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Malaria Eradication Group Inaugural Meeting Summary

Malaria Elimination
Initiative



University of California
San Francisco

MEG 2.0
Malaria Eradication Group

Malaria Eradication Group Inaugural Meeting

Hosted by the UCSF Global Health Group's Malaria Elimination Initiative
Santa Cruz, CA, USA
October 24 – 27, 2017

The Malaria Eradication Group (MEG 2.0) held its inaugural meeting in Santa Cruz, California on October 24-27, 2017. This report includes highlights from the presentations and discussions and is not comprehensive.

Meeting Objectives: to identify the scientific, financial, and operational requirements for malaria eradication, and articulate priority topics for MEG 2.0 to pursue over the coming years.

The Group members in attendance at the inaugural MEG meeting represent varied expertise in ecology, evolutionary biology, epidemiology, high-endemic malaria, urban malaria, child health, healthcare financing, macro-economics, global and regional leadership, advocacy, health systems strengthening, and more.

The Group deliberated on the direction of MEG 2.0, including its general role within the global malaria community. To supplement current efforts, the Group identified priority research topics for

further exploration:

- **Leadership and management:** How can the malaria community address operational challenges on the ground and foster policy level changes to efficiently and effectively get to zero?
- **Economics and finance:** How much will malaria eradication cost, who will pay for it, and what does the investment case for malaria eradication look like?
- **Future predictions:** What will the world look like in the coming decades, and what are key factors that will have positive and negative impacts on malaria?
- **Hardest cases:** As we approach eradication, where will the hardest cases be and how should they be confronted, both today and in the future?
- **Technology and innovation:** What are key attributes of future technologies that could be game changing accelerators for malaria eradication efforts?

The **Malaria Elimination Initiative (MEI)** at the University of California, San Francisco (UCSF) Global Health Group believes a malaria-free world is possible within a generation. As a forward-thinking partner to malaria-eliminating countries and regions, the MEI generates actionable evidence through operational research, shares new tools and approaches to help countries eliminate malaria more efficiently and effectively, documents and disseminates elimination best practices, assesses the costs and benefits of elimination, fosters regional initiatives for malaria elimination, and strengthens political and financial commitment to shrink the malaria map. With support from the MEI's highly skilled team, countries around the world are actively working to eliminate malaria—a goal that nearly 30 countries will achieve by 2020.

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Session 1: Introduction to MEG 2.0 and objectives

Chair: Richard Feachem

Presenters: Richard Feachem, Allison Phillips, Ingrid Chen, and Rebecca Cooney

- Much progress has been made in eliminating malaria since 1900; in 2017, roughly half of all countries are malaria-free and we are now looking ahead to the possibility of no human malaria transmission by 2040.
- Considered taboo just ten years ago, the concept of elimination is now mainstream. The Malaria *Elimination* Group formed in 2008 and helped elevate the concept of malaria elimination at the global level, bringing national and regional elimination programs together to collaborate and learn from one another.
- Today, the conversation has shifted to eradication and is being led by major global bodies, and informed by several processes and a new research agenda. The Malaria *Eradication* Group (MEG 2.0) will contribute to this conversation by identifying the scientific, financial, and operational requirements for malaria eradication. The Group aims to identify major areas of skepticism around malaria eradication so that we can address them in research papers and through evidence-based advocacy at global fora.
- A key objective of MEG 2.0 is to complement, supplement, and sometimes challenge the World Health Organization's Strategic Advisory Group on malaria eradication (WHO SAGme); MEG 2.0's Secretariat (the Malaria Elimination Initiative of UCSF's Global Health Group) has worked closely with the SAGme to identify priorities and gaps that MEG 2.0 can take on.
- Major questions that MEG 2.0 will address: Can we eradicate malaria in the coming decades? Is it worth the energy, time, and effort if we can? Are today's tools sufficient, and if not, what kinds of new tools will help us to accelerate to zero? If we agree that we can and should eradicate, how will we do it? Finally, what is the counterfactual – what will the world look like in 2040 if we do not pursue eradication as a goal?
- A flagship output for MEG 2.0 will be a Lancet Series or a Lancet Commission on malaria

eradication. MEG 2.0 will provide the intellectual shaping of the material and define topics and messaging, while Lancet editors and staff will provide guidance and support. Other, more creative dissemination options to be considered beyond the series include infographics, videos, and podcasts.

