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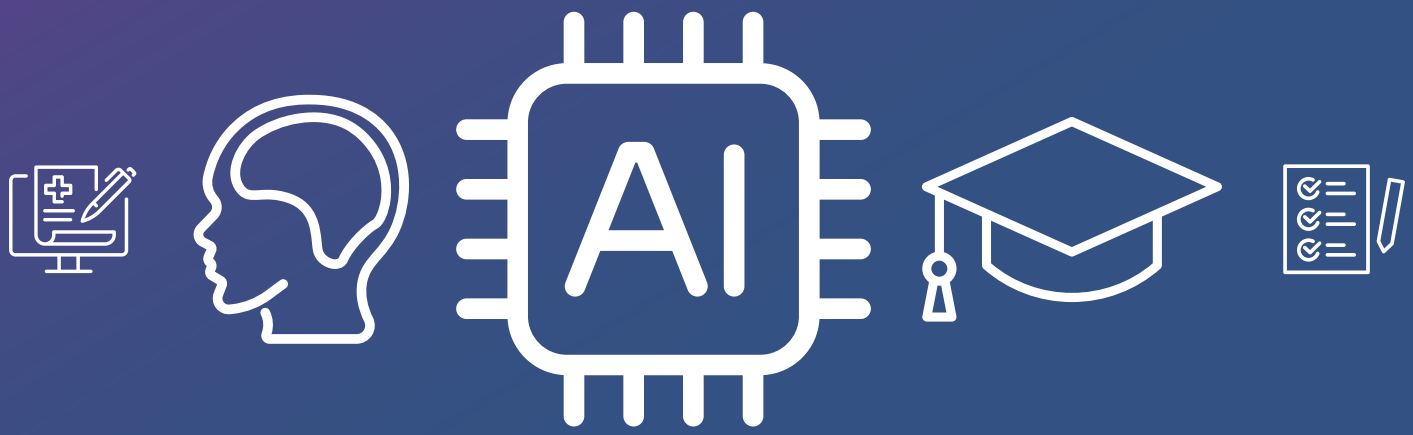
Health Education and Improvement Wales (HEIW)

Artificial Intelligence Education and Skills within NHS Wales

Landscape review



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Author: Dr Alexander Aubrey, Clinical Lead for Artificial Intelligence (HEIW) and Craig Barker, Assistant Director of Digital and Data Health (HEIW)

Executive Summary

This landscape review evaluates the current state of Artificial Intelligence (AI) education within NHS Wales and provides strategic recommendations to address significant gaps in AI skills and literacy across the healthcare workforce. The growing integration of AI technologies into healthcare underscores the urgency of preparing staff to use AI legally, safely, responsibly, ethically and effectively.

Purpose and Scope: This review aims to inform Health Education and Improvement Wales (HEIW) and the AI Commission for Health and Social Care about the current state of AI education within the healthcare sector. The primary objective is to evaluate what existing educational resources and provisions are being delivered and to what extent.

This review will help inform future commissioning and delivery and perform a baseline assessment of the current landscape. The review also covers a proposed model for the development of foundational and role-specific AI learning pathways that will require further consideration outside of this review.

Key Findings:

- **Current AI Education Gaps:** AI education within the NHS is fragmented and insufficient to meet the growing needs of the healthcare system. Both undergraduate and postgraduate healthcare training in Wales lack formal AI modules, leaving healthcare professionals underprepared to adopt AI technologies. The review highlights the absence of a centralised AI education resource for NHS Wales.
- **Need for AI Education:** AI has the potential to transform healthcare through enhanced clinical decision-making, diagnostic accuracy and operational efficiency. However, public and professional concerns such as the over-reliance on AI and the disruption of the patient-provider relationship, underscore the need for AI education that focuses on ethical, safe and effective use of AI.
- **Stakeholder Insights:** Key healthcare leaders and AI experts advocate for a foundational AI education programme, integrated into existing digital learning platforms like Y Ty Dysgu. Stakeholders from NHS England, academia and professional bodies suggest AI education should be flexible, outcome-driven and tailored to the specific roles within healthcare. Stakeholders emphasised the need for collaboration across the UK to share educational resources and avoid duplication.
- **Research and Survey Findings:** Evidence from medical literature and surveys supports the growing demand for AI education. Research shows that medical students and professionals across the UK are eager to learn about AI but lack access to structured educational programmes. HEIW's survey of NHS staff confirmed a strong desire for AI training despite limited current opportunities.

Proposed Model for AI Education:

- **Foundational AI Education Resource:** The review recommends the development of a foundational AI education resource accessible through the Y Ty Dysgu learning platform. This resource should cover AI basics, ethical considerations and real-world applications. It will be a bite sized participatory, non-assessed course, freely available to all NHS Wales staff. The content will also include case studies and promote the "human in the loop" approach to AI, ensuring that AI complements clinical expertise.
- **Tailored Learning Pathways:** The review proposes tailored learning pathways based on the archetypes identified in AI education literature (Shapers, Drivers, Creators, Embedders and Users). Each group will receive specialised training aligned with their roles, from high-level governance and policy to practical AI tool implementation and evaluation.
- **AI-Driven Education:** A novel recommendation is the use of AI to deliver AI education. The proposed "Healthcare AI Mentor," powered by an OpenAI API, will offer personalised, on-demand learning based on staff roles and needs. This model, integrated into Y Ty Dysgu, allows for flexible, scalable AI education while familiarising staff with AI technologies.
- **Resource Utilisation and Collaboration:** To avoid duplication, the review recommends leveraging existing high-quality AI education resources, such as those from NHS England's Digital Learning Hub and collaborating with UK-wide initiatives. This ensures alignment and consistency in AI education across the NHS.

Recommendations and Next Steps:

- **Adopt Existing Frameworks:** Adapt AI education frameworks like the English Digital Capabilities Framework (DCF) (which is open source) for use in Wales, ensuring coverage of generative AI.
- **Engage and Support the Workforce:** Provide accessible, bite-sized learning opportunities through webinars and workshops as well as interdisciplinary collaboration to build confidence and competence in AI.
- **Continuous Evaluation and Improvement:** Implement mechanisms for continuous feedback and updates to AI education content, ensuring relevance as AI evolves.

Conclusion:

The need for AI education within NHS Wales is clear and there is strong support from both staff and stakeholders for a structured, accessible AI learning programme. By adopting existing frameworks, leveraging external resources and introducing innovative AI-driven education methods, NHS Wales can build a digitally skilled workforce prepared to harness AI for improved patient care and operational efficiency.

The next steps include:

- finalising course content
- developing costed options for each educational model
- implementing a scalable AI education programme.
- Continuous evaluation will ensure that the workforce is equipped with up-to-date skills to meet the evolving demands of AI in healthcare.

1. Definitions

- **Artificial Intelligence (AI) in Healthcare**
  The use of digital technology to create systems capable of performing tasks commonly thought to require human intelligence. In relation to healthcare AI refers to the application of machine learning algorithms, predictive analytics and other computational methods to assist in clinical decision-making, enhance diagnostic accuracy, streamline administrative processes and improve patient outcomes. In healthcare, AI technologies are increasingly integrated into medical practices to augment human expertise.

- **AI Literacy**
  AI literacy is the knowledge and skills needed by healthcare professionals to understand, evaluate, engage and effectively use AI technologies in their practice. This includes technical proficiency, ethical considerations and critical appraisal including the ability to assess AI's impact on patient care and healthcare systems.

- **Digital Capabilities Framework (DCF)**
  The DCF is an initiative developed originally by NHS England to enhance digital literacy among healthcare professionals. Elements of the English have been adopted within the Welsh DCF. It includes identification and self-evaluation of the workforce digital capabilities.

- **AI Adoption in Healthcare**
  AI adoption in healthcare refers to the process of integrating AI technologies into clinical and administrative practices within healthcare settings. Successful AI adoption requires both technical infrastructure and a workforce equipped with the skills to use AI safely and ethically.

- **AI Education Pathways**
  AI education pathways are structured educational programmes or courses designed to build foundational AI knowledge for healthcare professionals. These pathways are essential to ensuring that AI technologies are understood, adopted and used effectively across different levels of healthcare practice.

