

## Operational Research in Health-care Settings

Origin of the term operational research (OR), also known as operations research, can be traced back to World War II when a number of researches carried out during military operations helped British Forces produce better results with lesser expenditure of ammunition. The world soon realised the potential of this kind of research and many disciplines especially management sciences, started applying its principles to achieve better returns on their investments.

Following World War II in 1948, the World Health Organization (WHO) came into existence with research as one of its core functions. It emphasized the need of identifying health-related issues needing research and thereby generation, dissemination, and utilization of the newly acquired knowledge for health promotion.<sup>[1]</sup> In 1978, Alma Ata Declaration acknowledged that primary health care was well known globally but, at the same time, also noted that modalities of its implementation were likely be different in different countries depending on their socioeconomic conditions, availability of resources, development of technology, and motivation of the community. A number of issues were yet to be resolved and researched before primary health care was operationalized under local conditions.<sup>[2]</sup>

### THE DEFINITION

The kind of research that Alma Ata Declaration recommended for improvement of health-care delivery is essentially OR. Described as “the science of better,” it helps in identifying the alternative service delivery strategy which not only overcomes the problems that limit the program quality, efficiency, and effectiveness but also yields the best outcome.<sup>[3]</sup> In its report on “The Third Ten Years of the WHO,” WHO has highlighted the usefulness of OR in improvement of health-care delivery in terms of its efficiency, effectiveness, and wider coverage by testing alternative approaches even in countries with limited national resources.<sup>[4]</sup>

OR has been variously defined. Dictionary of Epidemiology defined it as a systematic study of the working of a system with the aim of improvement.<sup>[5]</sup> From a health program perspective, OR is defined as the search for strategies and interventions that enhance the quality and effectiveness of the program.<sup>[6]</sup> A global meeting held in Geneva in April 2008 to develop the framework of OR, defined the scope of OR in context to public health as “*Any research producing practically usable knowledge (evidence, finding, information, etc.) which can improve program implementation (e.g., effectiveness, efficiency, quality, access, scale up, sustainability) regardless of the type of research (design, methodology, approach), falls within the boundaries of OR.*”<sup>[7]</sup>

OR, however, is different from clinical or epidemiological

research. It addresses a specific problem within a specific program. It examines a system, for example, health-care delivery system, and experiments in the environment specific to the program with alternative strategies to find the most suitable one and has an objective of improvement in the system. On the other hand, clinical or epidemiological research studies individuals and groups of individuals in search of new knowledge. In addition, ethical issues, which form an integral part of all clinical and epidemiological research, have their role poorly defined in OR, more so if it is based on secondary data.

The keyword in all the definitions is improvement, which is to be brought about by means of research in the operation of an ongoing program. Its characteristics include:

- a. It focuses on a specific problem in an ongoing programme
- b. It involves research into the problem using principles of epidemiology
- c. It tests more than one possible solution and provides rational basis, in the absence of complete information, for the best alternative to improve program efficiency
- d. It requires close interaction between program managers and researchers
- e. It succeeds only if the research is conducted in the existing environment and study results are implemented in true letter and spirit.

### THE PROCESS

In health-care settings, an ongoing health program often fails to achieve its expected objective and the program managers are faced with problems factors responsible for which are not apparent. This is the stage where process of OR is initiated. In a standard OR process, planning begins with organization of a research team, which should have a mix of people with different backgrounds such as epidemiology, biostatistics, health managements, etc., The program managers may not be able to carry out the research themselves because of their work responsibility and in all probability, their biased views. However, they need to have a working relationship with the research team to ensure smooth conduct of the research and ownership of the result by all parties.

According to Fisher *et al.*, OR is a continuous process of problem identification, selection of a suitable strategy/intervention, experimentation of the selected strategy/intervention, dissemination of the findings, and utilization of the information so derived.<sup>[8]</sup> However, it may not always be possible to follow a step by step approach in OR since it is carried out in the existing environment, and many of the activities may be taking place simultaneously. The process involves the following steps [Figure 1].