Highlights of Session 1 discussion

- Most people are in support of the idea of eradication and agree that it is what we should strive for; the existing skepticism tends to be around practical issues and challenges rather than the question of "Should we do it?"
- MEG 2.0 needs to clearly define what we mean by eradication, particularly as it pertains to non-human *Plasmodium* species and potential spillover into humans.
- "The road to eradication is paved with elimination" – we should be careful about drawing too firm a distinction between the two, and we cannot stop talking about elimination entirely; if we cannot get elimination right, we will not achieve eradication.
- On the other hand, there are important differences between elimination and eradication; when transmission reaches very low levels in an elimination setting, a handful of cases is not viewed as a public health emergency whereas these cases are high priority when striving for eradication.
- A Lancet Commission on malaria eradication may be a preferable alternative to a Lancet Series, but we need to define our primary audience; a commission will have greater impact at a global level, particularly in influencing a World Health Assembly (WHA) resolution on eradication, while a series may have more relevance at national/regional levels.

Session 2: Other related eradication initiatives

Chair: Winnie Mpanju-Shumbusho

The case for malaria eradication exceptionalism, presented by Bruno Moonen

- Key arguments in support of eradication: 1) Nobody should have to suffer from malaria; if

we do not eradicate malaria, where should we allow it to remain? 2) Once eradicated, we can cease all spending on interventions, and eradication will be infinitely cost-effective. 3) It is good that we do not have a magic bullet intervention, because this encourages a strong innovation pipeline and continued creative thinking by stakeholders about malaria.

- Receptivity and vulnerability to malaria transmission must be taken into account when considering eradication; despite high R0 values and increasing risk of importation in some areas, population movement/urbanization and environmental heterogeneity can increase or decrease the risk of malaria transmission.
- Malaria eradication does not need to be an all-or-nothing global campaign; sequential/parallel national and regional elimination will increasingly benefit neighbors.
- Eradication requires defining current and future challenges, identifying creative solutions, and continuing to invest in research and tool development.

WHO Strategic Advisory Group on malaria eradication (SAGme), presented by Edith Patouillard

- SAGme was established in 2016 to advise the WHO on malaria eradication through discussions and analyses of biological, technical, socioeconomic, political, and environmental determinants of eradication.
- Seven work packages have been defined by SAGme: Economics and Financing, Health Systems, High Transmission Areas, Threats to Eradication, Populations at Risk during Eradication Efforts, Community Engagement, and Past Eradication Efforts.
- The Economics and Financing work package aims to answer whether to invest in malaria eradication and examine financing mechanisms for eradication or explore alternative options. The work package currently focuses on the development of (i) a conceptual piece on the economics of malaria eradication (ii) empirical analyses of GDP and malaria (iii) impact of malaria on economic output in selected countries (iv) optimal level of control in different settings and (v) options for financing.

malERA Refresh update, presented by Roly Gosling

- The Malaria Eradication Research Agenda (malERA) initiative is a scientific consultative process launched in 2008 to identify knowledge gaps and new tools required for malaria eradication; the initiative was refreshed in 2015 to reflect new developments and considerations.
- malERA convened over 200 researchers to write collaborative papers on defined research topics; under Refresh, six expert panels have assessed the progress made since those papers were published in 2011 and identified new priority research areas.
- The panels will publish papers on six topics in PLoS Medicine in 2017: Basic Science and Enabling Technologies, Insecticide and Drug Resistance, Characterizing the Reservoir and Measuring Transmission, Tools for Elimination, Combination Interventions and Modelling, Health Systems and Policy Research

