KEY FINDINGS OF THE CONFERENCE

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## OBJECTIVES OF THE CONFERENCE

| Review recent technological developments | • High-yielding Artemisia varieties and production methods  
|                                           | • Artemisinin analysis and extraction/purification technologies  
|                                           | • Semi-synthetic and synthetic artemisinin production  
|                                           | • Control of resistance, other drugs in pipeline |
| Supply and demand projections for artemisinin and ACTs | • Anticipated artemisinin production 2010 and beyond  
|                                                       | • Anticipated cost of production and ACT prices  
|                                                       | • Anticipated funded demand 2010 and beyond  
|                                                       | • Integration of demand forecasting mechanisms |
| Financing mechanisms for artemisinin and ACT supply | • Global Fund and other Public Sector funding  
|                                                       | • AMFm update and future directions  
|                                                       | • A2S2 update and future  
|                                                       | • Views/needs of pharmaceutical industry |
| Future actions | • Follow up on Mumbai conference  
|           | • Next steps |
### RECOMMENDATIONS OF THE ARTEMISININ CONFERENCE 2009 (MUMBAI)

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<td>Better co-ordination of ACT demand forecasts to keep production in line with demand</td>
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<td>Artemisia and artemisinin production</td>
<td>Urgent action to increase production to meet forecasted demand, through:</td>
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<td>• Higher yielding Artemisia varieties</td>
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<td>• Processing innovations to raise extraction and purification efficiency</td>
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<td>• Realistic pricing throughout the supply chain to motivate farmers and extractors</td>
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<td>• Rapid introduction of A2S2 artemisinin loan fund</td>
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<td>Quality requirements of artemisinin</td>
<td>Discussions with WHO to clarify quality requirements of artemisinin as a starting material as well as an API</td>
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<td>Artemisinin monotherapy</td>
<td>Action to achieve withdrawal of artemisinin monotherapy as soon as possible</td>
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TECHNICAL DEVELOPMENTS
SEEDS and FIELD CULTIVATION

Presentations: Ellman (NRI), Bowles (CNAP), Bentley (NIAB), Simonnet (Mediplant)

Planting materials:
• HYVs being rolled out by CNAP, NIAB, Mediplant
• Seeds must be low cost and high yield (artemisinin/ha)
• Readily available to growers through extracting company
• Adapted to local conditions
• Importance of retaining pool of genetic diversity

Production systems:
• Target both small farmers and commercial growers
• Research and extension services critical: good agronomy can raise yields 30% or more
• Post harvest technologies important for securing artemisinin content
TECHNICAL DEVELOPMENTS
FIELD CULTIVATION (contd)

Costs of production:
• Vital to reduce COP but leaf price must be competitive with returns from other crops
• Leaf shortage/multiple buyers pushes price too high (China over $1,000 per tonne)

New Production sites:
• Size of global market for artemisinin is small
• Max 30-50,000ha A. annua needed depending on yield
• Important to retain current agro-ecological spread
• No new production sites needed unless real comparative advantage
TECHNICAL DEVELOPMENTS
Purification, Leaf and Artemisinin Analysis

Presentations: Hill (ETDL), Simonnet (Mediplant), Khambay (Kamtech)

- Single step technology for artemisinin purification/crystallisation needed
- HFC the best purification technology but solvent cost is high, therefore need to minimise losses
- Quick analysis using Near-Infrared Spectroscopy (NIRS) for leaf a/c and m/c
- Limitations of Pharmacopoea methods for Analysis
- Artemisinin as a starting material
TECHNICAL DEVELOPMENTS
SEMI-SYNTHETIC ARTEMISININ

Presentations: Nguyen (One World Health), Henri Farret (Sanofi-Aventis),

- Aim is to supplement plant-based production and stabilise supply
- Anticipated cost $350-400 per kg, comparable to high quality field production
- Short cycle time: less than 1 week to produce 500kg pure artemisinin
- Available to approved API manufacturers by first half 2012, commercial supplies 2nd half 2012
- Target capacity 40 tonnes pa.
- Is cost linked to cost structure of synthesis or cost of field production?
Artemisinin resistance, Sub-standard ACTs, Monotherapies

Presentations: Ringwald, Sabartova, Bosman (WHO)

