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Disability Training for Health Workers: A Global Evidence Synthesis

ABSTRACT

Background: Health worker training on disability is a recognized component of achieving high standards of health for people with disabilities, given that health worker's lack of knowledge, stigma, and negative attitudes towards people with disabilities act as barriers to high quality health care.

Objective: To understand the published literature on training health workers about disability.

Methods: We searched five databases for relevant peer-reviewed articles published between January 2012 and January 2021. Studies that focused on training health care workers to improve knowledge, confidence, self-efficacy, and competence to support people with physical, sensory, or intellectual impairments were included. Data about the details of the intervention (setting, participants, format, impact assessments, etc.) and its effects were extracted.

Results: There is an array of highly local tools to train health workers across stages of their training and careers (pre-service, in-service, and continuing professional development). Studies involving people with disabilities in the training, community placements, simulations, or interactive sessions were found to be most effective in improving knowledge, confidence, competency, and self-efficacy.

Conclusions: As part of initiatives to build inclusive health systems and improve health outcomes for people with disabilities, health workers around the world need to receive appropriate and evidence-based training that combine multiple methods and involve people with disabilities.

BACKGROUND

Human resources for health are at the heart of high-quality health systems. It is critical to improve health worker training to improve health care for populations that are systematically marginalized by health systems, such as people with disabilities. The World Health Organization (WHO) estimates that people with disabilities make up 15% of the world's population.¹ People with disabilities often face significant barriers to health care, including lack of accessible transport and facilities, limited financial protection, poor health worker attitudes that result in worse outcomes or limited health worker training on disability.² Even in countries where there is guaranteed universal access and financial protection, health workers' unfamiliarity with disability, or negative attitudes towards people with disabilities, can not only foster an unwelcoming environment, but also contribute to high rates of patient safety issues and poor quality care.¹

Health worker training on disability is a recognized component of achieving high standards of health for people with disabilities. While the UN Convention on the Rights of Persons with Disabilities (UNCRPD) Article 25³ has specific requirements on access to health care and SDG monitoring on health worker disability training, the recent World Health Assembly resolution most eminently highlights the role of health worker training in removing barriers to health care for people with disabilities.⁴ In addition, recent studies have highlighted the need to improve health care workers' attitudes, knowledge, and competency to provide care for people with disabilities. For example, a US study illustrated that just 40.7% of physicians were confident about providing care to patients with disabilities and most (82.4%) perceived that people with

significant disabilities have worse quality of life.⁵ Similarly, a study found that 87% of nursing students implicitly associated negative traits with physical disability,⁶ which may influence clinician behaviour. These studies illustrate the need to improve health workers' confidence, competency, attitudes, and comfort in treating patients with disabilities. Given these international agreements and recent studies, it is important that countries around the world begin to integrate disability training systematically and use examples of successful interventions as models.

This review directly builds on a previous review by Shakespeare and Kleine that explored health worker training on disability between 2000 and 2011.⁷ The study found that, while there are numerous interventions to teach medical professionals about disability, there are few common philosophical underpinnings, insufficient hands-on experience, and more opportunities to incorporate disability across the curriculum.⁷ Since this review, additional systematic reviews have examined health worker training on people with disabilities for certain populations of health workers⁸, certain impairments,⁹ or geographic areas. The existing piecemeal approach to disability inclusion in curricula limits the understanding and goal of having all health workers trained on disability. A broader definition of cadre, impairment, and geography is necessary to understand the full scope of best practices within health care on this topic. In addition to these reviews, there have been several calls to action to strengthen curricula around disability,^{10, 11} yet a concerted effort to integrate disability training into health worker curriculums around the world is still needed.

Given renewed international commitments to health worker training on disability and country-level plans in Australia¹² and the UK¹³ to train health workers on specific types of disability, it is

important to update Shakespeare and Kleine's review⁷ and outline the types of interventions to improve health worker's knowledge, confidence, self-efficacy, and competence in treating patients with disabilities. This study seeks to understand how all types of health workers are trained on disability. By understanding what training is available to health workers, we can evaluate the impact on key learner outcomes to further refine training. In turn, this can be evaluated in terms of patient health outcomes and econometric evaluations to adjust system-level policies and individual-level practices to improve care for people with disabilities. Ultimately, this review will help to understand the types of training that support positive and sustained improvements in service delivery for health workers serving people with disabilities.

METHODS

Search Strategy

Electronic searches were conducted for the EMBASE, Global Health, Medline, CINAHL, ASSIA and Web of Science databases between 18-19 January 2021. Search terms were developed in three domains: disability, health education, and health workers. Disability terms were general, focusing on various types of impairments; health education terms targeted aspects of health training (i.e., 'core competency', 'patient encounter', 'standardized patient', etc.); and health worker terms were developed using key terms from WHO's International Classifications of Health Workers.¹⁴ Terms were developed using MeSH, keywords, or equivalent as well as from other reviews on similar topics and searches were limited to papers in English, French, or Spanish. A full sample search strategy can be found in the ancillary materials (Supplementary **Material File 1**). These parameters and strategy were agreed upon by the authors and a research librarian before the search was conducted to ensure there were adequate words to capture articles across the three domains examined. The Preferred Reporting Items for Systematic Reviews and

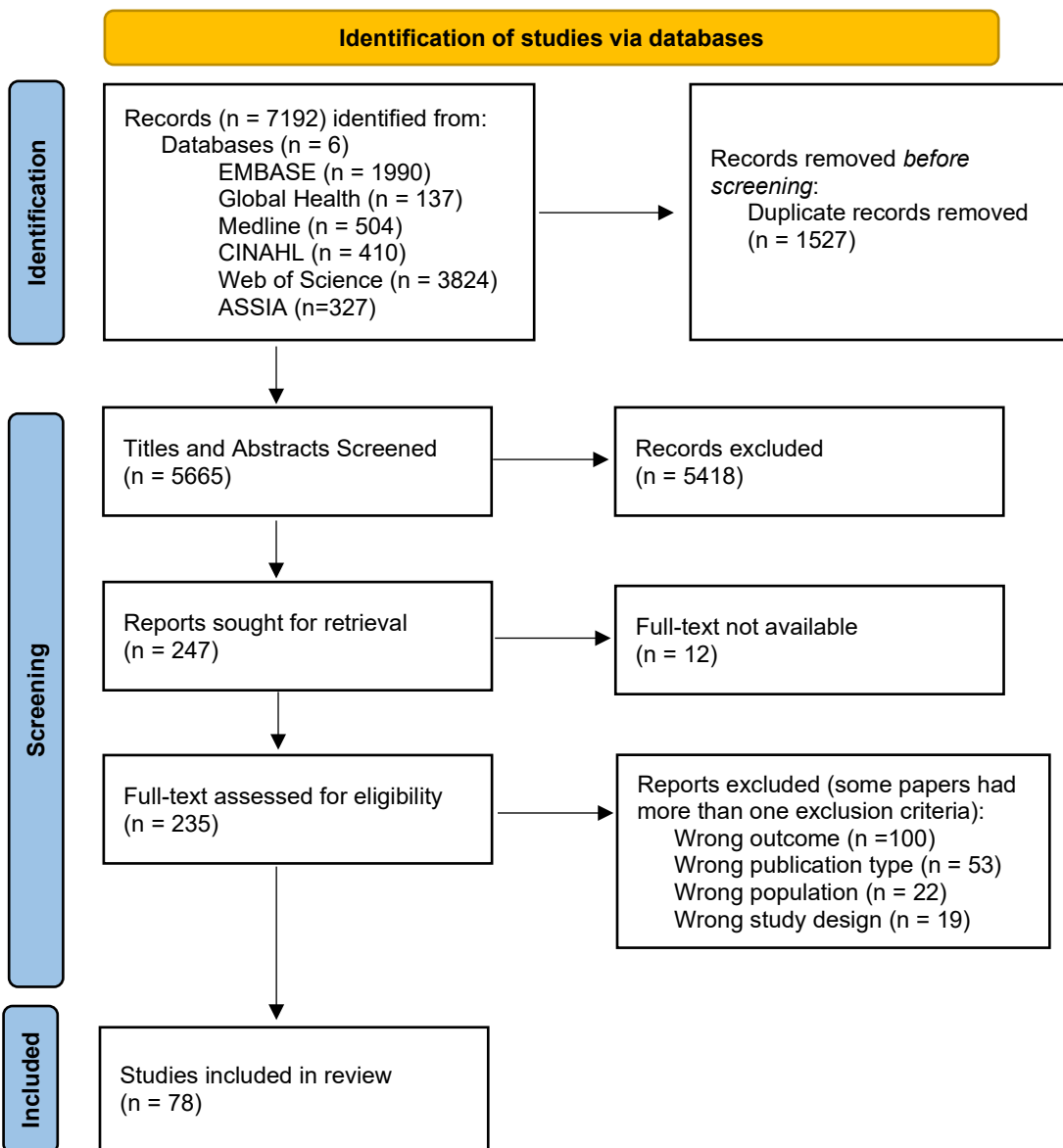
Meta-Analysis (PRISMA) statement was followed for conducting and reporting the review (PROSPERO Registration: CRD42021231120). All studies identified by the review were exported into an EndNote database (version X20, Clarivate Analytics, Philadelphia, PA, USA) and then exported into Rayyan (Qatar Computing Research Institute, Qatar) for screening.¹⁵

Selection Criteria

Our search strategy sought to identify peer-reviewed articles from around the world published between January 2012 and 2021. Given a previous systematic review covered this topic until 2011⁷, the search included articles published from 2012-January 2021 and included all health worker types, health education levels, and disability globally. The inclusion criteria required that studies were: qualitative and/or quantitative in methods; included a complete description of the intervention; explicit evaluation of the training's impact (i.e., pre- and/or post-training evaluations, follow-up surveys, etc.); and had a particular focus on improving disability competency, knowledge, confidence, self-efficacy, curricula, or teaching methods. Studies examining health worker attitudes towards people with disabilities were excluded on the basis that a positive attitude does not necessarily guarantee improved competency or care outcomes. Studies that measured attitudes alongside other criteria were included. Finally, the abundance of articles on training health workers about mental health, the authors decided that this topic merited further, independent exploration, and, therefore, we excluded papers that trained health workers only about mental health. Only papers that looked at physical, sensory, intellectual or developmental impairments were included.

