

Wk16 CER: Vaccine data CER analysis

Your goal: Analyze vaccine and antibody data and write a CER about immunity.

One product: Written CER analyzing a vaccine antibody graph: claim about how vaccines build immunity, two specific data-point evidence entries, reasoning connecting memory B cells to protection, and one limitation.

Question: What can a higher second antibody peak support, and what does it leave unknown?

Start the work

Specific binding can help block infection, and memory can speed a later response; neither guarantees protection.

1. Examine a graph of antibody levels after vaccination.
2. Make a claim about how vaccines build immunity.
3. Cite two data points as evidence.
4. Add reasoning connecting memory cells to protection.
5. Note one limitation of the data.

If access is unavailable, save the complete dated work and tell the teacher. Try the assigned upload when access works, then check that Schoology shows Submitted.

Words you will use

antibody

A protein released by plasma cells that binds a matching target.

antigen

A molecular structure recognized by an antibody or immune-cell receptor.

B cell

An immune cell that can develop into a plasma cell or memory B cell.

plasma cell

An activated B-cell descendant that releases antibodies.

memory B cell

A long-lived B cell that can help mount a later response to its target.

immune memory

Changes after an encounter that can improve a later response.

vaccine

A preparation that presents an antigen or instructions for making one to prepare an immune response.

dose

An amount given at one time; graph markers here are fictional dose events.

booster

A later vaccine dose intended to strengthen or renew protection.

primary response

The response to a first encounter with a particular target.

secondary response

The response to a later encounter with that target.

activation

Starting a cell response after the needed signals.

expansion

An increase in responding cell numbers through cell division.

protection

A reduced chance or severity of disease, not necessarily complete prevention.

neutralization

Blocking a pathogen or toxin from carrying out a harmful action.

circulating antibody

Antibody present in blood, rather than a count of memory cells.

waning

A decline over time.

peak

The highest value in a specified portion of a record.

sampled peak

The highest value among the provided points; a higher unobserved value may exist.

elapsed time

Time passed since a stated event.

axis

A reference line showing a graph variable and its scale.

arbitrary unit

A made-up or relative scale whose meaning must be stated; here it is not a clinical concentration.

AU

Arbitrary units, used only for this original teaching curve.

baseline

A starting value used for comparison.

data point

A paired time and value on a graph.

claim

An answer to the question.

evidence

Information supporting a claim, with its source and limits.

reasoning

An explanation connecting evidence to the claim.

CER

Claim, evidence and reasoning.

limitation

Something the evidence does not establish and why that matters.

mechanism

The steps through which a process could occur.

inference

An interpretation that goes beyond directly reported values.

causation

One factor bringing about a change in another.

variation

Differences among people, samples or responses.

toxin

A harmful substance made by a living organism.

tetanus

An illness caused by a toxin made by certain bacteria.

toxoid

A toxin altered so it can stimulate immunity without its usual toxic action.

antitoxin

An antibody that can bind and neutralize a toxin.

clinical

Related to actual patient care.

control group

A comparison group used to help evaluate an effect.

legend

A key explaining graph marks and lines.

lymphocyte

A white blood cell in the B-cell, T-cell or natural-killer-cell groups.

assay

A test used to measure or detect a substance or activity.

concentration

Amount of a substance in a stated volume.

vaccine effectiveness

How much vaccination reduces an outcome in a defined real-world comparison.