- **DART-Ed Programme**
  The DART-Ed Programme, developed by the NHS AI Lab, aims to promote AI literacy among healthcare professionals. It offers resources and training to support the integration of AI into healthcare practices, addressing both technical skills and ethical concerns.

- **Ethical Use of AI in Healthcare**
  Ethical use of AI refers to the responsible application of AI technologies in healthcare, ensuring that patient safety, privacy and autonomy are upheld. This involves understanding the potential biases in AI systems, ensuring transparency in decision-making and maintaining human oversight in clinical contexts.

- **AI Governance in Healthcare**
  AI governance involves the policies, regulations and ethical frameworks that guide the development, implementation and use of AI technologies within healthcare. Effective governance ensures that AI is used responsibly, safely and in compliance with legal standards.

% Operational Efficiency in Healthcare

Operational efficiency refers to the ability of healthcare organisations to deliver high-quality care while optimising resources such as time, staff and technology. AI technologies have the potential to enhance operational efficiency by automating routine tasks and improving decision-making processes.

% Machine Learning Algorithms

An approach to building models using (normally large amounts of) data. This differs from traditional approaches to building models by defining rules by hand. Machine learning algorithms are computational methods used in AI to learn from data and make predictions or decisions without being explicitly programmed. In healthcare, these algorithms are used in diagnostic tools, predictive analytics and personalised treatment plans.

% Predictive Analytics in Healthcare

Predictive analytics involves using data, statistical algorithms and machine learning techniques to identify the likelihood of future outcomes based on historical data. In healthcare, predictive analytics can forecast patient outcomes, anticipate resource needs and improve care planning.

% Generative AI

Generative AI refers to AI systems that can generate new content, such as text, images, or simulations, based on input data. In healthcare, generative AI has the potential to assist with administrative tasks, clinical decision support and even patient education, though concerns about overreliance and accuracy persist.

% Large Language Models (LLMs)

A large language model is a neural network that is trained on a vast amount of text. The training uses unlabelled text and some form of self-supervised learning. Usually, LLMs will have billions of parameters.

% AI Commissions for Health and Social Care

The AI Commission for health and Social Care is an advisory body that focuses on ensuring the safe, ethical and responsible use of AI in the health and social care sectors. Established to guide the integration of AI technologies into Welsh healthcare, the commission helps identify opportunities where AI can improve services, optimize patient outcomes and increase efficiency.

2. Introduction and Scope of the Review

2.1 Purpose

This review aims to inform Health Education and Improvement Wales (HEIW) and the AI Commission for Health and Social Care about the current state of AI education within the healthcare sector. The primary objective is to evaluate what existing educational resources and provisions are being delivered and to what extent. This review will help inform future commissioning and delivery and perform a baseline assessment of the current landscape.

2.2 Background and Strategic Landscape

The healthcare system in Wales, like the rest of the UK, is under significant pressure due to increasing patient demand, staff burnout and resource shortages. Tackling these challenges requires a cohesive approach, as outlined in several key strategies, including the **Topol Review** (2019), **the English NHS Long Term Plan** (2019), **NHS Long Term Workforce Plan** (2023), the **Digital Strategy for Wales** (2021), the **Welsh National workforce Strategy** (2020), the **Digital Health and Care Wales (DHCW) Digital and Data Strategy** (2022) and the **(HEIW) Digital and Data Strategy** (2022).

The English NHS Long Term Workforce Plan highlights the critical role of AI and digital technologies in reshaping the workforce to meet future healthcare demands, by automating administrative tasks, supporting clinical decision-making and enhancing diagnostic accuracy.

Similarly, the DHCW Digital and Data Strategy focuses on improving the use of health data to enhance patient care, while the Welsh Government Digital Strategy promotes a unified, "Once for Wales" approach to digital transformation across public services, including healthcare.

A major barrier to the adoption of AI and digital solutions, as identified in the Topol Review (2019), is the lack of digital and AI literacy among healthcare professionals. The HEIW Digital and Data Strategy aligns closely with this by prioritising the development of digital skills, data literacy and AI competency within the healthcare workforce.

This sentiment is clearly shared by Harvard Medical school (HMS), ranked the worlds best medical school who have just received a donation of $6 million for AI healthcare education. **HMS Dean George Q. Daley stated**:

> "To remain at the forefront of medical education, HMS must anticipate the physician of the future, practicing in an environment rich with cognitive support resources powered by artificial intelligence tools,"

Together, these strategies underscore the importance of building a digitally skilled NHS workforce to fully harness the potential of AI and data-driven innovation. Bridging the digital skills gap will not only improve operational efficiency but also support the broader goals of the Welsh Government Digital Strategy, the DHCW Digital and Data Strategy and the NHS Long Term Workforce Plan, ensuring that the healthcare system in Wales is prepared to meet future demands and deliver better patient outcomes. Bridging this skills gap is vital component of the **AI Commission for Health and Social Care's** aims for the safe and ethical use of AI.

2.3 Scope of the Review

This review is intended for the NHS workforce in Wales and covers the following areas:

- The current landscape of AI education in healthcare across the UK, with a focus on Wales.
- Insights from key stakeholders across NHS organisations, professional bodies, educational institutions and healthcare and AI leaders.
- Evaluation of existing educational frameworks and digital capabilities, highlighting gaps in AI literacy.
- An analysis of the risks and ethical considerations associated with AI in healthcare.
- A proposed model for closing the education gap, including actionable recommendations for HEIW and the NHS.

The review incorporates research evidence, stakeholder opinions and an assessment of current AI implementation in healthcare to make recommendations that align with both national and international best practices. By ensuring a structured, outcome-based approach to AI education, we can support the workforce to confidently and safely integrate AI into their practice.

Whilst non-NHS workforce areas are out of scope it is acknowledged that some of the principles, insights and actions considered within this review may be transferable outside of the NHS including interface areas such as integrated and social care.

3. Why is AI Education Needed

The integration of Artificial Intelligence (AI) into healthcare is no longer a matter of speculation but a growing reality. AI technologies, from machine learning algorithms to predictive analytics, have already demonstrated the potential to improve clinical decision-making, enhance diagnostic accuracy and streamline administrative processes.

Despite these advancements, there is a clear gap between the development of AI technologies and the ability of healthcare professionals to effectively and safely use these tools in their daily practice.

AI education is crucial for the healthcare workforce to ensure that AI is applied ethically, safely and responsibly. Currently, a lack of formal AI education presents a barrier to adoption and healthcare professionals risk being unprepared to integrate these technologies into patient care.

Interest in AI in healthcare is accelerating, but its success depends on gaining the confidence of patients, the public and NHS staff. A **survey conducted by the Health Foundation** in mid-2024 revealed general support for AI use: 54% of the public and 76% of NHS staff favour AI for patient care, while even more (61% of the public, 81% of NHS staff) support its use for administrative tasks.

However, concerns remain. Around 1 in 6 of the public and 1 in 10 NHS staff believe AI could worsen care quality. Younger individuals (16–24 years) and women are less likely to believe AI will improve care, indicating the need for targeted engagement to address these concerns. AI's potential to disrupt the relational aspects of care is a key issue, with 53% of the public and 65% of NHS staff feeling AI might distance them from healthcare professionals or patients.

There are also concerns about decision-making accuracy; 30% of the public worry that healthcare staff might not question AI outputs, leading to missed errors and most prefer AI outputs to be reviewed by a human. While 57% of NHS staff look forward to using AI, enthusiasm varies by role, with medical and dental staff more positive than healthcare assistants. Policymakers must consider these differences and provide tailored support for staff as AI becomes more integrated into healthcare.

Moreover, concerns about the potential negative impacts of AI persist. For example, 30% of the public worry that healthcare professionals may rely too heavily on AI without questioning its outputs, potentially leading to errors. Additionally, 53% of the public and 65% of NHS staff fear that AI could disrupt the relational aspects of care by distancing healthcare providers from their patients.

AI literacy within healthcare needs to be built on a foundation of safe, ethical and responsible use. Addressing these concerns requires comprehensive education that empowers healthcare professionals to understand not just the technical aspects of AI but also the ethical, legal and relational implications. By equipping the workforce with these skills, healthcare institutions can ensure AI's positive contribution to improving patient outcomes and operational efficiency while maintaining public trust in the system.

