Chief Clinical Informatics Officer (CCIO) FCI Working Group Report: Guidance for Job Descriptions

Version control:

Version	Date	Author	Notes
0.1	12.6.21	LT	First draft created
0.2	18.6.21	LT/LH	Revised draft for review by working group
0.3	28.6.21	RK/SB/VJ	Comments and edits from working group
0.4	29.6.21	LT	Incorporating comments from working group
0.5	9.7.21	LT	Incorporating comments from working group
0.6	3.8.21	LT	Incorporating comments from FCI Professionalism Standing Committee
0.7	6.8.21	LT/LH	Additional edits to increase clarity
0.8	17.8.21	LT	Incorporating edits from working group
1.0	15.9.21	LT	Feedback sought from Professionalism SC and FCI Council. Final version confirmed.

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Executive Summary

One of the key recommendations from the report of the Faculty of Clinical Informatics (FCI) Core Competency Framework (CF) Working Group was to work with key stakeholders to review job descriptions for clinical informaticians to develop a set of job / role descriptions and person specifications, beginning with a Chief Clinical Informatics (or Information) Officer (CCIO), before expanding to multiple roles. The FCI was aware, anecdotally, that there was inconsistency in terms of content of CCIO job descriptions (JDs) and a desire from its membership to have guidance in addressing this.

The purpose of this work, therefore, was to develop a resource, endorsed by the FCI and based on the CF, for members to use within their own organisations to support the professionalisation of the CCIO role.

A multi-professional working group, supported by an FCI project manager, developed assessment criteria based on the six domains of the CF and reviewed 41 existing digital health JDs (18 were CCIO) provided by members of FCI across all four nations. Findings supported the anecdotal evidence.

Guidance was subsequently developed and includes an exemplar with the recommendation that the FCI endorse organisations should a) use when developing new JDs; b) use to review existing CCIO JDs and c) negotiate locally to ensure that new and existing JDs align with the FCI CF.

1. Introduction

One of the key recommendations from the report of the Faculty of Clinical Informatics (FCI) Core Competency Framework (CF) Working Group was to work with key stakeholders to review job descriptions for clinical informaticians to develop a set of job / role descriptions and person specifications, beginning with a Chief Clinical Informatics (or Information) Officer (CCIO), before expanding to multiple roles.[1] The FCI was aware anecdotally that there was inconsistency in terms of content of JDs and a desire from its membership to have guidance in addressing this. The purpose of this work, therefore, was to develop a resource, endorsed by the FCI and based on the CF, for members to use within their own organisations to support the professionalisation of the CCIO role.

2. Purpose

This report documents the methods used in order to develop an exemplar JD for a CCIO and accompanying guidance notes to support users in developing their own CCIO JD. The results of these methods are outlined, followed by subsequent Recommendations for how the outputs of this work can be best utilised.

3. Methods

A multi-professional working group, supported by an FCI project manager, was assembled from the FCI membership (see Appendix A for a list of working group members). Through a combination of virtual meetings, email correspondence and collaborative working via MS Teams, the group developed assessment criteria based on the six domains of the CF and reviewed 41 existing digital health JDs provided by FCI members[2] (see Appendix B). 18 of these were formal CCIO JDs.

There are 36 categories across the six domains of the CF, which were summarised into 27 descriptors for the assessment checklist (see Appendix C). Even though the working group agreed that a CCIO should aspire to meet all 111 competencies in the FCI CF, and that JDs should refer to this, it was recognised that it, in reality, it would be unreasonable to expect all JDs to include reference to each individual one. The decision was therefore made to review at a level in between categories and domains, one that the group felt would be more relevant in practice and feasible to implement.

The assessors from the working group were asked to identify whether each descriptor from the FCI CF was “Included”, “Partially included” or “Lacking”. Assessors were also asked to record whether each of the following pieces of information were included in the JD:

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[1] 2021; *Core Competency Framework Working Group – Report*; Available at: https://facultyofclinicalinformatics.org.uk/web/content/3421?unique=f101852f9ca2b3e1444e7daecc228860bfd02caa&download=true [Accessed 14.6.21]

[2] *Chief Clinical Information Officer and related Job Descriptions*; Available at: https://discourse.digitalhealth.net/t/chief-clinical-information-officer-and-related-job-descriptions/14808 [Accessed 14.6.21]

- Grade
- Hours/ Sessions
- Department
- Reporting/ accountable to
- Key relationships
- Organogram

An overall rating was given as Poor/Satisfactory/Highly Satisfactory in terms of the degree of the FCI CF inclusion in the JD and to what degree the JD aligned with the assessor's understanding of the role of a CCIO. Assessors could provide further descriptive comments to reflect on the JD if they wanted to clarify or expand on any of their conclusions (see Appendix C).

The Chair of the working group carried out two initial assessments as examples of how the assessments should be conducted, with the intention of achieving a more standardised approach. Within the working group, seven individuals carried out an assessment of a subset of the JD sample using the assessment criteria. All 41 JDs in the sample were assessed by at least one person and 11 of these were assessed by two individuals, in order to determine the degree of reproducibility.

