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DDT, Water and Health: a transdisciplinary dialogue on risks, myths, and research findings

Rationale

Dichloro-diphenyl-trichloroethane (DDT) is a pesticide used in control of the malaria-carrying mosquito. While banned internationally, some countries, including South Africa, have been granted restricted use for indoor residual spraying under the Stockholm Convention of 2004.

In 2014, a debate re-emerged between various academic camps regarding the use of DDT in insecticides. Some argued that in 2015 SA will have probably met its Millennium Development Goal of halting and reversing the incidence of malaria, thanks to the careful, targeted spraying of insecticides, including DDT, in houses. The insecticides protect residents for an entire malaria transmission season, saving countless lives. This method of malaria control is safe for residents and the environment (if in compliance with spraying guidelines), and is approved by the World Health Organisation (WHO) and the world's leading malaria scientists.

Other scientists have argued for the health risks of DDT use. DDT is an endocrine disrupting chemical (EDC). EDCs represent a diverse range of man-made chemicals discharged into the environment that mimic or antagonise the function of hormones. These EDCs may interact with physiological systems and cause alterations in development, growth and reproduction in human and domestic/wildlife, such as fish, chickens egret egg shells, etc.

Added to this is the policy debate of how government should react when the science community disagrees, bringing to the fore the issue of evidence-based policy-making.

Aim of discussion

The WRC recognized that this issue needed to be discussed in a transdisciplinary manner. Additionally, the WRC hopes to develop a framework for collaboration, unpack the status of our knowledge and develop sustainable and responsible approaches in understanding the impact of DDT on the environment and society. Inter- and intra-institutional coordination and cooperation will be important to create a new paradigm for DDT use throughout the life cycle that not only ensures economic security but also environmental and social security, thereby striking the balance, or finding viable alternatives to DDT as a vector control that remains arguably the most successful weapon to fight malaria causing mosquitoes.

The facts gathered and documented here are not for public consumption given that the dialogue applied Chatham House rules. This forum, which should not be a once-off, must deal with the complexity of centralizing the importance of the food-water and energy nexus. Our focus should therefore be on finding a solution for malaria, i.e. research agenda which in turn will inform policy decisions.

Presentations

Speaker 1 outlined the impact of DDT and its derivatives on human health, with particular focus on Limpopo, especially Vhembe district. A historical overview of research dating back to 1945 was presented, including work done by a research consortium in Rietflei, near Pretoria, with greatest concern being use of contaminated dam water in irrigated crops. She also gave a brief on a research station (a clinic), in Limpopo. Lastly, serious concern was expressed on the compliance regarding the IRS despite having WHO approved guidelines.

It was also noted that malaria is particularly a 3rd world challenge, while the 1st world is much safer. We must be aware of industrial pressures and financiers of research. Another suggestion was on an inclusive DDT application programme, abbreviated as THEA. This programme must deal with the whole cycle and connectivity, land, food, water, animals, hygiene, society perspectives. It was further highlighted that in Africa, including Limpopo, we are dealing with impoverished and vulnerable communities, in very hot day temperatures.

A presentation by the National Department of Health clarified the departmental mission, which is basically to ensure a healthy SA population. It was noted that 10% of the national population reside in malaria prone areas, especially Limpopo, KZN and Mpumalanga. Key trends were noted, most especially the notable rise in malaria cases reported in the year 2013/14. There are various possibilities, one being the resistance to the chemical spray, another being the shift in priorities amongst priority

diseases that the Dept can allocate budget to given the escalating costs of intervention programmes. This is worsened by the lack of competition in DDT producers in the world. Another pressing challenge is the role of transboundary, neighbouring countries, Botswana, Mozambique, and Swaziland. These must have a coherent strategy on fighting malaria, but this is not always the case. Similarly, South Africa does not have a coordinated effort across relevant departments, such as DAFF, DEA, DWS, DoH and numerous research institutions. This means that South Africa may not necessarily have a unified position when participating in global forums such as COP, weakening the message and appeal for financial support. It was however noted that South Africa may not necessarily have to have a singular position but that these issues need to be debated and recorded in local discussion platforms first. This can be improved through improved coordination efforts within SA, for example through the signatory to Stockholm Convention, the DEA. However, DEA cannot deal with health matters, hence direct lines of communication are critical. DoH, in its strategy has planned a free malaria SA by 2018 campaign, in at least selected districts, such as Vhembe. This is a challenge, but not impossible to achieve through concerted effort.

