Modernising Scientific Careers
Scientist Training Programme
Work-based Learning Guide

Applied Epidemiology 2016/17
STP WORK BASED PROGRAMME IN APPLIED EPIDEMIOLOGY

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SECTION 1: GENERAL INTRODUCTION
READERSHIP

This Scientist Training Programme (STP) Learning Guide describes the STP work based training programmes in the UK for:

- academic and administrative staff, including external examiners within higher education institutions (HEIs);
- trainees, host departments and managers of services that employ healthcare science staff, including those in public health and in blood transfusion services;
- work-based trainers, including all those involved in supervising, mentoring, coordinating, assessing and delivering STP education and training;
- Local Education and Training Boards (LETBs) and all healthcare science education and training commissioning organisations in the UK;
- patients and the public;
- National School of Healthcare Science MSc accreditation panels.

A glossary of terms used is provided in Appendix 1.
Introduction

1.1 Scientist Training Programme (STP) Overview

1. Healthcare science (HCS) involves the application of science, technology, engineering and mathematics to health. Good Scientific Practice (GSP) (Appendix 2) sets out the principles and values on which education and training for healthcare science are founded. It makes explicit the professional standards of behaviour and practice that must be achieved and maintained in the delivery of work activities and clinical care for all those who work in healthcare science, the public and healthcare providers.

2. GSP and the Education and Training Standards of the Health and Care Professions Council (HCPC) are the basis for all Modern Scientific Careers (MSC) training curricula that contextualise the Standards of Proficiency set down by the HCPC in a way that is accessible to the profession and the public.

3. The HCS workforce and services have traditionally been grouped into three broad areas called divisions, namely: Life Sciences/Clinical Laboratory Sciences; Physical Sciences/Medical Physics and Biomedical Engineering; and Physiological Sciences/Clinical Physiology Sciences. Within each division there are a number of HCS specialisms. With advances in scientific technology, changes to the delivery of healthcare scientific services and the development of MSC, the boundaries between these divisions have been shifting and a fourth division, Clinical Bioinformatics, has been identified. MSC recognises this important change and to date has identified 13 STP themes within healthcare science, which enables training currently cross a total of 32 HCS specialisms, with curricula for additional specialisms still under development.

4. The STP is designed to provide healthcare scientist trainees with strong science-based, patient-centred clinical training in a specialist area of healthcare science. Initial rotational training provides a broad base of knowledge, skills and experience across a group of related cognate specialisms reflective of the evolving clinical and scientific changes and requirements, followed by specialisation in a single HCS specialism.

5. During the STP programme the scientist trainee is supernumerary but will contribute to the clinical work of the department in which they are training to gain the required clinical experience and competence.

6. The STP is an integrated training programme combining academic study leading to the award of a specifically commissioned MSc in Clinical Science and a work based training programme. Completion of both will lead to the award of a Certificate of Completion of the Scientist Training Programme (CCSTP) by the National School of Healthcare Science (NSHCS). Graduates will then receive a Certificate of Achievement from the Academy for Healthcare Science (AHCS) for a Certificate of Attainment and will then be eligible to apply to the HCPC for registration as a Clinical Scientist.

7. The MSc Clinical Science Learning Outcomes and Indicative Content, and the associated work based learning outcomes can be found by following the link www.networks.nhs.uk/nhs-networks/msc-framework-curricula. Further details of the MSc in Clinical Science can be found in the student handbook from the university with which each trainee is registered.

8. This introduction to work based learning provides an overview of the work based training programme and the guidance provided by the NSHCS for users of the online
learning and assessment tool (OLAT) and e-learning portfolio. All trainees and trainers will have access to the OLAT throughout their training.

9. All STP trainees will be registered with the NSHCS for the duration of their training and will be allocated a National Science Training Number (NSTN). The NSHCS, working through its Themed Boards, provides oversight and coordination of the STP; communicates with trainees and trainers with respect to national policy and events; liaises with the work based trainers, host employers and the academic providers; and reviews progress on assessments and trainee performance, including OLAT/Structured Final Assessment (SFA) and quality assurance of the workplace training environment. The School overall has a responsibility to provide confidential reports in accordance with agreed governance and oversight arrangements.

10. The work based training programme has four components, each underpinned by the professional practice curriculum:
   • induction
   • rotational training
   • elective training
   • specialist training.

11. It is anticipated that trainees will have a brief induction period in their host employing organisation prior to commencing the introduction to their MSc in Clinical Science. As the induction period may be up to 6 weeks in some departments, the time should be used to begin rotational training as well. The subsequent initial academic period is specifically designed to give an overview of the basic science and an introduction to aspects of professional practice relevant to HCS and the STP rotational training. The duration of this first university session will vary, depending on the MSc degree undertaken.

12. Details of the work based assessment programme can be found in Section 3 of this guide and also by logging on to the OLAT. Details of the assessment programme for the MSc in Clinical Science will usually be published in the student handbook provided by each university.

A broad overview of the STP is shown in the diagram overleaf.
Modernising Scientific Careers: Scientist Training Programme (STP):
Diagrammatic representation of employment-based, pre-registration, three-year
NHS commissioned education and training programme

Single Specialism Work Based Programme to include a 4- to 6-week period of Elective Training

Work Based Rotational and Specialist Training Programme

- Work Based Themed Rotational Programme
  - 4 x 12 weeks

Specialism
  - Specialism One
  - Specialism Two
  - Specialism Three
  - Specialism Four

Induction

Integrated Professional Practice

P/T MSC Clinical Science
Blended learning (incl problem based learning)

Year 3
- Specialist including Research Project

Year 2
- Specialist including Research Project

Research Methods

Year 1
- Theme

Generic Healthcare Science

Generic Education and Training
Themed Education and Training
Specialist Education and Training
1.2 Outcomes of the Work Based STP

13. On successful completion of the work based element of the STP, trainees will have gained clinical and specialist expertise in a specific HCS specialism, underpinned by broader knowledge and experience within a HCS division or theme. They will undertake complex scientific and clinical roles, defining and choosing investigative and clinical options, and making key judgements about complex facts and clinical situations. Many will work directly with patients and all will have an impact on patient care and outcomes. They will be involved in innovation and improvement, research and development, and education and training. Some will pursue explicit academic career pathways, which combine clinical practice and academic activity in research, innovation and education.

On successful completion of the work based training programme that forms part of the MSC STP, trainees will possess the essential knowledge, skills, experience and attributes required for their role and should demonstrate:

- a systematic understanding of clinical and scientific knowledge, and a critical awareness of current problems, future developments, research and innovation in health and HCS practice, much of which is at, or informed by, the forefront of their professional practice in a healthcare environment;
- clinical and scientific practice that applies knowledge, skills and experience in a healthcare setting, places the patient and the public at the centre of care, prioritising patient safety and dignity, and reflecting NHS/health service values and the NHS Constitution;
- clinical, scientific and professional practice that meets the professional standards defined by GSP and the regulator (HCPC);
- personal qualities that encompass self-management, self-awareness, acting with integrity and the ability to take responsibility for self-directed learning, reflection and action planning;
- the ability to analyse and solve problems, define and choose investigative and scientific and/or clinical options, and make key judgements about complex facts in a range of situations;
- the ability to deal with complex issues both systematically and creatively, make sound judgements in the absence of complete data, and communicate their conclusions clearly to specialist and non-specialist audiences, including patients and the public;
- the ability to be independent, self-directed learners demonstrating originality in tackling and solving problems, and acting autonomously in planning and implementing tasks at a professional level;
- a comprehensive understanding of the strengths, weaknesses and opportunities for further development of healthcare and healthcare science as applicable to their own clinical practice, research, innovation and service development, which either directly or indirectly leads to improvements in clinical outcomes and scientific practice;
- conceptual understanding and advanced scholarship in their specialism that enables the graduate to critically evaluate current research and innovation methodologies and develop critiques of them, and, where appropriate, propose new research questions and hypotheses;
- scientific and clinical leadership based on the continual advancement of their knowledge, skills and understanding through the independent learning required for continuing professional development (CPD).
14. Once registered as a Clinical Scientist, a range of career development options will be available, including competitive entry into Higher Specialist Scientist Training (HSST). Alternatively, others may choose to undertake further career development in post through a structured programme of CPD, provided through Accredited Scientific Practice, or pursue a clinical academic career. Clinical Scientists who successfully complete HSST, or who can demonstrate equivalence to its outcomes, will be eligible to compete for available Consultant Clinical Scientist posts.

1.3 Key Components of Work Based Training in STP

The trainee

15. The trainee is at the centre of the STP, supported on the one hand by the national oversight role taken by the NSHCS, working closely with local quality monitoring and performance processes currently undertaken by Health Education England (HEE) Local Education and Training Boards, and on the other by the day-to-day delivery of training in the workplace, facilitated by the underpinning and integrated MSC in Clinical Science programme. This guide contains important information that will help the trainee understand how the work based programme operates and its key elements.

16. At the core of successful work based training is appropriate educational supervision, facilitation and feedback. Each trainee will be allocated to a clinical training supervisor or training officer from within the employing host department. Trainees should ensure that a planned schedule of meetings with their training officer is agreed early in training, commencing with a meeting during the first week. Conversations between trainees and trainers are confidential, unless patient safety is at risk. When the trainee is following a rotational module a trainer from the host department will act as their main contact while they are away from their host department.

17. The local training departments, supported by the NSHCS working with others, are responsible for ensuring that trainees have access to training opportunities to enable the achievement of the learning outcomes of the STP. In return, trainees are expected to take responsibility for:

- ensuring that they fulfil their obligations to their employer and to patients (especially with regard to patient safety and confidentiality) as healthcare professionals;
- engaging as active adult learners by initiating work based assessments; contributing to learning activities; taking into account feedback received from their trainers and assessors; and giving considered and constructive feedback on their experience of their training;
- meeting the requirements of the academic MSc Clinical Science programme.

18. Critical reflection on progress and performance is an integral part of both the STP and of being a professional. Trainees should therefore regularly critically reflect on their

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2 https://www.hee.nhs.uk/our-work/developing-our-workforce/clinical-academic-careers
3 For the purposes of this document ‘training officer’ has been used; however, the title may vary between departments and may be subject to a title change in England as part of developments for the whole of the professional healthcare workforce. In essence, this is the person in the host department who is responsible for the training of each trainee for the duration of the three years.
progress and performance, enabling them to develop skills in self-evaluation and action planning.

1.4 Host Training Departments

19. The third key component for successful training in the STP is the employing host department and other service units facilitating work based training. The success of the training and the trainee experience requires the commitment and enthusiasm of those in the work base who oversee and provide the training.

20. Host departments should therefore ensure that they are fully familiar with the four components of the work based training programme, namely: induction, rotational, elective and specialist training; the underpinning professional practice curriculum; and should be aware of how the academic MSc in Clinical Science degree integrates with work based training.

21. All trainees must have a designated training officer who will have responsibility for:

- provision of support, guidance and mentoring for the duration of the programme, in the host department and related training environments;
- provision of a timetable that enables an appropriate balance of work and learning for the trainee;
- ensuring adequate support during periods of training outside the host department;
- ensuring that the programme of work based assessment is understood and that its outcomes for individual trainees is documented through the use of the OLAT;
- ensuring that the e-learning portfolio is discussed with the trainee and that there is clarity and agreement about its use;
- ensuring that clinical practice is well supervised for the safety of patients and the trainee, so that the acquisition of clinical competence is facilitated;
- ensuring that other contributors to the assessment process are fully aware of the requirements and the use of the OLAT.

Organisation of the training programme

22. The host department is responsible for organising the training programme for each of its trainees. This may involve liaising with other departments to facilitate necessary work based learning, and other contributors to the associated assessment requirements. While the NSHCS will provide support, host departments need to be satisfied that they are providing a training environment of appropriate quality, including appropriately trained staff and facilities. Furthermore, host departments are required to engage in the quality assessment management process established by the NSHCS and provide information as necessary to enable the NSHCS to fulfil this critical function. Details of the NSHCS quality assessment management policy for work based training provider departments can be found at www.nshcs.org.uk.

23. Induction

At the start of the STP training programme and of each new placement, trainees should be provided with an induction programme explaining trust and departmental arrangements. Initial work based induction in the host department should include an overview of the:
• hospital/healthcare setting and local policies, including health and safety, confidentiality, data protection, etc., relevant to the placement;
• range of services provided by the department;
• range of people who use the services provided by the department;
• function, operation, and routine and corrective maintenance requirements of equipment appropriate to the section(s) of the department in which the trainee will be working.

Moreover, the host department should ensure that the trainee has access to:

• host trust information technology (IT) systems, including the library and knowledge service as necessary;
• the OLAT, which is the electronic portfolio that supports the STP programme.

Induction should include an early discussion (within the first week) between the trainee and their training officer so that the curriculum, assessment and placement arrangements can be discussed. In addition, trainers should provide trainees with copies of:

• Good Scientific Practice;
• the STP work based Learning Guide;
• the OLAT learning guide;
• links to the NSHCS (see Section 3 for details of the role of the NSHCS in relation to STP training).

24. Rotational training

During rotational training each trainee will undertake four rotations, including a rotation in the area in which they will subsequently specialise. Trainees must successfully achieve all of the learning outcomes in each rotation. Each rotational placement should be of approximately 12 weeks duration. It is the responsibility of the host department to organise the rotational programme and to liaise with the trainers in the rotational placement departments on the requirements of work based training and supervision and the use of the OLAT. The NSHCS and local MSC leads will help to facilitate rotational placements for small specialisms or where there are local issues in respect of access to particular training elements.

The host department is responsible for setting the timetable for each of the four rotations, which will depend on local availability and may require some time to be spent out with your locality to ensure that the learning outcomes in totality can be achieved. In agreeing the rotational training, the host department will need to consider the periods of time the trainee will be required to attend the university or undertake academic activities for the MSc within the workplace.

The host department must be familiar with the content, delivery and assessment programme of the MSc in Clinical Science that the trainee is undertaking at university, and ensure that the departments where the trainee is placed for rotational placements are also familiar with the expected outcomes of each period of training and are trained in the assessment methods. The training officer in the host department should maintain contact with the trainee and should liaise with the person taking overall responsibility for the trainee while they are undertaking the rotation. Supervision meetings between the training officer and the trainee should continue while they are on their rotational placements.
25. Elective training

Each trainee must undertake an elective training period and successfully achieve all of its learning outcomes. The host department should agree the timing and content of the elective training period with the trainee and should then inform the NSHCS of the plans for the elective by completing the appropriate form and submitting it to the School. The aim of the elective is to facilitate a wider experience of healthcare and/or the practice of healthcare science in a cultural and/or clinical setting that is different from the usual training environment. This may involve healthcare or healthcare science in a different area of the health service and may involve study abroad or pursuit of a particular clinical or research interest. The elective period can be taken any time during the specialist training period, and may comprise a single period of 4–6 weeks or a series of shorter periods. It is important that the trainee is able to express their preferences and be fully involved in arranging the elective period, since it is designed to provide a broader experience for the trainee.

26. Specialist training

The host department will plan the timetable for specialist training. This will usually be in a single HCS specialism (except for Gastrointestinal Physiological and Urodynamic Science, which share modules in the specialist training period, and Immunogenetics and Histocompatibility, which share some specialist modules with Clinical Immunology). Each trainee must successfully achieve all of the learning outcomes in the specialist training modules, including, by the end of the training programme, all of the professional practice learning outcomes. If the host department itself is unable to provide the necessary work based training to enable the trainee to complete all of the required learning outcomes, it will need to arrange training in other training departments and environments.

27. Supervision

STP clinical and educational supervision should promote learning, reflective practice and support the trainee to produce action plans to address identified learning needs. It will need to ensure that the trainee learns specific skills and competencies, helping them to develop self-sufficiency and self-awareness in the ongoing acquisition of skills and knowledge. At every stage, patient safety must be paramount. Supervision will require the provision of pastoral care for some trainees. Supervision may, at times during the programme, be provided by other healthcare professionals outside healthcare science who will be appropriately trained, e.g. medical colleagues.

The first supervision meeting should be set up during the first week of the training programme. At this meeting the training officer should ensure that the trainee is undertaking an induction programme that includes the hospital and department. It is recommended that following areas should be explored and agreement reached at the first meeting with respect to the:

- expectations of the training officer and trainee;
- responsibilities of the training officer and trainee;
- boundaries between the training officer and trainee;
- confidentiality;
- frequency and duration of planned supervision meetings;
- methods of communication and responsibility for arranging meetings;
- level of support and arrangements for communications between meetings;
• models of reflection and action planning;
• record keeping;
• content of the work based training programme;
• the approach to assessment and the use of the assessment tools and the online system;
• sources of help and support.