The results of the JD assessments were presented to the working group and the group used the information from this process to develop an exemplar JD, incorporating the FCI CF, and accompanying guidance notes. A model CCIO JD was developed based on the one JD that was rated "Highly Satisfactory" and that had the closest mapping to the FCI CF and was 'enhanced' using aspects of other higher scoring JDs. The model JD was also structured into sections based on the Domains of the FCI CF.

4. Results

4.1. Summary

The findings of this work supported the anecdotal evidence of inconsistency in the content of JDs. Many of the CF categories were not included within JDs and there was variability of inclusion across the domains.

4.2. JD assessments

- There was a 54.9% mean agreement for duplicate assessments made by two individuals.
- This increased to 62.2% agreement for included (full OR partial) vs lacking.
- Several JDs were not specifically titled as CCIO roles, but instead were for other senior roles in digital health. Furthermore, some JD titles were given as "CCIO" but did not fit the definitions of a CCIO recognised by the working group and in other literature (please refer to the guidance notes produced by the group for more detail).
- Of the 41 JDs in the sample, 23 did not have the exact title of CCIO.
- A further 2 JDs were given the title of CCIO but were not felt to represent a CCIO role.

Overall rating:

- 1 highly satisfactory

- 15 satisfactory
- 9 poor
- 2 poor/satisfactory (different ratings by different assessors)
- 16 not scored

Inclusion in domains:

Table 1: The mean number of category summaries that was included within the JDs within each of the six domain headings of the FCI CF

	Domain 1 inclusion /5	Domain 2 inclusion /6	Domain 3 inclusion /4	Domain 4 inclusion /4	Domain 5 inclusion /3	Domain 6 inclusion /5
	HEALTH AND WELLBEING IN PRACTICE	**INFORMATION SYSTEMS AND TECHNOLOGIES**	**WORKING WITH DATA AND ANALYTICAL METHODS**	**ENABLING HUMAN AND ORGANISATIONAL CHANGE**	**DECISION-MAKING**	**LEADING INFORMATICS TEAMS AND PROJECTS**
Mean no. of category summaries included in a JD	3 / 5	3 / 6	1 / 4	3 / 4	1 / 3	4 / 5
Mean % of domain included	60 %	50 %	25 %	75 %	33 %	80 %

Inclusion of key information:

Table 2: A score out of 41 to represent the number of JDs that included six key pieces of information about the role. If the information was judged to be included it scored 1, if it was judged as "partially included" it scored 0.5. If 2 assessors disagreed then a middle score of 0.5 was applied, or the lower score of 0.5 if "Included" and "Partially included" were chosen by the two assessors.

	Salary/ Grade	**Hours/ Sessions**	**Department**	**Reporting/ accountable to**	**Key relationships**	**Organogram**
Score for inclusion, / 41	22	23.5	29.5	33	24.5	9

Descriptive comments:

Assessors were able to provide comments to describe their overall conclusions about a JD or to clarify their decisions throughout the assessment checklist. Below are a number of comments included in the assessments that exemplify some common themes that were provided.

> "Job was only offered to senior **doctor**(s) which in my opinion needs to be more inclusive. Appears to require a clinical doctor who is able to practice **quality improvement** to improve e-Health by contributing to information systems design."

"Very **limited detail** on expected competencies - "verbal skills, team-worker, etc"'"

"Have covered some of the leadership and management aspects but **lacking focus on information and technology**."

"The JD focuses on **strategic leadership** and **expects** the post-holder will also be the Caldicott Guardian and CSO. This should be a **separate** role that the post-holder will collaborate with."

"Some of these need to be assessed at **interview**, but I wonder if the interviewer would know what to ask."

"Relatively new JD written in 2020 and overall very difficult to score as the **granularity** in the framework is not in the JD"

"A **desirable** component of the PS is experience in **digital delivery and service** improvement which surely is a must for a role of this grade??!"

5. Discussion

Despite requesting CCIO JDs for our sample, a considerable number of JDs for non-CCIO roles were provided. This suggests a lack of understanding of the detail and requirements of a CCIO role and that this is true amongst informaticians, so is likely to be even less well understood amongst health and care staff who do not have a digital role.

It is interesting to note the level of agreement was quite low among the assessors in relation of whether or not a category had been included within a job description (62%). This suggests that there is a degree of ambiguity and that individuals have different notions of what constitutes meeting a requirement. The working group felt that this further demonstrated the need for guidance around developing job descriptions and helping to standardise the competencies asked for in the role.

Some of the FCI CF domains scored low in terms of their inclusion in the JDs, most notably domain 3, Working with data and analytical methods (25%) and domain 5, Decision making (33%), whereas domain 4, Enabling human and organisational change, and domain 6, Leading informatics teams and projects scored higher (75% and 80%, respectively).

Key pieces of information that could be considered essential to be included in any job description were commonly lacking across the sample, including the salary/grade and the number of hours. The department the CCIO would join and the person they would report to were more often included, but not in every case.

6. Recommendations

1. Organisations should use this guidance when developing new CCIO JDs.
2. FCI should encourage its members to review their own JD against the guidance and exemplar JD and update their JD/negotiate with their employer as required.
3. FCI should offer a support service to organisations who are developing CCIO JDs.
4. FCI should discuss the CCIO role with Agenda for Change and other regulatory bodies to

ensure there is appropriate salary grading available for CCIOs from all clinical backgrounds.