Note: malERA refresh publications are now available:

<http://blogs.plos.org/speakingofmedicine/2017/1/30/malera-refresh-collection-an-updated-research-agenda-for-malaria-elimination-and-eradication/>

Highlights of Session 2 discussion

- There is potential for content duplication between MEG 2.0, SAGme, and malERA. However, there are important nuances regarding our roles, objectives, and messaging. Given current coordination across groups and how much work needs to be done, duplication is not a major concern.
- Much of the work of SAG and malERA seems to be high-level without close attention to on-the-ground realities or direct engagement with national programs, which is essential for progress; we need to clarify at what level MEG 2.0 should operate – global vs regional/national.
- We also need to clarify what role MEG 2.0 should play – are we primarily focused on making intellectual contributions via a Lancet Commission/Series, should we take on more of an advocacy role to drum up support for

eradication at all levels, or should we leave room for our role to evolve over time?

tackling issues that no single country can resolve on its own.

Session 3: Malaria eradication by regional elimination

Chair: Roly Gosling

APLMA overview, presented by Ben Rolfe

- The Asia Pacific Leaders Malaria Alliance (APLMA) is an affiliation of heads of government formed in 2013 to accelerate progress toward elimination in all 22 countries by 2030.
- APLMA has developed a regional elimination roadmap and a dashboard to track progress toward milestones defined in the roadmap; member country ministers of health, finance, and defense convene annually to discuss progress and roadblocks.
- The APLMA secretariat seeks to create an enabling environment for technical innovations and financial support for the 22 countries; major challenges include *P. vivax* elimination, spread of artemisinin resistance, and declining global funding.
- Regional initiatives such as APLMA play a critical role in communicating progress and challenges, particularly to global donors; regional initiatives should supplement national efforts, not replace them.

E8 overview, presented by Richard Nchabi Kamwi

- The Elimination 8 (E8) was formed in 2009 as a means to coordinate national elimination efforts and jointly plan regional elimination; E8 aims to eliminate malaria in four frontline countries (Botswana, Namibia, South Africa, and Swaziland) by 2020 and in four second line countries (Angola, Mozambique, Zambia, and Zimbabwe) by 2030.
- Within E8, other subregional collaborations (MOSASWA, Zam-Zim) have formed to address unique cross-border issues between specific countries.
- Regional initiatives allow for pooling of otherwise limited resources to improve efficiency, conducting regional-level surveillance and facilitating data-sharing, and

Highlights of Session 3 discussion

- One size does not fit all when it comes to regional initiatives, as evidenced by APLMA and E8 – the former has more of an advocacy and funding support role, while the latter is more collaborative on an operational level.
- Regional initiatives have to take into account individual country operational and decision-making structure, political nuances, rivalries, etc in order to determine a communication and support strategy and drive continued progress; it is not enough to set a goal and define a roadmap, continued engagement is required.
- Country ownership and involvement in setting the eradication goal is essential.
- Setting an eradication goal is important to support and accelerate the work of regional initiatives, but timing is critical; a declaration in 2020 provides time to socialize the concept with countries, refresh previous elimination messaging, and initiate new funding requests.

Session 4: Anticipated challenges – non-human reservoirs and species extinction

Chair: Caroline Buckee

***Plasmodium knowlesi*: past, present & future**, presented by Caroline Buckee on behalf of Balbir Singh

- While human-to-human transmission of *P. knowlesi* via mosquito is possible in lab conditions, there is no clear evidence that this is happening in the field.
- Primary anopheline vectors of *P. knowlesi* are forest fringe mosquitoes; human cases are closely associated with human infringement on forest habitats of macaque species.
- Human *P. knowlesi* cases have now been reported in all SE Asia countries except Lao PDR (although there are known human cases there); the risk of spillover into humans across the entire region is significant but patchy, and likely to increase with rising human population and further changes to local forest ecology.

- The risk of spillover may be limited by host cell tropism; current research indicates that there is significant species clustering of host receptors on blood cells.

