifestyle and negatively affect one’s thinking, feeling or mood.18 A few examples of mental illness (MI) include depression, schizophrenia, bipolar disorder, anxiety and PTSD.18 In the United States, the one year prevalence, or annual rate, of AMI is approximately 20%, affecting over 40 million people.25 Lifelong prevalence refers to how many people will experience AMI at some point throughout their life and this rate is projected much higher around 80%.25

A more narrow subcategory that falls under AMI is Serious Mental Illness (SMI). Those with a SMI are greatly impaired in their functioning and completion of daily life tasks due to their illness.21 SMI retards the day-to-day lives of around 4.2%, or 10.4 million U.S. adults.21 Between 3-5% of those with SMI have been shown to have violent tendencies, which equates to about 312,000 – 520,000 American adults.7 The threat discussed later pertains to this population in particular – those with a SMI that exhibit violent tendencies.

In terms of treatment options, what has seemed revolutionary over the past 20 years has been labeled “more illusion than substance,” as an increasing number of people have access to treatment, yet mental health is not improving.12 Our current approach to “treating” MI is merely symptom management, rather than truly fixing the underlying problem. Current treatments may include medication, psychotherapy, hospitalization and group therapy.18

In combination with psychotherapy, medication is currently the best bet for managing MI. However, medication is only a quick fix that aids with the chemical imbalances incurred with MI. Solely pharmaceutical treatment of MI is not only impractical but naïve, as there are other forces at play including genetics, environment and lifestyle.9 Convoluting the chemical component, MI afflicts an entire circuit within the brain rather than one small region.9 The diagram to the right from Harvard shows the regions involved in depression alone.9 Drugs are also thwarted by a series of challenges, such as crossing the blood brain barrier (BBB) and suitable half-life times.2, 16, 23 While continued basic research will aid in improving current “treatments,” long-term, the most ideal and true non-pharmacological treatments will not face those same challenges.

**COMPOUNDING THE THREAT: TECHNOLOGICAL ADVANCEMENT IN THE UNITED STATES**

Trends indicate that by 2030, there will be a reduction in obstacles that currently deter state and non-state actors from acquiring chemical, biological and even nuclear weapons.19 Technological advancements combined with increasing commercialization and information will continuously diminish the expertise needed while increasing the availability and opportunity for lone actors and small groups to procure and utilize these technologies.4, 15, 19, 33 The same science and technologies that have arisen and catalyzed advancements in medicine and agriculture can be turned into “dual-use technologies;” this refers to when normal scientific advancements become harnessed as weapons.1, 4, 15, 19, 33, 34

While attacks using guns and (non-nuclear) bombs explosive impacts are constrained to a blast radius, biological weapons (BW) can have unbounding and much farther-reaching effects.33 One reason why this is centers around the characteristic of incubation periods regarding BW.33 During this period, an infected yet asymptomatic individual could spread the disease internationally in under a day. Similar to the rise of BW, greater technical abilities will arise as molecular biology and genetic engineering evolve out of their still-infant stages.1

Imagine a world in which the gap between these forms of WMD and the violent, serious mentally ill population is slowly closing. While maybe once a figment of science fiction, these threats are indeed real today and when they come to fruition, will catastrophically harm social, economic, military and government realms.24