## Identifying problems

Like any other research, it is essential to have a research question as to the first and foremost step for beginning the process of OR. Discussion with program managers and staff, review of project reports and local documentation, discussion with experts in the field and literature search gives an insight into why the problem is occurring and what are possible solutions; and help in the identification of the research question. OR methods are useful for the systematic identification of problems and the search for potential solutions. Structured approaches to identifying options, such as the strategic choice approach or systematic creativity approaches have great potential for use in low-resource settings.<sup>[9]</sup>

## Choosing interventions

Choosing appropriate interventions is clearly a crucial step. Effectiveness, safety, cost, and equity should all be considered, and researchers should be familiar with standard textbook methods for assessing these. Finding the best combinations and delivery methods is a major research exercise in its own right. Modeling different intervention strategies before rollout is now ubiquitous in many industries but is less common in healthcare.<sup>[10]</sup> Modeling work has been done on ways to reduce maternal mortality and in cervical cancer screening in low-resource settings.<sup>[11]</sup>

An appropriate intervention design, depending on available time and resources, should have a written protocol spelling out details of steps to be taken during implementation. Only valid and reliable instruments – be it quantitative or qualitative study – should be used; and wherever possible, a pilot study be carried out to further refine the conduct of the intervention. The contribution that OR and management science can make to design and delivery is not restricted to high technology. Oral rehydration therapy is a “low-tech–low-cost–high-impact” innovation, in which OR was used to explore ways it could be administered using readily available ingredients by laypeople, with an escalation pathway to treatment by health-care professionals when necessary.<sup>[12]</sup>

Small-scale projects generally need considerable modifications to work on a larger scale. Classic OR techniques such as simulation modeling can be used in locating services, managing the supply chain, and developing the health-care workforce.

## Integrating into health systems

After analysis of the result, the information gathered should be disseminated to stakeholders and decision-makers. The modalities of information utilization should have been predecided and included in the research proposal. Successes in global health programs often result from synergistic interactions between individual, community and national actors rather than from any single “magic bullet.” A greater focus is needed on how interventions should be used in a complex behavioral environment, to better capture the dynamics of social networks, and to understand how complex systems can adapt positively to change. This is a task where OR and management science tools can be useful, as demonstrated by

systems analysis of programs for cervical cancer prevention<sup>[13]</sup> or agent simulation modeling of spread of HIV in villages.<sup>[14]</sup>

## EVALUATION

One of the greatest challenges for global health is the measurement and evaluation of performance of projects and programs. The WHO defines evaluation as “*the systematic and objective assessment of an ongoing or completed initiative, its design, implementation, and results. The aim is to determine the relevance and fulfillment of objectives, efficiency, effectiveness, impact, and sustainability.*”<sup>[15]</sup> It may or may not lead to improvement.

Accelerated Child Survival and Development (ACSD) program, an initiative of UNICEF, was implemented in eleven West African countries from 2001 to 2005 with an objective of reducing mortality among under-fives by at least 25% by the end of 2006. Retrospective evaluation of the program was carried out in Benin, Ghana, and Mali by comparing data of ACSD focus districts with those of remainder districts. It showed that the difference in coverage of preventive interventions in ACSD focus areas before and after program implementation was not significant in Benin and Mali. This probably resulted in failure of ACSD program to accelerate survival of under-fives in-focus areas of Benin and Mali as compared to comparison areas. The inputs obtained from the

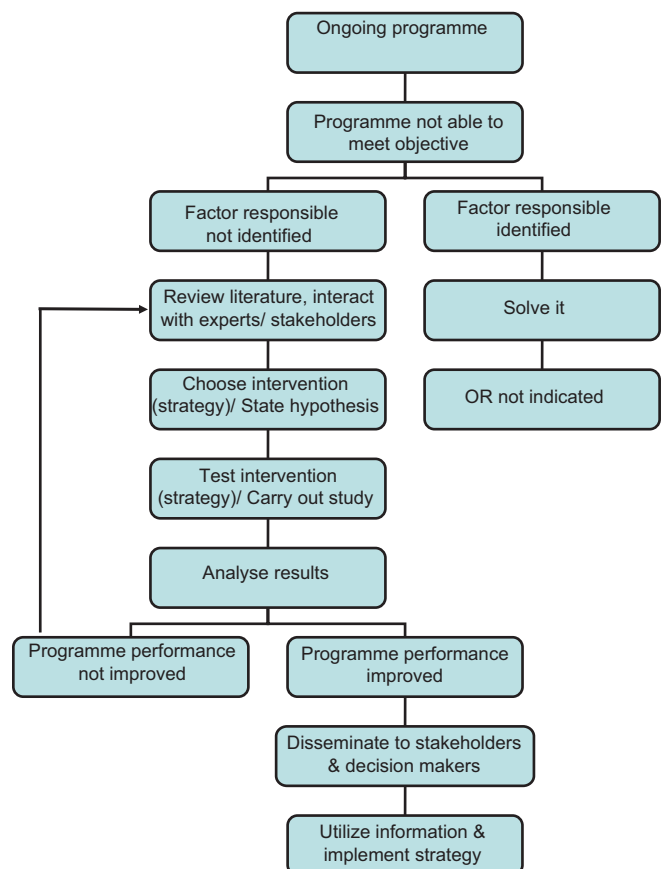


Figure 1: Process of operational research

evaluation of the program if translated into policy or national program would have delivered the desired result of ACSD program implementation.<sup>[16]</sup> Evaluation, thus, is fundamental to good management and is an essential part of the process of developing effective public policy. It is a complex enterprise, requiring researchers to balance the rigors of their research strategies with the relevance of their work for managers and policymakers.<sup>[17]</sup>

