D1.1 (a) Report on specific needs, preoccupations of stakeholders, and barriers

Web appendix 2. Detailed summary of responses given in the web survey

Part A. Demographics

1. In which country do you work/study?

Country	Student	Faculty	Expert	Total
Slovenia	30	18	2	**50**
Germany	22	10	7	**39**
Switzerland	27	4	0	**31**
Sweden	5	9	5	**19**
Poland	0	14	1	**15**
United States	0	4	11	**15**
Malta	5	0	1	**6**
Netherlands	0	2	1	**3**
Algeria	0	0	1	**1**
Czechia	0	0	1	**1**
Slovakia	0	0	1	**1**
Solomon Islands	0	1	0	**1**
Total	**89**	**62**	**31**	**182**

2. In which institution do you work/study?

Czechia (Masaryk University, Brno), Germany (University of Augsburg, Ruhr University of Bochum, University Bonn, University Hospital Cologne, Technical University Dresden, Hannover Medical School, Heidelberg University, Friedrich-Schiller-University Jena, University Rostock, Ludwig Maximilian University of Munich, University of Saarland, University Witten/Herdecke), Malta (EDU College of Medicine), Netherlands (Erasmus MC, Systems Research NL), Poland (Jagiellonian University of Kraków, Poznan University of Medical Sciences, Medical University of Warsaw), Slovenia (University of Maribor), Sweden (Mälardalen University, Örebro University), Switzerland (University of Bern), United States (All Ameriacan Institute of Medical Sciences, AT Still University School of Osteopathic Medicine, California University of Science and Medicine, Ithaca College, New York Institute of Technology College of Osteopathic Medicine, Philadelphia College of Osteopathic Medicine Georgia, SUNY Buffalo, Uniformed University of the Health Sciences, University of California, University of Cincinnati, University of New Mexico, Wake Forest School of Medicine, Wright State University).

3. What educational programme do you relate mostly to?

Educational programme	Total
Medicine	158
Nursing	10
Physiotherapy/Occupational therapy	8
Other	6
Total	**182**

Other: Athletic Training, Audiology, Genetics

4. How would you describe your primary role/roles at your institution?

Role	Count	%
Healthcare Professions Educator	63	35%
Physician	44	24%
Nurse	4	2%
Physiotherapist	0	0%
Occupational therapist	1	1%
Researcher	33	18%
Dean	7	4%
Curriculum Planner/Manager	25	14%
Course Director	18	10%
Student	90	49%

Other: Director of Simulation Education, Program Director, Programme co-ordinator, Researcher

5a. How many years of work experience in healthcare education (excluding years of undergraduate study) do you have?

n=92, Range: 1-50 years, Average: 14 years

5b. Your year of study

Year of study	Total	%
Year 1	14	16%
Year 2	8	9%
Year 3	10	11%
Year 4	9	10%
Year 5	21	23%
Year 6	25	28%
Other	3	3%
Total	**90**	

Other: Year 7 (Germany), PhD student

6. How confident are you in the following aspects of clinical reasoning?

Confidence in …	Extremely confident	Quite confident	Moderately confident	Somewhat confident	Not at all confident
Teaching	29%	41%	17%	8%	5%
Assessment	22%	38%	24%	13%	2%
Faculty development	10%	35%	30%	15%	9%
Clinical practice	30%	37%	26%	3%	3%

n=86

Part B. Students' Curriculum

7. Please rate the importance of inclusion of each of the following aspects in the envisioned longitudinal curriculum on clinical reasoning

CR Content [All]	7	6	5	4	3	2	1	IDN	Score
Gathering, interpreting, and synthesizing patient information	73%	23%	3%	1%	1%	0%	0%	0%	**6.66**
Generating differential diagnoses including defining and discriminating features	65%	27%	5%	2%	0%	1%	1%	0%	**6.51**
Developing a treatment/management plan	60%	27%	10%	2%	1%	0%	0%	0%	**6.42**
Developing a diagnostic plan	56%	33%	7%	3%	1%	1%	0%	0%	**6.39**
Self-reflection on clinical reasoning performance and strategies for future improvement	57%	26%	13%	1%	1%	0%	1%	1%	**6.26**
Errors in the clinical reasoning process and strategies to avoid them	52%	29%	14%	3%	0%	1%	1%	1%	**6.22**
Developing a problem formulation/hypothesis	39%	40%	15%	3%	0%	1%	0%	1%	**6.08**
Aspects of patient participation in clinical reasoning (e.g. shared decision making)	38%	34%	23%	2%	1%	1%	1%	0%	**6.01**
Interprofessional aspects of clinical reasoning	38%	40%	15%	3%	1%	1%	1%	1%	**6.01**
Collaborative aspects of clinical reasoning	38%	36%	19%	4%	1%	1%	1%	1%	**5.97**
Strategies to learn clinical reasoning (e.g. heuristics, rule out worst case scenario,	35%	33%	23%	7%	1%	1%	1%	1%	**5.86**
Theories of clinical reasoning (e.g. knowledge encapsulation, illness scripts, narrative reasoning	16%	40%	24%	10%	5%	2%	1%	2%	**5.34**

n=176

{7=Very important; 6=Important; 5=Somewhat important; 4=Neutral; 3=Rather unimportant; 2=Unimportant; 1=Very unimportant; IDN=I don't know}

