

CAREERS THROUGH MATHS: DERMATOLOGIST



JOB DESCRIPTION

A dermatologist in the UK is a fully qualified medical doctor who specialises in the diagnosis and treatment of skin, hair, and nail diseases. Their daily responsibilities are highly varied, ranging from managing common conditions like acne and eczema in outpatient clinics to diagnosing and treating complex skin cancers such as malignant melanoma. The work environment is primarily within the National Health Service (NHS) in hospital dermatology departments, but many also work in private practice, such as with providers like BUPA or The Harley Medical Group. A typical day involves conducting patient consultations, performing surgical procedures like skin biopsies or excisions, interpreting laboratory results, and using specialised equipment such as dermatoscopes for magnified skin examination.

The role extends beyond clinical practice to include significant teaching, audit, and research responsibilities, especially for consultants. Dermatologists must meticulously document patient interactions and treatment plans using electronic health record systems like SystmOne or EMIS, which are standard across the NHS. They work as part of a multi-disciplinary team (MDT) alongside clinical nurse specialists, pathologists, and plastic surgeons to provide holistic patient care. For instance, in a skin cancer MDT meeting at a major teaching hospital like St John's Institute of Dermatology in London, the dermatologist presents patient data and imaging results to collaboratively decide on the best treatment pathway.

Mathematics is central to the role, underpinning both clinical decision-making and research. Dermatologists constantly use quantitative reasoning to calculate drug

dosages based on a patient's body surface area, assess the percentage of skin affected by a condition like psoriasis using the Psoriasis Area and Severity Index (PASI), and interpret statistical data from clinical trials to determine the most effective new treatments. The entire evidence-based medicine approach, which is a cornerstone of NHS practice, relies on a deep understanding of biostatistics to critically appraise research literature and apply findings to patient care safely and effectively.

HOW MATHEMATICS IS USED

- **Biostatistics and Epidemiology:** This is the foundational mathematics for evidence-based medicine. Dermatologists use statistical principles to interpret the results of clinical trials, which inform National Institute for Health and Care Excellence (NICE) guidelines. For example, when assessing a new biologic drug for psoriasis, they must understand metrics like p-values, confidence intervals, and Number Needed to Treat (NNT) to evaluate its efficacy and safety compared to existing therapies. They also use epidemiological data to understand disease prevalence in different UK populations, such as analysing the rising incidence of melanoma in Scotland, which has the highest rates in the UK.
- **Geometry and Measurement:** Precise measurement is critical in dermatological surgery. When excising a skin lesion, a dermatologist must calculate the dimensions of the excision and plan the repair, often involving geometric principles to design flaps or grafts that minimise tension and maximise cosmetic outcomes. Calculating the Body Surface Area (BSA) using formulas like the Mosteller formula ($\sqrt{[\text{height}(\text{cm}) \times \text{weight}(\text{kg}) / 3600]}$) is essential for prescribing systemic medications like chemotherapy agents for skin cancer, ensuring the dosage is both safe and effective.
- **Probability and Risk Assessment:** Dermatologists daily assess probability to guide diagnosis and management. Using a dermatoscope, they analyse patterns in skin lesions based on predefined algorithms (e.g., the ABCDE rule for melanoma or the 3-point checklist) to estimate the probability of malignancy. They also calculate a patient's absolute risk of developing skin cancer based on risk factors such as Fitzpatrick skin type, family history, and cumulative sun exposure, which informs preventative advice and screening intervals.

- **Data Analysis and Modelling:** In clinical audit and research, dermatologists analyse large datasets to improve patient outcomes. For example, they might analyse their own departmental data on waiting times for skin cancer referrals against the NHS 2-week wait target, using statistical process control charts to identify trends. In research settings, such as within the UK Dermatology Clinical Trials Network (UKDCTN), they use mathematical modelling to predict disease progression or to analyse genomic data from tumour samples to identify prognostic markers.
- **Pharmacokinetics and Dosage Calculations:** This involves applying calculus to understand how drugs are absorbed, distributed, metabolised, and excreted by the body. When prescribing systemic treatments like isotretinoin for severe acne, dermatologists must calculate the cumulative dose (in mg per kg of body weight) over a course of treatment to maximise efficacy while minimising the risk of relapse. This requires careful mathematical planning of the dosage regimen over several months.

