

## **Wales COVID-19 Evidence Centre (WC19EC) Rapid Review**

**A rapid review of the effectiveness of alternative  
education delivery strategies for undergraduate and  
postgraduate medical, dental, nursing and  
pharmacy education during the COVID-19 pandemic**

**Report Number: RR00004 (August 2021)**

**ADDITIONAL INFORMATION (See Rapid Review section 7.1)**

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## 1. Full search strategies

Ovid Medline ALL: 08/06/2021

#		Results
1	exp Education, Medical/	171,333
2	exp Students, Medical/	36,453
3	exp Education, Graduate/	89,166
4	exp Clinical Clerkship/	5,324
5	exp Education, Premedical/	782
6	exp Education, Dental/	19,706
7	exp Education, Predental/	148
8	exp Students, Dental	6,695
9	exp Education, Nursing	84,950
10	exp Students, Nursing	25,798
11	exp Education, Pharmacy	8,288
12	exp Students, Pharmacy	3,504
13	((medical or medicine or dental or dentist* or nurs* or pharmacist* or pharmacy) adj3 (education* or training or teach* or student* or undergraduate* or postgraduate* or lecture* or syllabus or curriculum or curricular or college* or school* or learn* or trainee* or bachelor* or master*)).ti,ab,kw	262,059
14	OR 1-13	450,681
15	exp Coronavirus/	76,778
16	COVID-19/	83,208
17	((corona* or corono*) adj1 (virus* or viral* or virinae*)).ti,ab,kw	3,149
18	(coronavirus* or coronovirus* or coronaviri* or 2019-nCoV or 2019nCoV or nCoV2019 or nCoV-2019 or covid-19* or covid19* or ncov* or n-cov* or HCoV* or SARS-CoV-2 or SARSCoV-2 or SARSCov2 or SARS-CoV2 or severe acute respiratory syndrome).ti,ab,kw	153,396
19	((outbreak* or pandemic* or epidemic*) adj10 (wuhan or hubei or china or Chinese or Huanan)).ti,ab,kw	8,045
20	OR 15-19	165,278
21	14 and 20	3,888
22	21 and 2019:2021.(sa_year).	3,794
23	Limit 22 to English language	3665

Ovid EMBASE 1945-Present: 08/06/2021

#		Results
1	exp medical education/	353,341
2	exp medical student/	77,495
3	exp masters education/	409

4	exp postgraduate education/	16,710
5	exp dental education/	23,753
6	exp dental student/	8,240
7	exp nursing education/	90,538
8	exp nursing student/	28,638
9	exp pharmacy student/	7,785
10	((medical or medicine or dental or dentist* or nurs* or pharmacist* or pharmacy) adj3 (education* or training or teach* or student* or undergraduate* or postgraduate* or lecture* or syllabus or curriculum or curricular or college* or school* or learn* or trainee* or bachelor* or master*)).ti,ab,kw	352,540
11	OR 1-10	648,645
12	exp Coronavirinae/	52,472
13	exp coronavirus disease 2019/	118,528
14	exp severe acute respiratory syndrome/	10,043
15	exp Coronavirus infection/	137,973
16	((corona* or corono*) adj1 (virus* or viral* or virinae*)).ti,ab,kw	2,823
17	(coronavirus* or coronovirus* or coronaviri* or 2019-nCoV or 2019nCoV or nCoV2019 or nCoV-2019 or covid-19* or covid19* or ncov* or n-cov* or HCoV* or SARS-CoV-2 or SARSCoV-2 or SARSCov2 or SARS-CoV2 or severe acute respiratory syndrome).ti,ab,kw	152,351
18	((outbreak* or pandemic* or epidemic*) adj10 (wuhan or hubei or china or Chinese or Huanan)).ti,ab,kw	8,165
19	OR 12-18	176,298
20	11 and 19	5,952
21	20 and 2019:2021.(sa_year).	5,652
22	Limit 21 to English language	5,493

### EBSCOhost CINAHL 08/06/2021

#		Results
1	(MH "Education, Medical")	31,814
2	(MH "Students, Medical")	16,418
3	(MH "Education, Graduate+")	15,426
4	(MH "Education, Continuing+")	35,671
5	(MH "Education, Diploma Programs+")	1,067
6	(MH "Education, Dental")	4,083
7	(MH "Students, Dental")	2,817
8	(MH "Education, Nursing+")	84,609
9	(MH "Students Nursing+")	40,129
10	(MH "Education, Pharmacy")	1,882
11	(MH "Students Pharmacy")	1,389

12	TI (medical or medicine or dental or dentist* or nurs* or pharmacist* or pharmacy) N3 (education* or training or teach* or student* or undergraduate* or postgraduate* or lecture* or syllabus or curriculum or curricular or college* or school* or learn* or trainee* or bachelor* or master*)	82,569
13	AB (medical or medicine or dental or dentist* or nurs* or pharmacist* or pharmacy) N3 (education* or training or teach* or student* or undergraduate* or postgraduate* or lecture* or syllabus or curriculum or curricular or college* or school* or learn* or trainee* or bachelor* or master*)	119,149
14	OR 1-13	271,077
15	(MH "Coronavirus+")	2,015
16	(MH "Coronavirus Infections+")	27,868
17	(MH "COVID-19 Pandemic")	14,129
18	TI (corona* or corono) N1 (virus* or viral* or virinae*)	151
19	AB (corona* or corono) N1 (virus* or viral* or virinae*)	368
20	TI (coronavirus* or coronovirus* or coronaviri* or 2019-nCoV or 2019nCoV or nCoV2019 or nCoV-2019 or covid-19* or covid19* or ncov* or n-cov* or HCoV* or SARS-CoV-2 or SARSCoV-2 or SARSCov2 or SARS-CoV2 or severe acute respiratory syndrome)	40,642
21	AB (coronavirus* or coronovirus* or coronaviri* or 2019-nCoV or 2019nCoV or nCoV2019 or nCoV-2019 or covid-19* or covid19* or ncov* or n-cov* or HCoV* or SARS-CoV-2 or SARSCoV-2 or SARSCov2 or SARS-CoV2 or severe acute respiratory syndrome)	30,024
22	TI (outbreak* or pandemic* or epidemic*) N10 (wuhan or hubei or china or Chinese or Huanan)	687
23	AB (outbreak* or pandemic* or epidemic*) N10 (wuhan or hubei or china or Chinese or Huanan)	1,311
24	OR 15-23	59,528
25	14 and 24 (limited to 20191201-20210631; English Language)	1,786

