University of BRISTOL

Elizabeth Blackwell Institute for Health Research

Research for Health Scheme

Stage 1 - Call for Challenges Application Form

- **This call is open to doctors, nurses and allied health professionals employed by the NHS.**
- **Please use this form to describe a specific issue or challenge which you are currently facing in your area of healthcare delivery.**
- **The deadline for submission is 25 Feb 2014. Please email this application form to Lisa.Wheatley@Bristol.ac.uk**
- **If your challenge is selected, University of Bristol researchers have the opportunity to bid for funds to help them develop a solution. They will work in partnership with you to make sure the new technology, device or innovation will really work for you, your colleagues and your patients.**

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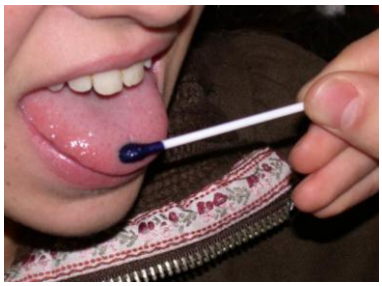
Challenge Title (max 20 Words)
Designing a taste threshold device for use as a clinical biomarker in primary care.

Please describe the specific problem which needs addressing
We need a way to administer our taste threshold test in a simple, neat but accurate manner. Specifically, we need to be able to apply, to the tip of the tongue, varying concentrations of bitter/sour/salt/sweet solutions via repeat dabs (up to 5 per concentration) which are held in an easily portable, readily storable device and can be prepared, potentially, well in advance. The specific problem we would like to solve is the engineering of such a device or system which would allow easy repeat testing of patients. This would assist with our research but ultimately would allow its use in primary care for clinical day-to-day use.

Taste thresholds used to be thought of as largely fixed. However, many examples of plasticity have been observed, e.g. we have shown that caffeine reduces bitter and sweet taste thresholds (so dark chocolate's bitter and sweet flavours are 'sharpened' or enhanced by a cup of coffee). A good demonstration of this can be found in studies of taste and mood, where a relationship has been noted for many years. Taste disturbance (dysgeusia) is a neglected symptom of depression, and high trait anxious individuals have been found to have a higher threshold for bitter and salt tastes.

Our research so far has shown some interesting results. By giving healthy volunteers two different types of antidepressants, one which increases serotonin (paroxetine) and one which increases noradrenaline (reboxetine), we found different taste effects after only 2 hours. Increases in serotonin reduced the thresholds for sweet and bitter, whilst increases in noradrenaline reduced the thresholds for bitter and sour. We have also shown taste threshold changes in opiate addicts, which may explain the 'sweet tooth' noted in heroin users (when opiate addicts take their prescribed opiate medication, their sweet thresholds rise from the normal level - equivalent to ½ teaspoon of sugar in a mug- to 5-6 teaspoons before they even taste any sweetness!). We have also found taste threshold differences in obesity.

We now know that serotonergic and noradrenergic receptors have a role in taste and mood, so we postulated that this may be a source for taste changes in depression. We have just finished collecting data on taste thresholds in depressed patients for confirmation of this and are now seeking to make this testing more widely usable and available.



Our current taste test consists of bottles of flavourings and a cotton bud to dab the flavourings on to the tip of the tongue – repeat dabs are required to find where the taste threshold is (at what concentration of salt/sugar/bitter/sour does someone first notice the taste?). Several concentrations need to be prepared in advance (with a short shelf life) in order to determine the threshold at which the taste can be detected, making this process cumbersome and lengthy.

How does this issue impact on you, your colleagues and your patients?

Prescribing antidepressants is a trial-and-error process; if we could narrow down and choose the right antidepressant more quickly, the gains would be massive.

There are several different types of antidepressant, all with different modes of action. NICE provide guidance on first and second line drugs to try, namely serotonin enhancing drugs first, and then drugs which enhance both serotonin and noradrenaline. However, it can take over 2 weeks for these drugs to show any effect, and many weeks, possibly months, before it can be determined if the drug is having a beneficial effect. During this time, the patient continues to suffer depression, and to make matters worse, probably also suffers the side effects of these drugs (which typically include nausea, vomiting, other gastrointestinal effects, rash, dry mouth, anxiety, headache, insomnia, tremor, dizziness, and sexual dysfunction). If the drug is unsuccessful, then the process must start again with another drug. This may or may not be a different type of drug, and may or may not require a period of withdrawal. Either way, it is a protracted process and a source of great distress to the patient,

and is, of course, time consuming for the GP.

It would be invaluable to know in advance of treatment which type of antidepressant might work best for the patient, because starting in the right place would significantly reduce the burden: the suffering of the patient, the cost of the ineffective medication and the time of the GP. We postulate that a simple taste test, which could be easily performed in the GP surgery, would be able to determine which thresholds are low, and therefore indicate which neurotransmitter might be lacking. This would indicate the likely source of the mood disturbance (i.e. serotonergic or noradrenergic) and direct the GP to prescribe an antidepressant that is most likely to work first time.

If we could manufacture a simple taste threshold device then this diagnostic test can become a reality in primary care. GPs would then be able to administer a quick taste test on their patients to determine their psychopharmacological requirements.

Can you estimate how many patients or staff are affected by this problem?
Can you describe any associated financial implications for the NHS or patients?
(Don't worry if you are not able to answer this question at this stage – it is not compulsory)

Depression is an illness treated by all GPs, and it can be a chronic illness. The World Health Organisation rates the burden of depressive and other mental illnesses as 6th highest, so any improvement in its treatment will have profound results. Patients may recover, only for the depression return again, and episodes of depression may last for months or longer. Psychosocial and 'talking' therapies, such as Cognitive-Behavioural Therapy (CBT), are recommended, but research has shown that therapies like CBT are best combined with a psychopharmacological treatment. However, antidepressants differ in efficacy and tolerability, and the side effects may affect adherence to treatment.

Recent figures from the Office for National Statistics show that one in five adults suffer from anxiety or depression (ONS Measuring National Wellbeing programme 2010-11, 40,000 households surveyed) and with a population of around 45 million adults, this is likely to be around 9 million adults in England and Wales. Large scale studies like 'STAR*D' (4041 patients) have shown that as many as 50% of patients require treatment modifications beyond first-line therapy. With 50 million prescriptions for antidepressants written in England in 2012, this number could be halved by finding the right antidepressant first time. With prescriptions costing around £1 (e.g. citalopram), the savings to the NHS could be substantial. In addition, patients may require fewer GP visits saving further GP time and associated costs.