TABLE A: Evidence Summary Table (Refs 1 & 35 are in Table A1 below - supporting references) (Tables B, C & D are below)

Count	Report ref.	Full citation	Date	Country	Aims	Methods / Description	Main outcome / notes / comments	Additional comments & rationale for inclusion
1	2	Davies A, Mueller J, Moulton G. Core competencies for clinical informaticians: A systematic review. Int J Med Inform. 2020 Sep;141:104237. doi: 10.1016/j.ijmedinf.2020.104237. Epub 2020 Jul 24. PMID: 32771960.	2020	UK	Building on initial work carried out by the Faculty of Clinical Informatics (FCI) in the UK, the creation of a national competency framework for Clinical Informatics is required for the definition of clinical informaticians' professional attributes and skills. We aimed to systematically review the academic literature relating to competencies, skills and existing course curricula in the clinical and health related informatics domains.	Two independent reviewers searched Web of Science, EMBASE, ERIC, PubMed and CINAHL. Publications were included if they reported details of relevant competencies, skills and existing course curricula. We report findings using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement.	Their review's primary focus was on informatics skills, competencies, skills, curricula, syllabi, and job descriptions. They found that a core a core set of skills and competencies around data, information management and information systems are fairly generic to all informatics disciplines. They summarised 35 publications (Tables 4 & 5 of their paper), describing the competencies and skills required in different informatics domains and 38 publications reporting details of curriculum design. The majority of courses and curricula described were at master's level (n=16) or undergraduate level (n=12). Only 3 courses were found at introductory level. They dentified eight key domains that cut across the different sub-disciplines of health informatics, including data, information management, human factors, project management, research skills/knowledge, leadership and management, systems development and evaluation, and health/healthcare. Some informatics disciplines such as Nursing Informatics appear to be further ahead at achieving widespread competency standardisation. Attempts at standardisation for competencies should be tempered with flexibility to allow for local variation and requirements.	Key paper for reference sources, development of FCI CCP. Important point " Attempts at standardisation for competencies should be tempered with flexibility to allow for local variation and requirements. "
2	3	Hersh et al. Ch. 13. From Competencies to Competence: Model, Approach and Lessons Learned From Implementing a Clinical Informatics Curriculum for Medical Students; *from* ; Health Professionals' Education in the Age of Clinical Information Systems, Mobile Computing and Social Networks: http://dx.doi.org/10.1016/B978-0-12-805362-1.00013-9	2017	USA	If clinical informatics is an essential competency for 21st century medical practice, then it must be introduced along with the rest of the curriculum in undergraduate medical education (UME). In this chapter, we describe details of our curriculum, starting with general principles, describing major areas of implementation, and discussing challenges and lessons learned	Aligned with this leadership, the transformation steering committee convened a Working Group on Integration of Biomedical Informatics and Technology as one of the key planning groups for the new curriculum. Once detailed planning was underway, we formed an informatics curriculum group composed of key faculty from our Department of Medical Informatics & Clinical Epidemiology (DMICE) and other clinical departments. This group met weekly to develop the initial architecture of the curriculum by (1) defining competencies and learning objectives in clinical informatics; (2) mapping these competencies to the ACGME competency domains, (3) proposing a timeframe for staging the introduction of these competencies into the UME curriculum appropriate to the learners' stage of development, and (4) devising an overall strategy for integrating informatics into the evolving new curriculum.	A set of 14 competencies and learning objectives for US medical students (Table 13.1)	**Users:** 14 Clinical informatics competency areas include; "Use & guide implementation of DSS" & " Find, search and apply knowledge-based information to patient care and other clinical tasks"
3	4	Hübner U, Shaw T, Thye J, Egbert N, Marin HF, Chang P, O'Connor S, Day K, Honey M, Blake R, Hovenga E, Skiba D, Ball MJ. Technology Informatics Guiding Education Reform - TIGER. Methods Inf Med. 2018 Jun;57(S 01):e30-e42. doi: 10.3414/ME17-01-0155. Epub 2018 Jun 20. PMID: 29956297; PMCID: PMC6193400.	2018	International	The primary aim of this study was to empirically define and validate a framework of globally accepted core competency areas in HI and to enrich this framework with exemplar information derived from local educational settings	Survey - 43 nursing experts from 21 countries. The questionnaire was comprised of 24 core competency areas in health informatics, which had been extracted from the international literature. Survey participants were asked to rate the relevance of the 24 core competency areas within the five roles on a scale from 0 to 100. Workshop - In order to validate the survey findings within a global expert community, a workshop was held at the 13th International Congress on Nursing Informatics. Twenty-eight experts from 13 countries on four continents attended the workshop	A recommendation framework of 24 core competency areas in 5 major nursing roles sorted by relevance; Clinical Nursing, Quality Management, Coordination of Inter-Professional Care, Nursing Management & IT Management in Nursing. This international recommendation framework for competencies in HI directed at nurses provides a grid of knowledge for teachers and learner alike that is instantiated with knowledge about informatics competencies, professional roles, priorities and practical, local experience. It also provides a methodology for developing frameworks for other professions / disciplines.	**Users:** Technology Informatics Guiding Education Reform - TIGER. "Decision support by IT" is a top 10 competency in 2 of the 5 nursing areas; clinical nursing (direct patient care) & IT management in nursing [see tables 3 & 4]
4	5	Lee, Juehea1; Wu, Annie Siyu2; Li, David3; Kulasegaram, Kulamakan (Mahan) PhD4. Artificial Intelligence in Undergraduate Medical Education: A Scoping Review. Academic Medicine: November 2021 - Volume 96 - Issue 11S - p S62-S70. doi: 10.1097/ACM.0000000000004291	2021	Canada	This scoping review aims to identify gaps and key themes in the peer-reviewed literature on AI training in UME. in the peer-reviewed literature on AI training in Undergraduate ME.	Scoping review	They found that there is little consensus on what to teach, and how to teach, about AI in undergraduate medical education. The review identified 5 key AI learning objectives & highlighted the importance of experiential learning for students.	Several mentions of AI in "decision-making" & one AI curricular recommendation "Help students integrate AI decision supppprt tools in clinical reasoning". **This is one of several articles on AI that indicate the importance of AI to clinical decision-making**
5	6	Paranjape K, Schinkel M, Nannan Panday R, Car J, Nanayakkara P. Introducing Artificial Intelligence Training in Medical Education. JMIR Med Educ. 2019 Dec 3;5(2):e16048. doi: 10.2196/16048. PMID: 31793895; PMCID: PMC6918207.	2019	International	Viewpoint article	Viewpoint article. They review the state of medical education at present and have recommended a framework on how to evolve the medical education curriculum to include AI.	They recommend content to be added at various stages of medical education, from pre-entry to medical school & higher training. "In the core phase of preclinical didactics, time should be devoted to working with health data curation and quality, provenance, integration, and governance, working with EHRs, AI fundamentals, and ethics and legal issues with AI. Course work in critical appraisal and statistical interpretation of AI and robotic technologies is also important. Physicians and machines working in combination have the greatest potential to improve clinical decision making and patient health outcome."	Link to clinical decision-making, use & training in EPRs
