Introduction to Coverage Assessment Methods for Selective Entry Programs

Mark Myatt · Brixton Health

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** ...

$$Cure\ Rate = \frac{Number\ Cured}{Number\ Treated} \times 100$$

… 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 **<u>must</u>** 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 **<u>efficacy</u>** but we can change **<u>effectiveness</u>**!

Coverage

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

$$\textit{Program Coverage} = \frac{\textit{Number in the program}}{\textit{Number who should be in the program}}$$

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

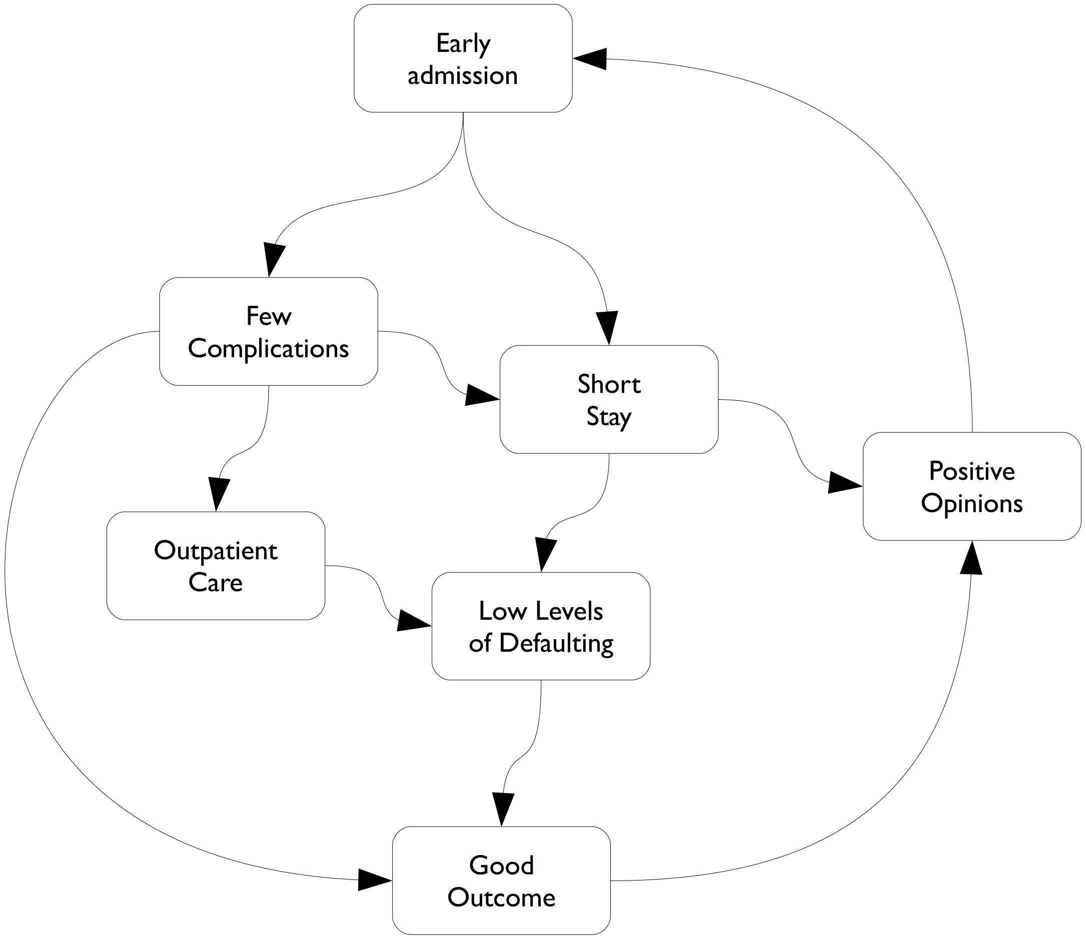
Coverage and effectiveness are linked :

They depend upon the same things … so ...

Good coverage supports good effectiveness

Good effectiveness supports good coverage

The effectiveness – coverage cycle

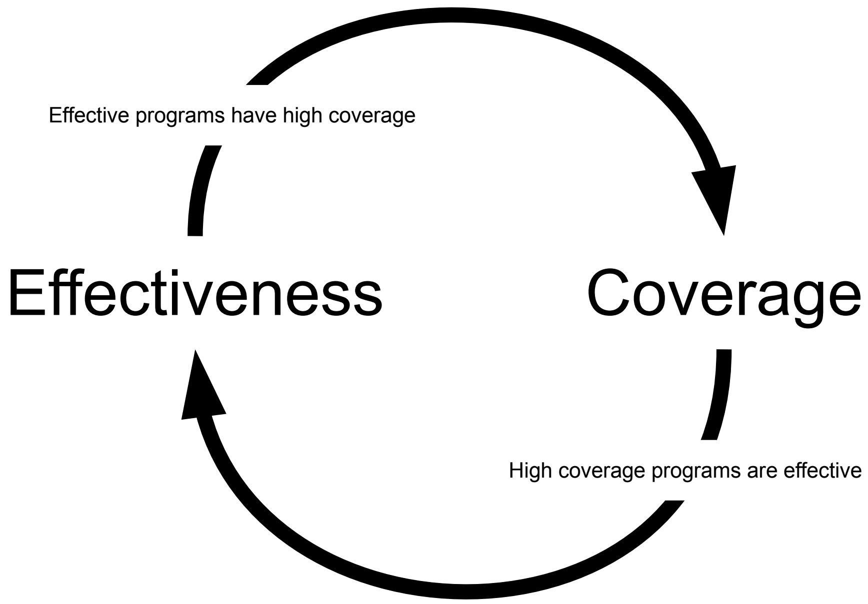


Meeting need

Meeting need requires both high effectiveness and high coverage :