EBSCOhost ASSIA 08/06/2021

#		Results
1	TI (medical or medicine or dental or dentist* or nurs* or pharmacist* or pharmacy) N3 (education* or training or teach* or student* or undergraduate* or postgraduate* or lecture* or syllabus or curriculum or curricular or college* or school* or learn* or trainee* or bachelor* or master*)	9,751
2	AB (medical or medicine or dental or dentist* or nurs* or pharmacist* or pharmacy) N3 (education* or training or teach* or student* or undergraduate* or postgraduate* or lecture* or syllabus or curriculum or curricular or college* or school* or learn* or trainee* or bachelor* or master*)	23,055
3	OR 1-2	24,942
4	TI (corona* or corono) N1 (virus* or viral* or virinae*)	0
5	AB (corona* or corono) N1 (virus* or viral* or virinae*)	18
6	TI (coronavirus* or coronovirus* or coronaviri* or 2019-nCoV or 2019nCoV or nCoV2019 or nCoV-2019 or covid-19* or covid19* or ncov* or n-cov* or HCoV* or SARS-CoV-2 or SARSCoV-2 or SARSCov2 or SARS-CoV2 or severe acute respiratory syndrome)	1,141
7	AB (coronavirus* or coronovirus* or coronaviri* or 2019-nCoV or 2019nCoV or nCoV2019 or nCoV-2019 or covid-19* or covid19* or ncov* or n-cov* or HCoV* or SARS-CoV-2 or SARSCoV-2 or SARSCov2 or SARS-CoV2 or severe acute respiratory syndrome)	2,041
8	TI (outbreak* or pandemic* or epidemic*) N10 (wuhan or hubei or china or Chinese or Huanan)	16
9	AB (outbreak* or pandemic* or epidemic*) N10 (wuhan or hubei or china or Chinese or Huanan)	38
10	OR 4-9	2,148
11	3 AND 10	34

## 2. Critical appraisal scores

**Table of critical appraisal scores from descriptive surveys**

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Arrongante et al 2021	Y	N	Y	N/A	N	N	Y	Y
Cowart et al 2000	Y	N	Y	N/A	N	N	UC	Y
Darici et al 2021	Y	Y	Y	N/A	Y	N	Y	Y
Harendze et al 2020	Y	N	Y	N/A	N	N	Y	Y
Kasai et al 2021	Y	N	Y	N/A	N	N	N	Y
Kawasaki et al 2021	Y	Y	Y	N/A	N	N	UC	Y
Kim et al 2020	UC	UC	Y	N/A	N	N	Y	Y
Martini et al 2021	Y	Y	Y	N/A	Y	Y	Y	Y
Monday et al 2020	Y	N	Y	N/A	N	N	Y	Y
Nathaniel and Black 2021	Y	Y	Y	N/A	N	N	Y	Y
Nijakowski et al 2021	Y	Y	Y	N/A	N	N	N	Y
Phillips et al 2021	Y	N	Y	N/A	N	N	UC	Y
Qaranto et al 2021	Y	N	Y	N/A	Y	N	UC	Y
Redinger and Greene 2021	Y	N	Y	N/A	N	N	Y	Y
Rosenthal et al 2021	Y	N	Y	N/A	N	N	Y	Y
Scoular et al 2021	Y	N	Y	N/A	Y	N	Y	Y
Singh et al 2020	Y	N	Y	N/A	N	N	Y	Y
Totlis et al 2021	Y	Y	Y	N/A	N	N	Y	N
Weston et al 2020	Y	N	Y	N/A	N	N	Y	Y
Kanzow et al 2021	Y	N	Y	N/A	N	N	Y	Y
Pang et al 2021	Y	N	Y	N/A	N	N	N	Y

1. Were the criteria for inclusion in the sample clearly defined?
2. Were the study subjects and the setting described in detail?
3. Was the exposure measured in a valid and reliable way?
4. Were objective, standard criteria used for measurement of the condition?
5. Were confounding factors identified?
6. Were strategies to deal with confounding factors stated?
7. Were the outcomes measured in a valid and reliable way?
8. Was appropriate statistical analysis used?

**Table of critical appraisal scores from randomised controlled trials**

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
Suppan et al 2021	Y	Y	Y	N/A	N/A	Y	Y	N	Y	Y	Y	Y	Y
Schmitz et al 2021	Y	Y	UC	N/A	N/A	UC	Y	N	Y	Y	Y	Y	UC

1. Was true randomization used for assignment of participants to treatment groups?
2. Was allocation to treatment groups concealed?
3. Were treatment groups similar at the baseline?
4. Were participants blind to treatment assignment?
5. Were those delivering treatment blind to treatment assignment?
6. Were outcomes assessors blind to treatment assignment?
7. Were treatment groups treated identically other than the intervention of interest?
8. Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analysed?
9. Were participants analysed in the groups to which they were randomized?
10. Were outcomes measured in the same way for treatment groups?
11. Were outcomes measured in a reliable way
12. Was appropriate statistical analysis used?
13. Was the trial design appropriate, and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?

### 3. Tool for assessing the confidence of synthesised findings from quantitative descriptive studies

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#### Adjustments to the GRADE process for quantitative surveys (cross-sectional; no comparison groups for outcomes/phenomena of interest)

##### A. Levels of quality of study findings

High quality: It is highly likely that new evidence *will not* substantially modify the study findings.

Moderate quality: It is somewhat likely that new evidence *will not* substantially modify the study findings.

Low quality: It is somewhat likely that new evidence *will* substantially modify the study findings.

Very low quality: It is highly likely that new evidence *will* substantially modify the study findings.