		Rank			
ID	**CR Content Priorities**	**All**	**Expert**	**Student**	**Faculty**
R01	Gathering, interpreting, and synthesizing patient information	1	1	1	1
R02	Generating differential diagnoses including defining and discriminating features	2	2	2	2
R04	Developing a treatment/management plan	3	4	4	3
R03	Developing a diagnostic plan	4	3	3	6
R07	Self-reflection on clinical reasoning performance and strategies for future improvement	5	6	5	4
R06	Errors in the clinical reasoning process and strategies to avoid them	6	5	6	7
R05	Developing a problem formulation/hypothesis	7	7	7	8
R12	Aspects of patient participation in clinical reasoning (e.g. shared decision making)	8	9	8	10
R11	Interprofessional aspects of clinical reasoning	9	10	11	5
R10	Collaborative aspects of clinical reasoning	10	8	10	9
R09	Strategies to learn clinical reasoning (e.g. heuristics, rule out worst case scenario,	11	11	9	11
R08	Theories of clinical reasoning (e.g. knowledge encapsulation, illness scripts, narrative reasoning	12	12	12	12

n=176

Other

- Educate clinicians in physiology, structural error detection and mathematics.
- Fundamentals of nursing and patient care for medical students
- Information presentation - oral and written, knowing owns limitation and asking for help
- Learning to work under pressure and adapting to it; getting to know the consequences of all actions and decisions, good or bad for the patients
- Situated cognition, distributed cognition, and very surprised nothing listed about use of resources and diagnostic aids. Clinical reasoning is no longer just an "in-the-head" activity. Augmented intelligence approaches will be increasingly important
- Strategies and management to use in a situation with Crowding, brief clinical judgement and prioritizing under time pressure.

8. Please rate the importance of inclusion of each of the following formats in the envisioned longitudinal curriculum on clinical reasoning

CR Teaching Format [All]	7	6	5	4	3	2	1	IDN	Score
Case-based Learning	59%	31%	9%	0%	0%	0%	1%	1%	6.44
Human simulated patients	45%	30%	15%	6%	1%	1%	1%	2%	5.99
Problem Based Learning (PBL)	39%	34%	17%	6%	2%	1%	2%	0%	5.95
Team-based Learning	36%	39%	18%	3%	1%	1%	1%	1%	5.91
High fidelity simulation (mannequins)	35%	32%	14%	10%	5%	3%	1%	2%	5.61
Virtual Patients (interactive online cases)	22%	38%	24%	9%	3%	1%	2%	1%	5.51
Lectures	16%	28%	31%	10%	7%	3%	3%	1%	5.12

n=176

{7=Very important; 6=Important; 5=Somewhat important; 4=Neutral; 3=Rather unimportant; 2=Unimportant; 1=Very unimportant; IDN=I don't know}

		Rank			
ID	CR Teaching Format Priorities	All	Expert	Student	Faculty
R03	Case-based Learning	1	1	1	1
R07	Human simulated patients	2	4	2	4
R02	Problem Based Learning (PBL)	3	3	3	2
R04	Team-based Learning	4	2	4	3
R06	High fidelity simulation (mannequins)	5	6	5	5
R05	Virtual Patients (interactive online cases)	6	5	6	6
R01	Lectures	7	7	7	7

n=176

Other

- E-learning (theory and cases) with flipped classroom. Short lectures, high degree of interactive moments. Work place based assessment with real cases.
- Mathematics
- Real Patient contact, Learning in the workplace
- What about root cause analysis around real errors? Review of actual cases and follow-up?
- Work with multi disciplinary teams consisting of PhD grade electrical engineers and mathematicians
- bed side teaching; clinical reasoning as part of clinical skills training; learning clinical reasoning with real patients in clinical teaching programs and internships

9. Are you aware of any good learning resources for clinical reasoning you could recommend to be used within DID-ACT for learning/teaching of clinical reasoning? If yes, please describe?

- "Teaching time" in clinical settings. Students should not only walk with the doctors on the ward - there should be planned time for teaching and learning, e.g. discussion of patient cases.
- 3D for medical - gives the user nearly Unlimited Access to the whole world of human anatomy with simulated movements of the heart and libs … AMBOSS - Wide ranged page/program for Looking up Things an summarizes Facts and Knowledge of whole topic blocks. Draw it to know it - Good for starting with topics and get a first visualization
- Amboss
- Application Prognosis. I think it has good principles for learning.
- Body- Interact: simulated clinical reasoning
- CASUS
- Clinical reasoning in healrh professions by joy higgs
- DocCom.Deutsch an interactive learning platform with modules also to clinical reasoning
- Example one, two three
- Focus on participation of the client is necessary
- https://zdm.wl.cm.uj.edu.pl/cm/uploads/2020/02/poster_VP.pdf
- i-human (not sure if it's still available, though) Aquifer series of online case material by specialty
- I am in a field of laboratory medicine (pathology)
- I found a very interesting site, called CNS Nexus, where there are actual cases, presented in an interesting way, with added imaging, explanations and schemes. It's found on the following link: https://cnsnexus.crowdwisdomhq.net/nexus/home/0
- I haven't done any research just yet, so not aware of any good ones at this stage.
- In Swedish(!) https://www.adlibris.com/se/bok/neurologi---diagnostisk-handledning-9789144040608 Principles how symtoms in timelines are essential in diagnosis of neurological conditions.
- InSimu
- Kollegiale Fallberatung (könnte als konkrete Methodik im Rahmen des Team - based learning umgesetzt werden) *[Translated from the German: "Peer consulting of cases (could be implemented as a specific method in team-based learning)"]*
- Osmosis - videos on clinical reasoning
- Osmosis.com
- PhD education in electrical engineering, specialization analog electronics and network theory with sveral years additional education in medicine and clinical practice
- Strongly recommend you check out a body of resources at the Society to Improve Diagnosis in Medicine (SIDM; www.diagnosis.org). There will also be a special edition in the journal Diagnosis, with Steve Durning as guest editor. This journal could also be very helpful to you. I also recommend you check our Hardeep Singh's work.
- Study electrical and electronic engineering at academic level
- Teaching Clinical Reasoning - ACP American College of Physicians

