



Neurotechnology Innovation Network

Biodesign workshop series episode 2: Mood and psychotic disorders
12 November 2019 | Workshop outputs

Contact : Dr Charlie Winkworth-Smith | Emerging Technologies and Industries | KTN



Innovate
UK

Connecting for
Positive Change.

Mood and Psychotic Disorders – Needs identification

Mental health disorders destroy more years of life than physical disabilities. Psychosis, severe depression and bipolar disorder cause an enormous burden of illness; on average, healthy life is reduced by 12 years, working life is reduced by 14 years and life expectancy is reduced by 9 years. Moreover, employment problems and the chance of divorce or separation are both twice as common compared to people that do not suffer from mental health disorders. There are also increased risks of suicide and self-harm, neglect, addiction and exploitation by others.

However, there is limited evidence on the most effective treatments and the patient care pathway is often little understood. The Mood and Psychotic Disorders biodesign workshop explored some of the neurotechnologies that can provide treatment to what are often debilitating disorders and aimed to identify some of the underlying unmet needs in the area.

Four technologies were discussed; brain-computer interfaces (BCI), transcranial magnetic stimulation (TMS), virtual reality (VR) and microcurrent stimulation. While each technology has its own specific challenges, there are a number of high-level needs that are common to all:

- Ensure new technologies can be adopted by the NHS
- Better evidence
- Better technology
- Education and training
- Patient acceptance

First and foremost, to improve patient outcomes, patients need access to new treatments. There are currently proven therapies which are only available in a small number of NHS facilities. For example, TMS has clear clinical evidence showing that it can treat severe depression, yet it is only available at four NHS sites in England and none in Scotland, Wales or Northern Ireland. TMS services are available privately but at the cost of approximately £3,000. People with acute depression are often unable to afford this sort of treatment due to the breakdown of their personal life caused by the illness. There need to be substantial improvements to care provision policies so TMS and other therapies are available to all.

NICE guidance can help new technologies enter the NHS. However, this can be a long process. To ensure the quickest route to acceptance, it is strongly advised that technology developers focus on one major benefit of their technology and collect the appropriate evidence to support their claims. This is the approach that was taken for the Alpha-Stim device; by focussing on the treatment of anxiety, the Microcurrent Site Ltd and the University of Nottingham were able to develop trials that would be directly relevant for a MedTech Innovation Briefing (MIB) from NICE. It is also essential that there is clear communication between trial designers and a company's marketing team to ensure that claims and trials are aligned.

Better evidence is essential to validate new technologies. More clinical studies with larger sample sizes are required. In the case of some technologies, for example BCI, a general framework for evidence is required so that different studies can be accurately compared. This will also require better reproducibility of the data which can be helped with better technology.

BCI has a number of technological challenges to overcome, particularly in the case of high levels of noise. Better electrodes and sensors will improve data collection. Collaborating with other sectors, for example, consumer electronics for gaming, sleep tech or audio (e.g. ear buds) will bring in much needed expertise. Furthermore, non-health applications for BCI are likely to be much larger markets, resulting in economies of scale and reduced time to market. These advances will then feed back into the health sector.

Multi-modal systems have the advantage of much greater levels of data collection. For example, eye tracking and skin conductance combined with VR could help deliver a more immersive experience as well as a greater understanding of patient response. Large amounts of data will require expertise in machine learning which again can be bought in by other sectors. The combination of different technologies could increase costs, but the uptake of these advancements in consumer electronics would help reduce costs. Developer toolkits for VR and BCI would enable researchers and developers to test out ideas at lower costs and lower the risk for investors. More comfortable devices that are easy to setup by patients at home will help improve patient acceptance of new technologies. Developers should also bear in mind the carers that are likely to be helping patients with these devices.

