

PLOS Science Wednesday: Hi Reddit, we're Oliver Cumming, Pinaki Panigrahi, & Yael Velleman and we're here to discuss how improved water, sanitation, and hygiene (WASH) programs will impact health outco

PLOSScienceWednesday¹ and r/Science AMAs¹

¹Affiliation not available

April 17, 2023

Abstract

Hi Reddit, I am Yael Velleman, a Senior Policy Analyst for Health & Hygiene at WaterAid. My work focuses on the links between water, sanitation and hygiene and health, and the implications for policy and programs. I am Pinaki Panigrahi, a professor of Epidemiology, Pediatrics, and Environmental-Agricultural-and-Occupational Health at the University of Nebraska Medical Center, and also the Director of the Center for Global Health and Development at the College of Public Health at University of Nebraska. My current research focus is to study the impact of environmental exposures on maternal and child health. I am Oliver Cumming, a Lecturer in the Environmental Health in Department of Disease Control at the London School of Hygiene and Tropical Medicine. My research focuses on access to safe water, sanitation, and hygiene and its impacts on childhood health and development. We recently published papers in PLOS Medicine examining the impacts of water and sanitation programs on public health. In a paper titled "From Joint Thinking to Joint Action: A Call to Action on Improving Water, Sanitation, and Hygiene for Maternal and Newborn Health," Yael and Oliver, in collaboration with several UN and academic agencies and institutions, set out the case for action on water, sanitation and hygiene for improving maternal and newborn health, and provided a set of policy recommendations. In "Risk of Adverse Pregnancy Outcomes among Women Practicing Poor Sanitation in Rural India: A Population-Based Prospective Cohort Study," Pinaki and colleagues found that open defecation led to more adverse pregnancy outcomes. The study enrolled more than 600 pregnant women and researchers tracked their sanitation practice during pregnancy. Those practicing open defecation had higher number of bad pregnancy outcomes, especially preterm births. Many other concomitant factors were also studied (apart from defecation practice), and against conventional wisdom, we did not find socioeconomic status to play any role in this, but the pregnant woman's education did. More research is needed to identify changes that are induced by open defecation ultimately driving an unhealthy pregnancy. We will be taking your questions about how WASH impacts global public health today at 1pm ET (10 am PT, 5 pm UTC) — Ask Us Anything! And don't forget to follow Yael on Twitter at @YaelVelleman.

[REDDIT](#)

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PLOSSCIENCEWEDNESDAY [R/SCIENCE](#)

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CORRESPONDENCE:

[danmilligan](#)

DATE RECEIVED:
October 29, 2015

"Women and children" excludes a minority adult male population. What would the reason be for this, as opposed to targeting improved health outcomes across the population as a whole?

Oliver: Thanks for flagging this and it's an interesting point. I have three reflections in response to your

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question. Firstly, I think that these health outcomes (maternal and neonatal mortality and morbidity) are given, and warrant, particular attention because progress has been unacceptably slow and so many women and neonates continue to die from largely preventable causes. Secondly, some studies have found that maternal mortality, as just one example of a maternal and newborn health outcome, has profound consequences for the health of both older children and other members of the family and community (Anderson, Morton et al. 2007, Yamin, Boulanger et al. 2013). Lastly, the recommendations which are made in the Call to Action paper stand to benefit not just mothers and neonates but also, for example, all the other patients, including adult men, using a health facility where water and sanitation infrastructure is installed.

"Women and children" excludes a minority adult male population. What would the reason be for this, as opposed to targeting improved health outcomes across the population as a whole?

[danmilligan](#)

Yael: Thank you for a very valid question. In terms of the Call to Action paper, the focus on maternal and newborn health is not meant to play down the importance of improving the health of the population as a whole; but it is necessary as maternal and newborn health are areas in which we are seeing considerably less progress. The argument we are making is that a great proportion of deaths associated with births can be prevented through the kind of services that most people living in high-income settings have come to take for granted. This paper was needed as the authors observed that WASH interventions are often ignored in efforts to improve maternal and newborn health.

I am currently stationed in Myanmar where most water supply is pumped from underground wells and frequent a industrial area to stay. Open sewage is an issue here in the city and I don't even know where most of it goes. I only drink bottled water but have no options on showering on other sources. What should I look for around my water sources?

Are there any indicators that my health and those around me are at risk from poor water quality?

Are there any new technologies or products suitable to introduce into such a market to ensure both an improvement on standards of living and maybe make a profit off at the same time?

[Tsurupettan](#)

Pinaki: If we knew the answer, we will be millionaires. I do not know of any technology to help you or the people of Myanmar. But, do not worry. I work in similar settings and keep my mouth closed while showering. As long as you do not drink contaminated water, you will be fine. Just a note - bottled water in those areas can be counterfeit too. I boil my own water and take in my own water bottle. You can also use the new UV water purifiers and fill up your bottles.

