

Where the two criteria disagree

468 children severe by weight-for-height alone, 24 by MUAC alone, 142 by both. A concordance of 22.4%, and the whole of the disagreement is age — 31.4 months against 14.3.

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Lesson 4 of 8

Nutrition Analysis: CMAM and SMART — Who is a case

What this lesson covers

- The question the register can answer
- Compute both on the same children
- The cross-tabulation
- The disagreement is age
- Which one is right?
- What it means for your numbers
- Report the pair, always
- What comes next

The question the register can answer

- Both admission criteria are in the case definitions and both are used in the field.

Compute both on the same children — In Python

```
import pandas as pd

cmam = pd.read_csv("cmam-admissions-2024.v1.csv")
cmam["whz"] = cmam.apply(whz, axis=1)           # from lesson 2

both = cmam[cmam["whz"].notna()].copy()
print(f"{len(both)} of {len(cmam)} admissions have both measurements")

both["sam_whz"] = both["whz"] < -3
both["sam_muac"] = both["muac_admission_mm"] < 115
```

Compute both on the same children — In R

```
both <- cmam |> filter(!is.na(whz))  
  
both <- both |>  
  mutate(sam_whz = whz < -3,  
         sam_muac = muac_admission_mm < 115)
```

The cross-tabulation — In Python

```
table = pd.crosstab(both["sam_muac"], both["sam_whz"],  
                    rownames=["SAM by MUAC"], colnames=["SAM by WHZ"])  
print(table)
```

The cross-tabulation — In R

```
both |> count(sam_muac, sam_whz)
```

The cross-tabulation

	Not severe by WHZ	Severe by WHZ
Not severe by MUAC	394	468
Severe by MUAC	24	142

The cross-tabulation — In Python

```
overlap = table.loc[True, True]
union = table.values.sum() - table.loc[False, False]
print(f"concordance {overlap / union:.1%} of {union} severe by either measure")
```

The cross-tabulation — In R

```
both |>  
  summarise(overlap = sum(sam_muac & sam_whz),  
            union = sum(sam_muac | sam_whz)) |>  
  mutate(concordance = overlap / union)
```

The cross-tabulation

- 22.4% — Of the children this register would call severe by one measure or the other, fewer than a quarter are called. . .

The disagreement is age — In Python

```
mean_age = pd.Series({
    "MUAC only": both.loc[both["sam_muac"] & ~both["sam_whz"], "age_months"].mean(),
    "WHZ only": both.loc[both["sam_whz"] & ~both["sam_muac"], "age_months"].mean(),
    "Both": both.loc[both["sam_muac"] & both["sam_whz"], "age_months"].mean(),
})
print(mean_age.round(1))
```

The disagreement is age — In R

```
both |>
  mutate(group = case_when(sam_muac & sam_whz ~ "both",
                           sam_muac ~ "muac only",
                           sam_whz ~ "whz only",
                           TRUE ~ "neither")) |>
  summarise(mean_age = mean(age_months), n = n(), .by = group)
```

The disagreement is age

Group	Mean age
Severe by MUAC only	14.3 months
Severe by both	15.6 months
Severe by weight-for-height only	31.4 months

The disagreement is age — In Python

```
by_age = both.assign(  
    band=pd.cut(both["age_months"], [5, 12, 24, 36, 60],  
                labels=["6-11", "12-23", "24-35", "36-59"])  
)  
.groupby("band")[["sam_muac", "sam_whz"]].mean()  
print((by_age * 100).round(1))
```

The disagreement is age — In R

```
both |>
  mutate(band = cut(age_months, c(5, 12, 24, 36, 60),
                      labels = c("6-11", "12-23", "24-35", "36-59"))) |>
  summarise(across(c(sam_muac, sam_whz), mean), .by = band)
```

Which one is right?

- **MUAC predicts mortality at least as well**, and better in several studies. If the purpose of admission is to treat. . .
- **Weight-for-height is the survey standard**, and the IPC thresholds and international comparisons are built on it. If. . .
- **MUAC is operationally feasible** at community level. Weight-for-height is not.

What it means for your numbers

- Caseload depends on the criterion — Admitting on either criterion gives a caseload of 634 severe children here; on MUAC. . .
- Prevalence is not comparable across measures — A GAM by MUAC and a GAM by weight-for-height are different indicators
- Discharge must use the admission criterion — A child admitted on MUAC and discharged on weight-for-height may be. . .
- A programme changing criterion breaks its own series — A caseload that rises 40% when the protocol changes is a. . .

What it means for your numbers — In Python

```
for name, mask in [("either", both["sam_muac"] | both["sam_whz"]),  
                  ("muac only", both["sam_muac"]),  
                  ("whz only", both["sam_whz"]]):  
    print(f"{name:10} caseload {mask.sum():>4}")
```

What it means for your numbers — In R

```
both |> summarise(either = sum(sam_muac | sam_whz),  
                  muac = sum(sam_muac), whz = sum(sam_whz))
```

Report the pair, always — Example

Severe acute malnutrition, admissions 2024, $n = 1,028$ with both measurements

By MUAC (<115 mm)	166	
By weight-for-height ($z < -3$)	610	
By either	634	
By both	142	(22.4% of those severe by either)

Children severe by MUAC alone average 14.3 months; by weight-for-height alone, 31.4 months. The two criteria identify overlapping but substantially different caseloads, and the difference is age.

What comes next

- You can classify children and you know what the classification depends on.

Read the full lesson, with runnable code

[https://data-analysis.cassion.dev/courses/nutrition-analysis-cmam-smart/
nutrition-04-muac-versus-whz](https://data-analysis.cassion.dev/courses/nutrition-analysis-cmam-smart/nutrition-04-muac-versus-whz)