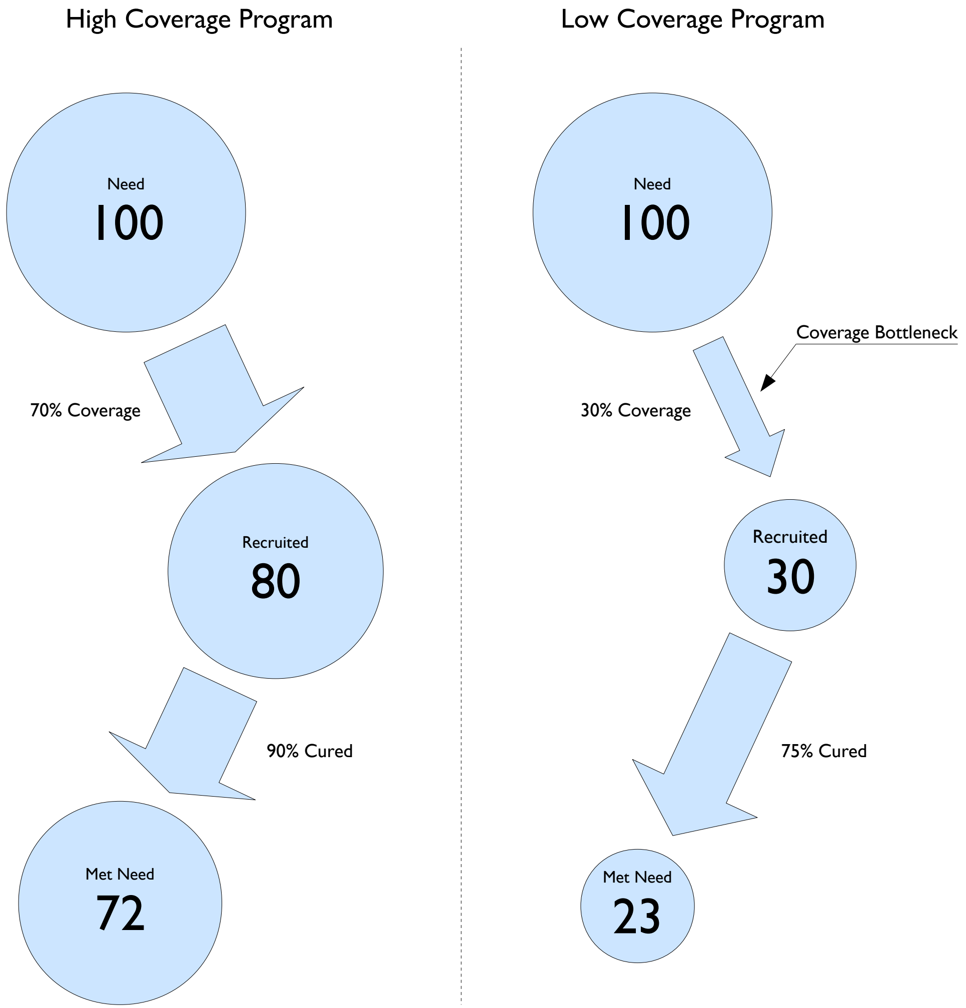
$$\textit{Met Need} = \textit{Effectiveness} \times \textit{Coverage}$$