6	7	Grunhut J, Marques O, Wyatt ATM. Needs, Challenges, and Applications of Artificial Intelligence in Medical Education Curriculum. JMIR Med Educ. 2022 Jun 7;8(2):e35587. doi: 10.2196/35587. PMID: 35671077; PMCID: PMC9214616.	2022	USA	Viewpoint article	Viewpoint article. "Physicians will be tasked regularly with clinical decision-making with the assistance of AI-driven predictions. Present-day physicians are not trained to incorporate the suggestions of such predictions on a regular basis nor are they knowledgeable in an ethical approach to incorporating AI in their practice and evolving standards of care.". They review the state of medical education at present and have recommended a framework on how to evolve the UG medical education curriculum to include AI.	"Medical schools should incorporate AI in the curriculum as a longitudinal thread in current subjects. Current students should understand the breadth of AI tools, the framework of engineering and designing AI solutions to clinical issues, and the role of data in the development of AI innovations. Study cases in the curriculum should include an AI recommendation that may present critical decision-making challenges. Finally, the ethical implications of AI in medicine must be at the forefront of any comprehensive medical education. During clinical rotations and residency, focus should shift toward relevant applications of AI in practice."	Link to clinical decision-making
7	8	Egbert N, Thye J, Schulte G, Liebe JD, Hackl WO, Ammenwerth E, Hübner U. An Iterative Methodology for Developing National Recommendations for Nursing Informatics Curricula. Stud Health Technol Inform. 2016;228:660-4. PMID: 27577467.	2016	Austria, Germany & Switzerland	This study aims at proposing methodology for developing national, country-specific recommendations and at implementing this methodology for developing recommendations in nursing informatics for Austria, Germany and Switzerland.	A 3 step iterative method involving; national competency identification, survey based on those idetified competencies and two expert focus groups.	We developed an iterative triple methodology to yield validated and country specific recommendations for informatics core competencies in nursing. We identified relevant competencies from national sources (step 1), matched and enriched these with input from the international literature (step 2) and fed the resulting 24 core competencies into a survey (120 invited experts from which 87 responded) and two focus group sessions with a total of 48 experts (steps 3a/3b). The subsequent focus group sessions confirmed and expanded the findings. As a result, we were able to define role specific informatics core competencies for three countries.	**Users**: Decision support recognised as one of 24 core informatics competency for nurses (Table 1). But did not feature in top 6 competencies in any of 5 nurse roles: nurse managemenr; IT management; Quality management; clinical nursing & inter-professional coordination of care.
8	9	Jidkov L, Alexander M, Bark P, et al. Health informatics competencies in postgraduate medical education and training in the UK: a mixed methods study. BMJ Open 2019;9:e025460. doi:10.1136/ bmjopen-2018-025460	2019	UK	To assess health informatics (HI) training in UK postgraduate medical education, across all specialties, against international standards in the context of UK digital health initiatives (eg, Health Data Research UK, National Health Service Digital Academy and Global Digital Exemplars).	A mixed methods study of UK postgraduate clinician training curricula (71 specialties) against international HI standards: scoping review, curricular content analysis and expert consultation. A scoping literature review (PubMed until March 2017) informed development of a contemporary framework of HI competency domains for doctors. National training curricula for 71 postgraduate medical specialties were obtained from the UK General Medical Council and were analysed. Seven UK HI experts were consulted regarding findings.	The International Medical Informatics Association (IMIA) Recommendations for Biomedical and Health Informatics Education were used to develop a framework of competency domains. The number (maximum 50) of HI competency domains included in each of the 71 UK postgraduate medical specialties was investigated. After expert review, a universal HI competency framework was proposed. A framework of 50 HI domains was developed from 21 curricula using a scoping review. Findings suggest UK PGME neglects competencies reflected in international standards. In the first comprehensive study across all 71 specialties in UK postgraduate medical training, we showed that health informatics (HI) is grossly under-represented in postgraduate clinical training curricula. HI competencies for training doctors were studied, but those for other clinicians, such as associate specialists, staff grade clinicians and consultants, have no national curricula, making it impossible to assess if HI skills are being promoted as part of their continuing professional development (CPD).	**Users:** Fifty Domains of Competency in HI: Domain 3: Efficient and responsible use of information processing tools to support healthcare professionals' practice and their decision making. *Domain 20* ; Principles of clinical/medical decision making and diagnostic and therapeutic strategies. Domain 35: Methods for decision support and their application to patient management, acquisition, representation and engineering of medical knowledge; construction and use of clinical pathways and guidelines.
9	10	Grunhut J, Wyatt AT, Marques O. Educating Future Physicians in Artificial Intelligence (AI): An Integrative Review and Proposed Changes. J Med Educ Curric Dev. 2021 Sep 6;8:23821205211036836. doi: 10.1177/23821205211036836. PMID: 34778562; PMCID: PMC8580487.	2021	USA	This study aims to review the current literature that covers the attitudes of medical students towards AI, implementation of AI in the medical curriculum, and describe the need for more research in this area.	An integrative review was performed to combine data from various research designs and	They found that the current knowledge of AI among physicians was at an 'alarmingly low' level and insufficient for future physicians. They concluded that there is a consensus on the importance of AI education in medical curriculum but a lack of actual planning and implementation. There are few plans or implementations reported on how to incorporate AI in the medical curriculum. Medical schools must work together to create a longitudinal study and initiative on how to successfully equip medical students with knowledge in AI.	As above - does not specifically relate to DSS but more AI in clinical decision-making. "the need for competent human–machine interaction for the use of data to aid clinical decision making will rise."
10	11	Honey ML, Skiba DJ, Procter P, Foster J, Kouri P, Nagle LM. Nursing Informatics Competencies for Entry to Practice: The Perspective of Six Countries. Stud Health Technol Inform. 2017;232:51-61. PMID: 28106582.	2017	International	Exploration of international competencies for nurse training to enter practise	Authors are members of IMIA NI Working Group - presentations to the WG	A summary of current status from each of 6 countries regarding the development and use of informatics competencies to educate nurses	**Users:** All 6 countries agree Informatics tools & competencies essential for using DSS. No detail on specific competencies. Despite the differences between the countries there is also a shared concern on how to educate and prepare nurses for a technology rich healthcare environment.
11	12	Enrico Coiera. Guide to Health Informatics. 3rd Edition.CRC Press 2015. ISBN 9781444170498	2015	Australia	Written for HCPs who wish to understand the principles and applications of information & communication methods & technologies in healthcare.	Overview of CDS with examples, risks & benefits (e.g. patient safety), coverage of AI, covers computational reasoning & DS models, model building for DS, data analysis & discovery.	Part 7 Clinical DS & analytics; Ch 25 CDS (& AI in medicine), Ch26 Computational reasoning methods, Ch27 Model building for DS, data analysis & scientific discovery	Goood general informatics education & training text, nothing about competencies or curricula, but important background knowledge.
