Tips on how to create a virtual patient for clinical reasoning in CASUS

This description intends to support authors in creating a virtual patient for iCoViP. If you have any questions, comments, or additions on this description, please feel free to add them here in the document!

Supporting resources

Before you start creating your first virtual patient (VP), please take a look at the following supporting material and also consider the explanations provided in this document.

The following video illustrates the general functionalities of the CASUS authoring system: **WAVES - Create a linear scenario in CASUS**

In this YouTube channel you will find additional videos on virtual patients and clinical reasoning: **Clinical Reasoning and Virtual Patients - YouTube**

To see a virtual patient from the student perspective, you can access the collection under **https://crt.casus.net**, please take a look at at least one VP to get to know the structure and specifics.

Please also see the checklist and make sure that you can tick-off all aspects or that you have provided a comment before handing the VP to the didactical review. This will ease the didactical review a lot and helps you to have all the different aspects in mind.

Learning objectives

The learning objectives for the VPs we create within the collection are pretty similar for each VP: The student will be able to ...

- analyze, interpret, and prioritize key clinical findings.
- identify and prioritize the most likely diagnoses based on the information provided.
- suggest appropriate treatment, therapeutic and prophylactic procedures
- compose a concise summary statement about the patient.

Thus, it is not about teaching background information or pathologies about all the diseases, but focused on the clinical reasoning process.

Creating a VP

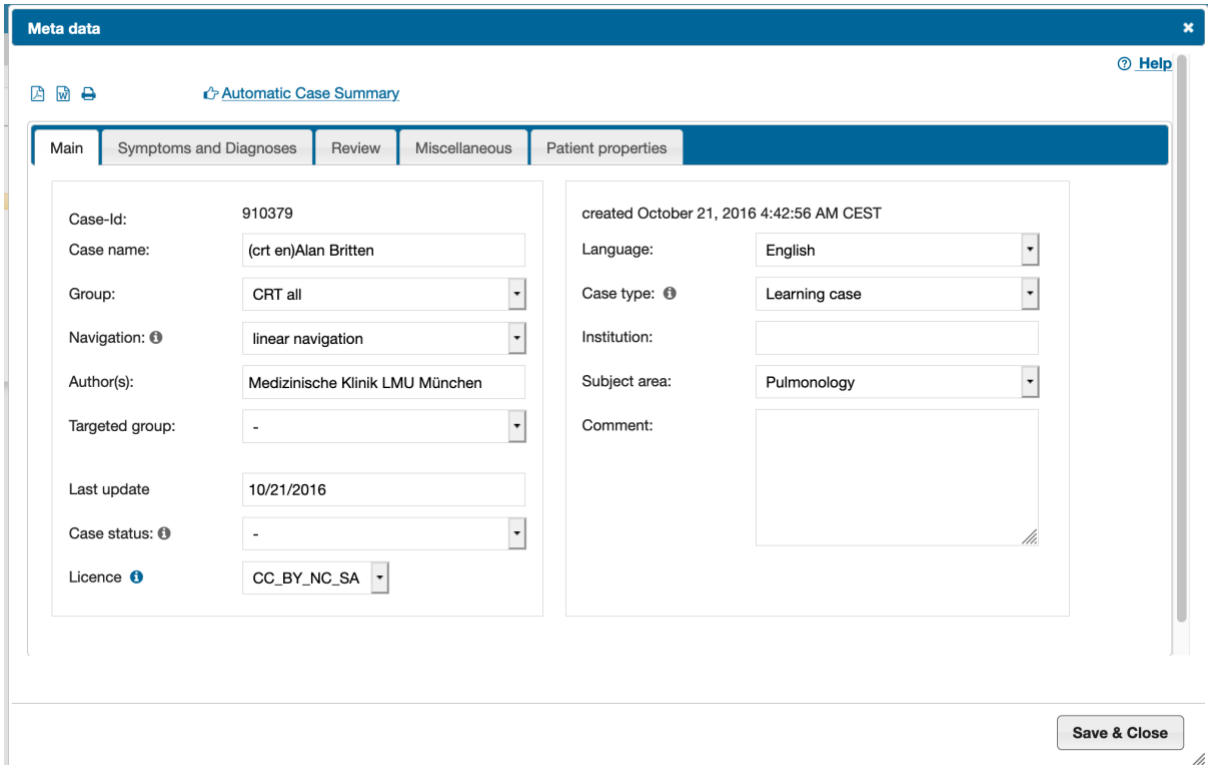
After logging into CASUS, open the **"Authoring" tab** and click on "Create new case" and choose the "iCoViP template", which already includes the cards and other specifics. You are then asked to enter a name (see under metadata) and click on save. To open existing cases, click on the name of the VP to edit.
If you do not have a CASUS account or cannot see the Authoring tab, please contact Inga to get your account setup properly.