On the way forward, a need was expressed for the resurrection of committees on PoP's (including DDT) as once led by DEA. There is a need to review ToRs of these committees to give them some authority so that their resolutions can reach Ministers, along with the advisory committee. These channels are critical to close gaps between research and policy. Prof Bloemberg is the current chairperson of the advisory committee. It is of utmost importance that research is conducted on DDT alternatives, which must meet stringent criteria (see slides), including efficiency on controlling the vector, sustainability, affordability, etc. SA will be preparing for the next COP, and inputs from dialogues such as this one are critical to generating a position of malaria. The projections on impact of climate change is also very important.

The final presentation reflected on the early days of research and observation in the field of environmental health impacts of DDT. One such WRC report gives a summary of DDT across the country (K5/1501). The most recent publications are on the concentration of DDT in serum, breast milk, tiger fish, chicken as well as in birds' eggshells. The DDT IRS vs hygiene issue was also raised. The impact of DDT on aquatic ecosystems and human health was further outlined. An emphasis was also placed on THEA as an urgent holistic approach to controlling malaria. DDT has been in use for about 70 years - is it successful? Alternatives are urgently needed, even on a moral basis, since treating disease with a chemical that is known to be toxic is unethical. The dynamics of DDT still need further understanding.

Facilitated discussion

The open discussion was preceded by panel members giving their inputs on DDT matters, challenges and successes. The role of Climate Change was further discussed, including altitude. The issue of IRS application guidelines and shortfalls were raised, to which the DoH indicated that there is another programme called IVM focused on DDT and malaria control. The issue of actual spraying and dynamics, such as different wall surfaces, whether painted or not, affects the dynamics of DDT. DoH agreed to this and assured the dialogue that sprayers are trained and should follow the rules.

A brief talk was given by one participant on the importance of understanding the dynamics of mosquito species, and the resilience to chemicals. This talk emphasised that the time for stopping use of DDT is only as far as a viable alternative is established. The licensing process is quite involved. The speaker also warned about risky use of DDT on beds. Potential funding via Bill Gates Foundation could be explored.

Another speaker introduced amongst other aspects, the issue of research on bio-control of vectors besides chemical control. This speaker suggested the cost-benefit analysis research on application of DDT. This will assist in comparative health risk assessment as well. This is basically ranking various diseases on a priority basis for policy attention and informed decision making, particularly in terms of departmental strategy and budget allocation. Alignment of methodologies is critical, such as those of MRC, WHO.

Another participant introduced the issue of mixtures (chemicals) versus individual substances in real life, and noted the fact that some chemicals tend to mimic others or behave the same in action. This can result in additive or negative effects. Due to the complexity, it was suggested that integrated approaches, with MONITORING (using natural and social indicators) is needed. While monitoring is arguably expensive, it is critical to inform research directions and justify any changes, expenditure, budget, social-economic, and environmental aspects. Similar to others, an emphasis was placed on domestic hygiene and public empowerment, as well as acceptance of interventions by community. The issue of female-led households vs migrant man and decision making was also raised.

In summary, the panel discussed the development of a "benefit-burden ratio", in order to calculate the potential impacts of malaria and DDT. Factors to be considered will include deaths and disabilities caused on both sides of the spectrum. The financial cost of DDT, compared with alternative chemicals, and the cost to develop anti-malaria medicine are also to be considered. This ratio should then be used to determine the importance of the DDT problem in relation to the other problems South Africa face.

