Future Horizons – Is South Africa ready for measles elimination?

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"The mission of the Decade of Vaccines is to extend, by 2020 and beyond, the full benefits of immunization to all people, regardless of where they are born, who they are, or where they live."
GVAP end-2020 targets

- All vaccines in national programmes: >90% national coverage, and >80% in every district by end 2020
- Polio: eradicated by end 2018
- Measles: eliminated in 5 regions by end-2020
- Rubella: eliminated in 5 regions by end-2020
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Measles & Rubella elimination targets, WHO Regions
2014 ASSESSMENT REPORT OF THE GLOBAL VACCINE ACTION PLAN

STRATEGIC ADVISORY GROUP OF EXPERTS ON IMMUNIZATION
Routine Immunisation Coverage – 8.2 million African infants not reached with 3 DTP doses in 2013

DTP3 coverage worsening in some African countries: 2013 and 2014
Un/Under Vaccinated Children in 2013: South Africa has the 9th highest number

Source: WHO. SAGE DoV WG – Coverage improvement activities. 15 March 2015

WHO 2015
GVAP mid-point targets

- **DTP3**: All countries >90% national coverage, and >80% in every district by **end 2015**

- **Polio**: transmission stopped by **end 2014**

- **Maternal and neonatal tetanus**: eliminated by **2015**

- **Measles**: eliminated in 4 regions by **end-2015**

- **Rubella**: eliminated in 2 regions by **end-2015**

- **Introduction of under-utilized vaccines**: At least 90 low or middle income countries to have introduced one or more such vaccines by **2015**
GVAP mid-point targets

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Global annual number of reported measles cases & measles vaccination coverage, 1980-2009

2010 63rd WHA set interim measles milestones

- > 90% coverage with 1st MCV nationally & 80% vaccination in every district
- Reduce annual measles incidence to <5 cases per million & maintain this
- Reduce measles mortality by 95% or more compared to 2000 estimates
Mortality Reduction Rate
U5 all cause mortality vs U5 Measles mortality

The state of the World Children, special edition, NICEF 2009;
WER: No. 49, 2009, 84, 505–516;
Global Challenges to measles elimination
Risk of resurgence: Scenario 2010 - 2013

• Projected worst case scenario: none of 47 priority countries carry out SIAs during 2010-2013

• Loss of contribution of measles to overall reduction in child mortality

Method from Lancet 2007; 369: 191–200

Strebel et al; JID 2011:204.
Inequity: % of children <1 year who received measles vaccine by household wealth quintile and region, 2000-2008

Need to focus immunization efforts on reaching out to the poorest quintile, who are also disadvantaged to access to curative health services

Weak health systems: Africa, 2009-2010

- 28 countries had measles outbreaks
  - > 100,000 confirmed measles cases reported
  - > 1300 reported measles deaths

- Why this happened:
  - gaps in routine immunization services
  - suboptimal coverage during recent SIAs (Angola, Namibia, Botswana)
  - too long intervals between SIAs (SA, Lesotho, Zambia)
Outbreak of 51 measles cases linked to Disneyland

Vaccine hesitancy
Impact of Humanitarian Emergencies on Measles Outbreaks: Ebola effects measles immunisation coverage 2013-2014

Liberia Observer (Monrovia)  »

Liberia: Measles Outbreak - Four Deaths - 363 Suspected Cases

Source: AFR monthly district RI coverage database 8 Apr 15
War and conflict: EMRO

Regional incidence: 25/million/year

Country incidence numbers in red are countries where surveillance still sentinel not nationwide.
Is global measles elimination feasible?

- Biological feasibility
  ✔
- Programmatic feasibility
  ✔
- Impact on health systems
  ✔
- Cost-effectiveness
  ✔
- Vaccine market analysis
  ✔
- Risk analysis for post-measles era
  ✔
- Global context and political will
  ❌

Who Technical Consultation, 2010
Is measles elimination feasible in South Africa?

<table>
<thead>
<tr>
<th>Category</th>
<th>Status</th>
</tr>
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<tbody>
<tr>
<td>Biological feasibility</td>
<td>?</td>
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<td>Programmatic feasibility</td>
<td>?</td>
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<td>✓</td>
</tr>
<tr>
<td>Global context and political will</td>
<td>✓</td>
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Biological and Technical Feasibility
Measles eradication is *technically* feasible

- Measles vaccines are safe and effective
- Vaccines provide long-term protection against all known genotypes
- Accurate diagnostic tests and lab networks
- Current vaccines have eliminated measles in the Americas

**Challenges:**
- Vaccine needs cold chain and sterile injection
- Not effective in early infancy
- 2 doses needed
Measles eradication is biologically feasible (properties of the virus and disease)

- Humans are the only host
- Life-long immunity after natural infection
- Only one serotype
- Genetically stable
- *Rinderpest virus* eradicated since 2001

**Challenges:**
- Highly infectious (>93-95% population immunity needed)
- Population growth and density, migration and international travel
- Changing population immunity
- HIV epidemic
Distribution of Measles Cases (N=17 468) in the 2009-2010 Measles Outbreak In South Africa

Available: www.nicd.ac.za
Proportion of Children with Seroprotective Levels of Measles Antibody < 6 months of Age

Simani O_Madhi SA et al AIDS 2013
Proportion of Children with Seroprotective Levels of Measles Antibody Pre-boost, post-booster and at 24 months of age

P<0.05

Simani O_Madhi SA et al AIDS 2013
Programmatic feasibility
Elimination demonstrated by the Americas: Lessons learnt

- Strong political leadership
- Strong regional Technical Advisory Group and strong country TAGS
- High routine immunisation coverage and frequent good quality SIAs
- MR Vaccination for men and women up to 39 years – needs to be determined by local epidemiology and costs
- Use of incentives
- Promoting economic benefits of eliminating measles
- Private sector participation (GPs and paediatricians)
What is South Africa’s EPI coverage: UNICEF vs DHIS Coverage 2009?