There is also a strong appetite for AI education within the NHS. HEIW's research, including findings from stakeholder sessions and survey results, found that staff expressed a desire to participate in training to learn more about AI in healthcare (despite holding negative views about the impact of AI in healthcare more generally).

However, structured AI education pathways remain limited, particularly within undergraduate and postgraduate training programmes. This review found that currently, no formal AI education exists in undergraduate healthcare curricula across the UK and many professionals lack the knowledge to assess AI solutions critically although the 'Medical Schools Council' (MSC) is due to deliver guidance on updating the curriculum for AI.

Therefore, AI education is not only about filling an existing knowledge gap but also about preparing the workforce to confidently adopt and utilise these tools as AI technologies become integral to healthcare. Based on this landscape review of existing strategies, literature and our own findings from stakeholder interviews and survey responses, it is evident that there is a clear need for targeted, interdisciplinary education programmes.

Additionally, the opportunity to improve the workforce's digital competence through AI education is a critical area that should not be overlooked.

4. Current AI Education Provision in Healthcare

The current landscape of AI education in healthcare is fragmented, with varied levels of accessibility, formal education and practical application. In the UK, several frameworks and initiatives have been introduced, including those from **NHS AI Lab**, **NHS England** (formerly Health Education England (HEE) and Digital Transformation initiatives such as the **DART-Ed programme**.

Despite these efforts, there are significant gaps in formal education, particularly within undergraduate and postgraduate training programmes. This lack of structured AI training in undergraduate and postgraduate programs leaves future healthcare professionals and current NHS staff underprepared for the increasing role AI is expected to play in clinical and operational settings.

Consequently, there is an urgent need to embed foundational AI literacy across healthcare education pathways to ensure a workforce capable of leveraging AI safely and effectively in patient care. This view is backed by a recent survey (2024) for existing NHS nursing and midwifery staff (n=408) who expressed concerns about AI and opportunities to learn.

4.1 Undergraduate and Postgraduate Education

This landscape review has found the majority of healthcare undergraduate programmes across the UK, including Wales, AI education is absent. At Cardiff University School of Medicine, for instance, while students are informed that AI will play a significant role in their future careers, there is currently no formal AI module in the medical curriculum; although this is now being addressed and there are plans to introduce compulsory modules from next academic year (25/26).

Students had been discouraged from using AI tools like ChatGPT in their studies due to concerns about overreliance and accuracy but thankfully there is now a framework they can use to ensure academic integrity.

This previous hesitation contrasted sharply with the growing enthusiasm for AI education among both faculty and students. This is a fluid situation and there are efforts to further evolve the education pathway for students as progress accelerates around AI technology and adoption.

In postgraduate settings, AI education is similarly limited. HEIW research conducted in 2024 revealed that NHS staff felt they lacked adequate training to understand and implement AI technologies. This gap is particularly pronounced in clinical disciplines where AI is beginning to be integrated, such as radiology and pathology. The lack of structured AI education pathways for both clinical and non-clinical staff, coupled with the growing role AI is expected to play, highlights the urgency of addressing this issue.

4.2 Current Initiatives

Several existing initiatives and resources could be leveraged.

For example:

- The NHS AI Lab has developed the DART-Ed programme and other resources aimed at fostering AI literacy among healthcare professionals.
- NHS England's **Digital Capabilities Framework (DCF)** includes some references to AI education, although these are not fully developed, particularly around generative AI technologies.
- The NHS Fellowship in Clinical Artificial Intelligence at Guy's and St. Thomas' NHS Foundation Trust provides a structured programme aimed at developing clinical AI leaders, though such opportunities are rare and selective.

While these efforts are steps in the right direction, they have not yet been integrated into formal, widespread educational curricula. The challenge lies in finding the right balance between introducing AI into an already crowded curriculum and ensuring that all healthcare workers, regardless of role or clinical focus, have access to a foundational AI education.

5. Research, Evidence and Stakeholder Insights

This review found that the demand for AI education in healthcare is not only evident through research but is reinforced by the perspectives of key stakeholders across the sector and further reinforced by a self-conducted survey with results from a sample of NHS Nurses and Midwives (n=408). Their collective insights highlight both the urgency, desire and the strategic considerations for developing comprehensive AI education in Wales.

Research Evidence A substantial body of research supports the need for AI education in healthcare. A scoping review in '**Medical Teacher' synthesised findings from over 278 publications, showcasing the wide applications of AI in clinical reasoning and decision support**. The review underscores the need for structured AI education that integrates technical proficiency with ethical, legal and relational considerations. Additionally, medical students in the UK and Ireland have expressed significant interest in AI education, with studies showing that two-thirds of final-year students had not received formal training despite believing it should be included in medical curricula.

5.1 Stakeholder Insights and Opinions

During an extensive fact-finding period lasting four months this review has engaged with a number of key stakeholders from NHS England and Wales, Academia, Royal Colleges, HEIW, the **Welsh National Data Resource (NDR)**, DHCW, WG in addition to leaders in the field of AI and digital transformation within health care. A full list of stakeholders can be seen in appendix 2.

Stakeholder Engagement

Key thought leaders and stakeholders in the healthcare and educational sectors have expressed a strong appetite for foundational AI education.

Their perspectives highlight the diverse needs across different healthcare roles and the potential models for AI literacy.

- **James Freed**, Deputy Director of NHS Digital Academy, advocates for leveraging existing frameworks and free resources, emphasising the need for AI education to be user focussed and outcome-centric. His focus on productivity increases and improvements to patient safety and workforce wellbeing highlights the importance of aligning education outcomes with tangible organisational benefits.
- **Cardiff University's School of Medicine** representatives expressed interest in integrating AI education into existing clinical and theory-based modules rather than adding separate AI courses. This approach aims to ensure that AI education is seamlessly integrated into medical training, focusing on safe, ethical and responsible use.
- **Dr Keith Grimes**, a Digital Health and Innovation Consultant with 20 years' experience of general practice, emphasised the importance of educating both staff and patients about AI. He advocates for practical training that begins with generative AI, allowing staff to engage with tools they can immediately use. Dr Grimes also stresses the need for continuous learning, with AI freeing up time for patient care.
- **Professor Hatim Abdulhussein**, former Clinical Lead for AI and Robotics at Health Education England (HEE), highlighted the importance of digital education strategies that promote a digital culture. His suggestions include collaboration with clinical AI fellows and the use of webinars to disseminate AI education at scale.

- **Dr Phillip Wardle,** Director of the National Imaging Academy in Wales, argues that clinicians should focus on evaluating AI tools rather than developing them. His view aligns with the broader consensus that AI education should empower clinicians to critically assess and safely integrate AI into clinical practice. Additionally, it would be ideal that NHS Wales had an environment which enable interested clinicians to develop tools in collaboration with academia and industry, ensuring they are as useful as possible.
- **Clem Price,** Assistant director of strategic workforce planning HEIW suggests AI has transformative potential for workforce planning, offering improved efficiency and solutions to challenges like an ageing population and a shrinking workforce. However, concerns remain in healthcare education and staff regarding overreliance on AI, critical thinking and automation bias, as well as resistance from those wary of change. Clear messaging and cultural engagement are essential to leverage AI effectively, contextualising data and fostering trust while addressing workforce challenges with actionable insights.
- Representatives from **various Royal Colleges** (see appendix 2), emphasised the need for AI education for both trainees and trainers. They advocate for a foundational resource that is valuable across different levels of healthcare professionals.

5.2 Collaborative Opportunities and External Resources

Many stakeholders have pointed out the need for collaboration across the UK and internationally to avoid duplication of efforts and ensure that education resources are shared effectively. Cardiff Business School, for example, expressed interest in developing AI in healthcare programmes for external students, potentially collaborating with HEIW on paid educational initiatives.

Additionally, NHS AI Lab's DART-Ed programme provides free resources that could be incorporated into the Welsh AI education framework. In addition DHCW have developed some content which is particularly useful to DDAT professionals.