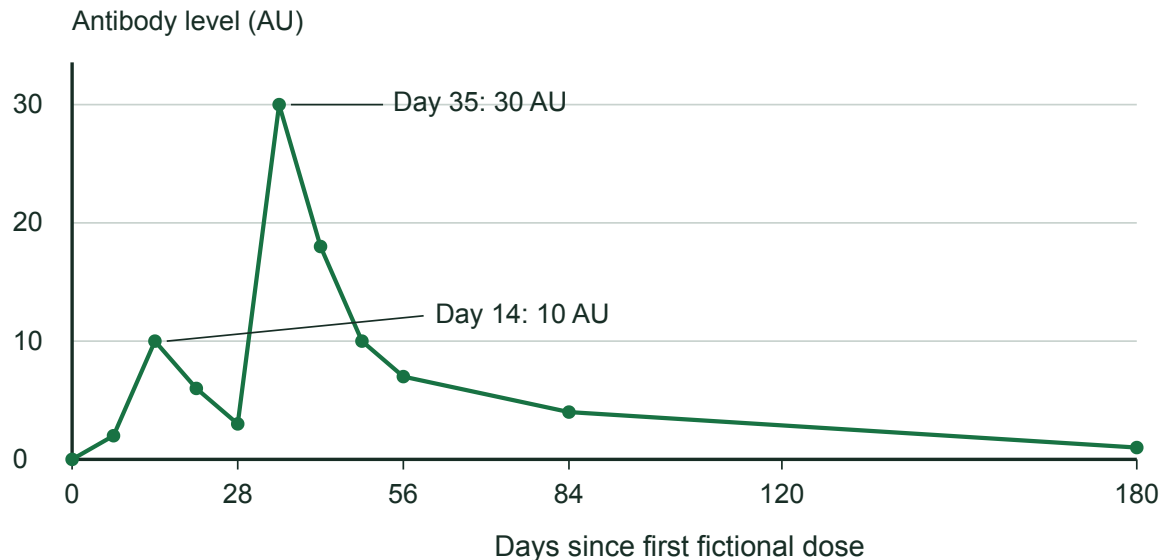
sampling

Recording selected points rather than every possible time or person.

V1: original constructed antibody curve

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Teaching illustration only. Not trial or patient measurements.



Dose events: day 0 and day 28, just after the listed readings.

Dots: D1 points. Lines: visual guides. AU: arbitrary teaching units.

V1 uses D1's complete eleven-point table. Equal day spacing is linear; lines guide the eye. No clinical concentration, participant or protection threshold is supplied.

Text description: Original constructed graph, not measured data. Days 0, 7, 14, 21, 28, 35, 42, 49, 56, 84 and 180 pair with AU values 0, 2, 10, 6, 3, 30, 18, 10, 7, 4 and 1. Fictional doses follow the readings at day 0 and day 28.

H1: your evidence task

Write a CER from the original graph V1 and its complete D1 table. Name two exact data points, explain a possible memory mechanism and state a meaningful limitation.

The curve is constructed for practice. It is not a vaccine trial, a participant record or measured class data. No person, vaccine product, sample size or health outcome is represented.

Use the May 3 principle about binding, memory and limits. Actual completion of that model is not assumed. Its model ticks and tokens are not the units or source of today's new curve.

E1: from cells to a possible explanation

Vaccination can prepare an immune response to a target. Selected B cells can expand and develop into plasma cells that release antibodies. Some responding cells become memory B cells.

A later encounter can activate memory cells and lead to quicker antibody output. This takes biological steps; it is not instant recognition followed by instant protection. Plasma cells make antibodies, while memory B cells support later responses.

An antibody curve measures or represents antibody level, not memory-cell number. A higher second peak can be consistent with memory, but the curve alone cannot prove that memory caused it.

Antibodies can help protect when they block a harmful process or support other defenses. Protection also depends on the target, response quality and person. A high level does not guarantee lifelong protection.

D1: complete constructed vaccine curve

V1 uses days since the first fictional dose on the horizontal axis and antibody level in arbitrary units (AU) on the vertical axis. AU here has no conversion to an actual blood concentration.

Complete paired table, written as day:AU: 0:0; 7:2; 14:10; 21:6; 28:3; 35:30; 42:18; 49:10; 56:7; 84:4; 180:1. All eleven values are authored teaching points.

Fictional dose events occur at day 0 and day 28, just after the listed value at each day. The day-28 point is before the second dose. No amount or vaccine formulation is supplied.