##### B. Factors that can *reduce* the quality of study findings

###### *Limitations in study design or execution*

We are more confident about the high quality of study results, when we have:

- . High validity and reliability of measurement of variables
- . Attention to minimization of confounding variables, through, for example, use of control variables

###### *Inconsistency of results*

We are more confident about the high quality of study results, when we have:

- . Homogeneity in the results across disaster types, national/cultural boundaries, etc.
- . Heterogeneity of results, if present, has a plausible explanation

###### *Indirectness of evidence*

We are more confident about the high quality of study results, when we have direct evidence, which is:

- . Direct - data are from affected populations, currently or in the past.
- . Less direct - data from populations who may be likely to be affected in the future.
- . Least direct - data from populations unlikely to be affected in the future
- . Study variables directly speak to question of interest and outcomes of interest

###### *Imprecision of results*

We are more confident about the high quality of study results, when results are more precise, which is:

- . Effect size is at least .20
- . Confidence interval (CI) does not contain a 0
- . Sample size is at least 200, if single group

###### *Publication bias \* (for a finding collated across multiple quantitative studies)*

We are more confident about the high quality of results collated as a finding across individual studies, when:

- . There is at least one study that shows nonsignificant/null results



#### 4. Evaluation of confidence using GRADE

Table of evaluation of confidence using an adapted version GRADE for descriptive studies

Citation Outcome	Limitations	Imprecision	Indirectness	Inconsistency	Quality
Arrogante et al. 2021 Competency	Serious limitations Rate down one level (Confounding not accounted for and baseline levels of the outcome of interest were not controlled for)	Very serious imprecision Rate down by two levels (Sample size under 200 and no CIs presented)	No serious indirectness	No serious inconsistency	Very Low (Due to serious limitations and very serious imprecision)
Cowart et al. 2000 Competency	Serious limitations Rate down one level (Confounding not accounted for and Likert scale not appropriate)	Very serious imprecision Rate down by two levels (Sample size under 200 and no CIs presented)	No indirectness	No serious inconsistency	Very Low (Due to serious limitations and very serious imprecision)
Cowart et al. 2000 Confidence	No serious limitations Do not downgrade (Confounding not accounted for)	Very serious imprecision Rate down by two levels (Sample size under 200 and no CIs presented)	No indirectness	No serious inconsistency	Low (Due to very serious imprecision)
Darici et al. 2021 Knowledge	Serious limitations Rate down one level (Confounding not accounted for, baseline levels of the outcome of interest were not controlled for)	Serious imprecision Rate down by one level (Sample size under 200)	No serious indirectness	No serious inconsistency	Low (Due to serious limitations and serious imprecision)
Harendze et al. 2020 Confidence	Serious limitations Rate down one level	Very serious imprecision	No serious indirectness	No serious inconsistency	Very Low

	(Confounding not accounted for and baseline levels of the outcome of interest were not controlled for)	Rate down by two levels (Sample size under 200 and no CIs presented)			(Due to serious limitations and very serious imprecision)
Kanzow et al. 2021 Knowledge	No serious limitations Do not downgrade (Confounding not accounted for)	Very serious imprecision Rate down by two levels (Sample size under 200 and no CIs presented)	No serious indirectness	No serious inconsistency	Low (Due to very serious imprecision)
Kasai et al. 2021 Competency	Serious limitations Rate down one level (Confounding not accounted for and Likert scale not appropriate)	Very serious imprecision Rate down by two levels (Sample size under 200 and no CIs presented)	No serious indirectness	No serious inconsistency	Very Low (Due to serious limitations and very serious imprecision)
Kawasaki et al. 2021 Knowledge	No serious limitations Do not downgrade (Confounding not accounted for)	Very serious imprecision Rate down by two levels (Sample size under 200 and no CIs presented)	No serious indirectness	No serious inconsistency	Low (Due to very serious imprecision)
Kawasaki et al. 2021 Competency	Serious limitations Downgrade by one level (Confounding not accounted for and Likert scale not appropriate)	Very serious imprecision Rate down by two levels (Sample size under 200 and no CIs presented)	No serious indirectness	No serious inconsistency	Very Low (Due to very serious limitations and very serious imprecision)
Kawasaki et al. 2021 Confidence	No serious limitations Do not downgrade	Very serious imprecision	No serious indirectness	No serious inconsistency	Low

	(Confounding not accounted for)	Rate down by two levels (Sample size under 200 and no CIs presented)			(Due to very serious imprecision)
Kim et al. 2020 Knowledge	No serious limitations Do not downgrade (Confounding not accounted for)	Very serious imprecision Rate down by two levels (Sample size under 200 and no CIs presented)	No serious indirectness	No serious inconsistency	Low (Due to very serious imprecision)
Martini et al. 2021 Confidence	No serious limitations Do not downgrade (Confounding not accounted for)	Very serious imprecision Rate down by two levels (Sample size under 200 and no CIs presented)	No serious indirectness	No serious inconsistency	Low (Due to very serious imprecision)
Monday et al. 2020 Confidence	No serious limitations Do not downgrade (Confounding not accounted for)	Very serious imprecision Rate down by two levels (Sample size under 200 and no CIs presented)	No serious indirectness	No serious inconsistency	Low (Due to very serious imprecision)
Monday et al. 2020 Knowledge	No serious limitations Do not downgrade (Confounding not accounted for)	Very serious imprecision Rate down by two levels (Sample size under 200 and no CIs presented)	No serious indirectness	No serious inconsistency	Low (Due to very serious imprecision)
Nathaniel and Black 2021	Serious limitations Rate down one level	Very serious imprecision	No serious indirectness	No serious inconsistency	Very Low

