Cognitive-science-based training for healthcare workers can improve patient outcomes

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Question

Can software that harnesses cognitive science improve healthcare-provider performance—and patient outcomes?

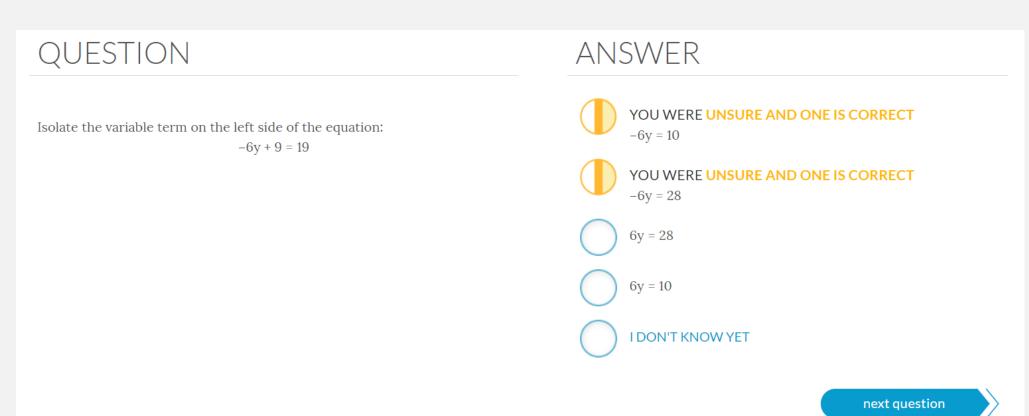
Learner Experience

Test before learning ANSWER -6y = 10 -6y = 28 6y = 28 6y = 10 DON'T KNOW YET

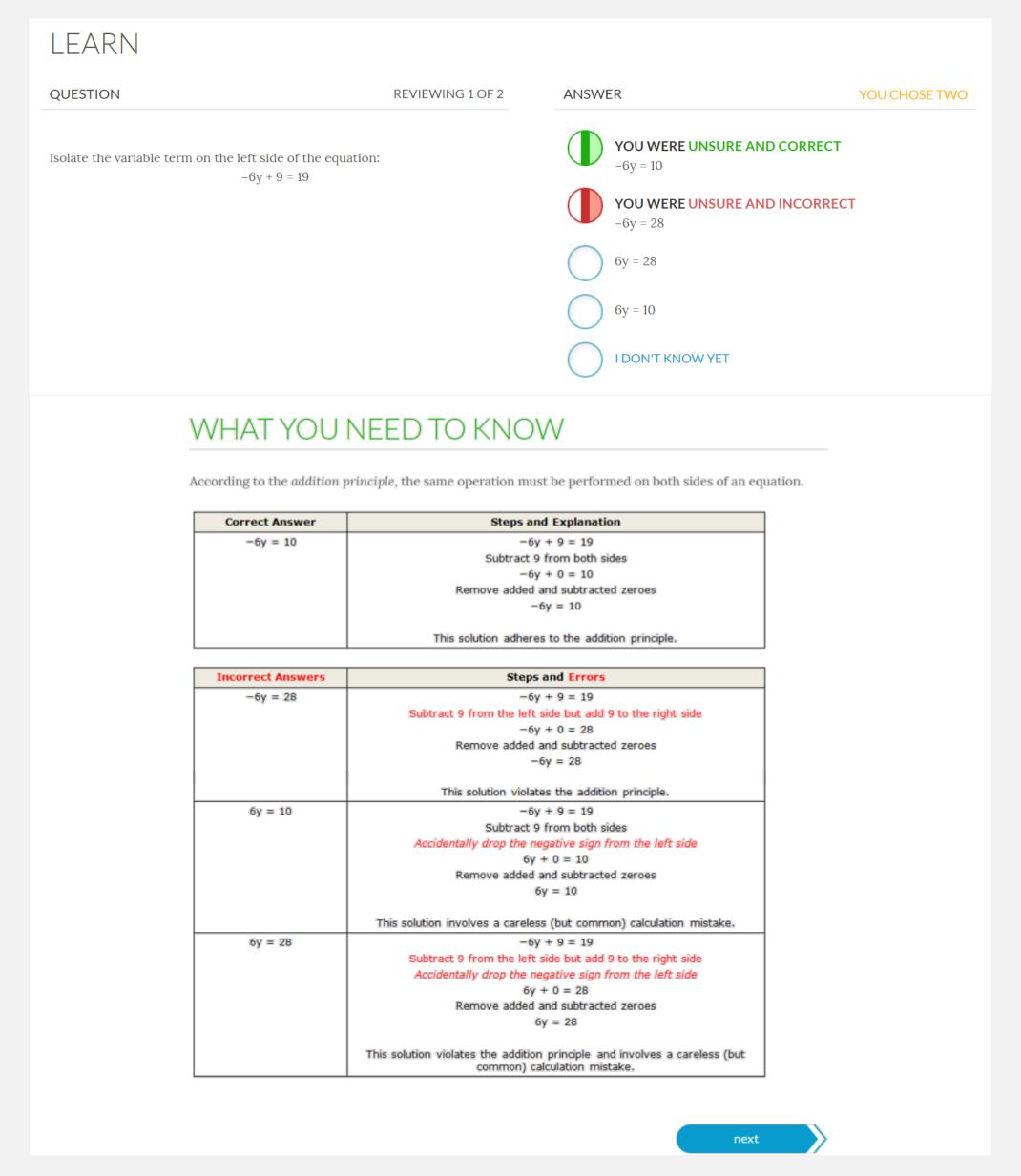
Confidence rating

| QUESTION | ANSWER |
|--|--|
| Isolate the variable term on the left side of the equation: $-6y + 9 = 19$ | I AM UNSURE $-6y = 10$ I AM UNSURE $-6y = 28$ $6y = 28$ $6y = 10$ I DON'T KNOW YET |
