

# Managing resident workforce and residency training amid COVID-19 pandemic: Scoping review of adaptive approaches

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## Systematic Review

**Keywords:** Residency, COVID-19, SARS-CoV-2 didactic, clinical, surgery, accreditation

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# Abstract

**Introduction:** The impact of Covid-19 on the healthcare system and training is tremendous and unpredictable. In addition to service re-organization, teaching institutions will have to devise adaptive mechanisms to cope up with the disruption in medical education and residency training.

**Objective:** to review available adaptive residency training approaches and management of resident work force in different residency programs amid Covid-19 pandemic

**Methods and materials:** We searched for websites of different professional associations and international or national specialty accreditation institutions. We looked for English studies (any form), reviews or editorials, perspectives, short or special communications, and position papers on residency education during the COVID-19 pandemic. Additionally, we searched: MEDLINE, EMBASE, and Google Scholar using keywords. Data extraction was done by two independent reviewers using a customized tool that was developed to record the key information of the source that's relevant to the review question. The difference between the two authors on data extraction was resolved by discussion.

**Results:** We identified 13 documents reporting on residency education during pandemics. Three were articles, 5 short or special communications, and the rest editorials and perspectives. We divided the data obtained into six thematic areas: resident staffing, clinical education, surgical education, didactic teaching, research activity, and accreditation process.

**Conclusions:** Residency programs must reorganize the resident's staffing and provide appropriate training to ensure the health and safety of residents during the pandemics. There are feasible adaptive approaches of maintaining residency trainings in the domains of didactic teaching, clinical education and some research activities. Although some innovative virtual surgical skills training methods are implemented in limited surgical residency disciplines, their effectiveness is not well examined. Guidance and flexibility of the accreditation bodies in ensuring competency of residents is one component of the response to the Covid-19 pandemic.

## Introduction

The 2019–20 coronavirus pandemic is an ongoing pandemic of coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)(1). The outbreak was first identified in Wuhan, Hubei Province, China, in December 2019. The World Health Organization (WHO) declared the outbreak to be a Public Health Emergency of International Concern on 30 January 2020 and recognized it as a pandemic on 11 March 2020 (2, 3).

As part of international crises in the health care system, residency training programs are facing a novel challenge due to SARS-COV-2 and mitigation measures implemented. The Centers for Disease Control recently recommended avoiding any gatherings with more than 10 people (4). As a result, in-person academic activities, including teaching conferences, morbidity and mortality conferences, and simulation

labs should be avoided. In addition, rotations between different sites, even while remaining within the same institution, should be limited or canceled, as rotating through multiple hospitals may significantly increase the risk to residents, patients, and other healthcare personnel. Finally, the American College of Surgeons (ACS), and even many government institutions, are recommending against the continuation of elective surgery(5) and most facilities are minimizing participants in any operation to essential personnel only. These factors will undoubtedly decrease resident case volume. As a result, all pillars of residency education will be affected: clinical education, surgical education, didactics education. The same is true for the resident's research activity.

Many programs have restructured their call schedules to reduce their number of in-house residents, while others face the possibility of resident redeployment to service with greater demand (e.g., trauma, intensive care). Residents during their dedicated research years grapple with institutional suspensions of critical research activities, which threaten their scientific progress(6). Given all these sudden changes, residents, especially in the surgical discipline, will see a dramatic drop in their in-person exposure to all aspects of their education, with no clear endpoint. This might result in an overall reduction in the experience and competency of the residents posing a problem on the accreditation process. This presents an extreme challenge for consultants. Given the rapidly evolving situation, there have not yet any universal or multi-institutional recommendations.

These unfathomable circumstances require flexibility and creativity with novel interventions to ensure training is provided without compromising quality. These need to be done while maintaining the safety and wellness of the learner, educators, and patients. Although there is clearly no substitute for time in the operating room for surgical disciplines, residency programs have been quick to migrate the didactic components of the training curriculum online. Web-based educational platforms have become the frontier of innovation in the era of COVID-19. Learning experiences well suited for online platforms include video conferencing, lectures, case conferences, and journal clubs, among many others(7). There have also been efforts to ameliorate the for the diminished surgical exposure by implementing virtual surgery atlases, live surgical video(8).