12	13	HEE Digital Literacy Capability Framework 2018. https://www.hee.nhs.uk/our-work/digital-literacy	2018	England	It is intended as a developmental and supportive tool that can empower and enable all staff.	This framework is designed to encourage all to explore the different levels of capability that sit under the six domains.	Digital literacy is person-centred and can be divided into six domains of capability. Each domain describes specific capabilities, made up of skills, behaviours and attitudes, to help improve the health and social care workforce. 1. Communication, collaboration and participation 2. Teaching, learning and self-development 3. Information, data and content literacies 4. Creation, innovation and research 5. Technical proficiency 6. Digital identity, wellbeing, safety and security. Indicative capabilities are listed across four levels against each of the six domains: novice, basic user, skilled user, expert user.	HEE Capability framework. Not specific for DSS, but useful for career progression (rather like DDaT)
13	14	Rimpiläinen, S., Morrison, C., Nielsen, S. L., & Rooney, L. (2019). Spotlight on Careers in Digital Health and Care: Addressing Future Workforce Development Needs in Digital Health and Care. Digital Health and Care Institute, University of Strathclyde Glasgow https://doi.org/10.17868/69247	2019	Scotland	The main purpose of this report is to highlight the issues underlying the lack of clear career pathways and offer advice for organisations involved in planning the education and training provision for the (Digital) Health and Care sector in Scotland.	Based on earlier research carried out by the DHI, the occupational categories in most urgent need of staff in Scotland's Digital Health and Care sector are: 1. Software Developers 2. Product Owners 3. Implementation Facilitators 4. Knowledge Engineers 5. Health Data Analysts, and 6. Cyber Security Specialists.	Based on desk research and qualitative in-depth interviews, the study outlines the following key findings: 1. General lack of awareness of the existing career opportunities and emerging job roles in the Digital Health and Care sector. 2. The emergence of a new type of occupational category: job roles at the interface of humans and technology translating data, knowledge and information between them. 3. The increasing importance of distinctly human soft skills across the six occupational categories. 4. The study shows valuable opportunities for considering common approaches to education, skills development and career planning across the six categories due to a vast, shared skills and capabilities base. The most skills-intensive occupational categories that we examined were Knowledge Engineers (KE) and Implementation Facilitators (IF). Both the KEs and IFs require the widest range of skills, the highest number of specialist skills, with both needing more in-depth capabilities than other categories. These two categories share a bulk of their required skills with one another. See Ch 4.3. Implementation Facilitators & appendix 5c. & Ch 4.4. Knowledge Engineers & appendix 5d.	Scottish focus. Includes new skills framework for each category (Ch. 3). See Table 3.1 for skills heat map & appendix 6.The Four C's - Critical thinking, Creativity, Collaboration and Communication - of the 21st Century skills feature prominently in the table, too. "Communication" emerged at the top as the most important capability of all. Many of the key skills and capabilities named during the interviews were judged to be soft skills, c.f. the SFIA framework is strongly based on professional skills, such as "information governance" or "network design"
14	15	NHS Education for Scotland, Public Health Scotland: Developing the Knowledge, Information and Data (KIND) Workforce for Health and Social Care. A Thematic Review of the Literature. https://beta.isdscotland.org/media/5068/developing-the-informatics-workforce-for-health-and-social-care-report-200619.pdf	2020	Scotland	This review presents a thematic analysis of policy documentation, research evidence and grey literature reports, to inform recommendations and a business case for development of the KIND workforce for health and social care in Scotland	This review presents a thematic analysis of policy documentation, research evidence and	Knowledge, Information and Data (KIND) staff are a key part of the Informatics workforce supporting Scotland's health and social care. The KIND workforce include data and information analysts and managers, library and knowledge staff and data scientists. This review combines research reports on skills development and organisation of the KIND workforce with evidence on the emerging strategic direction of travel for digital transformation in health and social care. Its analysis of future workforce development needs includes current changes reported in the literature, and the anticipated impact of new paradigms for health and social care founded on next generation technologies which embed informatics in day to day work and daily life.	Highlights need for changes in: Ways of working (focus on prevention, prediction & wellbeing), collaborate, support new users, co-design & support self-service options), Skills (technical, translational meta-skills) & Roles (generalists, hybrid roles, translators)

15	16	Developing healthcare workers' confidence in AI (report 2/2). October 2022. NHS AI Lab & Health Education England. https://digital-transformation.hee.nhs.uk/building-a-digital-workforce/dart-ed/horizon-scanning/developing-healthcare-workers-confidence-in-ai	2022	England	This research is a collaboration between the NHS AI Lab and Health Education England. Its primary aim is to inform the development of education and training to develop healthcare workers' confidence in artificial intelligence (AI). Supporting healthcare workers to feel confident in identifying when and how to use AI.	This is the second of two reports in relation to this research. The first report outlined a conceptual framework for understanding what influences confidence in AI among healthcare workers. This second report: ›› identifies archetypes within the workforce based on AI-related roles and responsibilities, ›› determines educational and training needs based on these archetypes and the findings and conceptual framework of the first report, ›› presents suggested pathways to develop related education and training offerings.	5 archetypes: **Shaper** (set direction for AI policy), **Driver** (champion & lead AI development & deployment at regional / local level), **Creator** (create AI technologies for use in healthcare settings), **Embedder** (implement, evaluate & monitor AI technologies deployed within healthcare settings), **User** (end user in healthcare settings). Educational approach will be at foundational, advanced & product-specific levels & the report lists capability requirements (knowledge taxonomy & skills and capabilities taxonomy) mapped against these 3 levels & the 5 workforce archetypes. (**Chapter 3 & Appendix A**). See section 3.2 for foundational AI education for all healthcare workers. See 3.3 for advanced AI education for specific workforce archetypes. See 3.4 for product-specific user training. Note recommendations for AI MDTs, Specialist AI skills within NHS, changes to DDaT.	Recommendations to be reflected in updated DDaT framework. See S3.2 (Foundation), S3.3 (Advanced), S3.4 (Product-specific). Generally see Chapter 3 & Appendix A
16	17	Kannry J, Sengstack P, Thyvalikakath TP, Poikonen J, Middleton B, Payne T, Lehmann CU. The Chief Clinical Informatics Officer (CCIO): AMIA Task Force Report on CCIO Knowledge, Education, and Skillset Requirements. Appl Clin Inform. 2016 Mar 16;7(1):143-76. doi: 10.4338/ACI-2015-12-R-0174. PMID: 27081413; PMCID: PMC4817341.	2016	USA	The American Medical Informatics Association (AMIA) identified a need to better delineate the knowledge, education, skillsets, and operational scope of the CCIO in an attempt to address the challenges surrounding the professional development and the hiring processes of CCIOs.	An AMIA task force developed knowledge, education, and operational skillset recommendations for CCIOs focusing on the common core aspect and describing individual differences based on Clinical Informatics focus.	The task force concluded that while the role of the CCIO currently is diverse, a growing body of Clinical Informatics and increasing certification efforts are resulting in increased homogeneity. The task force advised that 1.) To achieve a predictable and desirable skillset, the CCIO must complete clearly defined and specified Clinical Informatics education and training. 2.) Future education and training must reflect the changing body of knowledge and must be guided by changing day-to-day informatics challenges. A better defined and specified education and skillset for all CCIO positions will motivate the CCIO workforce and empower them to perform the job of a 21st century CCIO. Formally educated and trained CCIOs will provide a competitive advantage to their respective enterprise by fully utilizing the power of Informatics science. To achieve a predictable and desirable skillset, the CCIO must complete clearly defined and specified Clinical Informatics education and training.	**Both roles:** AMIA report. Emphasises importance of DSS & better information for decision-making at organisational / strategic level. Includes Clinical Decision Making and Care Process Improvement: Knowledge and skills to implement effective clinical decision making systems and develop clinical processes that support effective, efficient, safe, timely, equitable, and patient-centered care, with emphasis on Clinical Decision Support, Evidence-based care, Patient Safety, Clinical workflow analysis & Quality Improvement as key competencies (Table 1)