- There are a variety of resources that are presently being used in this pandemic. Aquifer, Online MedEd, critical care, CHOP and a variety of others. The kind of modules that place you in the most realistic simulation are the best. For example, OPENPediatrics places you as the physician in the ER with interruptions etc...its the most realistic scenario I have seen.
- USMLE questions are all of clinical nature
- Writing a case report and overview of the literature
- Yes, we have a step by step process diagramed out. Would be glad to share. Pat Croskerry's articles are wonderful. Thinking Fast and Slow. Dalhousie University Teaching and Assessing Critical Thinking Courses TACT 1&2

10. From which study year on should clinical reasoning be taught in the envisioned longitudinal curriculum on clinical reasoning?

Year	Total	%
1	80	44%
2	41	23%
3	44	24%
4	12	7%
5	2	1%
6	3	2%

n=182

11. Which of these assessment formats should be implemented in the envisioned longitudinal curriculum on clinical reasoning?

CR Assessment Format [All]	7	6	5	4	3	2	1	IDN	Score
Clinical examinations (e.g. OSCE or other practical examinations)	49%	39%	7%	3%	1%	0%	0%	1%	6.25
Workplace-based assessments (e.g. MiniCEX, summative approach)	39%	34%	14%	7%	1%	0%	1%	5%	5.73
Oral examination	28%	41%	16%	8%	4%	2%	1%	2%	5.63
Assessment using virtual patients	25%	41%	20%	9%	2%	1%	1%	1%	5.62
Written test (e.g. multiple choice questions, key feature approach, script concordance tests)	13%	32%	31%	10%	8%	4%	2%	1%	5.09

n=167

{7=Very important; 6=Important; 5=Somewhat important; 4=Neutral; 3=Rather unimportant; 2=Unimportant; 1=Very unimportant; IDN=I don't know}

		Rank			
ID	**CR Assessment Format Priorities**	**All**	**Expert**	**Student**	**Faculty**
R04	Clinical examinations (e.g. OSCE or other practical examinations)	1	1	1	1
R05	Workplace-based assessments (e.g. MiniCEX, summative approach)	2	2	4	2
R02	Oral examination	3	4	2	4
R03	Assessment using virtual patients	4	3	3	3
R01	Written test (e.g. multiple choice questions, key feature approach, script concordance tests)	5	5	5	5

Others:

- 360° assessment.
- I think that workplace based assessments would be an important feedback, but in my experience they are not precise enough and their quality is largely dependent from the supervisior.
- Mathematics
- Oral examination about a case e.g. first OSCE-like interaction with a patient, then after getting the important anamneses switch to a examinator, who will ask specific questions about differential diagnosis, diagnostic process, therapy strategy etc.
- Oral examination works only when prejudices of professors aren't a factor, like gender preference, antipathy towards a particular student, being amused by bluff of one student and angry when another student admits they don't know the answer
- Portfolio
- Portfolio for Reflections, Case reports, medical letters
- WBA method CBD (Case Based Discussion)
- Written tests have some value, but limited utility in predicting performance in actual practice. Work-based assessment can be good, but only if the person performing the observation has deep knowledge and skills in clinical reasoning. SCT are hard to develop and have limited utility. I would check out Michelle Daniel's excellent scoping review on all the assessment approaches available for assessing clinlcal reasoning. For example, a chart stimulated recall approach is a better approach for an oral exam. You may also want to check out the Assessment of Reasoning Tool (ART).

12. Are you aware of any good assessment resources for clinical reasoning you could recommend to be used within DID-ACT? If yes, please describe?

- A good culture of feedback would be very helpful!
- Again, please check our www.diagnosis.org. There are also new competencies that not only target the individual, but also team-based and institutional competencies. They also have some really helping shorty videos and some assessment resources as well.
- Bordage's Dx Thinking Inventory
- CRESME tool by Torre.
- Clinical Integrative Puzzle
- Concept Maps

- First Aid for Step II CS (USMLE)
- I haven't done any research just yet, so not at this stage.
- MDCalc. Best assessment tool across every discipline. Quick to use. Allows further information on scores etc.
- New key feature questions from IMPP. not the best, but for germany the orientation
- None, I'm looking.
- PLAB 2, USMLE STEP 2 CS, MRCS PACES
- Scripts Concordance is probably not appropriate until after clinical time is sufficient.
- Theme test.
- Theory of requirements and protocol validation.
- WBA method CBD (Case Based Discussion) with narrative assessment?

13. Do you have further suggestions for the envisioned longitudinal curriculum on clinical reasoning?

- Applying Theory to Clinical Reasoning. Information processing - developing illness scripts, deliberate practice and self regulatet learning
- Case based approaches with structured access: ´5D´: detect - describe - discuss - differential - diagnosis (for example)
- Discussions of cases in small groups with a professional
- E-Portfolio with scheduled assessments in a learning spiEal
- Evidens based algoritms as a support - how to use them and some important examples
- I think it would be very precious to find a way how to implement the trainig of clinical reasoning into the clinical training. I lacked this a lot in my clinical internships. It would already help me a lot to hear the doctors thinking loudly or explaining their thoughts to me, to help me understand their process of clinical reasoning. In a second step, a trainer could help me to develop the clinical reasoning skills in asking me questions about the findings and about the differential diagnoses and my hypothesis. Maybe bedside teaching can be a way to teach clinical reasoning to a small group of students.
- Interdisciplinary view on the Patient basic knowledge and evidence based information to use on the individual patient."
- It should be longitudinal and each year more sophisticated
- Keep it as close to reality as possible. I have learned the most during my internships by just observing (or even participate) the clinical resoning process. In my opinion this way of learning is way more sustainable than any simulation.
- Make it as realistic as possible
- Not at this stage.
- Please move beyond just the classroom, and please incorporate more of the team aspects of clinical reasoning. The curriculum as suggested above focuses heavily on the individual. While obviously important, we now know clinical reasoning, especially with complex patients, is a team sport. And please make sure you focus assessment beyond just the knows to show level (MIller) when thinking about assessment.
- Separate out the parts involved in clinical reasoning and bring them in at the right time in the curriculum.
- The necessary scientific skills for modern medicine cannot be combined in a single medical curriculum. Therefore it is my advice to setup a medical curriculum for physicists,

