

Unmix the data before blaming a shift

Compare meaningful groups with their denominators and context, and distinguish an observed difference from a causal explanation.



Fewer failures can still mean a higher observed rate

Fictional case: Brook Assembly reports eight nonconforming units from 100 inspected on line A and two from 20 on line B. Those values remain unchanged in the core exhibit. Supervisor Mara wants to congratulate line B for having fewer failures and assign corrective training to line A. Analyst Jo must reconstruct a fair comparison before the meeting.

Your role and the reference condition

Quality analyst with both line leaders

Normal: The response definition, observation period and inspection method are comparable. Each source retains numerator, denominator and product/operating context.

Gap: Raw counts hide unequal inspection amounts. Product mix, inspection differences and small-sample uncertainty remain unresolved.

Work within these conditions

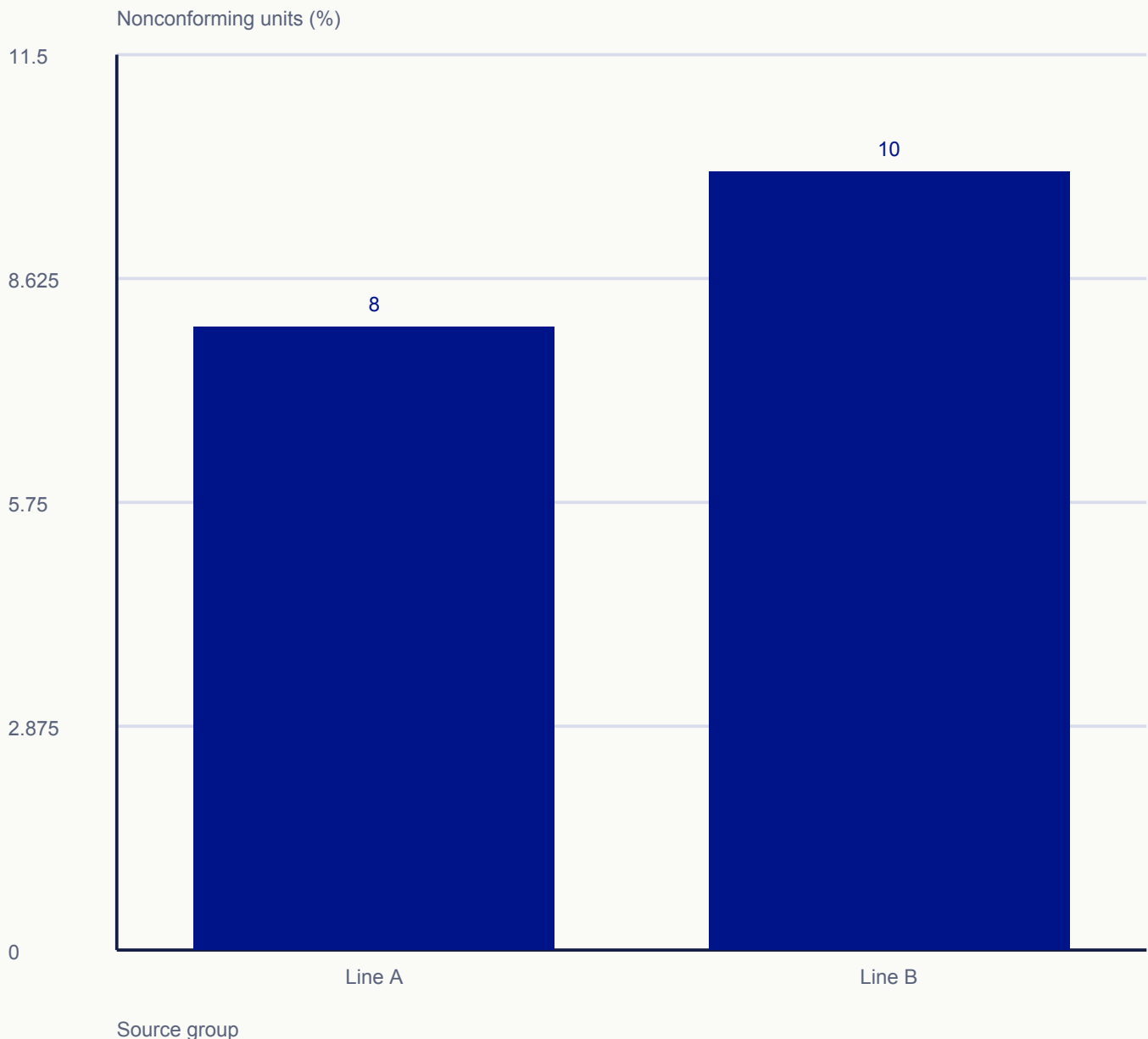
1. The groups are observational and small.
2. The exercise compares observed rates; it does not estimate a causal line effect or prove statistical significance.

Fictional teaching case. Supplied observations support the exercise; proposed actions are not verified customer results.

See how the method works

Stratification keeps meaningful source labels attached to the evidence. Pooling machines, shifts, products or suppliers can conceal patterns and can also create misleading comparisons. Define comparable opportunities before dividing the data into groups. In this example the smaller count belongs to the line with the higher observed nonconforming percentage. That difference still does not prove a line effect: the groups may have different products, inspection methods or random uncertainty. Compare relevant strata, examine the underlying process and retain the pooled view for context. Do not use a convenient grouping as a shortcut for blaming people.

