Risk-Benefit Analysis: Maintaining Essential RMNCAH Services vs. Risk of Covid-19 Infection

Comparison of **lives saved** through continued provision of essential services vs. **lives lost** due to increased exposure to the virus

1. **Mitigation strategies**
   - WHO June 2020 guidance document + country-defined

2. **Estimation of lives saved maintaining essential services**
   - Using LiST/Spectrum
   - Required: Estimates of impact of mitigation strategies on coverage (and effectiveness) of essential interventions

3. **Estimation of lives lost through increased risk of infection**
   - Required: Estimates of impact of mitigation strategies on risk of COVID-transmission
   - Risk to patient, caregiver (for children), and health care provider
   - Methodology example: LSHTM - Risk-benefit analysis immunization
Analysis Steps

1. Determine interventions/intervention packages to include
2. Determine original coverage
3. Figure out impact of COVID on coverage of different interventions/intervention packages
4. Establish mitigation strategies
5. Estimate impact of mitigation strategies on coverage (also added risk of COVID transmission for health worker and client)
6. Calculate number of lives saved through improved coverage (using LiST Tool)
7. Carry out COVID risk analysis to estimate number of lives lost in maintaining coverage of essential services
8. Calculate benefit-risk ratios
Step 1. Determine Packages/Interventions to Include in Analysis

### Family Planning
- FP - Pills
- FP - Condoms
- FP - Injectables
- FP - Implants
- FP - Male Sterilization
- FP - Female Sterilization
- FP - Traditional Methods

### Antenatal Care
- IT - Tetanus toxoid vaccination
- IPTp - Intermittent preventive treatment of malaria during pregnancy
- Syphilis detection and treatment
- Calcium supplementation
- Iron supplementation in pregnancy
- Multiple micronutrient supplementation in pregnancy
- Balanced energy supplementation
- Hypertensive disorder case management
- Diabetes case management
- Malaria case management
- MgSO4 management of pre-eclampsia
- PMTCT - Prevention of Mother-to-Child Transmission

### Delivery Care
- Clean birth practices
- Immediate assessment and stimulation
- Labor and delivery management
- Neonatal resuscitation
- Antenatal corticosteroids for preterm labor
- Antibiotics for pPROM
- MgSO4 management of eclampsia
- AMTSL - Active management of the third stage of labor
- Induction of labor for pregnancies lasting 41+ weeks
- Maternal sepsis case management
- Clean Postnatal Practices

### Newborn Care
- Chlorhexidine
- Case management of premature babies
- Thermal care
- Kangaroo-Mother Care (KMC)
- Full supportive care of prematurity
- Case management of neonatal sepsis/pneumonia
- Oral antibiotics
- Injectable antibiotics
- Full supportive care

### Breastfeeding
- Complementary feeding - Education only
- Complementary feeding - Supplementary feeding + Education

### Vaccines
- BCG - Single dose
- Polio - Three doses
- Pentavalent
- DPT - Three doses
- Hib - Three doses
- HepB - Three doses
- Pneumococcal - Three doses
- Rotavirus - Two doses
- Meningococcal A - Single dose
- Malaria vaccine - Three doses
- Measles - Single dose
- Vitamin A supplementation
- Zinc supplementation
- ORS - Oral Rehydration Solution
- Antibiotics for treatment of dysentery
- Zinc for treatment of diarrhea
- Oral antibiotics for pneumonia
- Vitamin A for treatment of measles
- ACTs - Artemisinin compounds for treatment of malaria

### Child Health
- Vitamin A supplementation
- Zinc supplementation
- ORS - Oral Rehydration Solution
- Antibiotics for treatment of dysentery
- Zinc for treatment of diarrhea
- Oral antibiotics for pneumonia
- Vitamin A for treatment of measles
- ACTs - Artemisinin compounds for treatment of malaria
- SAM - treatment for severe acute malnutrition
- MAM - treatment for moderate acute malnutrition
- Improved sanitation - Utilization of latrines
- Improved water source
- Improved water source - Water connection in the home
- Hand washing with soap
- Hygienic Disposal of Children's stool
- ITN
- Folic acid supplementation/fortification
- Safe abortion services
- Post abortion case management
- Ectopic pregnancy case management
- Blanket iron supplementation/fortification

### Other
- Make freestanding intervention
- Take out of package
Step 2+3. Determine Coverage pre-COVID and with COVID

- **Determine original coverage for key interventions**
  - Either from national documents or extract from Spectrum/LiST model

- **Figure out coverage reduction/disruption under COVID**
  - HMIS data
  - For packages such as FP, antenatal care, etc. % reduction can be applied to all sub-interventions (e.g. folic acid supplementation, syphilis testing, etc.)
### Step 4. Determine Mitigation Strategies

