Activity 2.1.5
Telehealth

A patient six thousand miles away, and a sensor that never stops reporting. Telehealth, remote monitoring and the glucose feedback loop. Today is the science and the ethics. Friday is the data.

DATE	PORTAL DAY	LESSON	TURN IN
Monday 2026-10-16	**Ethics of monitoring**	**Lesson 2.1 Talk to Your Doc**	**CER**

> **Where this sits.** Day 1 of 2. Portal calendar label for today: Ethics of monitoring.

01 Why today matters

Your next patient is on a video call from another country, and the only reason you can practice medicine on her at all is a sensor under her skin that transmits day and night.

Today you learn how the loop it is standing in for actually works, and you decide what a clinic owes a patient whose body is now a data stream.

02 What you already know

- You know what a vital sign is and how to read a number against a range. You met a wearable sensor in Unit 1 with the respiration belt.
- From last week's privacy work you know who is bound by the federal privacy rule and what a permitted disclosure is, and you will need all of that today, because a wearable's data crosses more hands than a paper chart ever did.

WHAT THIS SHEET WILL NOT TELL YOU

- No patient's monitoring data is interpreted on this sheet. That is Friday's work.

03 Vocabulary

TERM	WHAT IT MEANS, PLAINLY
Telehealth	Health services delivered at a distance using technology instead of the patient being in the room. The word literally means healing at a distance.
Remote patient monitoring (RPM)	Tracking a patient's measurements while they are living their normal life, outside any medical building.
Biosensor	A sensor that reads something biological and turns it into a signal a device can transmit. Built into wristbands, watches, patches and implants.
Biomolecule	One of the large molecules life is built from. There are four families: carbohydrates, lipids, proteins and nucleic acids. Three of the four can be burned for energy and one cannot.

Cellular respiration	The chain of reactions in which a cell uses oxygen to release energy from fuel. It runs in the mitochondria.
ATP	Adenosine triphosphate. The molecule a cell actually spends. Everything else is fuel that gets converted into this.
Glucose	A simple sugar. The body's first-choice fuel, released into the blood as carbohydrates are broken down.
Pancreas	An organ in the abdomen that releases the two hormones which push blood glucose down and pull it back up.
Hormone	A chemical message released into the blood by one part of the body to give instructions to another part.
Insulin	The hormone that tells cells to let glucose in. It does not destroy sugar. It opens doors.
Glucagon	The opposite signal. It tells the liver to release stored glucose back into the blood when levels fall between meals.
Type 1 diabetes	The pancreas makes little or no insulin, so the instruction never gets sent.
Type 2 diabetes	Insulin is still made, and cells stop responding to it. The instruction is sent and ignored.
Hyperglycemia	Blood glucose too high. Glucose piles up in the blood because it is not getting into cells.
Hypoglycemia	Blood glucose too low. Dangerous fast, which is why it is the one a monitor is set to shout about.
Negative feedback	A control loop where the response pushes the system back toward its set point. Sweating when hot, shivering when cold.
Positive feedback	A control loop where the response pushes the system further in the same direction. Negative and positive here mean the direction of the push, not good and bad.
Continuous glucose monitor (CGM)	A small sensor worn under the skin that reads glucose around the clock and transmits to a phone.
Insulin pump	A worn device that delivers insulin steadily rather than by injection.

Every term on this list is flagged for the illustrated glossary, scoped to this activity only. Terms are not shared forward or backward between activities, because a definition from a later activity can hand you an answer you were supposed to derive.

04 How to do the work

Half science, half argument. Do the feedback loop before you argue about the ethics, because the argument only makes sense once you can see the loop the technology is standing in for.