17	18	Robert M Wachter: Making IT Work: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/550866/Wachter_Review_Accessible.pdf Harnessing the Power of Health Information Technology to Improve Care in England. Report of the National Advisory Group on Health Information Technology in England	2016	England	In late 2015, the National Advisory Group on Health Information Technology in England was formed to advise the Department of Health and NHS England on its efforts to digitise the secondary care system. Our recommendations fall into two broad categories: ten overall findings and principles, followed by ten implementation recommendations.	The purpose is to radically improve the chances that important information will be available when and where it is needed. National Advisory Group - Report. The Advisory Group held nine 2-hour meetings by teleconference, as well as a two-day meeting in London in April 2016. During the April meeting, the Group heard presentations from about a dozen diverse experts and stakeholders. Dr. Wachter also held individual or group meetings with approximately 100 people, met with several stakeholder groups, and received written input from many other individuals and organisations. He conducted on-site visits at the Barts, Salford, and Imperial Trusts; he and several members of the Advisory Group also visited Addenbrooke's Hospital during the April meeting in England.	Getting it right requires a new approach, one that may appear paradoxical yet is ultimately obvious: digitising effectively is not simply about the technology, it is mostly about the people. The one thing that NHS cannot afford to do is to remain a largely non-digital system. It is time to get on with IT. Recommendation 4. Strengthen and Grow the CCIO Field, Others Trained in Clinical Care and Informatics, and Health IT Professionals More Generally	Recognises importance of DS for clinicians & patients. Rather dated now, but important foundations
18	19	Data Driven Healthcare in 2030: Transformation Requirements of the NHS Digital Technology and Health Informatics Workforce. Full Report: HEE Digital Readiness Programme March 2021 (Interim Report) https://tinyurl.com/ygrbgb8r	2021	England	The aim is to develop a 10-year workforce plan. This report provides an analysis of the NHS digital technology and health informatics workforce, which is at the heart of building and supporting the technology, data and knowledge infrastructure and ecosystem. Our modelling and demand forecast projection for an ambitious technological and data- driven NHS shows an estimated 78,000 staff members in supporting, professional, managerial and senior leadership roles will be needed in this workforce by 2030.	This project looks ahead to the NHS digital technology and health informatics workforce (the 'digital workforce') of 2030. This foresight was achieved through the following stages of the project: Stage 1: Developing future scenarios. Stage 2: Undertake a workforce demand forecasting exercise. Stage 3: Demand forecasting – modelling and projecting demand. Stage 4: Supply forecasting – modelling and projecting supply. Stage 5: Project 10-year demand and supply and identify possible shortages or excesses in workforce capacity. Stage 6: Identify structural shifts in the workforce. Stage 7: Highlight in-demand, emerging and critical job roles and skills.	An increase in staffing levels and embedding of new job roles and skills and capabilities in the digital workforce is required for NHS trusts progressing through the levels or stages of digital transformation. The greatest growth in demand for the digital workforce in the next 10 years will be for professionals and specialists in the areas of information management and clinical informatics.Recommendation 4: Develop standardised job roles for multi-professional clinicians, including clinician-informaticians, to address the workforce demand anticipated across the depth and breadth of clinical informatics. Recommendation 11: Develop key roles and a supply of professionals in the area of managing programmes and projects relating to the implementation of digital technology, and introduction of new technology-supported clinical and organisational processes in NHS trusts.	Knowledge management > +179% in workforce over next 10 yrs. Table 5.7: 21st Century Skills Plus framework – Digital Health and Care Institute (Ref 73 above). Table 6C.1 Knowledge engineer - includes summary of roles and skills required. Overlap with clinical informatics & explicit link to HCPC-registered clinical scientists. Section 6F Knowledge management - see Table 6F.1
19	20	The Topol review. Preparing the healthcare workforce to deliver the digital future. An independent report on behalf of the Secretary of State for Health and Social Care (February 2019)	2019	England	• How technological and other developments (including in genomics, artificial intelligence, digital medicine and robotics) are likely to change the roles and functions of clinical staff in all professions over the next two decades to ensure safer, more productive, more effective and more personal care for patients; • what the implications of these changes are for the skills required by the professionals filling these roles, identifying professions or sub-specialisms where these may be particularly significant; • the consequences for the selection, curricula, education, training, development and lifelong learning of current and future National Health Service staff.	From late 2017 to the present, our cross-disciplinary team of experts, including clinicians, educators, ethicists, computer scientists, engineers and economists, reviewed the available data and projected into the future what impact these technologies would have on the NHS workforce over the next two decades. Such an undertaking with experts from multiple disciplines and a country-wide perspective has not, to our knowledge, been undertaken previously.With patients placed firmly at the centre of our discussions, this report is the culmination of an extensive literature review, interviews, expert meetings and roundtables. We had an overwhelming response to the call for evidence from individuals and organisations, with responses from hundreds of patient representatives, professional groups, industry, education, regulators and national bodies.	The next decade presents an opportunity to address data governance and cyber security concerns, agree ethical frameworks and develop NHS staff/organisations to implement genomics and digital technologies in the workplace. The complexity of data governance requirements should not be a reason for inaction. Most importantly, there must be mechanisms in place to ensure advanced technology does not dehumanise care. While automation will improve efficiency, it should not replace human interaction. Within 20 years, 90% of all jobs in the NHS will require some element of digital skills. Staff will need to be able to navigate a data-rich healthcare environment. All staff will need digital and genomics literacy. This Review is about both the existing and the future workforce. We need to tackle differences in the digital literacy of the current workforce linked to age or place of work. Recommendation: The NHS should create or increase the numbers of clinician, scientist, technologist and knowledge specialist posts with dedicated, accredited time, with the opportunity of working in partnership with academia and/or the health tech industry to design, implement and use digital, AI and robotics technologies. (DM4/AIRS)	Recognises importance of AI-based technologies with overall focus on genomics & digital medicine. References HEE Digital Capabilities Framework (Ref 13 above)
20	21	Mozaffar H, Cresswell KM, Williams R, Bates DW, Sheikh A. Exploring the roots of unintended safety threats associated with the introduction of hospital ePrescribing systems and candidate avoidance and/or mitigation strategies: a qualitative study. BMJ Qual Saf. 2017 Sep;26(9):722-733. doi: 10.1136/bmjqs-2016-005879. Epub 2017 Feb 7. PMID: 28174319.	2017	UK	Hospital electronic prescribing (ePrescribing) systems offer a wide range of patient safety benefits. Like other hospital health information technology interventions, however, they may also introduce new areas of risk. Despite recent advances in identifying these risks, the development and use of ePrescribing systems is still leading to numerous unintended consequences, which may undermine improvement and threaten patient safety. These negative consequences need to be analysed in the design, implementation and use of these systems. We therefore aimed to understand the roots of these reported threats and identify candidate avoidance/mitigation strategies.	We analysed a longitudinal, qualitative study of the implementation and adoption of ePrescribing systems in six English hospitals, each being conceptualised as a case study. Data included semistructured interviews, observations of implementation meetings and system use, and a collection of relevant documents. We analysed data first within and then across the case studies. Our dataset included 214 interviews, 24 observations and 18 documents	We developed a taxonomy of factors underlying unintended safety threats in: (1) suboptimal system design, including lack of support for complex medication administration regimens, lack of effective integration between different systems, and lack of effective automated decision support tools; (2) inappropriate use of systems-in particular, too much reliance on the system and introduction of workarounds; and (3) suboptimal implementation strategies resulting from partial roll-outs/dual systems and lack of appropriate training. We have identified a number of system and organisational strategies that could potentially avoid or reduce these risks. Imperfections in the design, implementation and use of ePrescribing systems can give rise to unintended consequences, including safety threats. Hospitals and suppliers need to implement short- and long-term strategies in terms of the technology and organisation to minimise the unintended safety risks. Essential to this is promoting safety, in order to better anticipate potentially adverse conse- quences, and enabling safety, in order to potentially minimise their risks.	DSS risks v benefits & implications for patient / clinical safety. Important DSS lifecycle consideration.