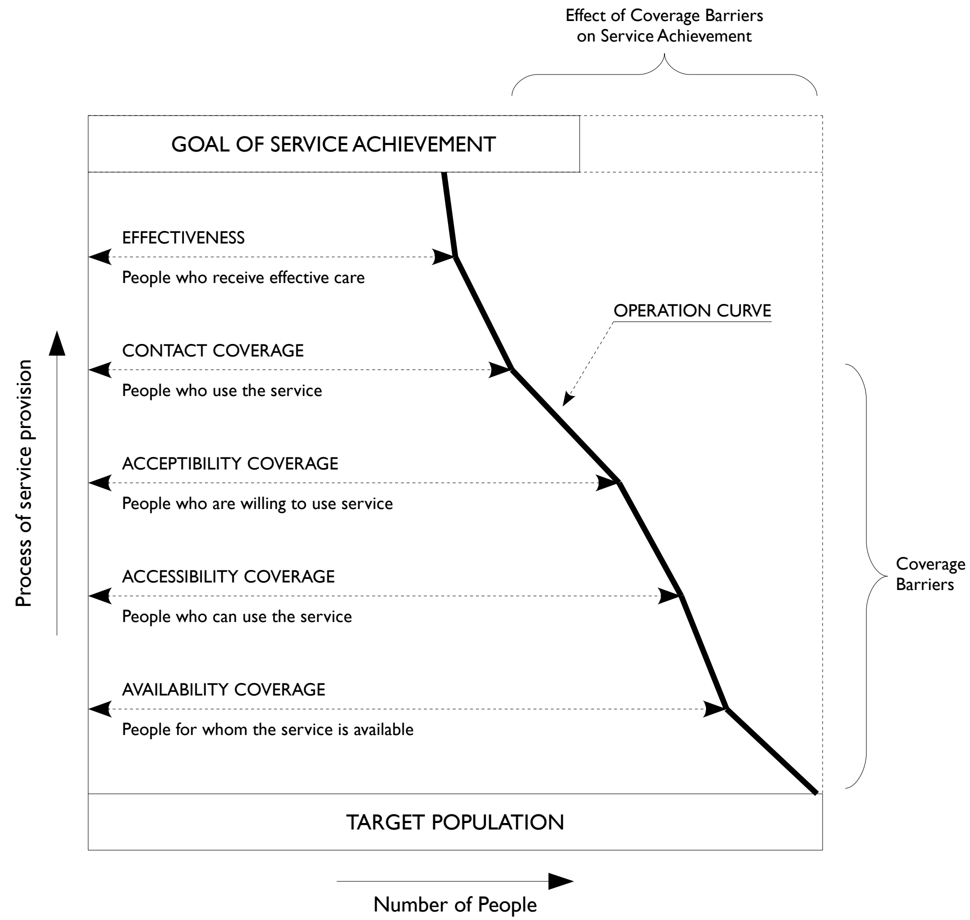
Effectiveness and coverage are linked :



Maximizing coverage maximises effectiveness and met need!

Meeting need





Programs with low coverage fail to meet need!

Meeting need

Meeting need requires both high effectiveness and high coverage :

$$\textit{Met Need} = \textit{Effectiveness} \times \textit{Coverage}$$

We need to define our target population … usually …

… **<u>all</u>** eligible persons in **<u>all</u>** 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 × 30**, **SMART**) :

- Two methods are used :

Directly using survey data :

$$Coverage = \frac{SAM\ cases\ found\ by\ the\ survey\ receiving\ SAM\ treatment}{All\ SAM\ cases\ found\ by\ the\ survey}$$

Indirectly using survey data, program data, and population estimates :

$$Coverage = \frac{SAM\ cases\ receiving\ treatment}{Prevalence\ of\ SAM \times Population_{6-59 months}}$$

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 ...

$n = 900$ from 30 clusters, $p = 2\%$, $cases \approx 900 \times 0.02 = 18$

… results in :

$$\approx \frac{18}{30} < 1 \, case \ per \ cluster$$

… 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

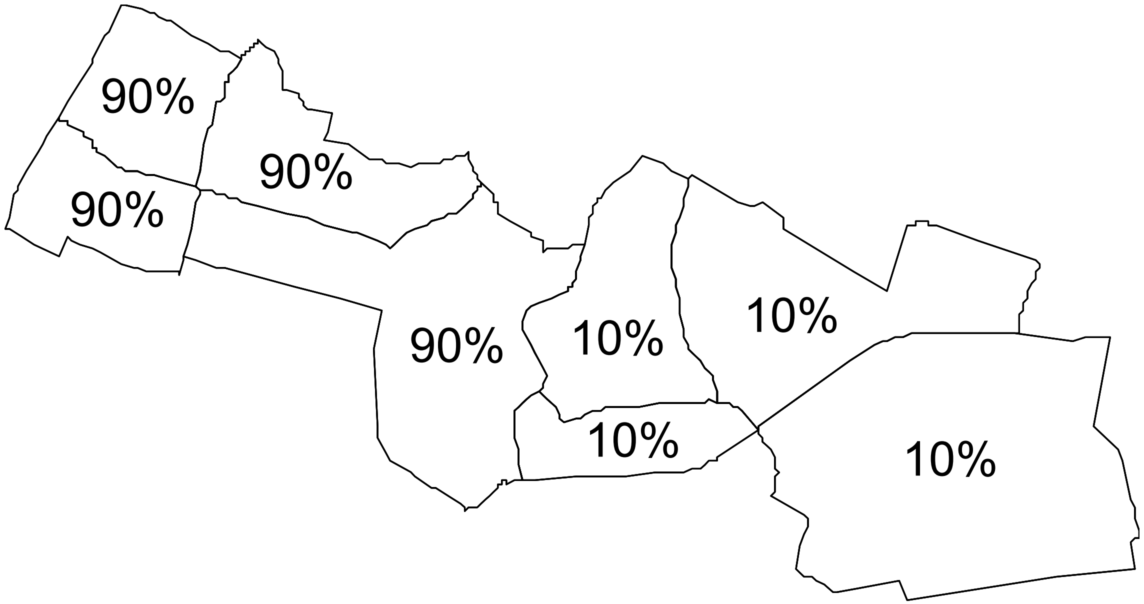
But …

… 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* = 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:

$$Coverage = \frac{SAM\ cases\ receiving\ treatment}{Prevalence\ of\ SAM \times Population_{6-59\,months}}$$

Unstable / unreliable denominator :

Prevalence estimate is relatively imprecise:

Example :

$n = 900$

$DEFF \approx 2.0$

$prevalence = 2\%$

$precision\ (95\%\ CI) \approx \pm\ 1.3\%$

$$Relative\ precision \approx \frac{1.3}{2} \times 100 = 65\%$$

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

Method	Date	Description
CSAS	2002	Spatial sample. Coverage estimated locally (mapped) and globally. Some information on barriers to coverage. Bit too expensive for routine M&E.
SLEAC	2008	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&E at clinic level.
SQUEAC	2008	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).
S3M	2010	Wide-area version of CSAS using improved spatial sampling and more efficient use of data. Some information on barriers to coverage.