	(Confounding not accounted for and baseline levels of the outcome of interest were not controlled for)	Rate down by two levels (Sample size under 200 and no CIs presented)			(Due to very serious limitations and very serious imprecision)
Nijakowski et al. 2021 Knowledge	Very serious limitations Rate down two levels (Confounding not accounted for, Likert scale not appropriate and baseline levels of the outcome of interest were not controlled for)	Very serious imprecision Rate down by two levels (Sample size under 200 and no CIs presented)	No serious indirectness	No serious inconsistency	Very Low (Due to very serious limitations and very serious imprecision)
Nijakowski et al. 2021 Skills	Very serious limitations Rate down two levels (Confounding not accounted for, Likert scale not appropriate and baseline levels of the outcome of interest were not controlled for)	Very serious imprecision Rate down by two levels (Sample size under 200 and no CIs presented)	No serious indirectness	No serious inconsistency	Very Low (Due to very serious limitations and very serious imprecision)
Pang et al. 2021 Competency	Very serious limitations Rate down two levels (No confounding and no controlling for baseline levels of the outcome of interest -retrospective assessment only and Likert scale not appropriate)	Very serious imprecision Rate down by two levels (Sample size under 200 and no CIs presented)	No serious indirectness	No serious inconsistency	Very Low (Due to very serious limitations and very serious imprecision)
Phillips et al. 2021 Knowledge	Serious limitations Rate down one level (Confounding not accounted for and baseline levels of the outcome of interest were not controlled for)	Very serious imprecision Rate down by two levels (Sample size under 200 and no CIs presented)	No serious indirectness	No serious inconsistency	Very Low (Due to very serious limitations and very serious imprecision)
Phillips et al. 2021 Competency	Very serious limitations Rate down two levels	Very serious imprecision	No serious indirectness	No serious inconsistency	Very Low

	(Confounding not accounted for, Likert scale not appropriate and baseline levels of the outcome of interest were not controlled for)	Rate down by two levels (Sample size under 200 and no CIs presented)			(Due to very serious limitations and very serious imprecision)
Phillips et al. 2021 Confidence	Serious limitations Rate down one level (Confounding not accounted for and baseline levels of the outcome of interest were not controlled for)	Very serious imprecision Rate down by two levels (Sample size under 200 and no CIs presented)	No serious indirectness	No serious inconsistency	Very Low (Due to very serious limitations and very serious imprecision)
Qaranto et al. 2021 Confidence	Serious limitations Downgrade by one level (Confounding acknowledged but not accounted for and details of outcome measures not reported)	Very serious imprecision Rate down by two levels (Sample size under 200 and no CIs presented)	No serious indirectness	No serious inconsistency	Very low (Due to serious limitations and very serious imprecision)
Redinger and Greene 2021 Knowledge	Serious limitations Rate down one level (Confounding not accounted for and baseline levels of the outcome of interest were not controlled for)	Very serious imprecision Rate down by two levels (Sample size under 200 and no CIs presented)	No serious indirectness	No serious inconsistency	Very low (Due to serious limitations and very serious imprecision)
Rosenthal et al. 2021 Confidence	No serious limitations Do not downgrade (Confounding not accounted for)	Very serious imprecision Rate down by two levels (Sample size under 200 and no CIs presented)	No serious indirectness	No serious inconsistency	Very low (Due to serious limitations and very serious imprecision)
Scoular et al. 2021 Skills	Very serious limitations Rate down two levels	Very serious imprecision	No serious indirectness	No serious inconsistency	Very Low

	(No confounding and no controlling for baseline levels of the outcome of interest)	Rate down by two levels (Sample size under 200 and no CIs presented)			(Due to very serious limitations and very serious imprecision)
Singh et al. 2020 Knowledge	Very serious limitations Rate down two levels (No confounding and no controlling for baseline levels of the outcome of interest)	Very serious imprecision Rate down by two levels (Sample size under 200 and no CIs presented)	No serious indirectness	No serious inconsistency	Very Low (Due to very serious limitations and very serious imprecision)
Singh et al. 2020 Confidence	No serious limitations Do not downgrade (Confounding not accounted for)	Very serious imprecision Rate down by two levels (Sample size under 200 and no CIs presented)	No serious indirectness	No serious inconsistency	Low (Due to very serious imprecision)
Totlis et al. 2021 Knowledge	Very serious limitations Rate down two levels (No confounding and no controlling for baseline levels of the outcome of interest)	Serious imprecision Rate down by one level (no CIs presented)	No serious indirectness	No serious inconsistency	Very Low (Due to very serious limitations and serious imprecision)
Weston et al. 2020 Knowledge	Very serious limitations Rate down two levels (No confounding and no controlling for baseline levels of the outcome of interest)	Serious imprecision Rate down by one level (Sample size under 200)	No serious indirectness	No serious inconsistency	Very Low (Due to very serious limitations and serious imprecision)

Publication bias was not relevant

We did not downgrade based on the absence of identifying and/or dealing with confounding factors

GRADE evidence profile - Limitations

Citation	Start	Randomisation	Allocation concealment	Blinding	Loss to follow up
Schmitz et al. 2021	Low risk of bias No serious limitations	Yes	Yes	N/A	Yes Of the 58 students initially randomized, 44 students (75% female) completed the study. In the control group, data from 23, in the test group, data from 21 students remained for analysis No analysis of differences undertaken
Suppan et al. 2021	Low risk of bias No serious limitations	Yes	Yes	N/A	Yes Numbers completing course evaluation E learning module (n=35/79; rr 44.3%) Video group (26/79; rr 32.9%). No analysis of differences undertaken

Table of evaluation of confidence using GRADE for RCTs

Citation	Limitations	Imprecision	Indirectness	Inconsistency	Quality
Schmitz et al. 2021 Knowledge	Serious limitations Rate down one level Students lost to follow up and not accounted for in any analysis	Very serious imprecision Rate down two levels Small sample size and no CI presented	No serious indirectness	Not relevant	Very Low
Suppan et al. 2021 Knowledge	Serious limitations Rate down one level Students lost to follow up and not accounted for in any analysis	Serious imprecision Rate down one level Small sample size	No serious indirectness	Not relevant	Low

## 5. Excluded studies

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### Excluded on full text screening

#### Description of innovations only

1. Gallenga et al 2021: Virtual learning solutions in COVID-19 era: University Italian Ophthalmology department perspective  
*Reason for exclusion:* No outcome data

#### Wrong study design

2. Osbourne et al 2021: Using medical reality television as a technology-enhanced learning strategy to provide authentic patient care experiences during clinical placements: a case study research investigation  
*Reason for exclusion:* Qualitative study
3. Neumann-Podczaska 2021: An experimental education project for consultations of older adults during the pandemic and healthcare lockdown  
*Reason for exclusion:* Qualitative study