Considering the above facts, we did a scoping review to synthesize evidence on adaptive (innovative) ways of maintaining residency education activities during the COVID-19 pandemic.

## Research Questions

1. What are available adaptive ways to continue residency clinical, didactic, and surgical teaching and research activity during COVID-19?
2. What are adaptive means (effective utilization of resident task force amid the Covid-19 pandemic) for resident staffing and clinical coverage maintaining safety and patient protection?
3. What is the guidance (response) regarding residency accreditation amid the Covid-19 Pandemic?

## Methods And Materials

## **Search strategy**

We searched for websites of different professional associations and international or national specialty accreditation institutions. We looked for the website and publication of the following: American Board of Orthopedic Surgery (ABOS), Association of American Medical Colleges

(AAMC), Accreditation Council for Graduate Medical Education (ACGME), American Board of Medical Specialties, American Board of Neurological Surgery, Congress of Neurological Surgeons, American Association of Neurological Surgeons, American College of Surgeons, Accreditation Council for Graduate Medical Education (ACGME), Council on Podiatric Medical Education (CPME), American Board of Obstetrics and Gynecology (ABOG), American Board of Radiology (ABR), European Board of Radiology (EBR), European Board of Ophthalmology (EBO), European Board of Urology (UBU) and European Board & College of Obstetrics and Gynecology (EBCOG).

In addition to searching the above professional associations and accreditation websites and publications, we also developed a search strategy using keywords residency, residents, education, training, COVID-19 to look for available documents. We searched the following databases: MEDLINE, EMBASE, and Google Scholar (Appendix 1, Table 1: Search strategy). The report included in this scoping review was prepared based on Preferred Reporting Items for a systematic scoping review (9). We considered the following inclusion criteria:

### **Population:**

We considered residents on training programs in different specialty programs.

### **Concepts:**

The review considered studies, reviews, position statements, or recommendations addressing the resident's education program during the COVID-19 pandemic.

### **Context**

The review considered worldwide documents/records addressing resident's education programs during the COVID-19 pandemic.

### **Types of documents/records.**

We included studies (any form), reviews or editorials, perspectives, short or special communications, and position papers on residency education during the COVID-19 pandemic. The search is limited to English and one year (considering the duration of the outbreak to be after December 2019).

### **Data extraction and synthesis.**

Data extraction was done by two independent persons using a customized tool that was developed to record the key information of the source that is relevant to the review question. The data extraction tool was developed for studies, reviews, and records related documents, consensus statements, and practice recommendations. Types of the document, timing of publication, and summary of recommendations were extracted. The difference between the two authors on data extraction was resolved by discussion. We looked for the resident's clinical teaching, didactic, and research activity during the COVID-19 pandemic. We categorized identified evidence into staffing, safety, and clinical coverage, clinical education, surgical education, didactic teaching, research activity, and accreditation process thematic areas, and the findings were described narratively (see Appendix 1, Table 2: Data extraction table).

**Table 1: Search conducted on May 2, 2020, MEDLINE (Ovid).**

Number	Search Query	Result.
1	("education, medical"[MeSH Terms] OR ("education"[All Fields] AND "medical"[All Fields]) OR "medical education"[All Fields] OR ("medical"[All Fields] AND "education"[All Fields])) AND ("COVID-19"[All Fields] OR "COVID-2019"[All Fields] OR "severe acute respiratory syndrome coronavirus 2"[Supplementary Concept] OR "severe acute respiratory syndrome coronavirus 2"[All Fields] OR "2019-nCoV"[All Fields] OR "SARS-CoV-2"[All Fields] OR "2019nCoV"[All Fields] OR (("Wuhan"[All Fields] AND ("coronavirus"[MeSH Terms] OR "coronavirus"[All Fields])) AND (2019/12[PDAT] OR 2020[PDAT]))	729
2	Limit 1 to English AND Human AND 1 year	300