In summary, the research and opinions of these stakeholders converge on the critical need for foundational AI education that addresses technical, ethical and practical aspects of AI use. The emphasis is on creating a flexible, outcome-driven programme that can be adapted to the diverse needs of the healthcare workforce, while also leveraging existing resources and collaboration opportunities.

6. Proposed Approach and Model for Closing the Identified Gap

Based on the evidence gathered during this review, addressing the significant gap between the current state of AI education and the needs of the NHS workforce is essential. We recommend the development of a foundational AI education resource to help bridge this gap.

Whilst there is signposting to external resources and content around AI in healthcare, the general view from stakeholders interviewed is that we lack a "one stop shop" for foundational AI educational material that is easily accessible and reliable. This does not address the learning needs analysis suggestion of personalised, tailored educational material and we elaborate further on how to solve this issue in our further recommendations.

This resource will ensure all healthcare professionals in Wales have the knowledge and skills to use AI safely, ethically and effectively. The approach builds on existing frameworks and recommendations from various stakeholders to offer a structured, accessible education model that addresses the diverse needs of the healthcare workforce.

6.1 Development of a Foundational AI Education Resource

Creating a foundational AI education resource available via Y Ty Dysgu, HEIW's digital learning platform, is the most efficient and scalable way to educate the workforce around basic principles of safe, ethical and responsible AI use.

This resource should:

- Cover the basics of AI, its real-world applications, potential risks, fears and ethical considerations.
- Include case studies and examples focusing on "human in the loop" and "learned intermediary" concepts, which mitigate concerns around job displacement and foster a culture of enthusiastic adoption.
- Be designed as a free, participatory-only resource without assessment, encouraging wide uptake across the workforce.
- Ensure integration into the existing Welsh DCF and HCSW DDaT
- Consideration of the adoption and updating of the English DCF AI element (given the omission of generative AI in the English DCF)

6.2 Utilising External Resources

The AI sector is fluid and fast moving, so AI literacy and skill requirements will no doubt vary greatly across healthcare within the UK. To avoid duplication and maximise resources, this initiative could signpost learners to free, curated high-quality AI education resources already available. By way of example NHSE, through its digital learning hub, which HEIW has access to, offers such resources and collaborations with NHSE and other home countries could ensure alignment across the UK.

6.3 Tailored Learning Pathways

It is vitally important to recognise the diversity of roles within the NHS. Tailored learning pathways are customised educational tracks that guide learners through relevant skills and knowledge based on their particular roles, whether they be clinical, administrational etc. In this model, the NHS uses role-based archetypes from Health Education England (HEE) to categorise learners into groups; **Shapers, Drivers, Creators, Embedders** and **Users** each with access to training relevant to their responsibilities. This method ensures that each group develops the necessary confidence and skills for the role they play in the AI landscape, from administrative tasks to direct patient care, fostering a well-rounded, AI-literate workforce across all NHS functions.

Adapting this foundational Tailored learning pathway model resource could ensure each archetype has access to learning relevant to their role, from technical AI development to practical use in clinical settings to administrative roles.

The two examples below show how clinical and administrative roles might benefit from this type of training. The key knowledge column clearly shows what can be taught using this model whilst the role and focus area show how the knowledge specifically fits into their needs.

For Clinical Roles

Archetype	Role (Clinical)	Focus Area	Key Knowledge
Shapers	Senior clinical leaders shaping AI policies and clinical governance	Overseeing AI safety, ethics and governance in clinical practice	High-level understanding of AI safety, ethics and regulation in clinical settings
Drivers	Clinical managers deploying AI in clinical environments	Operationalising AI tools to enhance diagnostics, treatment planning, procurement and patient care	Knowledge of AI tools for improving clinical workflows and patient outcomes
Creators	Clinical researchers or healthcare technologists developing AI tools	Designing and validating AI models for clinical use, such as diagnostic algorithms or decision support	Technical skills in AI model development, testing and validation specific to clinical applications
Embedders	Clinicians responsible for implementing AI tools in healthcare settings	Integrating AI solutions into everyday clinical workflows, ensuring compliance with safety standards	Practical knowledge of AI integration, patient safety and clinical system compliance
Users	Doctors, nurses and other healthcare professionals using AI	Applying AI tools in day-to-day clinical practice, such as diagnostics, treatment recommendations, or patient monitoring	Understanding AI's risks, benefits and safe application in clinical settings

Administrative Roles

Archetype	Role (Clinical)	Focus Area	Key Knowledge
Shapers	Senior administrators shaping AI policies for non-clinical operations	Overseeing administrative AI ethics, governance and policy implementation	High-level understanding of AI's ethical and regulatory impact on administration
Drivers	Mid-level administrators deploying AI in administrative processes	Streamlining operations, such as scheduling and resource management using AI	Operational knowledge of AI tools for administrative efficiency
Creators	IT and software specialists developing AI solutions for administrative tasks	Developing AI models for administrative functions like data management and workflow automation	Technical skills in AI programming, testing and validating administrative tools
Embedders	Administrators responsible for integrating AI systems into daily operations	Ensuring smooth integration of AI tools into routine administrative tasks	Practical knowledge of AI integrations, compliance and safety in administration
Users	Administrative staff using AI tools in day-to-day tasks	Applying AI routine tasks such as data entry, scheduling, or communication management	Basic understanding of AI functionality and safe usage in everyday tasks

An educational model utilising Tailored Learning Pathways could provide:

- **Continuous, bite-sized learning opportunities:** These will be designed to fit into the busy schedules of NHS staff, making it easier for them to integrate learning into their daily routines.
- **Interdisciplinary learning:** This approach will encourage collaboration across departments, ensuring that AI education is relevant to various roles / archetypes and fosters teamwork.
- **Confidence and competence building:** The focus will be on enhancing the workforce's ability to use AI tools effectively and with confidence.

All available evidence supports the idea that increasing education around digital technologies leads to greater enthusiasm and uptake within the workforce. To promote long-term engagement and career development, offering micro-credentials in specialised areas could be explored in the future.

This would allow for targeted professional growth while maintaining a balance that ensures widespread appeal, encouraging the use of educational materials without overwhelming staff or discouraging participation.

6.4 Using AI to Educate About AI: "Use AI to Learn AI"

Our innovative proposal is the creation of a "Healthcare AI Mentor" powered by a Large Language Model (LLM). This AI-driven mentor will be able to deliver tailored, on-demand educational content, allowing learners to explore topics most relevant to their role and needs.

By leveraging the capabilities of generative AI specifically LLMs, healthcare professionals can receive highly personalised educational materials aligned with their archetype (Shapers, Drivers, Creators, Embedders, or Users) and specific job roles already researched tried and tested and in use within NHSE.

The **Y Ty Dysgu** Learning Management System (LMS). CDSM, the platform's developers, have provisionally confirmed that there are no technical barriers preventing the integration of the OpenAI API into the LMS, ensuring seamless access for NHS Wales staff. This approach not only provides flexible and highly relevant learning opportunities but also exposes healthcare professionals to AI technologies in a practical, engaging way.

A key advantage of this model is its alignment with Bloom's 2 Sigma problem, which suggests that students receiving one-to-one tutoring perform two standard deviations better than those in conventional classroom settings. By delivering personalised, tailor-made educational material through the OpenAI API, the healthcare workforce can benefit from education that is more responsive to individual learning needs, leading to significantly improved outcomes.

This personalised approach is far more valuable than traditional "one-size-fits-all" learning, as it caters to the learner's specific role, background and skill level, maximising engagement and retention; all whilst exposing learners to AI models throughout their education journey.

By embedding AI tools into the education process, we can foster both the learning and practical experience needed to drive AI literacy in healthcare. Hosting educational resources in Y Ty Dysgu also enables integration of any learning with the digital capabilities framework (DCF) and personal development plans. This innovative model could position NHS Wales at the forefront of AI education by combining cutting-edge technology with accessible, workforce-specific tailored learning pathways. User research is being collated based on our 'proof of concept' GPT and may help to inform applications of this strategy across other educational needs for the workforce.

6.5 Collaboration and Alignment

The similarities of the four home nations combined with the fact some curated materials and resources are already available means it is practical to combine and collaborate as appropriate.