| | submit |

Immediate valence feedback



Short delay to corrective feedback

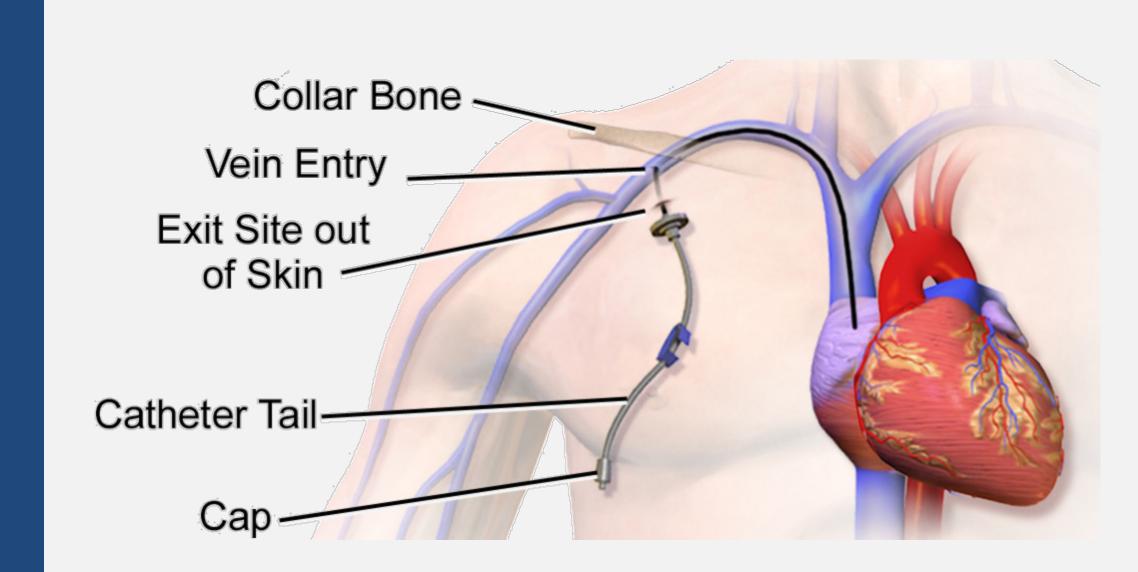


When wrong, question re-asked after longer delay Question retired after mastery

Background

Mistakes made by healthcare workers kill 250,000 people per year in the United States alone. Medical error is the third-leading cause of death in the U. S., behind only heart disease and cancer. The most common cause of medical error is "cognitive failures" (Joint Commission, 2015).