mathematicians and electrical engineers (PhD) who can work together with medical specialists for the interpretation of clinical data related to diagnostics and treatment.

- The teaching and assessment formats are already out there, we don't need anything new in particular. We don't need new formats, but need to include the right questions in our teaching and assessment.
- Way less writing/MC-tests and more clinical tests should be done. why should we learn stuff that even specialists tell us... "so far in my 30 years of practice i've never seen it". get a better weighting of the learning-goals... whats important should be declarated as such and also well tested. all the super fancy 1 in a million diseases can be told but shouldn't be widely tested. and there is a bias by teaching: you get well rewarded and even admired if you know rare things in stead of knowing whats important. then students maybe wouldn't end up beginning a differential diagnosis with 10 zebras before talking about the horses.

Part Bx. Present clinical reasoning curriculum

7.x. In your curriculum (i.e. overall programme, not a particular course or clerkship you might be overseeing), which of the following aspects are taught and assessed

a) content taught

CR Content Taught	4	3	2	1	IDK	Score
Gathering, interpreting, and synthesizing patient information	58%	29%	10%	0%	3%	3.39
Generating differential diagnoses including defining and discriminating features	42%	45%	13%	0%	0%	3.29
Developing a treatment/management plan	52%	32%	13%	0%	3%	3.29
Developing a diagnostic plan	48%	32%	13%	3%	3%	3.19
Developing a problem formulation/hypothesis	32%	42%	23%	3%	0%	3.03
Aspects of patient participation in clinical reasoning (e.g. shared decision making)	32%	35%	23%	6%	3%	2.87
Interprofessional aspects of clinical reasoning	13%	45%	23%	13%	6%	2.45
Collaborative aspects of clinical reasoning	13%	42%	26%	13%	6%	2.42
Errors in the clinical reasoning process and strategies to avoid them	23%	32%	10%	26%	10%	2.32
Strategies to learn clinical reasoning (e.g. heuristics, rule out worst case scenario,	23%	23%	26%	19%	10%	2.29
Self-reflection on clinical reasoning performance and strategies for future improvement	23%	26%	13%	23%	16%	2.16
Theories of clinical reasoning (e.g. knowledge encapsulation, illness scripts, narrative reasoning	3%	35%	29%	26%	6%	2.03

n=31

{4=To a great extent; 3=To some extent; 2=A little; 1=Not at all; IDN=I don’t know}

b) content assessed

CR Content Assessed	4	3	2	1	IDK	Score
Generating differential diagnoses including defining and discriminating features	35 %	48 %	13 %	0%	3%	3.13
Developing a treatment/management plan	42 %	35 %	16 %	3%	3%	3.10
Gathering, interpreting, and synthesizing patient information	29 %	55 %	13 %	0%	3%	3.06
Developing a diagnostic plan	26	52	13	3%	6%	2.87

	%	%	%			
Developing a problem formulation/hypothesis	19 %	42 %	32 %	6%	0%	2.74
Aspects of patient participation in clinical reasoning (e.g. shared decision making)	19 %	16 %	29 %	29 %	6%	2.13
Collaborative aspects of clinical reasoning	0%	45 %	29 %	16 %	10 %	2.10
Interprofessional aspects of clinical reasoning	3%	39 %	29 %	23 %	6%	2.10
Errors in the clinical reasoning process and strategies to avoid them	13 %	19 %	32 %	26 %	10 %	2.00
Self-reflection on clinical reasoning performance and strategies for future improvement	16 %	16 %	29 %	23 %	16 %	1.94
Strategies to learn clinical reasoning (e.g. heuristics, rule out worst case scenario,	0%	23 %	42 %	26 %	10 %	1.77
Theories of clinical reasoning (e.g. knowledge encapsulation, illness scripts, narrative reasoning	6%	13 %	35 %	35 %	10 %	1.71

n=31

{4=To a great extent; 3=To some extent; 2=A little; 1=Not at all; IDN=I don't know}

		Rank	
ID	**Present CR curriculum**	**Taught**	**Assessed**
R01	Gathering, interpreting, and synthesizing patient information	1	3
R02	Generating differential diagnoses including defining and discriminating features	2	1
R04	Developing a treatment/management plan	3	2
R03	Developing a diagnostic plan	4	4
R05	Developing a problem formulation/hypothesis	5	5
R12	Aspects of patient participation in clinical reasoning (e.g. shared decision making)	6	6
R11	Interprofessional aspects of clinical reasoning	7	8
R10	Collaborative aspects of clinical reasoning	8	7
R06	Errors in the clinical reasoning process and strategies to avoid them	9	9
R09	Strategies to learn clinical reasoning (e.g. heuristics, rule out worst case scenario,	10	11
R07	Self-reflection on clinical reasoning performance and strategies for future improvement	11	10
R08	Theories of clinical reasoning (e.g. knowledge encapsulation, illness scripts, narrative reasoning	12	12

n=31

{4=To a great extent; 3=To some extent; 2=A little; 1=Not at all; IDN=I don't know}

Others:

- Optimizing diagnostic strategies with integration of input from patient (history) and output (dicussing diagnostic results , ´translation´)

8.x How is clinical reasoning TAUGHT in your curriculum (i.e. overall programme, not a particular course or clerkship you might be overseeing) in sessions with a main focus on clinical reasoning?