5. The impact of this guidance on the content and quality of newly developed CCIO JDs should be reviewed in twelve months by seeking feedback through the FCI. A record of the number of enquiries made to FCI for assistance in their development should also be kept.
6. FCI should continue the work in this project to define the organisational structure of the 'office' of the CCIO and to develop model job descriptions for all members of this team, in collaboration with key stakeholders, such as FedIP.

Appendix A

Working group members:

Name	Role
Lesley Holdsworth (Chair)	Clinical Lead for Digital Health and Care, Scottish Government
Stephen Baguley	Consultant Sexual Health & HIV Physician, NHS Grampian Clinical Director eHealth, NHS Grampian Clinical Chair of Health Board Digital Leads, Scotland
Anna Bunch	Digital Medicines Programme Lead Portsmouth Hospitals NHS Trust
Vaibhav Joshi	Chief Data Officer, Centogene
Ramandeep Kaur	EPMA Lead Pharmacist Barking, Havering and Redbridge University Hospitals NHS Trust
Caroline Monzon	Divisional Nurse Informatics Lead Surgery, Womens and Oncology (SUWON) and Clinical Support Services (CSS) Oxford University Hospital NHS Foundation Trust
Brendan O'Brien	Chief Clinical Informatics Officer (CCIO) at NHS National Services Scotland
Sid Singh	Consultant Urologist & Chief Clinical Informatics Officer; George Eliot Hospital NHS Trust
Lindsay Turner (secretariat)	Project Manager, Faculty of Clinical Informatics

Appendix B

The following table summarises the job descriptions assessed as part of the sample by the working group. There were 43 job descriptions collected, with two identified as duplicates. The final column (CCIO by JD) considers whether the JD represented the role of a CCIO, as interpreted by the working group. A blank cell shows that the job role was considered to match the job title given in the JD. The table also indicates whether each JD specified that the CCIO would be a member of the Board, i.e. at an Executive level.

ID	Role title	Organisation	Nation	Reports to	Board member?	CCIO by Name	CCIO by JD
01	Clinical Lead - eHealth	NHS Greater Glasgow & Clyde	Scotland	Director of e-Health and Deputy Medical Director	Yes	No	
02	Chief Clinical Information Officer	Generic example	na	Chief Executive	Yes	Yes	
03	Chief Medical Informatics Officer (CMIO)	George Elliot Hospital	England	Not specified	Yes	Yes	
04	Chief Clinical Information Officer	Blackpool Teaching Hospitals NHS Foundation Trust	England	Deputy Chief Executive and Medical Director	Yes	Yes	
05	Chief Clinical Information Officer	Blackpool Teaching Hospitals NHS Foundation Trust	England	Deputy Chief Executive and Medical Director	Yes	Yes	
06	Chief Clinical Information Officer	The Shrewsbury and Telford Hospital NHS Trust	England	Director of Digital Transformation and Medical Director	Not specified	Yes	
07	Chief Clinical Information Officer	Warrington and Halton Hospitals	England	Clinical Director	Not specified	Yes	
08	Chief Clinical Information Officer	Dorset County Hospital NHS Foundation Trust	England	Executive Lead for Health Informatics (Director of Finance and Resources) and Medical Director	Not specified	Yes	
09	Chief Clinical Information Officer	Croydon Health Services NHS Trust	England	Chief Operating Officer and Medical Director	Yes	Yes	
10	Chief Clinical Information Officer	Northumbria Healthcare NHS FT	England	Director of Health Informatics	Not specified	Yes	
11	Chief Clinical Information Officer/ Associate Medical Director Job Description	Sandwell and West Birmingham Hospitals NHS Trust	England	Not specified	Not specified	Yes	
12	Deputy Chief Nurse Information Officer (Deputy CNIO)	Milton Keynes University Hospital NHS FT	England	Chief Nurse Informatics Officer Chief Technology Officer	Not specified	No	
13	Chief Clinical Information Officer	University College London Hospitals NHS FT	England	Not specified	Yes	Yes	
14	City-wide Clinical Informatics Leader/Leadership Office Executive	Leeds: City-wide Informatics Leadership Office	England	Not specified	Not specified	No	
15	Clinical Informatics Specialist	HSCB Integrated Care Office/ PHA (within Belfast LCG Area in first instance)	Northern Ireland	Director of Integrated Care/ Director of Public HealthAssistant Director of Integrated Care Head of General Medical Services.	Not specified	No	
16	Chief Clinical Information Officer	Queen Elizabeth Hospital, Gateshead	England	Deputy Director of Informatics and Medical Director	Not specified	Yes	
17	Chief Clinical Information Officer	Southern Health NHS FT	England	Medical Director and Director of Information	Not specified	Yes	