#### Non-OECD countries

4. Alsharif et al 2020: Effectiveness of whatsapp as a part of a hybrid learning environment: An opportunity for post-covid-19 pandemic pedagogy  
*Reason for exclusion:* non-OECD country - Taibah University Dental College, Saudi Arabia
5. Alamer and Alharbi 2021: Synchronous distance teaching of radiology clerkship promotes medical students' learning and engagement  
*Reason for exclusion:* non-OECD country: Qassim University, Saudi Arabia
6. Dutta et al 2020: Evaluation of e-OSPE as compared to traditional OSPE: A pilot study  
*Reason for exclusion:* non-OECD country: All India Institute of Medical Sciences, India
7. Liu et al 2021: Medical morphology training using the Xuexi tong platform during the covid-19 pandemic: development and validation of a web-based teaching approach.  
*Reason for exclusion:* non-OECD country - China
8. Joshi et al 2021: A comparative evaluation of students' insight of face-to-face classroom lectures and virtual online lectures  
*Reason for exclusion:* non-OECD country – India
9. Eurboonyanun et al 2021: Adaptation to open-book online examination during the COVID-19 pandemic  
*Reason for exclusion:* non-OECD country – Thailand



10. Foo et al 2021: A comparative study regarding distance learning and the conventional face-to-face approach conducted problem-based learning tutorial during the COVID-19 pandemic  
*Reason for exclusion:* non-OECD country – Hong Kong
11. Jiang and Ning 2021: The impact and evaluation of COVID-19 pandemic on the teaching model of medical molecular biology course for undergraduates major in pharmacy  
*Reason for exclusion:* Xi'an Jiaotong University Health Science Center, Xi'an, China
12. Rehman et al 2021: An innovation in Flipped Class Room: A teaching model to facilitate synchronous and asynchronous learning during a pandemic  
*Reason for exclusion:* Pakistan
13. Zhou et al 2020: The distance teaching practice of combined mode of massive open online course micro-video for interns in emergency department during the COVID-19 epidemic period  
*Reason for exclusion:* Tongji Hospital Affiliated to Tongji Medical College of Huazhong University of Science and Technology, China

#### **Wrong professional group**

14. Ekert et al 2021: Medical student-led simulation in COVID-19 crisis  
*Reason for exclusion:* A training exercise for staff (doctors, nurses, healthcare assistants and domestic staff) redeployed to look after Covid patients.
15. Elsayes et al 2020: Online liver imaging course; pivoting to transform radiology education during the SARS-CoV-2 pandemic  
*Reason for exclusion:* Online liver imaging course for a mixture of practicing radiologists, fellows, residents or medical students and a pooled analysis conducted
16. Morgan et al 2021: Simulation via instant messaging – Birmingham advance (SIMBA): an innovative simulation-based learning model that helped to keep medical education continue during the COVID-19 pandemic  
*Reason for exclusion:* One page research summary and it is not clear who the participants were or how they were recruited
17. Sukumar et al 2021: Designing and implementing a novel virtual rounds curriculum for medical students' internal medicine clerkship during the COVID-19 pandemic  
*Reason for exclusion:* mixture of students, residents and attending and about perceptions and general evaluation

#### **Not primary research**

18. Song and Haley 2020: Initial student perspective on plastic surgery virtual away rotations  
*Reason for exclusion:* -one page opinion article
19. Oldenburg and Marsch 2020: Optimizing teledermatology visits for dermatology resident education during the COVID-19 pandemic  
*Reason for exclusion:* Letter

20. Wald et al 2021: Incorporating a virtual simulation exercise into the preclerkship undergraduate curriculum  
*Reason for exclusion:* Conference abstract
21. Ali et al 2021: Electronic learning for healthcare e-dermatology modules as a key educational tool for trainees during the COVID-19 pandemic: A regional experience  
*Reason for exclusion:* Letter
22. Ghassemi et al 2020: Summary of performance in a first-year, integrated, doctor of pharmacy course using on-campus versus on-line instruction: A curricular comparison in response to COVID-19  
*Reason for exclusion:* Conference proceedings
23. Goldhamer et al 2020: Can covid catalyze an educational Transformation? competency-based advancement in a crisis  
*Reason for exclusion:* On page opinion article
24. Asher et al 2021: Remote one-to-one virtual surgical skills training: Evolving the delivery of operative skills training in the UK  
*Reason for exclusion:* Conference poster
25. Kuo et al 2021: Efficacy of vascular virtual medical student education during the coronavirus disease 2019 pandemic  
*Reason for exclusion:* one page summary of research study
26. Ashrafzadeh et al 2021: Strategies for effective medical student education in dermatology during the COVID-19 pandemic  
*Reason for exclusion:* Letter
27. Kilpatrick et al 2021: Assessing the utility of online simulation software for medical student evaluation  
*Reason for exclusion:* Conference abstract
28. Liu et al 2021: A distance-learning approach to POCUS training curriculum: An innovative ultrasound educational response to the COVID-19 pandemic  
*Reason for exclusion:* Conference abstract
29. Dalton et al 2020: Effect of video conference clinics on medical education  
*Reason for exclusion:* Letter
30. Faiz et al 2020: Teaching Operative Surgery to Medical Students Using Live Streaming During COVID-19 Pandemic  
*Reason for exclusion:* Letter
31. Maeda et al 2020: Experience with online lectures about endoscopic sinus surgery using a video conferencing app  
*Reason for exclusion:* Letter

32. Singh et al 2020: Using simulation to assess cardiology fellow performance of transthoracic echocardiography: lessons for training in the COVID-19 pandemic  
*Reason for exclusion:* Letter
33. Shah et al 2020: In-person musculoskeletal exam demonstration by rheumatologist more effective than virtual powerpoint presentation in teaching internal medicine residents  
*Reason for exclusion:* Letter
34. Pascoe et al 2021: Sustaining medical education in a lockdown environment. Student perceptions of a free online access medical education platform as an adjunct to the traditional undergraduate curriculum during lockdown  
*Reason for exclusion:* Letter
35. Sam et al 2020: Digital clinical placement for medical students in response to covid-19  
*Reason for exclusion:* Letter
36. Torlinski et al 2020: Postgraduate education and specialty training in anaesthesia and intensive care medicine during the COVID-19 pandemic: experience from a large teaching hospital in the United Kingdom  
*Reason for exclusion:* Letter
37. Foral et al 2020: Evaluation of an introductory pharmacy practice experience to reinforce student learning and increase student confidence immediately prior to advanced pharmacy practice experiences Amid a COVID-19 pandemic  
*Reason for exclusion:* Conference abstract
38. Park et al 2021: Simulation during the COVID-19 pandemic: A novel approach to increase trainee access with video  
*Reason for exclusion:* Conference abstract
39. Horn and McFarland 2021: "Escape the trauma room": A simulated learning experience  
*Reason for exclusion:* Conference poster
40. Ng et al 2021: Innovative pedagogical methods of delivering regular pediatrics online education within a hospital setting during COVID-19 pandemic  
*Reason for exclusion:* Conference poster
41. Zaver et al 2021: Remote surgical education for medical students at UK universities in the time of COVID-19  
*Reason for exclusion:* Conference poster
42. Yiannakopoulou and Fasoï 2021: Web based course of pharmacokinetics for teaching undergraduate nursing students during COVID-19 pandemic  
*Reason for exclusion:* Conference poster
43. Cosimetti and Thompson 2020: Evaluating online undergraduate geratology teaching at the University of Oxford Medical School during the Covid 19 pandemic