1.5 National School of Healthcare Science (NSHCS) and the STP

28. The NSHCS provides a national coordinating and oversight function to support trainees and host departments in the delivery of training. It is responsible for:

• national recruitment into STP, enabling a transparent and robust selection of the very best science graduates;
• providing national oversight of STP trainees throughout their training by managing and monitoring their progress through the OLAT, supporting trainees in difficulty, and coordinating national structured assessments both during and at the end of STP training;
• evaluation of ongoing work based assessment outcomes through the OLAT, enabling the School to benchmark training programme delivery for early identification of programme issues that may need to be addressed and resolved, and reporting these as part of agreed MSC governance arrangements;
• liaising with each HEI’s MSc Clinical Science programme director to ensure the integration and coordination needed to deliver the academic and work-based programmes that form the STP;
• working closely with workplace training departments and providing support as appropriate;
• organising national ‘Train the Trainer’ programmes to ensure common standards of delivery and content, and recommending ongoing training activities to support the continuing professional development of work based trainers.

Professional leads in each of the scientific divisions within the NSHCS will provide help and support with respect to organising rotations and/or specialist training that might require national coordination. To optimise the educational benefit and value of the OLAT and the e-learning portfolio, professional leads will also work with and support training departments in its use.

The School can be contacted on the following email nshcs@wm.hee.nhs.uk

1.6 The Structure of the Learning Frameworks

29. The work based programme is divided into modules, with each module following a standard format. The aim and scope of the module are set out, followed by a description of the:

• Learning Outcomes – high-level descriptors of required achievements for module;
• Clinical Experiential Learning – the learning activities that will facilitate learning and achievement of stated outcomes;
• Competences – further, outcome-based statements for each Learning Outcome;
• Knowledge and Understanding as applied to appropriate competences.
All of the above are focused on service need, patient care/pathway and continuous service improvement

1.7 Assessment during Work Based Training

Trainee assessment

30. The work based assessment programme is designed to promote learning, skill development and competence within the specialist healthcare context. Trainees will be able to identify areas for development and improvement.

The assessment programme is designed to enable both trainee and trainer to obtain regular feedback on progress and achievement. It aims to nurture the trainee by providing professional educational support and encouraging critical reflection, and generating regular feedback about progression. The programme embeds assessment tools to enable trainees to learn and develop, but also to generate evidence so that judgements about progression can be made and areas identified for trainee improvement based on supportable evidence.

The work based education and training programme should offer a constructive environment where a trainee understands that they are still developing, and the assessment tools are intended for use in this context. As part of each assessment the work-base assessor will facilitate a discussion in which the trainee is encouraged to reflect on their performance and identify their strengths and areas that could be improved, setting an action plan to achieve that improvement.

31. The structure of the work based assessment programme

There are several distinct elements of the work based assessment programme for all trainees:

- assessment tools, see Table 1 overleaf;
- competency log;
- online learning and assessment tool (OLAT), which is an electronic portfolio;
- exit assessment – objective structured final assessment (OSFA).

Assessment tools

32. The assessment programme utilises a range of work based assessment tools, designed to promote continuous assessment and generate feedback throughout training. The assessment promotes student-centred feedback to enable the trainee to gain skills in self-assessment. There is a requirement for each trainee to engage with the assessment process and to complete a defined number and range of assessments to successfully complete each module. These are set out in the OLAT.
<table>
<thead>
<tr>
<th>Assessment tool</th>
<th>Direct observation of practical skills (DOPS)</th>
<th>Observed clinical event (OCE)</th>
<th>Case-based discussion (CbD)</th>
<th>Multisource feedback (MSF)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>To assess a practical skill or procedure, which may include interaction with a patient. Feedback is generated, learning needs identified and an action plan generated</td>
<td>To assess a clinical encounter</td>
<td>To assess the trainee’s ability to apply their knowledge and understanding of an aspect of an activity, for example the underpinning science, aspects of professional practice</td>
<td>To provide a sample of attitudes and opinions of colleagues on the performance and professional behaviour of the trainee. It helps to provide data for reflection on performance and gives useful feedback for self-evaluation</td>
</tr>
<tr>
<td><strong>Method</strong></td>
<td>The assessor observes a practical activity and facilitates student-centred feedback either during or immediately following the observation. The trainee then generates an action plan</td>
<td>The assessor observes a clinical activity and facilitates student-centred feedback either during or immediately following the observation. The trainee then generates an action plan</td>
<td>The assessor facilitates a discussion with the trainee about a clinical case with which the trainee has been involved. This may include a report, record, result, or an aspect of professional practice arising from the case. Following the discussion the trainee generates an action plan</td>
<td>Using an online system the trainee gains feedback from a range of people (8–10) who work with them, and the trainee also rates themself. On completion, the report generated is reviewed in a discussion between the trainee and trainer, and using critical reflection an action plan is generated by the trainee</td>
</tr>
</tbody>
</table>
33. Competences

All trainees are required to provide evidence to demonstrate that they have completed each competence, which should then, at the request of the trainee, be signed off by a trainer. Trainees will gain competence at their own pace, but in line with the overall delivery of the relevant modules. Each competence may link directly to a specific learning outcome and some competences may be linked to more than one learning outcome, therefore successful completion cannot be achieved until demonstrated for all learning outcomes. All of the competences are contained within a competency log within the OLAT.

Completion of the competency log is essential for progression within the programme and in order to exit from the programme. The expectation is that as the trainee progresses the competency log will demonstrate an evidence base of achievement.

34. Online learning and assessment tool (OLAT)

The achievement of competences and all work based assessments are recorded in the OLAT. The OLAT is customised for each specialism and contains all the above assessment tools as well as the full list of competences for each programme and a reflective log.

The NSHCS will provide trainees with the information to allow them to register on the OLAT at the start of their programme. As part of their registration they must nominate their training officer, although others may contribute during the total period of work based training to the assessment process.

Short film clips that explain the principles of the assessment process and how to use each of the assessment tools are available on the OLAT.

35. Objective structured final assessment (OSFA)

At the end of training trainees will be assessed using an OSFA. This is a performance-based assessment used to measure trainees across a number of different standardised stations encompassing scientific, clinical and professional practice. The NSHCS, in partnership with the professional bodies and supported by the NSHCS Themed Boards, will design and deliver the OSFA, and the AHCS will provide external quality assurance of it.

All trainees will have the opportunity to undertake an OSFA mid-programme to provide formative experience of this assessment.

1.8 Quality Assurance and Quality Management

Quality assurance of work based training

36. All host and training departments are responsible for the delivery of the work based training quality standards detailed in the Learning and Development Agreement (LDA) agreed with and issued by HEE’s LETBs. All host and training departments providing training for trainees on the STP must also be MSC approved and accredited.
37. The NSHCS provides oversight of the quality management and quality control of the STP work based training environments through its Accreditation programme of work based training.  

38. The NSHCS works in partnership with the professional bodies through its Themed Boards and HEE’s LETBs to deliver a robust Quality Assessment Management (QAM) programme for the work based education and training programme. This QAM programme is UK-wide and independent from the direct delivery of education and training. The purposes of the QAM programme are to:

- ensure all STP training environments are accredited to deliver work based training;
- ensure that all training settings are working to the agreed standards;
- create an open and transparent culture where issues and concerns can be raised, investigated and resolved;
- ensure that trainees receive a high-quality educational experience wherever their training takes place;
- identify and share examples of good practice;
- provide evidence of the quality of work based education and training environments to those who regulate and register the profession;
- provide evidence of the high standard of work based education and training, and assurance that these standards are robustly managed.

39. Details of the quality management approach is available from the NSHCS. In summary, the quality framework includes the following.

- Receipt, analysis, review and response with respect to:
  - annual self-assessment progress reports from each work base;
  - trainee feedback questionnaires;
  - assessment progress reports;
  - ad hoc reporting of exceptions or changes to programmes;
  - individual work based education and training timetables for each trainee.
- A mechanism for receiving and reviewing reports with respect to the STP programme from trainees, trainers, patients, or other stakeholders.
- Visit programme, including:
  - a five-year rolling visit programme to each work base;
  - ad hoc visits to departments as required.

40. The NSHCS monitors the progress of each trainee and provides support for trainees in difficulty. Staff in the NSHCS also regularly review the STP programmes using information from the OLAT and other sources through the Themed Boards.

41. These quality assurance processes do not absolve the training provider from responsibility for continuously managing and maintaining the quality of its own provision. Local training departments are responsible for ongoing quality control and local education providers should therefore ensure that a high-quality education and training environment is maintained.

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4 http://www.nshcs.org.uk/for-trainees/accreditation/accreditation-of-work-place-providers
42. The following sections of this Learning Guide include an overview of the STP work based programme for the specialisms within this theme. This is followed by the Learning Frameworks for the Rotational, Elective, Specialist and Professional Practice components of the programme.

Additional information can be found in the Appendices.
SECTION 2: PROGRAMME OVERVIEW
STP WORK-BASED TRAINING PROGRAMME IN APPLIED EPIDEMIOLOGY

The diagram below provides an overview of the programme each trainee in Applied Epidemiology will follow.

Modernising Scientific Careers: Scientist Training Programme (STP): Diagrammatic representation of employment-based, pre-registration, three-year education and training programme

PROFESSIONAL PRACTICE

This module spans the whole of the three-year training programme, underpinning both work based training and the MSc in Clinical Science.

INDUCTION COMPONENT

At the start of the training programme and of each new placement all trainees will complete an induction programme.
ROTATIONAL COMPONENT: APPLIED EPIDEMIOLOGY

Trainees must successfully complete the rotations shown below.

<table>
<thead>
<tr>
<th>Rotation A (AE-1)</th>
<th>Introduction to Public Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotation B (AE-2)</td>
<td>Introduction to Public Health Policy, Practice and Professionalism</td>
</tr>
<tr>
<td>Rotation C (AE-3)</td>
<td>Introduction to Epidemiology</td>
</tr>
<tr>
<td>Rotation D (AE-4)</td>
<td>Introduction to Statistics</td>
</tr>
</tbody>
</table>

**Duration:** Each rotation should be of approximately 12 weeks duration.

ELECTIVE COMPONENT

The elective period can be taken any time during the specialist training. It may comprise a single 4- to 6-week elective or a series of shorter periods of elective training.

SPECIALIST COMPONENT: APPLIED EPIDEMIOLOGY

<table>
<thead>
<tr>
<th>Module 5 (AE-5)</th>
<th>Data Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module 6 (AE-6)</td>
<td>Visualisation and Presentation of Data (AE-6)</td>
</tr>
<tr>
<td>Module 7 (AE-7)</td>
<td>Design and Analysis of Epidemiological Studies</td>
</tr>
<tr>
<td>Module 8 (AE-8)</td>
<td>Scientific Communication</td>
</tr>
</tbody>
</table>

**Duration:** The work based component of the four specialist modules should be completed during the specialist training period. The work based component of the modules can run in parallel in order to use the time and clinical contacts to best advantage.
SECTION 3: ROTATIONAL LEARNING FRAMEWORKS
STP Learning Framework

This section describes the Learning Framework for the **Rotational Component** of work based learning covering the Learning Outcomes, Clinical Experiential Learning, Competence and Applied Knowledge and Understanding. Each trainee is also expected to build on and apply the knowledge, skills and experience gained from the MSc in Clinical Science.

<table>
<thead>
<tr>
<th>DIVISION</th>
<th>Clinical Bioinformatics</th>
</tr>
</thead>
<tbody>
<tr>
<td>THEME</td>
<td>Applied Epidemiology</td>
</tr>
<tr>
<td>SPECIALISM</td>
<td>Applied Epidemiology</td>
</tr>
</tbody>
</table>
AIM
The role of public health organisations is to promote and protect health and wellbeing, prevent ill health and reduce health inequalities. This module will provide the trainee with an introduction to the principles and practice of public health and the public health system in the UK. Trainees will be expected to apply their knowledge and develop their skills in applied epidemiology using routine data within a public health organisation.

SCOPE
During this module the trainee will be introduced to the importance of working within information governance legislation and good practice guidelines to ensure the appropriate use of information (both corporate and personal). They will be expected to be able to use routine health data to identify a current public health question and calculate a public health indicator, interpreting the significance of their findings and defending their interpretation. They will also begin to develop their skills in report writing and data presentation.

LEARNING OUTCOMES
On successful completion of this module the trainee will:

1. Successfully complete a recognised Information Governance training module.
2. Access health data from at least one of: a routine data source (e.g. Hospital Episode Statistics), a surveillance system, or a registration database to answer a public health question.
3. Use routine numerator and denominator data to calculate a public health measure of disease burden/frequency, interpret the significance of these data to patient and public health and present a report on the findings for a specific audience.
CLINICAL EXPERIENTIAL LEARNING

The clinical experiential learning for this module is:

- Visit a unit that provides routine healthcare data: discuss the sources of data and the challenges of producing high-quality data with staff working in the organisation, critically reflecting on your experience. For example, acute hospital trusts, British Paediatric Surveillance Unit (BPSU), cancer registries, National Child Measurement Programme, National Drug Treatment and Monitoring Service (NDTMS).

All of these experiences should be recorded in your e-portfolio.

The following section details the competence and knowledge and understanding each trainee must gain. Each competence is linked to the relevant learning outcomes and trainees must demonstrate achievement of each competence for each linked learning outcome.

PROFESSIONAL PRACTICE

Trainees should ensure they refer to the professional practice learning framework and continue to achieve the professional practice competences alongside the competences defined in this module.
<table>
<thead>
<tr>
<th>KEY LEARNING OUTCOMES</th>
<th>COMPETENCES</th>
<th>KNOWLEDGE AND UNDERSTANDING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Apply information governance principles and best practice in the workplace.</td>
<td>• The legislation, regulatory guidance and NHS protocols regarding the security, confidentiality and appropriate sharing of patient identifiable information. • Risks of inappropriate disclosure to patients and the public. • Role of the Caldicott Guardian. • The different arrangements and the associated responsibilities of clinical staff for security of all types of clinical information, especially electronically held, and for using such data for ‘secondary’ purposes.</td>
</tr>
<tr>
<td>1</td>
<td>Pass a recognised Information Governance training module.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Identify data needed to answer a public health question.</td>
<td>• How health outcomes are measured. • Current issues in public health appropriate to work placement.</td>
</tr>
<tr>
<td>2</td>
<td>Identify relevant population health data sources.</td>
<td>• Key sources of health and population data.</td>
</tr>
<tr>
<td>2</td>
<td>Assess the quality of data within the data source.</td>
<td>• Data collection process. • Limitations of coding systems. • Issues of data quality, including timeliness and completeness.</td>
</tr>
<tr>
<td>3</td>
<td>Identify appropriate indicators of disease and estimate the burden of disease.</td>
<td>• Population indicators. • Methods used to estimate the burden of disease. • Impact of disease on people, populations and the UK economy.</td>
</tr>
<tr>
<td>3</td>
<td>Describe the data and identify an appropriate comparator.</td>
<td>• Limitations of the data. • Interpret the analysis of the data. • Key concepts and current issues of public health. • Wider determinants of health and health inequalities. • Required public health outcomes or good practice standards.</td>
</tr>
<tr>
<td>3</td>
<td>Assess the significance of the data.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Identify the intended audience for the output of the analysis and interpretation of the data.</td>
<td>• Components of the public health system. • Roles, functions and priorities of the public health audience. • Legal context.</td>
</tr>
<tr>
<td>KEY LEARNING OUTCOMES</td>
<td>COMPETENCES</td>
<td>KNOWLEDGE AND UNDERSTANDING</td>
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<tr>
<td>-----------------------</td>
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</tbody>
</table>
| 3                     | Prepare a report detailing the findings; defend your conclusions and recommendations. | • Report writing framework.  
                        |                                                    | • Confidentiality and Caldicott principles.  
                        |                                                    | • Guidelines for writing and referring to people with disabilities. |

**MODULE TITLE**

**Introduction to Public Health Policy, Practice and Professionalism (AE-2)**

**AIM**

This module will provide the trainee with an introduction to how public health policy is developed, published, implemented and the impact monitored and aligned to the UK public health framework. They will apply their knowledge as they use their skills of critical review and analysis to identify the strengths and weaknesses of current policy and the challenges and solutions to successful implementation.

**SCOPE**

On completion of this module the trainee will be able to analyse a public health policy and critique the evidence base that underpins the policy, presenting conclusions and recommendations to colleagues. They will gain knowledge and experience of the role of stakeholders and stakeholder interaction and engagement in policy making within public health, including cross-boundary engagement. They will also have the opportunity to observe how public health policy is implemented in regional and local services, discussing strengths and weaknesses with service providers and users of the service.