**FINDINGS AND RECOMMENDATIONS**

1. ***Prioritize Mental Illness Through Increased Funding and Basic Research***

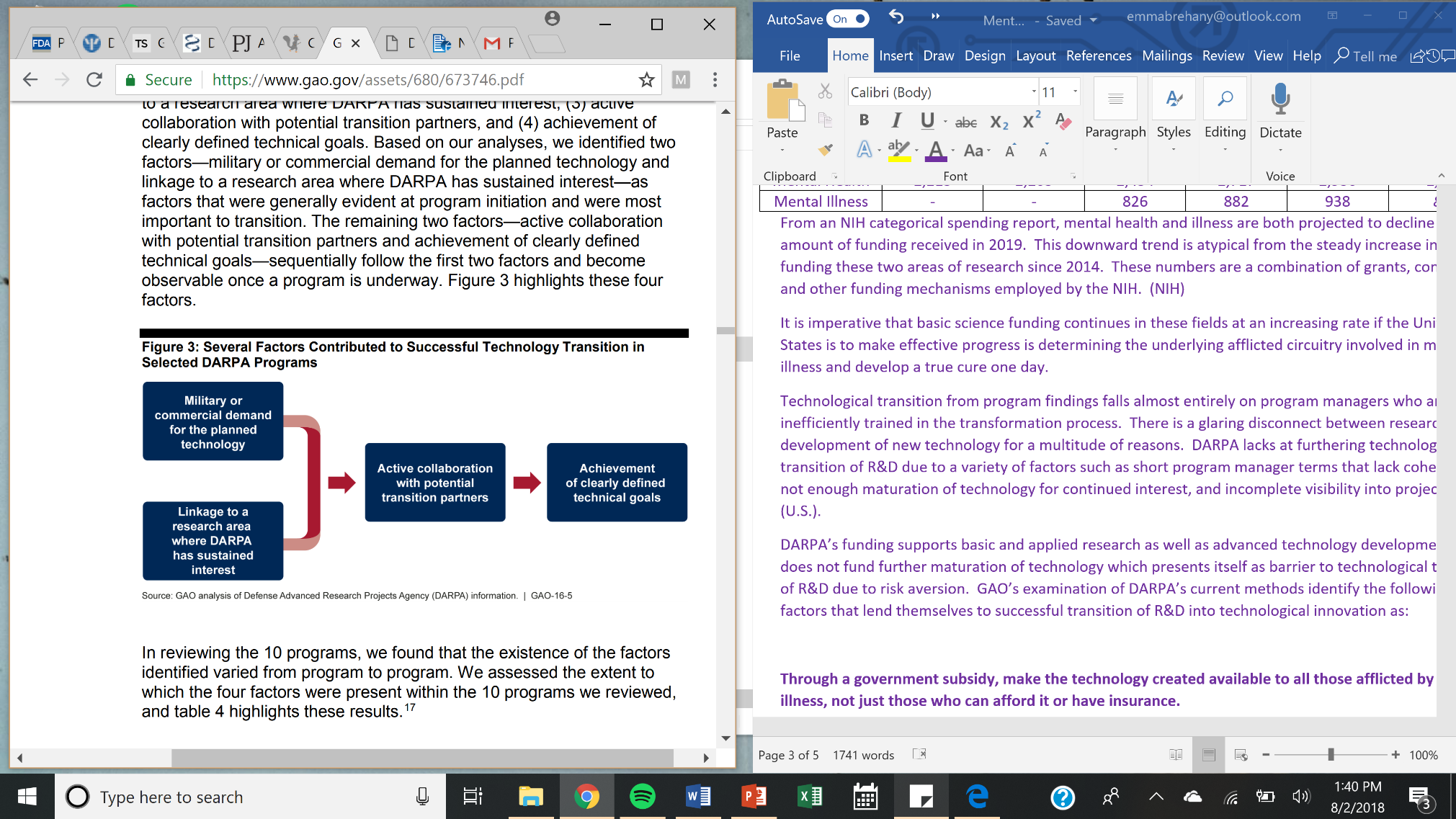
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| --- | --- | --- | --- | --- |
|  | **2016 Prevalence** | **2016 Budget** | **$/Case** | **% Budget** |
| **Cancer** | 15.1 million | $5,589,000 | $369.84 | 3.19% |
| **Mental Illness** | 44.6 million | $826,000,000 | $18.49 | 0.47% |

This chart pulls information from a NIH spending chart.20 Pulling statistics from the American Cancer Society, while cancer impacted roughly 1/3 of the number of people that MI did in 2016, it received almost seven times the amount of funding that same year.20 While not suggesting a decrease in cancer funding in subsequent years, this chart illustrates the lack of funding and attention given to MI. It is imperative that basic science funding for MI increases if the United States is to make effective progress is determining the circuitry involved in mental illness and develop a true cure one day. The United States must prioritize the understanding of mental illness, shown through increased funding and basic research.