Use days 0–28 as the first-response window and days 28–56 as the repeat-response window. Day 84 and day 180 extend the later decline. Connections between points guide the eye; they are not added observations.

For elapsed time to a sampled peak, subtract the relevant dose day from the peak day. Compare the two elapsed times, not the raw calendar positions. Do not assume the true peak occurred exactly at a sampled point.

Low starting value, first sampled peak and higher second sampled peak are three features to identify before drafting. Cite each selected point with its day, value, units and D1 identifier.

E2: limits that change the conclusion

No memory cells, infections, symptoms, neutralization results, control group or individual responses were measured in D1. The graph cannot establish vaccine effectiveness, a person's protection or the duration of memory.

The later decline describes waning represented antibody level. It does not prove memory vanished. It also does not prove that enough protection remains. Both stronger conclusions would require additional evidence.

A useful limitation names what is missing and its consequence. For example: without illness outcomes and a suitable comparison, this curve cannot estimate how much disease a vaccine prevents.

In actual research, a graph's methods, assay units, sample size, uncertainty and comparison groups matter. Ask for these with the actual assigned dataset. Do not invent them for the practice curve.

R1: a complete CER and review route

Claim: explain how vaccines can prepare immunity, while labeling D1 as an illustration. **Evidence:** write two separate entries, each giving one exact day and AU value. Select one point from each response window.

Reasoning: connect target exposure to B-cell activation, expansion, plasma-cell antibody release and a possible memory response. Distinguish the source-supported mechanism from what the constructed curve itself demonstrates.

Limitation: name at least one missing input and explain which conclusion it prevents. Keep claim, both evidence entries, reasoning and limitation in the same written CER.

Peer route: ask an available partner to find your two exact points and underline the cell mechanism. Record the actual comment. Then show one sentence before and after revision, with a reason.

Solo route: apply both checks yourself. Check A: are both day/value pairs accurate and labeled? Check B: does the reasoning name cells and avoid proving protection? Record findings and revise one sentence.

If returning after an absence or break, begin with the first unfinished CER part. A shorter three-sentence start still needs both exact evidence entries and the limitation. Use D1 until actual assigned data are available.

Q1: self-check and extension

Self-check: in a separate hypothetical record, blood antibody level falls by about six months after vaccination. No memory-cell or illness measurements are given. A student says the vaccine has stopped working. Is that established?

After answering, check your reasoning against E1 and E2: list what the record measured and what it did not, then decide whether a claim of failure or of preserved protection needs one of the missing measurements. Explain one further kind of evidence needed.

For the optional extension, compare antibody maintenance with memory. CDC describes tetanus as a toxin-caused illness. Antitoxin can act on unbound toxin, but cannot undo toxin already bound to nerve endings.

CDC's current adult guidance lists tetanus vaccination every ten years to maintain protection. Wound-related care and individual recommendations require separate clinical guidance. Do not use this classroom graph to set anyone's dose schedule.

CDC also explains that some vaccine responses last longer than others and antibody levels can fall. Propose why maintaining antibodies may matter even when memory is present. Explain why different diseases can need different schedules, without promising lifelong protection from any series.

P1: real work and next steps

For May 4, confirm which Lesson 3.2 antibody-data or Activity 3.2.2 analysis task is assigned. Obtain its actual graph, units, instructions and required proof. Follow that task's directions separately and use evidence from work you actually do.

Activity 3.2.2 Immune Defense includes cell research, bacterial-versus-viral comparisons, teacher-led origami and a ten-term concept map. Its assigned video, tours, template, full instructions and journal pages 7–8 remain separate materials.

Keep any unfinished May 3 model, official check-in and earlier 3.2.1 organizer/model/journal work on your checklist. Today's CER does not establish that those were done. Preserve the requested completion screenshot or note only after genuine work.

The May 3–7 checklist includes evidence through 3.2.3 Going Un-Viral, the Immune defense model, transmission, a plaque assay and eye dissection. Obtain the teacher-posted packet and assigned Khan immune resources when absent.