*Reason for exclusion:* Conference poster

44. Wilken et al 2021: Effectiveness of e-learning module vs Echo360 on interpreting panoramic radiographs

*Reason for exclusion:* Conference poster

45. Lara et al 2020: Remote assessment of clinical skills during COVID-19: A virtual, high-stakes, summative pediatric objective structured clinical examination

*Reason for exclusion:* Research in brief one page article with no sample details

46. Roy and Cecchini 2020: Implementing a structured digital-based online pathology curriculum for trainees at the time of COVID-19

*Reason for exclusion:* one page description of implementation

47. Nadgir et al 2020: teaching remotely: educating radiology trainees at the workstation in the COVID-19 era

*Reason for exclusion:* Opinion article

**Small samples with inappropriate statistical analysis or no statistical analysis**

48. Devaro et al 2021: Ophthalmology education in COVID-19: A remote elective for medical students

*Reason for exclusion:* n=18, used non parametric statistics

49. Steehler et al 2021: Implementation and evaluation of a virtual elective in Otolaryngology in the time of COVID-19

*Reason for exclusion:* n=5, completed the pre-test and post-test survey

50. Durfee et al 2020: Medical student education roadblock due to covid-19: virtual radiology core clerkship to the rescue

*Reason for exclusion:* No analytical statistics conducted

51. Belfi et al 2021: Medical student education in the time of COVID-19: A virtual solution to the introductory radiology elective

*Reason for exclusion:* n=26, completed the pre-test and post-test survey

52. Bode et al 2021: Interprofessional learning during SARS-CoV-2 (COVID-19) pandemic conditions: the learning project I-reCovEr as a substitute for a rotation on an interprofessional training ward

*Reason for exclusion:* n= 6 student nurses and n=9 medical students completed the pre-test and post-test survey

53. Atli et al 2020: A comprehensive multicomponent neurosurgical course with use of virtual reality: modernizing the medical classroom

*Reason for exclusion:* n=12 completed the pre-test and post-test survey

54. Singhal 2021: Facilitating virtual medicinal chemistry active learning assignments using advanced zoom features during COVID-19 campus closure

*Reason for exclusion:* The authors stated that statistical analysis was performed but this was not reported

55. De Pietro et al 2020: Medical student education during the COVID-19 pandemic: Initial experiences implementing a virtual Interventional radiology elective course  
*Reason for exclusion:* n=10 and n=7 completed post-test survey –knowledge of what interventional radiologists do and the procedures they perform
56. Fritsche et al 2020: Use of simulation patients in the third section of the medical examination  
*Reasons for exclusion:* Comparison of exam grades between 2019 and 2020 cohorts but no statistical analysis conducted
57. Huber et 2021: The use of the online Inverted Classroom Model for digital teaching with gamification in medical studies  
*Reason for exclusion:* General evaluation but no actual sample details or results reported just that the Inverted classroom model does not lead to worse results
58. Kahn et al 2021: Increasing medical student engagement through virtual rotations in radiation oncology  
*Reason for exclusion:* n=12 completed the pre-test and post-test survey
59. Kiles et al 2021: Development of a remote public health advanced pharmacy practice experience in response to COVID-19  
*Reason for exclusion:* n=16 completed the pre-test and post-test survey
60. Krawlec and Myers 2020: Remote assessment of video-recorded oral presentations centered on a virtual case-based module: A COVID-19 feasibility study  
*Reason for exclusion:* n=12; post test assessment
61. Manalo et al 2020: A strategy for undergraduate medical education in urology during the COVID19 pandemic  
*Reason for exclusion:* n=9 completed the pre-test and post-test survey
62. Krasowski et al 2021: Teaching pathology in an integrated preclinical medical school curriculum and adaptations to COVID-19 restrictions  
*Reason for exclusion:* Discussion of a change in curriculum pre COVID and how that could be adapted
63. Warren et al 2021: Using online simulation experiences to increase student nurses' confidence  
*Reason for exclusion:* Confidence measured but no statistical analysis conducted
64. Blythe et al 2021: Undertaking a high stakes virtual OSCE ("VOSCE") during Covid-19  
*Reason for exclusion:* n=9, just states that six students passed the VOSCE
65. Looi et al 2021: Conduct and evaluation of final-year medical student summative assessments in Psychiatry and Addiction Medicine during COVID-19: an Australian University Medical School experience  
*Reason for exclusion:* No statistical analysis conducted

66. Kronenfeld et al 2020: Medical student education during COVID-19: Electronic education does not decrease examination scores  
*Reason for exclusion:* Under 30 students in each cohort

67. Reynolds et al 2020: Educational methods and technological innovations for introductory experiential learning given the contact-related limitations imposed by the SARS-CoV2/COVID-19 pandemic  
*Reason for exclusion:* n=6; post test assessment

68. Shin et al 2020: Efficacy of virtual case-based general surgery clerkship curriculum during covid-19 distancing  
*Reason for exclusion:* n=16, post test assessment

69. Seifert et al 2021:  
*Reason for exclusion:* statistical analysis conducted for exam scores but mean scores not presented

