Review of Briet: Solar net fan: a potential tool to enhance bed net usage in hot climates

Reviewer: Anonymous

Reviewer: This is a very timely paper on a rather brilliant idea namely to use a solar powered fan inside of bednets. But even the most brilliant ideas need a little bit of empirical support to overcome skepticism. Currently the paper reads like a grant proposal. I wish the author all the best to win funding for his idea but for a publication in a scientific journal some critical skepticism is mandatory. Specifically one has to wonder:

1) How much will the complete net fan set – up including solar cells and batteries cost? This has to be addressed in a sensitivity analysis with reasonable lower and upper limits. There can be little doubt that the complete net fan set--up will cost orders of magnitude more than the bednet– which causes the problem.

Response: Without any existing scientific literature on the subject, at this stage, all one can do is ask for current large volume price quotes of existing components of a possible system, and it is difficult to give anything more precise than a very rough estimate for a price of such a system. Cost and price development may vary very much depending on scale of production and market competition etc., as seen with ITNs over time. A small Appendix was included giving a rough indication of the price of the system. If "orders of magnitude more" is to be interpreted as 100 times or more expensive, then indeed there is no way this system would function. However, it appears that the cost of system may be 2.5 to 10 times more expensive than an ITN, thus within the same 'order of magnitude'. For a full costing analysis, more data are needed, also for instance about the cost for petroleum saved if a system with a small light replaces petroleum lamps.

2) How long does such a set--up survive where it is most needed, i.e. in African mud huts.

Response: In principle, the two less durable components of the system are the mechanic fan and the deep cycle storage battery. The fan lifetime in various specifications of computer box cooling fans generally exceeds 100 000 hours of use, thus well beyond 10

years (continuous operation), and well beyond the life time of a long lasting insecticidal net. The least durable component is likely the storage battery. Its lifetime (number of cycles), apart from its type, depends on the environmental temperature, maintenance, and how deep the battery is discharged each time. A larger (more expensive) battery with over capacity will thus last longer than a smaller (cheaper) one. Lead acid batteries can support 200-300 cycles, Ni-MH batteries 300-500 cycles, Li-Ion 500-1000 cycles (and are maintenance free). Batteries can be replaced, of course. Source: http://batteryuniversity.com/learn/article/whats_the_best_battery.

Reviewer: Background: The introduction is way too long at 4 pages. The author should focus on a concise introduction. I can see no reason why the authors feel they have to educate the reader about the predicted mean vote and the humidity index since neither is directly relevant for the net fan.

Response: Two sentences of together 88 words were removed from the introduction in order to make it more concise. Also, the section about measurement of thermal comfort (240 words and 4 figures) was put into a separate box, as I agree with the reviewer that this section was somewhat out of place in the background, as it contains a new product, i.e. a world map of places where bednets might be expected to be experienced as hot. The reason to include that is to inform the reader where and for how many months per year a fan might be beneficial to comfort.

Reviewer: The author states that bednets have an effect on temperature and humidity inside the net but don't provide any data to support their hypothesis that bednets "trap metabolic heat and evaporated water". An alternative explanation could be the attenuation of airflow by bednets. I suggest to omit speculation on temperature and humidity inside bednets or to provide a reference from a peer reviewed journal.

Response: The publication type chosen, i.e. "hypothesis" normally does not allow presentation of new data. A few preliminary tests were done with a fan inside a mosquito net, inside a climate controlled room, but these tests were deemed not sufficient to provide more than anecdotal evidence about the exact thermal exchange processes going on. I could not find any literature on the climate inside a mosquito net other than Hill and Fink, 1910. If the reviewer is aware of any literature I would be most grateful for a reference.

As stated, inside bedrooms, it is not unreasonable to assume that air velocity is below 0.1 m/s, and that the cooling effect of forced air

velocity is negligible (see e.g. Olesen, 1982). Under this assumption, the main air currents above a person are thus free convective, and depend on temperature gradients and if the flow of air is obstructed (for instance by clothing or a bednet) or not. Irrespective of the exact mechanism of how a net renders the sleeping environment "hot and stuffy", what really needs to be tested if a low-capacity fan can render the sleeping environment more comfortable. Nevertheless, the author believes that some reasoning about the mechanisms may be a valid approach to develop hypotheses. The author concedes to the reviewer that there is some speculative nature in these untested statements, and the author has weakened them by including the word "may".

Reviewer: The author correctly states that a fan will provide airflow which will result in increased confection. The statement that a fan will replace "the hot and humid air inside the net by the cooler and drier air outside the net environment" is strictly speculative. It would require solid data to convince this reviewer that such a miracle is actually feasible. The air inside and outside the bed net is hot and humid. The fact is that any difference between the environment inside and outside the bednet equilibrates quickly.

If, as the reviewer states, any difference in temperature and humidity inside and outside a net equilibrates 'quickly', a net would probably not be experienced as hot and stuffy in rooms with negligible forced air velocity. A modification in the text has been made that now reads "A fan can bring relief by ***assisting the replacement*** *of the hot****ter*** *and* ***more*** *humid air inside the net by the cooler and drier air outside the net environment, and also by providing wind to increase convective heat loss and heat loss by evaporation."*

Reviewer: Hypotheses: The author dismisses the idea of a suspended fan without any empirical data based on speculation that there is a significant thermal difference between the top and bottom of the net. Such speculation has either to be omitted or supported by data.

Response: It is very well known that generally hotter air rises when in colder air (although there is some debate on why this happens), and that rooms are generally warmer towards the ceiling than towards the floor (irrespective of a net being present). The latter is especially likely to be the case in tropical housing in the evening, after a day's sunshine on the roof. In the preliminary tests mentioned above, which were omitted from the paper because of its nature as a 'hypothesis' paper, it was very clear that with a downward blowing fan suspended near the top of a conical net, the

dry-bulb temperature at bed-height rose a few degrees within seconds when the fan was switched on, and cooled down immediately after switching the fan off. The author believes that these test results are too 'obvious' to be reported on.
The author stresses that this is not the main reason to dismiss a suspended fan, as a suspended fan blowing downwards may well make up for the fact that is blowing the hotter air downwards by the increased air velocity that it generates (if the fan capacity is sufficient) enhancing convective and evaporative cooling. The other (together more important reasons) to prefer a different mounting position are 1) damage to the net by ripping possibly caused by the weight of the net suspended from the net, and the crossing of the power cable of the net (small rips occurred to a net in the test set up); 2) deforming the shape of a 'rectangular' frameless net (which happened in a test set up).

Reviewer: Summary: First instead of speculation it would be helpful if the author could provide a systematic plan how to arrive at the ideal net fan design (suspended, standing, etc.).

Response: The aim of this paper was not to describe the ideal net design, but to explore the idea of a solar net fan system, to share some thoughts on what might be important features of a design (not damaging the net, not deforming the shape, not prohibiting tucking in), to give some suggestions on how a design could accommodate these requirements, and to give a suggestion on how it could be established whether it could be a tool to improve net usage. Like any tool, it would be expected that the net fan system would be improved continuously.

Reviewer: Second without an estimate of the minimal and maximal costs of such a device it is difficult to take this idea seriously.

Response: See the first response. The author agrees with the reviewer that if the system costs several orders of magnitude more than the price of e.g. a long lasting insecticidal net, the idea is not viable.