CR Teaching Format	**4**	**3**	**2**	**1**	**IDK**	**Score**
Case-based Learning	35%	42%	23%	0%	0%	3.13

Lectures	19%	29%	39%	10%	3%	2.52
Team-based Learning	13%	52%	19%	6%	10%	2.52
Human simulated patients	19%	35%	16%	23%	6%	2.39
Problem Based Learning (PBL)	23%	35%	6%	26%	10%	2.35
Virtual Patients (interactive online cases)	3%	45%	16%	23%	13%	2.03
High fidelity simulation (mannequins)	6%	35%	23%	26%	10%	2.03

n=31

{4=To a great extent; 3=To some extent; 2=A little; 1=Not at all; IDN=I don't know}

Others:

- Comment on High fidelity simulation: We do not use mannequins, but vi simulate hearing measurements with underlying simulated patient-data

10.x From which study year on is clinical reasoning taught at your institution?

Is CR taught	Total	%
Year 1	20	65%
Year 2	4	13%
Year 3	4	13%
Year 4	2	6%
Year 5	1	3%
Total	**31**	

11.x How is clinical reasoning ASSESSED in your curriculum?

CR Assessment Format	4	3	2	1	IDK	Score
Written test (e.g. multiple choice questions, key feature approach, script concordance tests)	46%	29%	11%	11%	4%	3.04
Clinical examinations (e.g. OSCE or other practical examinations)	29%	50%	11%	4%	7%	2.89
Oral examination	29%	29%	11%	29%	4%	2.50
Workplace-based assessments (e.g. MiniCEX, summative approach)	21%	29%	21%	25%	4%	2.39
Assessment using virtual patients	14%	14%	25%	36%	11%	1.86

n=28

{4=To a great extent; 3=To some extent; 2=A little; 1=Not at all; IDN=I don't know}

Others:

- Note-writing exercises within clinical skills exams
- Oral and written group presentations of PBL cases.

16. Do you have a train-the-trainer course on clinical reasoning at your institution

Train-the-trainer course present	Total	%
Yes	3	12%
No	17	68%
Don't know	5	20%
Total	**25**	

16.x If yes, please describe?

- All faculty who sign up for small group facilitation are given a 3-hour workshop on the structure of the course and introduced to the tools used
- Trainers are trained in working with virtual cases, running the jnteractive sessions and evaluating the sudent's contribution.

Part C. Barriers/solutions for teaching and assessment of clinical reasoning

14. What, in your opinion, are the main barriers/challenges for introducing such a longitudinal curriculum on clinical reasoning at your institution?

Barriers for introducing longitudinal CR curriculum	Total	%
Lack of qualified faculty to teach clinical reasoning	50	57%
Lack of curricular time	50	57%
Lack of guidelines for clinical reasoning curriculum development	46	53%
Lack of financial resources	43	49%
Lack of awareness of the need for explicit clinical reasoning teaching	43	49%
Lack of top-down support	30	34%
Perception that clinical reasoning cannot be taught	20	23%
No particular challenges	11	13%
Curriculum invented elsewhere	6	7%
Don't know	3	3%

n=87

Other:

- Different perspectives on clinical reasoning and no real discussion about it
- Disincentives for teaching vs. clinical care
- In the education for nurse anesthetsist we are already teaching clinical reasoning. However, we dont explictly use the CR term when doing lectures, high fidelity simulations. But this is going to change . Havent encountered any barriars from the faculty involved in this education to RNA. We know the importance of this skill so we teach this to our students.
- Lack of time to teach it- people have a lot of other obligatory tasks to do
- Scientific education in mathematics
- Separate curriculum for electrical engineers

15. How could these challenges be overcome at your institution? Please explain.

- Better budget for faculty and resources.
- By focusing on targeted hiring of more specialised tutors and facilitators (often hard to find).
- By providing good faculty development materials
- By top-down promotion
- Change of professors/nestors mentality....
- Developing/improving existing guidelines and planning for activities according to these.
- Development if reliable financial incentives for clinical departments to free up faculty time for teaching.
- Educating teachers, introducing the idea to heads, promoting reasoning to students, ...
- Electrical engineers and physicists with a PhD are educated in medicine and a selected specialism for several years. They master mathematical skills and learn to use these for physiological modeling and simulation. These scientists are the right counterpart for the clinical laboratory in order to get the correct lab measurement interpretation related to the subject of diagnosis and treatment. Medical students have not the background, time and interest to pursue the necessary clinical reasoning that is demanded for modern medicine.
- Gaining support of key individuals. Slowly placing it in different courses
- Hope for a change in personnel at the top ranks.
- Information, Fortbildungen für Lehrkräfte (zum Teil als interdisziplinäres Programm), Erweiterung der Methodenkompetenz der Lehrkräfte bessere räumliche (kleinere und mehr) Lerngruppen und bessere technische Ausstattung
  [Translated from the German: "Information, train-the-trainer courses (partly as an interprofessional curriculum), development of the methodological competence of teachers, better spatial (smaller and more) learning groups and better technical equipment"]
- Integrated approach from the numerous healthcare programs (PT, OT, SLPA and AT), resources and commitments from administration, common assessment planning to teach and measure contextually specific CR
- Introduce PhD grade electrical engineers as part of the clinical team to form a multi disciplinary workforce.
- Link the importance to clinical outcomes - always the north star.
- Make teaching more attractive, more recognition needed, make it a career choice, like "Teaching professors"
- Money will help, but our university is barely solvent
- Motivation ,....
- Needs to be a collective understanding of what we all mean by clinical reasoning, and for local faculty to work together to do this.
- Relative small number of experienced colleagues. By tradition experienced physicians in Sweden do a lot of routine work instead of being available as a support to teach students, residents and others under training. A great share of the support is by telephone or between the learner and the consultant in front of a computer without the patient,... We need much more WBA like mini-CEX and CBD and much more bedside teaching. Also experienced probably has a lack of knowledge in clinical reasoning and training maybe should start here?
- Start small, make sure to demonstrate effects. For this, we Need protected time for teaching and assessing clinical reasoning skills. Currently, this is not the case.
- Teaching clinical reasoning must be part of faculty development program
- The recognition and awareness that CR is needed for the patients' well-being
- To increase perception and awareness of clinical reasoning