When starting a new VP, please also document this progress in Trello (VP creation progress), you can find a description of this board on the first card of the Backlog column.

Please also refer to the published blueprint to see the basic outline your VP is supposed to cover. If you need to make amendments to the VP (e.g. have a smoker instead of a non-smoker), please indicate the necessary changes on the Trello card of your case.

Metadata

Before starting the VP creation, please open the metadata form, by clicking on the case name in the upper left corner of the authoring screen. Please complete the following metadata fields:



Screenshot of the metadata form of a virtual patient.

- Please use the patient name as case name and add the following prefix "(icovip language)" e.g. "(icovip en)"
- Please add your name(s) as authors
- Please select the license "CC_BY_NC_SA"
- Please choose the language of the VP
- Click "Save and Close"

Please be aware that the **VPs you create need to be in English** to allow the review by other partners.

Text

If you want to highlight or emphasize certain text passages or phrases, please mark those words in **bold**. Avoid underlying words, as this implies that these words are hyperlinks and can be clicked on.

Multimedia Material

For more general information on how to proceed to obtain consent, please see this document.

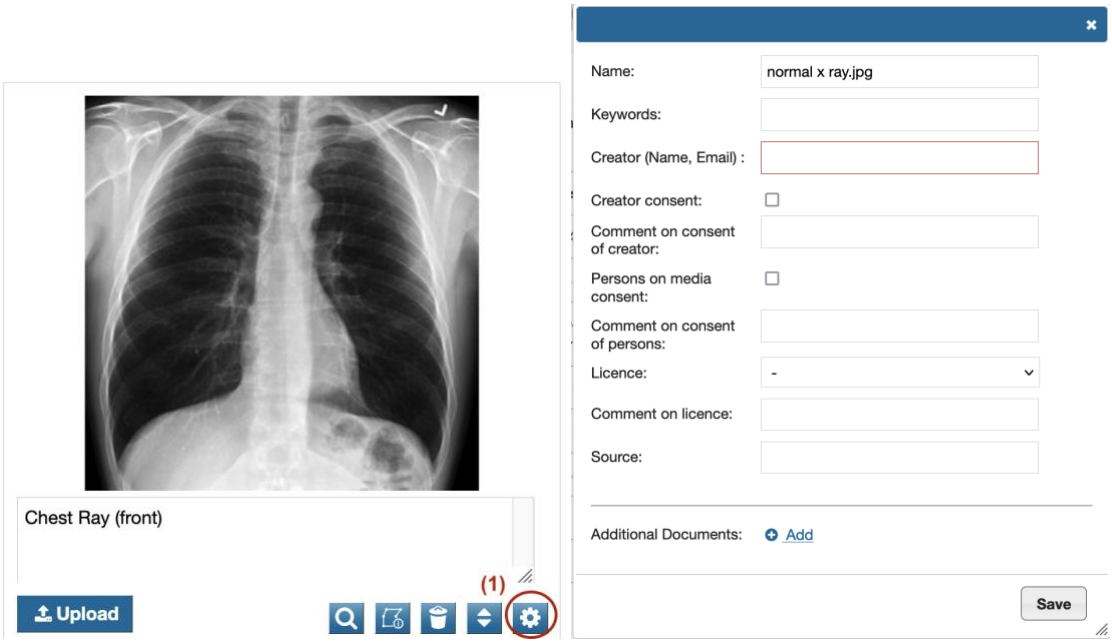
Patient image: To make a VP more realistic and set the context, each case will have an image of a "patient" in a clinical environment. We have an iStock license to choose suitable images from. You can either check for yourself and let us know which image to use or we