Hi, Im a hydrologist working on a rural water security project in India. One of the big pushes at the moment is toilet coverage - millions of toilets are being built over the next few years. Aside from the obvious challenges related to behavior change and adoption of toilets, we are seeing a worrisome trade off in sanitation coverage over water quality. India is the most dependent country on groundwater and the majority of rural drinking water supply comes from open wells, tubes wells and springs - all of which are being increasingly contaminated by improper construction or location of pit toilets, latrines, gutters and solid waste dumps. So on the one hand we seem to be increasing access to certain sanitation infrastructure while on the other we are hurting sustainable water access. There seems to be a disconnect between WASH and water resource management.

My question - how can we improve outcomes in the WASH-groundwater nexus?

Thanks for doing the AMA!

[joyfred](#)

Pinaki: Excellent question. I guess, just show the evidence to policy makers before a faulty policy has more negative impacts. We did not know about arsenic while setting up bore wells in Bangladesh. That was our ignorance. But, later on whenever a bore well is dug, people think about heavy metals. Now is time, as you rightly said - to be conscious about microbiological contamination of ground water.

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Oliver: This is an interesting public health dilemma. In most countries - including India - there is an accepted 'rule of thumb' for the minimum distance for siting pit latrines in relation to tube wells or boreholes. As you will know only too well as a hydrogeologist, the challenge with such rules is that they are context specific and what is safe depends on various factors including the hydrogeological conditions and the sanitation technology. In Bangladesh, which combines high population density, a range of hydrogeological conditions, and a very rapid expansion of basic onsite sanitation (e.g. pit latrines) in the last ten years, there has been a great deal of discussion around this problem. Dr Sirajul Islam at ICCDRB, in Bangladesh, is currently doing research to understand the extent to which onsite sanitation threatens groundwater supplies.

Regarding "From Joint Thinking to Joint Action":

What are some of the roles advocates, health workers, scientists, and policymakers can play in prioritizing the successful implementation of WASH policies, programs, interventions, etc. for improved maternal and newborn health?

Also, can you update us on any progress or lack of progress that has been made with implementing the WHO strategy on WASH in health care facilities?

Regarding "Risk of Adverse Pregnancy Outcomes in Rural India": Is your research team conducting any follow-up studies to further examine the finding that risk of adverse pregnancy outcomes and open defecation are associated?

What do you feel are the policy implications of your findings that open defecation is associated with a higher risk for adverse pregnancy outcomes?

[PLOSReddit](#)

On: "From Joint Thinking to Joint Action": In terms of the roles, there is a fairly comprehensive list

suggested in the article itself. If I had to pick some key areas, I would focus on: - Data collection and analysis – this is needed at all levels, from informing decisions and priorities at the healthcare facility level, to making decisions at national level on budgets and targeting. At the moment, we have very little robust data that can be used in this way, and certainly very little to inform global and national decision-making processes. - Policy makers need to make WASH a formal part of the health system, and the strategies to improve health outcomes. This should come with very clear roles and responsibilities at all levels and with adequate resourcing in terms of finance, skills and personnel (including maintenance and cleaning staff – which are often neglected). - Donors should be willing to fund strong health systems with all that that entails – not just specific interventions within the system. I think the rhetoric is moving in that way, but practice still needs to catch up. In terms of the WHO Strategy (which is now referred to as a Global Action Plan), there has been some encouraging progress; in March 2015, WHO and UNICEF released the first ever global report on WASH in healthcare facilities (data from 54 countries), and then convened a special meeting on WASH in healthcare facilities in Geneva, including research partners, donor governments and country representatives, with a strong focus on WASH in maternity units. The meeting has resulted in a draft Global Action Plan on WASH in healthcare facilities, and the setting up of several task teams to take forward work on this, in terms of research, global and facility-level monitoring, and advocacy. Importantly, the initiative involves several WHO departments including maternal and child health, universal health coverage, patient safety and WASH. In May 2015, a side event on the same topic was hosted by WaterAid, WHO and the governments of Zanzibar and Bhutan at the World Health Assembly. WASH also features strongly in the new Global Strategy on Women, children and Adolescent Health, and was discussed at the Global Conference on Maternal and Newborn Health just this past week in Mexico City. On the research and evidence side, there is growing interest among academics from different fields in understanding how poor WASH conditions at home and in health facilities influence maternal and newborn health outcomes. Since this paper was published, a number of new studies have been initiated and new results have been published. As will be discussed during the AMA session next week, a paper by Das and colleagues published in PLOS Medicine earlier this year is the first study to rigorously assess the association between poor sanitation access among pregnant women and adverse pregnancy outcomes. Naturally, this is only the beginning and there is still much work to be done, especially at national level to secure concrete progress.

