The four measurements, and what each is for

Weight, length or height, MUAC and oedema. Each answers a different question, each has a precision that decides what it can support, and the one that is not a measurement at all is the one that overrides the others.

Pierre Robentz Cassion

Lesson 1 of 8

Nutrition Analysis: CMAM and SMART — Measuring a child

What this lesson covers

- Four things, measured on one child
- Length or height, and the 0.7 cm that is not a rounding error
- MUAC, and why it is used at all
- Precision decides what a measurement can support
- Read the distribution before computing anything
- What a nutrition analyst checks first
- What comes next

Four things, measured on one child

Measurement	Unit	Precision	What it is sensitive to
Weight	kg	0.1 kg	Acute deficit — it falls fast and recovers fast
Length / height	cm	0.1 cm	Chronic deficit — it accumulates and does not recover
MUAC	mm	1 mm	Acute deficit, and mortality risk more directly than weight
Oedema	present / absent	—	Not a measurement; a clinical sign, and it overrides

Four things, measured on one child

- Weight moves and height does not — A child who was hungry for two months is lighter than a child of the same height who…
- Oedema is not on a scale — It is a clinical sign — bilateral pitting oedema, checked by pressing both feet for three…

Length or height, and the 0.7 cm that is not a rounding error

- Under 24 months, use the **length** standard, and if the child was measured standing, **add 0.7 cm** before looking up.
- 24 months and over, use the **height** standard, and if the child was measured lying, **subtract 0.7 cm**.

Length or height, and the 0.7 cm that is not a rounding error — In Python

```
import pandas as pd

smart = pd.read_csv("smart-nutrition-survey-2024.v1.csv")
print(smart["measured_lying"].value_counts())
```

Length or height, and the 0.7 cm that is not a rounding error — In R

```
library(dplyr)
smart |> count(measured_lying)
```

MUAC, and why it is used at all

- **It needs one measurement, not two.** A community health worker with a tape can screen a village; a weight-for-height...
- **It predicts mortality at least as well.** For a child of a given age, a small arm is a strong predictor of dying, and...
- **It requires no age.** Which matters enormously in populations without birth records, where the age that a z-score...

Precision decides what a measurement can support — In Python

```
muac = pd.read_csv("muac-screening-artibonite-2024.v1.csv")
values = muac.loc[muac["muac_mm"].notna(), "muac_mm"]

near_cutoff = values.between(123, 127).sum()
print(f"{near_cutoff} of {len(values)} children within 2 mm of the 125 mm cut-off")
```

Precision decides what a measurement can support — In R

```
muac |>
  filter(!is.na(muac_mm)) |>
  summarise(near = sum(between(muac_mm, 123, 127)), n = n())
```

Precision decides what a measurement can support

- **Never report a MUAC-based rate to two decimal places.** The measurement does not support it.
- **Expect a pile-up at the cut-off in programme data.** A worker who reads 114 and knows 115 is the admission threshold…

Read the distribution before computing anything — In Python

```
cmam = pd.read_csv("cmam-admissions-2024.v1.csv")

print(cmam[["muac_admission_mm", "weight_admission_kg", "height_cm"]].describe().round(1))
print(f"height missing: {cmam['height_cm'].isna().sum()} of {len(cmam)}")
```

Read the distribution before computing anything — In R

```
cmam <- readr::read_csv("cmam-admissions-2024.v1.csv")

summary(select(cmam, muac_admission_mm, weight_admission_kg, height_cm))
sum(is.na(cmam$height_cm))
```

What a nutrition analyst checks first

- **Position recorded?** Without `measured_lying`, the 0.7 cm adjustment is a guess.
- **Age present, and how was it obtained?** A z-score needs age; a heaped age distribution says it was estimated, which...
- **Oedema recorded as a separate field?** If it is folded into a general "complications" flag, the SAM count cannot be...
- **Units.** MUAC in mm or cm, weight in kg, height in cm. The cleaning course found seven centimetre entries in the...
- **Plausible ranges.** MUAC 80–220 mm, weight 2–30 kg, height 45–125 cm for 6–59 months. Outside those is a recording...

What a nutrition analyst checks first — In Python

```
implausible = cmam[
    ~cmam["muac_admission_mm"].between(80, 220)
    | ~cmam["weight_admission_kg"].between(2, 30)
    | ~cmam["height_cm"].between(45, 125).fillna(True)
]
print(f"{len(implausible)} admissions outside plausible ranges")
```

What a nutrition analyst checks first — In R

```
cmam |>
  filter(!between(muac_admission_mm, 80, 220) |
         !between(weight_admission_kg, 2, 30) |
         (!is.na(height_cm) & !between(height_cm, 45, 125))) |>
  nrow()
```

What a nutrition analyst checks first

Anthropometry is the only part of this sector's data where the measurement error is well characterised and published. Use that: it tells you what precision your indicator can carry, and it is the reason a two-point difference between two surveys is usually nothing.

What comes next

- You have four measurements and know what each is for.

Read the full lesson, with runnable code

https://data-analysis.cassion.dev/courses/nutrition-analysis-cmam-smart/nutrition-01-anthropometry