can make a suggestion. We recommend doing this in such a centralized manner as we have to make sure we are not using the same images for different VPs.
To check for patient images please go to our image folder and see whether you can find a suitable image. If you see one, please rename it with the number and name of your VP and move it to the folder “used images”, so that no one else will use it for another case. You can then download it and use it in your VP. If you need help in cropping or mirroring the image, please contact Inga and we can help you with that.

Clinical Images (x-rays, sonography, ECG,...): It is great if you have images from your clinical work you can use, just make sure that they are anonymized and any patient name etc. is not included. Please describe in the image metadata the license information for this image (a click on the wheel below the image opens the metadata window). For certain clinical images, you can check for example the HEAL project (make sure that the image license allows the usage)
If you cannot find any matching images, you can add them to our Trello board and we will regularly discuss this image list in our team meetings to see whether one of the partners might have a suitable image.
Please avoid providing tables or text documents as images, as this is very painful for the later translation of the case (text needs to be typed manually, translated, and uploaded again as an image).

Illustrative images: You can use illustrative images, just be aware that they have no additional value for the learning process, and might even increase the cognitive load of learners. If you use illustrative images, please make sure that you enter the license information under the image metadata and be 100% sure that you are allowed to use the image in this way under a CC license. We would like to avoid buying images just for illustrative purposes.

Entering license information:
(1) After having uploaded an image, click on the wheel symbol
(2) Enter the information you have about this image, especially where you have it from and under which conditions it can be reused (License, Source, Comment on license if needed)