Data Extraction

Fig 1. Flow chart of selected studies to review health worker training on disability ¹⁶



All data were extracted into a Google Sheet developed for this review. 78 full-text articles underwent data extraction, following a title, abstract, and full-text review by two reviewers (AA and BB). An additional three reviewers (AA, DD, EE) extracted data related to the general study information, setting, country, health worker cadre, number of participants, type of disability, features of the intervention, impact measurement, and outcomes. The extraction was double-

checked by a second reviewer and collectively checked again by the extractors (AA, DD, EE). Any conflicts in inclusion or extraction were resolved through discussion with a third and/or fourth member of the review team.

Given the wide array of study instruments and outcomes used to assess training impact, a meta-analysis could not be conducted, and a narrative synthesis was conducted instead. Quality and bias assessments were conducted by at least two reviewers in accordance with the SIGN50 (Scottish Intercollegiate Guidelines Network Checklists).¹⁷

Studies were rated as low bias, if all or almost all of the criteria were fulfilled, and those that were not fulfilled were thought unlikely to alter the conclusions of the study; medium, if some of the criteria were fulfilled, and those not fulfilled were thought unlikely to alter the conclusions of the study; or high, if few or no criteria were fulfilled, and the conclusions of the study were thought likely or very likely to alter with their inclusion.

RESULTS

The preliminary search identified 5,665 articles for title and abstract screening, after 1,527 duplicates were removed. Following screening, 247 articles were included for full-text review. Twelve studies were excluded because full-texts could not be retrieved and a further 154 studies did not meet the inclusion criteria as shown in Fig.1., and 3 articles included in the review were excluded during extraction because of an unclear intervention (n=1) and wrong population group (n=2).¹⁸

Included studies (n=78) represented a range of geographies, health workers, and intervention types. Among these, there were studies from 19 countries, including seven low- and middle-income countries.¹⁹ Most studies took place in the United States (n=35), followed by the United Kingdom (n=13). Among the studies included, 30 were rated as low, 43 as medium, and five as

high risk of bias [Supplementary Materials]. Studies varied in whether they were mandatory or optional; free or paid; and for certification or elective; however, many studies did not include this information. Various cadres of health workers were included in the study; doctors, medical students or residents (n=37), and nurses or nursing students (n=17) were the main recipients of training. These health workers were generally trained in the pre-qualification stage (n=52), though there were several in-service (n=7) and continuing professional development (CPD) programs (n=19). The review included studies across disability groups; the most common focus was training about people with intellectual and developmental disabilities (n=41), followed by general programs about people with disabilities (n=16). Most studies measured improvements in knowledge (n=57) and competence (n=42) outcomes, yet most studies used a self-designed evaluation instrument (n=54). There was a wide variety of techniques to train health workers about disability, including lectures or other didactic methods (n=65), and case studies (n=28); the majority of studies (n=58) used multiple teaching modalities [Appendix A].

Lecture/Didactic Methods

Most (n=65) studies included lectures or didactic methods, such as videos, multi-media formats, or online coursework. Many studies used these opportunities to introduce health professionals to the topic of disability from a rights-based perspective to enhance attitudes, awareness, and knowledge about disability. Some studies also taught particular skills that could be applied in-practice, such as an elective sign language class for medical and pharmacology terms²⁰ to improve skills for engaging with d/Deaf or hard of hearing individuals. Lectures were often combined with some other intervention (case study or simulation) to apply knowledge learned from the lecture. Participants in combined programs identified the content to be quite engaging

and contributed to greater improvements in key outcomes. However, for those who only completed lecture or didactic-based methods, there were still improvements in the general outcomes, but it was often less substantial than studies that combined multiple methods^{18,21,22}. Finally, some programs utilized novel, innovative technology and multimedia tools to teach about disability in a more engaging method than traditional lectures or didactic methods. For example, one study designed multi-media tools (MMLTs) to teach medical students about common visual impairments and compared the knowledge scores with those who had read a textbook. The findings highlight the importance of engaging material, as while there was no significant difference in knowledge (except for cataract recognition), the MMLT took less time and 87% of individuals found it more enjoyable than traditional teaching methods.²³

People with Disabilities as Teachers

Recognizing the important role of self-advocates and patients as educators⁷, several studies (n=19) invited people with disabilities to share their experiences in the health system, portray standardized patients, or give a lecture. Some universities hired people with disabilities to participate in simulated patient programs, while others asked patients to participate voluntarily. Many others found creative ways of engaging with people with disabilities. Cardiff University, for example, hired a self-advocacy theatre group to run a simulation and icebreaker activity.²⁴ These activities added a non-clinical dimension to medical training about disability, as it allowed participants to explore disability outside the health worker-patient relationship and engage in dialogue. Studies that measured participants comfort and attitudes before and after a person with a disability as a teacher demonstrated that participants felt the non-clinical interaction enhanced their comfort and attitudes towards people with disabilities.^{25,26}

Table 1: Characteristics of Included Studies

Variable	Number	Percentage (%)
Training Location		
North America	40	51.2
Europe	22	28.2
Asia	6	7.7
Oceania	4	5.1
Africa	4	5.1
South America	2	2.5
Disability Focus of Training**†		
Intellectual and developmental	41	51.9
All types of disabilities/unspecified	16	20.3
Physical/motor	13	15.2
Communication	9	11.4
D/deaf and hard of hearing	8	10.1
Visual impairment	3	3.8
Sensory impairment	2	2.5
Health Worker Type**		
Medics	37	35.2
Nurses	17	16.2
Occupational and Physical Therapists	17	15.2
Allied Health Professionals	8	7.6
Dentists	7	6.7
Audiologists and Speech Language Pathologists	6	5.7
Psychologists	4	3.8
Personal Care Workers	5	4.8
Community Health Workers	2	1.9
Pharmacists	2	1.9
Teaching Method*		
Lecture/didactic methods	65	34.7
Case study	28	14.9
Clinical encounter	26	13.9
Placements, experiential, and community-based learning	25	13.4
Simulation	24	12.8
People with disabilities as a teacher	19	10.1
Intervention Outcomes*		
Knowledge	57	28.4
Competence	42	20.9
Attitudes	31	15.4
Confidence	24	11.9
Comfort	15	7.5
Communication skills	12	6.0
Self-Efficacy	11	5.5
Other related outcomes	9	4.5
*Total number is greater than 78 because studies included multiple variables		
†categories include students and residents who are in training to become fully qualified as this type of health worker		

Case Studies

Case studies are a common tool in medical education to prepare health workers holistically for their education where a patient's records or scenario are presented without their presence. Case studies have a clear structure, details, and clinical observations to teach students about the topic.²⁷ Accordingly, many studies used case studies (n=28) as a way of learning how to improve care for people with disabilities. These tools were especially common in continuing professional development, as some programs ask patients to bring case examples to review anonymously to improve care^{28, 29} or were to spur reflection on their own work. Several case studies were conducted through online learning or innovative interactive methods. For example, the City University of London created CitySCaPE, which is a multi-media simulation that simulated different patient cases of people with intellectual disabilities with nursing students.³⁰ These types of case studies that blended the traditional case study and simulation aspects created greater engagement in settings where in-person or clinical encounters were not possible.

Placements, experiential, and community-based learning

Placements, experiential, and community-based learning (n=25) methods were sustained opportunities (i.e. multiple clinical sessions, a term placement, or residential program) to engage with people with disabilities in clinical and alternative settings that were common in in-service and pre-qualification training. For example, some studies examined the impact of clerkship placements in specialized clinics for people with disabilities,³¹ while others looked at nurses and occupational therapists' improvements after participating in a week-long summer camp for children with disabilities.³² In the clinical setting, students found that they improved skills because they were able to engage with people with disabilities for extended periods, rather than a singular interaction. Furthermore, the out-of-clinic engagement, such as at camps, schools, or

residential settings helped illustrate the non-medical and everyday lives of people with disabilities.