**LEARNING OUTCOMES**

On successful completion of this module the trainee will:

1. Select and analyse a public health policy using the UK public health framework and critically appraise the knowledge base underpinning the development of the policy.
2. Critically review the challenges in implementing this public health policy.
3. Develop and implement (in part or whole) an evaluation plan for a particular public health policy.
4. Present a summary report of your findings and present it to colleagues, justifying conclusions and recommendations.
CLINICAL EXPERIENTIAL LEARNING

The clinical experiential learning for this module is:

- Visit a health service setting responsible for the implementation of a specific public health policy, e.g. reduction in sugar consumption in the diets of children; chronic disease management; obesity treatment services; stop smoking services, and discuss the implications and impact of the appropriate public health policy on healthcare providers and users of the service. Critically reflect on your experience and how it will shape your future practice as a Clinical Scientist.
- Visit members of the public health team within a local council responsible for specific public health policy areas, which may include health promotion initiatives, e.g. smoking cessation, sexual health services, etc.
- Attend a multidisciplinary team meeting where public health policy is discussed and use your experience as you critically appraise the development and implementation of a health policy.
- Shadow a Director of Public Health in one of the regional or local centres within the UK to observe their role in the development, implementation and monitoring of the impact of public health policy.

All of these experiences should be recorded in your e-portfolio.

The following section details the competence, knowledge and understanding each trainee must gain. Each competence is linked to the relevant learning outcomes and trainees must demonstrate achievement of each competence for each linked learning outcome.

PROFESSIONAL PRACTICE

Trainees should ensure they refer to the professional practice learning framework and continue to achieve the professional practice competences alongside the competences defined in this module.
<table>
<thead>
<tr>
<th>KEY LEARNING OUTCOMES</th>
<th>COMPETENCES</th>
<th>KNOWLEDGE AND UNDERSTANDING</th>
</tr>
</thead>
</table>
| 1                    | Identify a contemporary public health policy to examine. | • Policy and strategy development life cycles.  
• Relevant current health and care policies and the associated strategies.  
• Strategy analysis methodologies (such as SWOT, PEST and Four Corners, etc.).  
• Context.  
• Content.  
• Processes.  
• Actors (stakeholders).  
• Current issues in public health, e.g. obesity, liver disease, ageing, antimicrobial resistance, tuberculosis, climate change, migrant health.  
• How evidence is used to inform and influence public health policy:  
  o introduction to evidence synthesis and hierarchy of evidence  
  o translation of evidence into policy and practice. |
| 1                    | Research the evidence for the need for your chosen public health policy. | • How the knowledge base is used to identify current key issues in public health and inform policy.  
• Introduction to key sources of public health data.  
• Measures of health, including burden of disease and mortality.  
• Health needs assessment.  
• Evaluation of public health policy and practice.  
• Roles of organisations such as National Institute for Health and Care Excellence (NICE), Cochrane.  
• How global policies and initiatives influence UK public health policies. |
| 1                    | Analyse the context of the policy. | • The relative merits and disadvantages of individual and population approaches to improving public health:  
  o prevention: primary, secondary, tertiary. |
<p>| 1                    | Analyse the factors that have been | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>involved in making the policy.</td>
<td>o prevention paradox (Rose hypothesis).</td>
<td>• Epidemiological basis to preventive strategies: high risk vs population strategies.</td>
</tr>
<tr>
<td>1</td>
<td>Appraise and critically review the role of stakeholders and stakeholder engagement in policy making within public health.</td>
<td>• Stakeholder engagement analysis and profiling.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Stakeholder engagement plans and strategy development and its implementation – benefits and challenges.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Management of and communication with stakeholders.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Engagement and inclusion methods and approaches.</td>
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<td></td>
<td></td>
<td>• Stakeholder impact on commissioning and delivery of (informatics) services.</td>
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<td></td>
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<td>• Critical appraisal and comparison with other available/accessible strategies.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Engaging and including vulnerable and hard-to-reach groups and individuals.</td>
</tr>
<tr>
<td>2</td>
<td>Critically review the literature to analyse:</td>
<td>• Major theoretical models of policy implementation, including the gap that can be demonstrated between what was planned and what actually occurred as a result of a policy:</td>
</tr>
<tr>
<td></td>
<td>(i) the legislation under which public health policy has been implemented;</td>
<td>o top-down approach</td>
</tr>
<tr>
<td></td>
<td>(ii) the public health bodies and patients/patient groups involved in implementation;</td>
<td>o bottom-up approach</td>
</tr>
<tr>
<td></td>
<td>(iii) key levers for successful implementation or barriers where the policy has not been a success.</td>
<td>o principal-agent theory (relationship between those who define policy and those who implement policy)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o interpretation: translation of the policy into administrative directives</td>
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<td></td>
<td></td>
<td>o organisation: establishment of administrative units and methods necessary to put a programme into effect.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The process of implementation of national public health policy:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o legislative framework</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o levers</td>
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<tr>
<td>KEY LEARNING OUTCOMES</td>
<td>COMPETENCES</td>
<td>KNOWLEDGE AND UNDERSTANDING</td>
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<tr>
<td></td>
<td></td>
<td>o the challenges and barriers to successful implementation</td>
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<tr>
<td></td>
<td></td>
<td>o the role of public health bodies in reducing health inequalities.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The process of implementation of local public health policy:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o local arrangements within the relevant country, e.g. local authority tiers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o levers</td>
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<tr>
<td></td>
<td></td>
<td>o the challenges and barriers to successful implementation</td>
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<tr>
<td></td>
<td></td>
<td>o how to engage local communities, including the public, voluntary and charitable sectors.</td>
</tr>
<tr>
<td>2</td>
<td>Critically appraise the development and implementation of a health policy, including the identification of key success factors.</td>
<td>• Range of potential success factors.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The selection of appropriate success factors to be used.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Challenges in the assessment of success factors.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Critical appraisal.</td>
</tr>
<tr>
<td>3</td>
<td>Evaluate public health policy.</td>
<td>• Contents of an implementation plan.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• How to measure the quality and appropriateness of the success factors in measuring the impact of the public health policy.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Limitations of success factor, methods of evaluation appropriate for policy and its applications for different types of policy.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The scientific principles and key questions that are common to all evaluations.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Health economics.</td>
</tr>
<tr>
<td>3</td>
<td>Develop and implement a plan for evaluation of a particular policy, exercising professional judgement.</td>
<td>• Identifying measures from the literature and practice that are, and are not, amenable to measurement within a specific context.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Developing a consensus for the evaluation and the plan.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Delivering the evaluation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• How to assess the impact of public health policy on patient safety, patient care and health outcomes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The importance of being able to be able to practise as an autonomous</td>
</tr>
<tr>
<td>3</td>
<td>Confirm through consultation that the evaluation success factors are appropriate.</td>
<td></td>
</tr>
<tr>
<td>KEY LEARNING OUTCOMES</td>
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</tr>
<tr>
<td>3</td>
<td>Present a summary report to colleagues, justifying conclusions and recommendations. Discuss: • key barriers to implementation • solutions for implementation • evaluation of the policy.</td>
<td>• The role of communication in enabling a range of audiences to understand how the public health function leads to health gain: o how to identify the range of stakeholders and audiences o the concept of health gain. • Report writing for a scientific and lay audience. • Structuring, delivering and evaluating an oral presentation. • How to answer questions. • Types of questions. • The approaches to effective communication with other health professionals and policy makers: o verbal and non-verbal communication skills o written communication skills o components of good team working o barriers to effective communication. • Benefits of good communication. • Personal responsibility and the importance of being able to justify decisions.</td>
</tr>
</tbody>
</table>
AIM

The work of epidemiologists impacts on populations and individuals within populations, including the prevention and control of disease and associated morbidity. The information provided by epidemiologists also supports commissioners of health services to enable them to better prioritise and allocate resources and underpin health promotion activities.

This module will provide the trainee with an introduction to epidemiology and its impact on patients, patient care and populations. They will understand and apply their knowledge of communicable and non-communicable disease epidemiology in the work base where epidemiological concepts are used to inform public health action. They will understand the role of epidemiology and the clinical scientist in: surveillance and monitoring of diseases; interpreting epidemiological surveillance data; and investigating outbreaks to guide interventions aimed at protecting and improving the public’s health.

Epidemiology examines the distribution of disease in populations and underlying causes. Examples of these include lead poisoning cases in children associated with ingestion of paint; food borne outbreaks involving bacterial or viral agents associated with poor food hygiene practices; clusters of cancers; the association between obesity and health-related outcomes.

SCOPE

On completion of this module the trainee will be able to evaluate the attributes of a surveillance system and make recommendations for improving systems, and analyse and interpret epidemiological surveillance data. They will develop their skills in critical appraisal and work as part of a team investigating an outbreak.

LEARNING OUTCOMES

On successful completion of this module the trainee will:

1. Generate a report describing and evaluating the attributes of a surveillance system.
2. Generate an epidemiological report analysing and interpreting surveillance data.
3. Present a critical appraisal of a peer-reviewed analytical study, discussing potential biases and their impact on the findings.
4. Participate in and document the steps that are taken to investigate an outbreak.
CLINICAL EXPERIENTIAL LEARNING

The clinical experiential learning for this module is:

- Visit a microbiology laboratory to gain an understanding of the processes and methods involved in identifying and typing infectious disease agents responsible for human infection, and with your supervisor, discuss how your experience will inform your future practice.
- Discuss with a relevant public health professional how surveillance data can be used to make decisions on programmes of work aimed at improving and/or protecting the patient’s and public’s health.
- Within an acute hospital setting, discuss with colleagues available hospital data sources and how surveillance data is used for decision making, e.g. data in relation to infection control, outbreak management, Hospital Episode Statistics.
- Shadow an environmental health officer during an inspection.
- Critically reflect on your experiences engaging with these public health professionals, including reflection on the effectiveness of the partnerships and communications underpinning good surveillance and outbreak investigation.

All of these experiences should be recorded in your e-portfolio.

The following section details the competence and knowledge and understanding each trainee must gain. Each competence is linked to the relevant learning outcomes and trainees must demonstrate achievement of each competence for each linked learning outcome.

PROFESSIONAL PRACTICE

Trainees should ensure they refer to the professional practice learning framework and continue to achieve the professional practice competences alongside the competences defined in this module.
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Identify a surveillance system and its objectives.</td>
<td>• The purpose of surveillance and surveillance system evaluation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Surveillance system attributes, e.g. completeness, timeliness, usefulness, representativeness, sensitivity, specificity.</td>
</tr>
<tr>
<td>1</td>
<td>Identify all potential attributes of this surveillance system.</td>
<td>• Guidelines for conducting a surveillance system evaluation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The public health importance of the clinical/health-related event under surveillance.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The purpose and operation of the surveillance system and resources (financial, personnel and other resources) needed to operate the surveillance system.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Surveillance system attributes and how to select attributes for evaluation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The rationale for surveillance and evaluate the strengths and weaknesses of different approaches.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The surveillance cycle: set objectives, data collection, data analysis, interpretation, action, evaluation.</td>
</tr>
<tr>
<td>1</td>
<td>Select and justify relevant attributes in consultation, and evaluate the system.</td>
<td>• Population under surveillance.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Types of surveillance, including: (i) active surveillance; (ii) passive surveillance; (iii) sentinel surveillance; (iv) syndromic surveillance.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Disease registration systems.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Cancer registration (as an example of disease registration).</td>
</tr>
<tr>
<td>1</td>
<td>Prepare a surveillance system evaluation report and make recommendations based on your findings.</td>
<td>• Typical structure of a surveillance system evaluation report.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Common errors in writing a surveillance system evaluation report.</td>
</tr>
<tr>
<td>1</td>
<td>Present and defend the report at a departmental meeting.</td>
<td>• How to prepare a presentation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Giving an oral presentation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Responding to questions.</td>
</tr>
<tr>
<td>KEY LEARNING OUTCOMES</td>
<td>COMPETENCES</td>
<td>KNOWLEDGE AND UNDERSTANDING</td>
</tr>
<tr>
<td>-----------------------</td>
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</tr>
</tbody>
</table>
| 2                     | Identify a surveillance system and extract data from it. | • The public health importance of the clinical/health-related event under surveillance.  
• Population under surveillance.  
• Types of surveillance including: (i) active surveillance; (ii) passive surveillance; (iii) sentinel surveillance; (iv) syndromic surveillance.  
• Disease registration systems.  
• Cancer registration (as an example of disease registration).  
• How to distinguish key features of communicable, non-communicable and environmental epidemiology. |
| 2                     | Analyse surveillance data (descriptive epidemiology). | • Types of data.  
• Time, place, person.  
• Frequencies and distributions.  
• The epidemiological methods available to analyse the data:  
  o summary statistics, i.e. mean, median, mode, measures of spread  
  o prevalence and incidence  
  o rates (crude, specific and standardised)  
  o risk adjustment. |
| 2                     | Interpret the results of the analysis and prepare a report detailing the findings exercising professional judgement. | • How to interpret an analysis of surveillance data.  
• Hypothesis generation.  
• Frameworks for report writing.  
• The importance of being able to be able to practise as an autonomous professional and exercise professional judgement.  
• Personal responsibility and the importance of being able to justify decisions. |
| 3                     | Identify a peer-reviewed analytic epidemiological study for review. | • How to perform a literature search.  
• Critical appraisal of scientific literature.  
• Epidemiological study designs and their measures of association. |
<table>
<thead>
<tr>
<th>KEY LEARNING OUTCOMES</th>
<th>COMPETENCES</th>
<th>KNOWLEDGE AND UNDERSTANDING</th>
</tr>
</thead>
</table>
| 3                     | Critically appraise the peer-reviewed manuscript, focusing on potential biases and how these may impact on the findings. | • The analytical methods employed in the study.  
• Potential study biases, confounding and chance and their impact on measures of association:  
  o selection bias  
  o information bias  
  o observer bias  
  o loss to follow-up  
  o misclassification  
  o confounding and chance. |
| 3                     | Present and defend the critical appraisal, e.g. at a journal club | • How to prepare a presentation.  
• Giving an oral presentation.  
• Responding to questions.  
• Critical reflective practice. |
| 4                     | Attend outbreak control team meetings. | • The principles of outbreak investigation.  
• How to establish the existence of the outbreak:  
  o identification of an outbreak using surveillance data  
  o confirmation of diagnosis.  
• How to establish a hypothesis related to the mode of occurrence.  
  o Contact cases in attempt to establish possible exposures associated with disease  
  o Analysis of data collected from cases  
• How to test the hypotheses:  
  o creation of data collection instruments, e.g. questionnaires  
  o selection of suitable control population to compare cases with  
  o the principles of epidemiological studies available to test hypotheses, e.g. case-control and cohort studies.  
• How to conduct an environmental and/or microbiological investigation. |
<p>| 4                     | Support the outbreak control team during the investigation. | |</p>
<table>
<thead>
<tr>
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</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>How to control the outbreak and prevent further occurrences.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Social, institutional and political background to outbreak control.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Need for timeliness to enhance preventive impact of control measures.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>How to build and sustain professional relationships as both an independent practitioner and collaboratively as a member of a team.</td>
</tr>
<tr>
<td>4</td>
<td>Critically reflect on and document the steps undertaken in the investigation that you have been involved in.</td>
<td>How to write an investigation report to share experience with the public health and scientific community.</td>
</tr>
<tr>
<td>MODULE TITLE</td>
<td>Introduction to Statistics (AE-4)</td>
<td>COMPONENT</td>
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<tr>
<td>AIM</td>
<td>The use of statistical techniques is intrinsically incorporated into the work of epidemiologists. In order to derive the information on which important public health decisions are based, a relevant statistical method has to be applied to data to obtain statistics relevant to the question being answered. The trainee should develop an understanding of the role of informed statistical advice in how to approach the process of answering questions of public health importance. They will gain an appreciation of the availability and quality of routinely collected data and its suitability to the question at hand. They will also begin to appreciate the many statistical approaches that can be taken to answering the question at hand and how to go about selecting one to use. They will understand the importance of prior planning of a statistical analysis, how to interpret the results obtained and how to convey these results in the form of a written report to the intended audience.</td>
<td></td>
</tr>
<tr>
<td>SCOPE</td>
<td>On completion of this module the trainee will be able to convert the aims and objections of a project into a set of statistical analyses and to write a statistical analysis plan. They will develop their analytical skills and gain an appreciation of the breadth of statistical approaches used in epidemiology.</td>
<td></td>
</tr>
</tbody>
</table>

**LEARNING OUTCOMES**

On successful completion of this module the trainee will:

1. Identify a pertinent public health question and draft a statistical analysis plan.
2. Execute the statistical analysis plan, producing a written report to summarise and interpret the findings.
3. Calculate the sample size required for an analytical study, or the power of a study that has already been conducted, and discuss the impact of this on the study and the interpretation of findings in relation to patients or the public.
CLINICAL EXPERIENTIAL LEARNING

The clinical experiential learning for this module is:

- Visit an external organisation involved in the collation and statistical analysis of data, e.g. Farr Institute, and critically reflect on the challenges of collating and analysing large data sets.
- Discuss with information staff the processes around the collection, collation and governance of surveillance data, with an emphasis of the quality and validity of data used in statistical analyses, and identify learning to inform your future practice as a Clinical Scientist.
- Read and critically reflect on the UK Statistics Authority Code of Practice for Official Statistics and discuss the key messages to your future role as a Clinical Scientist with your supervisor.