Malaria eradication and planetary health,

presented by Kate Jones

- Planetary health is defined as safeguarding both human health and the natural systems that underpin it; this approach takes into account the various factors that influence spread of infectious disease, including features of hosts, vectors, pathogens, and susceptible populations, as well as the role of the physical environment and socioeconomic drivers.
- For malaria there are multiple zoonotic hosts in addition to humans, and multiple species of vectors and *Plasmodia*; from a system-dynamics perspective, this means innumerable factors and interactions can be modeled.
- When discussing malaria eradication, we have to consider the unintended consequences in the environment; ecosystems are much more resilient when biodiversity is high – will malaria eradication destabilize local systems?

Highlights of Session 4 discussion

- *P. knowlesi* may not be a significant threat as long as you can identify and protect high-risk, forest-going groups; however, it does impact the concept of eradication in that we cannot cease all interventions even after eradicating the four human parasites – continued surveillance, prophylaxis, and/or personal protection measures will be required.
- There is concern that we have only identified a small proportion of monkey malaria species; the more we test different species of macaques and other simians, the more we may find – we cannot underestimate the threat posed by non-human malaria parasites.
- In addition to considering the unintended consequences of malaria eradication, we need to consider the unintended consequences of either doing nothing, or proceeding with business as usual without pursuing eradication – everything we do, even if we do nothing, will likely have impacts on our environment that we cannot predict.

- We need to distinguish between impact of the absence of the malaria parasite species vs impact of how we eradicate; the former may not have an impact other than improving human health, while the latter has many implications depending on which methods we use.
- An 'ethics of eradication' component to MEG 2.0 could explore these issues further.

Session 5: Anticipated challenges – changing transmission patterns and rural/urban malaria

Chair: Maria Clara Restrepo Mendez

Urban malaria: present and future, presented by Pete Gething

- Urbanization is occurring rapidly all over the world in nearly every country; by 2050, the proportion of the population living in urban areas is expected to increase to 66%.
- Models indicate that with every incremental increase in urbanicity/population density, there is a roughly stepwise decrease in malaria incidence rate; these trends largely hold across regions for both *P. falciparum* and *P. vivax*.
- In Africa, very rural areas are more hospitable for anopheline vectors but there is not enough human density to sustain transmission, whereas very urban areas are relatively inhospitable for anopheline vectors (with exceptions); incidence rates tend to be highest in periurban/suburban areas.
- Housing quality and impervious surfaces have been shown in models to have significant impact on malaria transmission, nearly of equal importance to environmental factors such as elevation and degree/type of vegetation.

Urban malaria in India: strategies, approaches, and challenges, presented by Alex Eapen

- Malaria morbidity and mortality rates in India have declined overall since 2000 but much of the population is still at high risk, including several urban centers that account for the majority of malaria transmission in their respective states.
- ½ to ¾ of reported malaria cases in Tamil Nadu occur in Chennai, where *An stephensi* and *An*

subpictus breed in manmade habitats associated with urban dwelling (water storage tanks, wells, cisterns, pots, gutters, etc).

- Larval Source Management, including the elimination of stagnant water, mosquito-proofing water storage tanks, and use of larvicides, is an essential component of malaria control in urban areas but identifying and accessing all potential breeding sites is a huge challenge. Additionally, tailored interventions are available for some breeding sites (e.g. covering water tanks with lids), but not for others (e.g. water in terraces after rain). An understanding of vector resting and feeding behavior as well as temperature and humidity patterns will help inform intervention choices.
- Treatment and diagnosis are also a challenge for urban malaria in India, as most cases are treated by private practitioners with varying quality of care.

Highlights of Session 5 discussion

- Urbanicity models are still being refined and will incorporate additional elements depending on availability of data, including seasonal population movement between rural and urban areas, transmission dynamics in different urban settings (slums vs other urban development), and baseline R0 in different settings without the effects of interventions.
- A similar model of urbanicity specific to India would be very useful, given the presence of a specialized urban vector *An stephensi*; however, there is currently not sufficient data available from India to facilitate this.