Simulations

Simulations were single-session events that either used actors or volunteers with disabilities to act as patients in a devised scenario to support skill development and learning outside of health worker-patient interactions. Many speech-language pathology, nursing, and medical student programs used simulations (n=24) as tools to develop confidence and communication skills when treating patients with communication disorders.^{33,34, 35} In addition, several medical schools integrated disability training into existing clinical simulation skills labs to improve care for people with disabilities. For example, at the University of Gothenburg medical students were videotaped during a simulated patient exercise to reflect on improving communications skills, particularly for the simulated patient with an acquired communication disorder.³⁵ Overall, the simulations were useful tools for improving knowledge, comfort, and competency in a low-pressure environment that is applicable to serving people with disabilities.

Clinical Encounters

Several programs (n=26) included singular clinical encounters with patients with disabilities as part of their disability training. These were often day-long programs to familiarize students with providing care in a clinical setting, often under supervision of a fully qualified doctor or expert, and were predominantly focused on improving knowledge and competency.³⁶ Most students who participated in these programs were advanced (i.e., penultimate or final year students) who had previously had some education on providing care to people with disabilities. These opportunities focused on practicing clinical skills to treat patients with disabilities, and, despite the short

exposure, did significantly affect participant's key outcome scores. For instance, clinical encounters used in CPD, such as in Rwanda, where instructors in a physiotherapist training program went to participants' clinics to provide immediate feedback on their practice.³⁷

Multi-pronged approach

Approximately 75% of papers utilized a combination of methods to have impact on training participants. These multi-pronged approaches helped reach various learning styles and cement learning. Two papers included in this review utilized all of the interventions measured in this paper. For example, two State University of New York medical colleges demonstrated the importance of integrating disability across health worker curricula, as all participants significantly improved their knowledge, attitudes, and core competencies in treating patients with disabilities.³⁸ Similarly, the University of South Florida had a 12-week clinical clerkship that involved classroom simulations, lectures, case studies, people with disabilities as teachers, and a twice-weekly placement in a community clinic that served people with disabilities. The immersion helped to significantly improve knowledge, attitudes, and comfort.³⁹

Training Effectiveness

While the diversity of outcome measures did not allow us to conduct a meta-analysis, it is important to note that almost all papers included in this review improved the outcomes they measured. Since every paper had improvements in at least one outcome of interest, we examined how intervention effectiveness varied by outcome of interest. 100% of studies that sought to improve and measure confidence, communication skills, and competence demonstrated that the intervention improved these outcomes. Studies that looked at knowledge demonstrated improvements in 94.7% of studies, while comfort improved in 93.3% and self-efficacy improved

90.9% of studies. Studies that included participants' attitudes as an outcome had the lowest number of studies with improvements at 80.6% of studies.

Only seven studies looked at long-term follow-up (three months or more after the intervention).

None of the studies had improved any of the outcomes after follow-up, but 51.7% of studies sustained learning at the long-term follow-up point. However, 42.9% demonstrated that participants had a decrease in the outcome measured at follow-up.

DISCUSSION

Numerous studies and examples serve as successful models to train health workers about disability and improve knowledge, competence, skills, self-efficacy, and confidence to treat patients with disabilities. All teaching methods had some positive impact on the outcomes measured in this study, regardless of health worker type, location, or training stage, though the most commonly used were lecture/didactic methods and case studies. Part of the success of these programs was the multi-pronged nature of the approach, as 75% of studies used multiple teaching methods. The two examples that utilized all teaching interventions demonstrate the importance of a multi-pronged approach that emphasizes mainstreaming disability in health curricula, either through sustained engagement in a curricula³⁸ or an intensive placement.³⁹ However, limited information about commonalities in curricula could be extracted from the data, given the diversity of interventions methods and topics.

It is important to note that these findings are not substantially different from the 2011 review.⁷

Similar methods are still used to teach health workers on disability and each example is highly localized, within either a certain school or region, other than two studies that examined national-

level training programs.^{37, 40} The limited evidence of systemic integration of disability training within health worker practices is concerning in this context as the current status of training appears to depend on where you received your training, where you live, or where you work. Enacting systemic-level change to ensure all health workers have the same level of high-quality training on disability will contribute to providing consistent, high-quality care and outcomes for people with disabilities.

Similarly, there was limited standardization in tools used to measure the impact of disability training on health workers. Of the 78 studies, nearly 70% designed their own instruments, and only two studies included the same standardized measure of outcomes.^{41,42} Few studies measured the longevity of the intervention's impact, though those that did demonstrated sustained or decreases in the outcomes measured. Sustained approaches that mainstream disability should help to ensure learning is not performative for post-intervention evaluation, but actually effect change in practice. This finding was previously noted⁷, yet there has been little improvement in the past decade. The diversity of tools to assess impact of training limits the comparability of training methods across geography, health worker cadres, and training stages hampers progress on this important topic. Developing—and using—a common, standardized cross-disability tool or protocol for evaluating immediate and long-term intervention impact may help support monitoring and evaluation efforts to further refine and improve training.

While the review uncovered many examples of disability training, one of the main limitations of the study is that it only highlights published examples of studies, which can leave out unpublished examples. Furthermore, without greater follow-up evaluation or standardization in

evaluation, it is difficult to assess the longevity and quality of impact to understand impact of training definitively. On the other hand, this study reveals some adaptable examples of how to integrate disability training into all stages of health worker training and development, which can serve as models for inclusion efforts around the world.

Future Directions

The lack of progress on training methodology since Shakespeare and Kleine's review demonstrates the need for further work in this area. The piecemeal nature of disability training creates disparities in provider competency and quality health care for people with disabilities around the world. Improving the standardization of core competencies that training on disability should address and measures of impact for disability training can further improve progress in this area. Having some standardized outcome measures to compare effectiveness of training and evaluate impact on patient outcomes will allow for further evidence to impact system-level changes on this topic. Furthermore, having sustained engagement on disability throughout training and health worker professional development is important, particularly because the limited evidence on long-term follow-up in this review suggested there were commonly declines in the impact of training even just three months after training. Therefore, working to include disability in training and better understand its impact through standardized outcomes are key areas to improve integration of disability training for health workers.

CONCLUSION

Significant health disparities and poor-quality health care still exist for people with disabilities around the world. These studies demonstrate that health worker training can be a useful tool to improve health workers knowledge, self-efficacy, attitudes, comfort, and competency to treat

people with disabilities Ensuring training centres the voices of people with disabilities, using multiple modalities, and ensuring there is sustained engagement throughout a health worker's stages of learning can be part of the toolkit to improve patient-centered care for people with disabilities. Without normalizing disability training as part of high-quality health worker training, there will continue to be limited progress on improving outcomes for people with disabilities. Catalyzing the post-pandemic health systems strengthening efforts to include these evidence-based and effective health worker training on disability can contribute to improved care and outcomes for people with disabilities.

Appendix A: Details of interventions in included studies

Citation	Place	Sample	Type of Disability Covered	Intervention Details	Lecture/	DwD as Teacher	Case study	Placement	Simulation	Clinical	Outcomes Measured	Description of Outcomes	
													PRE-QUALIFICATION
Thew et al. 2012 ⁴³	University of Rochester School of Medicine and Dentistry, USA	First-year medical students (n=99)	Hard of hearing and D/deaf people	Students participated in lectures about deaf people and their experiences in health care. They also participate in a role-reversal program where medical students are given a scenario to simulate being deaf in different health settings and are encouraged to use alternative forms of communication, such as interpreters, American Sign Language (ASL), gestures, or notes. Finally, deaf volunteers and lead a debrief.	x	x						knowledge, competence	Students report increasing cultural, linguistic, and communication skills, particularly for deaf patients. Long-term follow up also shows that students enjoy learning from deaf participants and apply the lessons to their practice, including with other non-English speaking patients.
Gilmore et al. 2019 ¹⁸	Queen's University Belfast, UK	Second year medical students (n=59)	Hard of hearing and D/deaf people	29 second-year students participated in a deaf awareness and sign-language module were compared to 30 controls to examine the course's impact on attitudes and knowledge of deafness. Previous participants were also contacted and evaluated to assess long-term impact.	x							knowledge, attitudes	After completing the module, students had significantly improved attitudes and knowledge to treat deaf individuals in comparison to the control group (p<0.05). There was also a significant negative association between years since undertaking the module and attitudes score (r=-0.29, p=0.04, n=51), with no significant association for knowledge score (r=0.22, p=0.11, n= 52).
Smith et al. 2016 ⁴⁴	School of Nursing at Kingston University and St George's, University of London, UK	First year nursing students (n=114)	People with intellectual disabilities (ID)	45-minute session developed and led by people with intellectual disabilities (with input from school lecturers) about their experiences accessing and receiving health and social care.		x						Knowledge, attitudes, confidence, comfort, communication skills	The session helped students reflect and improve how they interact with (94%), comfort to interact with (75%), and understanding of negative experiences health and social care system (87%), and confidence to work with people with intellectual disabilities (83%). Students expressed greater knowledge, changed attitudes, and greater engagement in material because of the direct involvement of people with intellectual disabilities.
Iannuzzi et al. 2019 ²⁶	University of Massachusetts Medical School's (UMMS) Graduate School of Nursing, USA	Rising third year Doctor of Nurse Practice Family Nurse Practitioner Program students (n=16)	Autism Spectrum Disorder (ASD)	Groups that were exposed to content at different points in the course: Lectures on ASD and common comorbidities given by developmental disability nurses; online modules on epidemiology, medical and diagnosis issues for ASD; and participation in Operation House Call, a parent- and self-advocate program to match health students with transition-aged youth.	x	x	x	x			x	self-efficacy, knowledge, attitudes	The intervention improved their comfort, self-efficacy, attitudes, and competency in providing care to transition-aged youth. Increased knowledge of 7.91 (range -5 -15) compared to a decrease of -3.43 (range -12.5 -7.5) for controls; increased attitudes by 3.1 points (range 0-7) compared to a decrease of -6.25 points (range of -3 to 3) for controls; and participants' self-efficacy for providing care to transition aged youth with ASD were 42.7 (range 24-61) compared to 5.19 (range: 5.0-27) for the control group.
Lapinski et al. 2015 ⁴⁵	Kirksville College of Osteopathic Medicine, USA	Osteopathic medical students (n=33)		A four-hour workshop on ASL that included a presentation on deaf culture, key vocabulary (alphabet, numbers, medical	x	x						confidence, competence	There were significant improvements in participants self-ratings (2.1 pre-workshop (SD= 0.5) and 2.6 post-workshop (SD= 0.4), p=.001), standardized patient