- Using faculty development to start a discussion about what clinical reasoning is (and what not) and from there develop a curriculum
- We need someone to show our teachers how important it is not only to show how good are they in CR, but how to teach other younger colleagues and students to do it. they do not feel the need to help younger doctors to develop these skills or if they do, they completely don't know how to do this.
- While learning more about the process and how it is used in daily clinical situation.
- With funding and convincing pilots on a volunteer base.

Part D. Train the trainer curriculum

17. Do you think the DID-ACT train-the-trainer course is necessary for healthcare educators at your institution?

	Total	%
Yes	66	80%
No	4	5%
Don't know	12	15%

n=82

18. What should the DID-ACT train-the-trainer course on clinical reasoning cover?

Train-the-trainer course	7	6	5	4	3	2	1	IDN	Score
Teaching methods on the wards and/or clinic	61%	33%	3%	1%	0%	0%	0%	1%	6.47
Strategies on how to avoid common errors and biases in clinical reasoning process	58%	32%	8%	0%	1%	0%	0%	0%	6.46
Teaching methods for face-to-face courses (e.g. seminars, problem-based learning courses, lectures)	56%	35%	8%	1%	0%	0%	0%	0%	6.44
Clinical reasoning strategies	51%	42%	7%	0%	0%	0%	0%	0%	6.44
Common errors in the clinical reasoning process	49%	47%	4%	0%	0%	0%	0%	0%	6.44
Assessment methods of clinical reasoning	46%	43%	4%	3%	3%	0%	0%	1%	6.19
Technology-enhanced methods (such as virtual patients, e-learning	39%	42%	13%	4%	1%	0%	0%	1%	6.06
Blended learning / Flipped (inverted) classroom methodology	35%	35%	22%	6%	0%	0%	0%	3%	5.85
Theory on clinical reasoning	22%	40%	29%	8%	0%	0%	0%	0%	5.76
Literature on clinical reasoning	24%	40%	19%	13%	1%	1%	1%	0%	5.63

Other

- all methods/formats and content of the student curriculum

19. In your opinion, what is the best format for the DID-ACT train the trainer course?

Best train-the-trainer format	Total	%
Blended learning/flipped classroom approach (combination of e-learning and face-to-face meetings)	46	59%
Series of face-to-face meetings	23	29%
E-learning course	6	8%
One time face-to-face meeting	3	4%

n=78

20. Why do you suggest the format above for the train-the-trainer course? Please explain

Blended learning/flipped classroom approach (combination of e-learning and face-to-face meetings)

- Because I think it is a combination of theory and practical engagement neccessary. I also think that experiences should be exchanged in the face-to-face courses.
- because in order to learn how to teach, we should practice the methods on one another, then give feedback and see how others are doing it- similar to course for being the simulation instructor- you need to practice and see how others are doing, give feedback, participate in the process like you were a student.
- Because it concerns development of professional processing skills that needs to land within each and every professional as a person. The importance of reading, reflecting, discussing and combining the learning/teaching methods is then perceived as important. The flipped learning can enhance the use of time, increase the deeper learning potential and give everyone a chance to read when they find time to do so.
- Because of adult learner theory and the need to show assimilation of the information
- Der Wechsel von eigenständiger Auseinandersetzung und Austausch und Diskussion im Wechsel kommt verschiedenen Lerntypen entgegen und so könnten später auch die Lernprogramme für die Studierenden konzipiert werden (gut, wenn die Trainer das in der eigenen Erfahrung ähnlich als Lernerfahrung erlebt haben). E-Learning ist für die zeitlich flexible Gestaltung der Teilnehmer wichtig. *[Translated from the German: "The alternation of self-study, [knowledge] exchange and discussion facilitates different learnings styles and so could later the student curricula be designed (good, if the trainers experienced this similarly in their time as learners). E-learning is important for flexible time management of the participants."]*
- Efficacy in time and learning.
- e-learning as introduction to modules, f2f-meetings to deepen the knowledge, to improve, to discuss questions and to further improve/develop the topics together
- face-to-face meetings can be via video connection
- I think it is a good combination as I think you can learn a lot in the discussion with others. If you have prepared before the meeting, for example through e-learning moment, the discussions can be more in-depth.
- I think it´s a good mix to prepare by myself, then learn more and finally discuss with other course members. This type of eduction stimulates to own reflection as well as a way to learn more .