HEIW will further explore opportunities to work with NHS colleagues across the four nations of the UK as well as other relevant stakeholders to ensure the foundational course and any subsequent learning pathways align with existing frameworks and national initiatives.

The theme of collaboration has been the most strongly shared and vocalised sentiment during our engagement and minimises duplication of efforts whilst promoting consistency in AI education across the UK.

6.6 NHS Fellowship in Clinical Artificial Intelligence

The NHS Fellowship in Clinical AI is a twelve-month programme which is integrated part-time alongside clinical work.

Clinical AI fellows are recruited competitively from across the NHS, drawn from a diverse clinical workforce including: medical and dental specialty trainees, nurses and midwives, allied health professionals and pharmacy professionals.

The fellows are individuals who will be equipped to adopt clinical artificial intelligence technology via the programme. Fellows gain experience deploying AI in clinical workflows in 12-month project placements, under expert supervision in multidisciplinary teams.

This unique programme is featured as an exemplar in upskilling clinicians for AI transformation in both the **NHS Long Term Workforce Plan (2023)** and the NHS Transformation Directorate report, **Developing Healthcare Workers' Confidence in AI (2022)**. The fellowship builds directly from the recommendation of the **Topol Review (2019)** to create posts for clinicians with dedicated time to implement AI technologies.

At the time of this report's publication, HEIW is funding two places for the AI Clinical Fellowship cohort 3. Unfortunately, despite considerable effort, funding has not been secured for cohort 4.

The assessment of the AI Fellowship (as outlined in the 24/25 IMTP plans for AI within HEIW, has commenced but is still under evaluation to determine whether to recommend the continuation of this programme into cohort 5 and to justify the continued investment associated with the programme.

At this point the review suggests that the case for continued investment should be a priority if we are to meet the **AI Commission for Health and Social Care's** NHS education and skills ambition.

7. Recommendations and Actions

To address the significant gaps identified in the current provision of AI education in healthcare, as outlined in this document and the gap analysis (Appendix 1), the following recommendations are proposed.

These are aimed at ensuring that AI literacy and skill development is effectively, safely and ethically integrated into healthcare education and skill development, preparing the workforce to safely adopt and utilise AI technologies. The following recommendation also fulfil the **AI Commission for Health and Social Care's** NHS education and skills ambition.

7.1 Recommendation 1 Adopt Existing Frameworks

Building on existing educational frameworks, such as the Digital Capabilities Framework (DCF) for Wales and the NHS AI Lab's initiatives, will enable a streamlined, cost-effective approach.

Specifically, the English DCF offers a comprehensive outline for AI education but currently lacks coverage on generative AI, which is crucial for addressing the recent surge in AI tools used in healthcare.

We recommend adapting this framework for the Welsh context to ensure it meets the needs of both clinical and non-clinical staff. In addition, the future could include making the DCF an AI-Enabled learning process.

7.2 Recommendation 2 Develop a Foundational AI Education Resource

This review recommends the development of a critical foundational AI Education Resource with the advantages as described in section 7.1 of this paper.

This foundational course would ensure that every healthcare worker, from trainees to senior staff, is equipped with the necessary AI literacy to make informed decisions about AI tools in their day-to-day roles. This includes understanding what AI tools exist and how they can be used to help them with their daily activities, allay fears of their use and ensuring they are aware of potential risks and how to mitigate those risks.

7.3 Recommendation 3 Utilise External Resources

To avoid duplication of efforts, it is recommended that external resources be leveraged where appropriate. With advantages as per section 7.2 of this review.

7.4 Recommendation 4 Adopt Tailored Learning Pathways

This review emphasises the importance of establishing tailored learning pathways to meet the varied AI education needs of the NHS workforce. A foundational course would introduce all staff to core AI concepts, with role-specific content guiding further learning based on each archetype.

This approach ensures that everyone, from frontline clinicians to administrative staff, begins with a solid AI foundation while progressing to relevant, advanced material as needed. Section 7.3 outlines the benefits, such as enhanced knowledge, ethical AI use and targeted skill development, which aligns with the Topol Review's vision and other strategic objectives.

By adopting this model, the NHS could build a workforce that uses AI responsibly and effectively, enhancing patient care and operational efficiency across the healthcare system.

7.5 Recommendation 5 Engage and Support the Workforce

A successful AI education programme must also focus on workforce engagement. We recommend adopting a strategy that provides bite-sized learning opportunities that fit into the busy schedules of healthcare professionals. Encouraging **interdisciplinary collaboration** will also be key to fostering AI literacy across different roles. This approach should focus on building both confidence and competence in AI tools.

Regular webinars and/or workshops and educational and training events can help keep learners up to date with latest developments and foster an inclusive and involving culture for improved staff engagement. The content should establish a common lexicon, consider the benefits and real-world applications of AI and balance enthusiasm with the appreciation of risks and fallibilities posed by AI in such a high-risk arena as healthcare.

Other allied professions such as those trained in clinical informatics and clinical scientific computing; that are trained at Clinical Scientist and Consultant Clinical Scientist levels will have a vital role to play. These roles specialise in critically appraising AI technologies, planning their implementation and managing associated risks. Leveraging their expertise can provide valuable local support in applying digital technologies to clinical services, aligning with the review's recommendations.

7.6 Recommendation 6 Continuous Evaluation and Improvement

As AI evolves, so must the educational tools that support it. The AI foundational resource should include mechanisms for continuous feedback and improvement, ensuring that the content remains relevant and up to date. Evaluating the success of the training using Kirkpatrick Level 4 criteria will also be crucial in demonstrating the positive impact on staff attitudes, organisational goals and productivity generally.

7.7 Recommendation 7 “Using AI to Learn AI”

Leveraging AI itself to deliver education is a promising opportunity. This novel solution proposed by this document’s author has already been created utilising the OpenAI tooling to create a Proof of Concept (POC) prototype. This POC has already proven that it is feasible to create, update and maintain such a tool whilst also utilising retrieval augmented generation (RAG) technology to maintain accuracy by sourcing trusted resources built into the model.

The proposed Healthcare AI Mentor, powered by the OpenAI API model and integrated into Y Ty Dysgu LMS, is a perfect example. This tool can deliver tailored, real-time educational content and dialogue based on user needs and feedback, providing personalised education that enhances learning outcomes. CDSM, the developers of Y Ty Dysgu, have confirmed that there are no technical barriers to this integration.

7.8 Recommendation 8 NHS fellowship in Clinical Artificial Intelligence

The review suggests maintaining the AI fellowship program, leveraging current evidence of its positive impact, while HEIW carries out a detailed internal review to assess its benefits and cost-effectiveness for the first cohort it has funded. This dual approach allows the NHS to continue developing AI expertise within its workforce to ensure ongoing progress in AI skills and application; while also providing a structured evaluation to determine the program’s long-term value, opportunities and benefits born of the program and its fellows and potential areas for improvement within Wales.

8. Resource Considerations for the Proposed Models

To fully assess the costs and resources required for each of the recommended models identified in this review, additional work is necessary. While some progress has been made, including an initial costing for the LLM component outlined in **Recommendation 7**, “Using AI to Learn AI,” this evaluation primarily focused on assessing the viability of a novel approach to delivering AI education.

This method, previously unexplored, needed evaluation to determine whether it might be cost-prohibitive and therefore unsuitable. Early indications are positive, with costs for the AI LLM element estimated at under £5,000.

A fully costed options paper will now be developed to provide a detailed estimate of the financial and resource requirements for each initiative.

This paper will include:

- A comprehensive cost-benefit analysis to enable informed decision-making regarding the potential implementation of these models.
- User research, incorporating feedback on each option, based on actual use of the proof-of-concept Healthcare AI Mentor (outside of Y Ty Dysgu).

To deliver this paper by Q4 2024/25, the Data and Analytics Team will recruit a fixed term 1xWTE Band 7 “AI and Data Literacy Manager” and will continue to leverage other internal resources, including the Clinical Lead for AI. The team will also explore potential support from the AI Skills Subgroup within the AI Commission to advance this initiative.