CSAS

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

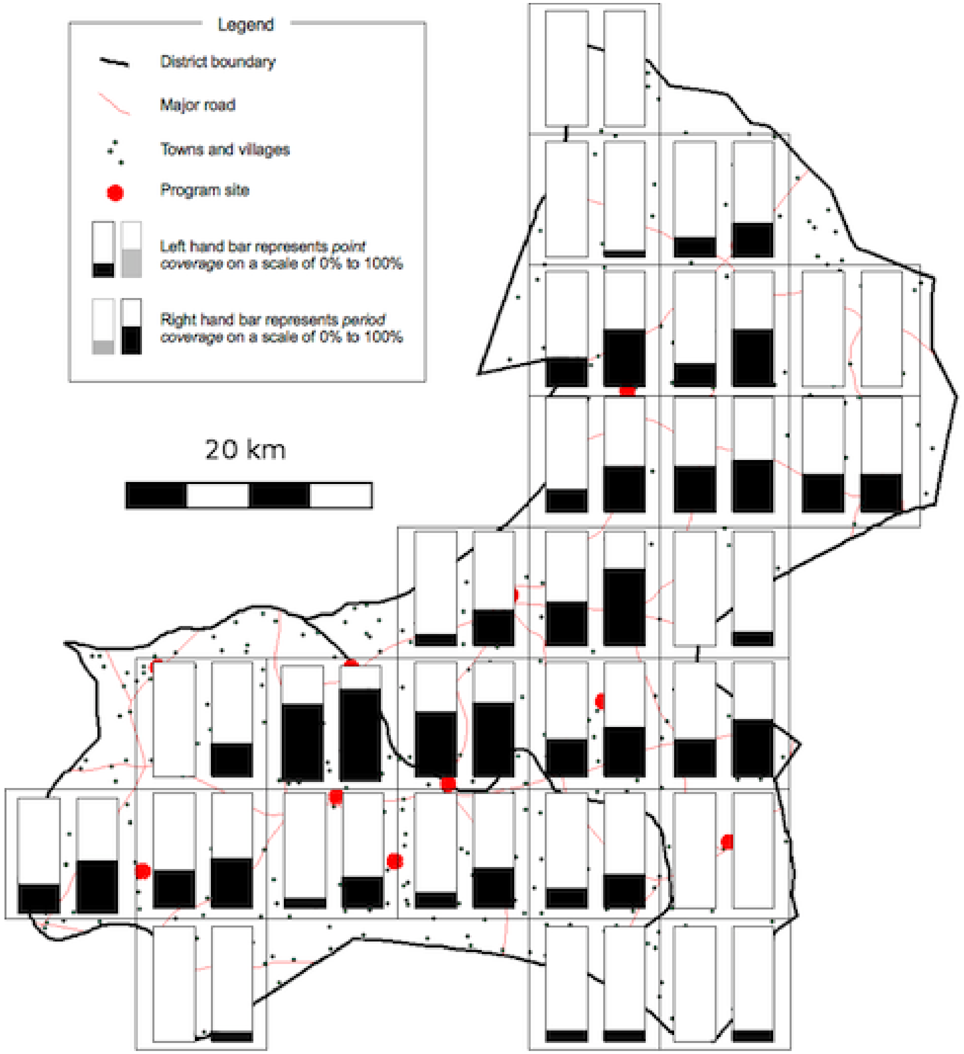
CSAS

CSAS method yields :

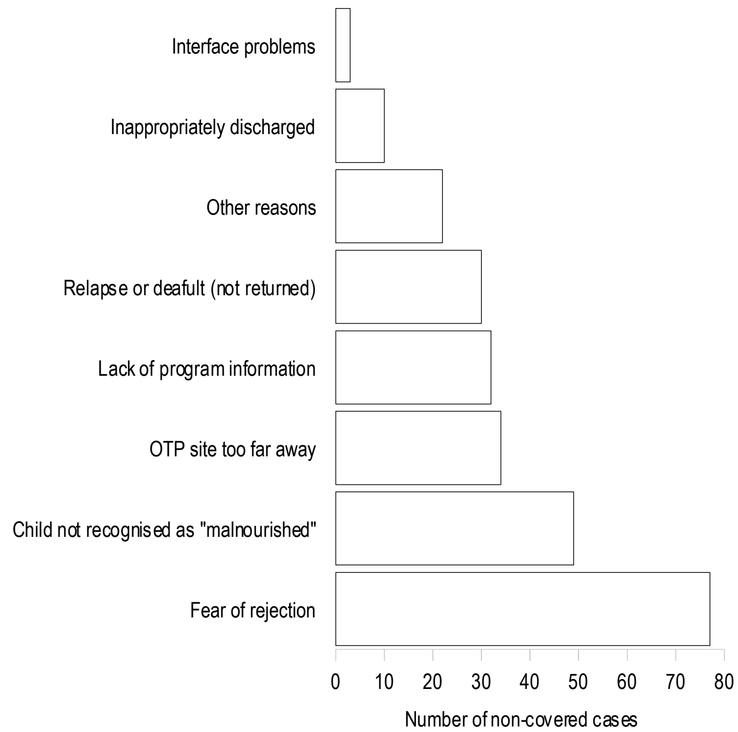
- Overall coverage estimate
- Local coverage estimates :
  - Coverage map
- Ranked list of barriers :
  - Can also be mapped