Along with the “benefit-burden ratio”, it would be necessary to monitor the use of DDT in South Africa. Since no other viable option has been implemented, South Africa is still dependant on the use of DDT to prevent malaria. This is mainly executed by indoor residual spraying (IRS). Educating the general public on the correct use of DDT for IRS, and the dangers of misuse must be implemented. This would require collaboration between researchers and government. It was clear that better communication should be fashioned between research, industry and government.

Monitoring the use, and misuse of DDT would encourage research to explore innovative alternatives to using such a harmful chemical. Monitoring one compound, such as DDT, could possibly lead to an early warning system of harmful effects from other novel compounds. Proper monitoring could boost the development of alternatives. Most research is done on either environmental or human health impacts. It is imperative for government, funders, researchers, and industry to investigate possible alternatives. The Global Environmental Facility (GEF) was mentioned as a possible funding party for future research in South Africa.

This panel discussion concluded that the relationship between research and governmental bodies must first be amended by expanding communication channels. Malaria should become a national focal point, with multi-stakeholder companies investing in the research. However, it is absolutely necessary for researchers to maintain their academic freedom.

Overall discussions and conclusion

The dialogue agreed on the urgent need for viable DDT alternatives to control malaria vectors.

Monitoring dominated the discussion as it provides needed feedback. Targets must be set, for the elimination of DDT in breast milk by a decided time. There was a question of adequacy of the WHO IRS/malaria control guidelines. Noting the changes over time, such as impact of climate change, building infrastructure (mud houses/painted walls). Willingness of the community, bottom up versus top down approach. Regular training of communities using user-friendly methods, is critical. This must empower communities based on holistic food-web or a chain of complexity, involving food-water transmission routes of DDT to man and environment. The importance of linking research with IVMC research prioritization was also raised. This will help avoid duplication, especially the THEA integrative approach that was being alluded to by speakers.

The meeting emphasised the fact that research on alternatives is urgently needed, and must be coordinated and directed to policy action, where appropriate. It is wise to consider a programme that will include transboundary research and programmed targeted at fighting malaria across boundaries as this is the only lasting approach. However, it has its complications as states prioritize and budget differently. Cooperation amongst research institutions and Government departments is vital. This will aid in sourcing even more international funding, such as Bill and Melinda Gates Foundation, GEF, etc. Decision-makers can listen much better to a coherent group, rather than competing views. This will commit Government to utilize research outputs. The DoH has key minimum standards that must be met when developing a viable DDT alternative. It is a lengthy process, culminating in registration of the chemical. SA needs to define and agree on the problem statement around DDT and set targets for a malaria free country. Year 2020 may be too soon to achieve the above, but the focus on two districts is promising. These are in Limpop and Vhembe.

In conclusion, the need for consolidation of information was emphasised, such as the status of PoP's that was previously conducted by DEA, but not published. Monitoring (environmental effects) must be done through accredited labs, as much as possible, otherwise follow best practises where no resources exist. Monitoring is key to reporting and justified statements on COP position, etc.

The need to link up authorities and role players, such as DEA as the signatory and national policy coordinator on PoP's (including DDT) was highlighted. This mapping must include a link to the national advisory committee and policy. However, representation of the research community at the national advisory committee is also critical. It is also important to have a forum or PoP/DDT community of practice where scientists can discuss and exchange views, including peer review. This can provide a space to sieve out what gets published or not. The media must be dealt with carefully due to sensitivity associated with DDT. There was also a call to review the ToR for the DEA national coordinating committee so that their recommendations can make an impact at the ministerial level.

The efforts and leadership showed by WRC on bringing key stakeholders under one roof was highly applauded by speakers and the participants. In fact, the issue of making dialogues regular was insisted upon. DEA announced quarterly meetings that they host and invited members to the meeting on the 19th of Feb.

WRC also announced that, in May there will be a national workshop on developing out a PoP's research agenda.