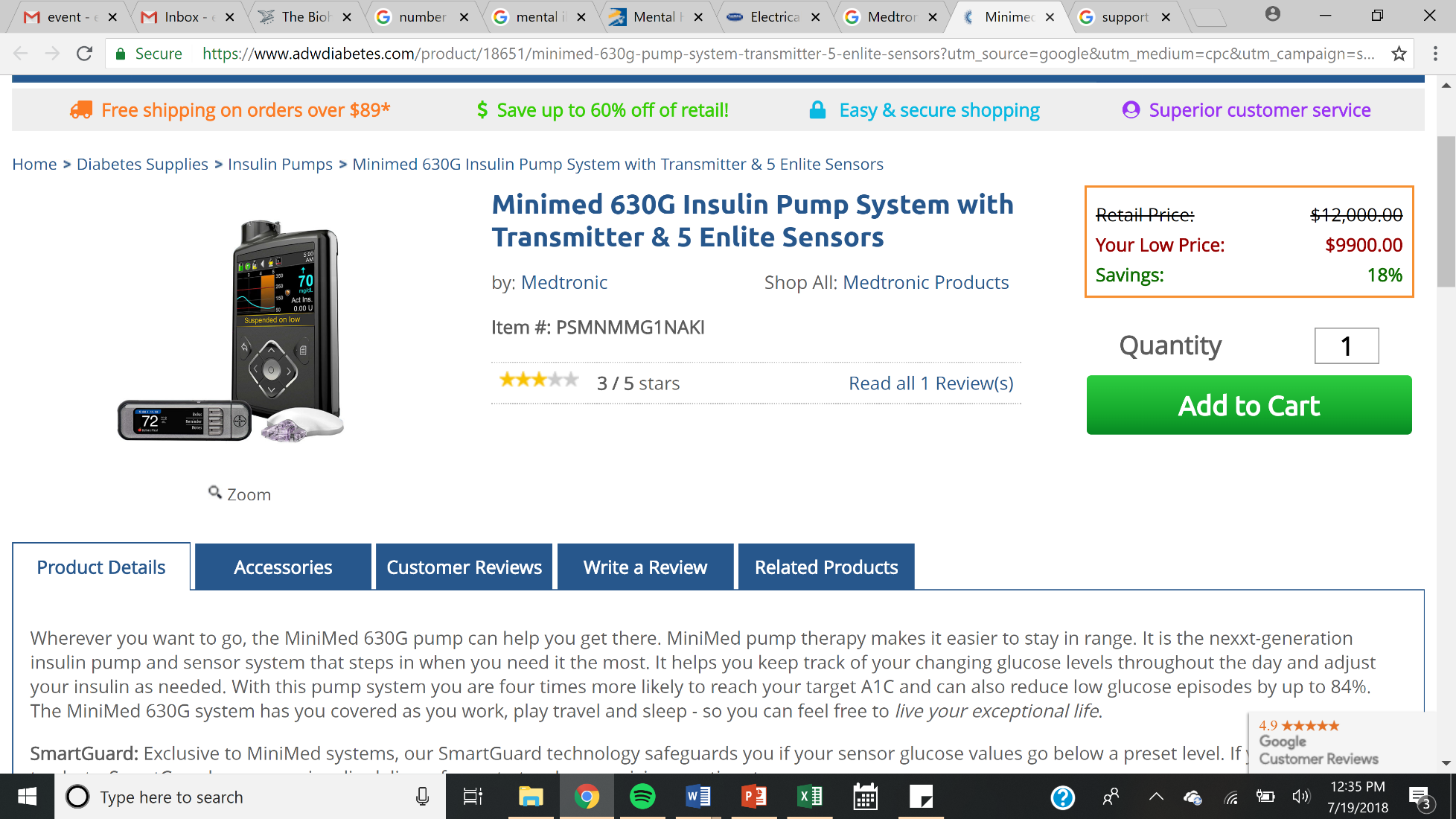
1. ***Establish a Permanent Technology Transition Office in DARPA to Improve Technological Transition Via Public-Private Partnerships***

In addition to the prioritization of mental illness as a national concern shown through increased funding, technological transition from R&D must improve. DARPA programs such as ElectRx and SUBNETS aim to develop non-pharmacological treatments for mental illnesses through modulation of one’s peripheral nervous system and utilization of the brain’s natural plasticity respectively.6, 28

However, studies of the current system for bringing forth meaningful technological transition from R&D show glaring disconnects and overall subpar results.8, 32 Short program manager terms perpetuate a cycle where the main advocate for the research and technology is headed out the door along with the program itself.32 In addition, it has been identified that these same managers are inefficiently trained in transitioning technologies.32  Another component is that DARPA’s funding supports technological development up to a relatively immature and unattractive point for industry to pick up and continue.8 Additionally, DARPA’s program time frames do not line up well with many of the DOD’s programs (which are primarily designed for more mature technologies) that are intended to facilitate technology transition.8 Finally, DARPA does not share data with key government sponsors, leaving a hole for R&D to fall into before it can be transitioned into useful technological advancements.8

Examination of DARPA’s current methods identified the factors pictured to the right in the successful facilitation of R&D into technologies.8 In place of a permanent technology transfer office, DARPA will occasionally establish a temporary special project office to aid in technological transfer.5  There is currently only one such office in operation for aerospace.5 To improve technological transition, DARPA needs to establish a permanent Technology Transition Office that facilitates public-private partnerships and develops meaningful technological advancements from current and future R&D.