21	22	Olakotan O, Mohd Yusof M, Ezat Wan Puteh S. A Systematic Review on CDSS Alert Appropriateness. Stud Health Technol Inform. 2020 Jun 16;270:906-910. doi: 10.3233/SHTI200293. PMID: 32570513.	2020	Malaysia	This review seeks to answer "what are the factors affecting CDSS alert appropriateness in supporting clinical workflow?"	A systematic review was carried out to identify factors affecting CDSS alert appropriateness in supporting clinical workflows using a recently introduced framework. The review followed the guidelines of Preferred Reporting Items for Systematic Reviews (PRISMA). Clinical decision support systems (CDSSs) provides vital information for managing patients by advising clinicians through an alert or reminders about adverse events and medication errors. Clinicians receive a high number of alerts, resulting in alert override and workflow disruptions.	The review findings identified several influencing factors of CDSS alert appropriateness including: technology (usability, alert presentation, workload and data entry), human (training, knowledge and skills, attitude and behavior), organization (rules and regulation, privacy and security) and process (waste, delay, tuning and optimization). The findings can be used to guide the design of CDSS alert and minimise potential safety hazards associated with CDSS use.	This review evaluated DSS alert appropriateness that was mostly contributed by technology factors, particularly system design that is related to alert content, accuracy, and usability.
22	23	Camacho, Jhon & Zanoletti-Mannello, Manuela & Landis-Lewis, Zach & Kane-Gill, Sandra & Boyce, Richard. (2020). A Conceptual Framework to Study the Implementation of Clinical Decision Support Systems (BEAR):Literature Review and Concept Mapping. Journal of Medical Internet Research. 10.2196/18388.	2020	Americas	Their objective was to propose an integrated framework that bridges the gap between the behavioural change and technology acceptance aspects of the implementation of CDSSs. To develop a framework, grounded in the literature about determinants of behavioral change and technology acceptance, that would be useful to researchers investigating the implementation of CDSSs as a strategy to foster the uptake of evidence-based recommendations.	They employed an iterative process to map constructs from four contributing frameworks—the Theoretical Domains Framework (TDF); the Consolidated Framework for Implementation Research (CFIR); the Human, Organization, and Technology-fit framework (HOT-fit); and the Unified Theory of Acceptance and Use of Technology (UTAUT)—and the findings of 10 literature reviews, identified through a systematic review of reviews approach.	The idea of BEAR originated in our search for a conceptual framework to guide our research in the use of CDSSs as a strategy to implement clinical practice guidelines. The resulting framework comprises 22 domains: agreement with the decision algorithm; attitudes; behavioral regulation; beliefs about capabilities; beliefs about consequences; contingencies; demographic characteristics; effort expectancy; emotions; environmental context and resources; goals; intentions; intervention characteristics; knowledge; memory, attention, and decision processes; patient–health professional relationship; patient's preferences; performance expectancy; role and identity; skills, ability, and competence; social influences; and system quality. We demonstrate the use of the framework providing examples from two research projects. BEAR framework. BEhaviour and Acceptance fRamework comprising 22 domains to bridge the gap between behavioural change and technology acceptance	**Research, Implementation & Spread:** This is relevant for implementation & dissemination roles in DSS, some references may also be relevant (Table 1). NB BEAR & BEARI are unrelated! **BEAR** domains: Knowledge; Skills, ability & competence; Role and identity; Beliefs about capabilities; Beliefs about consequences; Attitudes; Contingencies; Intentions; Goals; Memory, attention & decision processes; Environmental context and resources; Social influences; Emotions; Behavioural regulation; Intervention characteristics; Performace expectancy; Effort expectancy; Demographic characteristics; System quality; Agreement with the decision algorithm; Patient-Health professional relationship; Patient preferences.
23	24	Cho I, Bates DW. Behavioral Economics Interventions in Clinical Decision Support Systems. Yearb Med Inform. 2018 Aug;27(1):114-121. doi: 10.1055/s-0038-1641221. Epub 2018 Aug 29. PMID: 30175514; PMCID: PMC6115210.	2018	USA & S Korea	This review aimed to identify decision biases that lead clinicians to exhibit irrational behaviors or responses, and to show how behavioral economics can be applied to interventions in order to promote and reveal the contributions of CDS to im- proving health care quality.	Systematic review of studies published in 2016 and 2017 and applied a snowball citation- search method to identify topical publications related to studies forming part of the BEARI study (Application of Behavioral Economics to Improve the Treatment of Acute Respiratory Infections) multisite, cluster-randomized controlled trial performed in the United States.	10 behavioural economics concepts & 9 cognitive biases (Table 1) were addressed and investigated for clinician decision-making, and that the following five concepts, which were actively explored, had an impact in CDS applications: social norms, framing effect, status-quo bias, heuristics, and overconfidence bias. This review revealed that the use of behavioral economics techniques is increasing in areas such as antibiotics prescribing and preventive care, and that additional tests of the concepts and heuristics described would be useful in other areas of CDS. CDS systems have the potential to change the way medicine is taught, since responding to them well will become a key skill [85]. Clinicians are affected by their experiences, intuition, and cognitive shortcuts when making clinical decisions, and can be vulnerable to multiple cognitive biases. One method of addressing this problem is to apply behavioural economics approaches and the heuristics of cognitive psychology in CDS interventions. Several recent studies have shown that such approaches are more likely to change clinician behaviours in positive ways compared to using more traditional approaches.	**Implementation & Spread:** roles in DSS. Behavioural concepts & psychology principles relevant to DS support for clinicians and patients: Social norms; Framing effect; Status-quo bias; Loss/risk aversion; Decision fatigue; Order effects - primacy & recency; Salience effect; IKEA effect; Herding; Heuristics; Cognitive biases (overconfidence, anchoring, availability, hindsight, commission, omission, reprenentativeness, relative risk); too much choice / alternatives. Some references may also be relevant. NB BEAR & BEARI are unrelated!