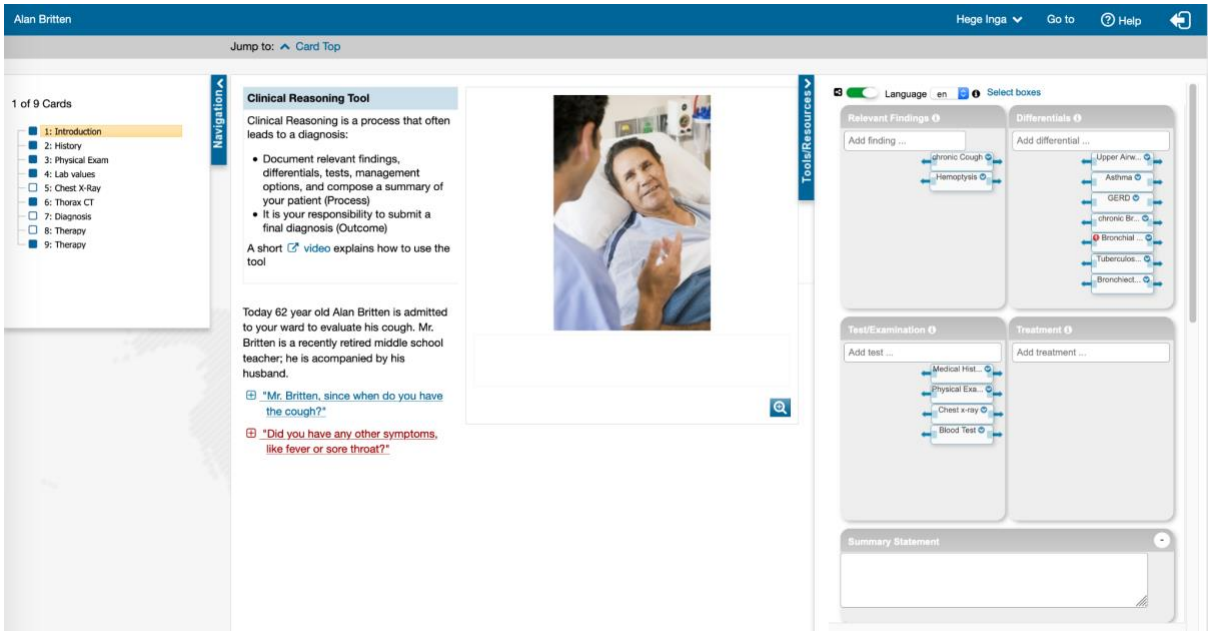


Please enter as much information as possible including at least

- Creator: Please add here who was responsible for obtaining the permission and can provide more information if needed.
- Select a license under which the image can be used (ideally the same as the VPs itself - BY-NC-SA. If the license is different, please provide a comment why this is necessary.)
- Source: Please describe where the images are from (e.g. hospital, private collection, …)

Structure of the VP

For creating and editing cards, please see the following video WAVES - Create a linear scenario in CASUS.
In the following we will provide specifics for creating a VP for the iCoViP collection:



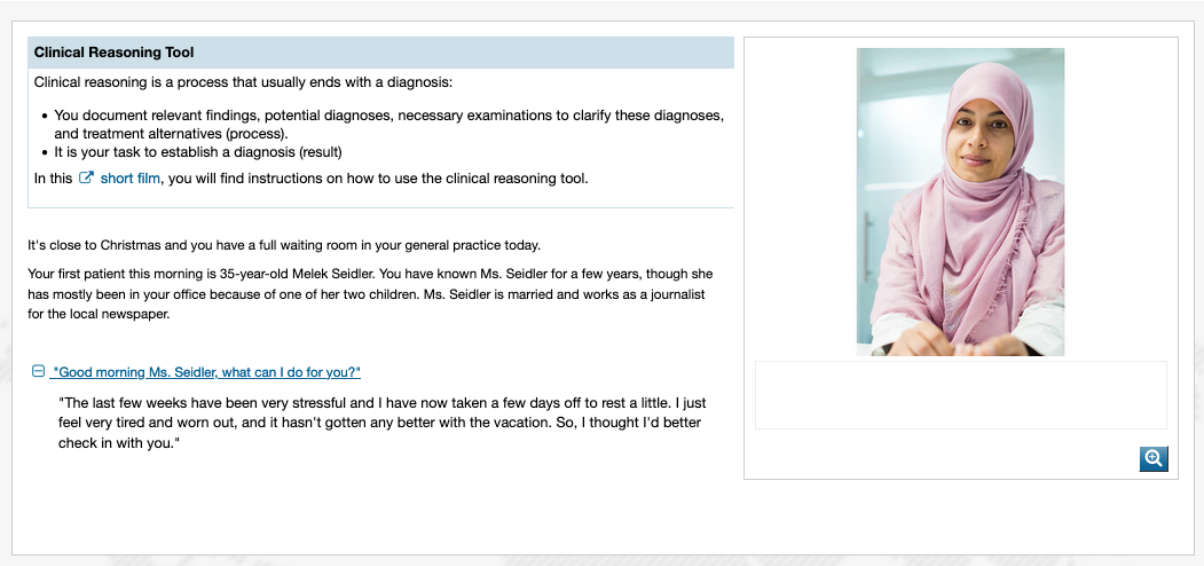
Screenshot of a virtual patient in the CASUS system. Left: Card navigation, Center: content, Right: Concept mapping tool to visualize the clinical reasoning process.

The virtual patients are supposed to be short, i.e. 5 to maximum of 10 cards, with the following structure:

Card 1: Introduction of the patient typically providing

- Picture of the patient (please contact us for that, we can provide images that can be used for that purpose)
- Full name, age of the patient, profession, accompanied by whom
- Setting of the scenario (e.g. practice, ER of a rural hospital, etc. - please avoid specialists settings as this limits the number of differential diagnoses)
- Key symptom the patient complains about
- Role of the learner (e.g. intern, resident, student,...)