CSAS

Coverage Map



Barriers



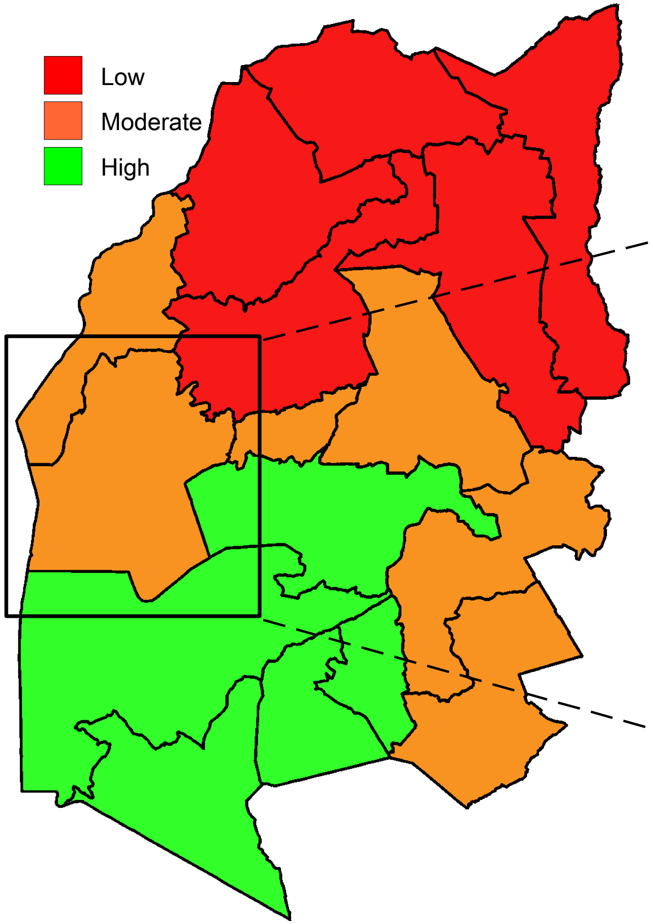
SLEAC

- 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

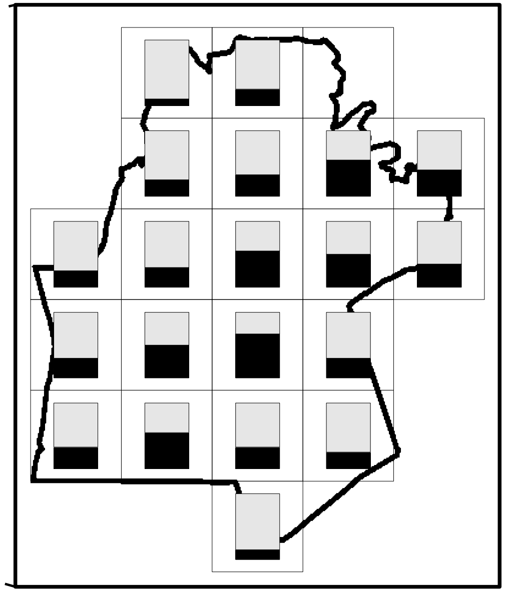
SLEAC

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 :