24	25	Kawamoto K, Houlihan CA, Balas EA, Lobach DF. Improving clinical practice using clinical decision support systems: a systematic review of trials to identify features critical to success. BMJ. 2005 Apr 2;330(7494):765. doi: 10.1136/bmj.38398.500764.8F. Epub 2005 Mar 14. PMID: 15767266; PMCID: PMC555881.	2005	USA	To identify features of clinical decision support systems critical for improving clinical practice.	Systematic review of randomised controlled trials. Studies had to evaluate the ability of decision support systems to improve clinical practice. Studies were assessed for statistically and clinically significant improvement in clinical practice and for the presence of 15 decision support system features (Table 1) whose importance had been repeatedly suggested in the literature.	Decision support systems significantly improved clinical practice in 68% of trials. Univariate analyses revealed that, for five of the system features, interventions possessing the feature were significantly more likely to improve clinical practice than interventions lacking the feature. Multiple logistic regression analysis identified four features as independent predictors of improved clinical practice: automatic provision of decision support as part of clinician workflow (P < 0.00001), provision of recommendations rather than just assessments (P = 0.0187), provision of decision support at the time and location of decision making (P = 0.0263), and computer based decision support (P = 0.0294). Of 32 systems possessing all four features, 30 (94%) significantly improved clinical practice. Furthermore, direct experimental justification was found for providing periodic performance feedback, sharing recommendations with patients, and requesting documentation of reasons for not following recommendations.	**Conclusions**: Several features were closely correlated with DS systems' ability to improve patient care significantly. Clinicians and other stakeholders should implement clinical decision support systems that incorporate these features whenever feasible and appropriate. A common theme of all four features is that they make it easier for clinicians to use a clinical decision support system, suggesting that an effective system must minimise the effort required by clinicians to receive and act on system recommendations
25	26	Van de Velde, S., Heselmans, A., Delvaux, N. *et al.* A systematic review of trials evaluating success factors of interventions with computerised clinical decision support. *Implementation Sci* **13**, 114 (2018). https://doi.org/10.1186/s13012-018-0790-1	2018	Europe	To examine which factors make CDS strategies more effective on a number of outcomes, including adherence to recommended practice, patient outcome measures, economic measures, provider or patient satisfaction, and medical decision quality. Computerised clinical decision support (CDS) can potentially better inform decisions, and it can help with the management of information overload. It is perceived to be a key component of a learning health care system. Despite its increasing implementation worldwide, it remains uncertain why the effect of CDS varies and which factors make CDS more effective.	They identified randomised controlled trials, non-randomised trials, and controlled before-and-after studies that directly compared CDS implementation with a given factor to CDS without that factor by searching CENTRAL, MEDLINE, EMBASE, and CINAHL and checking reference lists of relevant studies. We considered CDS with any objective for any condition in any healthcare setting. We included CDS interventions that were either displayed on screen or provided on paper and that were directed at healthcare professionals or targeted at both professionals and patients. The reviewers screened the potentially relevant studies in duplicate. They extracted data and assessed risk of bias in independent pairs or individually followed by a double check by another reviewer. We summarised results using medians and interquartile ranges and rated our certainty in the evidence using the GRADE system.	We identified 66 head-to-head trials that we synthesised across 14 comparisons of CDS intervention factors. Providing CDS automatically versus on demand led to large improvements in adherence. Displaying CDS on-screen versus on paper led to moderate improvements and making CDS more versus less patient-specific improved adherence modestly. When CDS interventions were combined with professional-oriented strategies, combined with patient-oriented strategies, or combined with staff-oriented strategies, then adherence improved slightly. Providing CDS to patients slightly increased adherence versus CDS aimed at the healthcare provider only. Making CDS advice more explicit and requiring users to respond to the advice made little or no difference. The CDS intervention factors made little or no difference to patient outcomes. The results for economic outcomes and satisfaction outcomes were sparse.	Supercedes Kawamoto, multi-method approach includes 66 trials. **Benchmark study.** (See also GUIDES study below)

26	27	Keyworth C, Hart J, Armitage CJ, Tully MP. What maximizes the effectiveness and implementation of technology-based interventions to support healthcare professional practice? A systematic literature review. BMC Med Inform Decis Mak. 2018 Nov 7;18(1):93. doi: 10.1186/s12911-018-0661-3. PMID: 30404638; PMCID: PMC6223001.	2018	UK	Three aims were addressed: to identify interventions with a technological component that are successful at changing professional practice, to determine if and how such interventions are theory-based, and to examine barriers and facilitators to successful implementation.	A literature review informed by realist review methods was conducted involving a systematic search of studies reporting either: (1) behavior change interventions that included technology to support professional practice change; or (2) barriers and facilitators to implementation of technological interventions. Extracted data was quantitative and qualitative, and included setting, target professionals, and use of Behaviour Change Techniques (BCTs). The primary outcome was a change in professional practice. A thematic analysis was conducted on studies reporting barriers and facilitators of implementation.	Sixty-nine studies met the inclusion criteria; 48 (27 randomized controlled trials) reported behavior change interventions and 21 reported practicalities of implementation. The most successful technological intervention was decision support providing healthcare professionals with knowledge and/or person-specific information to assist with patient management. Successful technologies were more likely to operationalise BCTs, particularly "instruction on how to perform the behavior". Facilitators of implementation included aligning studies with organisational initiatives, ensuring senior peer endorsement, and integration into clinical workload. Barriers included organisational challenges, and design, content and technical issues of technology-based interventions. The most successful technological intervention was healthcare professional decision support, suggesting this may have an important role to play in clinical practice. The most common intervention setting was within primary care; however more practice change occurred in hospitals.	Technological interventions must focus on providing decision support for clinical practice using recognized behavior change techniques. Interventions must consider organizational context, clinical workload, and have clearly defined benefits for improving practice and patient outcomes.