18	Clinical Director (Modernisation Programme)	Calderdale and Huddersfield NHS FT	England	Executive Clinical Lead (Divisional Director) and Director of The Health Informatics Service	Not specified	No	
19	Chief Clinical Information Officer	Bolton NHS FT	England	Parallel to Trust CIO and Medical Director	Not specified	Yes	
20	Chief Clinical Information Officer	Royal Cornwall Hospitals NHS Trust	England	Accountable to the Medical Director, but with close working relationships with the Executive lead for informatics and the Director of Transformation	Yes	Yes	
21	Clinical Informatics Director	NHS Commissioning Board	England	National Medical Director and Clinical Informatics Advisors Head of Clinical Informatics Networks Mobilisation	Yes	No	
22	Chief Clinical Information Officer	Northumberland Tyne & Wear NHS FT	England	Executive Director of Performance and Assurance plus Medical Director (medical CDs)Director of Nursing and Operations (non medical CDs)	Not specified	Yes	No
23	CCIO/Director of Digital Health	Surrey & Borders Partnership NHS FT	England	Chief Digital & Information Officer	Not specified	Yes	Yes
24	National Digital Lead Midwife	NHSX and NHS England & Improvement	England	National Digital Lead Midwife	Not specified	No	No
25	Chief Clinical Information Officer	Health Board CCIO	Scotland	Chief Executive	Yes	Yes	No
26	Associate Director for Digital Health	Calderdale and Huddersfield NHS FT	England	Director of Nursing	Not specified	No	No
27	Chief Nursing Information Officer	West Suffolk Hospital NHS Trust	England	Chief Information Officer and Executive Chief Nurse	Not specified	No	Yes
28	Chief Nursing Information Officer	St George's University Hospital NHS FT	England	Director of Nursing and CIO	Not specified	No	No
29	Chief Nursing Information Officer and Director of Digital Safety	NHSX	England	Chief Clinical Information Officer. Professionally accountable to the Chief Nursing Officer	Not specified	No	
30	Chief Nursing Information Officer	Aintree University Hospital NHS FT and The Royal Liverpool and Broadgreen University Hospitals NHS Trust	England	Deputy Chief Nurse and Chief Nurse	Yes	No	
31	Chief Nursing Information Officer	St George's University Hospital NHS FT	England	Chief Nurse and Director of Infection Prevention and Control and CIO	Not specified	No	
32	Chief Nursing Information Officer (J2125) (Deputy Associate Director of Nursing)	Wirral University Teaching Hospital	England	Deputy Director of Nursing with a dotted line relationship to the Director of IT and Informatics	Not specified	No	

33	Chief Nursing Information Officer	Aintree University Hospital NHS FT and The Royal Liverpool and Broadgreen University Hospitals NHS Trust	England	Deputy Chief Nurse and Chief Nurse	Yes	No	
34	Associate Director of Nursing (Informatics, Improvement & Transformation)	Cambridge University Hospitals NHS FT	England	Director of Improvement and Transformation Professionally accountable to Chief Nurse	Not specified	No	
35	Trust Lead Nursing Informatics	Imperial College Healthcare NHS Trust	England	Chief Information Officer / Deputy Chief Nurse	Not specified	No	
36	Clinical Director eHealth	NHS Grampian	Scotland	General Manager eHealth and Chief Operating Officer	Not specified	No	
37	Chair of the Clinical Change Leadership Group	Clinical Change Leadership Group (CCLG)-the leadership body within the clinical informatics community in Scotland	Scotland	Not specified	Not specified	No	
38	Senior Lead Nursing Informatics Specialist	NHS Wales Health Board/Trust	Wales	Director of Nursing & Midwifery	n/a	No	
39	National Clinical Informatics Lead Nursing and Assistant Head of Clinical Informatics	NHS Wales Informatics Service	Wales	Head of Clinical Informatics & Business Analysis Programmes and Medical Director Chief Clinical Information Officer	n/a	No	
40	National Director for Patients and Information	NHS COMMISSIONING BOARD	England	Chief Executive	n/a	No	
41	Chief Clinical Information Officer	NHS National Services Scotland	Scotland	NSS Digital & Security Director and Medical Director	n/a	Yes	
42	Chief Nursing Information Officer	Manchester University NHS FT	England	Chief Informatics Officer and Group Deputy Chief Nurse	Not specified	No	
43	Medical Director/Chief Clinical Information Officer	NHS Wales Informatics Service	Wales	Chief Information Officer (Health) NHS Wales Chief Medical Officer Head of Health and Social Care Informatics Head of Information Governance	n/a?	Yes	

Appendix C

Assessment criteria checklist:

Faculty of Clinical Informatics CCIO JD checklist

DOMAIN 1: HEALTH AND WELLBEING IN PRACTICE

ID	Category	Category summary	ID	Competency Description
1.1	Clinical Concepts and Language	Appropriate terminology when contributing to informatics projects	1.1a	Uses clinical, social, biomedical (including genomics) terminology, language and abbreviations appropriately when contributing to informatics projects and programmes to be able to facilitate accurate and appropriate communication across clinical informatics projects and/or teams
1.2	Clinical Governance	Main components of the clinical governance framework; how informatics can assist in monitoring and implementation; clinical audit, service improvements.	1.2a	Understands the main components (including clinical audit, clinical risk management, quality assurance, clinical effectiveness and staff development) of the clinical governance framework
			1.2b	Understands how informatics can assist in the monitoring and implementation of healthcare services and standards
			1.2c	Be able to use data and information effectively in clinical audit to identify service improvements
1.3	Models of Care Delivery	UK care delivery models, information systems and the latest initatives, drivers and constraints affecting health & social care planning and service delivery	1.3a	Demonstrates an understanding of the UK care delivery models, organisations and governance involved across the care pathway and their inter-relationships (*e.g.,* GP practices, hospitals, ambulance services, care homes, community services) and how they influence the delivery of informatics projects/programmes
			1.3b	Can identify and address the challenges related to using information systems in the health and social care sector for health care and/or research
			1.3c	Is aware of the latest initiatives, drivers and constraints affecting health and social care planning and service delivery to make sure that informatics plans are shaped accordingly
1.4	Health Administration and Servi	Resources, information flow and quality metrics sed through the UK Health System structure, administration and services - scientific and research skills.	1.4a	Demonstrates knowledge of how resources, information flow and quality metrics are used through the UK Health System structure, administration and services (*e.g.,* healthcare planning, service commissioning, delivery of health, social care and pharmacy)
			1.4b	Demonstrates knowledge about the social determinants of health (*e.g.,* environment, socio-economic, genetics), and their influence on the delivery of healthcare and informatics services and work
			1.4c	Recognise how UK and international health policies can change and how they impact on system and organisational informatics delivery, strategies and plans
			1.4d	Shows knowledge of clinical and business processes, indicators and reported outcomes for healthcare delivery and systems management and their role in the quality assurance of healthcare
1.7	Scientific and Research Skills		1.7a	Is able to perform searches and critically appraise literature to support evidence based decision making
			1.7b	Knows about hierarchies of evidence and appropriately applies them to evaluate informatics interventions
			1.7c	Defends methodologies and approach for a defined clinical informatics proposal and/or project
			1.7d	Understands research governance frameworks and guidance to ensure that informatics research projects/programmes are conducted to the appropriate standards including safeguarding of safety, wellbeing and rights
1.5	Informatics Strategies	Informatics strategy landscape and the role of health informatics and information systems in health and social care systesms learning from mistakes	1.5a	Has knowledge of the UK and international informatics strategy landscape including which organisations develop and deliver them, their similarities and differences and the stakeholders involved in influencing and/or funding them, and how they influence your informatics priorities, strategies and work
1.6	Informatics in Health		1.6a	Has awareness of the role of health informatics and information systems in the health and social care systems, and understands lessons learned from previous programmes to prevent replicating mistakes, promote best practice and ensure improvement of future informatics project implementations for healthcare practice and/or research

DOMAIN 2: INFORMATION SYSTEMS AND TECHNOLOGIES

ID	Category	Category summary	ID	Competency Description
2.1	Information Systems and Technologies Concepts and Development	Range of Health information systems and technologies - the selection and utilization of these systems and/or technologies to meet clinical and operational requirements - tender responses. Stage and associated processes of the lifecycle of how an information system is developed.	2.1a	Analyse key information technology components including hardware and software, and how they can be used in health and social care settings
			2.1b	Is able to demonstrate knowledge of computer science principles and terminology including modelling data and systems using appropriate representations (*e.g.,* UML, BLMN, MDA)
			2.1c	Discusses the range of health information systems and technologies available and how they can be or are used in the delivery of health and social care and research (*e.g.,* medicines management, telehealth, imaging, test requests and reports, electronic patient records, mobile-health)
			2.1d	Understands the qualities of a system/technology and the trade-off between them when developing/deploying them (*e.g.,* maintainability, scalability, performance, recovery)
			2.1e	Discusses systems and technologies in relation to current and future thinking around health systems, especially with technology providers to drive innovation to address health and care delivery
			2.1f	Can identify an appropriate technology to resolve healthcare problems and contribute to the development of good practice to do this
			2.1g	Applies knowledge of health data, information and workflow models to design and deliver information technology solutions
			2.1h	Understands each stage and associated processes of the lifecycle of how an information system is developed including the planning creating, testing and deploying stages, and when clinical engagement is key to a successful informatics project outcome
			2.1i	Awareness of the benefits and risks of different project methodologies (*e.g.,* agile, waterfall) when used for software development and is able to employ the appropriate strategies to meet the needs of the project
2.3	Selecting and Procuring Information Systems and/or Technology		2.3a	Demonstrates knowledge of the procurement framework including teams involved in contract negotiation and management, costs and how to identify return on investment
			2.3b	Is able to contribute to the selection and utilization of appropriate information systems and/or technologies to meet clinical and operational requirements through the evaluation of tender responses
			2.3c	Is able to identify informatics solutions that guarantee data privacy, patient and user confidentiality, security and integrity following current excepted standards
			2.2a	Has a good working knowledge of technical and clinical terminology and can demonstrate how the effective use of both can lead to a common understanding of an informatics project/programme