KEY SKILLS & TOOLS

Skill/Tool	Application
Electronic Health Record (EHR) Systems	Using NHS-standard systems like SystmOne or EMIS Web to record patient data. This involves quantitative data entry (e.g., PASI scores, lesion sizes) and utilising built-in calculators for drug dosages and clinical risk scores, ensuring accurate and auditable patient records.
Statistical Analysis Software (SPSS, R)	Using software packages to conduct research analyses. For example, a dermatologist at a university hospital might use R to perform a regression analysis on data from a cohort study investigating the link between eczema and food allergies in a UK paediatric population.
Dermoscopy and Digital Imaging	Operating dermatoscopes and total body photography systems to capture and analyse skin lesions. Mathematical algorithms are used for digital image analysis to track changes in the size, shape,

	and colour of moles over time, providing quantitative evidence for diagnosis.
Clinical Scoring Indices (e.g., PASI, SCORAD)	Applying validated clinical scoring systems that are inherently mathematical. The PASI score for psoriasis, for instance, involves complex calculations based on the area of skin affected and the severity of redness, thickness, and scaling, providing an objective measure for tracking treatment response in clinical trials and practice.
Surgical Planning Software	Using specialised software for Mohs micrographic surgery, a technique used for high-risk skin cancers. This process involves meticulously mapping the excised tissue onto a diagram, using geometric coordinates to ensure complete tumour removal while preserving healthy tissue, which is crucial for complex cases on the face.
Multi-disciplinary Team (MDT) Presentation	Synthesising complex patient data (histology reports, imaging measurements, statistical outcomes) into clear presentations for MDT meetings. This involves creating graphs and charts to visually communicate the mathematical rationale for a chosen treatment plan to colleagues from other specialities.
Clinical Audit Methodology	Applying the audit cycle, a systematic process of measuring care against standards. This requires designing data collection tools, analysing quantitative results (e.g., percentage of patients seen within a target time), and using statistical tests to determine if changes in practice have led to significant improvements, a key requirement for NHS appraisals.

Typical Pathway: The pathway begins with excelling in science and mathematics at GCSE and A-level (or Scottish Highers), with Chemistry and Biology being essential. Prospective dermatologists must then complete a medical degree (usually 5-6 years) at a university accredited by the General Medical Council (GMC). Following graduation, they enter the two-year UK Foundation Programme. After this, they compete for a place in a specialty training programme in Dermatology, which typically lasts 4-5 years (ST3-ST7). During this time, they pass rigorous examinations set by the Royal College of Physicians (RCP) to become a Member (MRCP) and may also pursue a postgraduate research degree (MD or PhD). Upon completion of training, they are eligible for entry onto the GMC Specialist Register and can apply for Consultant Dermatologist posts in the NHS. Continuous professional development

is mandatory, managed through the RCP's CPD diary system.

Industry Demand: Demand for dermatologists in the UK is consistently high and exceeds supply. The British Association of Dermatologists (BAD) frequently highlights workforce shortages. Key drivers include an ageing population (increasing skin cancer rates), rising public awareness of skin health, and the development of complex but effective new treatments requiring specialist supervision. The NHS Long Term Plan emphasises early cancer diagnosis, further increasing the demand for dermatological expertise. Opportunities exist in major teaching hospitals, district general hospitals, and a growing private sector.

Real-World Impact: Dermatologists have a profound impact on UK society and the economy. They are on the front line of skin cancer diagnosis, directly saving lives through early detection and treatment of melanoma, the fifth most common cancer in the UK. By effectively managing chronic conditions like psoriasis and eczema, they significantly improve patients' quality of life and reduce the long-term economic burden on the NHS and social care system. Their research, often conducted through UK centres of excellence like the St John's Institute of Dermatology, leads to innovations in treatment that are adopted worldwide, contributing to the UK's reputation for medical excellence and attracting international investment.