9. Conclusion and Next Steps

Conclusion

This landscape review clearly demonstrates, via the evidence collected, that there is significant need and enthusiasm for AI education across the NHS workforce in Wales. The increasing integration of AI technologies into healthcare and administrative workflows highlights the urgent requirement for healthcare professionals to be proficient in the safe, ethical and effective use of AI.

By adopting existing frameworks and leveraging resources available from national bodies such as NHSE (formerly HEE), we can develop a foundational AI education programme tailored to the unique needs of NHS Wales.

This will ensure that all staff, regardless of their role or digital proficiency, have access to the necessary education and support to adopt AI responsibly in their practice.

The collaborative approach of working closely with key stakeholders and aligning with UK-wide AI initiatives strategically positions NHS Wales as a potential leader in AI education and workforce skills development for healthcare. This integration ensures that NHS Wales's AI education pathways reflect broader national goals and expert recommendations, addressing crucial concerns around AI readiness, ethics and practical application raised in key strategic documents.

By fostering partnerships and staying in step with national AI advancements, NHS Wales can build a workforce adept in AI, enhancing healthcare delivery while meeting the standards and expectations of AI integration across the UK healthcare landscape.

Next Steps

The landscape review has been presented to the HEIW executive team for initial discussion and approval who supported the reviews recommendation and we now aim to achieve the following three key objectives:

1. **Wider Dissemination for Feedback:**
   Having received HEIW executive team approval, the document will be circulated to the AI Commission for Health and Social Care and other relevant stakeholders to gather input. This step ensures that the review benefits from a diverse range of expert perspectives, allowing for refinement and alignment with broader stakeholder priorities.

   It is felt that achieving some of the recommendations of this paper could play an important role in helping to achieve some of the Welsh Governments main objectives, namely around primary and community care and cancer and planned care. This has been incorporated into the IMTP for 25/26.

2. **Feasibility Study and Costed Options Appraisal:**
   As agreed with the HEIW executive team HEIW will undertake a feasibility study and prepare a "costed options paper" to analyse each recommendation's viability. This paper, forming part of HEIW's 24/25 IMTP strategic objective, will outline the benefits, resource needs and potential implementation frameworks for each recommendation. Additionally, user research and feedback will provide insights into the real-world applicability of each proposal, particularly the foundational material and the 'healthcare AI mentor". A full risk analysis

3. **Laying the foundation for 25/26 IMTP AI Strategic Objective:**
   Feedback from stakeholders and findings from the costed options paper will support a comprehensive submission for including AI education and skills development within HEIW's 25/26 IMTP delivery plan.

   This strategic alignment will ensure that AI readiness is integrated as a long-term goal, strengthening HEIW's capacity to deliver relevant, impactful AI education across the Welsh health and social care workforce.

This structured approach not only prepares HEIW to make informed, financially sound decisions but also positions it to lead in equipping the workforce with necessary AI skills.

In addition, the following steps are proposed to deliver the three key objectives above:

4. **Finalise the proposed Foundational AI Education Course Content:**
   a. Define the core content for the foundational AI course, ensuring it covers AI basics, ethical considerations and real-world healthcare applications.
   b. Collaborate with Higher education institutions and other key stakeholders to ensure alignment with existing medical education curricula, without oversaturating the existing frameworks.
   c. Perform user research on content and approach

5. **Determine Approach for Resource Development based on recommended models:**
   a. Ensure value for money and viability of models
   b. Explore the options of signposting to existing high-quality AI educational resources (e.g., those available through NHSE's digital learning hub) vs. developing in-house content. A blended approach may be necessary.
   c. Conduct user research, including demonstrations for external stakeholders including AI commission and HEIW senior management teams, using the "Healthcare AI Mentor" proof-of-concept LLM. This will help assess interest, gauge usability and determine the potential impact and adoption of AI-driven educational tools within the workforce.
   d. Engage further with CDSM (Y Ty Dysgu vendor) to ensure viability of seamless integration of LLMs and Y TY Dysgu's ability to support other models.

6. **Secure Executive Buy-in and Approval:**
   a. Present costed options paper backed by user research to the HEIW Executive Team for approval and ensure alignment to IMTP.

Appendix 1: Gap Analysis against the preferred training and education AI model

Executive Summary

Objective: To identify gaps between the current AI training provisions in Wales' healthcare sector and the preferred model, which emphasises safe, ethical and responsible use of AI technologies.

Key Gaps Identified:

- Lack of formal AI education in undergraduate and postgraduate healthcare curricula.
- Underutilisation of available resources and frameworks such as:
  - NHSE DART-Ed
  - NHS England DCF (AI section)
  - Digital learning hub / elfh

Need for:

- Foundational AI education that acknowledges various archetypes of healthcare professionals, from leaders to frontline workers.
- Targeted, tailored educational material delivered in bite sized chunks.

Recommendations

Develop a foundational AI training programme within the HEIW platform, 'Y Ty Dysgu', focusing on safe, ethical and responsible use of AI.

Leverage existing external resources and adopt the English digital capabilities framework (DCF) with AI-specific updates.

Create a custom GPT utilising OpenAI's API platform to deliver truly targeted education for the user.

Introduction

The purpose of this gap analysis is to assess the existing AI education in healthcare within Wales against the preferred training model and strategies identified by our Landscape review. The preferred model aims to provide outcome-based, accessible AI education that empowers healthcare professionals across different roles (from users to decision-makers) to use AI safely and effectively.

Preferred AI Training and Education Model

The ideal or preferred AI training model, as suggested by various stakeholders in the document, includes:

- **Content:** Training on the types of AI, practical applications in healthcare (e.g., radiology, pathology etc as well as non-clinical roles and applications), ethical considerations and safe use of AI tools.
- **Delivery Methods:** Blended learning approaches including online modules, workshops and practical use cases as well as a custom GPT that users can refer to at their convenience with their own specific questions, all hosted via HEIW's online learning platform, 'Y Ty Dysgu'.
- **Accessibility:** Courses available to all healthcare professionals at different levels (executive, clinical, clerical) within the healthcare and social care workforce in Wales.
- **Resources Needed:** A digital platform (like 'Y Ty Dysgu') that hosts both foundational courses, a n educational custom GPT and links to a curated catalogue of external resources.
- **Learning Objectives:** Core competencies in AI literacy, including understanding AI risks, bias mitigation and safe integration into clinical practice whilst also focusing on real world examples.
- **Evaluation:** Use of learning outcomes that align with the Kirkpatrick Level 4 criteria to ensure that training impacts real-world clinical outcomes.

Current State of AI Training and Education

Based on the landscape review, the current state of AI training in Wales has these characteristics:

- **Existing Initiatives:** Wales (and the UK generally) lacks formal AI education in both undergraduate and postgraduate medical training, though there is an appetite for AI education, as shown by the enthusiasm of 400 NHS respondents as well as key stakeholder discussions as detailed in the landscape review.
- **Resources Available:** Resources such as NHSE's DART-Ed, Digital learning hub, the AI Lab and existing frameworks are underutilised.
- **Challenges:** Limited structured pathways for AI education, lack of understanding of AI among healthcare professionals and outdated digital infrastructure creating an atmosphere of cynicism and fear.
- **Learning Gaps:** There is no consistent foundational AI education for the entire healthcare workforce. Medical schools and postgraduate programmes include minimal **AI training, despite its growing relevance.**
- **Enthusiasm and Engagement:** NHS staff exhibit interest in learning AI but are not currently provided with formal pathways for doing so.