Example:



Exemplary card 1 with patient explaining the key symptom in her own words.

Card 2: History taking

- Focused questions - please use direct speech using the hyperlink option "Hide and Reveal Mode" and laymen language (see "Using direct speech below")

Card 3: Physical Exam

- Description of findings of the physical exam, not directly revealing any findings, but let students interpret (e.g. provide audio of auscultation and let student interpret instead of describing a murmur, write down “blood pressure” instead of e.g. “hypertonus”)
- Can be accompanied by a question (e.g. if an auscultation audio is provided students can be asked a questions about what they hear)

Card 4-x: Any other examinations (labs, radiology,...)

- Provide image material wherever possible and let students interpret the material (e.g. by asking questions)
- On the last card (5-x) students will be asked to decide about the final diagnosis in the concept mapping tool and they get feedback whether their solution was correct and if not they can try again. Please do not reveal the diagnosis on that card or prior. They also will be asked to think about treatment options.

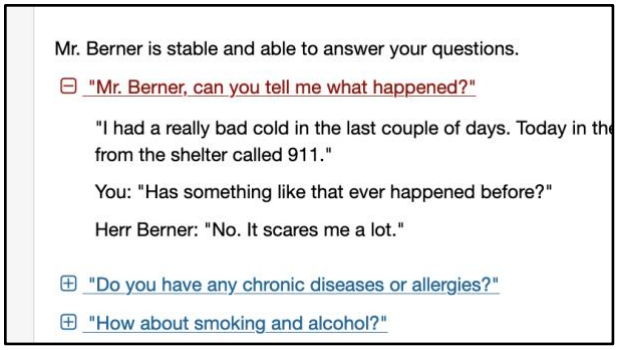
Last card: Closing of case

- Provide the diagnosis to the patient
- Treatment options are discussed with the patient
- Case is closed by describing what happened next (e.g. patient was discharged, died some weeks later, etc…)
- Provide 1-3 main references for further information, e.g. UpToDate or relevant international guidelines

Please try to name the cards according to the content and avoid using the same name (e.g. "Additional examination") for multiple cards, as this makes it difficult for students to find a specific card, when they go back in a case.

Using Direct Speech

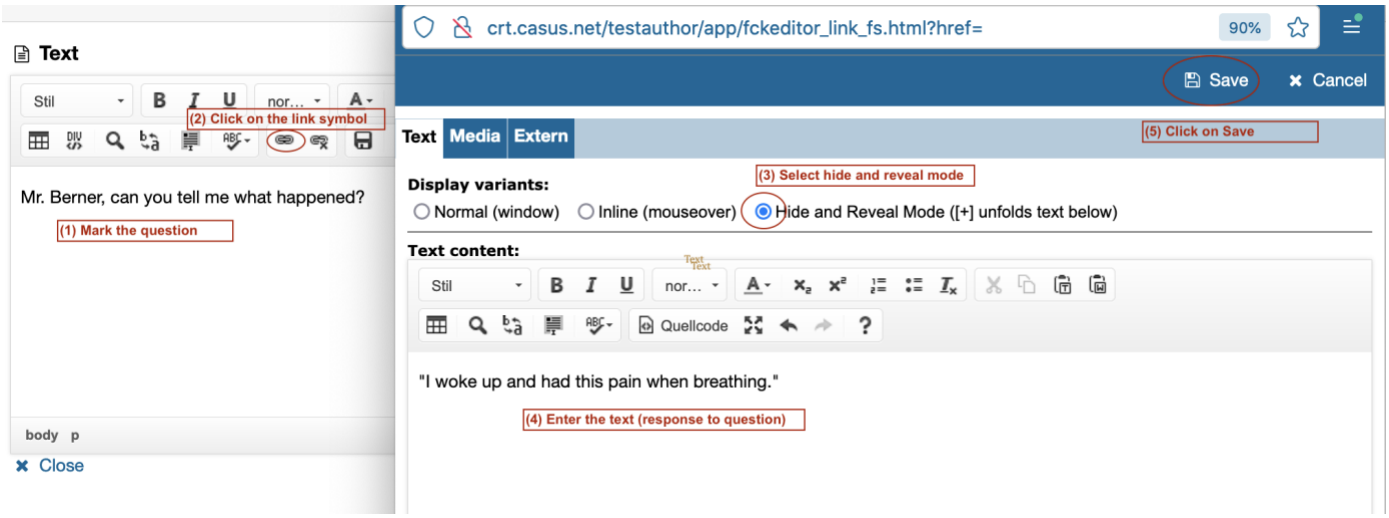
It supports the clinical reasoning of learners, if you use direct speech for the conversation in a case. This way it is more realistic and learners are required to "translate" layman language into medical terms, which is an important step in the clinical reasoning process.



