Worked example | New case

A probiotic for weaned piglets

COMPLETED EXAMPLE: ROUND 1 DIAGNOSIS

CASE FILE

A pig unit wants to test whether a probiotic feed additive improves growth after weaning. Forty-eight piglets are housed six per pen in eight pens. Four pens are randomly allocated to standard feed and four to probiotic feed, which is delivered through one shared trough in each pen. Every piglet is weighed weekly for six weeks, and the proposed analysis treats the 24 piglets on each diet as independent treatment replicates.

Understand the patient

Intended biological question	Does adding a probiotic to feed improve growth of weaned piglets?
Treatment / factor and levels	Probiotic feed versus standard feed.
Response variable	Piglet weight gain over six weeks, measured weekly.
Experimental unit	Pen, because one diet is delivered through the shared trough.
Independent units per treatment	Four pens. The 24 piglets are observations within pens.

Primary diagnosis

What has been done well?	There is a concurrent control, eight treatment units, balanced allocation and random assignment of pens.
What is the most serious design flaw or threat?	The analysis counts piglets as independent treatment replicates. Diet was applied to pens, so this is pseudoreplication.
What alternative explanation could account for the result?	Piglets in a pen share feed, environment and social conditions. A pen-specific difference could affect all six piglets.
What conclusion would NOT be justified?	It is not justified to claim n = 24 independent replicates per treatment or to calculate uncertainty as if all 48 piglets were treatment units.

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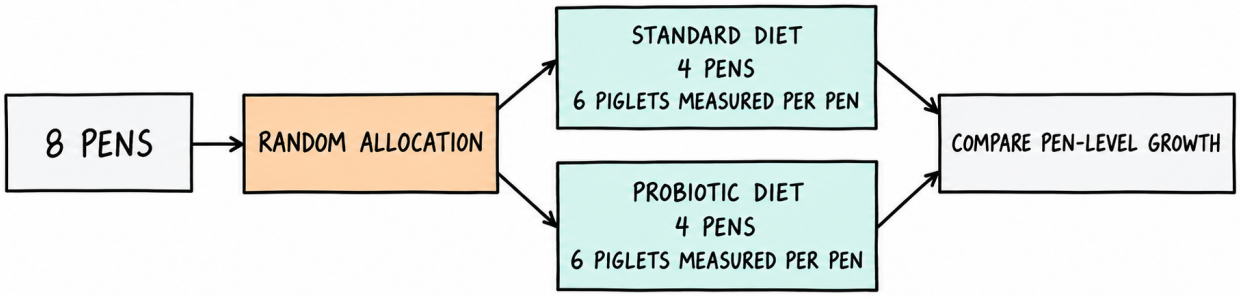
Repair: A probiotic for weaned piglets

COMPLETED EXAMPLE: ROUND 2 REPAIR

REALISTIC CONSTRAINT **No additional pigs or pens are available.**

Completed design sketch

WHAT THIS SKETCH DOES It maps the experimental units, allocation, treatment groups, measurements within units, and the comparison. It is a structure diagram, not a picture of the farm.



READ IT TOP TO BOTTOM A treatment decision is made for each pen. Piglets are measured within pens; they do not turn four pens into 24 independent treatment units.

Exact comparison	Compare the growth outcomes from four probiotic pens with those from four standard-feed pens.
Allocation	Randomly allocate the eight pens, four to each diet, and retain pen identity in the data and analysis.
Problem eliminated	Piglets are no longer counted as independent treatment replicates; treatment replication is correctly located at pen level.
Limitation remaining	Only four pens per treatment are available, so precision and generalisability may be limited.
Second opinion	Strength: balanced random allocation. Risk: pen conditions may vary. Improvement: standardise management and record important pen-level conditions.