**Table 2: Data abstraction form.**

### Intervention areas

Author	Staffing, safety, and clinical coverage.	Didactic education	Surgical education	Clinical education	Research activity.	Accreditation.
<b>Stambough et al</b>	Under emergency declaration residents give priority to patient care per hospital arrangement.	Virtual lectures and journal club	surgical video databases, such as the OVT and OVT plus cadaver and bone-substitute simulations	Suspend clinical teaching	Not reported	Suspended but states that graduation is left to the discretion of the program director.
<b>Bambakidis et al.</b>	Decreasing resident staffing to 50% of normal and allowing teams to rotate on for a week at a time.	Online education.	Surgical cases limited to one resident and the rest videoconference.	One resident in place and teleconference	Not stated	Not stated
<b>Tomlinson et al.</b>	Not reported	Virtual didactic	Neurosurgical Atlas and 3D models and web-based simulations.	-grand round webinars  -live interactive  Virtual Visiting Professor sessions	Not reported	Not reported.
<b>John R Potts</b>	Tele-supervision	Not reported	Not reported	Not reported	Not reported	postpone all scheduled and requested accreditation site visits
<b>Vargo et al</b>	Limited at hospital and consultation from home(rotation)	Virtual didactic	high-priority elective” robotic cases with intraoperative	Academic  Conference . morning sessions, journal club	Not specified.	Not stated.

surgical principles.

<b>Schwartz et al</b>	“active-duty inpatient” and “remotely-working.” (2-week cycle)	Protected time for virtual teaching	Virtual reality or simulation training.	post-clinic virtual conference between attendings and on-service residents (video-enabled telemedicine)	Video-enabled virtual research meetings	Not stated.
<b>Nassar et al</b>	3 exclusive patient care domains: inpatient, operative, and clinic rotating every 7 <sup>th</sup> day.	Not reported	Not reported	Not reported	Not reported	Not reported.
<b>Rakowsky et al</b>	Not reported.	Remote learning/virtual.	Not reported	email-based clinical vignettes with associated questions and clinical images.	Not reported.	Not reported
<b>Chong et al</b>	Safety assured residents divided into 2 groups, (every 1wk) with one group reporting to clinical service, and the other assigned to home learning; PPE,	Virtual learning	Not applicable	case-based conferences and lectures by videocast, online educational resources, teleconferencing,	Home-based	minimum requirements for graduation; readdressing credentialing requirements
<b>Crosby et al</b>	- appropriate	a nationwide	online training	Teleconferencing	a research curriculum	Additional didactic

	PPE, 2 groups (clinical activities, work from home).  -Mental health (virtual sessions for social connectedn ess)	didactic curriculum, virtual sessions	modules, skills labs	(not detailed)	implement ed.	sessions to make sure adequate KI according to ACGME
<b>Alvin et.al</b>	1wk on 1wk out the schedule  PPE	Digital learning resources  Online  virtual	Not applicable	virtual live or recorded conference s	Discuss with a mentor on other projects which can be done from home	Delayed examinatio n and credentialin g  Work with accreditati on bodies
<b>Amparore et.al.</b>	Not reported	Not reported	Tele mentoring of surgical procedures  simulation	Telemedicin e	Not reported	Not reported
<b>Robert Connor et.al</b>	Maintain the safety of residents	-flipped virtual classroom  - Teleconfere ncing	-online practice questions,  - simulation lab and  - facilitated use of surgical videos	- telemedicin e clinics with resident  - Tele-  conferenci ng	Not reported	Not reported

## Results

We reviewed different websites, PubMed, EMBASE, and Google Scholar. The search yielded a total of 404 records. After removing duplicates, 320 documents were retained for further examination. After screening the titles and abstracts, 34 papers were retained for full-text review. Based on pre-defined inclusion criteria, 13 records were included in the scoping review (Fig 1).