#### Coverage Reduction as a result of:

- **Shortage of health workers**
  - Deliberate several interventions in one visit, prioritize high-risk cases, provide several months of supplements or contraceptives at a time, taskshifting

- **Supply and equipment bottlenecks**
  - Strengthen supply chain, involve private sector

- **Decreased demand due to fear of infection, financial barriers**
  - Establish safe and efficient patient flow, provide PPE
  - Suspend co-payments or user fees

- **Physical access restrictions, reduced transport availability**
  - Telemedicine solutions
Step 5. Estimate impact of mitigation strategies on coverage and COVID transmission risk

Example Antenatal Care:
- Reduce required number of ANC visits, provide all relevant care in those reduced visits, provide woman with several months of micronutrient supplements at a time

Impact on coverage:
- Maintains pre-COVID coverage

Impact on effectiveness:
- Might keep effectiveness of ANC about the same

Impact on risk of COVID transmission:
- Reduces transmission risk as it reduces required number of trips to the health facility and contacts with a health care provider, reducing risk of transmission and risk of COVID mortality among pregnant women and health care providers
Step 6. Calculate number of lives saved through improved coverage

- All calculations in Excel except for this step
- Use of Spectrum/LiST tool to calculate number of lives saved
- Since LiST data entry relatively complex, Excel model will prep and arrange data so they can easily be copied into the LiST tool (below)
- LiST results copied back into Excel model

<table>
<thead>
<tr>
<th>Antenatal Care</th>
<th>2020 With COVID</th>
<th>After Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetanus toxoid vaccination</td>
<td>76.5</td>
<td>61.2</td>
</tr>
<tr>
<td>IPTp - Intermittent preventive treatment of malaria during pregnancy</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Syphilis detection and treatment</td>
<td>13.8</td>
<td>11.0</td>
</tr>
<tr>
<td>Calcium supplementation</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Iron supplementation in pregnancy</td>
<td>19.3</td>
<td>15.4</td>
</tr>
<tr>
<td>Multiple micronutrient supplementation in pregnancy</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Balanced energy supplementation</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Hypertensive disorder case management</td>
<td>48.4</td>
<td>38.7</td>
</tr>
<tr>
<td>Diabetes case management</td>
<td>18.2</td>
<td>14.6</td>
</tr>
<tr>
<td>Malaria case management</td>
<td>54.2</td>
<td>43.4</td>
</tr>
<tr>
<td>MgSO4 management of pre-eclampsia</td>
<td>14.3</td>
<td>11.4</td>
</tr>
<tr>
<td>PMTCT - Prevention of Mother-to-Child Transmission</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Step 7. Calculate number of lives lost through excess COVID transmission risk

Excess Risk

- Additional infections/deaths among households that are attributable to a health facility visit, that would not have occurred during the course of the epidemic if not for the visit to the health facility.

Step 7. Calculate number of lives lost through excess COVID transmission risk

- **Additional risk of infection incurred during travel to clinic, waiting at clinic and interacting with health care worker**

- Also additional risk incurred by health care worker providing the intervention

- Depending on community prevalence and mitigation strategies in place

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**Excess Risk Calculation**

Additional infections/deaths among households that are attributable to a vaccination visit/adult visit to a health facility, that would not have occurred during the course of the epidemic if not for vaccination/adult visit to a health facility.

<table>
<thead>
<tr>
<th>Country</th>
<th>Variable</th>
<th>Mean</th>
<th>Min</th>
<th>Max</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of children receiving vaccination/adult receiving health intervention</td>
<td>20,000</td>
<td>20,000</td>
<td>20,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Excess number of SARS-CoV-2</td>
<td>N2</td>
<td>2.5</td>
<td>1.6</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>Percentage of population at risk of infection</td>
<td>%</td>
<td>76</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Incidence of SARS-CoV-2</td>
<td>x</td>
<td>4.85</td>
<td>1.05</td>
<td>6.45</td>
</tr>
<tr>
<td></td>
<td>Percentage of community members</td>
<td>%</td>
<td>4.85</td>
<td>1.05</td>
<td>17.45</td>
</tr>
<tr>
<td></td>
<td>Probability of excess SARS-CoV-2 infection for household of a child who gets vaccinated</td>
<td>%</td>
<td>0.85</td>
<td>0.05</td>
<td>3.35</td>
</tr>
<tr>
<td></td>
<td>Probability of excess SARS-CoV-2 infection for the whole household of a child who gets vaccinated</td>
<td>%</td>
<td>0.05</td>
<td>0.001</td>
<td>0.995</td>
</tr>
<tr>
<td></td>
<td>Number of days an infected individual spreads the virus</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

