Effect of noncompliance on the impact of mass drug administration for elimination of lymphatic filariasis

Ain Shams University, Cairo, Egypt; Washington University, St. Louis, MO, USA
Lymphatic filariasis in Egypt

- Nocturnally periodic lymphatic filariasis caused by *W. bancrofti* infection is prevalent in rural areas of Egypt.

- *Culex pipiens* is the main mosquito vector.

- The disease has focal distribution in several governorates in the Nile Delta.
Endemic villages in the Nile Delta & Giza
Elimination program in Egypt

Objective: Eliminate LF as a public health problem

Mass drug administration (MDA) to interrupt transmission

- Annual dose of DEC (6 mg/kg) + Alb (400 mg)
- Village with $\geq 1\%$ antigen prevalence rate
- Coverage rate of $\approx 80\%$
- Children $< 2$ years of age & pregnant women are excluded from MDA
Mass drug administration by MOH&P

Preparatory phase:
- Identification of endemic villages
- Update village census
- Training of physician & nurses
- Social mobilization

Implementation:
- MDA September (2000)
- Over 2.5 million in 161 & 181 endemic villages
- Independent evaluation
## MDA Coverage rate (2000)

<table>
<thead>
<tr>
<th>Region</th>
<th>No district</th>
<th>No Village</th>
<th>At risk population</th>
<th>No Treated</th>
<th>% MDA coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qalubia</td>
<td>7</td>
<td>68</td>
<td>986,620</td>
<td>818,488</td>
<td>82.96</td>
</tr>
<tr>
<td>Menofia</td>
<td>4</td>
<td>24</td>
<td>213,991</td>
<td>190,024</td>
<td>88.80</td>
</tr>
<tr>
<td>Sharkia</td>
<td>6</td>
<td>32</td>
<td>323,130</td>
<td>272,722</td>
<td>84.40</td>
</tr>
<tr>
<td>K.Sheikh</td>
<td>1</td>
<td>1</td>
<td>23,155</td>
<td>18,200</td>
<td>78.60</td>
</tr>
<tr>
<td>Dakahlia</td>
<td>1</td>
<td>24</td>
<td>213,677</td>
<td>192,063</td>
<td>89.88</td>
</tr>
<tr>
<td>Gharbia</td>
<td>2</td>
<td>2</td>
<td>59,033</td>
<td>51,782</td>
<td>87.72</td>
</tr>
<tr>
<td>Giza</td>
<td>4</td>
<td>10</td>
<td>267,796</td>
<td>216,274</td>
<td>80.76</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>25</strong></td>
<td><strong>161</strong></td>
<td><strong>2,087,402</strong></td>
<td><strong>1,795,553</strong></td>
<td><strong>86.81</strong></td>
</tr>
</tbody>
</table>
Independent evaluation

Monitoring the MDA program

- 4 sentinel villages
  - two in Giza (highest prevalence rate and intensity of infection)
  - two in Qalubya (more typical of LF endemic villages)

Assessment parameters:

- MDA coverage rate (Questionnaire)
- Related to infection (10% randomly selected households):
  - Antigenemia (CFA, ICT)
  - Microfilaraemia in CFA positive cases (membrane filtration)
- Related to transmission:
  - Antifilarial antibodies (Bm14) in schoolchildren
  - Mosquito infection rates (SspI-PCR)

Effects of noncompliance on the impact of MDA in the 2 Giza villages
MDA Coverage Rates (%): 2000-2004

- **Compliance** is based on interviews in study villages
- MOHP estimated **coverage rate** is the mean for the entire governorate
Impact of MDA on microfilaremia prevalence rates

- MF prevalence rates fell sharply in both study areas.
- MF prevalence rates declined to zero in Qalubyyia after three MDA rounds.
- MF prevalence rate decreased significantly in Giza (90%) after 5 MDA rounds.
Impact of MDA on CFA prevalence rates

- The reduction in CFA prevalence rates was smaller than the reduction in microfilaria prevalence rates.
- CFA prevalence rates fell more rapidly in Qalyubia villages than in Giza villages.
- CFA prevalence rate in Giza decreased significantly following each MDA.
- CFA prevalence rate decreased significantly (75%, Giza & 77%, Qalubya) after 5 MDA rounds.
Impact of MDA on Bm14 antibody rates in primary schoolchildren

- Pre-MDA antibody prevalence rates were higher in Giza schools (23.8%) than Qalubia schools (7.38%) and in grade-5 than grade-1.
- Antibody prevalence rate for grade-1 (Qalubia) fell to zero after 3 MDA rounds.
- Antibody prevalence rate for grade-1 (Giza) fell 98.9% from 18.3% to 0.2%.
Effect of MDA on mosquito infection rates