All of these experiences should be recorded in your e-portfolio.

The following section details the competence and knowledge and understanding each trainee must gain. Each competence is linked to the relevant learning outcomes and trainees must demonstrate achievement of each competence for each linked learning outcome.

PROFESSIONAL PRACTICE

Trainees should ensure they refer to the professional practice learning framework and continue to achieve the professional practice competences alongside the competences defined in this module.
<table>
<thead>
<tr>
<th>KEY LEARNING OUTCOMES</th>
<th>COMPETENCES</th>
<th>KNOWLEDGE AND UNDERSTANDING</th>
</tr>
</thead>
</table>
| 1                     | Identify a relevant public health question. | • How to identify which are the primary and secondary objectives.  
                           • Relevant outcome measurements for each objective. |
| 1                     | Identify a relevant data set for analysis and describe the variables. | • Key sources of public health data. |
| 1                     | Identify the relevant statistical methods to answer the question and draft an analysis plan for consultation with a colleague. | • How to identify which statistical method is appropriate for the research question at hand.  
                           • How to plan the conduct of a statistical analysis. |
| 2                     | Use appropriate software to summarise variables. | • Summary statistics, e.g. mean, mode, median, measures of spread (range, interquartile range, variance, standard deviation).  
                           • Data distributions.  
                           • P-values and confidence intervals.  
                           • Statistical vs clinical significance.  
                           • Measures of association.  
                           • Tests for comparing means.  
                           • Tests for comparing proportions.  
                           • Correlation and linear regression.  
                           • Non-parametric methods.  
                           • How to choose an appropriate software package, including strengths and weaknesses. |
| 2                     | Calculate relevant statistics to address the public health question. | • Interpret outputs from computer-generated analysis.  
                           • The meaning of the output in terms of the public health question. |
| 2                     | Interpret the meaning of the point estimate and confidence interval and make inferences about the population. | • Interpret outputs from computer-generated analysis.  
                           • The meaning of the output in terms of the public health question. |
| 2                     | Draft a report detailing the data analysis, interpretation and conclusions. | • Presentation of statistical results, including the quantification of uncertainties, e.g. confidence intervals.  
                           • Visualisation of results. |
<table>
<thead>
<tr>
<th>KEY LEARNING OUTCOMES</th>
<th>COMPETENCES</th>
<th>KNOWLEDGE AND UNDERSTANDING</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Determine the type I and type II error that is acceptable.</td>
<td>• Formulation of the null hypothesis.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Statistical hypothesis testing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Type I (false positive) and type II (false negative) errors.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Primary and secondary outcomes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Statistical vs clinical significance.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Expected magnitude of effect.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Necessary assumptions, e.g. proportion of controls exposed, standard deviation of the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>outcome measurement.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• How power may have affected the interpretation of the study results.</td>
</tr>
<tr>
<td>3</td>
<td>Estimate the proportion exposed among the controls or the attack rate</td>
<td>• How to choose statistical software, strengths and weaknesses.</td>
</tr>
<tr>
<td></td>
<td>among the unexposed using available data or from the literature.</td>
<td>• When and how to adjust sample size for non-response.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Calculations of sample size.</td>
</tr>
<tr>
<td>3</td>
<td>Determine the appropriate magnitude of effect that you wish to detect.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Use appropriate statistical software to calculate sample size and adjust</td>
<td></td>
</tr>
<tr>
<td></td>
<td>sample size for non-response.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Using data already available use above steps to calculate the power of the</td>
<td></td>
</tr>
<tr>
<td></td>
<td>study.</td>
<td></td>
</tr>
</tbody>
</table>
SECTION 4: PROFESSIONAL PRACTICE LEARNING FRAMEWORK
**STP Learning Framework**

This section describes the Learning Framework for the **Professional Practice Component** of work based learning covering the Learning Outcomes, Clinical Experiential Learning, Competence, and Applied Knowledge and Understanding. This module spans the Rotational and Specialist period of training. Each trainee is also expected to build on and apply the knowledge, skills and experience gained from the MSc in Clinical Science.

<table>
<thead>
<tr>
<th>PROFESSIONAL PRACTICE</th>
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</thead>
<tbody>
<tr>
<td><strong>DIVISION</strong></td>
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<tr>
<td><strong>THEME</strong></td>
</tr>
<tr>
<td><strong>SPECIALISM</strong></td>
</tr>
</tbody>
</table>
Introduction

*Good Scientific Practice* (GSP) sets out the principles and values on which good practice undertaken by the HCS workforce is founded. GSP sets out for the profession and the public the standards of behaviour and practice that must be achieved and maintained in the delivery of work activities and the provision of care. GSP uses as a benchmark the Health Professions Council (HPC) Standards of Proficiency and Standards of Conduct, Performance and Ethics, but expresses these in the context of the modalities within healthcare science.

*Good Scientific Practice* represents standards and values that apply throughout an individual’s career in healthcare science at any level of practice. Therefore the standards have been contextualised for the role of healthcare scientist. There will, however, always be a requirement for an individual to work within the limits of their scope of practice and competence.

Professional Practice in the STP Training Programme

This generic professional practice module, which all STP trainees have to complete, defines the knowledge, skills and experience that each trainee is expected to gain and apply during the STP programme and develop in subsequent employment. The degree to which each specialism applies the knowledge, skills and experience will vary, but this module sets the baseline for all trainees. Each rotational and specialist learning framework then develops areas as appropriate, for example clinical history taking in patient-facing specialisms.

While it is expected that trainees will be able to achieve the majority of the learning outcomes and competences within their specialism, some specialisms may have to make special arrangements to ensure all trainees achieve the learning outcomes and competences defined in this learning framework. For example, working with a local clinical skills laboratory to help trainees develop basic skills in history taking.

The Learning Framework that defines the learning outcomes, clinical experiential learning, competences, and knowledge and understanding are contained on the following pages.
<table>
<thead>
<tr>
<th>MODULE TITLE</th>
<th>Component</th>
<th>Generic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional Practice (PP1)</td>
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</table>

**AIM**

Professional Practice is part of the generic curriculum (applicable to all trainees) on the Scientist Training Programme. The overall aim of the module is to ensure that each trainee has the underpinning knowledge and applies this and the accompanying skills and attitudes to work as a healthcare scientist in accordance with *Good Scientific Practice* (GSP).

**SCOPE**

GSP sets out the principles and values on which the practice of healthcare science is undertaken. It sets out for the profession and the public the standards of behaviour and practice that must be achieved and maintained in the delivery of work activities and the provision of care. This module encompasses the knowledge, skills, experience and attitudes across four of the five domains of GSP, namely Professional Practice, Scientific Practice, Clinical Practice, Research and Development, and Clinical Leadership, but all other modules within this programme will contribute to embedding professional practice at the centre of the work of each trainee.

**LEARNING OUTCOMES**

On successful completion of this module the trainee will:

**Professional Practice**

1. Place the patient at the centre of care in daily practice, ensuring the needs of patients are respected.
2. Communicate with patients, relatives, service users, other healthcare professionals, colleagues and the public with respect, empathy and sensitivity, including listening, speaking, giving and receiving information, and giving and receiving feedback.
3. Respond to the ethical and legal issues and challenges arising from the practice of healthcare science.
4. Demonstrate a commitment to the continuing professional development of themselves and others, and attend professional meetings.

**Clinical Practice**

5. Make appropriate and effective use of information and communications technology.
6. Under supervision, obtain a patient history from a normal volunteer or typical patient referred to your service and present the findings to a colleague or peer in order to understand the clinical decision-making process in clinical practice.
7. Promote the importance of patient safety and general health, safety and security in the workplace, including infection control and information governance.
Research, Development and Innovation

8. Apply knowledge, skills and experience of research, development and innovation appropriate to the role in order to identify effectively actions that will improve service provision.
9. Engage in evidence-based practice, participate in audit procedures and critically search for, appraise and identify innovative approaches to practice and delivery.

Clinical Leadership

10. Demonstrate a range of leaderships skills required of an emerging leader within healthcare science.
CLINICAL EXPERIENTIAL LEARNING

The clinical experiential learning for this module is:

- Attend clinics, ward rounds, treatment and/or rehabilitation sessions, etc., in primary or secondary care, or in the charity or voluntary sector where patients attend, and observe how patient–professional relationships are developed and maintained, and reflect on how the following impact on the patient–professional relationship:
  - response to illness
  - patient and carer perspective
  - health belief models
  - diversity of the patient experience
  - disability, including learning disabilities
  - potential health inequalities
  - self-care
  - impact of life-threatening and critical conditions
  - patient involvement in decisions regarding their healthcare.
- Observe a current screening programme in the workplace and discuss with your training officer the principles and practice of screening programmes in healthcare as a means of reducing disease burden.
- Observe and participate in internally and externally accredited quality management systems and critically appraise both in your area of practice.

All of these experiences should be recorded in your e-portfolio.

The following section details the competence and knowledge and understanding each trainee must gain. Each competence is linked to the relevant learning outcomes and trainees must demonstrate achievement of each competence for each linked learning outcome.
<table>
<thead>
<tr>
<th>KEY LEARNING OUTCOMES</th>
<th>COMPETENCES</th>
<th>KNOWLEDGE AND UNDERSTANDING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Professional Practice</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 1 | Treat each patient as an individual, respecting their dignity and confidentiality and upholding the rights, values and autonomy of every service user. | • NHS Constitution.  
• Patient-centred care and the patient–carer perspective with respect to:  
  o response to illness  
  o patient and carer perspective  
  o health belief models  
  o diversity of the patient experience  
  o disability, including learning disabilities  
  o potential health inequalities  
  o self-care  
  o impact of life-threatening and critical conditions  
  o patient involvement in decisions regarding their healthcare.  
• Local guidelines for responding to unacceptable behaviour by patients, carers, relatives, peers and colleagues, including harassment, bullying and violent behaviour. |
| 1 | Discuss personal values, principles and assumptions, emotions and prejudices, and how these may influence personal judgement and behaviour, and identify how you will practise in accordance with Good Scientific Practice. | • Good Scientific Practice.  
• The importance of maintaining own health. |
| 2 | Communicate effectively with the public, services users and other healthcare professionals, adapting | • The principles of effective communication, including:  
  o written and electronic, verbal and non-verbal and feedback  
  o the way effective communication can assist in identifying problems accurately, increase patient satisfaction, enhance treatment adherence, and reduce |
<table>
<thead>
<tr>
<th>KEY LEARNING OUTCOMES</th>
<th>COMPETENCES</th>
<th>KNOWLEDGE AND UNDERSTANDING</th>
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<tbody>
<tr>
<td>communication style and language to meet the needs of listeners.</td>
<td>patient distress and anxiety&lt;br&gt;o the importance of some key ideas, for example signposting, listening, language, non-verbal behaviour, ideas, beliefs, concerns, expectations and summarising in communication&lt;br&gt;o the range of question types that can be used in a communication.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Give and receive feedback sensitively to or from a peer or colleague.</td>
<td>• The range of feedback models for giving and receiving feedback.&lt;br&gt;• The evidence base underpinning the importance of effective feedback/feedback models.</td>
</tr>
<tr>
<td>2</td>
<td>Obtain, analyse and act on feedback from a variety of sources and use it to consider personal impact and change behaviour.</td>
<td>• How to analyse feedback and frameworks for action planning.&lt;br&gt;• Behavioural change models.</td>
</tr>
<tr>
<td>2</td>
<td>Present complex ideas in understandable terms in both oral and written formats.</td>
<td>• The importance of public engagement in science and its role in health and society.&lt;br&gt;• The factors that enable scientists to communicate to specialist and non-specialist audiences.&lt;br&gt;• Barriers to effective communication.</td>
</tr>
<tr>
<td>2</td>
<td>Use effective negotiation skills, including influencing colleagues.</td>
<td>• Communication channels with/in your host department, patients and the public, your employing institution, your profession and professional body, and the wider healthcare science community.</td>
</tr>
<tr>
<td>2</td>
<td>Work constructively and effectively as a member of a multidisciplinary team.</td>
<td>• The underpinning principles of effective teamwork and working within and across professional boundaries.</td>
</tr>
<tr>
<td>3</td>
<td>Comply with relevant guidance and laws, to include those relating to:</td>
<td>• Principles, guidance and law with respect to:&lt;br&gt;o medical ethics&lt;br&gt;o confidentiality&lt;br&gt;o information governance&lt;br&gt;o informed consent</td>
</tr>
<tr>
<td>KEY LEARNING OUTCOMES</td>
<td>COMPETENCES</td>
<td>KNOWLEDGE AND UNDERSTANDING</td>
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<tr>
<td></td>
<td>governance</td>
<td>o equality and diversity</td>
</tr>
<tr>
<td></td>
<td>patient confidentiality</td>
<td>o child protection</td>
</tr>
<tr>
<td></td>
<td>data protection</td>
<td>o elder abuse</td>
</tr>
<tr>
<td></td>
<td>equality and diversity</td>
<td>o use of chaperones</td>
</tr>
<tr>
<td></td>
<td>use of chaperones</td>
<td>o probity</td>
</tr>
<tr>
<td></td>
<td>informed consent</td>
<td>o fitness to practise</td>
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<tr>
<td></td>
<td></td>
<td>o the importance of maintaining your own health.</td>
</tr>
<tr>
<td>4</td>
<td>Contribute to the education and training of colleagues.</td>
<td>The key principles and evidence base underpinning clinical education, encompassing curriculum design, planning, delivery and assessment.</td>
</tr>
<tr>
<td>4</td>
<td>Take responsibility for your learning and demonstrate a commitment to continuing professional development.</td>
<td>How continuous personal development can improve personal performance.</td>
</tr>
<tr>
<td>4</td>
<td>Meet commitments and goals in your professional practice, using a range of organisational and planning tools.</td>
<td>Different methods of planning, prioritising and organising, and how they can enhance personal effectiveness.</td>
</tr>
<tr>
<td>4</td>
<td>Reflect on your practice and generate a reflective diary that demonstrates how you utilise the skills required of an independent learner and your commitment to your continuing professional development.</td>
<td>Core theories of learning, particularly adult learning and reflective practice, and demonstrate how these are relevant to your practice as a healthcare scientist. Personal values, principles and assumptions, emotions and prejudices, understanding how these may influence personal judgement and behaviour. The role of critical reflection and reflective practice and the methods of reflection that can be used to maintain or improve knowledge, skills and attitudes.</td>
</tr>
<tr>
<td>4</td>
<td>Take responsibility for keeping your professional and scientific knowledge</td>
<td>How to horizon scan, identify and evaluate the potential role for new and innovative technologies and scientific advances.</td>
</tr>
<tr>
<td>KEY LEARNING OUTCOMES</td>
<td>COMPETENCES</td>
<td>KNOWLEDGE AND UNDERSTANDING</td>
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<tr>
<td></td>
<td>and skills up to date.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Develop an action plan based on your experiential learning and reflection on completion of the Scientist Training Programme.</td>
<td>• Action planning.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Models and frameworks for critical reflection.</td>
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<tr>
<td></td>
<td><strong>Clinical Practice</strong></td>
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</tbody>
</table>
| 5                     | Use a range of information and communications technologies within the workplace for service delivery, research, audit and innovation, including data filing and archiving:  
• word processing  
• databases  
• statistics packages  
• PowerPoint  
• internet  
• email. | • The range and application of clinical information systems used in the work base. |
<p>|                       |                                                                           | • The systems in use in the work base to file and archive information and the processes for retrieval. |
|                       |                                                                           | • The principles underpinning identification, storage and retrieval of scientific literature, for example end note/end note web. |
|                       |                                                                           | • The purpose of a range of NHS information systems, including the regulations in place to ensure data security and confidentiality. This may include hospital information system, linked information systems (e.g. laboratory information management system) and middleware linking equipment to information systems. |
| 6                     | Under supervision, demonstrate that you can obtain and present a patient history from a normal volunteer or consenting patient in order to better understand the clinical decision-making | • The importance of patient-centred care and how it ensures that the wishes, beliefs, concerns, expectations and needs of patients are respected. |
|                       |                                                                           | • Patient and carer perspective with respect to illness, disability, health inequalities and diversity of the patient experience. |
|                       |                                                                           | • Structured models for presenting a patient history.                                         |
|                       |                                                                           | • Process of patient-centred interviewing and the features of a good consultation, including initiating the session, gathering information, building the relationship, explaining and planning, and closing the session. |</p>
<table>
<thead>
<tr>
<th>KEY LEARNING OUTCOMES</th>
<th>COMPETENCES</th>
<th>KNOWLEDGE AND UNDERSTANDING</th>
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</thead>
<tbody>
<tr>
<td>process in your clinical practice.</td>
<td>• Link between the patient history and examination and development of clinical investigation and management plans.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Apply current regulations with respect to patient safety and safe systems within the workplace. To include, as appropriate to scope of practice: • risk management • biological specimen handling • COSHH • RIDDOR • radioactivity • fire safety • electrical safety • moving and handling • display screen equipment • incident reporting • infection control.</td>
<td>• The importance of health and safety within the workplace, wider healthcare environment and NHS. • Principles, process and governance of risk management. • Factors influencing health, safety and security. • Current legislation, codes of practice, guidance notes and related documents. • Principles and practice of health and safety in the workplace. • The requirements of relevant local health and safety guidelines, manuals and other documents, including the underpinning legislation. • The cause of errors related to patient safety, including patient and/or sample identification.</td>
</tr>
<tr>
<td>7</td>
<td>Use clinical coding and medical terminology in accordance with stated guidance, as appropriate to scope of practice.</td>
<td>• The importance of the correct use of clinical coding and medical terminology in contributing to good healthcare science practice. • Information governance principles and process.</td>
</tr>
<tr>
<td>7</td>
<td>Keep accurate records in accordance with current</td>
<td>• Best practice recommendations for record keeping and data security. • The Data Protection Act and current key guidelines, and the legal framework for</td>
</tr>
<tr>
<td>KEY LEARNING OUTCOMES</td>
<td>COMPETENCES</td>
<td>KNOWLEDGE AND UNDERSTANDING</td>
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<tr>
<td>-----------------------</td>
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<td>-----------------------------</td>
</tr>
<tr>
<td>guidelines and the legal framework for data security.</td>
<td>7</td>
<td>data security.</td>
</tr>
</tbody>
</table>

**7 Use, in your practice:**
- standard operating procedures
- protocols
- clinical guidelines.

- Standard operating procedure, protocol and guideline, and understand the purpose of and difference between each document.
- Evidence base that underpins the use of procedures employed by the service.