27	28	Van de Velde S, Kunnamo I, Roshanov P, Kortteisto T, Aertgeerts B, Vandvik PO, Flottorp S; GUIDES expert panel. The GUIDES checklist: development of a tool to improve the successful use of guideline-based computerised clinical decision support. Implement Sci. 2018 Jun 25;13(1):86. doi: 10.1186/s13012-018-0772-3. PMID: 29941007; PMCID: PMC6019508.	2018	Europe	The goal of the GUIDES project was to increase the success of guideline-based CDS. By developing a checklist, we aimed to assist those involved with the implementation of CDS interventions to consider success factors for guideline-based CDS in a structured way.	Computerised decision support (CDS) based on trustworthy clinical guidelines is a key component of a learning healthcare system. Research shows that the effectiveness of CDS is mixed. Multifaceted context, system, recommendation and implementation factors may potentially affect the success of CDS interventions. This paper describes the development of a checklist that is intended to support professionals to implement CDS successfully. We developed the checklist through an iterative process that involved a systematic review of evidence and frameworks, a synthesis of the success factors identified in the review, feedback from an international expert panel that evaluated the checklist in relation to a list of desirable framework attributes, consultations with patients and healthcare consumers and pilot testing of the checklist.	We screened 5347 papers and selected 71 papers with relevant information on success factors for guideline-based CDS. From the selected papers, we developed a 16-factor checklist that is divided in four domains, i.e. the CDS context, content, system and implementation domains. The panel of experts evaluated the checklist positively as an instrument that could support people implementing guideline-based CDS across a wide range of settings globally. Patients and healthcare consumers identified guideline-based CDS as an important quality improvement intervention and perceived the GUIDES checklist as a suitable and useful strategy. The GUIDES checklist can support professionals in considering the factors that affect the success of CDS interventions. It may facilitate a deeper and more accurate understanding of the factors shaping CDS effectiveness. Relying on a structured approach may prevent that important factors are missed.	The checklist contains 4 domains, each including 4 factors, making 16 factors in total. Designed for DSS implementation. Fantastic evidence-based resource.
28	29	Improving Outcomes with Clinical Decision Support. An Implementer's Guide (Second Edition) Jerome A Osheroff et al. HIMSS 2012. ISBN: 978-0-9844577-3-1	2012	USA	The purpose of this Guide is to help drive measurable CDS-enabled improvements in care quality, patient safety, and efficiency. Our overarching objective is to help the audience develop and implement a successful, sustainable CDS program.	Each of the nine chapters in this Guide follows a standard format with highly interdependent sections to guide you—whether implementer, HIT vendor, student or other CDS stakeholder—toward understanding and applying the chapter's guidance. Part 1. Building a Strong Conceptual Foundation and CDS Program. Ch.1 Basic concepts & approach. Ch.2. Organising a successful CDS program. Ch.3. Other key CDS program building blocks: systems, workflow & measurement. Ch.4. Knowledge management for CDS programs. Part 2. Selecting, Configuring and Implementing CDS Interventions. Ch.5. Foundational considerations for effective CDS interventions. Ch. 6. Selecting interventions to deliver targetted improvements. Ch. 7. Configuring the interventions. Ch.8. Putting interventions into action. Ch. 9. Measuring results and continuously refining the program.	This book is about helping you do two things: Part I (Chapters 1 through 4) helps you set up (or refine) a successful CDS program in a hospital, health system, or physician practice; and Part II (Chapters 5 through 9) helps you configure and launch specific CDS interventions that recipients appreciate and that measurably improve targeted outcomes. CDS is all about intelligence: clinical knowledge and data intelligently applied at the point where healthcare decisions are made. Simply put, CDS involves making sure that all those engaged in care processes—patients, nurses, physicians, pharmacists, and many others—have the information they need to make good decisions and take appropriate action that will lead to desirable outcomes. Straightforward to say, not so easy to do.	This really is the standard text for implementers of CDS systems. "Think of this Guide less as a book than as a dynamic roadmap for the journey to transform healthcare quality, safety, and efficiency." Highly structured approach for implementers.
29	30	Green T, Martins T, Hamilton W, Rubin G, Elliott K, Macleod U. Exploring GPs' experiences of using diagnostic tools for cancer: a qualitative study in primary care. Fam Pract. 2015 Feb;32(1):101-5. doi: 10.1093/fampra/cmu081. Epub 2014 Nov 30. PMID: 25448163.	2014	UK	To explore GPs' experiences of incorporating the Risk Assessment Tools (RATs) for lung and bowel cancers into their clinical practice and in so doing, identify constraints and facilitators to the wider dissemination of the tools in primary care.	One of the initiatives in England intended to support primary care professionals has been the development of cancer risk assessment tools (RATs). These tools assist in identifying and quantifying the risk of cancer in symptomatic primary care patients. We conducted semi-structured interviews over the telephone with 11 project managers who implemented the study and 23 GPs who used the tool.The interviews were digitally recorded, professionally transcribed verbatim and analysed through the construction of a 'thematic framework'.	The training and support package was fundamental to the successful integration of the RATs into GPs' daily routines. Ongoing support from cancer networks alongside acknowledgement of the clinical expertize of the GPs by those implementing the study enhanced GPs' uptake of the tool in practice. Findings suggest that the embedding of clinical decision support tools into clinical practice is more likely to be achieved when they are perceived to support but not supersede the clinical judgement of their users.This element of our findings is a focal point of this article.	Small but interesting primary care implementation study. The acceptability of the RATs was enhanced by them being derived from a primary care source and because there was a strong primary care involvement in the delivery of the study. Indeed, one of our major findings is that GPs felt well supported throughout and, importantly, felt their clinical expertize was acknowledged and valued by the team implementing the study.
30	31	Davies A, Mueller J, Hassey A, Moulton G. Development of a core competency framework for clinical informatics. BMJ Health Care Inform. 2021 Jul;28(1):e100356. doi: 10.1136/bmjhci-2021-100356. PMID: 34266851; PMCID: PMC8286765.	2021	UK	Until this point there was no national core competency framework for clinical informatics in the UK. We report on the final two iterations of work carried out in the formation of a national core competency framework. This follows an initial systematic literature review of existing skills and competencies and a job listing analysis.	Methods: An iterative approach was applied to framework development. Using a mixed-methods design we carried out semi-structured interviews with participants involved in informatics (n=15). The framework was updated based on the interview findings and was subsequently distributed as part of a bespoke online digital survey for wider participation (n=87). The final version of the framework is based on the findings of the survey.	Over 102 people reviewed the framework as part of the interview or survey process. This led to a final core competency framework containing 6 primary domains with 36 subdomains containing 111 individual competencies. An iterative mixed-methods approach for competency development involving the target community was appropriate for development of the competency framework. There is some contention around the depth of technical competencies required. Care is also needed to avoid professional burnout, as clinicians and healthcare practitioners already have clinical competencies to maintain. Therefore, how the framework is applied in practice and how practitioners meet the competencies requires careful consideration.	**Users:** FCI CCF is here https://facultyofclinicalinformatics.org.uk/core-competency-framework

Table A1 - Supporting References

Count	*Report ref.*	*Full citation*	*Date*	*Country*	*Aims*	*Methods / Description*	*Main outcome / notes / comments*	*Additional comments & rationale for inclusion*
1	1	*Derived from* ; Davies S, Herbert P, Wales A, Ritchie K, Wilson S, Dobie L, Thain A. Knowledge into action - supporting the implementation of evidence into practice in Scotland. Health Info Libr J. 2017 Mar;34(1):74-85. doi: 10.1111/hir.12159. Epub 2017 Jan 1. PMID: 28042697.	2017	Scoland	To translate the concepts described in the model into tangible activities with the intention of supporting better use of evidence in health care and subsequently improving patient outcomes.	Four areas of activity were addressed by small working groups comprising knowledge services staff in local and national boards. The areas of activity were as follows: defining existing and required capabilities and developing learning opportunities for the knowledge broker network; establishing national search and summarising services; developing actionable knowledge tools; and supporting person-to-person knowledge sharing.	The knowledge into action model for NHS Scotland provides a framework for librarians and health care staff to support getting evidence into practice. Central to this model is the development of a network of knowledge brokers to facilitate identification, use, creation and sharing of knowledge.	This work presents the development of practical tools and support to translate a conceptual model for getting knowledge into action into a series of activities and outputs to support better use of evidence in health care and subsequently improved patient outcomes.