"Hide-and-reveal" mode for dialogs

To create such a dialog do the following (see also screenshot below) :
(1) Mark the text you want to be clickable (usually the question)
(2) Click on the link icon
(3) Select "Hide and reveal"
(4) Enter the response to the question
(5) Click "Save"

Go to the preview to test and see how students will experience this dialog.



Steps to create a hide-and-reveal dialog

Covering COVID-19

For sustainability reasons we recommend the following:

- Avoid mentioning specific restrictions that are likely to change within the next few months and are not required for the case. For example: mentioning that due to Corona restrictions a relative is not allowed to enter the room with the patient or standard COVID-19 testing of all patients etc.
- If your patient has COVID-19 typical symptoms a test can be included and also COVID-19 as differential diagnosis. However, it should not dominate the case, but could be in a similar way as influenza. (Franciszek Kizior is a good example as ist provides the results of the COVID-19 testing together with other lab results.)

Questions/Answers

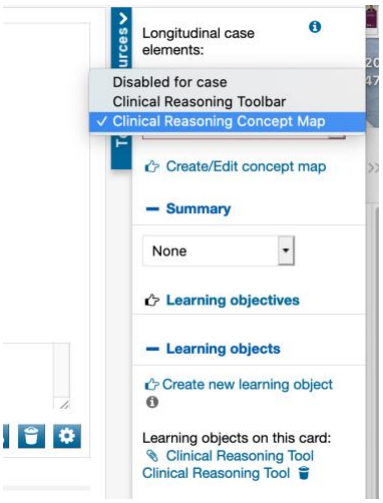
You can select from a range of question types in Casus. Which of these is the best option depends of course on the objective you want to achieve with the question.
In our type of VPs it is a good idea to ask questions when you provide clinical images (e.g. x-ray, CT, ECG,...) and let students interpret these. This way you make sure that their clinical reasoning is not stuck on the interpretation level and you provide guidance if needed.

General tips:

- Avoid negative questions, such as "What of the following is NOT correct"
- Avoid questions that are in parallel to the concept map, e.g. what tests would you do? What is the correct treatment? etc.
- Avoid questions that are specific for your environment, such as "in which order do you perform the following tests?"
- Avoid questions that are subjective (and for example depending on differentials students have in mind), e.g. "What do you think should be done next?", "What do you prioritze? etc. Students might interpret this question differently based on the differentials they want to work on and in their thinking the answer might be different from yours.
- For questions on clinical findings, it is advisable to always include a "no pathological finding" option
- In Multiple Choice questions, please use one item per answer box (not something like "A and B" or "blood test, ECG, and x-ray") as this often gives away the correct answer and raises cognitive load unnecessarily for students ;-)
- Explain the correct (and incorrect) answers in your answer comment, so why this is (in)correct.
- Short freetext answers are suitable if there is a **well defined set of answers** (without room for interpretation and with a limited set of synonyms). If using this question type, please be aware to enter the synonyms only to the answer item it belongs to (not to all answer items).

For **questions related to clinical images**, such as x-rays we recommend to provide a second image illustrating where they should have seen something. For example, highlight pathologies on an x-ray or CT with arrows or colored borders. Alternatively, we recommend using the **Region of interest** question type, which asks students to point out pathologies or specific structures in an image.