**7 Continuously improve your practice through good practice in:**
- identifying common sources of error
- identification of risk
- reporting critical incidents.

- The desirability of monitoring performance, internal and external quality control, learning from mistakes and adopting a no-blame culture in order to ensure high standards of care and optimise patient safety.
- The importance of honesty and effective apology in responding to errors of practice.
- The principles and practice of risk management and the effective investigation of incidents, resulting in the identification of root causes.

**Research and Innovation**

**8, 9 Participate in innovation, research, service development and audit activities, complying with guidance and laws relating to research ethics.**

- The importance of innovation across healthcare science.
- The role of innovation in improving quality and patient care.
- Processes to disseminate innovation, research and audit findings.
- The role of the healthcare scientist and the potential impact of scientific research in your area of practice.
- The role of the healthcare scientist in service developments in your area of practice.
- Current and developing clinical practice.
- The effectiveness of investigations, therapies, interventions and treatments, and the mechanisms by which they contribute to patient care.
- How to horizon scan, identify and evaluate the potential role for new and innovative technologies and scientific advances.
<table>
<thead>
<tr>
<th>KEY LEARNING OUTCOMES</th>
<th>COMPETENCES</th>
<th>KNOWLEDGE AND UNDERSTANDING</th>
</tr>
</thead>
</table>
|                      |             | • The role of the healthcare scientist and the potential impact of scientific developments, for example health prevention, genomic medicine, diagnostics and rehabilitation.  
|                      |             | • The importance of public engagement in science and its role in health and society.  
|                      |             | • The legal framework relevant to informed consent and the application to clinical care, research, audit and teaching. |
| 8, 9                 | Contribute to service and quality improvement and productivity in the work base and embed evidence-based developments within routine practice. | • How planning can actively contribute to the achievement of service goals.  
|                      |             | • How to measure and monitor performance against agreed targets.  
|                      |             | • The current structure, management, legal framework, and quality improvement structures and processes within the NHS.  
|                      |             | • The current quality improvement structures and processes within the NHS and give examples of the implications for healthcare science.  
|                      |             | • Importance of self-care and shared care as part of NHS function and the impact of life-threatening and critical conditions.  
|                      |             | • Principles and application of evidence-based practice. |
| 8, 9                 | Undertake a literature review and prepare and present to peers a critical analysis of a publication from the scientific literature. | • How to critically analyse scientific literature.  
|                      |             | • How to structure and present a critical analysis.  
|                      |             | • Systems of referencing.  
|                      |             | • Reference manager software. |
| 8, 9                 | Prepare and deliver an oral scientific communication to peers at a local, national, or international meeting. | • How to prepare an oral scientific communication.  
|                      |             | • How to give an effective and timely oral presentation.  
|                      |             | • How to respond to questioning. |

**Clinical Leadership**
<table>
<thead>
<tr>
<th>KEY LEARNING OUTCOMES</th>
<th>COMPETENCES</th>
<th>KNOWLEDGE AND UNDERSTANDING</th>
</tr>
</thead>
</table>
| 10                    | Lead in your clinical role through appropriate application of:  
• self-management  
• self-development  
• integrity  
• self-direction  
• problem solving  
• dealing with complex issues  
• making sound judgements in the absence of complete data. | • How self-awareness, self-management, self-development and acting with integrity at all times contribute to leadership.  
• The use of evidence, both positive and negative, to identify options in addressing challenges.  
• Methods of prioritising and organising academic and work based tasks to optimise own performance. |
| 10                    | Identify potential areas for change and accept change identified by others, working across different provider landscapes as required. | • Structure of the NHS.  
• The need for change, working across different provider landscapes as required.  
• Change management methodologies. |
SECTION 5: ELECTIVE LEARNING FRAMEWORK
STP Learning Framework

This section describes the Learning Framework for the **Elective Component** of specialist work based learning, covering the Learning Outcomes, Clinical Experiential Learning, Competence, and Applied Knowledge and Understanding. This module spans the Rotational and Specialist period of training. Each trainee is also expected to build on and apply the knowledge, skills and experience gained from the MSc in Clinical Science.

<table>
<thead>
<tr>
<th>ELECTIVE</th>
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<tbody>
<tr>
<td>DIVISION</td>
</tr>
<tr>
<td>THEME</td>
</tr>
<tr>
<td>SPECIALISM</td>
</tr>
</tbody>
</table>

The elective period can be taken any time during the specialist training. It may comprise a single 4- to 6-week elective or a series of shorter periods of elective training.
### AIM

The aim of the elective period is to facilitate wider experience of healthcare and/or the practice of healthcare science in a cultural and/or clinical setting that is different from the usual training environment. This may involve healthcare or healthcare science in a different area of the health service, or in pursuit of a particular clinical or research interest.

### SCOPE

The elective provides opportunities for you to:
- explore in depth areas of particular interest beyond the scope of the Scientist Training Programme;
- increase awareness of important health issues and develop an understanding of the effect of disease on communities and individuals in different cultural contexts;
- explore unfamiliar scientific, social, economic, or cultural areas;
- become more proficient at communication with individuals from different social, cultural and ethnic backgrounds;
- gain hands-on experience that might not otherwise be possible in a Scientist Training Programme;
- design and undertake a significant assignment with appropriate guidance and supervision, thereby developing personal and organisational skills;
- undertake a small audit or research project in a different clinical setting;
- relate your experiences to your own area of practice.

### LEARNING OUTCOMES

Learning outcomes are specific to each student. With guidance, you are expected to identify your own educational objectives and organise an elective to achieve them.

1. Agree, organise and complete a period of education and training that provides a wider experience of healthcare and/or the practice of healthcare science, and aligns with *Good Scientific Practice*.
2. Critically reflect on your experience in your elective and develop an action plan as part of your continuing personal and professional development.
3. Prepare a presentation and present your elective experiences to colleagues, including trainee healthcare scientists.
<table>
<thead>
<tr>
<th>KEY LEARNING OUTCOMES</th>
<th>COMPETENCES</th>
<th>KNOWLEDGE AND UNDERSTANDING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Produce learning outcomes for the elective training period and link these to <em>Good Scientific Practice</em>.</td>
<td>• <em>Good Scientific Practice</em>.</td>
</tr>
</tbody>
</table>
| 2                    | Write a report of your elective training that includes your learning outcomes (mapped to *Good Scientific Practice*), a critical reflection on your experience and an action plan. | • Report writing.  
  • Critical reflection.  
  • Action planning. |
| 3                    | Plan, prepare and deliver an oral presentation that describes and reflects on the learning from your elective and shows how your experience will shape your future practice. | • How to prepare an oral communication.  
  • How to give an effective and timely oral presentation.  
  • Use of visual aids.  
  • How to respond to questioning. |
SECTION 6: SPECIALIST LEARNING FRAMEWORK: APPLIED EPIDEMIOLOGY
This section describes the Learning Framework for the **Specialist Component** of work based learning covering the Learning Outcomes, Clinical Experiential Learning, Competence and Applied Knowledge and Understanding. Each trainee is also expected to build on and apply the knowledge, skills and experience gained from the MSc in Clinical Science.

### Specialist Modules

<table>
<thead>
<tr>
<th>DIVISION</th>
<th>Clinical Bioinformatics</th>
</tr>
</thead>
<tbody>
<tr>
<td>THEME</td>
<td>Applied Epidemiology</td>
</tr>
<tr>
<td>SPECIALISM</td>
<td>Applied Epidemiology</td>
</tr>
</tbody>
</table>
### APPLIED EPIDEMIOLOGY: SPECIALIST MODULES

<table>
<thead>
<tr>
<th>Module</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module 5 (AE-5)</td>
<td>Data Management</td>
</tr>
<tr>
<td>Module 6 (AE-6)</td>
<td>Visualisation and Presentation of Data</td>
</tr>
<tr>
<td>Module 7 (AE-7)</td>
<td>Design and Analysis of Epidemiological Studies</td>
</tr>
<tr>
<td>Module 8 (AE-8)</td>
<td>Scientific Communication</td>
</tr>
<tr>
<td>MODULE TITLE</td>
<td>Data Management (AE-5)</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>AIM</td>
<td>To ensure that we support effective public health action there is a requirement for an informed understanding of both the data and the topic area, underpinned by a sound scientific interpretation of the evidence. Such evidence must frequently be transformed from raw data into consumable information before it can be used for making decisions, determining policy, and conducting and evaluating public health programmes. High-quality accurate public health data support the development of public health policy, strategy, development and introduction of public health programmes and ultimately improve health outcomes. This aim of this module is to enable the trainee to develop their knowledge and understanding of data management and apply their skills to ensure that data are governed appropriately and managed in accordance with legislative and good practice guidelines.</td>
</tr>
<tr>
<td>SCOPE</td>
<td>On completion of this module the trainee will be able to specify the development of a database that is supported by comprehensive documentation and designed appropriately, in line with information governance requirements. They will be able to access data from a relational database, extracting what is required and translating data where needed, and undertake analyses that are based on an understanding of database design and the data that are within. The trainee will also be cognisant of data quality issues and be able to identify, describe, mitigate and resolve them.</td>
</tr>
</tbody>
</table>

**LEARNING OUTCOMES**

**On successful completion of this module the trainee will:**

1. Document and design a specification for a relational database for collecting or storing health data, ensuring compliance with security, governance and ethical issues.
2. Extract, import and manipulate data within a data set.
3. Draft a report summarising the quality of the data, make recommendations required to improve the data quality and agree an action plan.
CLINICAL EXPERIENTIAL LEARNING

The clinical experiential learning for this module is:

- Arrange a face-to-face interview with an information governance officer, having prepared a document describing what regulations and legislation you feel are relevant with regard to data and data management, including when you are using patient identifiable information and the related issues. Discuss the document and then amend to reflect any additional information.
- Shadow a database manager or system administrator to better understand the process of developing databases and their relationships.

All of these experiences should be recorded in your e-portfolio.

The following section details the competence and knowledge and understanding each trainee must gain. Each competence is linked to the relevant learning outcomes and trainees must demonstrate achievement of each competence for each linked learning outcome.

PROFESSIONAL PRACTICE

Trainees should ensure they refer to the professional practice learning framework and continue to achieve the professional practice competences alongside the competences defined in this module.
<table>
<thead>
<tr>
<th>KEY LEARNING OUTCOMES</th>
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<th>KNOWLEDGE AND UNDERSTANDING</th>
</tr>
</thead>
</table>
| 1                     | Liaise with an information manager to identify how a database specification should be written. | • The key elements and importance of database design:  
  o creating the database – considerations on size, logical structure for data storage  
  o structure – tables, views, joins, primary/foreign keys  
  o field types  
  o nulls and empty strings – how do we deal with missing data?  
  o normalisation (to ensure data consistency and save space, primary/foreign keys)  
  o indexes  
  o importance of documentation  
  o importance of using standardised coding. |
| 1                     | Define the user requirements for the relational database, including purpose, scope, structure and security. | • The relational model of data.  
• Implementation of relational databases.  
• Schema and tables and be able to explain different data types and models.  
• Database relationships, keys and indexes and normalisation.  
• Common identifiers and fields to link data sets.  
• Distributed relational systems and data replication.  
• Security considerations (e.g. backups, access and management of risk).  
• The role of ‘big data’ in epidemiology.  
• Large data set methodologies.  
• Database standards and standards for interoperability and integration.  
• The need to manage records and all other information in accordance with applicable legislation, protocols and guidelines.  
• Legal requirements that may form part of the agreements, including |
<p>| 1                     | Identify the key elements of the database’s design, including relationships and keys/indexes and techniques to provide quality assurance. | |
| 1                     | Produce appropriate documentation to define the system. | |</p>
<table>
<thead>
<tr>
<th>KEY LEARNING OUTCOMES</th>
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<th>KNOWLEDGE AND UNDERSTANDING</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>those that underpin our work.</td>
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<tr>
<td></td>
<td></td>
<td>• How the agreements tie in with information governance policy and procedures.</td>
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<td></td>
<td></td>
<td>• The role of the Caldicott Guardian, patient confidentiality/disclosure and the Data Protection Act (including the impact on privacy).</td>
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<tr>
<td></td>
<td></td>
<td>• How system security measures facilitate the appropriate use of sensitive data (e.g. encryption).</td>
</tr>
<tr>
<td>2</td>
<td>Identify a database containing health or exposure data and extract the relevant fields from multiple tables within the database to answer a specific question using Structured Query Language (SQL).</td>
<td>• Common identifiers and fields to link data sets.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Relational databases.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Principles of database structure and formats.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• How to write a script using a common programming language.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Import and Export Wizard, SQL.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Table relationships/joins (covered by selecting from multiple tables).</td>
</tr>
<tr>
<td>2</td>
<td>Import data into software which allows further data analysis, e.g. R, SQL.</td>
<td>• How Open Database Connectivity (ODBC) connections can be used to transfer data between applications.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Importing data:</td>
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<tr>
<td></td>
<td></td>
<td>o Import and Export Wizard</td>
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<td></td>
<td></td>
<td>o SQL insert, update, delete.</td>
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<tr>
<td></td>
<td></td>
<td>• Parsing data (e.g. XML and JSON formats).</td>
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<tr>
<td></td>
<td></td>
<td>• Principles of and drivers for the automation of routine tasks.</td>
</tr>
<tr>
<td>2</td>
<td>Run queries to identify quality issues, including coding anomalies, incomplete data and general data inaccuracies.</td>
<td>• Querying language.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Manipulate, manage and quality assure data within a data set:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o variables – types, numeric formats, decimals, date and time, string</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o data structure – selecting observations and variables, renaming and reordering, sorting, collapsing data, combining files.</td>
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<tr>
<td></td>
<td></td>
<td>• Data quality:</td>
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<td></td>
<td>o principles: completeness, accuracy, validity, accuracy, timeliness,</td>
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<tr>
<td>KEY LEARNING OUTCOMES</td>
<td>COMPETENCES</td>
<td>KNOWLEDGE AND UNDERSTANDING</td>
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<td></td>
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<td>consistency</td>
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<td>• standards.</td>
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<td></td>
<td>• Data validation.</td>
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<tr>
<td></td>
<td></td>
<td>• Data dictionaries, standards and coding.</td>
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<tr>
<td>2</td>
<td>Resolve issues identified where possible.</td>
<td>• Analytical techniques.</td>
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<tr>
<td></td>
<td></td>
<td>• Importance of data quality and how to mitigate and improve it.</td>
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<tr>
<td></td>
<td></td>
<td>• Potential data quality issues and methods to avoid and address, including technical solutions/mitigation.</td>
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<tr>
<td></td>
<td></td>
<td>• How to deal with missing data.</td>
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<tr>
<td></td>
<td></td>
<td>• Documentation commands – labels</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Calculations – generate and replace, recoding, checking correctness, missing data.</td>
</tr>
<tr>
<td>2</td>
<td>Identify relevant fields and de-duplicate data.</td>
<td>• The principles of de-duplication.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Importance of documentation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Approaches to automated data manipulation.</td>
</tr>
<tr>
<td>2</td>
<td>Manipulate the data to produce aggregated counts.</td>
<td>• Select, Where, Group by, Order by, Count.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Information governance policy (e.g. disclosure, records management, version control).</td>
</tr>
<tr>
<td>3</td>
<td>Produce a short report describing and evaluating the quality issues identified.</td>
<td>• Potential data quality issues and methods to avoid and address, including technical solutions/mitigation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Quality issues and causes.</td>
</tr>
<tr>
<td>3</td>
<td>Propose recommendations to resolve or mitigate the data quality issues.</td>
<td>• Potential data quality issues and methods to avoid and address, including technical solutions/mitigation.</td>
</tr>
<tr>
<td>3</td>
<td>Present findings to colleagues, defend the recommendations and agree an action plan.</td>
<td>• Potential impact of quality issues on outcomes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Oral communication skills, including explaining, describing, listening, language, non-verbal behaviour, summarising, types and use of questions.</td>
</tr>
<tr>
<td>KEY LEARNING OUTCOMES</td>
<td>COMPETENCES</td>
<td>KNOWLEDGE AND UNDERSTANDING</td>
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<tr>
<td></td>
<td></td>
<td>• The importance of being able to be able to practise as an autonomous professional and exercise professional judgement.</td>
</tr>
<tr>
<td>MODULE TITLE</td>
<td>Visualisation and Presentation of Data (AE-6)</td>
<td>COMPONENT</td>
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<tr>
<td><strong>AIM</strong></td>
<td>The aim of this module is to enable the trainee to apply their knowledge as they develop skills to clearly and accurately present the results of epidemiological analysis, for example an outbreak investigation, a risk factor analysis, or an analysis of health service use. The audience will vary according to the analysis but could be an outbreak control team, a local authority public health team, or a planning and commissioning organisation.</td>
<td></td>
</tr>
<tr>
<td><strong>SCOPE</strong></td>
<td>On completion of this module the trainee will be able to create visualisations that have impact and that assist decision makers and help to inform decisions. The visualisations will be in a variety of formats and will draw on a range of data and analyses. The visualisations need to be appropriate to their audience, including members of the public, and need to take into account the needs of those with visual and/or hearing impairments.</td>
<td></td>
</tr>
</tbody>
</table>