- I think there is a need to be present with one another to help build comradarie. But, with this likely being an international collaborative, chances to do this would be limited so I would see this being predominantly distance and blended.
- I think we should pratic what we preach re: active learning and prework.
- If done with peers so there is peer-peer discourse, then the learning increases as it does with students. Skip lectures, stick to application of the principles and the theory. Emphasis on theory has minimal benefit.
- It allows the person who is learning to have time to go througj the material, gives them an interaction to practice and ask questions and possibly create content as they go through the training.
- it takes some time to understand the topic, so some basic matrials should be accesible online, and then further discussed with faculty
- Practical aspect: more flexibility for both trainer and trainee Learning aspect: the more modalities involved in a learning process the better!
- Serial educations should be used, as people forget one time meetings. Also they have time to reflect on the material at home. Possibility of e-learning also allows them to schedule their own time.
- Some face-to-face meetings can really help to deepen understanding through dialogue, creation of shared understanding and mental models, and team-based learning.
- students have to come with knowledge in the course, with inverted classrooms you can try to have the same preknowledge and it helps in teaching responsibility for their own studies. In the course you can concentrate on the clinical decision part.
- Theoretical background can be taught/learned online, everyone at his/her own pace. Self-reflection can be included. Teaching of methods need experiencing and practicing with others, therefore face-to-face Meetings in groups are needed (this also includes learning from other participants, not just from the facilitator).
- There should be some face-to-face. But most of theoretical study can be done solo, guided online...
- using the same format for teaching the educators as the students. In addition there always should be a transfer project after the course with a follow-up, this is standard in our faculty development courses.

<u>Series of face-to-face meetings</u>

- Better to meet people and to interact
- face to face meetings are open interactive effective way to share the knowledge
- Informations, in particular misinterpretation, can be cleared immediately without a delay
- It need to be interactive and it feels like it should be done in scenarios or in case studies.

<u>E-learning course</u>

- As we are a first European digital medical faculty, e-learning is at the very heart of our institution. Therefore, a well-structured e-learning course that can be implemented during the theoretical learning phase is a necessity for us.
- Time differences for various countries and the learners can do it on their own time.

<u>One time face-to-face meeting</u>

- one face to face than e-learning course there you can repeat the scills

21. Do you have further suggestions for the DID-ACT train-the-trainer course?

- Combination of theory in clinical judgement and virtual cases (mostly e-learning?) + methods of bedside training and assessment, pedagogical approach (coaching and feedback) and assessment. Part of the course for supervisors that is under further development?
- Like mentioned above> i would like to have mixed course- first, theory of CR done by e-learning, second part- interaction with people, role playing, assessing, taking part in different methods as a student and as a tutor
- Mandatory and/or cme credits for participants
- No.
- No. JUST TOTALLY interested in it!
- Not at this stage.
- Not at this time
- See above.
- Should be mandatory for clinical teachers
- Small groups
- Would love to be a part! *[e-mail]* Would share all of our resources.

Part E. Barriers / Solutions for train the trainer

22. What critical aspects/barriers/challenges do you see in implementing the DID-ACT train-the-trainer course at your institution?

	Total	%
Lack of time of participants	58	71%
Lack of time of trainers	52	63%
Lack of qualified trainers to teach the train-the-trainer course	46	56%
Lack of financial resources	43	52%
Lack of awareness of the need for a train-the-trainer course	36	44%
Lack of guidelines for teaching and assessing clinical reasoning	32	39%
Lack of top-down support	31	38%
Perception that clinical reasoning cannot be taught	10	12%
No particular challenges	9	11%
Course invented elsewhere	0	0%

n=82

23. How could these challenges be overcome at your institution?

- sensitisation of responsibles for the topic to reach a change of mindset (if and where needed); 2. resources (money) for qualification of train-the-trainers, for trainers
- As above.
- By hiring more tutors with a focus on clinical reasoning classes and convincing the board members and stakeholders that it is important to invest in them.
- By top-down promotion
- Changes in how we work, see next reply. E-learning module in combination with the supervisor course program.

- Have designated trainers from our institution that offer courses through the year. So multiple attendings can be possible.
- If they are prioritized from higher management.
- It is probably a matter of priority
- Lead up and buy in accomplished by the local faculty and leadership. Clear understanding of the required resources up front.
- Low cost
- Make it easily accessible (online, sched. independent), and affordable
- Money and leadership push
- No idea..
- Not sure
- Our institution develops medical knowledge that could only be appreciated by clinicians if they just had enough interest, courage and feeling for the patients they treat to work together with mathematicians, physicists and PhD grade electronic engineers.
- Participation should be mandatory. After the first participants (stakeholders and respected clinical teachers) have completed the class, news of ist usefulness will spread quickly and more teachers will want to participate.
- The awareness of the faculty that it is necessary!
- The leading authorities must be convinced about the importance of this task
- The need to implement the master plan and the associated necessity of the course would have to be recognised by all hospital directors, so that they would be obliged to release their staff for this course - independent of requirements for habilitation.
- There is a lot of challenges here. The most important is time- no one has spare time, people are overworked. We could promise them a day off after the course if they participate and pass the certificate. We also need someone from other university who is experience in methods of teaching CR in ordere to teach us how to do it. We should also put a great importance into the fact, that we need to help each other, take care of younger colleagues and support them
- There is always tension between research and education. Time constraint is always present and to this I don´t have a solution. This course need to be inspiring since it needs to compete with so many other tasks a teacher have to do.
- To increase perception and awareness for courses
- Using Bland's article on how to change a curriculum
- When the student curriculum will be introduced there will be some pressure on the faculty to attend such a train-the-trainer course (otherwise they are not allowed to teach). Additionally, we will approach people directly and ask them to participate,