### Characteristics of included records/documents.

We retained 13 documents for scoping review according to predefined inclusion criteria. Three were articles, 5 short or special communications and the rest editorials and perspectives (See Table 3 below)

**Table 3: characteristics of included documents or records.**

Record/document/ Corresponding Author	Type of document.	Country and affiliate institution	Type of residency training.	Areas of intervention.
<b>Stambough et al(10)</b>	Short communication.	USA (related to America Board Orthopedic Surgery)	Orthopedic surgery.	-Accreditation. -Clinical teaching -Didactic (virtual lectures and journal clubs) -surgical teaching.
<b>Bambakidis et al (11)</b>	Editorial.	University Hospitals Cleveland Medical Center, USA	Neurosurgery	Clinical education Didactic teaching Surgical education Resident staffing.
<b>Tomlinson (8)</b>	Editorial.	University of Rochester Medical Center, New York/USA and Indiana University, Indianapolis, Indiana	Neurosurgery	Clinical education Didactic teaching Surgical education
<b>John R Potts(12)</b>	Special article	USA, ACGME	Accreditation council for all.	Accreditation. Resident staffing
<b>Vargo et al (13)</b>	Short communication.	Cleveland Clinic Akron General Urology Residency Program's	Urology surgery.	Clinical education Didactic teaching Surgical education Resident staffing.
<b>Schwartz et al (6)</b>	Short communication	Department of Orthopedics, Emory University School of Medicine, USA.	orthopedic surgery	Clinical education Didactic teaching

				Surgical education Resident staffing. Research activity.
<b>Nassar et al (14)</b>	Special Communication	Department of Surgery, University of Washington, USA	General Surgery Residency	Resident staffing.
<b>Rakowsky et al (15)</b>	Short communication	Israel Deaconess Medical Center	Internal Medicine Program	Didactic teaching Clinical education.
<b>Chong et al (16)</b>	Article	US, UC San Diego School of Medicine	Radiology	Clinical teaching Didactic (virtual lectures and journal clubs) The resident Taskforce and safety Research Accreditation
<b>Crosby et al (17)</b>	Article	The US, Southern Illinois University School of Medicine	Otolaryngology	Surgical education Accreditation Resident Safety Research Didactic Clinical education
<b>Alvin et.al (18)</b>	Perspectives	US, 4 radiology programs	Radiology	Taskforce Mx Didactic Clinical Research accreditation
<b>Amparore et.al(19)</b>	Article	Italy, all universities with urology programs	Urology	Surgery Clinical

## Key Findings:

- Residency directors must reorganize residents staffing to ensure health and safety during the pandemics, in addition to training residents on infection prevention in a clinical setting including appropriate use of personal protective equipment (PPE) and personal hygiene
- Ground round webinars live interactive virtual visiting professor sessions, virtual academic conference, case-based conferences and morning session webinar, journal club webinar, email-based clinical vignettes with associated questions and clinical images, virtual live or recorded conferences were being used for clinical education in a different residency program.
- Surgical video databases, cadaver and web-based simulations, virtual reality (VR) platforms, and tele mentoring of surgical procedures simulation were used as alternative hands-on training for residents during COVID-19 pandemics.
- Virtual didactics such as virtual lectures, journal clubs, flipped virtual classrooms, and teleconferences were viable alternatives for resident's didactic education.
- Video enabled virtual research meetings and encouraging residents working from home (nonclinical resident) to develop research projects or Practice Quality Improvement (PQI) projects with faculty during off-work time is recommended to maintain resident research activity during COVID-19 pandemics.

## Discussion

### 1. Staffing, safety and clinical service organization (resident safety, emotional and psychological integrity amid COVID-19)

