Introduction to Coverage Assessment Methods for Selective Entry Programs

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WHY?
Efficacy of the CMAM protocol

Efficacy:

*How well does the CMAM protocol work in **ideal** or **controlled** settings?*

This is measured by the **cure rate** ...

\[
\text{Cure Rate} = \frac{\text{Number Cured}}{\text{Number Treated}} \times 100
\]

… usually estimated in a clinical trial

For the CMAM protocol, the cure rate is ...

… close to 100% in **uncomplicated incident** cases …

… MUAC at or just below admission criteria and / or mild oedema

**Little room for significant improvement in efficacy!**
Effectiveness of the CMAM protocol

Effectiveness:

*The cure rate of the CMAM protocol in a normal patient cohort under program conditions?*

Achieved effectiveness depends on what we mean by *normal*:

- Varying levels of severity (less severe = better effectiveness)
- Compliance may vary (better compliance = better effectiveness)
- Patients default (drop out) (less defaulting = better effectiveness)

An effective program *must* have:

- Thorough case-finding / recruitment and early treatment seeking
- Good compliance (e.g. no sharing of RUTF with siblings)
- Good retention from admission to cure

We cannot change **efficacy** but we can change **effectiveness**!
Coverage

One factor (with effectiveness) in a program's capacity to meet need …

\[
\text{Program Coverage} = \frac{\text{Number in the program}}{\text{Number who should be in the program}}
\]

Coverage depends upon:

- Thorough case-finding / recruitment and early treatment seeking:
  - Majority of admissions are uncomplicated incident cases …
    - … leads to good outcomes (close to 100% cure rate)
  - Good retention from admission to cure

Coverage and effectiveness are linked:

- They depend upon the same things … so …
  - Good coverage supports good effectiveness
  - Good effectiveness supports good coverage
The effectiveness – coverage cycle

- Early admission
- Few Complications
- Outpatient Care
- Short Stay
- Low Levels of Defaulting
- Good Outcome
- Positive Opinions
Meeting need

Meeting need requires both high effectiveness and high coverage:

\[ \text{Met Need} = \text{Effectiveness} \times \text{Coverage} \]

Effectiveness and coverage are linked:

Maximizing coverage maximises effectiveness and met need!
Meeting need

High Coverage Program

Need 100
70% Coverage
Recruited 80
90% Cured
Met Need 72

Low Coverage Program

Need 100
30% Coverage
Recruited 30
75% Cured
Met Need 23

Coverage Bottleneck

70% Coverage
30% Coverage

Effect of Coverage Barriers on Service Achievement

GOAL OF SERVICE ACHIEVEMENT

EFFECTIVENESS
People who receive effective care

CONTACT COVERAGE
People who use the service

ACCEPTABILITY COVERAGE
People who are willing to use service

ACCESSIBILITY COVERAGE
People who can use the service

AVAILABILITY COVERAGE
People for whom the service is available

Target Population

Number of People

Programs with low coverage fail to meet need!
Meeting need

Meeting need requires both high effectiveness and high coverage:

\[ \text{Met需} = \text{Effectiveness} \times \text{Coverage} \]

We need to define our target population … usually …

… all eligible persons in all of the program area

This requires us to define:

• Eligibility

• The extent of the program area:

  Defined before assessment:

  **Intended catchment** area of program:

  From contracts, proposals, agreements with MoH / donors

  Redefining during / after assessment to the achieved catchment area is called “gaming the indicator” (lying to make a program look good)

Once we have done this we can can start to measure coverage
HOW?

We can't do it with SMART
Why can't we do this with SMART?

Logic:

SMART is just a modified EPI method

EPI is a coverage assessment method

⇒ We can measure feeding program coverage with SMART

The logic appears flawless but there is a category error:

The Expanded Program of Immunisation (EPI) is a universal program:

All children eligible

CMAM is a selective entry program:

Few children are eligible

Note: Some EPI programs don't use the EPI method …

… PAHO (e.g.) pushes spatially stratified LQAS for EPI
Why can't we do this with SMART?

When assessing coverage using two stage cluster-sampled nutritional anthropometry surveys (e.g. \(30 \times 30\), SMART):

- Two methods are used:
  
  **Directly** using survey data:
  
  \[
  \text{Coverage} = \frac{\text{SAM cases found by the survey receiving SAM treatment}}{\text{All SAM cases found by the survey}}
  \]

  **Indirectly** using survey data, program data, and population estimates:
  
  \[
  \text{Coverage} = \frac{\text{SAM cases receiving treatment}}{\text{Prevalence of SAM} \times \text{Population}_{6-59 \text{ months}}}
  \]

  Note: The denominator here is an estimate of need
Why can't we do this with SMART?