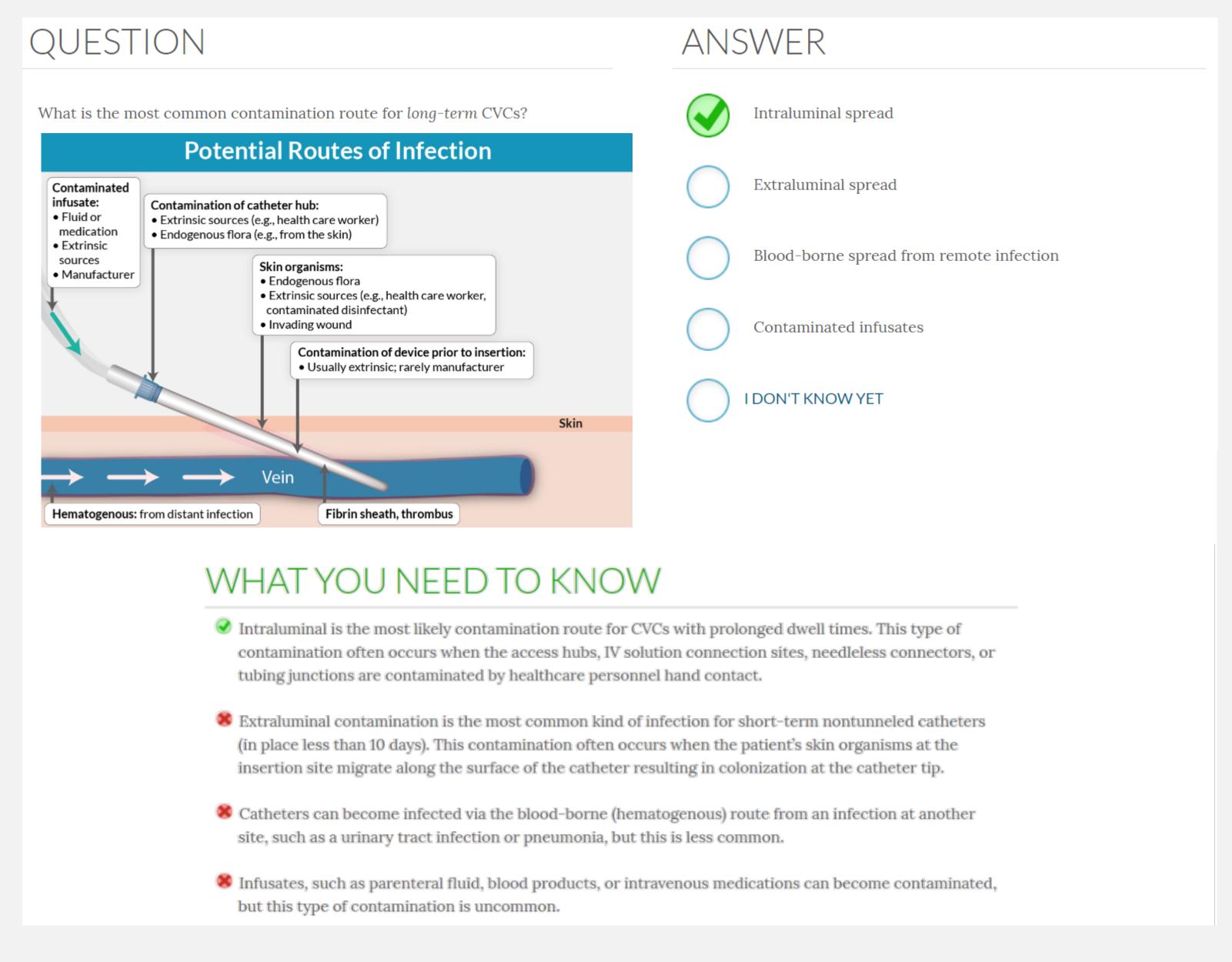
Study 1: Hospital-acquired central-line infections (N = 3,712)