2.2	Working with and communicating with project stakeholders	Effective communication of clinical and business requirements, patient safety, usability and cost, while managing expectations of stakeholders and guiding prioritisation toward incremental development	2.2b	Is able to manage expectations of stakeholders and guide prioritisation toward incremental development that is both clinically useful and/or technically possible within the available resources
			2.2c	Awareness of the phenomenon that some problems cannot be solved by conventional requirements gathering and classical product design, and if they are applied will actively make things worse
			2.2d	Is able to clearly and effectively communicate clinical and business requirements to technology suppliers, specialists, helping them understand how to align their solutions to health and social care practices and objectives
			2.2e	Considers patient safety, usability and cost when specifying requirements for informatics projects and is able to discuss the trade-off between them
			2.2f	Be able to highlight and communicate about problems with information systems to technical groups and provide feedback and information for healthcare professionals
2.4	Interoperability and Integration	Appropriate health informatics standards systems including coding systems, data structures, data security and privacy, and system-to-system messaging to enable system interoperability and procurement/design of future systems	2.4a	Recognise that interoperability is an unresolved problem and the issues surrounding this (*e.g.,* lack of adherence to informatics standards, different processes surrounding informatics system) impact on the delivery of integrated care
			2.4b	Demonstrates knowledge of the range of technology for transmitting information (*e.g.,* messaging between systems) and clinical standards (*e.g.,* standards for structuring clinical information) for information needed to support the creation of interoperable systems, and promotes their importance to drive an integrated delivery care model
			2.4c	Demonstrates knowledge of the basis, application and limitations of clinical coding systems, terminologies and classifications and understands their purpose in delivering safer health care
			2.4d	Is able to discuss the appropriate health informatics standards systems including coding systems, data structures, data security and privacy, and system-to-system messaging to enable system interoperability and procurement/design of future systems
2.5	System architecture		2.5a	Assesses clinical models and is able to interpret mapping of data relationships and dependencies of health information system architecture (*e.g.,* electronic health records, decision support systems, prescribing systems)
			2.5b	Applies information technology best practices (*e.g.,* quality management systems, testing, service level agreements, business continuity and incident management) throughout the system life cycle
2.6	Data Security and Cyber Security	Security and governance of data, systems, devices and networks (inlcuding trends in cybersecurity risk in healthcare), international and national standards and regulatory frameworks for quality management, software deployment, medical devices, clinical safety	2.6a	Demonstrates knowledge of the security and governance of data, systems, devices and networks (*e.g.,* Data Security and Protection Toolkit), and is able to use this to contribute to the development of solutions required to manage data
			2.6b	Appreciates the international and national standards and regulatory frameworks for quality management, software deployment, medical devices, clinical safety (e.g., DCB0129, DCB0160) and interoperable systems (*e.g.,* ISO9001, ISO80001 family)
			2.6c	Understands what informatics solutions (*e.g.,* current GP systems and/or clinical decision support that includes Artificial Intelligence or any coded algorithms) constitute as a medical device and must adhere to the Medical Device Regulations
			2.6d	Understands the trends in cybersecurity risk in healthcare (*e.g.,* cloud computing, medical physical systems, data confidentiality, malware, app security, insider threats)
			2.6e	Knows about cybersecurity capability, countermeasures and risk mitigation strategies (*e.g.,* technological solutions, risk assessment frameworks, regulatory and legislation, healthcare/team education to embed digital security practices, encryption) so as to develop secure systems and team/local policy and protocols to protect patient safety
			2.6f	Understands the procedures to report any cyber or data security incident
2.7	Maintaining and Support for Healthcare Information Systems	Processes, methods and evaluation criteria to continuously assess the safety, efficacy and key qualities of information systems	2.7a	Is able to work with other system developers and healthcare professionals to consider the key qualities of a system (*e.g.,* scalability, maintainability, performance, structure, availability) when designing and developing information systems (*e.g.,* electronic health records), and apply current best practice to these
			2.7b	Is able to develop processes and methods with other colleagues to continuously assess the safety and efficacy of information systems
2.8	Evaluation of Information Systems		2.8a	Can use knowledge of key aspects of information systems (*e.g.,* usability, performance, cost effectiveness) to develop evaluation criteria to assess and evaluate digital solutions and information systems in practice settings to make sure they are useful and/or successfully adopted
			2.8b	Demonstrates awareness of evidence and regulatory frameworks used to assess digital technologies (*e.g.,* NICE) in order to contribute to discussions of the development of digital health interventions

DOMAIN 3: WORKING WITH DATA AND ANALYTICAL METHODS

ID	Category	Category summary	ID	Competency Description
3.1	3.1 Analytical Methodologies and Applications	Different data sources, role of data custodians and others and the data analytical methods to be used Awareness of the lateste techniques and their application to healthcare including the challenges in deployment and usage of these.	3.1a	Is able to use basic descriptive statistics and explain the concepts of probability, predictive modelling and machine learning techniques to discover patterns and knowledge in recorded data, and know when to use them to solve health and social care, clinical practice and research problems
			3.1b	Understands what clinical questions can be addressed with different data sources, and working with data custodians and others can understand what data is required and the data analytical methods to be used to address the problem and derive insights
			3.1c	Is able to demonstrate how data quality affects analysis, and resulting clinical and healthcare insights, and how important it is to improve to derive maximum potential from its utilisation
			3.1d	Understands how technologies (*e.g.,* R, Python, Jupyter notebooks) facilitate the analysis, display of results, and reproducibility of analyses to be able to re-run protocols to verify results and modify for other purposes
			3.1e	Is aware of the latest techniques (*e.g.,* AI) and their application to healthcare (*e.g.,* imaging and genomics interpretation, clinical diagnostic evaluations, prediction of readmission risk, extracting semantic information from text) and the challenges in deployment and usage of these in health and clinical settings (*e.g.,* population data and algorithmic bias, explainability of results, robust regulation and quality control, metrics vs clinical applicability, ethics and unintended negative consequences)
3.2	Data Sources and Characteristics		3.2a	Demonstrates an understanding of the key attributes of data and information including quality, integrity, accuracy, timeliness and appropriateness and can discuss their limitations within the context of intended use
			3.2b	Understands the variety of data streams and sources that contribute to health decision making including those not necessarily primarily collected for health (*e.g.,* mobile, sensors, phenome)

