*1) Describe the initiative and how it has addressed research waste in at least one of the 5 stages of research (questions, design, conduct, publication, reporting) in the area of health*

Open Source Malaria (OSM) aims to discover and develop new medicines for the treatment of malaria by adopting an open source research model, in which there is no secrecy in the research. The consortium operates according to a set of Six Laws, the most important of which are: i) all data and ideas are freely shared, ii) anyone may take part at any level and iii) there will be no patents.

The consortium, founded in 2012, has operated with a modest funded core of one full-time researcher supported by the Australian government and an NGO (the Medicines for Malaria Venture, Geneva). This core leverages considerable in-kind contribution from the wider community: to date more than 300 people have participated in various ways, from strategic advice and technical expertise through to physical samples of drug candidates.

To date four sets of molecules have been evaluated. The first showed promise, but was parked because of (currently) insuperable roadblocks; the work was published.[1] Series 2 was abandoned when it was discovered that another group was working on it, in secret. Series 3 is undergoing basic studies to identify its molecular mechanism of action. Series 4 has been extensively evaluated because of its exceptional promise: the constituent molecules are able to cure mice of a model of malaria. This Series 4 has the best chance to date of providing molecules derived from open source project of entering clinical trials, which would be the first time this has ever happened.

OSM reduces research waste in the following ways. Examples are provided under Question 2.

**a) Conduct.**

The most important way in which OSM reduces research waste is by avoiding unnecessary duplication of effort, because everything is in the public domain in real time – including the failures, inactive molecules and undesirable outcomes.

**b) Reporting.**

Transparency in the reporting means that all onlookers knows what everyone is doing, and if work is contributed it is because that contributor knows that that work is currently needed. The knock-on effect is that contributions may be made spontaneously by highly qualified individuals anywhere in the world.

**c) Questions**

The direction of the research consortium is openly debated, on a platform where seasoned pharmaceutical professionals are able to interact with junior students. That the debate takes place at the same time as the research is taking place *allows the research to change direction before it is done*.

**d) Design**

The technical platform uses existing online infrastructure[2],[3] allowing the widest number of people to participate, and builds/promotes open standards wherever it can. Improvements required in the future are actively promoted as part of the discussion so that others from the outlying disciplines of e.g. software development can contribute.

**e) Publication**

OSM publishes its work in open access journals, but also makes use of other publicly accessible media to ensure full data availability for other researchers. Research papers are constructed in public, to allow authorship by anyone. The papers themselves make clear what the community can do next to advance the science quickly.

*2) Describe any (pilot) data showing how the initiative has lowered research waste.*

Further to the above, specific examples of how OSM has lowered research waste are as follows:

**a) Conduct**

Biomedical research is expensive, of resources and peoples’ time. Since all drug candidates are shown openly, along with their biological efficacy, it is clear to all which molecules are worth pursuing and which are not.

Abandonment of Series 2 early.

Spontaneous contributions by people with high levels of expertise, Series 4 Pfizer. Crowdsourcing.

Student lab outputs are new, and contribute to the primary research effort.

OSM operates a highly decentralized model in which the team expands and contracts as needs arise. There is no inflexible infrastructure cost and people are not contractually locked in.

**b) Reporting**

Machine availability of search, molecules that can be tested against other things.

**c) Questions**

This continual peer review lowers research waste by making it less likely that unproductive research lines will be followed.Series 1 PAINS

Parking of Series 3.

What can be bought (thank you Mandrake).

**d) Design**

SCINDR published, so we can now seek funding for this proposal and coalesce people around the idea.

How we do things, technically, e.g. manage molecules that need to be made so there is no duplication.

**e) Publication**

Example of how we published the first paper. The What Next

Example of how we’re publishing the current paper, divvying up effort, consulting.

*3) Describe how the initiative might potentially be scaled up*

a) Open Source Pharma

b) Could mean that a series is not pursued, i.e. fails faster, because of this. Series 2.

c) OSM is covered by the Creative Commons CC-BY licence, meaning everything it generates may be used by anyone else for any purpose, including to make money, provided the consortium is appropriately cited. This retains the widest possible use and discoverability of the discoveries while maintaining the possibility of a commercial body taking a discovery through to market if that is the most efficient way to help patients.

4) *Provide a justified estimate of the potential reduction in research waste that the initiative might achieve.*

Most is the promotion of efficient, non-duplicate research. This is difficult to quantify because it is highly granular – there are many small savings across many projects.

However, an easier estimate of savings would be if, unfortunately, a series progresses into clinical trials and then fails, perhaps for a generic reason of safety which highlights a problem with a whole series of molecules. In that case the full project transparency would save X.

The other potential mechanism would be