1.

History

The earliest form of regression was the method of least squares, which was published by Legendre in 1805, and by Gauss in 1809. Legendre and Gauss both applied the method to the problem of determining, from astronomical observations, the orbits of bodies about the Sun (mostly comets, but also later the then newly discovered minor planets). Gauss published a further development of the theory of least squares in 1821, including a version of the Gauss–Markov theorem.

The term "regression" was coined by Francis Galton in the 19th century to describe a biological phenomenon. The phenomenon was that the heights of descendants of tall ancestors tend to regress down towards a normal average (a phenomenon also known as regression toward the mean). For Galton, regression had only this biological meaning, but his work was later extended by Udny Yule and Karl Pearson to a more general statistical context. In the work of Yule and Pearson, the joint distribution of the response and explanatory variables is assumed to be Gaussian. This assumption was weakened by R.A. Fisher in his works of 1922 and 1925. Fisher assumed that the conditional distribution of the response variable is Gaussian, but the joint distribution need not be. In this respect, Fisher's assumption is closer to Gauss's formulation of 1821.

In the 1950s and 1960s, economists used electromechanical desk "calculators" to calculate regressions. Before 1970, it sometimes took up to 24 hours to receive the result from one regression.

Regression methods continue to be an area of active research. In recent decades, new methods have been developed for robust regression, regression involving correlated responses such as time series and growth curves, regression in which the predictor (independent variable) or response variables are curves, images, graphs, or other complex data objects, regression methods accommodating various types of missing data, nonparametric regression, Bayesian methods for regression, regression in which the predictor variables are measured with error, regression with more predictor variables than observations, and causal inference with regression.

2.

The terms medical record, health record are used somewhat interchangeably to describe the systematic documentation of a single patient's medical history and care across time within one particular health care provider's jurisdiction. A medical record includes a variety of types of "notes" entered over time by healthcare professionals, recording observations and administration of drugs and therapies, orders for the administration of drugs and therapies, test results, x-rays, reports, etc. The maintenance of complete and accurate medical records is a requirement of health care providers and is generally enforced as a licensing or certification prerequisite.

The terms are used for the written (paper notes), physical (image films) and digital records that exist for each individual patient and for the body of information found therein.

Medical records have traditionally been compiled and maintained by health care providers, but advances in online data storage have led to the development of personal health records (PHR) that are maintained by patients themselves, often on third-party websites. This concept is supported by US national health administration entities and by AHIMA, (the American Health Information Management Association.).

Because many consider the information in medical records to be sensitive private information covered by expectations of privacy, many ethical and legal issues are implicated in their maintenance, such as third-party access and appropriate storage and disposal. Although the storage equipment for medical records generally is the property of the health care provider, the actual record is considered in most jurisdictions to be the property of the patient, who may obtain copies upon request.

3.

**Difference between a ‘Referral’ and a ‘Transfer?**

The phrases “Transfer of Care” and “Referral” are used frequently, all over the NHS and they feature especially often when talking about interoperability between IT systems.

Sometimes the two concepts are conflated and the terms used interchangeably; they both involve passing the responsibility of care for a patient to someone else but the nature of the responsibility and the way it is resolved is different.

Here is an attempt at describing the difference between the two:

**Referral**

A referral is a request made by one clinician or organisation to another clinician or organisation for them to take responsibility for part of a patient’s care.

This part responsibility might be for a specific problem the patient has, or for a particular activity (e.g. medical imaging and other diagnostic tests) to assist the GP with further diagnosis.

The referral, and therefore the responsibility, will often have a defined end point – for example until a particular activity has been completed (or ‘discharged’), or until a particular problem has been resolved. In other cases it might be an ongoing responsibility – for instance management of a Long Term Condition.

**Example**

A patient has visited their GP because with a painful back. The GP feels that they may need some further investigations, for example an MRI scan, to find out what is going on.

The GP makes a referral for the patient to the radiology department at the local hospital asking that they use medical imaging to help diagnose the patient’s back problems. The patient is told that the referral has been made and to wait to be contacted by the hospital.

The patient receives an appointment from the radiology department. They attend the appointment and the appropriate scans are taken of their back.

The consultant radiologist then produces a report describing the results of the scan which is sent back to the GP who made the referral. This particular referral is then completed and responsibility for the next steps are back with the patient’s GP.

**Transfer**

A ‘Transfer of Care’ is where a clinician or organisation passes the overall responsibility for a patient’s care to another clinician or organisation.

This is often related to a patient moving to a different stage in an overall pathway of care, or to a change in their condition which requires a different type or level of care.

**Example**

A patient is feeling unwell on a Saturday evening, and calls NHS 111 to get some help. They have a conversation with a nurse who feels that they really need to see an out of hours doctor in their area.

The nurse takes some more details from the patient and searches for an out of hours service near to the patient. He finds an appropriate service and advises the patient that he will arrange for them to see a doctor within the next 4 hours.

Once all confirmed, he initiates a transfer of care from NHS 111 through to the out of hours service, sending all of the details he has recorded about the patient through to the out of hours service.

The out of hours service accepts the transfer of care and is now responsible for the ongoing care of that patient.

The nurse in the NHS 111 service is no longer responsible for that patient’s ongoing care, and moves on to look a new patient.