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Pinaki: You should be giving the answer to your first question. Sounds like you are passionate about it. WASH in health care facilities is very important, but just a small piece of the much bigger problem. I am not fully conversant on the current position WHO takes on this. But yes, we are very much into finding out the mechanism - why did open defecation cause premature delivery and are doing followup

studies. Policy implications are huge. A nation's strength and economy depends on its citizens. Producing babies that become burden to the society (with chronic disease for the rest of their lives etc.) is a very serious affair. It is a complex issue, otherwise it would have been solved by now. Even in the west preterm delivery is a big problem. But, the causes are different (we think). In our study, we found some unexpected results and are now trying to address the mechanisms. As scientists, we can only generate knowledge, how it is used is up to the reader. With Prime Minister Modi, there is some hope. He had the courage to accept the shameful problem India faces at the United Nations. No one did earlier. Brushing it under the carpet does not help. Once you know what the problem is, no matter how complex it is, you will solve it - if you have the will. Do politicians have the will? Answer is definitely NOT (in general with exceptions). If they take did, they will be out of jobs. If citizens of a country like India are educated, healthy, and productive, do you know how many so called politicians (not leaders) will lose their jobs? In the developed nations it is different. If they do not make a difference, a change, they lose their jobs - again in generic terms. But, my job is to learn maternal and neonatal health problems and attempt to address the mechanisms and then find solutions. Why am I responding to your last question? I am not in the business of changing the world, you are.

India experiences many of the issues you mention, and efforts have been made to educate the poor, rural population about the benefits of just washing your hands. A challenge was simply the cost of a bar of soap, something we don't even think about.

Unilever developed a small bar of LifeBuoy soap that could be sold for, if I recall correctly, 5 rupees. They also had an ad campaign to convince people that washing their hands was a thing to do!

Has this made an impact in India, or have things really not changed?

[nallen](#)

Oliver: Thanks for this question and for highlighting the importance of hand washing with soap, and the role of behaviour change, marketing, and affordable products (soap). From my experience, the cost of soap in India (and other places) is less of an obstacle than the challenge of actually motivating people to use soap at all the times which are important for preventing disease transmission. However, one positive recent example from India is described in a paper published last year (Biran et al 2014; Lancet Global Health). This paper by Adam Biran reports a hygiene promotion intervention that was successful in changing hand washing behaviour.

It seems to me that, as with so many other issues, education (or the lack thereof) is one of the primary obstacles to improvement in this area.

Could you please explain the approach to education on the ground in these affected areas, and what is being done to combat the cultural norms that negatively impact WASH (open defecation, for example).

[improbablewobble](#)

Pinaki: If I had a second life, or 20-30 years guaranteed by God, I would put it into education - education of women, children and all. If done well, all of us will be out of jobs (doctors, WASH scientists and others discussing this). You seem to be in this field and need to tell the world the best way to educate people in different settings.

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[improbablewobble](#)

Yael: I agree that education is very crucial and that there is a proven link between increased education levels among women and increased child survival. However, when it comes to outcomes related to birth settings, I think the problem is far more rooted in other issues, such as lack of prioritisation of basic services in terms of politics and resources, lack of staffing and skills (and the investment in these), social aspects that contribute to inequitable access to resources (even within the family, with a particular detrimental impact on women and children), etc. It's important to take a more holistic view of these issues.

I read in many places on the internet that water-based toilets are sort of a luxury.

1. Regarding dry and portable low cost latrines, is there any prototypes on field trials that can be used and delivered to remote areas?
2. Can vacume toilets be designed for on the ground purposes? I like the design for their less water use and efficiency.

[SmokingSloth](#)

Pinaki: I was just replying to questions without going over all of them first. Absolutely yes. What you say is what is being experimented (I am told) and, I am sure soeming good will come out of it.

I am a prospective graduate student in biomedical engineering, and I am hoping to break into the entrepreneurial space with the goal of changing global health outcomes for the better. Can you suggest any universities that encourage such kinds of social entrepreneurship in global health?

[Catman72](#)

Pinaki: I wish I had a straight answer. I am only familiar with U.S. universities and all major ones promote entrepreneurship. You must be seeing ads by NGOs giving grants for ideas (which they may like to promote themselves later). I would suggest to select a good global health program first. Entrepreneurship is not taught any where, and sounds like you already have it. Once you know the problems out there and think about solutions, you will find some and try to implement a few. All universities protect your invention via "discloures" which is dated. So, someone else yo are talking to cannot take the idea and run with it. They also have lawyers and persons with business contacts who try to help your idea blossom into reality. Look for a President or Dean who calls himself/herself as the CEO of the institution (some do publicly), and you will need all the support you need.