		Contemporary health informatics standards for the recording of health data, clinical practice and research. Ability to review linked data analysis	3.2c	Discusses the opportunities and challenges with using real-world health data for analysis and to drive decision-making
3.3	Data Structure, Standards and Linkage		3.3a	Applies current best health informatics standards for the recording of health data (*e.g.,* classifications, vocabularies) to increase data quality and utilisation for improving healthcare and clinical practice and research
			3.3b	Understands the importance of data linkage, record linkage methods, and the relevant strengths and limitations, to be able to conduct or review linked data analysis
3.4	Data Management		3.4a	Demonstrates an understanding of the data inter-relationships and dependencies among the various health information systems (*e.g.,* decision support systems, electronic health records, order entry, registries, *etc.*)
			3.4b	Has awareness of the different approaches used to store health data and the pros and cons of using these approaches, and how these effect data accessibility and analyses
3.5	Information Governance, Accessibility and Ethics	Ethical, legal and regulatory guidelines relating to the protection of patient information and ensure confidentiality	3.5a	Explains the ethical, legal and regulatory guidelines to determine the appropriate access, use, disclosure and protection of data to protect patient information and ensure confidentiality, and applies them when processing patient data at all times
			3.5b	Demonstrates an understanding of processes, guidelines, and governance structures needed to achieve trustworthy use of methodologies such as Artificial Intelligence, and is able to assess these with others to address health care problems
			3.5c	Has some awareness of privacy enhancing technologies (*e.g.,* K-anonymity, homomorphic encryption), and how and what they might be used for
3.6	Data visualisation	Visualisations used to present data analyses and information	3.6a	Demonstrates an understanding of a range of visualisations used to present data analyses and information so as to be able guide others in their usage
			3.6b	Contributes to quality analysis by organizing and transforming data into reliable and meaningful information to support decision making
			3.6c	Presents information in a way that is effective for users' decision making, and that takes into account the variability in the user capability to assess methods and draw appropriate conclusions

DOMAIN 4: ENABLING HUMAN AND ORGANISATIONAL CHANGE

ID	Category	Category summary	ID	Competency Description
4.1	Quality Improvement and Clinical Safety	QI, process & change management including human factors	4.1a	Applies quality improvement and process engineering to facilitate business and clinical transformation, measuring and analysing appropriate outcomes
			4.1b	Appraises patient safety risk in the design and development of information systems and technologies and ensures that all risk is assessed and managed appropriately to minimise or avoid harm
4.2	Change management		4.2a	Can use change management tools and techniques in the implementation of new processes or informatics systems within clinical practice and/or research and is able to communicate the change effectively to a range of stakeholders
			4.2b	Engages with identifying 'best practice' in informatics enabled change across settings and look at translation to a local setting
4.3	Behavioural change		4.3a	Understands the organisational and human factor challenges to effective use of health information systems and technologies and can apply appropriate methods to address these and ensure maximum user engagement and widespread adoption
4.4	Usability and design	Methods and techniques for gathering, design, and user-centred evaluation and testing for health systems and technologies.	4.4a	Appreciates the methods and techniques for requirements gathering, design, and user-centred evaluation and testing for health systems and technologies, understanding their strengths and limitations, and applies these to clinical informatics projects
			4.4b	Demonstrates an understanding of the clinical input, knowledge, workflow and impact when proposing informatics solutions and interventions
			4.4c	Analyses situations critically to address usability and accessibility issues, design problems and use of digital health technologies
			4.4d	Assesses the demand for evolving services in your organisation&/or system, and appropriately present results to various stakeholders
4.5	Patient involvement and engagement	Contemporary knowledge of latest developments in patient access to health records and information	4.5a	Appreciates the range of patient resources providing information on healthcare interventions, public health and engaging with the patient and technology used to deliver it (including the quality of information, type and assessment) to inform patients' decision-making
			4.5b	Discusses the value of technologies that enable co-production of health (*e.g.,* mobile applications, social media, sensors) to improve health and promote citizen (patient) engagement
			4.5c	Demonstrates understanding of the latest developments in patient access to health records and the implications this has on the nature of relationship between healthcare professionals and patient
			4.5d	Discusses the impact of digital interventions (including data sharing and usage) on governance frameworks and public trust
			4.5e	Is able to support patients when accessing and viewing their health data (*e.g.,* access guidance and processes, correction of factual inaccuracies) and other health data sources to empower them to make decisions about self-care and share in the decision-making
			4.5f	Uses appropriate communication strategies and language to effectively present and impart knowledge and explain concepts to non-expert and expert audiences through involving patients in projects, speaking at meetings/conferences, publishing articles etc.
4.6	Evaluation		4.6a	Is able to contribute to the evaluation of the design, implementation and functionality of systems so that they can evolve to support best practice in clinical care