Ask your teacher which remaining unit tasks and deadlines apply, including any debate or analysis work; do not treat this CER as all weekly work.

No homework is due before this class. May 5 has 25-minute Submit tracker and evidence preparation in Class Records, separate from today's eighty minutes. The next lesson concerns pathogen transmission and antiviral action.

Save the complete CER with the annotated graph and review/revision notes. Use the original practice, actual data/official task, peer or solo review, tracker and submission checks to identify a specific next action; describe only work you actually do. Never invent a measurement, partner comment or upload.

M1: a different worked curve comparison

M1 is a separate fictional teaching record. Dose events are day 0 and day 40. Listed antibody levels are day 0:0 AU, day 10:8 AU, day 40:2 AU and day 50:16 AU. It is not D1.

My claim is that a repeat exposure can support a stronger response through immune memory; M1 illustrates this pattern. My two evidence entries are day 10 at 8 AU and day 50 at 16 AU.

Time to the sampled peaks is $10 - 0 = 10$ days and $50 - 40 = 10$ days. Thus both sampled peaks occur the same time after their doses in this record; only the second peak is higher. These are times within the invented record, not predictions for a real vaccine.

My reasoning names activation of memory B cells, development of plasma cells and antibody release. That mechanism could explain a repeat response; M1 did not count those cells.

My limitation is that no illness outcomes are supplied, so the curve cannot prove protection. A reviewer flags my earlier sentence, The curve proves permanent immunity. My revision is: M1 illustrates a higher repeat antibody response, but it does not establish permanent protection. This removes an outcome claim that the record cannot support.

Try the decision

What does the second peak in D1 support?

- Compare both sampled peaks and their timing, then state what memory could explain while actual memory and protection remain unmeasured.
- Recognition by memory cells is instant, so the model proves permanent protection.
- Declining antibody levels after the later peak prove that protection is absent.

Explain your choice using the reading. Discuss it or say it to yourself. This practice does not add another submission.

Your 80-minute flow

0–10 minutes	Read H1/E1 and answer both warmups. Orient V1 and mark baseline, doses and peaks.
10–25 minutes	Read D1/E2 and M1; annotate response windows and compute elapsed peak times.
25–45 minutes	Use R1 to draft claim, two evidence entries and cell-mechanism reasoning.
45–58 minutes	Add the missing-input limitation and answer Q1.
58–70 minutes	Use actual peer feedback or both solo checks; show a justified revision.
70–80 minutes	Finish and submit the full CER if access allows; identify your next action. Optional extension after core work.

Your response record

Use these labels on paper or in your document. The space below also works when this page is printed.

Predict and orient

Answer both warmups: what mechanism could explain a higher repeat peak, and why might a blood antibody level miss part of protection? Label V1 axes, doses and three key features.

Use the low starting point and both sampled peaks. Say could explain, not proves.

Use this space or the same labeled section in your existing document. Add paper when your table, graph or drawing needs more room.