Nine documents have reported on resident staffing and safety amid COVID-19(6, 10-14, 16-18). Reorganizing residents staffing to ensure health and safety during the pandemics is a priority. Besides residents must be trained in infection prevention in a clinical setting including appropriate use of personal protective equipment (PPE) and personal hygiene(16, 20). This training can be conducted online via different virtual platforms(10, 11, 20). Many recommend creating social media platforms communications such as Twitter, Instagram, and Slack to keep residents and staff stay in

communication with each other to ease fear and anxiety about the pandemic(16, 17). Crosby and Sharma on Otolaryngology residency training recommended virtual sessions for social connectedness to help residents suffering from the added mental tax of worrying about not only their own safety, but also for the safety of family, friends, colleagues, and patients(17). To preserve the workforce and minimize transmission of the virus among residents many residency programs have designed different innovative staffing mechanisms. Most of the resident staffing techniques amid COVID-19 involves significantly reducing the number of residents staying in hospital by dividing them into two groups and rotating every 1-2 weeks. One group involved in clinical service(active inpatient or on service group) and the other group will stay at home remotely providing tele supervision, consultation, and arrange different virtual teaching programs(6, 11-13, 16-18). Naser et al reported experience of restructuring of general surgery residents during pandemics into three exclusive groups (inpatient, operative, and clinic) rotating weekly to practice appropriate physical distancing and reduce the possibility of transmission among residents (14).

## **2. Resident clinical education (Morning, case presentations, bedsides, round, seminars (management session), journal club)**

Few residency programs suspend resident clinical teachings(10) while many residency training programs designed alternative innovative technologies to maintain resident clinical education during COVID-19 pandemic(6, 11, 13, 15-19). Bambakidis reported experience of neurosurgery at Cleveland Medical Center that one or two residents to be in place with patient discussion with the team by teleconference(11). Similarly, Schwartz et al recommended post-clinic virtual conference between attendings and on-service residents (video-enabled telemedicine) for clinical education(6). Ground round webinars live interactive virtual visiting professor sessions, virtual academic conference, case-based conferences and morning session webinar, journal club webinar, email-based clinical vignettes with associated questions and clinical images, virtual live or recorded conferences were being used for clinical education in a different residency program(8, 13, 15-19). In these different virtual teachings used in different residency programs, many recommended using different mechanisms such as using tools that promote interaction and audience participation, using the platform in which users can submit questions through a live chat function to decrease participant talk-over and allows for a more fluid presentation(7, 16)

## **3. Resident surgical education (Hands-on training).**

The shutdown of elective surgeries caused a significant decrease in the amount of time in the operating room which will not be replaced by simple academic conferences and telehealth. Many residency programs had instituted alternative surgical teaching methods during COVID-19(6, 8, 10, 11, 13, 17, 19). For example, Stambough et al reported on orthopedic surgical education by using surgical video databases, such as the Orthopedic Video Theater (OVT) and Orthopedic Video Theater plus (OVT plus), cadaver and bone-substitute simulations(10). Tomlinson reported Neurosurgical Atlas and 3D models and web-based simulations as innovative neurosurgical hands-on training amid COVID-19 at the University of Rochester Medical Center, New York(8). Neurosurgical Atlas is a free, online, multimedia resource focused on operative techniques and microsurgical anatomy. Vargo et al reported on the

experience of Cleveland Clinic on videoconference teaching of high-priority elective” robotic cases with intraoperative surgical principles for general urology residency program’s(13) Department of Orthopedics, Emory University School of Medicine are using virtual reality or simulation training for orthopedic surgical education. Surgical simulators and virtual reality (VR) platforms have been developed for total hip and total knee arthroplasty surgery(6). Tele mentoring of surgical procedures simulation, online training modules, skills labs, online practice questions and facilitated use of surgical videos were among other methods used for surgical education by different residency programs(7, 17, 19).

#### **4. Resident didactic teaching(Lectures)**

Nine of identified records reported on alternative virtual didactic residency education during COVID-19(6, 7, 10, 11, 13, 15-18). These virtual didactics include virtual lectures, journal clubs, flipped virtual classrooms, and teleconferences. The University of California uses novel methods of social-media-based Facebook platform group titled “ABSITE Daily,” to provide daily practice questions to prepare residents for the American Board of Surgery In-Training Examination (ABSITE). This platform not only allows for daily exposure to practice questions but also allows for another avenue of discussion of surgical topics without a requirement for in-person meetings(7).