Gap Analysis

Aspect	Current state	Preferred state	Gap
AI literacy	Lack of formal AI education in most healthcare training. Some courses like MSc Clinical Management touch on innovation but lack depth in AI.	Comprehensive AI literacy across all roles (clinical, administrative, leadership).	Significant gap in basic AI understanding and competencies.
Content	No structured AI curriculum in undergraduate or postgraduate training. Opportunistic learning rather than formal integration.	Structured foundational AI education focusing on safe, ethical use. Specific modules for clinical and non-clinical staff.	Significant gap in structured learning.
Resources and infrastructure	Existing resources (DART-Ed, AI DCF, external courses) are underused. Lack of internal platforms for AI education.	Leveraging external resources, hosted or signposted via an internal platform like 'Y Ty Dysgu'. Blended learning with external and internal resources and material.	Underutilisation of external resources and no comprehensive internal platform or material.
Accessibility	AI education is ad hoc and limited to those actively seeking it out eg clinical fellowships in AI (only 2 fellows funded), trail-blazing clinicians.	AI training accessible to all healthcare professionals, regardless of role, through an organised platform.	Training is not universally accessible.
Practical application	Few hands-on AI experiences for clinicians. AI is mentioned but not embedded into practical training.	Courses with practical use cases and simulations to prepare staff for AI integration in their roles.	Lack of hands-on learning experiences.
Learning objectives	Training is not clearly outcome-based or mapped to competencies like Kirkpatrick level 4.	Learning outcomes focused on real-world clinical improvements and productivity gains (e.g., 2% productivity target, feedback questionnaires, NPS scoring etc).	Outcomes are not clearly defined or measured.
Evaluation methods	Minimal evaluation of AI training effectiveness.	Continuous feedback and assessment of AI training through participant questionnaires and learning analytics.	No robust evaluation mechanism.

Impact of Gaps

- **AI Literacy:** The lack of formal education on AI limits healthcare professionals' ability to adopt and use AI safely, ethically and responsibly, increasing the risk of ethical and clinical issues in the future.
- **Operational Inefficiencies:** Without proper AI integration, staff may miss out on potential productivity gains, such as reduced administrative workloads through automation.
- **Patient Care Risks:** Gaps in understanding and safely using AI may lead to improper use of AI tools, putting patient safety at risk. In addition NOT training staff to utilise AI could negatively impact patient care through below par adoption of solutions. This is an ethical consideration that many stakeholders are grappling with.

Recommendations and Next Steps

- **Develop a Foundational AI Training Resource:** Create a free foundational AI course tailored to healthcare professionals in Wales, hosted on the 'Y Ty Dysgu' platform. This should focus on AI literacy, ethical use and practical applications in different healthcare roles.
- **Adopt and Adapt the English DCF for Wales:** Incorporate AI-specific competencies from the English Digital Capabilities Framework into the Welsh system.
- **Leverage External Resources:** Utilise existing high-quality resources such as NHSE's DART-Ed programme, Digital learning hub, NHSE AI DCF.
- Create a custom GPT using OpenAI API platform, hosted via 'Y Ty Dysgu' to ensure material meets the learning needs analysis and delivers tailored, bite size and role specific education for professionals to consult at their convenience.
- **Evaluation Framework:** Ensure the programme meets Kirkpatrick Level 4 criteria to ensure that training impacts clinical practice and operational efficiencies and improvements can be measured.
- **Blended Learning Approach:** Implement a blended approach that includes both HEIW-created material and signposting to external resources.

Conclusion

The current AI education and training in Wales fall short of the preferred model, particularly in structured learning pathways, accessibility and hands-on experience. Addressing these gaps through a foundational AI programme and leveraging existing resources will help HEIW equip the workforce for the challenges and opportunities posed by AI in healthcare.

Nb. The main reference for this document is the HEIW Landscape review. This document (and all the references and appendices therein) can be obtained on request by emailing Dr Alexander Aubrey at alexander.aubrey@wales.nhs.uk

Appendix 2: Stakeholder List

Category	Contributor Role/ Area of Expertise	Insights
Royal Colleges	Representatives from RCGP, RCP, RCA, RCR, RCPath	Provided insights and feedback from key medical specialities during stakeholder meetings
HEIW and Cardiff University	Deanery leaders from HEIW, Cardiff University (central and medical school)	Contributed to discussions aroun education and training in the AI healthcare space
Thought Leaders and NHS AI Advisors	James Freed (Deputy Director, NHS Digital)	Shared expertise in digital health strategy
Thought Leaders and NHS AI Advisors	Dr. Keith Grimes (Digital HEalth and Innovation Consultant with 20 years experience as a GP)	Provided signights on digital health innovations
Thought Leaders and NHS AI Advisors	Dr. Hatim Absulhussein (Former Clinical Lead for AI HEE, CEO for Health Innovation Kent Surrey Sussex)	Contributed knowledge on AI education and healthcare innovation
Clinical AI fellowship	Dr. Alexander Deng (Programme Manager for Fellowship in Clinical Artificial Intelligence)	Shared expertise on clinical AI and author of the Clinical Artificial Intelligence Curriculum
Clinical AI fellowship	Beatrix Fletcher (Programme Manager for Fellowship in Clinical Artificial Intelligence)	Provided programme management expertise for clinical AI fellowhsip programmes
Thought Leaders and NHS AI Advisors	DHCW, NDR and CDPS	Consideration of links to the NDR and DHCW viewpoints as well as the advanced analytics learning programme, AI Commission and WR?
Welsh Government	General AI and AI in health care: Includes conversation with AI commission members	Provided expertise on AI applications in radiography and healthcare
NHS Wales Workforce	445 UK based NHS Nurses and Midwives	Completed a questionnaire to provide insights on the current state of AI education, literacy and enthusiasm in NHS Wales.

Appendix 3: Assessment Framework for the NHS Clinical Fellowship in AI

Introduction

This document outlines a comprehensive framework for assessing the NHS Clinical Fellowship in AI. The fellowship is designed to equip clinicians with the skills and experience to adopt and integrate AI technologies into clinical workflows. This framework leverages qualitative and quantitative evaluation methods to measure the programme's impact, using information from cohort exit surveys, project updates and stakeholder feedback.

1. Objectives of the Fellowship

The NHS Clinical Fellowship in AI aims to:

- Develop a skilled workforce adept at adopting clinical AI technologies.
- Foster impactful AI projects within the NHS.
- Address recommendations from the Topol Review and align with the NHS Long Term Workforce Plan.

2. Evaluation Categories

The following categories will be used to assess the fellowship programme:

- **Programme Relevance:** Assess alignment with strategic objectives such as the NHS Long Term Workforce Plan and the Topol Review recommendations.
- **Participant Learning Outcomes:** Evaluate the achievement of skills in AI fundamentals, regulation, validation, integration and strategy.
- **Project Impact (Short-Term):** Measure immediate outputs like pilot project initiation and usability testing.
- **Project Impact (Long-Term):** Assess broader system changes including efficiency, staff satisfaction and patient safety.
- **Barriers to Implementation:** Identify administrative, ethical, or technical challenges encountered.
- **Stakeholder Feedback:** Collect feedback from fellows, supervisors and organisational stakeholders.
- **Qualitative Outcomes:** Capture narrative feedback, case studies and participant experiences.
- **Quantitative Outcomes:** Analyse metrics like time saved, diagnostic accuracy, sensitivity/specificity rates and cost-effectiveness.

3. Data Sources and Methods

Data will be collected through a variety of methods, including:

- Programme documentation and any other strategic NHS reports
- Self-assessment surveys and post-programme evaluations
- Project progress reports and case studies
- Longitudinal follow-ups with fellows and stakeholders
- Interviews, focus groups and structured surveys
- Quantitative data from project metrics and operational analyses

4. Evaluation based on Exit survey of previous cohorts

The data from Cohort 2's exit survey and ongoing project feedback demonstrates that the NHS Clinical Fellowship in AI is addressing key NHS priorities and delivering measurable benefits. Below is an analysis of the data and a compelling argument for continued investment.

1. Alignment with Strategic Priorities

- **NHS Long Term Workforce Plan (2023):** The fellowship directly supports workforce development in artificial intelligence, aligning with the NHS's strategic goals for AI integration in healthcare delivery.
- **Topol Review Recommendations (2019):** The creation of dedicated posts for clinicians implementing AI technologies is a cornerstone of the fellowship, directly addressing this recommendation.
- **Developing Healthcare Workers' Confidence in AI (2022):** This programme is highlighted as an exemplar for upskilling clinicians, enhancing their confidence in deploying AI effectively.