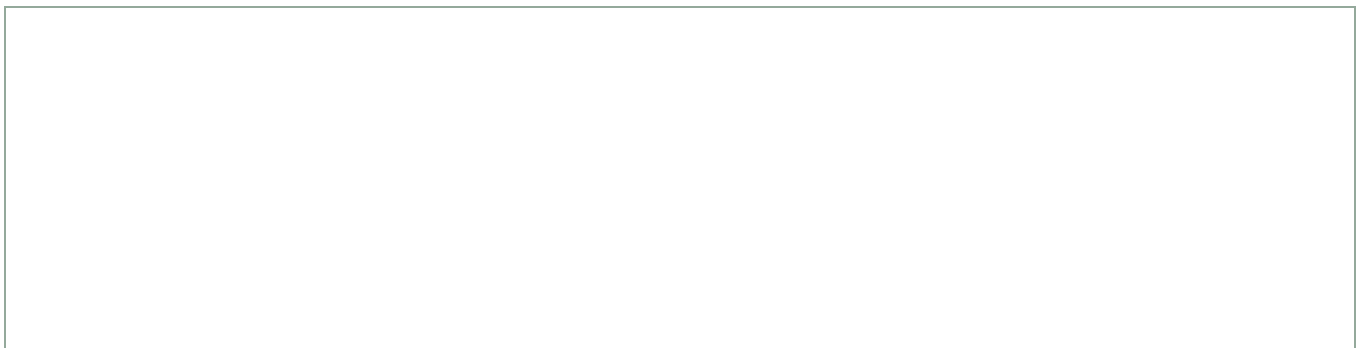


Compare like intervals

Mark both response windows and calculate elapsed dose-to-sampled-peak time for each. Label memory-cell involvement as an inference, not a measured curve.

Use D1's subtraction rule and M1. Keep days and AU distinct.

Use this space or the same labeled section in your existing document. Add paper when your table, graph or drawing needs more room.



Write the full CER

Write the claim, two separate exact D1 evidence entries and reasoning naming memory B cells and plasma cells.

Cite day and AU for both points. Explain how vaccines can prepare immunity without calling D1 a real trial.

Use this space or the same labeled section in your existing document. Add paper when your table, graph or drawing needs more room.

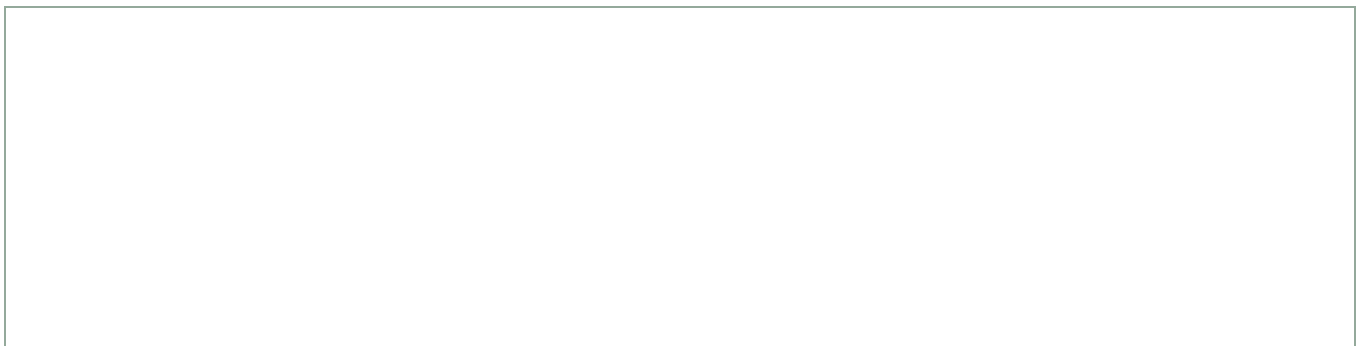


Add the limitation

Name one missing input and the conclusion it prevents. Answer Q1's six-month self-check.

Use E2 to decide what a lower antibody level alone can and cannot establish.

Use this space or the same labeled section in your existing document. Add paper when your table, graph or drawing needs more room.



Review and revise

Use actual peer feedback or both R1 solo checks. Record the route and show a before/after sentence with a reason.

Do not invent a peer. Revise unsupported proof, instant-response or lifetime language.

Use this space or the same labeled section in your existing document. Add paper when your table, graph or drawing needs more room.