#### **5. Resident research activity.**

Research has been suspended at many institutions with laboratory closures and IRB mandates to stop in-person participant visits during the pandemics. To overcome such factors, some residency programs are using alternative ways of continuing residency research programs (6, 16-18). Video enabled virtual research meetings and encouraging residents working from home (nonclinical resident) to develop research projects or Practice Quality Improvement (PQI) projects with faculty during off-work time is recommended. This can be done by video conference with their research mentor weekly to develop a plan. Southern Illinois University School of Medicine Otolaryngology Department is using such methods to maintain resident's research activity. They designed in a way that, at the end of each week, a virtual research meeting is held for all residents. One resident provides an in-depth update on their project and they review details of the research techniques and statistical analyses specific to that project(17). Four USA based radiology residency programs encourage trainees and their research mentors to have continued discussions regarding other projects able to be worked on during the pandemic, securing grant funding for future studies, and reshaping disrupted works-in-progress into publishable or presentable material so as not to lose value from the work already performed (18).

#### **6. Accreditation process.**

The pandemic is affecting the current accreditation process and will have an undue effect to get minimum case log or minimum activity volume (MAV) required to graduate and sit for board examinations(20). America Board of Orthopedic Surgery(ABOS) suspended all current accreditation process but states that graduation is left to the discretion of the program director(10). ABOS swiftly responded to the pandemic crisis by increasing the "time away" from residency training activities from 4

to 6 weeks per academic year to provide flexibility and also stressed that program directors to work to make sure residents meet Accreditation Council for Graduate Medical Education (ACGME) minimum case requirements necessary to graduate and sit for board examinations(10, 20). As of March 9, ACGME has also decided to indefinitely postpone all scheduled and requested accreditation site visits(20). The American Board of Radiology (ABR) has postponed the board certification exam until at least September 1, 2020 (21). Delayed graduation and credentialing might impact subsequent start time for incoming residents. Radiology and Otolaryngology residency programs in the USA suggested minimum requirement for graduation, using additional didactic sessions to fulfill the requirements and closely working with accreditation bodies and with their local clinical competency committee to solve the problems(16-18).

## Conclusions

### Implications for practice.

The undue effect of the COVID-19 pandemic on residency education is well recognized across many residency programs. Residency directors must reorganize residents staffing to ensure health and safety during the pandemics. Besides residents must be trained in infection prevention in a clinical setting including appropriate use of personal protective equipment (PPE) and personal hygiene. Different innovative alternative teaching methods were evolving to substitute the former face to face teaching to maintain residency didactic, clinical, surgical education, and research activity. During COVID-19 pandemic alternative teaching methods such as video teleconferencing, virtual lectures, virtual ground rounds, virtual case conferences, journal clubs webinars, E-learning modules, electronic textbooks, email-based clinical vignettes with associated questions and clinical images, live interactive virtual visiting professor sessions, web-based video platforms, Podcasts, Online blogs, Webinars, E-literature searches, surgical simulators, and virtual reality (VR) platforms can be used to maintain all pillars of residency education. Residency directors also must closely work with accreditation bodies and with their local clinical competency committee to solve easily the impact of COVID-19 on the accreditation process.

### Implications for research.

This scoping review is very timely putting together evidence for keeping residency education during the COVID-19 pandemic. The review also has its own limitation. The documents included in this scoping review were mainly from surgical areas such as orthopedics, neurosurgery, urology, otolaryngology, and radiology residency. Though most of the evidence applies to other residency programs it would be more valid if we synthesis evidence from available specific residency programs for generalizability. Therefore, we recommend the generation of more evidence on innovative alternative teaching methods used worldwide across different residency programs which might be used to shape future residency education.

## Declarations

## **Ethical Considerations.**

Formal ethical permissions are not required for this review and all data used is included in the manuscript and supplementary material.

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Not applicable.

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## **Conflicts of interest.**

The authors declare no conflict of interest in this review.