2	35	Armstrong, P. (2010). Bloom's Taxonomy. Vanderbilt University Center for Teaching. Retrieved [todaysdate] from https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/.	2001	USA	Revised taxonomy (cognitive domain)	A group of cognitive psychologists, curriculum theorists and instructional researchers, and testing and assessment specialists published in 2001 a revision of Bloom's Taxonomy with the title A Taxonomy for Teaching, Learning, and Assessment. This title draws attention away from the somewhat static notion of "educational objectives" (in Bloom's original title) and points to a more dynamic conception of classification.	Revised Bloom's levels - **Remember: Understand: Apply: Analyse: Evaluate: Create**	

TABLE B - Competency frameworks included within the Objective 3 review

Report ref.	Framework	URL	Notes
	EU / USA HITComp 2015 tool and repository	http://hitcomp.org/	Workforce development tool
	American Medical Informatics Association, (AMIA) 2017	https://academic.oup.com/jamia/article/25/12/1657/5145365	AI competencies probably map best to **Translational bioinformatics** practice area
	HIMSS Technology Informatics Guiding Education Reform, (TIGER)	https://www.himss.org/tiger-initiative-international-competency-synthesis-project	TIGER International Competency Synthesis Project (see Table A Ref 4)
	Australasian Institute of Digital Health (AIDH), CHIA Certification	https://www.healthinformaticscertification.com/about/	CHIA Competency domains A4-66, B1-6, C1-3, D1-6, E1-6, F5-9, F11
	International Medical Informatics Association, IMIA 2010	https://imia-medinfo.org/wp/imia-endorsed-documents/	Seems somewhat out of date now (2010): Knowledge Domains; 1.5-1.9, 1.14-1.17, 1.19, 2.3, 2.5, 2.6, 3.8, 3.9, 3.12, 4.2, 4.3.
	Quality and Safety Education for Nurses (QSEN)	https://qsen.org/informatics/	Links back to TIGER
	Global Skills & Competency Framework for the Digital World (SFIA8)	https://sfia-online.org/en/sfia-8/sfia-8	All 6 catageory areas important, notably; ISCO, IRMG, STPL, ARCH, INOV, EMRG, INVA, COPL, SCTY, INAS, PEDP, GOVN, QUMG, QUAS, TECH, METL, PGMG, PRMG, PROF, BUSA, FEAS, REQM, BSMO, BPTS, BPRE, OCDV, ORDI, CIPM, BENM, PROD, DLMG, SLEN, DESN, SWDN, PROG, SINT, TEST, PORT, RESD, SFEN, SFAS, DATM, DTAN, DENG, DATS, MLNG, BINT, VISL, URCH, UNAN, HCEV, USEV, INCAICPM, KNOW, SCMO, NUAN, ASUP, CFMG, RELM, USUP, PBMG, CHMG, SEAC, EEXP, PDSV, ETMG, TMCR, RLMT, CSMG.
32	UK FCI Core Competency Framework	https://facultyofclinicalinformatics.org.uk/core-competency-framework	See Core Competencies for DSS Framework table
33	UK Digital Data and Technology Capability Framework (DDaT)	https://www.gov.uk/government/collections/digital-data-and-technology-profession-capability-framework	See Core Competencies for DSS Framework table
34	CILIP Professional Knowledge & Skills Base (PKSB)	https://www.cilip.org.uk/page/PKSB	The CILIP Professional Knowledge and Skills Base was included in the profile template development process (with permission) but cannot be reproduced in this report for licensing / IP reasons.

Report ref.	Key
nn	key source for developing DSS draft competency framework

TABLE C - Job descriptions included within the Objective 3 review

Specialist Lead - HIS Decision Support (AfC Band 7) Scottish DHI Knowledge manager (Grade 7) Senior Business Analyst NDSP NHS Greater Glasgow & Clyde (AFC7) Knowledge Exchange Assistant (Decision Support). University of Strathclyde (Grade 6) Programme Manager – HIS Decision Support (AfC Band 7) JD573	
Model CCIO Job description – UK Faculty of Clinical Informatics	https://facultyofclinicalinformatics.org.uk/job-descriptions

TABLE D - Academic courses included within the Objective 3 review

Course	URL	Notes
AMIA 10x10 with the University of Utah - Clinical decision Support	https://amia.org/education-events/education-catalog/amia-10x10-university-utah	An in-depth course about Clinical Decision Support (CDS) tools, standards, and implementation (Course now closed). The online course was designed following active learning principles. It teaches state-of-the-art principles and practices to enable effective CDS. Topics include a review of the various types of CDS tools; principles of CDS governance and knowledge management; CDS technical architectures, standards (e.g., FHIR, SMART, CDS Hooks, Infobutton), and tools (OpenInfobutton, OpenCDS); and CDS implementation and evaluation.
UCL / University of Manchester MSc/PGDip/PGCert Health Informatics Joint Award - Decision Support Systems (course unit)	https://www.manchester.ac.uk/study/masters/courses/list/12478/msc-pgdip-pgcert-health-informatics-ucl-uom-joint-award/course-details/IID561402#course-unit-details	This unit focuses on patient data and clinical knowledge and how they are used to inform clinical decision making using computational methods. Students learn about the different forms of healthcare knowledge and decision making; how knowledge can be represented in computable form; and the design and evaluation of decision support systems. The module will also consider clinical decision support (CDS) systems in a wider perspective, studying methodological and technological challenges involved in integrating decision support into clinical practice.
University of the West of Scotland - Decision Support Systems (module)	https://psmd.uws.ac.uk/moduledescriptors/ModuleDescriptorsCodesA_Z/ModuleDescriptor.aspx?documentGroupCode=MD0002971	This module introduces a collection of computer technologies that support decision making process. Making decisions may require considerable amounts of relevant data, information, and knowledge. The module will focus on how all stages of the decision-making process can be supported by conventional and intelligent decision support systems for improving the overall quality of decisions. The students will learn how to apply different decision support technologies for solving various practical real-life decision problems and how to develop simple decision-support systems. It has three major components: First, the types of decision to be made based on working environments, people and styles of decision making. It addresses if it is possible to construct a generalised DSS given the diversity of environments and examines ways in which the organisation may change as a consequence of applying this technology. The second component focuses on Decision Theory and reviews the generalised theories which have been developed for supporting decisions. The final component merges these two to demonstrate that DSS can indeed be of use and have real potential.
University College Dublin - PHPS41040 - Clin Infor & Decision Support (module)	https://hub.ucd.ie/usis/!W_HU_MENU.P_PUBLISH?p_tag=MODULE&MODULE=PHPS41040	This module provides a comprehensive overview of clinical IT systems, how they form part of the overall fully electronic patient record, and an overview of how to acquire systems and measure progress.