**LEARNING OUTCOMES**

On successful completion of this module the trainee will:

1. Select and create appropriate charts or plots for at least two different audiences using a defined data set.
2. Create clear and accurate charts in a range of software.
3. Create a simple info graphic.
4. Create a simple interactive data product using public health data.
5. Use graphing tools (e.g. ggplot2 used in R), visual exploratory data analysis tools (e.g. Tableau) and interactive tools (e.g. Tableau Public, Plot.ly and Shiny).
6. Present health data using a Geographic Information System (GIS) and assess how the findings might be used to inform local or national public health action.
CLINICAL EXPERIENTIAL LEARNING

The clinical experiential learning for this module is:

• Review examples of health information, in particular visualisations, in the media and offer a critique of how they are being used to convey particular messages (NB. The BBC and major national broadsheet websites all make regular use of visualisations of data relevant to public health).
• Observe conversations between colleagues and non-technical public health staff involved in decision making, drawing on and evaluating the usefulness of visualisation data, and critically reflect on the positive aspects of each consultation and aspects that could be improved. Develop an action plan to support your personal development.
• Attend multidisciplinary meetings at which epidemiological/health information outputs are discussed with clinicians and other decision makers (this could include an outbreak control team, a Health and Wellbeing Board, a clinical priorities forum, or other similar types of meetings). Discuss the role of the multidisciplinary team in public health with your supervisor.
• Gain experience of each of the following and personally reflect on the importance, application and effect on health and care services, patient care and patient outcomes, and how your experience will impact on your future practice as an epidemiologist:
  o the scope and function of the epidemiology function within public health;
  o the preparation of visual information outputs for a variety of audiences;
  o the reporting of results and dissemination of outputs for public health use;
  o the impact of visual information in conveying important public health messages.

All of these experiences should be recorded in your e-portfolio.

The following section details the competence, knowledge and understanding each trainee must gain. Each competence is linked to the relevant learning outcomes and trainees must demonstrate achievement of each competence for each linked learning outcome.

PROFESSIONAL PRACTICE

Trainees should ensure they refer to the professional practice learning framework and continue to achieve the professional practice competences alongside the competences defined in this module.
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<tr>
<th>KEY LEARNING OUTCOMES</th>
<th>COMPETENCES</th>
<th>KNOWLEDGE AND UNDERSTANDING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Identify a public health topic that could be informed by data visualisation.</td>
<td>• The impact of visual perception on the construction of data presentations for different audiences, e.g. public, patients and decision makers.</td>
</tr>
<tr>
<td>1</td>
<td>Identify the appropriate data set.</td>
<td>• The range of data presentations available, e.g. tables, graphs, maps and infographics. • How to select the most appropriate presentation modality for different data types and audiences.</td>
</tr>
<tr>
<td>1</td>
<td>Define the target audience and select a suitable type of visualisation to communicate the important messages in the data to the audience.</td>
<td>• How to identify the target audience. • How to characterise the needs and prior knowledge of the audience. • How to select the type of visualisation that is appropriate for the data. • How to interpret the data. • How to determine if the information/message has been understood, by the target audience.</td>
</tr>
<tr>
<td>1</td>
<td>Create the visualisations and gain feedback from the intended audience.</td>
<td>• How to create the visualisation. • Testing the effectiveness of the visualisation.</td>
</tr>
<tr>
<td>2</td>
<td>Identify available software packages and practise creating charts.</td>
<td>• The range of data presentation software available. • Strengths and weaknesses of each software package.</td>
</tr>
<tr>
<td>2</td>
<td>Gain feedback on each chart, identifying areas for improvement.</td>
<td>• Considerations for creating charts for people with disabilities. • How to evaluate charts and infographics.</td>
</tr>
<tr>
<td>3</td>
<td>Identify a suitable software tool for producing an infographic.</td>
<td>• The range of software tools for producing infographics available. • How to evaluate and select the most appropriate software tool for producing presentations. • Considerations for creating infographics for people with disabilities.</td>
</tr>
<tr>
<td>3</td>
<td>Identify a suitable data set and define a target audience.</td>
<td>• How to identify the target audience. • How to characterise the needs and prior knowledge of the audience. • How to select the type of visualisation that is appropriate for the data.</td>
</tr>
<tr>
<td>KEY LEARNING OUTCOMES</td>
<td>COMPETENCES</td>
<td>KNOWLEDGE AND UNDERSTANDING</td>
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</tr>
</tbody>
</table>
| 3                    | Create an infographic and gain feedback, identifying areas for improvement. | • How to create effective infographics.  
                      |                                                                   | • How to evaluate charts and infographics.                                                                                                                                 |
| 4                    | Choose an interactive tool to create an interactive product from public health data. | • The principles and uses of interactive data products.  
                      |                                                                   | • Strengths and weaknesses of interactive data products.  
                      |                                                                   | • Considerations for creating interactive data products for people with disabilities.  
                      |                                                                   | • How to evaluate interactive data products.                                                                                                                                 |
| 4                    | Identify suitable data sets and define an appropriate audience.              |                                                                                                                                                           |
| 4                    | Create an interactive data product using the chosen tool and gain feedback, identifying areas for improvement. | • Methods to evaluate interactive data products.                                                                                                                                                                     |
| 5                    | Choose at least one graphing tool and at least one interactive tool.        | • How to evaluate and select the most appropriate software tool for producing presentations.                                                                                                                                 |
| 5                    | Identify suitable data sets and define an appropriate audience.              |                                                                                                                                                           |
| 5                    | Create a visualisation using each of the chosen tools and gain feedback, identifying areas for improvement. | • Methods to evaluate interactive data products.                                                                                                                                                                     |
| 6                    | Identify a health data set that has suitable geographical data.             | • The concepts of Geographic Information Systems (GIS) and the application of GIS to public health.  
                      |                                                                   | • How to identify the advantages and disadvantages of GIS and steps to be taken to quality assure the use of GIS in Epidemiology.  
                      |                                                                   | • Consideration of disclosure risk.                                                                                                                                                                                   |
| 6                    | Decide which geographical level(s) is/are appropriate for the analysis.     | • How the findings might be used to inform a local or national public health action.  
                      |                                                                   | • The importance of being able to be able to practise as an autonomous professional and exercise professional judgement.                                                                                                                                 |
AIM
The aim of this module is to enable trainees to develop and apply their skills in the design and analysis of epidemiological studies from identifying the public health problem; designing a study to address the problem, and leading the study through to the presentation of the results and their implications for population health, patient care and patient outcomes.

SCOPE
On completion of this module the trainee will be able to design an epidemiological study to address a public health problem; gain ethical approval if required; collect high-quality data using a validated data collection instrument; analyse the data; interpret the results; and disseminate the findings and recommendations. The trainee will have to work within legislative and local governance arrangements, including confidentiality.

LEARNING OUTCOMES
On successful completion of this module the trainee will:

1. Write a study protocol for an epidemiological study and consider ethical issues if required.
2. Develop an appropriate quality-assured data collection instrument.
3. Collate and manage the data and prepare the data set for analysis.
4. Analyse data according to the data analysis plan; archive data and analysis code as required.
5. Interpret study results, including a critique of study limitations.
6. Write a report presenting the results of the analysis and their implications for population health, patient care and patient outcomes.
**CLINICAL EXPERIENTIAL LEARNING**

The clinical experiential learning for this module is:

- Attend an ethics committee meeting as an observer and critically reflect on your learning from the experience.
- Attend a research governance group meeting as an observer and critically reflect on your learning from the experience.
- Visit an academic, clinical, or clinical trials unit, and discuss its role in public health research and the partnership with research volunteers.

All of these experiences should be recorded in your e-portfolio.

The following section details the competence and knowledge and understanding each trainee must gain. Each competence is linked to the relevant learning outcomes and trainees must demonstrate achievement of each competence for each linked learning outcome.

**PROFESSIONAL PRACTICE**

Trainees should ensure they refer to the professional practice learning framework and continue to achieve the professional practice competences alongside the competences defined in this module.
<table>
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<th>COMPETENCES</th>
<th>KNOWLEDGE AND UNDERSTANDING</th>
</tr>
</thead>
</table>
| 1                    | Identify the public health problem and justify the study, considering any ethical issues that may be relevant in order to protect patients and the public. | • Resources to conduct the study (e.g. human, financial).  
• Consideration of the time constraints.  
• Alignment with public health strategy.  
• Internal reporting and monitoring of progress. |
| 1                    | Conduct a literature review.                                                                       | • How to conduct a literature review.                                                            |
| 1                    | Define a research question and study objectives.                                                   | • How to define a research question and set study objectives.                                   |
| 1                    | Define study hypotheses and translate to statistical hypotheses.                                  | • How to define a study hypothesis.  
• How to translate study hypotheses to statistical null hypotheses.                               |
| 1                    | Determine the study population and study design.                                                   | • How to determine the study population.  
• How to choose the relevant study design:  
  o cross-sectional studies  
    i. prevalence and prevalence ratios  
  o prospective and retrospective cohort studies  
    i. attack rates, risk ratios and rate ratios  
    ii. attributable fraction  
  o case-control studies  
    i. odds and odds ratios  
  o case-case studies  
  o case-crossover studies  
  o case and control selection. |
<table>
<thead>
<tr>
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<th>KNOWLEDGE AND UNDERSTANDING</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>• How to select the study participants:</td>
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<tr>
<td></td>
<td></td>
<td>o cohort</td>
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<td></td>
<td></td>
<td>o cases selection</td>
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<td></td>
<td></td>
<td>o control selection.</td>
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<td></td>
<td></td>
<td>• How to prevent bias in study design and data collection:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o information bias</td>
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<td></td>
<td></td>
<td>o selection bias.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 Describe sampling strategy and calculate sample size.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• How to choose a sampling strategy:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o non-probability sampling: convenience sampling, judgement sampling, quota sampling and snowball sampling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o probability sampling: simple random, systemic, stratified, multi-stage, cluster.</td>
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<tr>
<td></td>
<td></td>
<td>• How to assess the impact of response to the study.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• How to conduct sample size calculation:</td>
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<td>o OpenEpi, R</td>
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<td></td>
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<td>o methods for estimating the desired value of the measure of effect</td>
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<td>o power, significance.</td>
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<tr>
<td>1</td>
<td>Develop an analysis plan, including dummy tables and document the justification for modifications.</td>
<td>• How to plan for the relevant analysis:</td>
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<tr>
<td></td>
<td></td>
<td>o descriptive analysis</td>
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<td></td>
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<td>o bivariate analysis</td>
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<td></td>
<td></td>
<td>o univariate analysis</td>
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<td>o multivariable analysis, if necessary.</td>
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<td></td>
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<td>• How to correct bias in data analysis.</td>
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<tr>
<td></td>
<td></td>
<td>• How to choose the appropriate dummy tables for presentation of</td>
</tr>
<tr>
<td>KEY LEARNING OUTCOMES</td>
<td>COMPETENCES</td>
<td>KNOWLEDGE AND UNDERSTANDING</td>
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</tr>
</tbody>
</table>
| 1                    | Define the strategy for communication of results taking into account diversity in patients and populations. | • How to define the audience for communication.  
• How to select the appropriate method for communication. |
| 1                    | Consider ethical issues that might be relevant and consult the National Research Ethics Service and apply and gain ethical approval if necessary. | • Ethical and research governance process.  
• Patient confidentiality and the limits of the concept of confidentiality.  
• Caldicott/Caldicott Guardians.  
• Legal issues, e.g. legislation – Data Protection Act – ICO, impact of breaches.  
• Confidentiality.  
• Secure data storage.  
• Archiving of study data. |
| 2                    | Identify data needed to answer the study question and design an appropriate quality-assured data collection instrument. | • How to determine the information required.  
• How to define target respondents.  
• How to choose the method(s) of reaching target respondents, including patients.  
• How to describe the key elements of questionnaire design:  
  o information required  
  o define target respondents  
  o choose the method(s) of reaching target respondents  
  o question content: demographic information, establish rapport, information required for the study  
  o question wording: closed, open-ended and open response-option questions  
  o meaningful order and format  
  o length of the questionnaire  
  o layout |
<table>
<thead>
<tr>
<th>KEY LEARNING OUTCOMES</th>
<th>COMPETENCES</th>
<th>KNOWLEDGE AND UNDERSTANDING</th>
</tr>
</thead>
</table>
| 3                     | Conduct data collection and entry. | • How to conduct data entry:  
  o double entry  
  o data entry checks. |
| 3                     | Conduct data handling and data management. | • How to manipulate, manage and quality assure data within a data set:  
  o variables – types, numeric formats, decimals, date and time, string  
  o getting data into and out of programmes  
  o documentation commands – labels  
  o calculations – generate and replace, recoding, checking correctness, missing data  
  o data structure – selecting observations and variables, renaming and reordering, sorting, collapsing data, combining files  
  o folders, filenames, variable names, error prevention.  
  • How to assure data quality:  
    o completeness, accuracy, validity, accuracy, timeliness, consistency  
    o data validation  
    o data dictionaries, standards and coding. |
| 3                     | Check the data for inconsistencies and missing data and prepare data set for analysis. | • Software commands and syntax.  
  • Reading data.  
  • Data types.  
  • Generating and recoding variables.  
  • Sorting data. |
<p>| 3                     | Generate summary variables as necessary. | • How to combine information from separate variables to produce a single summary variable. |</p>
<table>
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<tr>
<th>KEY LEARNING OUTCOMES</th>
<th>COMPETENCES</th>
<th>KNOWLEDGE AND UNDERSTANDING</th>
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</thead>
</table>
| 4                     | Undertake a descriptive analysis of the data variables. | • How to describe data variables:  
  o categorical variables  
  o continuous variables. |
| 4                     | Conduct bivariate analysis. | • How to assess the association between independent variables:  
  o Parametric tests  
  o Non-parametric tests |
| 4                     | Conduct univariate analysis. | • How to assess the association between the dependent (outcome) variable and independent variables:  
  o calculate the relevant measure of association  
  o calculate confidence intervals  
  o test the relevant hypotheses. |
| 4                     | Conduct stratified analysis to identify effect modification and confounding. | • How to conduct stratified analysis.  
  • How to identify confounding and effect modification from stratified analysis. |
| 4                     | Conduct multivariable analysis if required to adjust for multiple confounders and effect modifiers. | • How to conduct multivariable analysis.  
  • How to identify confounding in multivariable analysis.  
  • How to identify interaction in multivariable analysis. |
| 4                     | Archive data and analysis code as required. | • How to ensure reproducibility of analyses and outputs:  
  o how to save the data  
  o how to automate analysis, e.g. by generating a '.R' file. |
| 5                     | Interpret significant and non-significant findings. | • How to interpret the results of the statistical analyses conducted.  
  • How to assess whether additional analyses are needed.  
  • How to infer findings to the population.  
  • The importance of being able to be able to practise as an autonomous professional and exercise professional judgement. |
| 5                     | Identify limitations and make a final conclusion about the study results. | • How to identify study limitations, including possible sources of bias.  
  • How to conclude the study results, taking limitations into account.  
  • How to infer causality (Bradford-Hill or similar criteria). |
<table>
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<tr>
<th>KEY LEARNING OUTCOMES</th>
<th>COMPETENCES</th>
<th>KNOWLEDGE AND UNDERSTANDING</th>
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<tbody>
<tr>
<td>6</td>
<td>Draft a report summarising the study findings and their impact on patients and the population.</td>
<td>• How to use the STROBE statement to identify items that should be included in the reports of observational studies. • How to use the standard IMRaD format in study reports:  ○ Introduction  ○ Methods  ○ Results  ○ Discussion.</td>
</tr>
<tr>
<td>6</td>
<td>Share report with appropriate colleagues for comment, collate comments and amend draft following feedback.</td>
<td>• How to identify relevant colleagues. • How to receive and evaluate critical feedback. • How to use version control for documents.</td>
</tr>
<tr>
<td>6</td>
<td>Share report for final sign-off and disseminate through appropriate communications channels.</td>
<td>• How to follow the process for final sign-off and dissemination. • How to identify the appropriate communication channels.</td>
</tr>
<tr>
<td>6</td>
<td>Summarise findings for a lay audience.</td>
<td>• How to identify the target audience. • How to characterise the needs and prior knowledge of the audience. • Principles of presenting information for the public, including the use of clear unambiguous language, i.e. non-scientific language that should be easily understood. • How to ensure information is presented in a way that recognises and respects different cultures. • Communicating with people who have a hearing or visual impairment.</td>
</tr>
<tr>
<td>MODULE TITLE</td>
<td>Scientific Communication (AE-8)</td>
<td>COMPONENT</td>
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<tr>
<td>AIM</td>
<td>The aim of this module is to enable trainees to develop and apply their skills to communicate complex scientific ideas to both professional and non-specialist audiences.</td>
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<tr>
<td>SCOPE</td>
<td>On completion of this module the trainee will be able to create and deliver clear, concise and appropriate presentations for the relevant audience and develop concise and appropriate briefings for mass media. They will also further apply their knowledge of research, development and innovation as they prepare communications (an abstract and manuscript) for a scientific conference and a manuscript for submission to a journal for peer review. This module will require the trainee to utilise the knowledge and skills gained in all of the preceding modules, including the ability to communicate with a diverse range of stakeholders, including the public, policy makers and colleagues.</td>
<td></td>
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</table>

