ISSN: 0975-766X
CODEN: IJPTFI

Available Online through *Review Article*

www.ijptonline.com

PHARMACECONOMICS:CUTTING EDGE IN PATIENT CARE

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Received on 22-07-2017 *Accepted on: 20-09-2017*

Abstract:

Economic study can be defined as the study that understands the relationship between available resources or products and their unlimited consumption. This was the standard tool of the health economists as well, to study the supply and demand in a given population. However, the emergence of the evidence based medicine changed this procedure and emphasized on proving any drug both therapeutically and economically. In 1986, Ray Townsend from the Upjohn Company used the term "pharmacoeconomics" in his oration for a conference of pharmacists in Canada. Since then, Ray and his colleagues were conducting various studies using the term pharmacoeconomics among pharmacists in their field of work. Doctors, pharmacists, nurses and researchers including different societies for pharmacoeconomics are cutting edge in the field of pharamcoeconomics. Evaluating economics helps in the decision making and further assumptions can be made on how the society will benefit from the limited health care resources. It identifies the benefits and costs of such spending such as reduction in illness and improvement in quality of life.

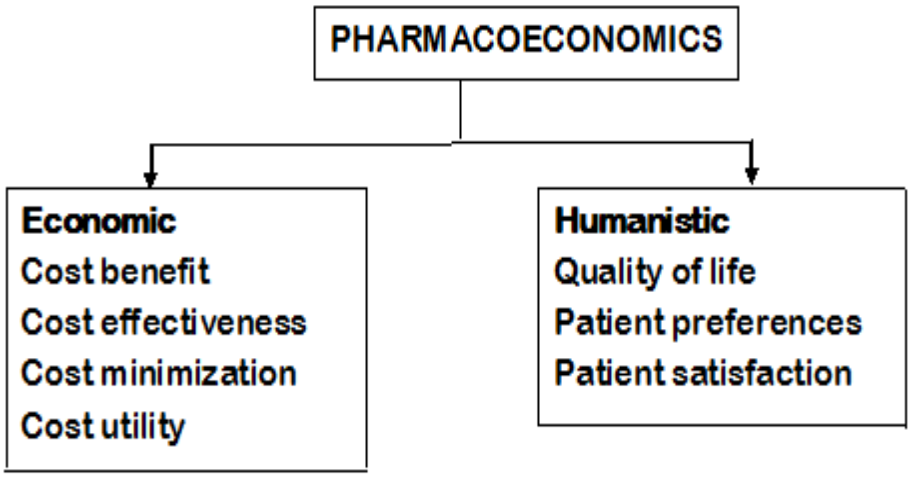
Key-words: Cost, Direct Cost, Indirect Cost, Economic analysis.

Introduction:

In the present era of evidence based health care, there is an increased interest in economic efficiency of health care due to the limitations on relevant resources. One of the major targets of cost savings in health care is spending on drugs. Other than the decision makers, expenditure on drugs is equally a focus of concern for patients, physicians, insurance companies, hospital administrators and on the whole, the society.[1]This background led to the branch of sciences called "Pharmacoeconomics".

Pharmacoeconomics, derived from health economics, estimates and measures the value of one medication or treatment approach to another. Pharmacoeconomic study deals with the cost incurred and the effect such as health

status and quality of life of a pharmaceutical product on an individual.[2]There are several types of pharmacoeconomic evaluation such as cost-minimization analysis, cost-effectiveness analysis, cost-utility analysis and cost benefit analysis. Pharmacoeconomic studies provide a standardized and scientific aspect for allotting health care resources in a paradigmatic manner. The economic evaluation is based on the financial costs of the disease to the society which can be divided into direct and indirect costs. Direct costs consist of health care costs and non- health care costs. Health care costs include the costs for visiting a clinician, costs of drugs, hospital inpatient charges, laboratory tests and costs for psychotherapy and adverse events. Non-health care costs include time and travel costs of the patients. Indirect costs are suffered by the patients, family members and caregivers that arises due to adversity and lack of ability to be productive. [3]Pharmaceconomics draws a balance between economic, humanistic and clinical outcomes.(Figure 1).



Application of pharmacoeconomics:

The primary outcome of a pharmacoeconomic study is the therapy being of good value for the cost. The secondary outcome is the analysis of the disease burden in terms of mortality, costs, morbidity and quality of life. Different study designs for pharmacoeconomic analysis are clinical trials, decision analytical models and observational studies.