• Delayed parasite clearance on Thai/Cambodia and Thai/Myanmar borders, China and Vietnam
• No consensus whether this is resistance, partial resistance or tolerance
• International Task Force for Containment established
• Strategy:
  • Detect and treat all malaria cases in danger zone
  • Reduce transmission through vector control
  • Reduce pressure on artemisinin and partner drug
  • Urgent development of new antimalarials
• Study of ACTs in 6 African countries shows 28% not meeting QC requirements
• 50% of monotherapy manufacturers known to WHO are non-compliant
  60% of these are from India, 20% from Nigeria
• 28 countries allow marketing of monotherapies, 17 in Africa
ACT DEMAND PROJECTIONS

Presentations: Lamiaux (BCG), Cheung (CHAI), Ambachew (UNITAID), den Besten (i+solutions)

- Current best estimates for 2010 are 229m treatments (114.5t art), estimates for 2011 are 245m treatments (122.5t artemisinin)
- Earlier CHAI forecasts were low: damaging effect on producer confidence
- Demand forecasting consortium formed Oct 2010 for unified forecasting mechanism supported by UNITAID
- AMFm will increase demand for ACTs
- Large scale use of RDTs and LLINs will reduce it
- Need for continuous update of demand forecasts – new, integrated, forecasts will be quarterly
ARTEMISININ SUPPLY, PRICING AND MANUFACTURING COST

Presentation: Pilloy (Artepal)

- Estimated 2009 production 60MT but stocks sufficient to fill gap
- Estimated 2010 production (extracted Oct 2010-June 2011) is 90-105MT
- 2011 estimated global demand 115-130t (25t gap)
- Artemisinin production cost ranges from $320-400 per kg
- Leaf price has risen sharply, especially in China ($880-1200/MT)
- Competition between buyers has pushed artemisinin price to $430-450/kg
- A price **not** in excess of $400/kg is needed to ensure sustainability in the artemisinin, API and ACT supply chain
PROMOTIONAL/FINANCING MECHANISMS FOR ARTEMISININ SUPPLY – A2S2

Presentations: Den Besten (i+solutions), Jansen (Triodos)

• A2S2 launched 2009 for 2 years to boost artemisinin production
• Prefinancing mechanism for approved extractors
• Covers maximum 60% of sales contract
• $5m allocated to date
• $3m still available for 2010
• Aim to help create long term supply contracts e.g. 1yr
• Ensure regular communications throughout supply chain of artemisinin production statistics, prices etc
ACT SUPPLY & FINANCING MECHANISMS

Presentations: Jouberton (AMFm), Dickerson (PMI), Blasco (UNICEF), Ambachew (UNITAID)

- Global Fund is biggest buyer of ACTs: $152.6m 2009, $185.7m 2010
- AMFm co-finances quality ACT purchases to make price comparable to Cq and SP and push out monotherapies
- AEDES/OTECI Consortium has replaced CHAI as price negotiating Agent
- USAID/PMI, UNITAID, WB and DFID are important additional funders
PROPOSALS FOR ACTION

• Earliest roll out of affordable high yielding seeds, through extractors linked to approved API/ACT manufacturers
• Need for effective services for small-scale and commercial farmers, to ensure the potential of high yielding varieties is fully realised
• Promote development and dissemination of efficient purification/crystallisation technology
• Need for improvement and standardisation of artemisinin analysis technology
• Make available artemisinin reference standard for analytic purposes
• Finalise technical specifications for artemisinin as a starting material
• Urgently implement the demand forecasting system supported by UNITAID
• Recommend an artemisinin price not exceeding $400/kg to ensure sustainability in the artemisinin, API and ACT supply chain
• Increase market intelligence and information sharing throughout the Artemisia-ACT supply chain
• Continued information-sharing on plans for semi-synthetic artemisinin production
PROPOSALS FOR ACTION - contd

• Strengthen strategies to contain artemisinin resistance
• Intensify informed action to eliminate oral artemisinin based monotherapies and substandard ACTs
• Support research and development of new chemical entities effective against artemisinin resistant malaria
• Promote large-scale utilisation of malaria diagnostics in order to secure availability of ACTs to people in need
• Call for an extension of A2S2 in view of risk of shortages in the artemisinin supply chain for 2011/2012
• Consider additional ACT purchase mechanisms to secure sustainable supplies e.g. Allocation of orders to multiple suppliers
• In view of the dynamic nature of the Artemisia-ACT supply chain and the critical importance of the evolution of artemisinin resistance, it is recommended that the next international Artemisinin Conference is convened in the last quarter of 2011.