Salama and Al-Balkhi 2020 ²²	College of Dentistry, King Saud University, Saudi Arabia	Dental students (n=150)	People with disabilities	A 30-minute DVD presentation on providing oral care for people with disabilities.	x									knowledge, competence	The mean±SD score of all 150 students' (30 students from each of the five dental levels) pre-test was 15.46±2.97, which increased to 18.09±3.37 on the post-test.
Mohebbi et al. 2014 ⁵²	Tehran University of Medical Sciences, Iran	Senior dental students (n=70)	People with disabilities	The intervention group received training on providing care for disabled patients through group discussions, lectures, and hands-on clinical fluoride varnish/screening for autistic children.	x							x	x	knowledge, attitudes	The intervention group significantly increased their attitudes and knowledge after the intervention, even after controlling for backgrounds and experience with disability (p<0.05).
Bailey et al. 2021 ²⁰	Ferris State University College of Pharmacy, USA	First and second-year pharmacy students (n=39)	Hard of hearing and D/deaf people	A four-class, optional, co-curricular course was offered to pharmacy students, focusing on deaf culture, communication, and ASL. Included time to interact with a deaf physician over Skype and with deaf/HOH individuals from the community.	x	x								confidence, communication	Pharmacy students had significant increases in their confidence to provide care and communicate with d/Deaf, hard of hearing individuals, and interpreters after the course.
Watmough et al. 2014 ³¹	University of Liverpool, UK	Third year medical students (n=42)	People with disabilities	A 7-week community placement for third year medical students, including six full-day, small-group sessions, a 5-day GP placement where students clerk with at least two patients with disabilities, communications skills development, and visits to community disability centers	x								x	knowledge, comfort	Students better understood disability by participating in the program and felt that the community center visits, having patients as educators (through clinical contact), and workshops throughout the placement had significant impacts on their knowledge and comfort.
Ahmad et al. 2020 ⁵³	Faculty of Dentistry, Universiti Teknologi MARA, Malaysia	Undergraduate dental students (n=165)	Children with visual impairments	Dental students (years 1-5) received a lecture on management of individuals with visual impairments followed by a participating in a clinic where each dental student was assigned to manage of a child with visual impairment at a special education school as part of a dedicated module.	x								x	knowledge, competence, behaviour, attitudes, learning	Students positively improved their knowledge, professionalism, behaviour, attitudes, and learning by participating in the clinic.
Crane et al. 2020 ⁵⁴	Ohio State University Wexner Medical Center, USA	Third-year medical students (n=169)	People with disabilities (mobility, sensory, cognitive)	Medical students participated in a patient encounter with a PWD where they were asked to complete a brief social and medical history.									x	confidence, competence, and comfort	Students initially showed significant improvements in confidence, skills, and comfort. A year later, 35% of participants were surveyed and found these benefits were sustained in most students, though many felt the need for more training and exposure.
Tai et al. 2018 ⁵⁵	University of Melbourne, Australia	Final year graduate audiology students (n=15)	Hard of hearing and D/deaf people	Students had a clinical encounter filmed and re-played during a clinical communication education session to see their perspectives on their clinical communication skills.									x	communication	Audiology students demonstrated that they were able to reflect on critical communication areas and be more attentive to patient's needs, understanding, and questions.
Ozkan et al. 2020 ⁵⁶	Faculty of Health Sciences, State University in Turkey	Third-year nursing students (n=70)	People with intellectual disabilities	Students participated in a clinical practice for three weeks (2.5 days per week) in 12 different fields- one of them being in a special education school. The experimental group went to a clinic that served special education schools and were exposed to case studies, nursing care examples, and videos care for people with disabilities.	x							x	x	knowledge, competence, attitudes	After the placement, the experimental group had higher total attitudes to people with disabilities (172.02±14.59 pre-test to 177.54±13.95 post-test) compared to the control group (176.31±16.25 pre-test to 171.97±13.69 post-test). Students also noted that they improved their attitudes, knowledge, and skills for caring for people with intellectual disabilities.

Sinai et al. 2013 ⁵⁷	University College London, UK	Undergraduate medical students (n=387)	People with intellectual disabilities	A 14-week course taught undergraduate medical students about training patients with intellectual disabilities. As part of the block, participants did a three-week specialist placement on learning disability services.	x		x	x						knowledge, attitudes	Students basic knowledge significantly improved after the intervention (p<0.001) and improved their attitudes, though not significantly.
Abdi and Metcalf 2020 ²⁴	Cardiff University, UK	Fourth-year undergraduate medical students (n=110)	People with intellectual disabilities	Medical students participated in a mandatory communication skills session that included case studies and simulated patients. This was run by the Speech Language Therapy team three times during the academic year.	x		x							confidence, attitudes	Mean scores improved from 115 (SD=14.5) to 122 (SD=17.2), or a mean difference of 6.92 (C.I: 4.69, 9.16), which was statistically significant. Participants also noted their confidence on treating patients with disabilities also improved.
Shields et al. 2013 ⁵⁸	Department of Physiotherapy, La Trobe University, Australia	First- and second-year physiotherapy students (n=17)	People with Down syndrome	Students participated in a 10-week, twice weekly community placement at a gymnasium for adolescents with Down syndrome. There, participants were expected to enact a progressive resistance training program.			x		x					communication, comfort, knowledge	Physiotherapy students improved their clinical skills, professional skills, and understanding of young people with disabilities.
Hensel et al. 2015 ³²	University-affiliated wilderness children's camp, USA	Junior-level BSN students (n=9)	Children with intellectual impairments or wheelchair users	Nursing students went to one of two weekend-long fall camps for children with disabilities aged 8-18.									x	knowledge, comfort, attitudes	Students found the placement challenging, but overall improved their confidence and competency to provide care to children with disabilities/medical complexities. They also developed more positive attitudes towards caring for patients with disability.
Watkins and Colgate 2016 ⁵⁹	Cardiff University, UK	Medical students (n=45)	People with intellectual disabilities	A self-advocacy agency, Cardiff People First, ran a one-hour video and ice breaker activity. Subsequently, students assessed a simulated patient played by an actor with an intellectual disability. Students then participated in a focus group discussions.	x	x							x	knowledge, attitudes	Students attitudes improved significantly from a mean score of 13.7 (SD=1.29) to 10.52 (SD=1.12) (a mean difference of 3.17 (95% CI=2.41-3.94), p<0.001). Knowledge also improved significantly from a mean of 14.84 pre-intervention to 10.65 post-intervention (mean difference 95%CI = 4.22(3.3-5.14), p<0.001)
Forsgren et al. 2017 ⁶⁰	University of Gothenburg, Sweden	Fourth-year medical students (n=69)	People with acquired communication disorders	All students participated in a 45-minute mandatory lecture on acquired communication disorders. 36 students then participated in a 2.5-hour long workshop with a simulated patient to practice communication skills, and 15 were video recorded during the simulation pre- and post-workshop.	x		x						x	knowledge, attitudes, communication	Students who participated in the workshop had significantly higher post-test results than students who only participated in the lecture, though all groups had knowledge and communication improvements. There was also a statistically significant increase in perceived confidence from pre-lecture (m=13) to post-lecture (m=18.9, p=0.001) as well as from pre-workshop (m=15.3) to post-workshop (m=21.9, z=5.168, p=0.001). Video recordings supportive strategies were used more significantly post-workshop.
McIntosh et al. 2018 ⁶¹	Ball State University School of Nursing, USA	Senior nursing students (n=84)	Autism Spectrum Disorder	Students were exposed to Autism through lectures, case studies, a documentary video, and description of the simulation prior to the study, which was an encounter with a standardized patient. In the encounter, a 14-year-old boy with a fractured wrist was admitted to the emergency department. Students were expected to assess the patient and associated behavioral and emotional symptoms.	x		x						x	knowledge, competence	87% of students indicated that they used communications strategies learned, while the rest remained neutral. 86% also thought the supplemental information provided ahead of time supported their learning. Overall, the simulation and pre-requisite classroom instruction improved their knowledge of ASD.