Concept Mapping Tool



While working through the cards, students are asked to enter the findings, differential diagnoses, tests, and treatment options to the concept mapping tool and make connections if applicable. As feedback they can access the map you created for this VP. (video showing the student view)
To provide this feedback, please activate the concept mapping tool by selecting "Clinical Reasoning Concept Map" in the toolbar.
Then click on "Create/Edit concept map"

The creation of the expert maps works similar to the student view (see video above). However, it is important to make sure that your findings, differentials, tests, treatment options, and connections are shown on the appropriate card. E.g. when during the physical exam on card 3 it turns out that the patient has fever, "fever" should appear on this card. Please also select your final diagnosis.
You can change the card on which an item appears, by clicking on the arrow next to an item and changing the card number. The item will then be relocated.

If you cannot find the correct terms in the type-ahead list, we can manually add it. For that, please go to this document and add it to the table at the bottom. Once we have all translations we will add it to the list and you can then add it to your concept map.

The following video explains the creation of a problem list:
https://www.youtube.com/watch?v=fMug-dBvbmE

Summary Statement

Please see the video "How to write a Summary Statement"
Typically, a summary statement could be composed on card 3 (after physical exam). Please enter it in the textbox below the concept mapping tool, it will be displayed from the card on, selected by you. It will be saved automatically, when you click somewhere outside the textbox and a confirmation about the saving should be displayed. A quick overview about important aspects shows the following table:

Table 1

Components of an Assessment Rubric for Evaluating Medical Students' Summary Statements in Virtual Patient Cases

Component	Definition
Factual accuracy	• Student includes accurate information and does not include misleading information
Appropriate narrowing of the differential diagnosis	• Student appropriately narrows her/his differential diagnosis by including pertinent key features of the primary problem to frame understanding, rather than reporting all information indiscriminately • Student facilitates understanding of the primary problem
Transformation of information	• Student expresses key findings in qualified medical terminology (HR 150 = tachycardia). • Student synthesizes details into unifying medical concepts (rales, S3, edema = CHF)
Use of semantic qualifiers	• Student uses qualitative terms, more abstract than patient's signs, binary in nature (gradual versus acute, unilateral versus bilateral)
Global rating	• Overall rating of summary statement

Aspects to consider when assessing summary statements of students / composing a summary statement

(Smith S et al. The Development and Preliminary Validation of a Rubric to Assess Medical Students' Written Summary Statements in Virtual Patient Cases: Acad Med. 2016;91(1):94–100.)

Table 5-4. Summary Statements/Problem Representation

Component to Evaluate	Definition
Narrows differential diagnosis	Appropriately narrows the differential diagnoses by including the following: who this patient is, how he or she is presenting with respect to time, and the key features with which he or she is presenting
Transforms	Enhances meaning of statement by expressing key findings of case in qualified medical terminology and/or synthesizing details into unifying medical concepts Replacing lay language (e.g., *swelling*) and or discrete data (heart rate, 180 beats/min; sodium, 125 mEq/dL) with more precise and meaningful medical terminology (*edema*, *tachycardia*, *hyponatremia*) Combines constellation of findings into a syndrome (shortness of breath, rales, lower-extremity edema, elevated JVP, S_3 → volume overload or heart failure); may or may not use semantic qualifiers to do this
Semantic qualifiers	Qualitative terms, more abstract than the patient's actual signs or symptoms, often are binary in nature: e.g., onset over 3–4 mo is gradual (and not sudden), right and left or unilateral (and not bilateral); intermittent vs. constant; stable vs. progressive