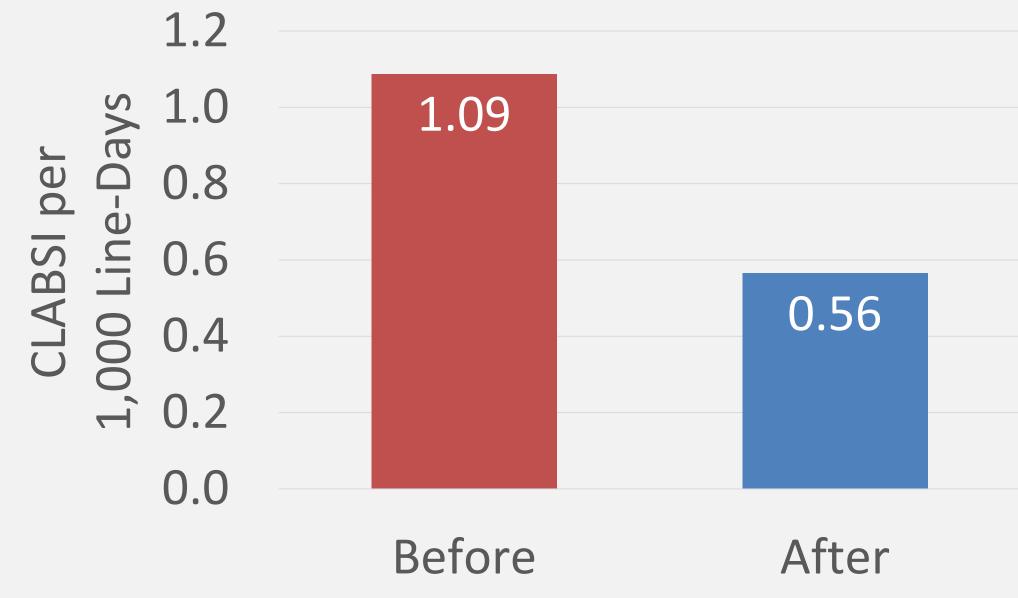


A central line is a thin tube (catheter) placed into a large vein. Central lines are used to administer nutrition or medication (e.g., drugs for chemotherapy), and to monitor central venous pressure during acute care.

When a healthcare provider contaminates the equipment or the entry site, the patient can develop a central-line-associated bloodstream infection (CLABSI). The incidence of CLABSI is expressed in terms of the number of infections caused for every 1,000 days that patients had central lines ("CLABSI per 1,000 line-days").

Central-line-attending nurses at a healthcare system were trained in the cognitive-science-based Amplifire platform. An example question and its corrective feedback:



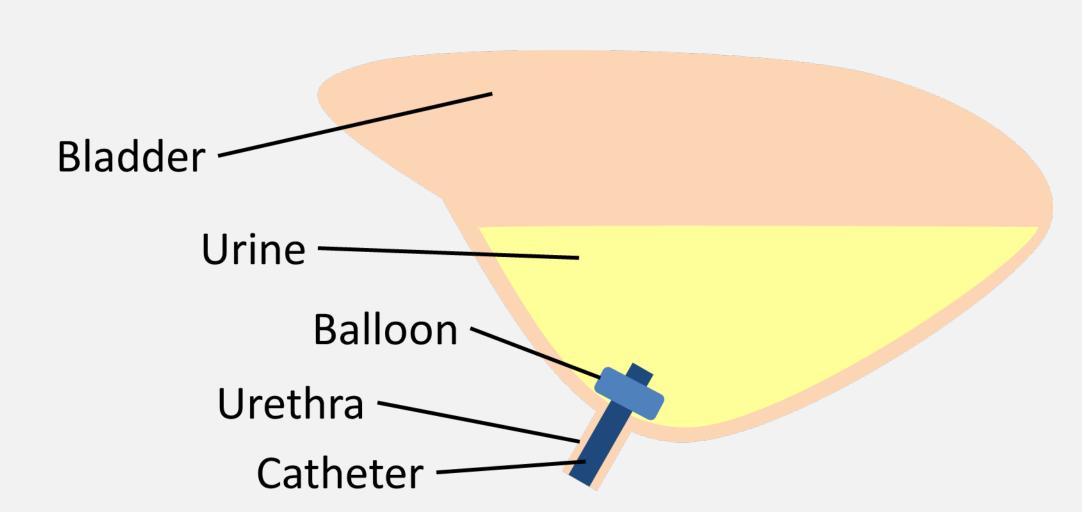


Before training, there were 1.09 CLABSI per 1,000 line-days.

After training, there were 0.56 CLABSI per 1,000 line-days—a reduction of 48%. An exact Poisson test indicated that the CLABSI rate was statistically significantly reduced after training: p = .00014.

Given CLABSI's mortality rate of 25%, this reduction should save ~13 lives per year.