Woodard et al. 2012 ⁶²	University of South Florida Health, Morsani College of Medicine (USF), USA	Primary care clerkship for third-year undergraduate medical students (n=245)	People with physical, sensory, or intellectual disabilities	Students participated in a 12-week Primary Care and Special Populations clerkship that included a special 6-week module on disability, half-day classroom sessions, online modules, and community site visits twice a week. Classroom sessions included simulations, case studies, and communication and exam technique advice from individuals with disabilities.	x	x	x	x	x	x	knowledge, competence, comfort	Students significantly improved their knowledge of, attitudes, and comfort of working with people with disabilities by a mean score of 2.36, 4.20, and 15.00, respectively, after completing the clerkship program (p<0.001 for all).
Jones et al. 2015 ⁶³	Queen's University, Canada	Medicine (n=100), nursing (n=93), clinical psychology (n=6), and rehabilitation students (n=133) (total n=332)	People with intellectual disabilities	Students participated in a three-part course that consisted of an e-learning and case models pre-requisite prior to a day-long course that consisted of group lectures, multidisciplinary experiential learning, and inter-professional team-based learning.	x	x	x				knowledge, competence, attitudes	Across all disciplines, there was a significant difference (p<0.01) in mean percentage correct between pre-course (M=0.64, SD=0.25) and post-course (M=0.70, SD=0.25) skills scores, of which nurses had the most significant improvements. Knowledge improved pre-course (M=0.51, SD=0.22) and post-course (M=0.64, SD=0.23) significantly (p<0.01), though this was independently significant for medical, rehabilitation, and nursing students. There were no statistically significant differences in attitude.
Beverly and Wooster 2018 ⁶⁴	University of South Alabama, USA	Speech language pathology, occupational therapy, and physiotherapy graduate students(n=9)	Autism Spectrum Disorder	A one-credit online course and day-long conference included lectures, panel discussions, group problem solving, and parent perspectives. Content was focused on inter-professional education and diagnosis and co-morbidities of ASD.	x		x				knowledge, competence, attitudes	There were significant increases in participants basic ASD knowledge after the course (p<0.05). Participants were more aware of their role and that of their team members in the screening and assessment of ASD.
Coret et al. 2018 ⁶⁵	Michael G. Degroote School of Medicine, McMaster University, Canada	First-year medical students (n=27)	Intellectual/developmental disabilities (IDD)	Control and intervention groups participated in a baseline introductory video about healthcare and communication skills. After the video, the intervention group were shown videos of individuals and families of individuals with IDD who spoke about their lives, challenges, and perspectives on health care and participated in a reflective activity. Controls were only given a post-intro video quiz. Both groups participated in four clinical encounters and their skills were assessed by a final-year student.	x						comfort, confidence, and competence	Students communication skills assessment mean rating scores were higher for students in the narrative group relative to the control group for self-ratings mean [SD] 4.49 [0.73] vs. 4.37 [0.69]), patient educator ratings(5.43 [0.52] vs. 5.33 [0.76]), and senior medical students(5.01 [0.69] vs. 4.75 [0.79]). Similarly, students' qualitative evaluations demonstrated improved communication, comfort, confidence, adaptability, and learning from the methods used in the intervention group.
Jain et al. 2013 ⁶⁶	Department of Family Medicine, Lehigh Valley Health Network, USA	Third- and fourth-year medical students (n=44)	Wheelchair users	Two patients with disabilities were trained to teach medical students about disability. In an hour-long session, they described their daily routines and experiences interacting with health care for medical students, followed by Q and A. Students who participated in the session were asked questions about awareness, sensitivity, and competency.	x	x					comfort, knowledge, competency, communication	Respondents qualitative responses suggested greater competency and awareness and sensitivity after the intervention, particularly since prior to the training 89% felt uncomfortable interacting with patients with disabilities. Overall, 98% stated the program was beneficial.

Karl et al. 2013 ⁶⁷	University at Buffalo School of Medicine and Biomedical Sciences, USA	Third-year medical students (n=144)	People with disabilities (mostly people with developmental disabilities)	Third-year medical students participating in a family medicine clerkship program engaged in a day-long clinical experience at a family practice serving people with disabilities. Students observed and assisted the staff and then were asked to write a reflection. Students had previously done lectures, small group encounters of people with disabilities and their families, and other workshops.										x	communication, comfort, attitudes, knowledge	Students felt that the encounter highlighted gaps in communication skills, as well as increasing comfort in caring for people with disabilities. The program also highlighted quality and standard of care issues for people with disabilities and that ones' disability can wrongly be attributed as the cause of the issue, when it's not. Students also noted issues with the organizational structure of the medical facility and environmental and technical accommodations necessary for support.
Thomas et al. 2014 ⁶⁸	University College London, UK	4th year undergraduate medical students (n=47)	People with intellectual disabilities	All participants had attended a 3-hour lecture on ID, session by a speech and language therapist, group work, watching a communication DVD, and basic Makaton training (a simplified British Sign Language). The second session involved students rotating through four stations in groups of four to work with simulated patients with ID.	x									x	competence, comfort, communication	There was significant improvement in medical students' perceived skills (p=0.002), comfort level (p=0.004), and type of clinical approach (p=0.003) in managing patients with no disability. Furthermore, significantly improved scores for all three factors were obtained by medical students regarding patients with mild and severe disability levels (p<0.001), with even greater benefits for managing severe disabilities compared to mild.
Saldert et al. 2016 ³⁵	University of Gothenburg, Sweden	Medical students (n=59, 33 only lecture, 26 lecture & workshop)	People with speech language disorders	Students attended a 45 min mandatory lecture on different forms of speech disorders. A subset of students attended a mandatory 2.5-hour mixed format workshop two weeks later, led by speech language pathologists, involving role play, a lecture on communication strategies, and discussions.	x		x							x	knowledge, confidence, competence, attitudes	Students from both the lecture and the workshop reported significantly increased knowledge (p=0.001) and how to support communication in speech-language disorders. Only the workshop group also displayed a statistically significant increase in ability to suggest suitable communications strategies (p=0.001) and change in attitudes (p=0.001).
Baylor et al. 2019 ⁶⁹	University of Washington, USA	Second-year medical students (n=224)	People with communication disorders	Students received the FRAME training, which looks at five key areas of communication skills, including familiarizing patient communication preferences, reducing rate, assisting patients, mixing methods, and respecting autonomy. Students participated in a 20-minute module on key characteristics of communications disorders, a 2-hour in-person session and practice strategies and simulated patients with aphasia and dysarthria.	x									x	knowledge, self-efficacy, communication, confidence	Knowledge scores significantly increased from a mean of 4.96 pre-training (SD=1.1) to 7.23 post-training (SD=1.8) (p=0.000), while self-efficacy improved significantly across all measures (p=0.000). Students also significantly improved their communications skills, particularly in diagnosing and familiarizing with patient communication preferences (except for reducing rate in the dysarthria scenario).
Lynch et al. 2019 ²⁵	Medical School in Ireland	Undergraduate, graduate entry, and international medical students in second or third year(n=320)	People with disabilities	Students taking a mandatory 12 week 'Understanding Disability' module in their course. This involved weekly lectures, applied anatomy laboratory sessions, a day visit to a national rehabilitation hospital, practice taking patient history in rehabilitation programs, and case studies.	x	x	x	x						x	competence, attitude	An overall positive effect across the module was observed with significantly improved measurements from pre-intervention to post-intervention across the 4 variables, anxiety (p<0.0125), attitude and competency (p<0.001), and empathy (p=0.03).