Modified EPI methods all use a two-stage cluster-sampling approach:

- **Population proportional sampling** (PPS) in first stage (select clusters)
- **Proximity sampling** in second stage (select households and children)
- **Assumes homogeneity** of coverage (i.e. overall estimate only)

Coverage surveys ‘bolted-on’ to nutrition surveys …

… **sample size problems** (for selective entry programs)
Why can't we do this with SMART?

Population proportional sampling:

Bulk of data collected from the most populous areas / communities:

- Some low population-density areas not sampled …
  … potential for **upward bias** in coverage estimates
- No guarantee of an even spatial sample …
  … **some areas** usually **unrepresented** by the sample

**Not** suitable when the denominator is:

  … **all** eligible persons in **all** of the program area

Also, PPS relies on population estimates …

  … often unreliable … particularly with displacement …
  … displacement common in emergencies / famine

**NOTE**: The appropriate weighting is local population × local prevalence …

Do we (or can we) know this?
Proximity sampling

Not representative at the cluster level ...

... no estimation / comparison at cluster level

Even if a representative sampling method is used:

Within-cluster **sample size is too small** to estimate coverage within clusters ...

\[ n = 900 \text{ from 30 clusters, } p = 2\%, \text{ cases } \approx 900 \times 0.02 = 18 \]

... results in:

\[ \approx \frac{18}{30} < 1 \text{ case per cluster} \]

... no estimates possible for many clusters ...

... no mapping of coverage
Real problems?

These problems are not important if the homogeneity assumption is true:

- Unlikely to be true of more centralised programs
- Unlikely to be true during start-up or expansion phases of a program
- Difficult to test without a more expensive survey ...

... then a survey is not needed

But ...

... lack of precision (low sample size) may still a problem
If the homogeneity assumption is untrue ...

Coverage is uneven and ...

... it is useful to be able to identify ...

... where coverage is good

... where coverage is poor

But ...

... modified EPI methods can only provide a single wide-area estimate ...

... this estimate might not be true anywhere!
If the homogeneity assumption is untrue …

An illustration …

Overall coverage is 50% … but …

Where is coverage 50%?

Nowhere is coverage 50%!

So … what does the 50% estimate mean in this context?
Sample size (direct method)

Best case example:

30 × 30 design, \( n = \text{c. 900} \) ← Large sample for SMART

Assume:

Prevalence = 5% ← High prevalence
Coverage = 50% ← We hope for some coverage!
Design effect = 2.0 ← Low for a patchy phenomena

Survey finds:

\( n = 45 \) cases (i.e. 5% of 900) ...

... estimate = 50% ± c. 30% ← This is a best case!

Sample size is too small to ...

... estimate overall coverage with useful precision
... enumerate and rank important barriers
Denominator (indirect method)

Coverage estimated as:

\[ \text{Coverage} = \frac{\text{SAM cases receiving treatment}}{\text{Prevalence of SAM} \times \text{Population}_{6-59 \text{ months}}} \]

Unstable / unreliable denominator:

Prevalence estimate is relatively imprecise:

Example:

\[ n = 900 \]
\[ \text{DEFF} \approx 2.0 \]
\[ \text{prevalence} = 2\% \]
\[ \text{precision (95\% CI)} \approx \pm 1.3\% \]
\[ \text{Relative precision} \approx \frac{1.3}{2} \times 100 = 65\% \]

Also … may be difficult to correct the population estimate to account for displacement, migration, and high mortality in the target population
Denominator (indirect method)

Example:

\[ n = 900 \]

Cases found = 18

\[ DEFF = 2.0 \]

Prevalence (estimated) = 2% (95% CI = 0.4%, 4.3%) ← This is a best case!

Population = 17,000 ± 10%

SAM cases in treatment in our program = 163

Gives:

Estimated need = 340 (95% CI = 68, 731)

Estimated coverage = 47.9% (95% CI = 22.3%, 239.7%) ← Crazy numbers!
Recycled data (indirect method)

Indirect method:

Usually applied when data (i.e. from a recent survey) for the direct estimation is **not** available:

Initial assessment data:

Historic rather than current prevalence estimate:

Is it any real use (i.e. current relevance)?

If you have to ask … then … probably not!
Why can't we do this with SMART?

Some good reasons:

- Implausible homogeneity assumption
- Uneven spatial sampling:
  - Urban bias
- Proximity sampling:
  - No mapping
- Inadequate sample size:
  - Overall estimate with useful precision
  - Enumeration and ranking of barriers
  - Per-cluster estimates:
    - No mapping
- Denominator problems (indirect method)
- Potential for inappropriate data-analysis and misreporting
What can we do?