Do you believe that there can be such a thing as oversanitation? Such as sanitizing so much that our immune systems suffer and either start attacking harmless things or don't work as well when we do get sick? I've seen this suggested as the cause of growth in food allergies.

[monkeydave](#)

Pinaki: You are right about lack of exposure to the prokaryotic world and allergy. But, we are FAR FAR away from that scenario when settings in the developing countries are being discussed. So, not to worry about allergy now, unless yo are caring for your young infant/child in an incubator type environment (some crazy people do - e.g. not allowing anything into the mouth of the child unless it is

boiled). What we have evidence of is the over population of the gut with microbes. This burden causes gut dysfunction in many different ways, and lead to undernutrition (India is a prime example where in spite of no food security, half of the children are stunted. So, we do not have to worry about over-sanitation for at least hundred years, unless there is some miracle that burns and destroys everything from the ground and sterilizes the land and water.

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[monkeydave](#)

Oliver: the papers presented here concern settings which are (1) high burden with regard to maternal newborn health and (2) where universal access to even the most basic level of sanitation is a distant prospect. From my perspective, in these settings, where women and children are dying in large numbers from preventable causes, I am much more concerned about 'under sanitation' rather than 'over sanitation'.

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[monkeydave](#)

I wholeheartedly agree with the responses of Pinaki and Oliver on this.

Why are we still fluoridating water when the health benefits have been shown to be dubious or marginal? No other vitamin or mineral supplements are added to the drinking supply.

[andyjeff76](#)

Pinaki: Although there are guidelines, the levels of fluoride added to municipal supply is different in different states, countries, I think. This is simply because of the reasons you just stated. I do not know about the standards followed in other countries. There needs to be a ton of evidence before one can think of adding something to municipal water that goes to the mass.

How much do you use GIS in your research? I dream of getting into spatial epi but don't know how viable a career that is.

[minorsecond](#)

Pinaki: Medical geography and GIS are emerging and hot areas for sure.

It seems like the problem is mostly a cultural one, perhaps similar to bad cultural practices surrounding HIV in many countries.

What are some good techniques you've gleaned from successful education campaigns in other countries?

Also, what do you see as a viable toilet model in these situations, short of installing wasteful water-driven toilets as used in the west?

Do vented pits work as well when coupled with good hand washing?

[discoer](#)

Oliver: Thank you for sharing your reflections. You are absolutely right with regard to the centrality of human behaviour. For water, sanitation and hygiene, health benefits only accrue when the infrastructure is in place or accessible, and people use it. For sanitation in rural areas, in particular, this is a huge challenge and the sanitation sector is littered with anecdotes of new latrines being used for a whole range of things other than defecation (e.g. storing food, corralling chickens etc). In the India context, and in the state of Odisha where the paper posted today was sited, a recent cluster-randomised controlled trial for the effect of a sanitation intervention on diarrhoea found very low levels of compliance (i.e. even when people had access to latrines, many preferred to defecate in the open) [Clasen et al 2014; Lancet Global Health]. Another cRCT of a sanitation intervention in another Indian state, Madhya Pradesh, published in PLOS Medicine last year (Patil et al 2014), in India, found similarly low levels of compliance.

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[discoer](#)

Pinaki: This is where technology comes. I am sure, we will see toilets that do not need any water or as much water to flush. Simple "materials science" and some "negative pressure" generation will do. Air plane toilets today are the best examples. While the west has been wasteful in many fronts including water, if you buy a new toilet today in the market, it uses one tenth of water compared to what we had ten years ago. I am not an engineer. Pits are good as long as designed well and the disposed off well. Otherwise, we get into contaminating the groundwater as dicussed earlier.

Thanks for doing this AMA.

Where clean water is in short supply, it may appear wasteful to use it to wash hands.

How about promoting rubbing hands with alcohol? Has that been tried?

I can think of some pros and cons.

- Pro: it's easy to make a liquid with substantial alcohol content at home from the kinds of ingredients that are usually distributed as food aid (sugar, grain).
- Con: people will drink it instead.

[weaselword](#)

Pinaki: good point. but, I am not sure if it is possible to take it to scale. It is used in hospital and other

health care setting. Even in the U.S. studies have shown that providers are more likely to use alcohol-based hand sanitizers compared to soap and water between patients and/or around them in the hospital. But, in a home/community setting we have to be careful, because there will be kids, neonates, and some that like to consume alcohol in any form. Your idea of making home-made alcohol is a good one.