Garavatti et al. 2018 ³⁹	University of Central Florida, USA	2nd year medical student (n=20), final year Doctor of Physical Therapy Students (n=20)	People with disabilities	Medical and physical therapy students in the intervention group went through an interprofessional education (IPE) clinical experience that included an encounter with a disabled patient. 20 students attended a 3.5-hour IPE clinical session, focused on knowledge and interacting with individuals with disabilities through an orientation, performing a neurological examination, and group discussion. The control group (n=20) did not attend the IPE clinical session.	x									knowledge, attitudes, competence	Before the intervention, interactions of disabled persons was significantly higher in the experimental group and higher in medical students. Pre and posttest scores for the intervention group revealed a statistically significant (p<0.001), with improved comfort levels in 5 of 6 subscales. However, mean scores did not differ significantly between control and experimental groups (p>0.05). Both medical and physical therapy students reported greater comfort levels and perception attitudes in working with patients with disabilities after the intervention.	
Saunders and Berridge 2015 ⁷⁰	City University London, UK	Undergraduate adult, child, and mental health nurses (n=182)	People with intellectual disabilities	Nursing students participated in a 3-hour session on education around people with intellectual disabilities. This involved 'Shareville', a virtual simulation/software allowing for navigation of real-life scenarios of individuals with disabilities. Group discussions occurred prior to and after Shareville utilization.	x								x	knowledge, confidence	Students reported that the Shareville scenarios were sufficiently real and generally had a positive evaluation, citing improved confidence, knowledge, clinical practice, and decision making. Lecturers identified strengths in the blended learning and collaborative teaching approach.	
Sheepway et al. 2014 ³⁴	Faculty of health sciences, Australia	Third year undergraduate speech-language pathology students (n=73)	People with communication impairments	Third year speech language pathology students participated in three clinical placements to develop clinical competency over 12 months. The intervention sought to examine the impact of the sequence of placements, setting, and intensity of placements.									x	x	competence	Students performed better on the 11 competencies measured in COMPASS with each subsequent clinical encounter. Mean competency scores for placement 1 400.96 (SD=57.404), placement 2 451.55 (SD=81.116), and placement 3 510.53 (SD=92.874). Students in child placements were found to achieve greater growth in overall competency than those in adult placements.
Steedman et al. 2012 ²³	Queen's University, Canada	Second year medical students (n=25)	People with visual impairments	Students were split into two groups and watched either a multimedia learning tools (MMLTs) and read a textbook excerpt, covering different topics (Acute visual loss vs cataracts), followed by the other method.	x										knowledge	There was no significant difference in student performance between MMLT and textbook excerpt for either visual loss or cataract, however the MMLT cataract group did get higher knowledge scores (mean 75% vs. 61%, p=0.201).
Dyer et al. 2014 ⁷¹	East Midlands, UK	First and second year nursing students (n=138)	People with disabilities	Students watched a 30 minute 'Sexual Respect' DVD to educate on the types of sexual problems individuals with disabilities face, tips on initiating the conversation about sex with patients as well as self-help and peer support groups that patients can be directed to. Clinicians and people with disabilities are featured in the video.	x	x									knowledge, confidence, attitudes, competence	Students had significantly greater scores in knowledge, confidence, comfort, and willingness after watched the DVD compared to baseline and pre-DVD (p<0.001), with no significant difference between post-DVD and the 2 week follow up (except for comfort, which was statistically significant). Lack of knowledge was cited as the most common barrier to discussing sex with patients (48%) but found that the training made it easier (64%).
Provident and Colmer 2013 ⁷²	Camp Kon-o-Kwee/Spencer in Pennsylvania, USA	Level I fieldwork Occupational therapy students (n=37)	Children with muscular dystrophy and related muscle diseases	Students participated in a weeklong summer camp for campers who have muscular dystrophy or related muscle diseases. Students interviewed families on medical care, shadowed nurses, and assisted with daily routines, transfers, and other counsellor duties, as necessary.										x	knowledge, confidence, comfort	Students improved their average comfort rating from 4.5/10 on day 1 to 9.18 on the last day. Students also qualitatively identified that they improved their skills, knowledge, relationships, understanding of caregivers and documentation, and comfort in providing care to people with muscular dystrophy.

Adib-Hajbaghery and Rezaei-Shahsavarloo 2015 ⁷³	Kashan University of Medical Sciences, Iran	Final year nursing students (n=71)	Hard of hearing and D/deaf people	Nursing students participated in two clinical simulations with D/deaf and hard of hearing patients to improve knowledge and performance and confidence in supporting hearing impaired individuals.														knowledge, competence	61.5% of students had low-very low levels of knowledge and 87.3% had weak to very weak performance in communicating with D/deaf and hard of hearing patients. There was a significant correlation between the mean knowledge scores and the students' performance in the simulation. No students had knowledge of Persian sign language, but some (11.3%) had a history of caring for a patient with hearing impairment.
VandeWaa et al. 2019 ³³	University of South Alabama, USA	Graduate-level audiology (n=24), undergraduate nursing (n=53), graduate-level speech language pathology (n=24) students (total n=101)	Speech or D/deaf and hard of hearing people	Students completed online training one week prior to a simulation, which used enhanced interprofessional education (Sim-IPE). During the simulation, students worked in groups of 3 (one from each field) and completed 4 scenarios related to medication side effects with simulated patients. The emphasis was on teamwork of the group with emphasis on effective patient communication.	x													knowledge, competence	Students from all 3 disciplines were found to score higher in knowledge of medications that impact communication after the intervention compared to before. The average pretest score across the disciplines was 5.48 (SD=1.53) which significantly (p<0.001) increased to 6.39 (SD=1.29). Overall students' impressions were positive with improved healthcare team communication.
Tate et al. 2020 ⁷⁴	The Ohio State University College of Nursing, USA	Second-year nursing students (n=161)	People with communication impairments	Nursing students took part in the StudentSPEACS program which involved a 1 hr. online training component to improve communications skills, followed by a 1.5 hr. in class lecture on assessing communication abilities and strategies, and then a 1.5hr clinical simulation.	x													attitudes, competency	Students reported improved communication skills after the training, on average, and 98% of students reported using StudentSPEACS in the clinical setting.
Theoret et al. 2020 ⁷⁵	Rutgers University, USA	Medical students (n=56, 19 members and 37 non-members)	people with intellectual and physical disabilities	Students that are members of the Involvement with Disability Education and Advancement (IDEA) partnered with a local middle/high school for students with intellectual and physical disabilities. Students conducted health related workshops (including sexual education) in the classroom and did arts, crafts, and exercise programs to increase independence, confidence, and self-efficacy.														confidence	Regardless of IDEA membership, medical students of all year perceived themselves to be more comfortable caring for physically disabled than students with intellectual disabilities or non-verbal patients after participating in the program. A higher percentage of IDEA members answered with a higher comfort level of 5 or greater when indicating comfort with eliciting information from patients with intellectual disabilities compared to non-members (89.5% vs 59.5%, p=0.0207). Conversely, non-members had higher comfort providing care to patients with physical disabilities than non-members.
Watters et al. 2015 ⁷⁶	New York University College of Dentistry, USA	Fourth year dental students (n=364)	people with disabilities	Students participated in instruction before each clinic session for an hour and a half and were assigned articles and case studies. Students participated in a 4-6-week rotation (half days) in the special needs clinic in groups of seven to nine students. Students took turns providing care and serving as dental assistants to practice skills, improve comfort, and self-efficacy of students.	x													competency, confidence, self-efficacy, attitudes	Students reported greater confidence in treating people with intellectual disabilities and medical complexities, (p<0.001). Furthermore, the students agreed less (2.6, SD=1) than before (3, SD=1.1) the rotation that people with disabilities care less about their oral health p<0.001. People with less previous experience showed the greatest improvement when dealing with medically complex patients.

Vento-Wilson et al. 2015 ⁷⁷	Large Urban University in Southern California, USA	Nursing students (n=103)	People with communication impairments	Principal investigator conducted a 1 hr. course to train student nurses on Augmentative and Alternative communication strategies (AAC) to improve communication with patients who have severe communication deficits (SCDs).	x									knowledge, confidence, competence	After the AAC training, students felt more confident in utilizing the tools (p<0.01), with 90% feeling some level of confidence and 42 % feeling very confident compared to 7% before. From the follow-up, 30 students reported using all 4 AAC techniques taught. Students who participated reported that the techniques were new to them and were helpful in improving communication with patients with SCDs.
Kirshblum et al. 2020 ⁷⁸	Rutgers Medical School, USA	First-year medical students (n=355)	People with physical disabilities	The training on caring for people with physical disabilities was part of the two-year Health Equity and Social Justice curriculum. The program discussed prevalence, issues with accessible health care and health status, skills to improve care, and perspectives of people with physical disabilities. The course included a lecture, video vignette discussion (2nd year only), and patient panel to illustrate disparities.	x	x								knowledge, comfort	Students' knowledge and comfort improved compared to baseline. For knowledge, there was significantly increased awareness around different treatment, homogeneity of the population, health status, appropriate interaction with service dogs to initiate encounter, and legal instruments. For comfort, the initial pre-survey responses were nearly split between negative and positive (169 vs 174), there was a 35% increase (50.7%-85.8%) in positive responses between the pre-to post-surveys (p<0.05).
IN SERVICE															
Read and Rushton 2013 ⁷⁹	University Hospital of North Staffordshire, UK	Nurses and other allied health professionals (n=157)	People with intellectual disabilities	A year-long intervention included a series of 8 workshops and a toolkit. The workshops were led by clinicians and people with ID to teach about admission, assessment, discharge planning, and values and attitudes regarding ID. The toolkit included a resource directory, assessment tool, DVD, posters, communication book, cue cards, and leaflets about good practices to support people with intellectual disabilities.	x	x	x							knowledge, competence, attitudes	Pre- and post-intervention scores show significant improvement in knowledge, skills, and attitudes (mean score of 36.50 pre-intervention increased to 42.12 post-intervention; p<0.0001).
Major et al. 2013 ⁸⁰	33 academic programs across the United States	Pediatric and medicine-pediatric residents (n=114)	Autism spectrum disorder	A trial piloting 7 case-based modules on 1) early warning signs, 2) Screening, 3) Communication, 4) Diagnosis, 3) Early Intervention and Education, 6) Treatment, and 7) Anticipatory Guidance at 33 different sites across the US. Each site offered one of the 7 modules.	x		x							knowledge, communication, confidence, competence	Participants attitudes improved and knowledge improved significantly (58.6% pre-test to 75.3% post-intervention, a 16.7% improvement, p<0.001). Participants self-assessment of confidence and communication also improved significantly (the mean pre-test score was 2.26 on a 4-point Likert scale (1=poor,4=excellent) to a mean of 3.08 post-test, p<0.001)
Tuffrey-Wijne et al. 2017 ⁸¹	Residential homes for people with intellectual disabilities, UK	Staff in residential/support ed living services (n=114)	People with intellectual disabilities	Three-day course consisting of World Café sessions (w/case studies), presentations, feedback from people with intellectual disabilities, and a teaching expert on discussing death and dying.	x	x	x							competence, confidence, communication	Participants valued the opportunity to hear the perspectives of people with intellectual disabilities and the World Café, which provided an opportunity to discuss case studies. Students improved their knowledge, skills, and confidence on communicating about death and dying, which was sustained at 3-months post-intervention.
Chiang et al. 2013 ³⁰	Two public hospitals in Taiwan	Licensed nursing staff (n=62)		Nurses watched multi-media interactive DVD to improve knowledge and assessment skills. Controls were assigned conventional	x		x							knowledge, competence	Participants had significantly improved assessment skills and greater knowledge than the experimental group that was sustained at follow-up assessments (p<0.001).