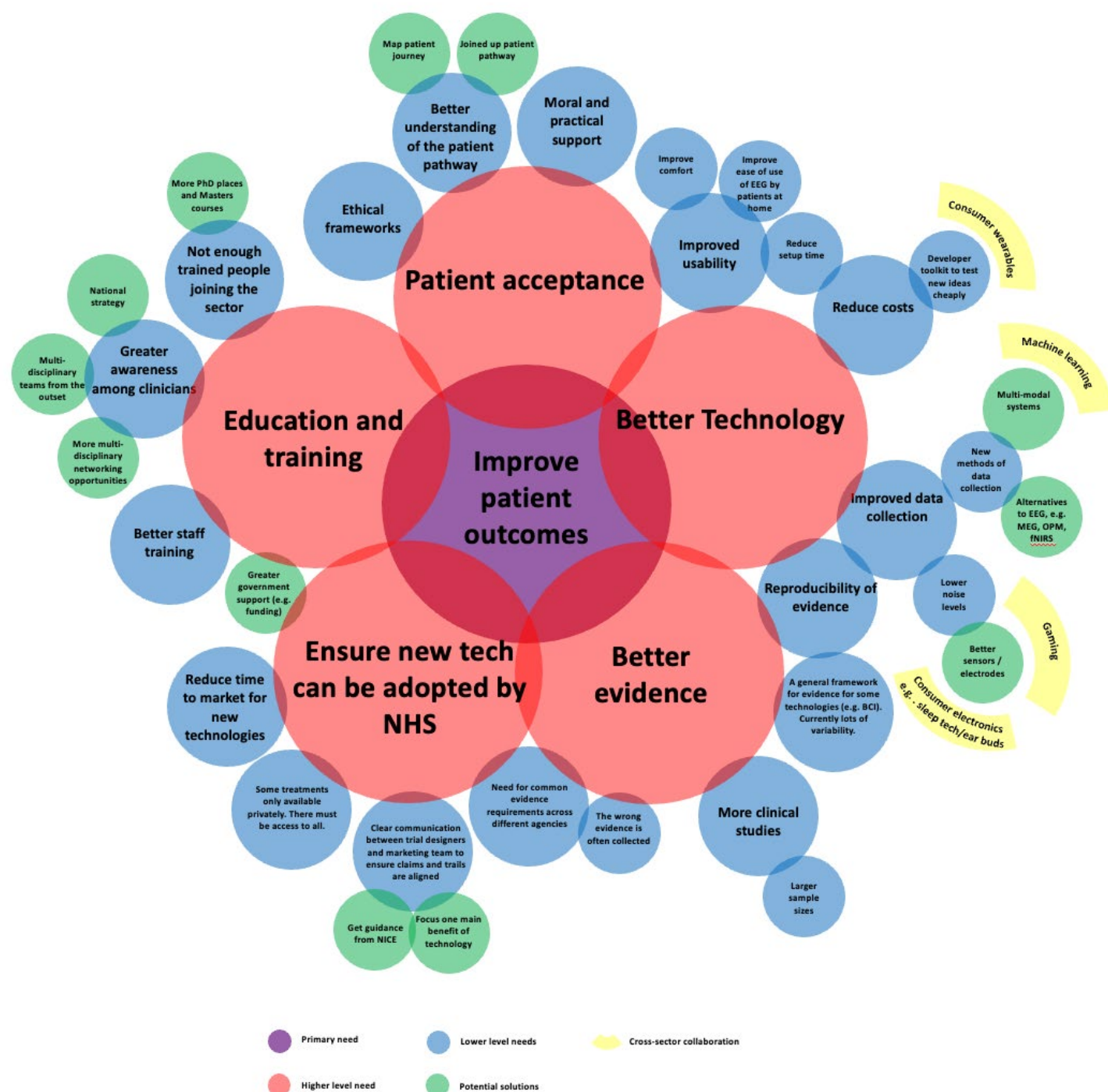


Figure 1. Needs and potential solutions for the treatment of mood and psychotic disorders.

There is a limited understanding by the general public of many technological therapies for mood and psychotic disorders. For some, scary treatments such as lobotomies or shock therapy are the first that come to mind so there needs to be much more public engagement to discuss concerns and educate the general public on the many benefits of current and future treatments. The public engagement work being done by the Royal Society on Neural Interface Technologies demonstrates an appetite from the general public to learn about the potential health care benefits of neurotechnology, but far more needs to be done with patient groups.

As well as educating patients and the general public, there needs to be much greater awareness amongst clinicians, many of whom do not know about therapies such as TMS and are therefore unable to recommend its use. The formation of multidisciplinary teams at the outset of new technology development will help spread the awareness of new technologies to different disciplines. It is also vital that there are also enough people with sufficient skills and expertise entering the sector at Masters and PhD level.

A national strategy must be put in place to join up all these disparate needs. This could be initiated by a dedicated institution that could ensure quality control. It would also be well placed to better understand the patient journey and create a far more joined up patient pathway. Such an institution could also provide a greater understanding of how different technologies can work together in care pathways and bring multidisciplinary teams together. Importantly, it could help develop a full ethical framework for new technologies.