International Collection of Virtual Patients - Digitized Education in Europe beyond the pandemic

iCoViP

2020-1-DE01-KA226-HE-005754

IO1 - Blueprint for the virtual patient collection

Intellectual Output	IO1
Delivery date	June 2021
Status	final
License	BY-NC-ND
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Reviewed by	All partners

Co-funded by the
Erasmus+ Programme
of the European Union

The creation of these resources has been (partially) funded by the ERASMUS+ grant program of the European Union under grant no. 2020-1-DE01-KA226-005754.

1. Rationale

The careful design of a virtual patient (VP) collection is a crucial aspect to foster deliberate practice of clinical reasoning and is often neglected in the development of digital collections [Kassirer 2010]. A random VP collection represents the real world only to a limited extent with regard to disease- and patient-related aspects [Urresti-Gundlach et al. 2017].
Therefore, in this first intellectual output (IO) of the iCoViP project, we defined and populated a blueprint template in order to facilitate the creation of the VPs in IO2 based on the **criteria** established in this blueprint**.**

The first aspect we considered are the **key symptoms** covered by our VP collection. First, the most common symptoms should be present in such a collection to represent a realistic patient population. Second, the key symptoms should facilitate students comparing and contrasting patients with similar symptoms and differential diagnoses. Therefore, all partners agreed on 40 common and suitable key symptoms (see Annex) prior to the grant proposal submission. During the process of blueprint development further discussions on the key symptoms resulted in a further reduced list of 30 symptoms. This even better facilitates comparing & contrasting based on key symptoms while still representing the most common reasons for patient consultations.

Regarding the **diagnoses**, a meaningful European VP collection should entail the most frequent clinical conditions in Europe. This ensures the applicability in the majority of health-care study programs and provides access to diagnoses students are most likely to encounter in their work.
Furthermore, the diagnoses should be relevant for medical students and entail relevant/frequent differential diagnoses to facilitate deliberate practice of clinical reasoning. In this regard, it is also purposeful to have some of the diagnoses occurring more than once in the collection.

In addition to the disease-related aspects, **patient data** (e.g. demographics) play an important role in clinical reasoning. A VP collection should represent a realistic sample of the real world, otherwise it might trigger biases through its “hidden curriculum”. This includes a variety of features, such as gender, sexual orientation or ethnic background of the patients [Turbes 2002].

These aspects (and potentially some more) influence the clinical reasoning process of healthcare students and professionals and affect the difficulty of solving the VP. Therefore, the creation of an elaborate blueprint based on the described criteria is the basis for creating a high-quality VP collection showing a diversity and a realistic representation of the patient population in Europe and at the same time facilitating deliberate practice and comparing and contrasting.

2. Development of the blueprint template

Based on the criteria described above, we developed a blueprint template (google spreadsheet) which includes all these aspects. In addition, we discussed and agreed on including metadata describing the encounter between the VP and the learner and a mapping with national competency frameworks. The following table describes the template and its aspects:

Related to	**Factor**	**Description**	**Format**
Disease	Key symptom	The symptom/problem with thich the VP arrives	List selection
	Final diagnosis/es	Final diagnosis/-es of the VP (including cases without a final diagnosis)	Free-text
	Disease Group	Categorization based on the (main) final diagnosis, important to compare frequency with "real world"	List selection
	Onset	referring to the duration of the key symptom of the VP (e.g. acute, chronic)	List selection
Patient data	VP Name		Free-text
	Age of VP		Number
	VP sex	female, male or trans	List selection
	Profession of VP		Free-text
	VP socio-economic status		Free-text
	VP ethnicity	Asian, Afro-American, …	List selection
	VP disability	any disabilities of the VP	Free-text
	VP addiction	Any substance abuse of the VP (alcohol, drugs,...)	Free-text
	VP Sexual Orientation	homo-, bi-, heterosexual or Not Applicable/Not Stated	List selection
Encounter	Learner role	Role the learner plays in the scenario	List selection
	Encounter setting	Location where the initial contact takes place	List selection
Competency	Mapping with National Competency Frameworks	Learning objectives covered by the VP matched with the framework of partner countries.	Free-text

Table 1: Description of the blueprint template

3. Filling the blueprint

To support partners in completing the blueprint we provided a supporting document describing the required data and the process. Questions that arose during the data collection were discussed with the IO1 coordinator in our bi-weekly meetings or via email.