1. Watch the telehealth appointment, then list four groups of people for whom a remote visit is not a convenience but the difference between care and no care. Be specific about the barrier in each case.
2. Record the four families of biomolecules. For each, note the foods it comes from and where it sits in the order the body reaches for fuel. One of the four is not a fuel at all. Say which and say why.
3. Draw a cell membrane in your notebook. On the drawing put glucose outside the cell, a receptor in the membrane, and insulin arriving. Use the insulin action model to check your drawing, then write in one sentence what insulin actually instructs the cell to do.
4. Draw the blood glucose feedback loop as a circle. Put in: carbohydrate eaten, glucose released into blood, pancreas, insulin, cells taking glucose in, blood glucose falling, and then the return leg through glucagon and the liver when levels drop too far.
5. On the same diagram, mark in a different color where the loop is broken in type 1 diabetes. One arrow should be the one that fails. Then write the sentence that describes what happens to blood glucose after a carbohydrate-heavy meal

when that arrow is missing.

6. Answer this in writing: is blood glucose control a negative or a positive feedback loop, and what in your diagram proves it?
7. Read both diary entries. Note two things the technology changed that a number on a chart would never show you.
8. Argue the security question with a partner. A connected pump that can be adjusted remotely can, in principle, be reached by somebody who should not reach it. Research how these devices are protected, then take a position on whether the family's worry is proportionate.
9. Write your claim, evidence and reasoning on the ethics question in the box below.

Target blood glucose ranges used in this activity.

WHEN	PERSON WITHOUT DIABETES	PERSON WITH DIABETES
Before breakfast	below 100 mg/dL	70 to 130 mg/dL
Before lunch, dinner or a snack	below 110 mg/dL	70 to 130 mg/dL
Two hours after eating	below 140 mg/dL	below 180 mg/dL
Before bed	below 120 mg/dL	90 to 150 mg/dL

THE QUESTION YOUR CER ANSWERS TODAY

- Continuous monitoring produces a record of a patient's body, minute by minute, that did not exist before. It is shared with the patient, with the family, with the clinic, and it travels through an app owned by a company.
- Should a clinic recommend continuous remote monitoring to a patient, and what has to be true for that recommendation to be responsible?
- Argue it with the privacy rule from last week in one hand and the diary entries in the other. Somewhere in your reasoning, name what the patient gains, name what the patient gives up, and name who else can see it.

05 Where students get stuck

- Reading positive and negative feedback as good and bad. They describe direction only. A negative loop pushes back toward the set point and is what keeps you alive. A positive loop pushes further the same way, which is right for childbirth and clotting and catastrophic for body temperature. Neither word is a compliment or an insult.
- Saying insulin burns sugar. It does not touch the sugar. It is a message telling cells to open up and take glucose in. Everything that goes wrong in this activity follows from getting that one sentence backwards.
- Confusing the two types of diabetes. Type 1: the message is not sent, because the pancreas makes little or no insulin. Type 2: the message is sent and cells stop listening. The blood glucose ends up high in both, which is why people collapse them together, and the reason it ends up high is completely different.
- Forgetting the return leg of the loop. Most students draw insulin bringing glucose down and stop. A loop that only goes one way is not a loop. Glucagon and the liver are the half that stops you dying between meals, and a feedback diagram without them will not earn full credit.
- Treating the sensor reading as the blood reading. A continuous monitor samples the fluid between cells, not blood in a vessel, so it runs a few minutes behind a fingerstick and lags most when glucose is moving fastest. That is exactly why a careful patient still pricks a finger to check the device. Trust in a device is a claim, and it needs evidence like any other.
- Arguing the ethics without naming a mechanism. An answer that says technology has pros and cons is worth nothing. Name the specific data, the specific route it travels, and the specific person at the other end.

06 What you turn in

CER

Your feedback loop diagram, annotated for type 1 diabetes, plus a claim, evidence, reasoning response on the monitoring question in the box. Claim: your position, in one sentence. Evidence: what the diary entries show, what the device actually measures and transmits, and what your research found about how these devices are secured. Reasoning: connect the privacy principles from Activity 2.1.6 to this specific data stream, and state the condition that would change your answer.

07 Check yourself

- [ ] In one sentence each, say what insulin instructs and what glucagon instructs. (Vocabulary, insulin and glucagon)
- [ ] Why is blood glucose control a negative feedback loop rather than a positive one? (Vocabulary, negative feedback)
- [ ] Name one thing a continuous monitor can show a clinician that four fingerstick readings a day cannot, and one thing a fingerstick still does better. (Where students get stuck, the sensor trap)