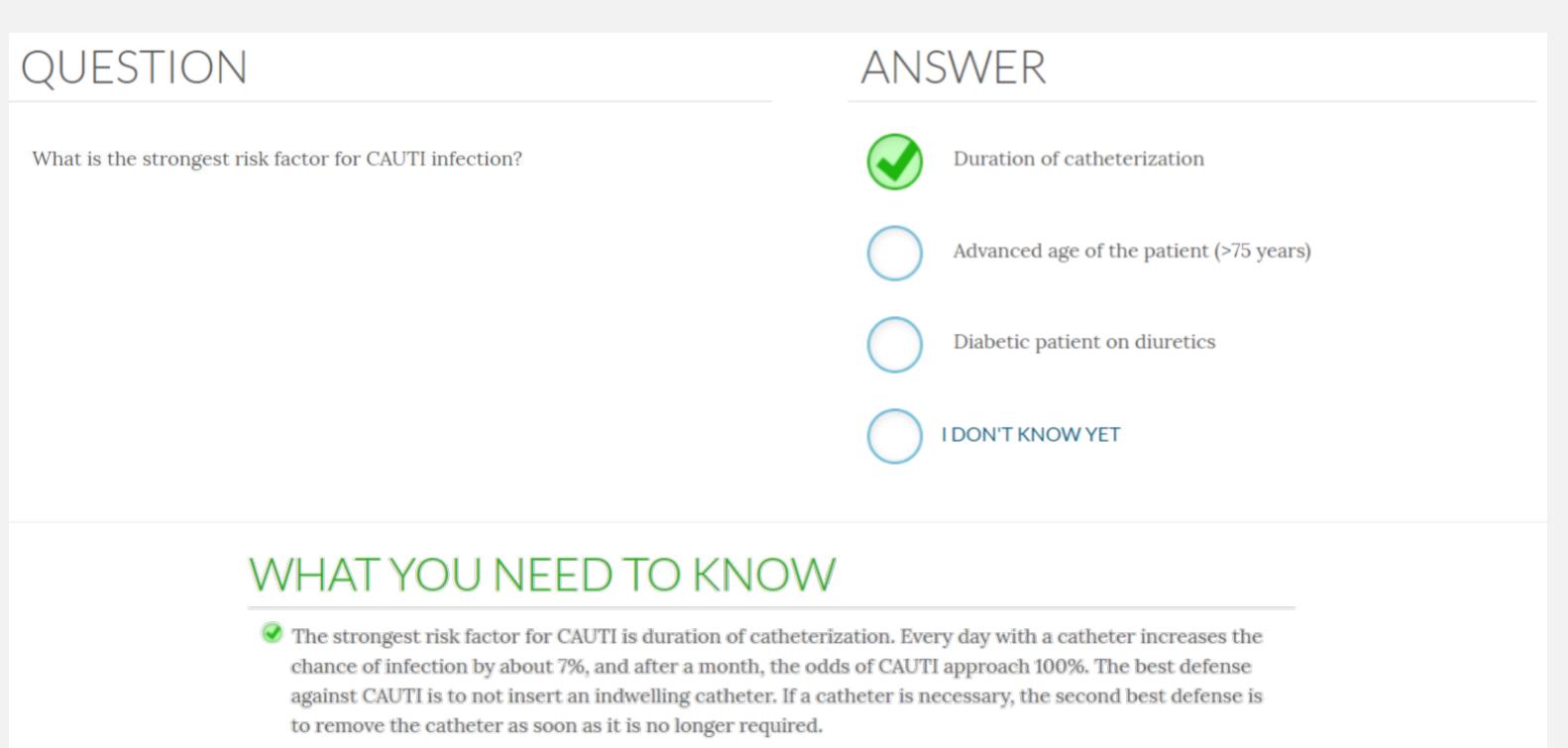
5 Study 2: Hospital-acquired urinary-catheter infections (N = 4,512)



A urinary catheter is a thin tube inserted into the bladder via the urethra. An indwelling catheter remains in the urethra and bladder for continuous drainage of urine and monitoring of urine output during acute care.

As with central lines, healthcare workers' mistakes can contaminate indwelling urinary catheters. As a result, the patient can develop a catheter-associated urinary tract infection (CAUTI). As with CLABSI, the incidence of CAUTI is expressed in terms of the number of infections caused for every 1,000 days that patients were catheterized ("CAUTI per 1,000 catheter-days").

Urinary-catheter-attending nurses at the same healthcare system as in Study 1 were trained in Amplifire. An example question and its corrective feedback:





Before training, there were 1.29 CAUTI per 1,000 catheter-days.

After training, there were 0.88 CAUTI per 1,000 catheter-days—a reduction of 32%. An exact Poisson test indicated that the CAUTI rate was statistically significantly reduced after training: p = .01363.

Although both CLABSI and CAUTI were reliably reduced, the smaller magnitude of the CAUTI reduction may be attributable to two factors. First, only nurses interact with central lines, but both nurses and technicians interact with urinary catheters; part of the caregiver population was not trained on CAUTI. Second, the CAUTI course did not employ any multimedia (Mayer, 2017). A revised and improved CAUTI course will be distributed to both nurses and technicians in the coming months.

References

Joint Commission (2015). Patient safety. *Joint Commission Online*. Retrieved from https://goo.gl/CeMeiw Mayer, R. E. (2017). Using multimedia for e-learning. *Journal of Computer Assisted Learning*, 33, 403-423.

Answer

Yes.