1. ***Create Automated, Internalized Mental Illness Treatments to Personalize and Improve Current Treatment***

While the long-term approach to truly treating mental illness will revolve around non-pharmacological methods, there must be a way to improve the current treatments available for MI. This could be attained through the creation of an automated, internalized device that increased personalization and decreased responsibility for the patient. Similar in theory to the pictured FDA approved Medtronic MiniMed670G that automates insulin delivery for diabetics, this new device for MI could monitor neurotransmitter levels and self-adjust.3 While still a form of symptom management rather than a cure, new technologies such as this would improve current MI management while long-term progress continues to be made.

Current setbacks in creating a technology such as this stem from a lack of understanding MI exacerbated by self-report bias, the artificial environment in which the data is collected and the large gaps in data collection between physician visits.22 However, with more funding/research and greater opportunities for R&D to transition itself into advanced technologies, the creation of an automated, internalized MI treatment is not as far-fetched as it seems. New, automated, internal technologies must be developed to improve the current treatments available for mental illness through increased personalization and decreased responsibility.

1. ***Require Cyber Experts Involvement in Mental Illness Technology Creation***

A key part of the development of the automated, internalized device involves its ability to transmit over a wireless network to one’s physician. Any wireless transmission subsequently opens up numerous vulnerabilities within the technology; in theory one’s brain could be hacked.11 For example, someone could go in and alter another’s neurotransmitter levels or turn the device off entirely. These new technologies need to be created securely in the first place or they would allow for just as must harm to be done as good. Therefore, cyber expert involvement must be required (in addition to physicians and engineers) in the creation of new automated, internal MI technologies to address security threats proactively rather than reactively.

1. ***Subsidize Emerging Mental Illness Technology to Ensure Equal Access***

In addition to being secure, these new technologies must be available to everyone who needs them. A 2014 study showed that only 44% of American adults diagnosed with a mental illness received any form of treatment within the last year.10 This, combined with the already discussed lack of true cures for MI means that not only do our current treatments lack efficacy but also availability. These new technologies will not serve the intended purpose to mitigate mental illness if they are not equally available across socio-economic groups. The government needs to provide a subsidy to ensure that all those who need emerging technologies receive it, not just those who can afford it or have insurance.

1. ***Develop Algorithms from Big Data to Predict Behavior and Prevent Attack***

The technology proposed above in Recommendation 3 would (if subsidized) be there for those individuals actively seeking treatment. Tying back to the main purpose of this paper, those who are seriously mentally ill with violent tendencies and set on acquiring WMD’s are probably not seeking help. Therefore, the United States need to determine a way to predict and prevent these kinds of attacks while still making progress in treating MI patients that are looking for help. One way this could be done is through the conglomeration of big data and subsequent development of algorithms to predict behavior and prevent attacks. This kind of mass data collection and predictive targeting is already happening. The idea is similar to predicting Parkinson’s from video surveillance, recognizing a narcissist utilizing psycholinguistics and Target tailoring coupons to expecting mothers based on a purchase as simple as unscented lotion – all of which are already happening.13, 14, 27

There is already a mass amount of data being collected on U.S. citizens from street cameras to credit cards to social media. It is time to start capitalizing on these readily-available and highly informational insights into human behavior for the nation’s own protection. Thus, there is a need to open-source big data and create algorithms from which artificial intelligence and law enforcement can predict behavior and intervene to prevent an attack respectively.

**CONCLUSION**

Advancing technologies that can be used for sinister purposes compounded by the little true progress made in treating mental illness puts the United States at an ever-increasing risk of attack. Halting technological innovation in the United States in this day and age is not an option. Therefore, action must be taken to alleviate the toll mental illness imposes on society. To not overstate the problem and say that 40 some million Americans pose a serious risk to society, do understand that the threat lies in one of those few hundred thousand American adults with a SMI that have violent tendencies going out and procuring those technologies with bad intentions.

A series of steps can help to quell the hazard of a violent SMI patient effectively weaponizing a WMD. In short, the recommendations to reduce the threat level and ultimately eliminate it involve funding basic science for MI and efficiently turning this R&D into new technology that is secure and available. Finally, utilizing big data and predictive algorithms to address the issue of those who do not seek treatment and wish to exact harm will close to loop in preventing the mentally ill from inflicting widespread harm.

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