			People with disabilities	classroom education on disability assessment.														
Toro et al. 2017 ⁸²	University of Pittsburgh, USA	61 total participants including clinicians (n=20), manual wheelchair users (n=20), and power wheelchair users (n=21)	Wheelchair users	A wheelchair maintenance training program was developed to improve knowledge in both clinicians and wheelchair users. The clinicians training was a one-day program, and the user training was a two-day program that provided information, simulations, and hands-on experience for wheelchair maintenance.	x								x	x	knowledge, competence	Clinicians participating in this training had a significant increase in knowledge (mean improvement of 25 points (manual wheelchair), 21.9 (power wheelchair), 27.3 (multiple choice), and 51.6 (capacity). The Performance score at pre-training was 11%, suggesting that training wheelchair users in wheelchair maintenance is uncommon.		
Keisling et al. 2017 ³⁶	Boling Centre for Developmental Disabilities, University of Tennessee Health Science Center, USA	Medicine and Paediatrics Residents (n=203)	People with developmental disabilities	Residents participated in a 1) home visit, 2) interview with an agency director/advocate and a parent who has a child with special health care needs (discuss affect children chronic illness history), and 3) Grand Rounds presentation to better understand the health care needs of this population. Residents undergo this training ('Project DOCC, Delivery of Chronic Care) during the Developmental-Behavioral Pediatrics rotation.	x										x	x	knowledge, empathy, collaboration	The program impacted residents' family collaboration, resource coordination, and integrated home care. Most significantly, participants knowledge had a lasting impact on their subsequent medical practice, including in engaging with the disability community (24%), initiating conversations with parents on disability (62.1%), and including home visit lessons into daily practice.
Bogetz et al. 2015 ⁸³	Stanford University, USA	Paediatric residents (n=48)	Children with special health care needs (CSHCN)	Residents participated in the Special Care Optimization for Patients and Education (SCOPE) program over four or more months. The program consists of home visits, monthly communication, and participation in a case-based discussion. In addition, residents had to go through a toolkit, which included how to review a patient's goals, a contact tree for care issues, plan of care, and home visit summary resources.										x		self-efficacy, attitudes	Intervention participants had greater self-efficacy improvements in 6 of 9 domains, including understanding the child in their home context (2.47 vs 3.76, P< 0.001), planning care (2.82 vs 4, P< 0.001), and helping navigate health (2.82 vs 4.12, P< .001) and community care settings (2.71 vs 3.82, P = 0.001). Participants also improved in attitudinal domains and demonstrated (qualitatively) the challenges CSHCN and their families deal with.	
Casson et al. 2019 ⁸⁴	Queen's University, Canada	Family medicine residents (n=100)	People with intellectual and developmental disabilities	The program includes clinical encounters with patients with intellectual and developmental disabilities to improve core competencies of caring for patients with intellectual and developmental disabilities. Residents were asked to share their field notes and reflect on clinical encounters.											x	competence, confidence, communication	Students felt their exposure to people with intellectual and developmental disabilities revealed greater competency in communication, awareness of ethical considerations, access to care, and other core competencies. In particular, the program showed participants the needs of this population, how to improve communication, and empathy towards people with intellectual and developmental disabilities.	
CONTINUING PROFESSIONAL DEVELOPMENT																		
McGonigle et al 2014 ⁸⁵	Pennsylvania, USA	Emergency department staff and emergency service providers (n=110)	Autism spectrum disorders	Participants attended of three structured sessions for emergency medical services and emergency department staff to improve confidence, knowledge, and awareness of patients with ASD. All sessions included a DVD, case studies, and manual.	x										x	knowledge, comfort	Participants significantly increased their knowledge and comfort providing care to emergency department patients with ASD after the intervention (p<0.05), even when prior knowledge was accounted for.	

Doyle and Bennett 2014 ⁸⁶	Pacific Northwest, USA	Occupational therapists (n=19)	People with physical disabilities	An 8-hour workshop for occupational therapists to improve upper-limb post-stroke sensory impairments.	x								knowledge, attitudes, competence	Knowledge, attitudes, client-centered care, and intended application of skills acquired at the workshop significantly improved compared to pre-test scores.
Dunleavy et al. 2018 ⁸⁷	Two settings: a central urban region and a southern, more rural part, Rwanda	Physiotherapists (n=69)	People with disabilities	Six courses were developed to build clinical skills, improve decision making and evaluation, and treatment techniques for various orthopedic, neurologic, pediatric, and respiratory conditions, as well as leadership and advocacy. These were offered to physiotherapists in over multiple weekends in the central urban region and a southern, more rural part.	x		x		x	x			quality, competence	Participants thought they improved the quality of their physiotherapy care (mean 6.4 SD 1.5, scale of 0–10/10 with 0/10 not at all, 5/10 some, 10/10 great deal), particularly in treating people with disabilities (mean 7.8 SD 1.5). Overall, their skills improved across the clinical domains (decision making, treatment, functional activities, improvement goals, functional activities, outcome measurement, and adjusting treatment plans) (average 8/10 for all).
Mazurek et al. 2020 ²⁸	Various medical clinics across the USA	Primary care providers (n=16)	Autism spectrum disorders	Primary care providers attended 12 weekly one-hour video-conference sessions taught by interdisciplinary experts to improve knowledge and care for people with ASD.	x	x	x						knowledge, self-efficacy, competence	Overall, participants improved self-efficacy in caring for patients pre-training (M = 181.9, SD = 54.0) to post-training (M = 210.5, SD = 38.9; Z = -2.93, p = 0.003) across all domains. They also improved overall knowledge (as assessed by the Knowledge Quiz) from pre-training (M=67.3%, SD= 11.5%) to post-training (M= 71.9%, SD=12.6%; Z= -1.79, p= 0.074).
Mazurek et al. 2020 ⁸⁸	10 academic medical centers in the USA and Canada	Primary care providers who provide care to children and to an underserved population (n=117)	Autism spectrum disorder	Over 6 months, 10 academic medical centers participated in a randomized control trial of 12 two-hour long training from interdisciplinary Autism experts through didactic presentations, PCP-generated case presentations, and group discussions.	x		x						competence, knowledge, self-efficacy, barriers to care	Over 6 months, there was an increase in autism screening rates from 65% (95% CI, 40%-84%) to 71% (95% CI, 52%-84%) (P= .63) and a small 6-month decrease in mean percentage of comorbidities addressed from 81% (95% CI, 67%-90%) to 77% (95% CI, 66%-86%) (P= .59). Participants also increased their knowledge and overall self-efficacy (9% increase; 95% CI, 4%-13%; P< .001) and (29% increase; 95% CI, 25%-32%; P< .001), respectively, even in follow-up.
Locke et al. 2019 ⁸⁹	University of Antananarivo, Madagascar	Doctors participating in a rehabilitation medicine diploma program (n=8) and physiotherapists (n=10)	People with physical disabilities	A 400-hour rehabilitation medicine program was developed in collaboration with the University of Leeds and offered in three sections: general principles of rehabilitation, neurological condition rehabilitation, and musculoskeletal condition rehabilitation. Participants were recruited from different national and regional hospitals to participate in the program.	x								knowledge, improved care	Doctors who participated in the program had significantly improved confidence and competency for care. Given the limited number of trained rehabilitation practitioner, the program also increased the number of trained physicians and physiotherapists in the country in a sustainable way.
Edinger et al. 2019 ⁹⁰	Rutgers University Office of Continuing Professional Education, USA	First responders (n=33)	People with developmental disabilities	A one-hour online workshop was held to improve disaster and critical care responders (knowledge and self-efficacy for working with people with developmental disabilities. The intervention included an overview of developmental disabilities, training on communication, and identification and interaction techniques.	x								knowledge, self-efficacy,	Overall knowledge improved from 66% correct to 81% correct, including significant (p<0.05) changes in 4 domains. Self-efficacy also improved from 53% on the pretest to 92% on the posttest, indicating an increase of 39% with significant (p<0.05) changes in all 10 domains.
Auberry et al. 2019 ⁹¹	Indiana University School of Nursing, USA	Volunteer direct support professionals that worked with		Volunteers participated in sessions on medication administration for people with intellectual and developmental disabilities. The session was facilitated by a doctoral-	x							x	knowledge, confidence	Students significantly improved their knowledge and skills to administer a variety of medications through participating in the program (p<0.05 for all topics). They expressed greater confidence in treating patients