- MI rates were similar in both areas before MDA.
- MI rates in Qalubia fell more sharply, 94% after MDA-1 and 100% after 5 MDAs.
- MI rates in Giza decreased by 43% and 94% after MDA-1 & MDA-5, respectively.
Study of noncompliance

- Evaluate the effects of noncompliance on the impact of MDA in 2 villages in Giza governorate (highest prevalence rate and intensity of infection)

- Data from the two villages were combined
Compliance to MDA rounds

- All MDAs: 52.4%
- Never: 7.4%
- One: 5.4%
- Two: 9.4%
- Three: 15.2%
- Four: 10.2%
Comparison between antigenaemia and MF rates after different MDA rounds

<table>
<thead>
<tr>
<th>No of MDA rounds</th>
<th>Total</th>
<th>Ag positive</th>
<th>MF positive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>No MDA</td>
<td>79</td>
<td>10</td>
<td>12.7</td>
</tr>
<tr>
<td>One MDA</td>
<td>57</td>
<td>6</td>
<td>10.5</td>
</tr>
<tr>
<td>Two MDAs</td>
<td>99</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>Three MDAs</td>
<td>162</td>
<td>7</td>
<td>4.3</td>
</tr>
<tr>
<td>Four MDAs</td>
<td>109</td>
<td>3</td>
<td>2.8</td>
</tr>
<tr>
<td>Five MDAs</td>
<td>557</td>
<td>15</td>
<td>2.7</td>
</tr>
</tbody>
</table>

* ≈ 33.0% reduction (Ag & MF) from pre-MDA, herd treatment effect
† 98.3% (MF) & 78.7% (Ag) reduction from pre-MDA

Approximately 33.0% reduction in antigenaemia and microfilaria (MF) rates from pre-MDA, indicating a herd treatment effect. Furthermore, there is a 98.3% reduction in MF and a 78.7% reduction in antigenaemia from pre-MDA.
Compliance to MDA rounds

- All MDAs: 52.4%
- Never: 7.4%
- One: 5.4%
- Two: 15.2%
- Three: 10.2%
- Four: 9.4%
## Reason for not taking the treatment

<table>
<thead>
<tr>
<th>Reason for not taking the drug</th>
<th>No. *</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pregnant</td>
<td>24</td>
<td>18.5</td>
</tr>
<tr>
<td>Lactating</td>
<td>10</td>
<td>7.7</td>
</tr>
<tr>
<td>Severe illness</td>
<td>1</td>
<td>0.7</td>
</tr>
<tr>
<td>Hate tablets</td>
<td>14</td>
<td>10.8</td>
</tr>
<tr>
<td>Fear from drug side effects</td>
<td>19</td>
<td>14.6</td>
</tr>
<tr>
<td>Not present during MDA</td>
<td>27</td>
<td>20.8</td>
</tr>
<tr>
<td>House missed by MDA team</td>
<td>14</td>
<td>10.8</td>
</tr>
<tr>
<td>Refused to take treatment</td>
<td>21</td>
<td>16.2</td>
</tr>
</tbody>
</table>

* Total=130 subjects, representing ≈ 13% of the total sample examined
Options for managing noncompliance

- DEC medicated salt (not acceptable)
- Vector control (very expensive)
- Specific targeting based on MOHP records
Conclusions

- Comprehensive monitoring of the Egyptian LF elimination program indicates that MDA had dramatic effects on filariasis infection and transmission rates.

- Excellent compliance reduced prevalence of MF, antibodies in children, and mosquito infection rates to near zero in sentinel villages.

- Elimination indicators were achieved more quickly in the low prevalence area.
Conclusions

- Residual infection rates were significantly higher in persons who took <2 rounds of MDA.
- Our data suggest that elimination programs should aim to have all eligible subjects take at least two MDA rounds.
- Since most of the 181 localities included in the MDA program had low baseline infection parameters, our results suggest that 5 rounds of MDA has probably eliminated LF in most endemic villages in Egypt.
Ain Shams U & Wash U ICI DR: 2005-2010

- Egyptian Program Endgame
- National evaluation to assess current status of LF after 5 years of MDA
- Comprehensive monitoring (antigen, antibody, mosquito) in 44 MDA communities (22 per year, retested every 2 years)
- Active surveillance in excluded localities
- Test endpoints
  - MF testing (goal <0.5% by smear)
  - Antigen testing (goal < 2%)
  - Antibody testing (kids age 6, <2%)
  - Mosquitoes (MX) (0.25%)
New Scale of Work

- 23,000 blood samples per year
- Prototype regional reference laboratory
- Mosquito collection: Gravid traps
- 200 pools per locality
- DNA isolation: BB method
- Real-time PCR for high throughput