Session 6: Anticipated challenges – confronting the hardest cases

Chair: Bruno Moonen

Driving down malaria transmission in a high endemic setting: strategies, challenges, and potential solutions from Uganda, presented by Grant Dorsey

- Cohort studies among young children in Uganda indicate that chemoprevention along with routine malaria control interventions (LLINs and case management) is highly effective in reducing frequency and severity of malaria.

- Combining routine interventions with IRS and monthly chemoprevention with ACTs (dihydroartemisinin-piperazine) resulted in 99.5% protective efficacy among children aged 6 mos–2 yrs; prevalence of malaria (including submicroscopic parasitemia) among the treated population declined from 40% to 0.8%.
- Turning proof of concept into policy is very challenging and will require more research on implementation, cost-effectiveness, and risk analyses, as well as sustained financial support.

Highlights of Session 6 discussion

- Chemoprevention reduces community costs in terms of trips to the clinic and work/school absenteeism, it reduces the quantity of drugs used, and it also has a vaccination effect in that even after treatment ceases, children have fewer than average annual cases.
- Despite the positive outcomes of these research studies, there is considerable hesitance among program managers and global bodies such as WHO to using ACTs for chemoprevention, for fear of driving drug resistance.
- The malaria community continues to build the evidence base in areas where we already have sufficient data. There needs to be a fundamental shift in thinking toward what is needed to achieve eradication, with investment in areas that are either unknown or unproven - particularly on interventions that achieve and sustain long term transmission reduction rather than interventions with only short term effects.

Session 7: Road to eradication – operational requirements

Chair: Neelam Sekhri Feachem

Health systems challenges: integration, decentralization, management, and beyond, presented by Jim Tulloch

- Eradication is inherently a top-down concept; it is dangerous to assume that national programs are as motivated as we are to achieve this goal, and getting programs on board requires adequate motivation, compensation, and incentives.

- Providing financial support is not enough – the global community needs to provide boots on the ground and managerial support to guide supervision, microplanning, and community engagement, and help alleviate the enormous burden placed on national programs.
- The management structure of malaria programs may not be appropriate for achieving elimination – disciplines tend to be siloed, leading to inefficiency and poor communication; reorganization may be necessary when programs reach the elimination phase.
- The strength and style of leadership at the global level is key; to achieve eradication, there must be a direct line of communication and accountability between global leaders, national programs, and field staff.
- Training programs need to be implemented under a rigorous management framework and with a longer term vision; too many trainings are short term and do not take existing national structures and capacity into account.
- Successful elimination and eradication require us to constantly reinforce the message of what we are doing and why for programs and the communities they serve; delivering a clear and consistent message starts with leadership and strong management.

Session 8: Road to eradication – financial requirements

Chair: Richard Nchabi Kamwi

Donor healthcare financing in the era of the MDGs and the SDGs: implications for malaria, presented by Joe Dieleman

- In 2016, malaria accounted for 6% of all spending on development assistance for health; donor funding has stagnated at less than 2% annual growth rate since 2010.
- Global Fund and USAID/PMI are the biggest malaria spenders, and a large proportion of the money is put toward health system strengthening and treatment.
- Forecasting future spending on health is complex and highly variable by country; in general, modeled increases in future spending are primarily driven by national government resources while development assistance for health drops to negligible levels.

Disease eradication as an investment, presented by Dean Jamison

- Making an investment case for eradication is challenging because as malaria transmission goes down, there are very few incremental lives saved for every dollar spent; previous analyses have shown that cumulative expenditures on malaria are actually higher once a country achieves elimination as compared to maintaining a high level of control.
- Malaria will likely resemble smallpox in that once the disease is eradicated, interventions and spending will cease; eradication becomes increasingly cost-effective over time.