2. Participant Outcomes

The programme equips clinicians with AI-related skills that are immediately applicable to healthcare settings:

- **High Achievement Rates: Most participants rated their confidence and application of AI fundamentals, regulation, validation and integration highly:**
  - Achieved and applied skills across all major themes: AI Fundamentals, Regulation and Standards, Validation and Evaluation, Integration and Systems Impact.
  - A significant number of participants reported being confident in these skills post-fellowship.
- **Post-Fellowship Plans:** A majority of fellows envision pursuing AI-related roles within healthcare (e.g., shaper, driver, or creator roles in the HEE AI framework), showing that the programme is fostering a pipeline of AI leaders.

3. Project Outcomes

Projects undertaken by fellows demonstrate tangible benefits and potential for scale:

- **Example 1 Histology Slide Triage System**
  - An ongoing project from the fellowship involves using an AI product (PAIGE.ai) to triage digital histology slides for malignant features.
  - **Objective:** Use AI to prioritise digital histology slides with malignant features for faster triage.
  - **Outcomes:** Anticipated sensitivity and specificity improvements; the pilot study will provide crucial evidence on the utility of this system in routine workflows and its potential benefits.
  - **Challenges:** Current progress includes funding acquisition, user agreement signing and preparation for a pilot study of 100 cases. Challenges have primarily been bureaucratic, requiring ethical approval before implementation. Once initiated, the project will collect data on system performance and usability
- These projects provide measurable performance outcomes, such as diagnostic accuracy and time saved, which directly impact patient safety and care efficiency.

4. Programme Benefits

- **Workforce Retention and Morale:** The fellowship provides a structured pathway for professional growth, retaining talent within the NHS while enhancing job satisfaction.
- **Networking Opportunities:** Fellows reported high satisfaction with workshops, data camps and networking sessions, which foster collaborative innovation across the four home nations.
- **Upskilling Across Disciplines:** The fellowship's multidisciplinary approach ensures representation from diverse clinical professions, enriching collaboration and knowledge sharing.

5. Recommendations for Ongoing Evaluation

- **Develop a robust framework to measure long-term impact:**
  - **Metrics:** Patient outcomes, system efficiency, staff satisfaction and cost-effectiveness.
  - **Methods:** Surveys, project performance data and longitudinal studies.
- Incorporate qualitative feedback from fellows, supervisors and patients to contextualise quantitative metrics.

What the fellowship programme says:

- Executive Summary for Sponsors of NHS employees:
  - Successful adoption of clinical Artificial Intelligence (AI) technology does not happen by accident. It is driven by clinical professionals with specialised knowledge and skills.
  - The NHS Fellowship in Clinical Artificial Intelligence is an established UK fellowship which trains clinical professionals in the specialised knowledge and skills to adopt AI technology in healthcare, safely and effectively.
  - The fellowship strongly emphasises practical AI project experience under expert supervision. Projects involve real-world deployment and evaluation of AI technology in the UK National Health Service (NHS).
  - World-class leaders in clinical AI deliver an intensive course of interactive masterclass workshops to enhance these practical experiences.
  - This fellowship is recognised in the UK's NHS Long Term Workforce Plan as a flagship NHS training programme to maximise the benefits of clinical AI technology.

Key benefits of the NHS Fellowship in Clinical Artificial Intelligence for Sponsors of NHS employees

- **Prestigious career development opportunity for clinical professionals**
  - Improve the retention and job satisfaction of top-tier clinical talent through a prestigious career development opportunity in a high-profile UK NHS hospital.
  - Fellows gain a valuable skillset at the unique intersection between medicine and AI, delivered by a world-class faculty.
  - Fellows are connected to ready-made professional networks in international centres of excellence for collaboration in clinical AI research and innovation
- **Targeted strategic regional workforce development**
  - Create a cohort of clinical AI subject matter experts who can align to and deliver your bespoke regional priorities for digital healthcare transformation.
  - Fellows return to the regional workforce as leaders and educators. They will disseminate knowledge and skills to peers and head specialised clinical AI delivery teams modelled on their practical experience from the fellowship.
  - Position your regional workforce as early adopters and key opinion leaders in clinical AI, able to influence the conversation as experienced stakeholders.
- **Enhanced regional capacity for AI-driven healthcare delivery**
  - Realise the transformational benefits to improved efficiency, personalised healthcare and population health with AI technology.
  - Future-proof your workforce against the substantial system shock anticipated from the digital transformation of healthcare systems.

Finances

Projected total cost to sponsor 1 fellow/year: ~£29k – £42k (range due to different base salaries)

Cost breakdown:

1. Reimbursement of fellow's salary to Employer at 0.4FTE, including contributions to NI and pensions etc.: Variable per fellow by workforce. –
   a. Workforce: Registrar doctors (England) Base salary: £43,923 – 55,329
   b. Workforce: NHS banded staff, band 7-8b (England) Base salary: £43,742 – 58,972

2. Course fee: ~£6-8k per fellow per year - Charged at-cost for the overhead to run the programme. The fellowship programme does not operate at a profit.

3. Travel and subsistence to in-person taught activities:
   a. Variable per fellow by geography. - Indicative annual schedule of activities requiring travel:
      i. 1x 3-day residential workshop block ('bootcamp'), London
      ii. 3x full day workshops in regional AI centres of excellence, UK
      iii. 1x Graduation and networking event, London - To be reimbursed to fellow according to local procedure

Evaluating the Clinical AI Fellowship: Insights and Implications

As part of our broader evaluation of AI education pathways, we examined some data (qualitative and quantitative) from the NHS Clinical Fellowship in Artificial Intelligence to assess its value, relevance and potential for continued investment in Wales. The data is still fairly immature, given cohort 3 isn't yet completed. A recent analysis of feedback and outcome data from Cohort 2 highlights not only a high level of satisfaction among fellows but also several key themes that are instructive for the development of future workforce education and strategic planning.

Nearly all respondents indicated they would recommend the fellowship to colleagues, reflecting strong confidence in the programme's educational value. Fellows consistently rated components such as the AI project experience, masterclass workshops, and peer networking as particularly beneficial.

While elements such as Datacamp and the KCL Innovation Scholars module received more mixed feedback, the overall sentiment remains highly positive. The combination of structured learning with real-world project application appears to be a key strength of the fellowship model.

Importantly, fellows reported significant development across five core competency domains: AI fundamentals, regulation and standards, validation and evaluation, integration and systems impact, and strategy and culture. The data shows that these competencies were achieved primarily through programme teaching, personal study, work-based learning, and supervision, reinforcing the value of a blended learning model that incorporates experiential learning alongside formal instruction.

This multi-modal approach aligns closely with the educational philosophy recommended in this review. Survey data on onward plans also indicates strong alignment between the fellowship and the broader ambition to develop a digitally enabled clinical workforce.

Most fellows intend to continue in AI-related work within the NHS (many through further project involvement), demonstrating the programme's success in seeding long-term clinical AI capability and although unproven, potentially improving our ability to retain our most talented NHS staff. A smaller proportion reported plans to enter academic research or industry roles, reflecting the diverse trajectories the fellowship can support.

Next Steps and Future Strategic Planning

The insights gained from this evaluation will directly inform HEIW's ongoing assessment of the fellowship programme, as outlined in the 2025/26 IMTP. While the current data supports the value of continued investment, a fuller evaluation is underway to assess long-term outcomes, cost-effectiveness, and alignment with NHS Wales workforce needs.

These findings will also contribute to the next iteration of the 'Artificial Intelligence Education and Skills within NHS Wales Landscape review'. They will inform decisions about the investment in future fellowships, role-specific training models and competency frameworks.

As we continue to refine our AI education strategy, the fellowship provides a compelling example of how role-specific, immersive learning can upskill healthcare professionals in the safe and effective use of AI. It also highlights the importance of ongoing data collection, user feedback and workforce impact evaluation in shaping a responsive and future-ready education system and ultimately, healthcare workforce.

Conclusion

The NHS Clinical Fellowship in AI has demonstrated significant progress in its objectives, with substantial evidence supporting its value in upskilling clinicians, fostering innovation and enhancing patient care.

Continued investment in this programme is critical to maintain momentum, address NHS workforce priorities and realise the full potential of AI in healthcare. The current data provides a strong foundation and future cohorts will only amplify these benefits as projects like the histology triage system move from pilot to full implementation.