#### **Wrong study design: Post-test only**

70. Gomez et al 2020: Innovation born in isolation: rapid transformation of an in-person medical student radiology elective to a remote learning experience during the covid-19 pandemic  
*Reasons for exclusion:* post test only; n=116, all students passed

71. White et al 2021: Continuing undergraduate pathology medical education in the coronavirus disease 2019 (COVID-19) Global pandemic: the Johns Hopkins virtual surgical pathology clinical elective  
*Reason for exclusion:* Post-test only, n=not specified, Just states that all students received a final pass grade

72. Williams et al 2021: Adapting to the educational challenges of a pandemic: development of a novel virtual urology sub internship during the time of COVID-  
*Reason for exclusion:* n=10, post assessment only

#### **Pre COVID or not COVID related**

73. Ceri et al 2021: Effect of non-cadaveric methods on the anatomy education of medical students  
*Reason for exclusion:* The aim is to explore alternative methods of teaching anatomy because of a shortage of cadavers

74. Rohle et al 2021: Practical teaching in undergraduate human and dental medical training during the COVID-19 crisis. Report on the COVID-19-related transformation of peer-based teaching in the Skills Lab using an Inverted Classroom Model  
*Reason for exclusion:* Research conducted pre COVID and no outcomes of interest

75. Salameh et al 2020: Effects of a complex case study and high-fidelity simulation on mechanical ventilation on knowledge and clinical judgment of undergraduate nursing students  
*Reason for exclusion:* Research conducted pre COVID

76. Yakin and Linden 2021: Adaptive e-learning platforms can improve student performance and engagement in dental education  
*Reason for exclusion:* Research conducted pre COVID

77. Kim et al 2020: Effects of the non-contact cardiopulmonary resuscitation training using smart technology  
*Reason for exclusion:* Data were collected from 13 June 2016 to 9 June 2017

78. Poncette et al 2020: Undergraduate medical competencies in digital health and curricular module development: Mixed methods study  
*Reason for exclusion:* Digital Health module developed over 2 years and implemented for the first time in January 2020

### **Wrong outcomes**

79. Cooke et al 2021: Developing a blended learning postgraduate teaching programme in anaesthesia: pandemic and beyond  
*Reason for exclusion:* Experience and satisfaction

80. Johnston et al 2021: Implementation and evaluation of a virtual learning advanced pharmacy practice experience  
*Reason for exclusion:* Survey of perceptions and experiences

81. Nolan et al 2021: Changes to summative skills-based assessments within the Big Ten Academic Alliance Performance-Based Assessment Collaborative (BTAA-PBAC) due to COVID-19  
*Reason for exclusion:* Experience of pharmacy skills lab coordinators when transitioning summative skills-based assessments

82. Austin et al 2020: COVID-19 educational innovation: Hybrid in-person and virtual simulation for emergency medicine trainees  
*Reason for exclusion:* Satisfaction

83. Hampshire et al 2020: Medical school in the era of COVID-19: Innovations in direct near peer teaching of immunology/microbiology content during the pandemic  
*Reason for exclusion:* Student experience

84. Allande-Cusso et al 2020: Creating learning scenarios for final-year nursing students during the COVID-19 pandemic  
*Reason for exclusion:* Knowledge about how to treat COVID-19 patients

85. Armon et al 2021: The efficacy of different types of pedagogical methods used such as lectures, discussions, and PBL sessions using 5 point Likert scales  
*Reason for exclusion:* Survey related to satisfaction and challenges

86. Carmody et al 2020: Preparing for work-integrated learning during COVID-19: How a new virtual orientation tool facilitated access for all  
*Reason for exclusion:* Survey related to satisfaction and critical reflection of the teaching

87. Yang et al 2021: A telesimulation elective to provide medical students with pediatric patient care experiences during the COVID pandemic  
*Reason for exclusion: Survey related to satisfaction and experience*
88. Tanaka et al 2021: Perceptions of a remote learning pathology elective for advanced clinical medical students  
*Reason for exclusion: Student engagement -and overall quality*
89. Pettit-Schieber et al 2021: Implementation and evaluation of eight virtual surgical electives for medical students during the COVID-19 pandemic. Levels of comfort, interest in pursuing career and understanding of speciality  
*Reason for exclusion: Levels of comfort, interest in pursuing career and understanding of speciality*
90. Donn et al 2020: A pilot of a Virtual Objective Structured Clinical Examination in dental education. A response to COVID-19  
*Reason for exclusion: Pilot study with 3 students describing the planning and organisation of an OSCE in dentistry and commenting on feasibility and acceptability to students and staff*
91. Friedlander et al 2021: Diversity in reproductive health and human sexuality: assessing attitudes comfort and knowledge in learners before and after pilot curriculum  
*Reason for exclusion: Workshop in sexual and reproductive health piloted for 2 years because it was thought to be lacking in the regular syllabus and how confident students felt afterwards with discussing this topic*
92. Guinez-Molinis 2021: Collaborative clinical scenarios for medical students: Viewpoint  
*Reason for exclusion: Design and development of a web platform (not specially COVID related)*
93. Gulati et al 2021: Virtually prepared! Student-led online clinical assessment  
*Reason for exclusion: Experiences of using virtual platforms for learning and assessment process*
94. Hannan et al 2021: Designing and running an online Objective Structured Clinical Examination (OSCE) on Zoom: A peer-led example  
*Reason for exclusion: Design and implementation of online OSCE via zoom and general feedback via interview and online form*
95. Heinzmann et al 2021: Interactive, case-based seminars in the digitized pediatrics block internship from the students' perspective  
*Reason for exclusion: Acceptability of the mode of delivery and general usefulness 'Students said they learned a lot'.*
96. Jimenez-Rodriguez & Arrogante 2020: Simulated video consultations as a learning tool in undergraduate nursing: students' perceptions  
*Reason for exclusion: Satisfaction and perceptions*