The crisis in low quality and unreported private diagnosis and treatment of malaria, presented by Altaf Lal

- India currently faces a severe shortage of qualified microscopists and health workers trained in RDT usage, which may lead to countless undiagnosed malaria cases and inappropriate treatment of patients who do not have malaria.
- The private market conducts up to 200 million malaria tests per year, yet their diagnoses are frequently incomplete, incorrect, or incomprehensible, and they are not reported to the public sector.
- Poor quality drugs and artemisinin monotherapies are common in India and studies indicate some antimalarial drugs from India as well as China do not meet standards of quality and effectiveness. This impacts patient management and may cause drug resistance and the undermining of consumer confidence in public and private health systems.

Highlights of Session 7 discussion

- Much can be learned from previous eradication efforts regarding management and leadership: for polio, elimination managers were affiliated with both WHO and national ministries of health, yet operated independently, with higher recruitment and accountability standards and a clear management structure.

- Countries eliminating later may not have to spend as much to achieve elimination if their neighbors have already eliminated and the importation burden is alleviated; this has implications for current spending – is it appropriate to ask countries currently eliminating to pay more than their fair share, or should international donors shoulder more of the financial burden up front?

Highlights of Session 8 discussion

- Smallpox was a single, global campaign, but with malaria we are eliminating region by region in a sequential manner – maintaining a malaria-free state in a region is easier and more efficient compared to maintaining a malaria-free state in a single country.
- The assumption that domestic financing will have to increase to cover the huge projected funding gaps is inappropriate; as the malaria map shrinks, the final countries to eliminate in central Africa are also the poorest, with the highest burden.
- An important factor when considering the cost of eradication is how long it will take us; the only conclusion is that we need to speed up the process to keep costs down.
- Costing projections and models need to be revised to capture a broader concept of both costs and benefits beyond the cost of deliberate malaria activities, including indirect costs related to environmental impact, climate change, and population movement and displacement.

Session 9: MEG 2.0 early work products

Chair: Dennis Shanks

Learning from the past: an overview of previous eradication efforts, presented by Ingrid Chen

- In previous eradication campaigns for smallpox, Guinea worm, and polio, declarations by the World Health Assembly were vital in kick-starting progress.
- Setting time-limited goals for eradication typically lead to increases in funding which help

spur technical innovations; overall, the goals help build momentum and drive enthusiasm and support among the global community.

- WHO was not always the single, most important leader in previous efforts; regional and national leadership was also essential for success, and many other organizations played key technical and financial leadership roles.

GDP, health spending, and elimination targets, presented by Pete Gething

- There is a strong relationship between a country's wealth and its level of malaria endemicity; wealthier countries spend more on health and malaria control activities, they are more urbanized with improved infrastructure and housing quality, and in turn, low malaria endemicity leads to a healthier workforce, improves tourism, etc.
- Examining average GDPs of past eliminators does not tell us much – there is a lot of variation over time and across regions with no clear threshold, indicating that GDP on its own cannot predict elimination potential.
- Projecting into the future, the vast majority of malaria-endemic countries will not reach the median GDP of past eliminators before 2040; in many cases they will not reach it for decades.

Highlights of Session 9 discussion

- World Health Assembly declarations are important but are not always the key driver of momentum; a missing component is community engagement – previous eradication campaigns involved massive mobilization efforts and the same needs to happen with malaria.
- GDP is an imperfect measure and we need to consider other factors that influence or are related to GDP: housing quality, rate of urbanization, strength of health systems, access to care, climate, and temperature.
- Even if we cannot make global generalizations, this analysis is useful at the national level in terms of informing countries on historical average spending on health and malaria and the impact of malaria elimination on GDP.

Session 10: Exploring sources of skepticism – should we strive to eradicate malaria by approximately 2040?

Chairs: Winnie Mpanju-Shumbusho and Jim Tulloch

Should we strive for eradication by approximately 2040?