3.1 Completing the blueprint and reaching consensus

As a first step we added the already existing 86 VPs (covering 75 diagnoses) to the blueprint template to ensure that the newly created VPs will optimally match.
Then, partners from UAU, UPSaclay, UNIZAR, UPORTO and JU suggested 25 VPs each, specifying the disease-related aspects in the blueprint. An interim evaluation showed that the 40 key symptoms were well-covered in this first draft. The partner from KUM served as a reviewer and observer of the process and provided valuable feedback.

To ensure including the most common diagnoses and reaching consensus, we performed a five-step evaluation process:

1. All physicians of the iCoViP team reviewed the list of diagnoses in the blueprint and suggested 50 further ones that they considered as highly relevant.
2. We compared the list to the data sources identified in our literature search, adding missing diagnoses to the list (see above).
3. Overall, we had a total of 300 diagnoses at that stage. All partners voted independently on these 300 diagnoses in a Delphi-like method choosing for each diagnosis between “definitely include”, “maybe include”, or “not include”.
4. As a synthesis of the matching and voting results, a proposal list of 186 diagnoses was set up, where some of the diagnoses occurred multiple times, and thus resulting in a total of 211 VPs (86 existing, 125 new). Following a consent-making approach, all partners had the chance to raise objections in case of disagreement.
5. Finally, we held a consensus meeting to discuss the raised objections and distribute the new diagnoses to partners replacing those we had excluded in the previous steps. For that purpose, one representative of each partner took part in the meeting which followed a standardized procedure: In a preset order, the representatives could pick one diagnosis per round until all diagnoses were distributed.

After having completed this evaluation process, the five partners involved in the VP creation completed the disease-related aspects, patient and encounter-related data for their 25 VPs.

3.2 Overview of national competency frameworks

To match the VPs of the collection with the learning objectives from the national competency frameworks, all partners reviewed the available competency frameworks in their countries. Table 2 shows a summary of the identified frameworks. The next steps will include a thorough review of each catalog and a mapping of the VPs with the learning objectives in these frameworks. This will be done directly in the database of the VP system CASUS as this will be an important metadata to ensure that certain VPs can be specifically found and selected by educators and students. It also will facilitate the mapping of the VPs to curricular courses.

Country	**Publisher**	**Description /Title**	**Language**
France	Ministry of higher education, research and innovation	Competency framework for the second cycle of medical education, 2020	fr
Germany	Medical Faculty Convention	Version 2.0 of the national competence based catalog of learning objectives for undergraduate medical education (NKLM), 2021	de
Poland	Ministry of Science and Higher Education	Standards of education for medicine, including formal requirements, catalog of learning outcomes and general descriptions of the study program, 2019	pl
Portugal	National Health Service	List of learning outcomes that are assessed in the National Examination (done after finishing the Medical Course and before entering the internship), 2019	pt
Spain	National Agency for Quality and Accreditation (ANECA)	White paper on the degree in medicine, including level and depth of knowledge and competences for graduates, 2005	es

Table 2: Overview of national competency frameworks in medicine

4. Analyzing the blueprint data

To verify whether the outlined VP collection fulfills our requirements, we performed an initial analysis based on identified literature.