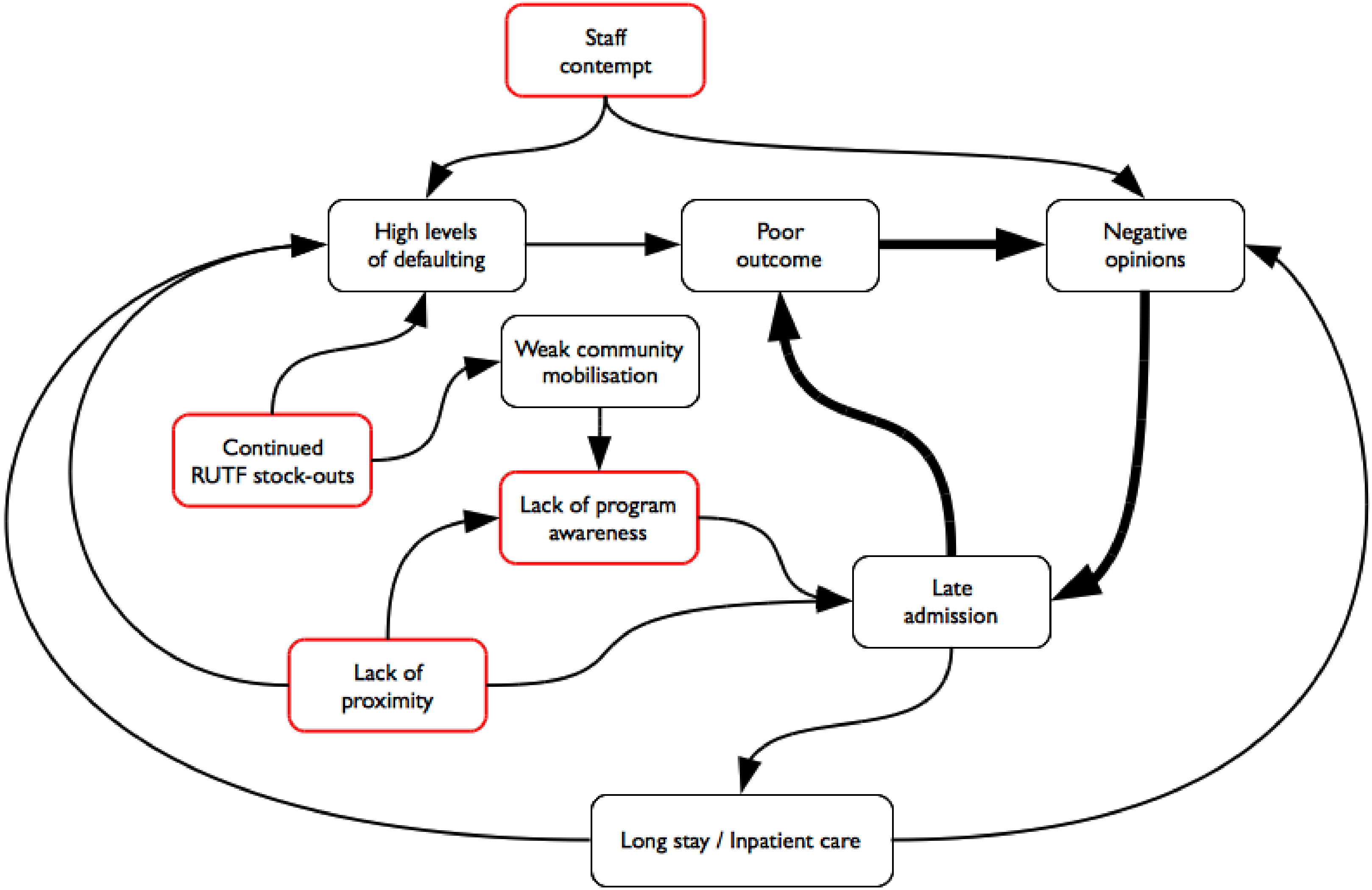
- Intelligent use of routine monitoring data …
  - ... other data may be collected on a ‘little and often’ basis

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



SLEAC / SQUEAC

SLEAC and **SQUEAC** can be used in combination :

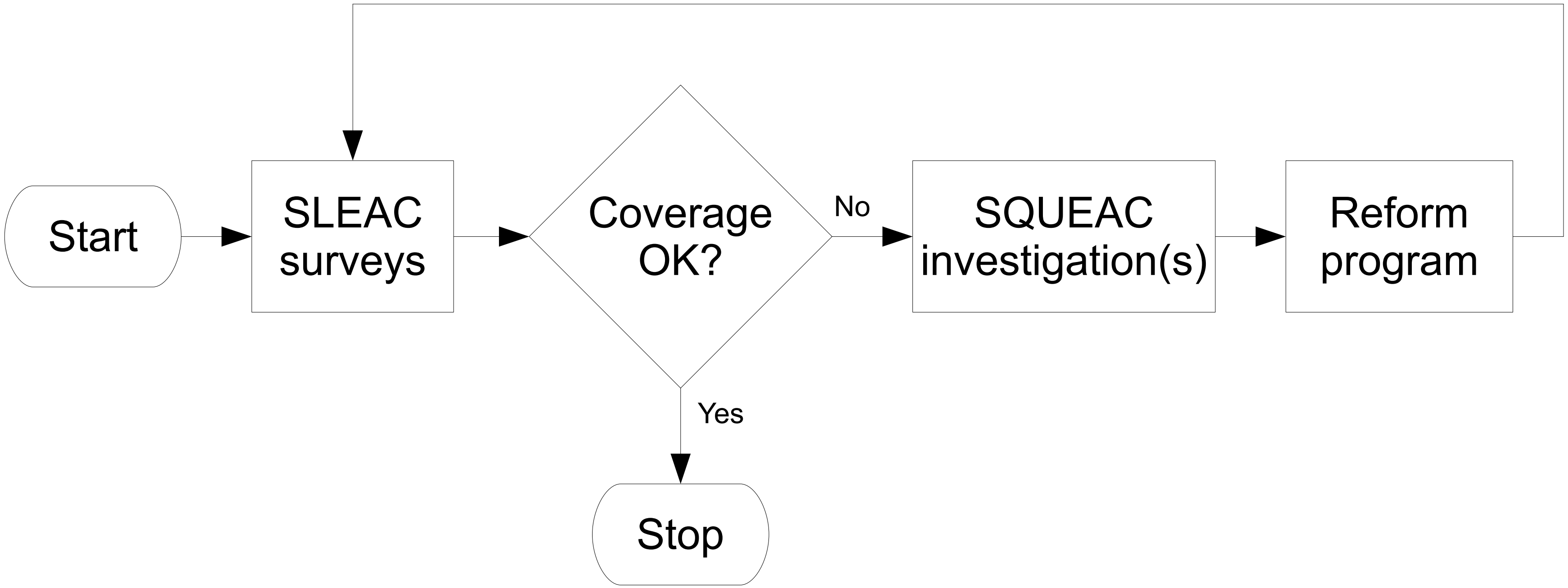
SLEAC identifies good or bad coverage areas for **SQUEAC** investigation …