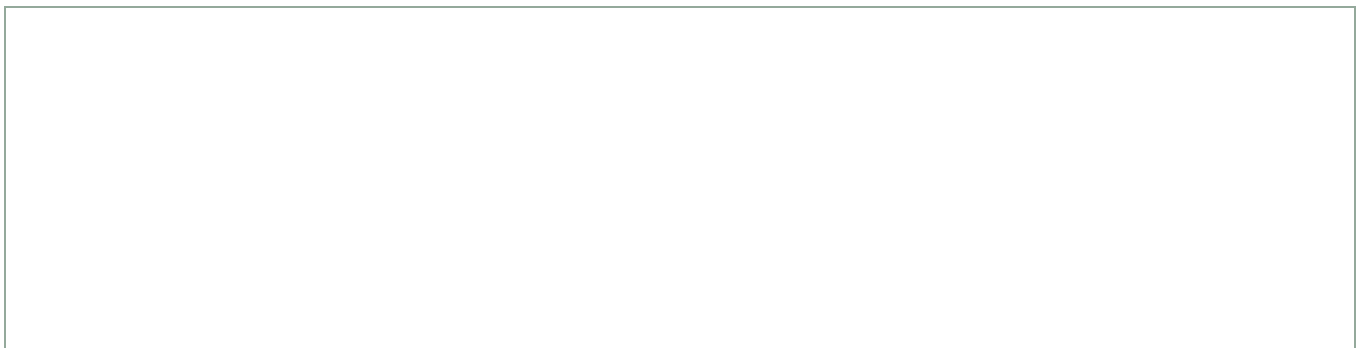


Optional booster comparison

Use Q1's tetanus and vaccine-duration facts to propose why antibody maintenance and memory can matter differently across diseases.

Do not recommend an individual dose or infer a schedule from D1. Finish the core CER first.

Use this space or the same labeled section in your existing document. Add paper when your table, graph or drawing needs more room.



Save and carry forward

Keep all five CER parts, graph annotations and revision in the report. Use P1 to identify what you checked and anything you need, then prepare for the next lesson.

Use the supplied practice while you ask for missing actual data or access.

Use this space or the same labeled section in your existing document. Add paper when your table, graph or drawing needs more room.

Check your product

- CER includes claim, evidence, and reasoning.
- Reasoning correctly explains immune memory.
- Both evidence entries include day, value, AU and D1; the limitation changes what can be concluded.

Keep the limit: D1 is an original illustration of antibody levels over fictional days. It supports practice reading and mechanism reasoning. It cannot establish memory cells, causation, vaccine effectiveness, personal protection or official completion.

Turn in your work

Submit the full CER and supporting graph/revision notes to Wk16 CER: Vaccine data CER analysis.

HBS 1292: <https://app.schoology.com/assignment/8544597421/info> . HBS 6792:

<https://app.schoology.com/assignment/8544597435/info> . Confirm your enrolled section and current due date; the Schoology folder is Claim Evidence Reasoning.

If access is unavailable, save the complete dated work and tell the teacher. Try the assigned upload when access works, then check that Schoology shows Submitted.

[Section 1292: Wk16 CER: Vaccine data CER analysis](#)

[Section 6792: Wk16 CER: Vaccine data CER analysis](#)

Carry forward

An antibody curve shows a pattern; explaining memory and protection requires evidence beyond the curve.

Tomorrow, distinguish how a pathogen spreads from how an immune response acts. Keep the evidence for each claim separate. Which evidence concerns pathogen transmission, and which concerns immune response?

Sources and resources

[Open today's page](#)

OS · 21.4 The Adaptive Immune Response: B-lymphocytes and Antibodies

OpenStax, Rice University

<https://openstax.org/books/anatomy-and-physiology-2e/pages/21-4-the-adaptive-immune-response-b-lymphocytes-and-antibodies>

CDC · Chapter 1: Principles of Vaccination

Centers for Disease Control and Prevention

<https://www.cdc.gov/pinkbook/hcp/table-of-contents/chapter-1-principles-of-vaccination.html>

TET · Chapter 21: Tetanus

CDC Pink Book; mechanism background

<https://www.cdc.gov/pinkbook/hcp/table-of-contents/chapter-21-tetanus.html>

TET-NOW · Tetanus Vaccine Recommendations

CDC; updated September 10, 2026

<https://www.cdc.gov/tetanus/hcp/vaccine-recommendations/index.html>