DOMAIN 5: DECISION-MAKING

ID	Category	Category summary	ID	Competency Description
5.1	5.1 Evidence-based Practice	Evidence-based practice and its application to informatics	5.1a	Understand the definition, key components and the rationale of evidence-based practice and the application of informatics
			5.1b	Develops and assesses evidence-based search strategies and guidelines to support clinical management and decision making
			5.1c	Demonstrates an understanding of the different types of clinical knowledge and their sources from across the health system and how they can be applied to make clinical and operational decisions
			5.1d	Promote evidence based practice, use of guidelines and care pathways across different healthcare settings and contribute (where appropriate) to the development and use of guidelines
5.2	5.2 Knowledge Management	Knowledge management understanding	5.2a	Demonstrates understanding of models for effective knowledge acquisition, storage and dissemination, including strengths and limitations
			5.2b	Understands how knowledge can be transformed from generation to modelling into a computable form
			5.3a	Understands the nature of clinical decision making and defines the processes of clinical decision making and diagnostic strategies

5.3	5.3 Clinical Decision Making and Support	Decision support tool best practice	5.3b	Demonstrates knowledge of the types of clinical decision support tools (*e.g.*, computer interpretable guidelines), including their strengths and weaknesses
			5.3c	Demonstrates understanding of best practice and approaches (including how information is accessed, sources of information, integration into systems) used to construct and translate clinical pathways and guidelines into decision support tools
			5.3d	Discusses best practice in the development and application of clinical decision support tools to individuals and/or populations
			5.3e	Is able to lead discussions about risk assessment and mitigation, and validation of a decision support system
			5.3f	Knows the core concepts to be able to evaluate impact of implementation on behaviour, workflow and decision-making such that these can be understood and used to inform next iteration or usage

DOMAIN 6: LEADING INFORMATICS TEAMS AND PROJECTS

ID	Category	Category summary	ID	Competency Description
6.1	6.1 Management Principles		6.1a	Applies theories, concepts and practices of management to informatics projects (including: setting clear goals and objectives, developing effective internal and external project communications using clear and unambiguous language to ensure progress is easily understood; financial and budget management; setting up governance structures to ensure clear accountability and management/ownership of risk; building procurement and vendor relationships; recognising the differences in organisational culture, and adopt approaches to manages these whilst being clear of your own values and principles) to develop clear strategies and plans for delivery of clinical informatics projects/programmes
6.2	6.2 Professionalism and Education	Professional culture & continuous development including training and research	6.2a	Creates a professional culture & facilitates continuous individual, team and organisational learning and development to ensure thinking is kept up-do-date and relevant for the future delivery of services
			6.2b	Defines the needs for good quality training in informatics and knows how informatics can facilitate research and improve digital literacy to be able to embed and increase the knowledge across healthcare professionals and other informaticians
6.3	6.3 Multi-disciplinary and Organisational Working	Transparent information sharing and multi-disciplinary team working, effective communication	6.3a	Promotes open, transparent information sharing and multi-disciplinary team working to solve clinical informatics challenges through effective communication, development of a supportive network and the recognition of individual and team achievements to increase visibility of individuals and required skills for completion of informatics projects
			6.3b	Has awareness of different roles of people working in informatics and the knowledge and skills they should have and is able to identify how they can contribute to the successful delivery of an informatics project/programme through collaborative working
6.4	6.4 Project Leadership	Project leadership, management & dissemination	6.4a	Has awareness of project management and change management methodologies, tools and techniques considering factors (*e.g.*, team-working and governance, resources, project planning , business cases, monitoring and reporting) and is able to apply them to informatics projects/programmes
			6.4b	Is able to contribute to project planning, implementation, monitoring and evaluation of informatics projects, ensuring that programme/project goals remain aligned to clinical and operational objectives where appropriate, to increase project/programme success
			6.4c	Is able to recognise when an informatics project/programme is not going according to plan, and can appraise benefits, risks for continuation, change of direction or stopping, and can communicate these through appropriate governance structures
			6.4d	Adapt an appropriate communication style to be able to distil information to deliver key messages to address a range of audiences and stakeholders (*e.g.*, organisational boards, project teams, other healthcare professionals)
6.5	6.5 Informatics Strategy and Innovation	Strategic level contribution and implementation including financial	6.5a	Have awareness of stakeholders influencing development and funding of clinical informatics projects and/or programmes at local or national level
			6.5b	Understand and evaluate local and national health informatics policies and strategies and their key elements of technology, process, clinical engagement and governance
			6.5c	Discusses the components for successful innovation and its adoption and/or scalability into other healthcare contexts/organisations
6.6	Planning		6.6a	Creates and assesses strategic, implementation and financial plans for clinical and health information systems to ensure increase chances of a successful deployment
			6.6b	Justifies allocation of resources to informatics for service redesign to improve delivery of health and social care and patient safety