**LEARNING OUTCOMES**

**On successful completion of this module the trainee will:**

1. Create and deliver clear, concise and appropriate presentations for the relevant audience, e.g. the public, professional organisations, other healthcare professionals, decision makers.
2. Submit an abstract for oral or poster presentation to a scientific conference.
3. Draft a manuscript for submission to a peer-review journal.
4. Develop and evaluate concise and appropriate briefings for mass media aimed at patients and the public.
CLINICAL EXPERIENTIAL LEARNING

The clinical experiential learning for this module is:

- Arrange an interview with a scientific journal editor; plan the interview and gain advice from the editor to maximise the likelihood of successful acceptance of a manuscript.
- Shadow a press officer to better understand the process of developing proactive press materials for patients and the public, and reactive strategies for dealing with press queries. Attend a public health-related press conference and critically reflect on how your experience will impact on your future practice as a Clinical Scientist in Applied Epidemiology.
- In liaison with your press office, arrange a visit to a print or broadcast media outlet to gain inside knowledge on how the media work with health news to present news stories for patients and the public, and critically reflect on how your experience will impact on your future practice as a Clinical Scientist in Applied Epidemiology.

All of these experiences should be recorded in your e-portfolio.

The following section details the competence and knowledge and understanding each trainee must gain. Each competence is linked to the relevant learning outcomes and trainees must demonstrate achievement of each competence for each linked learning outcome.

PROFESSIONAL PRACTICE

Trainees should ensure they refer to the professional practice learning framework and continue to achieve the professional practice competences alongside the competences defined in this module.
<table>
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<tr>
<th>KEY LEARNING OUTCOMES</th>
<th>COMPETENCES</th>
<th>KNOWLEDGE AND UNDERSTANDING</th>
</tr>
</thead>
</table>
| 1                     | Identify the target audience and characterise their needs and prior knowledge. | • How to identify the target audience.  
• How to characterise the needs and prior knowledge of the audience.  
• Principles of presenting information for the public, including the use of clear unambiguous language, i.e. non-scientific language that should be easily understood.  
• How to ensure information is presented in a way that recognises and respects different cultures.  
• Communicating with people who have a hearing or visual impairment. |
| 1                     | Design a presentation appropriate to this audience and context for delivery. | • How to design a scientific presentation for the different audiences, e.g. public, patients and decision makers.  
• How to convey complex scientific findings in a comprehensible manner.  
• Techniques for constructing an engaging and effective presentation.  
• Range of data presentations available, e.g. tables, graphs, maps and infographics.  
• How to determine if the information/message has been understood by the target audience. |
| 1                     | Rehearse the presentation and deliver to an audience including your supervisor within allocated time. | • The principles of effective verbal presentation skills, including body language and presence; confidence-building techniques; credibility, status and rapport using non-verbal behaviour.  
• Techniques for delivering an effective presentation.  
• Principles of public speaking and presentation. |
| 1                     | Design a means of gathering feedback on the presentation and critically reflect on this, identifying examples of good practice and | • Critical reflective frameworks.  
• Giving and receiving feedback, including feedback frameworks.  
• How to develop and implement effective action plans to address feedback as part of the cycle of reflection. |
<table>
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<tr>
<th>KEY LEARNING OUTCOMES</th>
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<td></td>
<td>areas for improvement.</td>
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</table>
| 2 | Identify a conference suitable for disseminating study findings and identify and invite relevant co-authors to contribute to the submission. | • How to identify the right conference.  
• Process for creation, ratification and submission of a conference abstract.  
• Techniques for minimising word count.  
• How to write a scientific abstract.  
• Techniques for negotiation. |
| 2 | Obtain relevant guidelines for abstract format from the conference website and draft an abstract conforming to guidelines. | |
| 2 | Agree contents of abstract with co-authors and submit. | |
| 3 | Identify a target journal suitable for disseminating study findings and invite relevant co-authors to contribute, ensuring any potential conflicts of interest are declared. | • How to identifying the target journal, e.g. audience, impact factor, open access, cost.  
• Declaration of potential conflicts of interest.  
• Guidelines for authorship and author roles (correspondent, guarantor). |
| 3 | Access author guidelines from journal website and draft manuscript according to International Committee of Medical Journal Editors (ICMJE) uniform requirements and journal house style. | • ICMJE guidelines on preparing a manuscript for submission to a biomedical journal.  
• How to prepare a manuscript for journal submission – format, structure, authorship, contributorship.  
• How to convey complex scientific findings in a comprehensible manner.  
• Reporting guidelines, e.g. STROBE. |
<p>| 3 | Co-ordinate sequential rounds of distribution of draft among co-authors and integration of | • How to maintain version control. |</p>
<table>
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<tr>
<th>KEY LEARNING OUTCOMES</th>
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<td>comments.</td>
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<tr>
<td>3</td>
<td>Assess relative contributions of co-authors and agree authorship order accordingly.</td>
<td>• Techniques for negotiation.</td>
</tr>
</tbody>
</table>
| 3                     | Submit agreed manuscript and manage ensuing process of reviewing peer-review comments, proof reading and copyright/licensing agreement. | • Sign-off mechanisms within organisations.  
• Political sensitivities of publication.  
• Post-submission process – proof reading, copyright transfer.  
• Declaration of potential conflicts of interest. |
| 4                     | Agree with relevant stakeholders key messages for inclusion in the media briefing for patients and the public. | • Use of appropriate and engaging language to convey clear and readily comprehensible message.  
• Use of language to minimise likelihood of misunderstanding or unwarranted public alarm.  
• How to draft a press statement.  
• Political sensitivities of publication.  
• Risk of disclosure of personal data.  
• Potential for misinterpretation of data.  
• Principles of presenting written information for the public, including the use of clear unambiguous language, i.e. non-scientific language that should be easily understood.  
• The boundaries of stakeholder engagement and interaction.  
• Challenges of dealing with public health issues, e.g. the role of the press in shaping public opinion and the extent to which that influences political action. |
| 4                     | Discuss and agree a communications strategy with the lead press officer, including identification of an appropriate spokesperson. | |
| 4                     | Draft the press statement and background briefing materials. | |
| 4                     | Distribute and agree press statement with relevant stakeholders and senior level sign-off. | |
SECTION 7: CONTRIBUTORS
Contributor List

Members of the STP MSc and Work Based Programme in Applied Epidemiology

Development of the STP Programme (MSc Clinical Sciences and Work Based Programme) for Applied Epidemiology has been coordinated by the Modernising Scientific Careers team working with Public Health England. The professionals who have contributed to the development of this Scientist Training Programme since 2015 include:

Samantha Bracebridge  Lead Editor; Public Health Strategy, Public Health England
Charlotte Anderson  National Infection Service, Public Health England
John Battersby  Chief Knowledge Officer Directorate, Public Health England
Andre Charlett  National Infection Service, Public Health England
Stephen Davies  Finance and Commercial Directorate, Public Health England
Valerie Decraene  National Infection Service, Public Health England
Lorraine Doherty  Public Health Agency, Northern Ireland
Julian Flowers  Chief Knowledge Officer Directorate, Public Health England
Rachel Freeman  National Infection Service, Public Health England
Maya Gobin  National Infection Service, Public Health England
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Theresa Lamagni  National Infection Service, Public Health England
James Lewis  Health Protection Directorate, Public Health England
Janet McCulloch  National Infection Service, Public Health England
Tim McIlhinney  National Infection Service, Public Health England
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Isabel Oliver  National Infection Service, Public Health England
Eamonn O’Moore  Health and Wellbeing Directorate, Public Health England
Sam Organ  National Infection Service, Public Health England
Natasha Roberts  Chief Knowledge Officer Directorate, Public Health England
Satnam Sagoo  Organisation and Workforce Development, Public Health England
David Stirling  NHS National Services, Scotland
Adrian Wensley  National Infection Service, Public Health England
Ruth Robertson  Health Protection Scotland/NHS Education for Scotland

Professional bodies and societies and patient groups were invited to review the MSc and their feedback has shaped the final publication:

- Academy of Medical Royal Colleges
- Association of Directors of Public Health UK (ADPH)
- Centers for disease control and prevention (CDC)
• Chartered Institute of Environmental Health
• Chief Scientific Officer (England): Professor Sue Hill
• Chief Scientific Officer: Professor Ian Young (Northern Ireland)
• Communicable Disease Surveillance Centre Wales (CDSC)
• Council for Healthcare Science
• Department of Health
• European Centre for Disease Control and Prevention (ECDC)
• Faculty of Public Health
• Health Protection Scotland
• Health Protection Society
• Healthcare Science Officer (Scotland): Karen Stewart
• Institute for Public Health Ireland
• Interim Chief Scientific Adviser (Health) Wales: Christine Morrell
• Local Government Association (LGA)
• MSC Higher Specialist Scientist Clinical Bioinformatics Curriculum Development Group
• National Infection Service Department Heads
• National Institute for Health Research: Public Health Research Network Programme
• National School of Healthcare Science
• Public Health Agency for Northern Ireland
• Public Health and Intelligence Division, National Services Scotland
• Public Health England
• Public Health England Centre Directors
• Public Health England Chairman
• Public Health England Chief Executive Officer
• Public Health Information Group: Local Area Research + Intelligence Association
• Public Health Wales
• Public Health Wales Observatory
• Royal College of General Practitioners
• Royal College of Paediatrics and Child Health
• Royal College of Pathologists
• Royal College of Physicians
• Royal College of Obstetricians and Gynaecologists
• Royal Society of Public Health
• Scottish Health Protection Network – workforce education group
• Scottish Public Health Observatory
• Scottish Public Health Workforce Group
• Training Programs in Epidemiology and Public Health Interventions Network (TEPHINET)
• UK Health Forum

Patient Groups

• Academy for Healthcare Science Patient Representatives
• Medical Royal Colleges Patient panels
• People’s Panel
• UK Public Health Forum

Professional Reviewers: Individuals

• Professor Paul Cosford, Director for Health Protection and Medical Director, Public Health England
• Professor Derrick Crook, Director, National Infection Service, Public Health England
• Dr Chris Gibson, Head of the School of Healthcare Science
• Dr Susan Hopkins, Consultant Healthcare Epidemiologist, Public Health England
SECTION 8: APPENDICES
### APPENDIX 1: GLOSSARY

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Clinical experiential learning</td>
<td>The cyclical process linking concrete experience with abstract conceptualisation through reflection and planning.</td>
</tr>
<tr>
<td>Clinical experiential learning outcomes</td>
<td>The activities that the trainee will undertake to enable and facilitate their learning in the workplace.</td>
</tr>
<tr>
<td>Competence</td>
<td>The ability of an individual to perform a role consistently to required standards, combining knowledge, understanding, skills and behaviour.</td>
</tr>
<tr>
<td>Competence statements</td>
<td>Active and outcome-based statements that provide a further breakdown of the Learning Outcomes – reflecting what the trainee will be able to do in the workplace at the end of the programme. Each competence should be linked back to the numbered Learning Outcomes.</td>
</tr>
<tr>
<td>Component</td>
<td>An indication of the type of module within a learning guide, i.e. rotational, specialist, or elective.</td>
</tr>
<tr>
<td>Curricula</td>
<td>An outline of the expected educational outcomes across a subject area. The learning that is expected to take place during the Scientist Training Programme described in terms of knowledge, skills and attitudes.</td>
</tr>
<tr>
<td>Division</td>
<td>A high-level description of an area of practice within healthcare science. There are three divisions: Life Sciences, Physical Sciences, and Biomedical Engineering and Physiological Sciences.</td>
</tr>
<tr>
<td>Domains of learning</td>
<td>Cognitive (knowledge and intellectual skills), affective (feelings and attitudes), interpersonal (behaviour and relationships with others) and psychomotor (physical skills).</td>
</tr>
<tr>
<td>Feedback</td>
<td>Specific information about the comparison between a trainee’s observed performance and a standard, given with the intent of improving the trainee’s performance (van de Ridder JMM, Stokking KM, McGaghie WC and ten Cate OT. What is feedback in clinical education? <em>Medical Education</em> 2008: 42: 189–197).</td>
</tr>
<tr>
<td>Genetics</td>
<td>The study of hereditary</td>
</tr>
<tr>
<td>Genomics</td>
<td>The study of genes and their functions, and related techniques.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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<tr>
<td><strong>Genomic Healthcare</strong></td>
<td>The use of genomic information and technologies at any stage of the healthcare continuum to determine disease risk and predisposition, diagnosis and prognosis, and the selection and prioritisation of therapeutic options. Genomic healthcare also takes into account the potential ethical, psychological and social implications of genomic information and the application of genomic technologies.</td>
</tr>
<tr>
<td><strong>Good Scientific Practice</strong></td>
<td>Non-statutory guidance on the minimum requirements for good practice for the healthcare science workforce.</td>
</tr>
<tr>
<td><strong>Host department</strong></td>
<td>The department that is responsible for the three-year training programme and in which the training officer is based.</td>
</tr>
<tr>
<td><strong>Job</strong></td>
<td>A specific definition of the work activities, requirements and skills required to undertake work activities within a local context. This differs from a role – see below.</td>
</tr>
<tr>
<td><strong>Key learning outcome</strong></td>
<td>A defined learning outcome linked to relevant competence(s) within the workplace Learning Guide.</td>
</tr>
<tr>
<td><strong>Knowledge and understanding</strong></td>
<td>The knowledge and understanding that must be applied in the workplace to achieve the stated competence.</td>
</tr>
<tr>
<td><strong>Learning framework</strong></td>
<td>The specification for work-based learning contained within the Learning Guide.</td>
</tr>
<tr>
<td><strong>Learning module</strong></td>
<td>A distinct set of learning outcomes and competences that form part of a programme. Modules may be rotational, specialist, elective, or professional practice and can be combined to meet the needs of specific programmes.</td>
</tr>
<tr>
<td><strong>Learning outcome</strong></td>
<td>A high-level, outcome-based statement that describes what a trainee will be able to do at the end of the module.</td>
</tr>
<tr>
<td><strong>Mentoring</strong></td>
<td>Mentoring is <em>a process in which a trainer (mentor) is responsible for overseeing the career and development of the trainee</em>. The emphasis is therefore on the relationship (rather than the activity).</td>
</tr>
<tr>
<td><strong>Module aim</strong></td>
<td>The overall objective of a work-based learning module – defining the intended learning achievements of the trainee. The aim works together with the ‘Scope’ statement to define the overall objectives and scope of the module.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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<tr>
<td>Module scope</td>
<td>A statement within work-based learning modules that defines the range/limits of the learning undertaken by the trainee in a module – patients/investigations/equipment/modalities, etc.</td>
</tr>
<tr>
<td>National Occupational Standards</td>
<td>Nationally recognised standards of expected workplace performance and level of competence for a role. The standards are outcome based, defining what the role holder should be able to do, as well as what they must know and understand to demonstrate competent work performance. National Occupational Standards are supported by nationally agreed frameworks of expected attitudes, behaviour and skills.</td>
</tr>
<tr>
<td>Practical skill</td>
<td>A cognitive, psychomotor, physical, or communicative ability that supports performance of the required role.</td>
</tr>
<tr>
<td>Programme</td>
<td>The package of learning, teaching assessment and quality assurance leading to an award.</td>
</tr>
<tr>
<td>Provider</td>
<td>An organisation that delivers required training and learning activities to specified quality assurance requirements.</td>
</tr>
<tr>
<td>Role</td>
<td>A collection of functions undertaken in the workplace that represent the main broad areas of work for all similar workers at national level. A role differs from a job, the latter being defined specifically for a local context.</td>
</tr>
<tr>
<td>Specialism</td>
<td>A focused area of practice within a theme of healthcare science.</td>
</tr>
<tr>
<td>Sporadic cancer</td>
<td>Cancer that occurs in people who do not have a family history of that cancer or an inherited change in their DNA that would increase their risk for that cancer</td>
</tr>
<tr>
<td>Trainer</td>
<td>A qualified individual who provides learning and development support for trainees.</td>
</tr>
<tr>
<td>Theme</td>
<td>A cluster of related specialisms within a division of healthcare science.</td>
</tr>
<tr>
<td>Work-based learning</td>
<td>Learning that takes place in a real work setting and involves the application of academic learning to real work activities.</td>
</tr>
<tr>
<td>Work performance</td>
<td>The requirements of satisfactory and consistent demonstration of competence in specified functions for a work role.</td>
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<tr>
<td>Term</td>
<td>Definition</td>
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<tr>
<td>Workplace</td>
<td>A real work setting in which the trainee can apply learning.</td>
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Good Scientific Practice