This workshop will introduce a set of method that address these issues
## The methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSAS</td>
<td>2002</td>
<td>Spatial sample. Coverage estimated locally (mapped) and globally. Some information on barriers to coverage. Bit too expensive for routine M&amp;E.</td>
</tr>
<tr>
<td>SLEAC</td>
<td>2008</td>
<td>Rapid method. Classifies coverage at SDU level. Some information on barriers to coverage. Can estimate and map coverage over wide areas (e.g. national coverage surveys). Designed for low cost M&amp;E at clinic level.</td>
</tr>
<tr>
<td>SQUEAC</td>
<td>2008</td>
<td>Semi-quantitative method. In-depth analysis of barriers and boosters to coverage. Mapping of coverage using small area surveys. Estimation of coverage using Bayesian techniques. Designed as a routine program monitoring tool (intelligent use of routine monitoring data / other data may be collected on a “little and often” basis).</td>
</tr>
<tr>
<td>S3M</td>
<td>2010</td>
<td>Wide-area version of CSAS using improved spatial sampling and more efficient use of data. Some information on barriers to coverage.</td>
</tr>
</tbody>
</table>
CSAS design:

Spatially stratified sample:

All of program area covered by survey

Active and adaptive case-finding (snowball, chain-referral):

Representative of sampled communities:

All or nearly all cases found for SAM …

… MAM need a different strategy

Similar approaches are used in all of the methods presented in this workshop
CSAS

**CSAS** method yields:

- Overall coverage estimate
- Local coverage estimates:
  - Coverage map
- Ranked list of barriers:
  - Can also be mapped
CSAS

Coverage Map

Barriers

- Fear of rejection
- Child not recognised as "malnourished"
- Relapse or default (not returned)
- Lack of program information
- OTP site too far away
- Interface problems
- Inappropriately discharged
- Other reasons

Number of non-covered cases
SLEAC

Spatially stratified sample / active and adaptive case-finding

Small sample sizes \((n \leq 40)\)

**SLEAC** method yields:

Overall coverage *classification*

Can be used over wide areas:

Local coverage *classifications*:

Coverage map

Wide-area *estimate* (as overall sample size increases)

Ranked list of barriers
Coverage mapping: SLEAC vs. CSAS

**SLEAC**

Districts are classified as having low, moderate or high coverage. Regional or national mapping of program coverage is possible.

**CSAS**

Mapping of program coverage within districts.
SQUEAC

Semi-quantitative method

**In-depth analysis** of barriers and boosters to coverage:

- Concept mapping

Mapping of coverage using small area surveys:

- Uses a ‘risk mapping’ approach

Estimation of overall coverage using *Bayesian* techniques

Designed for routine program monitoring:

- Intelligent use of routine monitoring data …

  ... other data may be collected on a ‘little and often’ basis
SQUEAC: Coverage mapping by risk mapping

Coverage map shows areas where collected data indicate coverage is likely to be acceptable.

This map shows the achieved vs. intended catchment area.
SQUEAC: Concept map of barriers and boosters

- Staff contempt
- High levels of defaulting
- Poor outcome
- Negative opinions
- Weak community mobilisation
- Continued RUTF stock-outs
- Lack of program awareness
- Late admission
- Lack of proximity
- Long stay / Inpatient care
SLEAC / SQUEAC

SLEAC and SQUEAC can be used in combination:

SLEAC identifies good or bad coverage areas for SQUEAC investigation …

… lessons learned from SQUEAC applied to wider program …

… stop bad practice

… spread good practice
SLEAC / SQUEAC combination

Start → SLEAC surveys → Coverage OK? → Yes → Stop

Coverage OK? → No → SQUEAC investigation(s) → Reform program → Start
SLEAC / SQUEAC combination

Start

SLEAC surveys

Coverage OK?

SQUEAC investigation(s)

No

Yes

SQUEAC investigation(s)

Compare & contrast

Reform program
S3M : The Simple Spatial Survey Method

Development of CSAS for very wide area usage:

• Triangular irregular network (TIN) rather than a grid sample
• Highly efficient use of sample (c. 6 ×) reuse of data
• Lower cost than CSAS (10 × area at 2 × cost)
• Maps a ‘coverage surface’
• Automatic smoothing of data
• Simple to understand
• Simple enough for NGOs / MoHs to do

Outputs are similar to CSAS:

Coverage map
Ranked barriers

S3M / SQUEAC combination also possible
S3M : Coverage Mapping
Summary

You can’t use SMART!

A set of alternative methods are available
PPS vs. CSAS for coverage

An example unrelated to CMAM

Map of the UK showing 3G mobile 'phone / mobile internet coverage.

Statutory obligation is 90% coverage.

This map shows the situation with 90% coverage by PPS but less than 50% by CSAS (i.e. by area).

The use of PPS-derived coverage estimates means that the mobile 'phone companies can argue that they have met their statutory obligation … but there is no way that people living in over 50% of the UK will ever get 3G coverage.

In this case PPS has led to …

Ongoing marginalization of the already marginalised

A lot of empty sea getting excellent coverage