Standard control trial approaches to evaluation are sometimes feasible and appropriate but often a more flexible systems-oriented approach is required, together with modeling to help assess the effectiveness of preventive interventions.<sup>[18]</sup> Decision tree modeling can give rapid insights into the operational effectiveness and cost-effectiveness of procedures<sup>[19]</sup> and programs.<sup>[20]</sup>

## OPERATIONAL RESEARCH IN HEALTH-CARE SETTINGS: EXAMPLES

The relevance of OR in health-care settings cannot be overemphasized. It has been successfully used all over the world in various health programs such as family planning, HIV, tuberculosis (TB), and malaria control programs to name a few. Its role in causing improvement in various health programs and the development of policies has been acknowledged globally. Sustained OR efforts of several decades helped in developing the Global strategy for control of TB. India and Malawi provide the most successful example of OR in this field.<sup>[21]</sup> In India, it was demonstrated by OR that successful implementation of DOTS strategy throughout the country led to reduction in the prevalence of TB, reduction in fatality due to TB and release of hospital beds occupied by TB patients; and thereby a potential gain to the Indian economy.<sup>[22]</sup>

For the treatment of TB, about half of TB patients in India rely on the private sector. In spite of it being a notifiable disease, TB notification from private sector has been a challenge. In 2014, Delhi state, by adopting direct “one to one” sensitization of private practitioners by TB notification committee, was able to accelerate notification of TB cases from the private sector.<sup>[23]</sup>

In view of the growing burden of multidrug-resistance TB (MDR-TB), an OR was conducted in the setting of Revised National Tuberculosis Programme on patients with presumptive MDR-TB in North and Central Chennai, in 2014 to determine prediagnosis attrition and pre-treatment attrition, and factors associated with it. Prediagnosis and pretreatment attrition were found 11% and 38%, respectively. The study showed that patients with smear-negative TB were less likely to undergo drug susceptibility testing (DST) and more attention was required to be paid to this group for improving DST.<sup>[24]</sup>

One of the most successful examples of OR in India is the experimental study carried out in Gadchiroli district of Maharashtra from 1993 to 1998. In their path-breaking field trial, Bang *et al.* trained village level workers in neonatal care who subsequently made home visits at scheduled intervals

and managed premature birth/low birthweight, birth asphyxia, hypothermia, neonatal sepsis, and breastfeeding problems. This led to a significant reduction in neonatal mortality rates in intervention villages.<sup>[25]</sup> Encouraged by the success of this field trial, Home-Based Newborn Care has been adopted by many districts in India to combat neonatal mortality.

In leprosy case detection campaign (LCDC), introduced under National Leprosy Eradication Programme of India in 2016, false-positive diagnosis is a major issue. A study carried out in four districts of Bihar found 30% false-positive cases during LCDC. Using “appreciative inquiry” as a tool, Wagh *et al.* were able to achieve a decline in false-positive diagnosis.<sup>[26]</sup>

OR has been successfully used in hospital settings too. In Latin America, unsafe abortions used to be one of the most common causes of high maternal mortality. Billings and Bensons reviewed ten completed OR projects conducted in public sector hospitals of seven Latin American countries. Their findings indicated that sharp curettage replaced by manual vacuum aspiration for conducting abortion reduced the requirement of resources for postabortion care, reduced cost, and length of hospital stay and reduced maternal mortality.<sup>[27]</sup>

## CONCLUSION

Following Alma Ata declaration and Millennium Development Goals, all countries of the world have instituted their own National Health Programmes in a bid to improve health of their countrymen. Although health programs are in place, Governments are committed, guidance from the WHO is available, support from NGOs have been garnered, still many countries have not been able to achieve their desired goals. Operational Research is now being used as a key instrument, especially in resource-poor countries, to tap the untapped information. Administrators are using it as a searchlight for discovering what is still in the dark. It is there to stay. It is high time that the scientific community working in health-care settings gets acquainted with the nuances of OR and uses it more often for improving the outcome of health programs and for making them more efficient and effective.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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##### DOI:

10.4103/ijcm.IJCM\_4\_19

**How to cite this article:** Kunwar R, Srivastava VK. Operational research in health-care settings. *Indian J Community Med* 2019;44:295-8.

**Received:** 02-01-19, **Accepted:** 20-09-2019