Section 1: The purpose of this document

There are three key components to the Healthcare Science workforce in the UK:

1. Healthcare Science Associates and Assistants who perform a diverse range of task based roles with appropriate levels of supervision.

2. Healthcare Science Practitioners have a defined role in delivering and reporting quality assured investigations and interventions for patients, on samples or on equipment in a healthcare science specialty, for example Cardiac Physiology, Blood Sciences or Nuclear Medicine. They also provide direct patient care and more senior Healthcare Science Practitioners develop roles in specialist practice and management.

3. Healthcare Scientists are staff that have clinical and specialist expertise in a specific clinical discipline, underpinned by broader knowledge and experience within a healthcare science theme. Healthcare Scientists undertake complex scientific and clinical roles, defining and choosing investigative and clinical options, and making key judgements about complex facts and clinical situations. Many work directly with patients. They are involved, often in lead roles, in innovation and improvement, research and development, and education and training. Some pursue explicit joint academic career pathways, which combined clinical practice and academic activity in research, innovation and education.

This document sets out the principles and values on which good practice undertaken by the Healthcare Science workforce is founded.

Good Scientific Practice sets out for the profession and the public the standards of behaviour and practice that must be achieved and maintained in the delivery of work activities, the provision of care and personal conduct.

Good Scientific Practice uses as a benchmark the Health Professions Council (HPC) Standards of Proficiency and Standards of Conduct, Performance and Ethics, but expresses these within the context of the specialities within Healthcare Science, recognising that three groups of the workforce, Biomedical Scientists, Clinical Scientists and Hearing Aid Dispensers are regulated by the HPC. The aim is that the standards are accessible to the profession and understandable by the public.

Good Scientific Practice represents standards and values that apply throughout an individual’s career in healthcare science at any level of practice. The standards will be contextualised by the role within Healthcare Science that an individual
undertakes. This means that the standards must be interpreted based on the role that an individual performs. For example, in supervised roles where individuals work within defined procedures, rather than autonomously, some standards will need to be interpreted appropriately for the context of the specific role. There will, however, always be a requirement for an individual to work within the limits of their scope of practice and competence.

Students and trainees will be expected to be working towards meeting the expectations set out in this document. However, if an individual is undertaking further training and development following qualification from a professional training programme, he or she will be expected to be able to meet the standards in this document within their scope of practice.

The standards have been used to support curriculum development and will be used to underpin the process of judging individual equivalence, particularly for emerging specialisms.

The standards have been divided into five domains. The domains of Good Scientific Practice detailed in section 2 are:

1. Professional Practice
2. Scientific Practice
3. Clinical Practice
4. Research and Development
5. Clinical Leadership

Section 2: The Domains of Good Scientific Practice

Domain 1: Professional Practice

All patients and service users are entitled to good standards of professional practice and probity from the Healthcare Science workforce, including the observance of professional codes of conduct and ethics. In maintaining your fitness to practise as a part of the Healthcare Science workforce, you must:

1.1 Professional Practice

1.1.1 Make the patient your first concern
1.1.2 Exercise your professional duty of care
1.1.3 Work within the agreed scope of practice for lawful, safe and effective Healthcare Science
1.1.4 Keep your professional, scientific, technical knowledge and skills up to date
1.1.5 Engage fully in evidence-based practice
1.1.6 Draw on appropriate skills and knowledge in order to make professional judgements
1.1.7 Work within the limits of your personal competence
1.1.8 Act without delay on concerns raised by patients or carers or if you have good reason to believe that you or a colleague may be putting people at risk
1.1.9 Never discriminate unfairly against patients, carers, or colleagues
1.1.10 Treat each patient as an individual, respect their dignity and confidentiality and uphold the rights, values and autonomy of every service user, including their role in the diagnostic and therapeutic process and in maintaining health and wellbeing

1.1.11 Respond constructively to the outcome of audit, appraisals and performance reviews, undertaking further training where necessary

1.2 Probity

1.2.1 Make sure that your conduct at all times justifies the trust of patients, carers and colleagues and maintains the public’s trust in the scientific profession

1.2.2 Inform the appropriate regulatory body without delay if, at any time, you have accepted a caution, been charged with or found guilty of a criminal offence, or if any finding has been made against you as a result of fitness to practise procedures, or if you are suspended from a scientific post, or if you have any restrictions placed on your scientific, clinical or technical practice

1.2.3 Be open, honest and act with integrity at all times, including but not limited to: writing reports, signing documents, providing information about your qualifications, experience and position in the scientific community, and providing written and verbal information to any formal enquiry or litigation, including that relating to the limits of your scientific knowledge and experience

1.2.4 Take all reasonable steps to verify information in reports and documents, including research

1.2.5 Work within the Standards of Conduct, Performance and Ethics set by your profession

1.3 Working with Colleagues

1.3.1 Work with other professionals, support staff, service users, carers and relatives in the ways that best serve patients’ interests

1.3.2 Work effectively as a member of a multidisciplinary team

1.3.3 Consult and take advice from colleagues where appropriate

1.3.4 Be readily accessible when you are on duty

1.3.5 Respect the skills and contributions of your colleagues

1.3.6 Participate in regular reviews of team performance

1.4 Training and Developing Others

1.4.1 Contribute to the education and training of colleagues

1.4.2 If you have responsibilities for teaching, develop the skills, attitudes and practices of a competent teacher

1.4.3 Ensure that junior colleagues and students are properly supervised

1.4.4 Support colleagues who have difficulties with performance, conduct, or health

1.4.5 Share information with colleagues to protect patient safety

1.4.6 Provide work-based development for colleagues to enhance/improve skills and knowledge
Domain 2: Scientific Practice

As a part of the Healthcare Science workforce, you will keep your scientific and technical knowledge and skills up to date to effectively:

2.1 Scientific Practice

2.1.1 Develop investigative strategies/procedures/processes that take account of relevant clinical and other sources of information
2.1.2 Provide scientific advice to ensure the safe and effective delivery of services
2.1.3 Undertake scientific investigations using qualitative and quantitative methods to aid the screening, diagnosis, prognosis, monitoring and/or treatment of health and disorders appropriate to the discipline
2.1.4 Investigate and monitor disease processes and normal states
2.1.5 Provide clear reports using appropriate methods of analysing, summarising and displaying information
2.1.6 Critically evaluate data, draw conclusions from it, formulate actions and recommend further investigations where appropriate

2.2 Technical Practice

2.2.1 Provide technical advice to ensure the safe and effective delivery of services
2.2.2 Plan, take part in and act on the outcome of regular and systematic audit
2.2.3 Work within the principles and practice of instruments, equipment and methodology used in the relevant scope of practice
2.2.4 Demonstrate practical skills in the essentials of measurement, data generation and analysis
2.2.5 Assess and evaluate new technologies prior to their routine use
2.2.6 Identify and manage sources of risk in the workplace, including specimens, raw materials, clinical and special waste, equipment, radiation and electricity
2.2.7 Apply principles of good practice in health and safety to all aspects of the workplace
2.2.8 Apply correct methods of disinfection, sterilisation and decontamination, and deal with waste and spillages correctly
2.2.9 Demonstrate the appropriate level of skill in the use of information and communications technology

2.3 Quality

2.3.1 Set, maintain and apply quality standards, control and assurance techniques for interventions across all clinical, scientific and technological activities
2.3.2 Make judgements on the effectiveness of processes and procedures
2.3.3 Participate in quality assurance programmes
2.3.4 Maintain an effective audit trail and work towards continuous improvement

Domain 3: Clinical Practice
As a part of the Healthcare Science workforce, you will keep your clinical skills up to date and undertake the clinical duties appropriate to your role in order to effectively:

### 3.1 Clinical Practice

3.1.1 Ensure that you and the staff you supervise understand the need for and obtain relevant consent before undertaking any investigation, examination, provision of treatment, or involvement of patients and carers in teaching or research

3.1.2 Ensure that you and the staff you supervise maintain confidentiality of patient information and records in line with published guidance

3.1.3 Ensure that you and your staff understand the wider clinical consequences of decisions made on your actions or advice

3.1.4 Demonstrate expertise in the wider clinical situation that applies to patients who present in your discipline

3.1.5 Maintain up-to-date knowledge of the clinical evidence base that underpins the services that you provide and/or supervise and ensure that these services are in line with the best clinical evidence

3.1.6 Plan and determine the range of clinical/scientific investigations or products required to meet diagnostic, therapeutic, rehabilitative, or treatment needs of patients, taking account of the complete clinical picture

3.1.7 Plan and agree investigative strategies and clinical protocols for the optimal diagnosis, monitoring and therapy of patients with a range of disorders

3.1.8 Ensure that detailed clinical assessments are undertaken and recorded using appropriate techniques and equipment, and that the outcomes of these investigations are reviewed regularly with users of the service

3.1.9 Ensure the provision of expert interpretation of complex and/or specialist data across your discipline in the context of clinical questions posed

3.1.10 Undertake and record a detailed clinical assessment using appropriate techniques and equipment

3.1.11 Provide specialised clinical investigation and/or analysis appropriate to your discipline

3.1.12 Provide interpretation of complex and/or specialist data in the context of the clinical question posed

3.1.13 Provide clinical advice based on results obtained, including a diagnostic or therapeutic opinion for further action to be taken by the individual directly responsible for the care of the patient

3.1.14 Provide expert clinical advice to stakeholders in order to optimise the efficiency and effectiveness of clinical investigation of individuals and groups of patients

3.1.15 Prioritise the delivery of investigations, services, or treatment based on clinical need of patients

3.1.16 Represent your discipline in multidisciplinary clinical meetings to discuss patient outcomes and the appropriateness of services provided

3.1.17 Ensure that regular and systematic clinical audit is undertaken and be responsible for modifying services based on audit findings

### 3.2 Investigation and Reporting
3.2.1 Plan and conduct scientific, technical, diagnostic, monitoring, treatment and therapeutic procedures with professional skill and ensuring the safety of patients, the public and staff

3.2.2 Perform investigations and procedures/design products to assist with the management, diagnosis, treatment, rehabilitation, or planning in relation to the range of patient conditions/equipment within a specialist scope of practice

3.2.3 Monitor and report on progress of patient conditions/use of technology and the need for further interventions

3.2.4 Interpret and report on a range of investigations or procedures associated with the management of patient conditions/equipment

**Domain 4: Research, Development and Innovation**

As part of the Healthcare Science workforce, research, development and innovation are key to your role. It is essential in helping the NHS address the challenges of the ageing population, chronic disease, health inequalities and rising public expectations of the NHS. In your role, you will undertake the research, development and innovation appropriate to your role in order to effectively:

4.1 **Research, Development and Innovation**

4.1.1 Search and critically appraise scientific literature and other sources of information

4.1.2 Engage in evidence-based practice, participate in audit procedures and critically search for, appraise and identify innovative approaches to practice and delivery of healthcare

4.1.3 Apply a range of research methodologies and initiate and participate in collaborative research

4.1.4 Manage research and development within a governance framework

4.1.5 Develop, evaluate, validate and verify new scientific, technical, diagnostic, monitoring, treatment and therapeutic procedures and, where indicated by the evidence, adapt and embed them in routine practice

4.1.6 Evaluate research and other available evidence to inform own practice in order to ensure that it remains at the leading edge of innovation

4.1.7 Interpret data in the prevailing clinical context

4.1.8 Perform experimental work, produce and present results

4.1.9 Present data, research findings and innovative approaches to practice to peers in appropriate forms

4.1.10 Support the wider healthcare team in the spread and adoption of innovative technologies and practice

**Domain 5: Clinical Leadership**

All patients and service users have a right to expect that Healthcare Science services efficiently and effectively managed to meet service needs. As a leader in Healthcare Science, you will seek to effectively:

5.1 **Leadership**
5.1.1 Maintain responsibility when delegating healthcare activities and provide support as needed
5.1.2 Respect the skills and contributions of your colleagues
5.1.3 Protect patients from risk or harm presented by another person’s conduct, performance, or health
5.1.4 Treat your colleagues fairly and with respect
5.1.5 Make suitable arrangements to ensure that roles and responsibilities are covered when you are absent, including handover at sufficient level of detail to competent colleagues
5.1.6 Ensure that patients, carers and colleagues understand the role and responsibilities of each member of the team
5.1.7 Ensure that systems are in place through which colleagues can raise concerns and take steps to act on those concerns if justified
5.1.8 Ensure regular reviews of team performance and take steps to develop and strengthen the team
5.1.9 Take steps to remedy any deficiencies in team performance
5.1.10 Refer patients to appropriate health professionals
5.1.11 Identify and take appropriate action to meet the development needs of those for whom you have management, supervision, or training responsibilities
5.1.12 Act as an ambassador for the Healthcare Science community

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APPENDIX 3: FURTHER INFORMATION

NHS Networks
An open network to share curricula produced for the Modernising Scientific Careers programme. Join this network to get updates whenever there is new content.
Details of the Scientist Training Programme, including MSc Clinical Science Curricula, Work Based Learning Guides.

Council of Healthcare Science in Higher Education (CHS)
The Council of Healthcare Science in Higher Education builds a unified identity of academic healthcare science by representing the interests of the sector. Working to improve and maintain quality in healthcare science education and training, the Council itself is made up of senior members of the academic healthcare science team. The work of the Council is also informed by two special interest groups made up of staff involved in the delivery and implementation of the Modernising Scientific Careers programme. The Scientist Training Programme Special Interest Group brings together the providers of the MSc-level programme.
www.councilofhealthcarescience.ac.uk/

National School of Healthcare Science (NSHCS)
The National School of Healthcare Science is an important part of the new system for healthcare science training established through Modernising Scientific Careers. This new system was set up to ensure that patients benefit from the scientific and technical advances by ensuring that healthcare science staff have the knowledge and skills to put these advances into practice.
www.nshcs.org.uk

Academy for Healthcare Science (AHCS)
The Academy for Healthcare Science is a UK-wide organisation bringing together a diverse and specialised scientific community working within the National Health Service (NHS) and other associated organisations (e.g. the Health Protection Agency, NHS Blood and Transplant), Health and Social Care Northern Ireland (HSCNI), and the academic and independent healthcare sector.
www.ahcs.ac.uk

Health and Care Professions Council (HCPC)
The Health and Care Professions Council is a regulator set up to protect the public. It keeps a register of health professionals who meet the HCPC standards for their training, professional skills, behaviour and health.
www.hpc-uk.org/

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