Commentary

Operational Research Methodology in the General Medical Rounds

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Abstract

Operations Research (OR), also called Operational Research in the United Kingdom (UK), uses various computational tools for solutions to complex problems within a system. It deals with challenges in planning, scheduling, forecasting, process analysis and decision analysis. It also addresses individual components of the system. The methodology used for decisions based upon stochastic (random) processes can also be adapted for the common general medical ward round. Operational Research techniques add speed, efficiency, quality and consistency to the documentation in the case notes, and reduces the time taken for ward rounds. There is obvious benefit to the individual patient. It also acts as a learning tool which can be audited, and lends itself to research questions.

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Introduction

Operations Research, also known as Operational Research in the UK, has an important role to play in cost-effective management in many sectors. It has its origins in military operations during the Second World War, and began when scientists in Britain were asked to develop procedures for the use of radar in a new and effective air defence system, that is, this was research to improve operations. Operations Research builds mathematical models of decision-making processes, and applies the resulting techniques and algorithms in the fields of engineering, finance, service systems and management. The methodology may also be used in medicine in predictive health, disease modelling, public health, medical preparedness, logistics, quality improvement and informatics. This has applications in reducing waiting times, triage in the Emergency Department, work-flow development, Operation Theatre and Day Surgery management, outsourcing of services, management of information technology, nurse scheduling, bed forecasting, ambulance scheduling, portering operations, stock inventory, salaries, waste disposal, catering and in manpower planning, to name a few. Operations Research has a vital role in emergency planning for natural disasters, during which there may be periods of mass utilisation of men and materials. The discipline of managerial science, also known as Operations Research, applies scientific methods to provide decision makers with more insights and information about their systems. The issue of how best to reduce utilisation of diagnostic studies without detracting from patient management necessitates a meeting of managerial science with medicine.[1] Bree et al[2] studied a new utilisation management tool, the Consultant Radiologist as a gatekeeper, for its ability to improve inpatient diagnostic imaging. This was an example of the use of Operations Research in medicine. These gatekeeper principles are used to develop utilisation management tools such as critical pathways, and are especially useful in high-cost and high-usage operations. By creating lanes and barriers, the clinician learns which examinations are useful and which are not.[3]

Decision-tree Analysis

Decision Analysis is the methodology used in Operations Research to design formal processes upon which decisions are based. It is an approach to selecting a choice from among several variable alternatives.[4] The graphical demonstration of decision analyses is the decision tree. Every clinical examination finding or laboratory investigation can be considered a "test", which must necessarily have a high likelihood-ratio to justify its cost-effective use. Uncertainties are addressed using probability tests. An example is the use of Bayesian analyses of pre-test probability and post-test probability. The rapid analysis of the input is part

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of the neural network used for clinical reasoning. This cognitive function depends upon the clinician's experience, qualifications, training, religious and cultural orientation, language and communication skills, interpretation of body language, innate wisdom, and understanding of the human condition. Though Operations Research methodology uses science to make decisions, the human element cannot be discounted, for the art of medicine is intuitive. The "red herrings" in the data must be accurately identified. The cognitive, analytical, subjective, physical and emotional environment plays a major role in the output, and impairment of any of these parameters will mar the quality of the output. When this process is sub-optimal, there is no new plan for the patient, and the daily entry continues to be the same, or the words "status quo" is entered into the case notes. When the process of clinical reasoning is simplistic, the broad catch-all terms such as "sepsis", "nil acute" or "nil hyperacute" are used. Courage and experience is needed to say if something is normal.

Housekeeping

Sometimes clinical charts are mixed up, which leads to wrong entries, wrong administration of medication, missed drug allergies, wrong patients being sent for tests, and duplication of tests on the same day, thus increasing the rate of adverse events and contribute to unnecessary costs and wastage within the system. Repair of damaged case notes is as much the responsibility of the doctors, as that of the ward clerks and nurses. This due care for the patient and the case notes, along with precautions taken with standard drugs, dangerous drugs and controlled drugs is what distinguishes quality care from sub-standard care. Certificates of accreditation for the institution must be translated into the care of the individual patient, rather than to portray broad statistics. This is dependant upon individual doctors and nurses, assisted by the team of pharmacists, physiotherapists, ward clerks, porters, occupational therapists, radiographers, electrocardiogram (ECG) technicians, speech and swallowing therapists, dieticians and podiatrists (i.e. the medical team).

Fuzzy Logic

Individual human input is subject to the usual human frailties. This is manifest in simple things such as handwriting, and what is documented in the notes reflects clarity of the thought processes. Human beings cannot be compared with machines, for there is fuzzy logic used in their thinking. Alignment of thought may not always be present, and sometimes the conclusions may defy logic. Encouraging the process of lateral thinking or thinking "outside the box" contributes to the wide variation in output. This output is also subject to personal feelings. All documentation must nonetheless, be medico-legally defensible.

Commissions of Enquiry and Coroner's Inquiries

The judgements of many commissions of enquiry and other public enquiries like those of the Coroner often cite the causes of error as being inadequate or improper documentation, flaws in the seamless delivery of care and poor communication. Correcting these operational factors avoids unnecessary harm to patients, and prevents ill-will and costly and time-consuming litigation. A court case is enough to result in disillusionment, cynicism, resignations and feelings of abandonment. Public ire is also provoked when the system fails or does not seem to work.

Operational research methodology can address all these flaws in the system. The concepts of operational research mentioned here are, however, not meant to be comprehensive. Logistics is often the key to provision of good service, rather than clinical acumen, for the clinician works within the system, and Operations Research improves the logistics within the system.