Rates with declared denominators



Denominators: Line A: 8/100, Line B: 2/20

Rates compare denominators; two small groups do not establish causal differences.

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Follow the evidence and decisions

Inspect the supplied case inputs

Source	Nonconforming / inspected	Known context
Line A	8 /100	Product mix not separated
Line B	2 /20	Smaller observation group
Pooled	10 /120	Combines both sources, with unequal weights

01 / Retain the source labels

Jo preserves which line produced each inspected unit and confirms the observation window and classification rule. He does not strip source fields after calculating one pooled total.

Why: Stratification is possible only when the collection record carries meaningful group identity. Reconstructing a source from memory would introduce another uncertainty.

Evidence / check: Each observation retains line, product, time and inspection status where available.

02 / Calculate rates with the actual denominators

He reports A as $8/100=8\%$ and B as $2/20=10\%$. He shows the counts next to the percentages rather than presenting equally precise-looking bars without sample sizes.

Why: The line with fewer recorded failures can have the larger observed fraction. Denominator visibility prevents the visual from implying equal evidence amounts.

Evidence / check: Two percentages with their corresponding inspected populations.

03 / Calculate the weighted pooled result

He sums failures and inspected units: $10/120=8.33\%$. He rejects the unweighted average of 8% and 10%, which would be 9%.

Why: Pooling must weight by the underlying population counts. A mean of percentages answers a different question when denominators differ.

Evidence / check: The pooled numerator and denominator reconcile to both groups.

04 / Investigate comparability before attribution

Jo requests product family, inspection method, sampling timing and relevant operating conditions. He proposes within-product comparisons if both lines make the same products.

Why: A source label locates a pattern but does not explain it. Product mix or measurement differences can account for an apparent source difference.

Evidence / check: The decision record labels line effect as unverified and names missing stratifiers.

05 / Choose a proportionate response

Mara pauses the blame-based training assignment and commissions a comparable observation window while responding to actual nonconforming product under its own procedure.

Why: Better comparison does not mean ignoring known product problems. It means keeping product response separate from an unsupported causal claim about a team.

Evidence / check: The action names collection improvements and responsible owners rather than declaring a worse shift.

Completed source comparison

Comparison	Result	Interpretation
Line A	8% from 100 inspected	More failures, lower observed fraction
Line B	10% from 20 inspected	Fewer failures, higher observed fraction
Pooled	8.33% from 120	Weighted mixture, not a line-effect estimate
Cause	Not established	Need comparable product/measurement context

The apparent winner changes within product

A later record shows the two lines made very different product mixes.

Decision

Separate the products where enough comparable observations exist, retain pooled and stratified views, and report gaps where one line has no matching product.

Reasoning

A convenient aggregate can hide or reverse relationships. Do not manufacture comparable groups by discarding inconvenient units without an explicit rule.

What would change the decision?

Each comparison declares its product scope and actual exposure.

Practise with a changed case

A changed two-group comparison

New fictional records show line C with 3 nonconforming of 30 and line D with 8 of 160. Product mix is still unknown.

Line	Nonconforming	Inspected
C	3	30
D	8	160

Your task

1. Calculate each rate and the pooled rate.
2. Explain why the mean of the two percentages is not the pooled fraction.
3. State the next evidence needed before attributing the difference to line performance.

Use the next page to record your reasoning before reading the answer.

Your practice worksheet

A changed two-group comparison

Group numerator and denominator

Rates

Pooled calculation

Comparability checks

Bounded conclusion

Complete your reasoning before turning to the answer. Use the separate learner workbook for group practice.

Check your reasoning and transfer it

1. C is 10%; D is 5%. The pooled fraction is $11/190=5.789\%$, approximately 5.79%. The unweighted average 7.5% gives the small and large groups equal influence.
2. Request product, sampling and measurement context and collect comparable evidence. The observed difference is not proof that C causes more defects or needs a specific intervention.

Suggested completed record

Group	Calculation	Result
C	3/30	10%
D	8/160	5%
Pooled	11/190	5.79%

Plausible wrong turns

1. A small count is not necessarily a small rate.
2. A source difference is not automatically a cause.

Evidence of a sound answer

1. Use actual denominators.
2. Distinguish pooled and average-of-rate questions.
3. Name a concrete missing comparator.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Quality data owner with process leaders
Record	Source-stratified comparison and collection plan
Review	At the next comparable observation window
Verification evidence	Consistent classifications, denominators and product context
If unresolved	Improve source capture or sampling before assigning a cause-specific action.

Help someone else apply the method

Prepare

1. Source-labelled unit records
2. Calculator
3. Blank comparison table

Minutes	Activity and coaching prompt
4	Challenge the count-only story Which line looks better before dividing?
8	Reconcile the pooled value Why is 8.33% nearer 8%?
10	Complete the changed comparison What makes a fair product comparison?
5	Debrief attribution Which sentence would unfairly blame a team?

Debrief

1. Ask learners to explain unequal weighting with units rather than a formula alone.
2. Separate containment of known product from investigation of the source pattern.

Individual or remote practice

Write a careful meeting statement containing both rates, sample sizes and one remaining uncertainty.

Connect the method and check its boundaries

Before application

1. Preserved source labels
2. Comparable denominators

Outside this lesson

1. Proof that a shift caused the difference
2. Adjustment for all confounders

ASQ: Stratification

ASQ: Stratification

Separate observations by relevant source categories so aggregated data do not conceal patterns.

Public primary-source summary; underlying paid standards/forms are not reproduced.

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