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**Risk Interventions**

- Vaccination

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**References**

Step 8. Calculate benefit-risk ratios

<table>
<thead>
<tr>
<th>Service</th>
<th>Lives Saved through Mitigation Measures</th>
<th>Lives Lost through Added COVID Infections</th>
<th>Benefit-Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family Planning</td>
<td>8 (4)</td>
<td></td>
<td>2.1</td>
</tr>
<tr>
<td>Antenatal Care</td>
<td>64 (4)</td>
<td></td>
<td>17.5</td>
</tr>
<tr>
<td>Delivery Care</td>
<td>261 (9)</td>
<td></td>
<td>28.6</td>
</tr>
<tr>
<td>Newborn Care</td>
<td>1,125 (8)</td>
<td></td>
<td>145.1</td>
</tr>
<tr>
<td>Breastfeeding</td>
<td>--</td>
<td></td>
<td>--</td>
</tr>
<tr>
<td>Vaccines</td>
<td>212 (74)</td>
<td></td>
<td>2.8</td>
</tr>
<tr>
<td>Child Health</td>
<td>50 (4)</td>
<td></td>
<td>8.7</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1,720 (105)</strong></td>
<td></td>
<td><strong>16.5</strong></td>
</tr>
</tbody>
</table>
Key Findings Across Countries

- Overall Benefit-Risk Ratio across countries between 11.7 and 79.2, i.e. for every 11.7 to 79.2 lives gained due to increased RMNCA coverage, there was one excess COVID death.

- More specifically, for all countries and for all health packages, the benefit risk ratio was (in many cases significantly) above 1, i.e., maintaining services saved more lives than were lost due to additional deaths caused by COVID acquired during contacts with the health system.

- The number of lives saved depended on a large number of factors and their interactions, mainly:
  - Interventions included (the more highly effective RMNCAH interventions included, the higher the impact)
  - Baseline coverage (the lower the initial coverage, the lower the impact of disruption and recovery)
  - Coverage disruption (the higher the initial disruption, the more impactful the potential recovery)
  - Number and impact of mitigation measures
  - HH size and age structure of population (COVID assumed to spread within family, older population suffering much higher fatality than children and younger adults)
High-Impact RMNACH Interventions

Health Packages with the Highest Benefit-Risk Ratios:

❖ Breastfeeding (low number of contacts with health system, extremely effective intervention, long-term impacts (1-2 years), large number of lives saved)
❖ Newborn care (highly effective interventions such as clean delivery care, newborn resuscitation and treatment of newborn sepsis/pneumonia)
❖ Delivery care (AMTSL, C-section and assisted vaginal delivery saving many lives)

Health Packages with Lower, but Still Positive Benefit-Risk Ratios:

❖ Child Health (in particular, when high-impact interventions such as ORS, ARI treatment included)
❖ Antenatal Care (main impact seen when tetanus toxid coverage is restored, many lives saved due to timely recognition of pregnancy complications not captured here, but under delivery and EmOC care)
❖ Vaccine (assumption that vaccination disruption is temporary, impact only calculated for one year, in which existing herd immunity does still provide protection, important that vaccination catch up after interruption)
❖ Family Planning – main impact on number of birth and pregnancies, not deaths
**Mitigation Measures**

**Mitigation Measures Reducing Transmission Risk**
- Some empirical studies available on effectiveness of mitigation measures, but wide range of estimates
- Most effective: Hygiene and social distancing measures, in particular masks and PPE with training of health care providers in correct usage
- Also effective: Move to e-/telehealth and move of selected services to community level/outreach teams

**Mitigation Measures Improving Coverage**
- No empirical, published data available at all
- Effort to try and err on the conservative side when estimating impact
- Total impact capped so WITH mitigation coverage did not exceed original baseline coverage by more than 2%
- Most measures working through restoration of confidence of population in safety of health facility visits
- Some measures increasing coverage through the fixing of supply side shortages (staff, supplies)
- Impact of any individual measures usually in the 1-5% range
Limitations of Risk-Benefit Exercise

- Recent and constantly shifting nature of the COVID-19 pandemic (second, third waves, new strains of the virus, vaccine development) makes estimates and predictions difficult.

- Limited empirical evidence available to support estimates for the impact of mitigation measures on reduced transmission of COVID-19.

- No evidence to support estimates for the impact of mitigation measures on increased coverage. These estimates must be communicated with this caution.

- HMIS data of varying quality, problem of delayed or missing data, no data for breastfeeding.

- New application of the LiST model (previously only used for gradual scale-up of coverage, never for disruption).

- LiST model only capable of producing annual estimates, which complicates what can be modeled.