… lessons learned from **SQUEAC** applied to wider program …

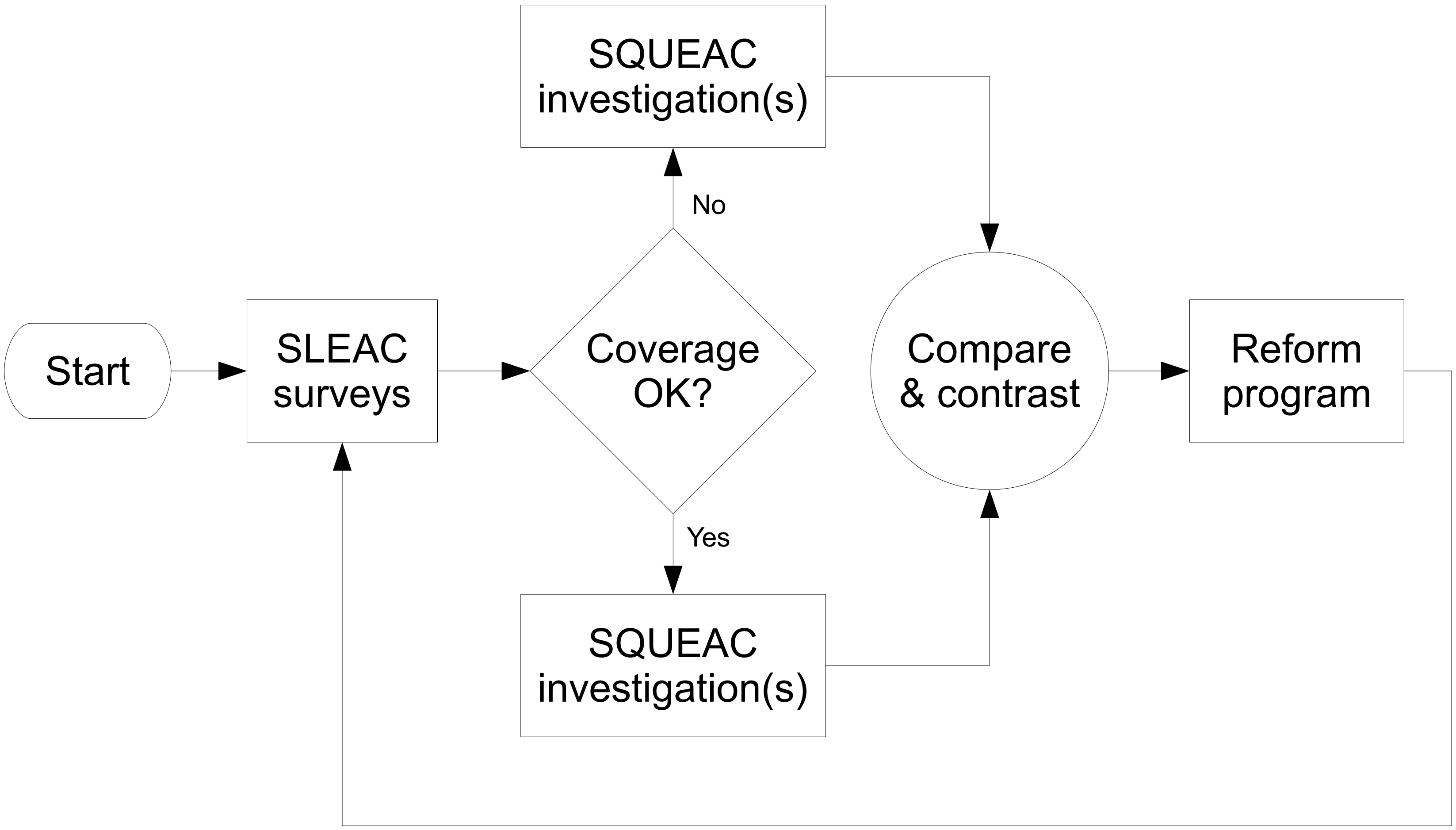
… stop bad practice

… spread good practice

SLEAC / SQUEAC combination



SLEAC / SQUEAC combination



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