A strong infrastructure, adequate equipment and funding is possible only with proper utilisation of resources. Proper utilisation is an all-encompassing term, and is the sum total of clinical treatment, materials management and cost savings. The benefit to society is obvious. It should be to this aspect that the search for new talent in healthcare be directed. Clinical service champions, known as "blackbelts" in those institutions where lean healthcare is practiced, are the key drivers of the concept of proper utilisation. They also require institutional support. The traditionalists among these leaders will drive the "train" along the same track. The innovators will drive the train onto a new track, but must first construct and test a track. A turtle can move forward only by sticking its neck out!

Operational Research in Internal Medicine

Healthcare management science is a specialty. Although this is relevant for those studying management, this article is to emphasise that operational techniques of management science can also be used by practising clinicians in Internal Medicine. The relevant books may have to be consulted for the mathematical principles of operational research. The process is often binary, and thus offers a choice of alternatives for the practising clinician. Variations in medical practice are inherent in the system.[5] In operational terms, this translates into a stochastic model in which the outcome depends upon several random events. Although there are several possible outcomes, some are more probable than others. Thus, probability theory and forecasting is used to make a decision, and is based upon the prevalence of the clinical condition. In simple terms, the process is driven by inputs over a period of time, for example, during a period of in-patient stay. Stochastic (random) processes in the medical field may be speech, blood glucose control,

radioactive beam intensity, audio and video, and other data such as a patient's ECG, Electroencephalography (EEG), blood pressure or temperature. The deterministic model of Operations Research is one that is used in planning rosters. The use of Operational Research methodology is cost-effective, efficient and reduces wastage. Operations Research when adapted for use in the general medical rounds can be used to formulate a template for ward rounds. This is especially useful when different teams of doctors look after 1 patient. Handover would be more streamlined. The variance lies in the interpretation of the findings elicited, and the different permutations and combinations possible would allow flexibility in management plans. Thus, the template will not promote "cookbook" medicine.

The general pattern of following "SOAP" (Subjective, Objective, Assessment and Plan) may not be consistently practiced. In the UK, General Internal Medicine is an integral part of the specialist's work. In many other countries, subspecialty physicians may be called upon to take care of general medical patients. A template for carrying out ward rounds would standardise the documentation and ensure that particular findings are not overlooked. It would be of a sufficient standard to pass a rigorous audit. The purpose of this article is to introduce a template that would add to the value stream of medical care. The template (an example is given in the appendix) describes the condition of the patient at the time of admission and the daily progress, and acts as a basis for in-house case discussions and for mortality rounds. It enables the clinicians from differing specialties doing internal medicine to assess the risks posed to patients with multiple general medical conditions, and the interactions with the medications and fluid balance, on a daily basis. For example, an inordinately high urine output raises the possibility of the polyuric phase of acute tubular necrosis or secondary diabetes insipidus. Complex clinical situations can be analysed in all its permutations and combinations for a cost-effective result, be it in the investigations, medications or any other relevant intervention. Alternatives could be generated, and this is the inherent strength of Operational Research. In this globalised world, doctors from overseas would also find a template useful, since they may initially have problems adjusting to a new medical and cultural (including language) system. It would also facilitate clinical governance.

In summary, operational research methodology should be taught in medical schools, both for under- and postgraduates. Many terms have been used to ensure proper utilisation, such as "lean healthcare management", "clinical process improvement projects" and "breakthrough series". If the use of operational research gains appeal within the medical community, clinicians could be sent on courses for learning the methodology. A broad catchword for this could be Operational Medicine. Operational Medicine can construct a framework within which variance can occur. This variance would naturally give rise to research questions, thus contributing to research and evidence-based medicine. Operational Medicine, though it has been carried out in various forms over the years, may become the new byword in healthcare, where resources are scarce, healthcare expenditure is a burden to the individual and to the state, and there is an increasing cost of litigation.

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REFERENCES

1. Forman HP, McClennan BL. Meeting of managerial science with medicine: the pace quickens. JAMA 1996;276;1599-600.
2. Bree RL, Kazerooni E, Katz SJ. Effect of mandatory radiology consultation on inpatient imaging use: a randomized controlled trial. JAMA1996;276:1595-8.
3. Pearson SD, Goulart-Fisher D, Lee TH. Critical pathways as a strategy for improving care: problems and potential. Ann Intern Med1995;123:941-8.
4. Einarson TR, McGhan WF, Bootman JL. Decision analysis applied to pharmacy practice. Am J Hosp Pharm 1985;42:364-71.
5. Chassin MR, Brook RH, Park RE, Keesey J, Fink A, Kosecoff J, et al. Variations in the use of medical and surgical services by the Medicare population. N Engl J Med1986;314:285-90.

Appendix: Template

Pre-round work:

Identification of new admissions (including patients transferred in overnight from other sectors)

Identification of critically ill patients

Drawing of fasting blood tests

Date: Time:

Name of doctor:

BP Pulse Respiration Temperature

Antibiotics: Intake/Output:

Chest X-Ray (date): Blood glucose:

ECG (date):

Subjective (symptoms):

Objective (signs):

Assessment: Principal diagnosis (reason for admission):

Complications after admission:

Additional diagnosis: pre-existing co-morbidities

Plan:

Discharge: Home/Nursing home/ step-down care

ABCDE of safe discharge (ADLs-activities of daily living):

Ambulation, Bathing, Cooking, Dressing, Eating

(Speech and swallowing assessment, dietition, occupational therapist, physiotherapist)

Factors preventing discharge:

Medical: Critically ill/Completion of treatment/Awaiting procedures

Social: caregiver (self, family, maid, nurse in nursing home or community)

Financial/medico-social worker

Follow-up: (Essential for duration of medications dispensed)

Hospital (medical/other specialities)/Community (GP/Polyclinics)