24. What incentive other than a certificate might be helpful for motivating participation in this course?

- A potential motivation could be that they can not only improve their teaching, but it might also help them to reflect on their clinical work and better train junior doctors. The course attendance certificate can be accredited as part of a national certificate (required for habilitation purposes etc).
- A useful and practical design that is perceived as easy to apply with students learning.
- As a part of improvements in teaching clinical reasoning it is necessary to improve the quality and especially the volume of bedside teaching and assessment. We therefore need combine the course with changes in the way we work, the experienced should work closer to the

students and residents and focus on supervision and not routine work on their own. That could raise the motivation for the senior colleges. The course could be a part of the change.
- Bonus--but do not have the budget for that. We are a tuition-driven school.
- By implementing this course from the early stages the participants will be able to practice saver medicine and that their patients and institutions they work for will benefit from it.
- CME credits and/or financial benefits for the departments.
- Career options in teaching, as Teaching professors...
- Change the course curriculum as indicated above.
- Day off education points course organised in a nice place and without payment from them
- Ein gutes Seminar dazu! *[Translated from the German: "A good seminar on this!"]*
- Having it eligible for CME credit points
- I don´t know
- I think the "incentive" for the hospital directors should be that they may only assign doctors for teaching on the ward or for the supervision of students on the ward who have attended the course.
- Letter/support for academic promotion. Some degree of resources--enrolling and content at a reasonable price (assuming that there will be a charge)
- Link to the importance of educational and clinical outcomes. Tell stories - everyone has a story of harm (I know I do - lost my father to a diagnostic error). Stories can be powerful.
- One of the best incentives is having the right kind of peer-peer learning so that participants learn from one another and 'bond' going forward with a collective approach.
- Personal interest. Buy down of time to be a clinical coach. Importance in promotion
- Possibility of becoming trainers with financial stimulation.
- Proof of completion via a nice certificate is all that is needed for most folks
- The course could be compulsory
- There must be a motivation for the participant to join the programme first.
- Understanding and conviction. If this fails - making the course mandatory
- Wider promotion of the concept

Part F. Final Question

25. Do you have any further comments?

- Any part of oral testing has to include a feedback! It is of no use to any student if one gets tested on human interaction and clinical reasoning and afterwards no explanation on what went good/bad is provided.
- Clinical reasoning will be influenced, completed and imporved by AI in the next years, with increasing impact. It should be integrated in planning of a clinical reasonning curriculum. Mandatory are standardized interfaces for I/O of clinical information
- EXCELLENT and much NEEDED idea! Thank you
- Everyone working in the medical field needs to focus on the patients' well-being which is not necessarily equivalent to the 'patients' health', therefore CR with all its aspects is essential to reach this goal a common understanding and the need for it is needed and must be included in the studies/trainings
- Good luck
- Good questionnaire! Good luck!
- Great to see you doing this - please let me know if I can help further and good luck.
- Hope this helps!

- I am interested how the curriculum can be implemented in the different health professions educations in germany. It is difficult, but can be a transportation of better understanding the differences of health professions. So maybe they will be working better together and improve healthcare with a better reasoning for the health of the patients
- I am interested in potentially collaborating with you on this project. We are currently developing out our clinical reasoning curriculum/assessment system at our University and the timing of your survey is very serendipitous. My contact information is *[e-mail]*. Thank you.
- I wish the project a lot of success and I support it very much.
- I would be happy to work with your organization in order to get clinical reasoning up to date and advice you how you could proceed in the envisioned additions in clinical research teams and find a suitable and effective curriculum. *[e-mail]*
- I would love to be a part of this!
- In my opinion, one of the most important factors in education is THE TEACHER, if the teacher is tired doctor who cares only about spending as little time as possible for some extra money then students have a problem. Plus students educating other students in seminars is not equal teacher educating students.
- Looking forward to this, and anxious for it to be available :)
- Mehr Praxis (klinische Skills), mehr Bedside wäre super und mehr echte Patientenfälle, die man mit einem Fach (!)-Arzt besprechen kann (wir hatten in PBL viel fachfremde Ärzte und folglich waren die teilweise schrecklich). Bitte keine Online-Fälle wie z.B. in der Virtuellen Hochschule Bayern (für mich kein Lerneffekt!!!) -> leider hat die Kardiologie uns dadurch versucht EKG beizubringen, ohne Vorlesungen, Seminare oder dergleichen. Viele meiner Komillitonen und ich jätten gerne einen Freieilligen-Kurs besucht zum EKG, leider wurde keiner angeboten.
  [Translated from the German: More practice (clinical skills), more bedside [teaching] would be great and more real patient cases that can be discussed with a specialist (!) (we had a lot of non-specialist doctors in PBL and consequently they were sometimes terrible). Please no online cases such as in the Virtuelle Hochschule Bayern (no learning effect for me !!!) -> unfortunately the cardiology [department] tried to teach us ECG without lectures, seminars or the like. Many of my fellow students and I would like to have attended an elective course on ECG, unfortunately none was offered.]
- Nein. Viel Erfolg! *[Translated from the German: No. I wish you success!]*
- Not at this stage.
- Thank you for starting this Project. I am really looking Forward to the results!
- Thank you for the opportunity to participate in the survey.
- Thanks that you are developing this teaching project on clinical reasoning! Clinical reasoning is a skill that I missed a lot in my curriculum.
- This is a very good initiative. Many young doctors and also seniors need to improve for a safer and more efficient healthcare.
- What does an excellent clinical reasoning and other worshipped strategies in this survey help a future doctor if he does not know how to use a simple, cheap and unharmful portable diagnostic ultrasound device to instantly check the predictions made with his great diagnostic process? Beside that I totally agree with your goal I additionaly think that in the modern era curriculums should not be so slow to follow and adapt to technology advancements especially because they are now producing doctors for next 40 years... teaching percussion while for 1k bucks you get US - sentimental ?