- Members agreed that yes, we should strive for eradication, although there were varying degrees of skepticism regarding whether we can actually achieve eradication by approximately 2040. The group agreed, however, that setting a target date for eradication is important in order to build political will, meet interim national and regional elimination targets, and secure commitment from governments, organizations, and other stakeholders. Furthermore, there is a great human and financial cost associated with not eradicating malaria. Finally, eradication has an impact beyond malaria – achieving eradication requires strengthening of health infrastructure, surveillance systems, spatial decision support systems, and more, all of which will benefit other health and disease programs.
- The group agreed on numerous challenges that must be addressed to achieve malaria eradication:
 1. Eradication will require substantial financial commitment.
 2. Current advocacy messaging needs to shift to eradication; a World Health Assembly resolution is necessary to get everyone on board.
 3. We need proof of concept that we can eliminate in a difficult, highly-endemic area.
 4. We need strong leadership at all levels, including a new D.A. Henderson for malaria.
 5. We need new tools and ongoing research, including identification of other non-human reservoirs and better understanding of zoonotic threats.

This commitment and momentum must also be sustained in the face of many competing priorities. The successful eradication of polio would be of great benefit to gaining political will and ambition for malaria eradication.

- The group identified a number of enabling factors that would accelerate the path to malaria eradication. These include:
 1. Obtaining health financing from the private sector, individual philanthropists, and via non-traditional methods such as crowd-sourcing.
 2. Maintaining commitment and activism already present in support of both elimination and eradication.
 3. Drawing on the successful examples of Zambia and Botswana to serve as proof of principle.
 4. Considering the gains made from economic development that show an overall downward trend in the burden of disease.
 5. The strong research and development pipeline for both malaria and basic science may lead to availability of game-changing innovations (e.g. CRISPR/Cas9, highly efficacious vaccine, a perfect drug meeting SERCAP requirements).
 6. The current data revolution that will increase the availability of real-time country-level data.
 7. The human and financial resources that will become available if polio is eradicated.
 8. That if there is a WHA resolution on malaria eradication in 2020, we would still have 20 years to achieve success.

Closing Session: Next steps and preparation for Lancet Series or Commission on malaria eradication

Richard Feachem and Ingrid Chen

- Five priority topics were identified by the group for further exploration, as described below. The MEG Secretariat will maintain communication with members to confirm topics of focus and define roles and responsibilities.
 1. **Leadership and management:** How can the malaria community address operational challenges on the ground and foster policy level changes to efficiently and effectively get to zero? This work stream will explore best practices to advance program

management and strengthen health systems.

2. **Economics and finance:** How much will malaria eradication cost, who will pay for it, and what does the investment case for malaria eradication look like? This work stream will use past and present malaria financing trends to predict directions for the future, with a particular focus on the relationship between malaria financing, national GDP per capita, and total healthcare expenditure per capita.
3. **Future predictions:** What will the world look like in the coming decades, and what are key factors that will have positive and negative impacts on malaria? Changing trends could include: urbanization, population size and distribution, land use, growth in GDP per capita, etc. This work stream will incorporate disease forecasting and modeling to produce 5-year increment malaria endemicity maps through 2040/2050, comparing a business-as-usual approach with other drivers of change.
4. **Hardest cases:** As we approach eradication, where will the hardest cases be and how should they be confronted, both today and in the future? This work stream will use the future prediction scenarios described above, but with a tailored focus on equatorial Africa.
5. **Technology and innovation:** What are key attributes of future technologies that could be game changing accelerators for malaria eradication efforts? This work stream will examine the potential impact of innovations such as CRISPR-Cas9 gene drive technologies or a long-acting vaccine on the path to eradication.
 - As a next step, the MEG Secretariat will communicate with Lancet editors on group consensus to produce a Lancet Commission on malaria eradication rather than a Lancet Series.
 - The Secretariat will also seek possible additional representation from the India malaria program; Zambia malaria program; China malaria and/or development assistance programs; geopolitical expert; social/political scientist and/or an advocacy expert to shape our communications.
 - The next MEG 2.0 meeting will take place at Wiston House in Sussex, England on May 7-10, 2018.

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