

The case definitions, and the clause everyone drops

Severe, moderate and global acute malnutrition, the cut-offs the sector agreed on, and the oedema clause that makes every "count below the threshold" implementation wrong.

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Lesson 3 of 8

Nutrition Analysis: CMAM and SMART — Who is a case

What this lesson covers

- The definitions
- The implementation that is wrong
- The implementation that is right
- Check that the parts sum to the whole
- The MUAC definitions, on the register
- What a definition does not say
- What comes next

The definitions

Term	Weight-for-height z	MUAC	Oedema
SAM — severe acute malnutrition	below -3	below 115 mm	present
MAM — moderate acute malnutrition	-3 to below -2	115 to below 125 mm	—
GAM — global acute malnutrition	below -2	below 125 mm	present

The definitions

- GAM is SAM plus MAM — It is not a separate condition; it is the total burden of acute malnutrition, and it is the. . .
- Each row is a complete definition on its own — A child is SAM by weight-for-height, *or* by MUAC, *or* by oedema — the. . .
- The oedema column is an OR, not an AND — A child with bilateral pitting oedema is severe whatever their measurements say

The implementation that is wrong — In Python

```
# WRONG: the definition everybody writes first  
sam_wrong = (smart["whz"] < -3).sum()
```

The implementation that is wrong — In R

```
# WRONG  
sum(smart$whz < -3, na.rm = TRUE)
```

The implementation that is right — In Python

```
import pandas as pd

analysable = smart[smart["whz"].between(-5, 5)].copy()
oedema = analysable["oedema"] == True

analysable["sam"] = (analysable["whz"] < -3) | oedema
analysable["mam"] = (analysable["whz"].between(-3, -2, inclusive="left")) & ~oedema
analysable["gam"] = analysable["sam"] | analysable["mam"]

n = len(analysable)
for label in ["sam", "mam", "gam"]:
    print(f"{label.upper():4} {analysable[label].sum():>4} / {n} "
          f"{analysable[label].mean():.1%}")
```

The implementation that is right — In R

```
analysable <- smart |> filter(between(whz, -5, 5))
```

```
analysable <- analysable |>  
  mutate(sam = whz < -3 | oedema,  
         mam = whz >= -3 & whz < -2 & !oedema,  
         gam = sam | mam)
```

```
analysable |> summarise(across(c(sam, mam, gam), list(n = sum, rate = mean)), n = n())
```

The implementation that is right

- MAM excludes oedema explicitly — An oedematous child whose z-score falls in the moderate band is severe, not moderate, . . .
- The bounds are half-open — $-3 \leq z < -2$
- The denominator is stated — 852, not 930 — the difference is children with no computable z-score and children outside. . .

Check that the parts sum to the whole — In Python

```
assert (analysable["sam"] & analysable["mam"]).sum() == 0, "a child is both"  
assert analysable["gam"].sum() == analysable["sam"].sum() + analysable["mam"].sum()
```

Check that the parts sum to the whole — In R

```
stopifnot(sum(analysable$sam & analysable$mam) == 0,  
          sum(analysable$gam) == sum(analysable$sam) + sum(analysable$mam))
```

The MUAC definitions, on the register — In Python

```
muac = pd.read_csv("muac-screening-artibonite-2024.v1.csv")
measured = muac[muac["muac_mm"].notna()].copy()
oed = measured["oedema"] == True

measured["sam"] = (measured["muac_mm"] < 115) | oed
measured["gam"] = (measured["muac_mm"] < 125) | oed

print(f"n = {len(measured):,}   GAM {measured['gam'].mean():.1%}   "
      f"SAM {measured['sam'].mean():.1%}")
```

The MUAC definitions, on the register — In R

```
muac |>
  filter(!is.na(muac_mm)) |>
  summarise(n = n(),
            gam = mean(muac_mm < 125 | oedema),
            sam = mean(muac_mm < 115 | oedema))
```

The MUAC definitions, on the register

- Name the measure in the indicator — `gam_muac_percent` and `gam_whz_percent` are different indicators that both get...

What a definition does not say

- Age — The definitions apply to children 6 to 59 months

What a definition does not say — In Python

```
out_of_scope = ~analysable["age_months"].between(6, 59)
print(f"{out_of_scope.sum()} children outside 6-59 months")
```

What a definition does not say — In R

```
sum(!between(analysable$age_months, 6, 59), na.rm = TRUE)
```

What a definition does not say

- Admission — A case definition says who *is* malnourished
- Severity within severe — SAM with complications needs inpatient care; SAM without needs outpatient

What a definition does not say

A case definition is a classification rule, not a treatment decision. Confusing the two produces a caseload figure that does not match any programme's admissions and an argument nobody can resolve from the data.

What comes next

- You can classify a child by either measure.

Read the full lesson, with runnable code

[https://data-analysis.cassion.dev/courses/nutrition-analysis-cmam-smart/
nutrition-03-sam-and-mam](https://data-analysis.cassion.dev/courses/nutrition-analysis-cmam-smart/nutrition-03-sam-and-mam)