4.1 Literature search

We performed a search in Google and PubMed to identify the most **frequent and relevant diagnoses** within Europe and North America.
For the **frequency of diagnoses** we identified the following, which also represent a variety of regions, settings, and measurement methods:

- A systematic review on the most common reasons for visits in primary care worldwide [Finley et al. 2018]

- A study comparing the most frequent episode titles of incidence and prevalence in family medicine of Malta, the Netherlands and Serbia [Soler et al. 2012]
- Panel data of most common ICD-10 diagnoses by German general practitioners [Panel data GBE 2015]
- A ranking of the most frequent leading primary diagnosis groups for office visits listed in the US National Ambulatory Medical Care Survey [National Center for Health Statistics 2017]
- A ranking of the most common medical diagnoses based on ICD-10 in US ambulatory care provided by a software company for electronic health records [Practicefusion 2016]
- A register study of the most common ICD-10 codes in the population of Stockholm including primary care, specialists and hospitals [Wändell et al. 2013]

We also included the following articles and sources focussing on the **relevance of diseases** in daily clinical practice and medical education:

- A survey performed in an Australian hospital about clinical conditions that medical students should know at graduation [Rolfe et al. 2002]
- A survey among physicians across the US identifying frequent medical errors [Schiff et al. 2009]
- A study about common missed diagnoses in primary care settings in the US based on electronic health records [Singh et al. 2013]

For socio-demographic aspects, we included the following sources:

- Demographics for patients requiring admission to the hospital by age and sex: NHS digital statistics. https://digital.nhs.uk/
- Reports on the Health of refugees and migrants in the WHO / European region https://www.euro.who.int/en/publications/abstracts/report-on-the-health-of-refugees-and-migrants-in-the-who-european-region-no-public-health-without-refugee-and-migrant-health-2018
- Statistics regarding the healthcare professionals demographics for specialists and non-specialists https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Healthcare_personnel_statistics_-_physicians#Healthcare_personnel

4.2 Review and approval of the final blueprint

An initial evaluation of the published blueprint showed that it is, in general, quite well aligned with "real-world" data from the sources described above. However, we discovered a few mismatches:

- Overhead of female and relatively young VPs
- Low percentage of smokers
- Low percentage of VPs with disabilities

So, our final step was a re-adjustment of the collection focusing on these aspects. The blueprint was then agreed upon by all partners and is publicly available as google spreadsheet.

Although this version of the blueprint is an excellent starting point for the creation of the VPs, we are aware that during the creation phase it might be necessary to make further adaptations and refinements. Therefore, we consider the current version as a dynamic document we will regularly consult and analyze in more depth during the creation process (IO2).

5. Conclusions

Through this quite complex and multi-perspective approach, we are confident that our blueprint ensures the development of a high-quality and diverse VP collection which provides a realistic representation of the patient population in Europe and facilitates deliberate practice of clinical reasoning.

Although this process was time-consuming and required a lot of steps, we considered it a valuable investment, not only for planning the VP collection but also for enhancing our common understanding of what we want to achieve with this VP collection and what clinical reasoning is. This is a crucial step in our project to ensure that also during the VP creation we are sharing the same vision and aims.

6. References

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Annex 1 - Key symptoms

Key symptoms	Initial assessment	Excluded during IO1
abdominal pain	important	
back pain	important	
blurry vision	less important	x
cough	important	
diarrhea	important	
diplopia	less important	x
dysphagia	important	x
dyspnea	important	
fatigue	less important	
fever	important	
haemoptysis	important	x
headache	important	
hematemesis	important	
hematuria	important	x
jaundice	important	
joint swelling	important	
lower urinary tract symptoms/dysuria	important	
mucosal ulceration(s)	less important	x
nausea	important	
obstipation	important	
oedema	important	
oliguria	less important	x
pain (extremities)	important	
paraesthesia	less important	
polyuria	less important	x
rash	important	
rectal bleeding	important	x
red eye	less important	x
sleep disorders	less important	
sore throat	less important	
swollen lymph nodes	important	
syncope / loss of consciousness	important	

thoracic pain	important	
vertigo	important	
vomiting	important	
wheezing	important	
weight/appetite gain	less important	x
weight/ appetite loss	less important	

Key symptoms included in the VP collection and agreed upon by all partners.