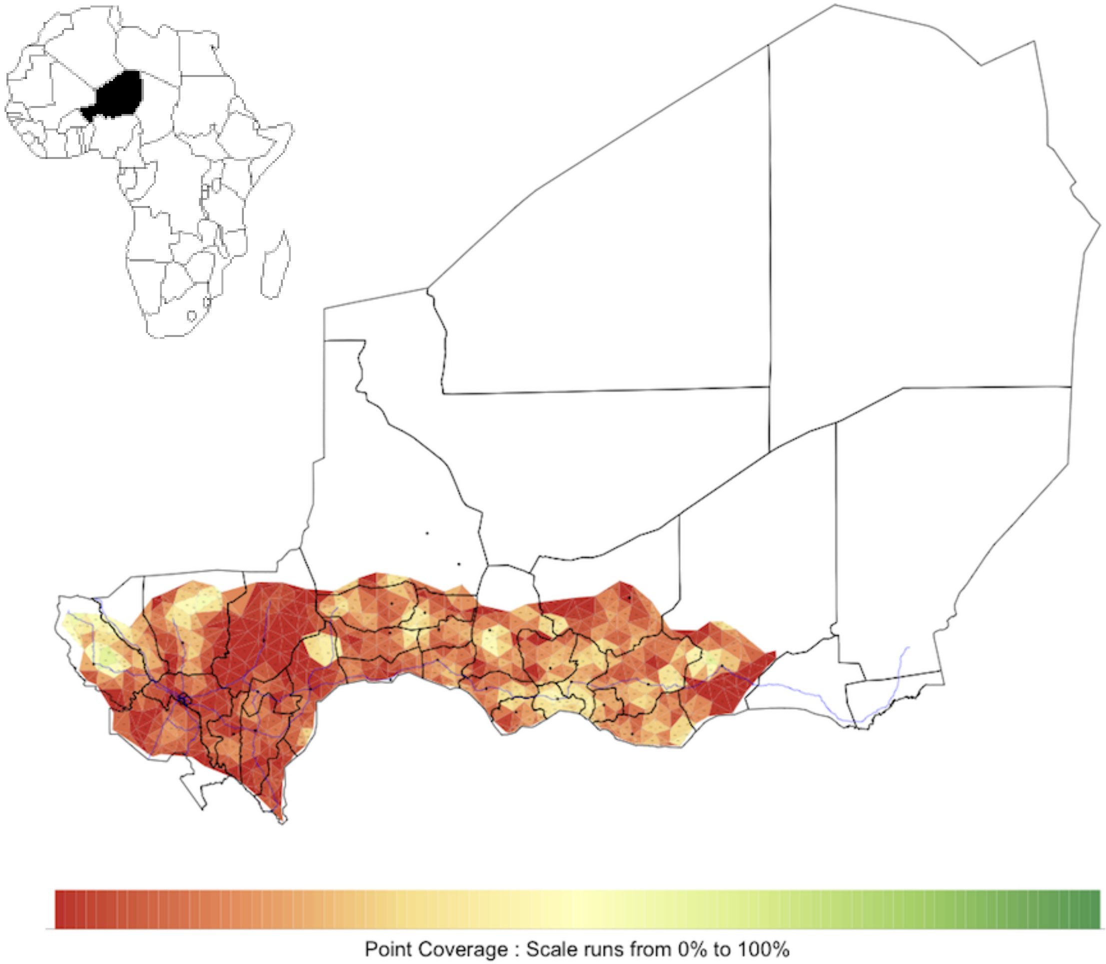
Outputs are similar to **CSAS** :

Coverage map

Ranked barriers

S3M / **SQUEAC** combination also possible

S3M : Coverage Mapping

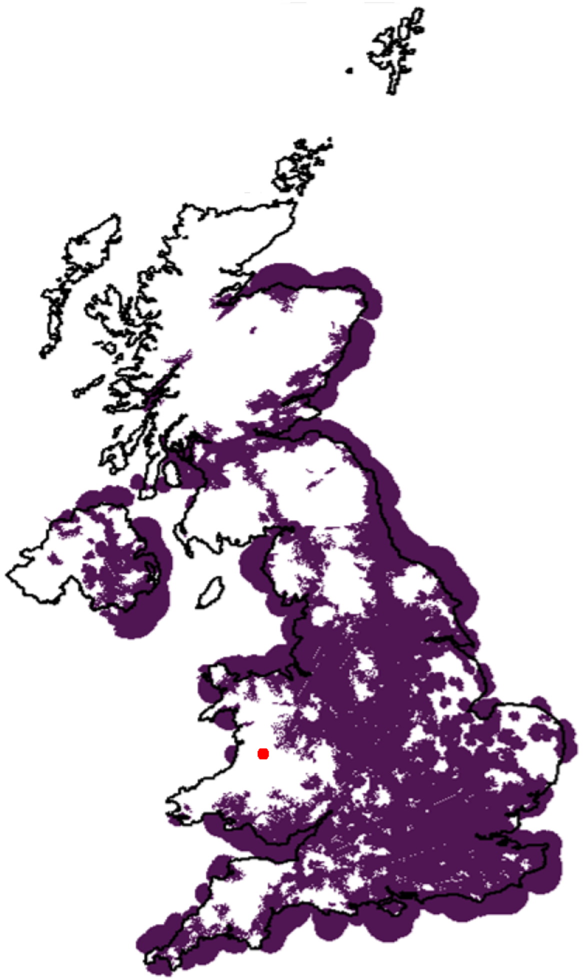


Summary

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