		intellectual and developmental disabilities (n=12)	People with intellectual and developmental disabilities	trained and bachelor-trained registered nurse (RN) certified in developmental disability nursing covered various medication practice instructions through didactic lectures and simulations.											(p<0.02 for all metrics) and appreciated the opportunity to practice skills.
Olowoyeye et al. 2019 ⁹²	Ifo Local Government Area, Ogun State, Nigeria	Maternal and child health care workers (MCHWs) (n=65)	Children with visual impairments	MCHWs participated in a pre-test and focus group discussion on leading causes, identification, management, and prevention of childhood blindness. Participants then participated in a lecture and practical session on eye diseases and asked to log any referrals following the intervention. After 3 months, the participants did a post-test questionnaire.	x							x	knowledge		Participant's knowledge scores increased significantly after the training, particularly in identifying common diseases, locally available vitamins, and conjunctivitis prevention. 45.9% MCHWs felt they had inadequate training prior but did not significantly increase knowledge in immunizations for preventable blindness, or glaucoma/cataract treatment. Six children were referred for services because of the program.
Cameron et al. 2017 ⁹³	Metropolitan Hospital in Australia	Health professionals (n=52)	People with Aphasia	The intervention programme consisted of a 1-h lecture that discussed strategies for communicating effectively with people with aphasia (PWA). This lecture was provided by a speech language pathologist member of the research team. This was immediately followed by a 15–20-minute practical conversation with a PWA to facilitate application of the discussed strategies and approaches.	x							x	confidence, knowledge		The participants self-reported a mean confidence rating of 75.8 mm (SD= 12.2) after completing the training which was significantly higher than the rating of 46.6 mm (SD= 15.7) before completing the training (p< .001). At the pre-intervention assessment, participants identified a median of three strategies for facilitating communication with PWA. Following the training, the HPs were able to identify a total of 35 strategies.
Mac Giolla Phdraig et al. 2015 ⁴¹	Residential care homes in Dublin, Ireland	key care staff of residential home (n=22), people with ID (n=155)	People with intellectual disabilities	22 trainees from intervention group attended a multi-tiered oral health educational program on the oral health and oral hygiene of people with intellectual disabilities. Trainees were expected to train peers. A control group lived in centers where staff received no training.	x							x	knowledge, attitude, self-efficacy		The intervention improved the oral health-related knowledge, attitude, self-efficacy, and behavior of residential care-staff who provided care to a population of people with ID. A reduction in gingivitis and plaque scores were found in the people who lived in care homes where staff participated by 10.5% and 8.5% respectively, though not statistically significant between groups.
Dagnan et al. 2018 ²¹	An English Improving Access to Psychological Therapies (IAPT) service, UK	Therapists (n=68)	People with intellectual disabilities	Therapists working in an Improving Access to Psychological Therapies Service participated in a one- or two-day workshop on supporting people with intellectual. The workshop was divided into 8 sessions, including introduction to intellectual disability, stigma, assessment, adaptation of therapeutic techniques, approaches, and local services/resources.	x								confidence, self-efficacy, attitude		Therapists had improved confidence, self-efficacy, and attitudes across both therapist groups. There was a statistically significant improvement from pre- to post-training (p<0.001), and while improvements were sustained 3-months later, there was not a statistical significance. Qualitatively, several respondents noted the workshop increased awareness and sensitivity, adapted materials, communications, and interventions.
Catteau et al. 2013 ⁹⁴	Dental practices across France	Dentists (n=26)	People with disabilities	A 10-module online curriculum 'Autonomy and Oral Health' (30-50h of coursework) covered dental health for persons with disabilities, ranging from lack of autonomy to special care dentistry. Dentists also conducted an oral health promotion course for people with disabilities at institutions for children and adults.	x							x	knowledge, self-efficacy		Dentists scored their self-efficacy significantly higher both after the online training (p<0.01) and after the course (p<0.05). Overall, 94% of the staff/caregivers of the institutions where dentists implemented their interventions indicated an improvement in the oral hygiene of the residents.

Clark et al. 2019 ³⁷	University of Rwanda	Physical Therapists (n=66)	Children with physical disabilities	Physical therapists, to improve paediatric clinical decision making, were taught for a total of 48 hours over the course of 4 weekends. Teaching involved classroom lectures, small group case studies, laboratory skills practice, and clinical visits to participants place of work.	x		x						knowledge, confidence, competence	Physical therapists' performance on paediatric rehabilitation knowledge questionnaire improved from an average of 53.7% pre course to 82.2% after the course. Participants indicated an increased confidence in the eight clinical skills taught, which was also observed by US based therapists on clinic visits.
Quinn and Smolinski 2018 ⁹⁵	National Association of School Nurses annual conference, USAghent	School nurses (n=248)	People with intellectual disabilities	School nurses participated in three-hour educational sessions that focused on increasing their knowledge related to pain and pain assessment for students with intellectual disabilities.	x								knowledge, competence	Before, school nurses rating their difficulty in identifying pain in ID students ranked it a 6 (range 1-10, SD=1.9) compared to 3.41 in neurotypical (range 0-10, SD=2.25) children. This decreased to 2 (range 1-7, SD=1.8, p<0.0001) post-session. 74% of nurses changed their practices and reported significant decreases in difficulty when assessing pain (p<0.0006-0.1) six months after the intervention.
Phlypo et al. 2018 ⁹⁶	Ghent University and a local residential facility in Belgium	Residential facility caregivers (n=99, control =42, intervention=37)	People with intellectual disabilities	Students initiated an oral health promotion project for people with intellectual disabilities and their caregivers living in a residential care home. Facility caregivers were randomized and those in the intervention group received a booklet including chapters on oral hygiene, nutrition, visiting the dentist and practical tips on providing health care for people with disabilities and an information session for residents and caregivers.	x								knowledge, attitudes, self-efficacy	Caregivers significantly improved their knowledge index in the intervention group (mean of 5.9 pre-intervention to 7.1 post-intervention, p=0.03). Both groups improved their behaviors, attitudes, and self-efficacy, but not in the intervention group and not significantly in the control group.
Sanchez et al. 2017 ⁹⁷	Federally Qualified Health Care Centre in Nogales, Arizona, USA	Female community health-care workers (n=12), 4 of which participated in facilitator training	Hard of hearing and D/deaf people	CHWs attended two-hour focus groups and a 3-hour workshop that included didactic methods and simulation. CHWs who participated in the workshop held community screenings and some participated in an additional 8 sessions over 6 weeks to become facilitators. The goal was to improve screening, understanding, referrals and effective communication.	x		x	x	x				knowledge, confidence, competence	CHWs knowledge and confidence regarding peer support for community members with hearing loss increased and they were able to apply their skills to specific situations and help address the audiological needs of the community.
Mac Giolla Phadraig et al. 2012 ⁴²	Community-based residential care homes in Dublin, Ireland	Residential care home staff (n=219)	People with intellectual disabilities	22 trainees from intervention group attended a day long training session provided by a team of oral health trainers (lectures, group based practical sessions, role play, group feedback). Trainees were given training packs to go back to care home and train peers. The control group received no training. The goal was to see if training can improve the Knowledge, Attitudes, Self-efficacy, and Reported Behaviour (KBAS) of the intellectual disability staff.	x			x	x				knowledge, competence, attitudes	The mean knowledge index score for the intervention group rose from K= 7.23 (SD=1.34) to K= 7.86 (SD=1.27) p<0.0001. BAS scores also significantly increased from 4.73 (SD=1.32) to 5.42 (SD=1.51), p<0.0001. There was no significant difference in K and BAS scores in the control group.
Pasco et al. 2014 ⁴⁰	Cities across Romania (Bucharest, Cluj, Iasi, Timisoara)	Professional training programme (n=1075) online		Three-stage training program to increase knowledge of ASD and share best practices (two 3-day courses, six 6-day courses, and 30h of supervised practice). Two online	x			x					knowledge, competence	Scores on the ASD knowledge test were found to increase from 6.9 before to 11 after the training session (p<0.05). Six-months after, 94% reported using the knowledge and skills in current practice. Overall, the

		course (n=613, general practitioners (GPs) and psychiatrists)	Autism spectrum disorder	courses for GPs and Psychiatrists on improving diagnosis and treatment were also offered, among other initiatives as part of a nationwide project to improve awareness and social inclusion of people with ASD.											program enhanced knowledge and practical experience among medical professionals and other specialists working with children and young people with ASD.
Figueiras et al. 2014 ⁹⁸	18 Municipal Health Units in Belém, Pará, Brazil	Health professionals in primary care (n=221)	Cerebral palsy, autism, and preterm newborns	A course including lectures, discussion, videos, readings, and practical assessments related to assessing developmental disabilities. Participants were followed up 1-3 years later to see the impact on their practice.	x		x						x	knowledge, competence	Health practitioners who participated significantly increased their knowledge and skills of child development (p<0.001). Mothers also identified that practitioners asked more about child development and intervened more after participating.

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