- Administrative: 96% fully immunised
- WHO/UNICEF estimates: 64% fully immunised
SA Measles 2 coverage: 2008-2011
### Spot map of Lab positive Measles cases of South Africa 2014

<table>
<thead>
<tr>
<th>Province</th>
<th>Suspected case</th>
<th>Confirmed case</th>
</tr>
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<tbody>
<tr>
<td>Eastern Cape</td>
<td>997</td>
<td>3</td>
</tr>
<tr>
<td>Free State</td>
<td>154</td>
<td>2</td>
</tr>
<tr>
<td>Gauteng</td>
<td>984</td>
<td>18</td>
</tr>
<tr>
<td>KwaZulu-Natal</td>
<td>1445</td>
<td>6</td>
</tr>
<tr>
<td>Limpopo</td>
<td>301</td>
<td>0</td>
</tr>
<tr>
<td>Mpumalanga</td>
<td>569</td>
<td>4</td>
</tr>
<tr>
<td>North West</td>
<td>387</td>
<td>1</td>
</tr>
<tr>
<td>Northern Cape</td>
<td>321</td>
<td>34</td>
</tr>
<tr>
<td>Western Cape</td>
<td>1167</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6325</strong></td>
<td><strong>74</strong></td>
</tr>
</tbody>
</table>

- One dot represents one case

**Legend:**
- **Black dot**: Suspected case
- **Red dot**: Confirmed case
Impact of Measles Elimination Efforts on Immunization and Health Systems
Impact of Measles Eradication on immunization and health systems

- 6 countries:
  - Cameroon, Tajikistan, Brazil, Vietnam, Bangladesh and Ethiopia

- Document reviews and interviews
- Both positive and negative impacts, but overall positive impact in ALL countries studied.
- Negative impact more pronounced in poorer countries with weak health systems and multiple SIAs
- SA Data in rural areas suggests negative impact of SIAs (Hoffman et al 2013)

LSHTM WHO 2010
Is South Africa ready for measles elimination?
Challenges preventing measles elimination

- Varying capacity across provinces
- Shortage of trained staff at all levels
- Impact of SIAs on routine immunization and health services
- Impact of new vaccine programmes on routine immunisation
- Collection tools outdated
- Poor data quality from facility to district to national resulting in unreliable numerators
- Data not verified and monitored by supervisors
- Unreliable denominator: is STATS SA correct?
- Immunisation not incentivized or compulsory/opt out e.g. for school entry
- Have we done a good enough sell of immunisation benefits to leadership?

Van den Heever, 2014
Why we need to tackle measles elimination

• Clusters of susceptible children/adults resulting in recurrent measles outbreaks
• HIV is changing immunity in HIV infected and uninfected exposed children and in HIV infected adults
• Proportion of infants with seroprotective levels of measles antibody is reducing
• Maternal immunity is changing because wild virus infections have diminished
• If we ‘fix’ measles we will improve the whole immunisation programme
What needs to be done.....

• An immunisation coverage survey: 20 million Rands investment for a 1.2 billion Rand programme

• Improve data quality of routine immunisation coverage and produce meaningful statistics

• Tie measles immunisation activities to the soon to be introduced rubella vaccine rollout ensuring high coverage to prevent an increase in congenital rubella syndrome  AND

• **South Africa should be a regional leader in attaining global immunisation goals**
Acknowledgments

- Shabir Madhi, NICD
- Okwo-Bele, WHO
- Peter Strebel, WHO
- Alya Dabbagh, WHO
- Paul Rutter, WHO
- Johann van den Heever, EPI Programme
Economic analysis
Economic Analysis of Measles Eradication

<table>
<thead>
<tr>
<th>Measles vaccine given</th>
<th>No. of future deaths averted 2011-2020</th>
</tr>
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<tbody>
<tr>
<td>Measles 1st Dose</td>
<td>10.6M</td>
</tr>
<tr>
<td>Measles 2nd Dose</td>
<td>0.4M</td>
</tr>
<tr>
<td>Measles supplementary immunization activities</td>
<td>3.1M</td>
</tr>
</tbody>
</table>


- Field evaluations in 6 countries:
  - Brazil, Bangladesh, Columbia, Ethiopia, Tajikistan, Uganda
  - Global analysis of costs
- Results
  - Baseline: 90% mortality reduction
  - Measles eradication by 2020 was highly cost-effective in all 6 countries and globally (cost-saving in Brazil & Columbia)
- Measles eradication ranks among top best buys in public health

David Bishai and Ann Levin/Colleen BurgessWHO Consultation 2010
What has worked in measles immunisation delivery strategies?

Number of doses of measles vaccine administered, by delivery strategy, 2000-2009

- 2nd routine dose: WHO/UNICEF Joint reporting form (no reports from Canada, Finland, Ireland, Italy, Luxemburg, Monaco, New Zealand, USA, Uruguay, SIA dose: WHO SIA database, July 2010 (Provisional data)

![Graph showing number of doses of measles vaccine administered by delivery strategy, 2000-2009. The graph includes data for 1st routine dose, 2nd routine dose, and SIA. The Measles Initiative is highlighted.]
Risk analysis for post-eradication era
Risk analysis for post-eradication era
- Ray Sanders

- Measles virus will continue to exist after eradication
- Re-introduction could occur from "natural" or "laboratory" sources
- Risk of accidental reintroduction from any source, including persistent infections and lab materials is low to very low,
- If immunization levels fall, measles will become a credible agent for bioterrorism
- Conclusion: post-eradication risks are low, and should not deter any attempt at measles eradication.