## **Authors' contribution.**

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Data curation: Lemi Belay Tolu, Wondimu Gudu Jeldu

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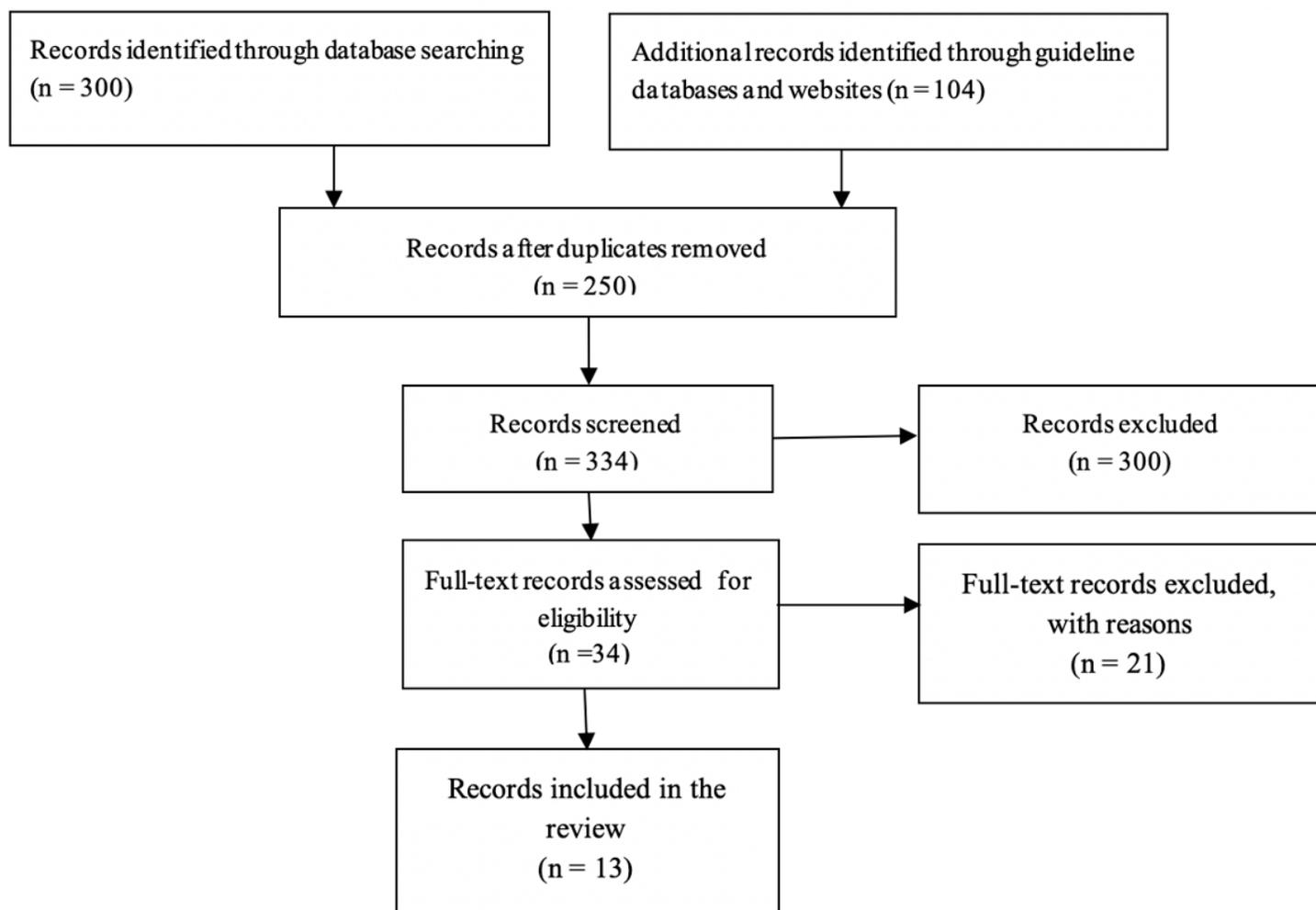
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## Figures



**Figure 1**

Prisma flow showing study selection process.

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [S1TableScopingreviewPRISMAchecklist.docx](#)