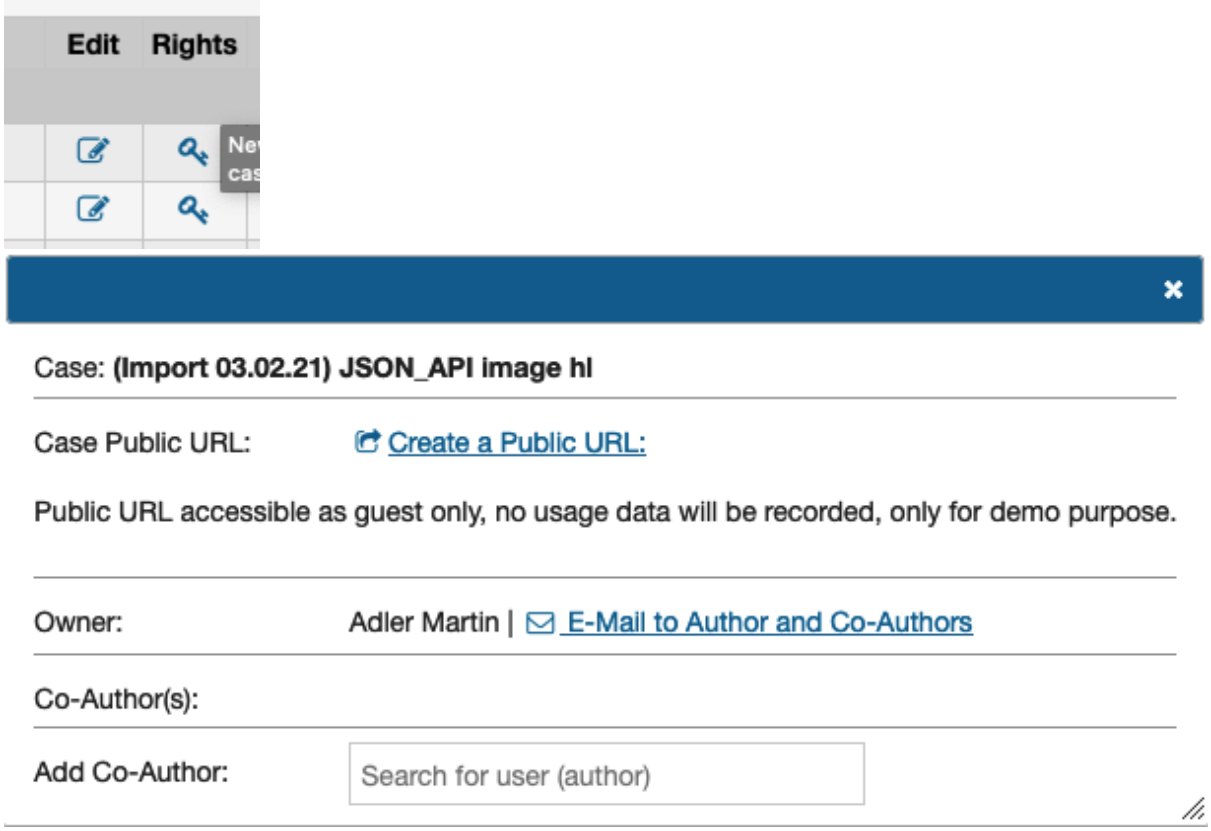
Data obtained from reference 23. JVP = jugular venous pressure; S_3 = third heart sound.

Source: Trowbridge RL, Rencic JJ, Durning SJ. Teaching Clinical Reasoning. ACP TEaching Medicine Series. American College of Physicians. Pennsylvania, USA.

Sharing your VPs with colleagues/for review

Anytime during the creation of a VP, you can share it with colleagues and also work together on a VP (not simultaneously, though):

(1) Co-Authors can be added on the case selection page in the authoring system by clicking on the key icon “Rights”: You’ll get a dialog, where you can add or remove co-authors. Please be aware that co-authors can open the case in the authoring system and can edit and delete anything within your case.



(2) Additionally you can create a temporary URL for your case, with this link only guest viewer access is possible, no editing of the case is possible. As this prevents any learning analytics we do not recommend using this feature regularly, but only using it for quick feedback from colleagues.

(3) For setting up reviewers for the content review, please see this document that contains a short description on how to proceed.

If you have any questions: please let us know