97. Wands et al 2020: Positive outcomes of rapid freeware implementation to replace baccalaureate student clinical experiences  
*Reason for exclusion:* General evaluation of student experience
98. Karwat et al 2021: Transition of a collaborative in-person health care innovation course to online learning  
*Reason for exclusion:* Quality of the course, difficulty, instructor ability to engage with the students
99. Krasowski et al 2021: Teaching pathology in an integrated preclinical medical school curriculum and adaptations to COVID-19 restrictions  
*Reason for exclusion:* Quality of the course
100. Morgan et al 2021: Moving assessment online: Experiences within a school of pharmacy  
*Reason for exclusion:* Experiences and preferences
101. Nagjii et al 2020: Converting to connect: a rapid RE-AIM evaluation of the digital conversion of a clerkship curriculum in the age of COVID-19  
*Reason for exclusion:* User engagement and adoption
102. Phillips et al 2021: Slack as a virtual undergraduate dermatology community: a pilot study  
*Reason for exclusion:* Quantitative survey exploring the quality of the Slack platform and qualitative evaluation
103. Ross et al 2021: Teaching sexual history taking in health care using online technology: a PLISSIT-plus zoom approach during the coronavirus disease 2019 shutdown  
*Reason for exclusion:* General feedback and comments
104. Wish-Baratz et al 2020: Assessment of mixed-reality technology use in remote online anatomy education  
*Reason for exclusion:* General experiences and views presented as a research letter
105. Goob et al 2021: Dental education during the pandemic: Cross-sectional evaluation of four different teaching concepts  
*Reason for exclusion:* advantages/disadvantages, functionality and user satisfaction of three digital learning modalities
106. Byrnes et al 2021: Evaluation of an interactive virtual surgical rotation during the COVID-19 pandemic  
*Reason for exclusion:* General experience of the course
107. Savage et al 2021: Remote OSCE experience: What first year pharmacy students liked, learned, and suggested for future implementations.  
*Reason for exclusion:* Experience of undertaking remote OSCEs

108. Son et al 2020: Effects of S-PBL in maternity nursing clinical practicum on learning attitude, metacognition, and critical thinking in nursing students: A quasi-experimental design

*Reason for exclusion:* Wrong outcomes- critical thinking, attitude and metacognition

109. Goodacre et al 2021: An educational experiment resulting from COVID-19: The use of at-home waxing and webinars for teaching a 3-week intensive course in tooth morphology to first year dental students

*Reason for exclusion:* Students ability to complete high-quality waxing and number of A to D grades given

110. Rutledge et al 2020: Telehealth education: An interprofessional online immersion experience in response to COVID-19

*Reason for exclusion:* Preparing interprofessional teams of health care students (including social work and athletic training) to use telehealth during the pandemic and beyond

111. Silva et al 2021: Where do we go from here? Assessing medical students' surgery clerkship preparedness during COVID-19

*Reason for exclusion:* Preparedness after disruption due to COVID-19 and performance in shelf examinations

112. Stuart et al 2021: Building a handoff communication virtual experience for nursing students using virtual humans

*Reason for exclusion:* Comparison of metacognitive questions and metacognitive prompts strategies whilst viewing a nursing simulation video

113. Hope et al 2021: Candidates undertaking (invigilated) assessment online show no differences in performance compared to those undertaking assessment offline

*Reason for exclusion:* Comparison of online and in-person assessments

### **Non-English language**

114. Garcia-Seoane et al 2021: Changes in the Objective Structured Clinical Examination (OSCE) of University Schools of Medicine during COVID-19.

Experience with a computer-based case simulation OSCE (CCS-OSCE)

*Reason for exclusion:* English abstract – Spanish publication

### **Fellowship**

115. Arrighi et al 2021: Competency-Based Medical Education for Fellowship Training During the COVID-19 Pandemic

### **Residency**

116. Mouli et al 2020: Effectiveness of simulation based teaching of ventilatory management among non-anaesthesiology residents to manage COVID 19 pandemic - A Quasi experimental cross sectional pilot study

117. Cates et al 2020: Comparing the effectiveness of a virtual toxicology escape room at two emergency medicine residencies

118. Asselin et al 2021: Simulation of adult surgical cricothyrotomy for anesthesiology and emergency medicine residents: Adapted for COVID-19

119. Brooks et al 2020: A novel curriculum to improve resident knowledge and comfort with menopause care
120. Bhattacharyya et al 2021: Evaluating the effectiveness of the Imperial Femoral Intramedullary Nailing Cognitive Task Analysis (IFINCTA) tool in a real-time simulation setting (Distributed Interactive Simulation): A randomized controlled trial
121. Falfoul et al 2021: E-learning for Ophthalmology Training Continuity During COVID-19 Pandemic: Satisfaction of residents of Hedi Raies Institut of Ophthalmology of Tunis
122. Hoyt et al 2021: Implementation of a virtual learning and simulation curriculum for orthopaedic resident training during COVID and beyond
123. Dasgupta et al 2021: Impact of ophthalmic webinars on the resident's learning experience during COVID-19 pandemic: An insight into its present and future prospects
124. Bhattacharyya et al 2021: Evaluating the effectiveness of the Imperial Femoral Intramedullary Nailing Cognitive Task Analysis (IFINCTA) tool in a real-time simulation setting (Distributed Interactive Simulation): a randomized controlled trial
125. Fernandes Cabral et al 2020: Coronavirus Disease 2019 (COVID-19) and Neurosurgery Residency Action Plan: An Institutional Experience from the United States
126. Kwon et al 2020: Adapting Urology Residency Training in the COVID-19 Era
127. Miles et al 2021: Learning fundamentals of laparoscopic surgery manual skills: An institutional experience with remote coaching and assessment
128. Matalon et al 2020: Trainee and attending perspectives on remote radiology readouts in the era of the COVID-19 pandemic
129. Herbst et al 2021: A Virtual Reality Resident Training Curriculum on Behavioral Health Anticipatory Guidance: Development and Usability Study
130. Navia et al 2020: Adapting Plastic Surgery Residency Training During COVID-19: The Experience of a Chilean University Hospital
131. Pasricha et al 2020: Remote corneal suturing wet lab: microsurgical education during the COVID-19 pandemic
132. Gilhuly et al 2021: Bridging barriers: Assessing an innovative virtual geriatrics curriculum for family medicine residents during the COVID pandemic
133. McRoy et al 2020: Radiology Education in the Time of COVID-19: A Novel Distance Learning Workstation Experience for Residents
134. Asselin et al 2021: Simulation of adult surgical cricothyrotomy for anaesthesiology and emergency medicine residents: adapted for COVID-19