1) Phase III clinical trial can use pharmacoeconomic analysis to provide data for pricing, registration and early use of drugs.
2) Post marketing surveillance uses pharmacoeconomic analysis to evaluate costs, effectiveness as well as adverse effects related to the drug.[4]
3) Decisions regarding drug therapy in order to help the doctors and practitioners can be obtained from pharmacoeconomic principles and methods.

4) It also provides data to help clinicians decide on patient therapy.

5) Clinical and Policy decision making as guidance in clinical practice.

6) Practitioners can apply pharmacoeconomics to their daily practice

7) It quantifies the value of pharmacy and health care services[5]

Recent studies:

In china, in the year 2014, Zang et al. conducted a study on pharmacoeconomics in schizophrenics and revealed that drugs integrated with psychological and social treatment was more profitable and worthwhile than routine treatment approach towards early-stage schizophrenics.[6] Einarson et al. conducted a study in Norway where comparison of direct costs and outcomes between palperidonepalmitate long acting injection (PP-LAI) and olanzapine pamoate (OLZ-LAI) in treating chronic schizophrenia was done. They found out that paliperidonepalmitate long-acting injection (PP-LAI) was more cost-effective when compared with olanzapine pamoate (OLZ) for treating chronic schizophrenia. The authors suggested that if OLZ is replaced by PP, Norwegian health system may save money. The study also pointed out that if PP is added to the drug formulary in Norway, it would only have a slight impact on the drug budget.[7]

In a study conducted in Greece by Einarson et al., the total expense of patient therapy with palperidone palmitate long (PP=LAI) acting injection was cheaper than with risperidone long acting injection (RIS-LAI) by 12,098.18(€166) even with higher acquisition cost. In the case of PP-LAI, medication costs were found to be the largest section of the total costs (61%), while hospital charges (30%) and medical care the remaining (9%). Costs for RIS-LAI had a similar pattern of distribution, with 56% due to drugs, 33% hospital care and 11% medical care. In cost utility analysis PP-LAI has a lower cost and a greater number of QALYs (Quality adjusted life years), it is considered supreme over RIS-LAI.

In cost effective analysis done in the same study, PP-LAI was shown to dominate RIS-LAI in terms of low costs and superior outcomes.[8] Bounthavong et al. in the year 2007 conducted a study to evaluate the cost effectiveness between risperidone, olanzapine and haloperidol, the authors found that risperidone was superior over olanzapine as the drug was less expensive and larger number of patients responded to resperidone leading to reduction in the total expense of drugs.[9] In another study conducted in Sweden by Kasteng et al., cost effectiveness of aripiprazole versus olanzapine was studied and the results showed that there was a significantly lower chance of developing metabolic syndrome with aripiprazole when compared to olanzapine which further translates into lower overall treatment cost and

improved quality of life over time.[10] The results of the microsimulation model indicated that olanzapine had the lowest mean annual direct health care cost 5,81,846.40 ($8,544) followed by generic risperidone 6,18348 ($9,080). In addition, olanzapine resulted in more QALYs than risperidone (0.733 vs. 0.719). The base case and multiple sensitivity analyses found olanzapine to be the dominant choice in terms of incremental cost-effectiveness per QALY gained. [(11)]Cost-Effectiveness of risperidone, olanzapine, and conventional antipsychotic medications by Jeanette M Jerelle concluded that olanzapine group demonstrated better compliance over time.[(12)]

In 2014, two quality of life instruments, Short form 36 health surveys and WHOQOL-BREF was used on patients with schizophrenia by Su et al. The results indicated that the scores of both questionnaires were valid and reliable and detected different aspects of QOL in the population with schizophrenia.[(13)]In Nigeria in the year 2013, Mosanya et al. studied on quality of life using WHOQOL-BERF, revealed that self-stigma was a typical factor for patients with schizophrenia.

It is related to poor treatment outcome, highlighting the need to involve procedures into mental health care systems that removes stigma caused by the disease. [(14)]In 2013, February, The prevalence of chronic pain in quality of life of schizophrenia was assessed by Almedia et al. This study showed results that chronic pain was a day to day affair in schizophrenic patients and decreased their quality of life.[(15)]

Sildenafil is the drug of choice for men suffering from erectile dysfunction. The conclusion to prescribe this drug should include factors such as the cost-risk benefit balance, ingress into patient details, pathways for drug distribution, and prescription drug coverage. A study conducted on sildenafil revealed its efficacy, adverse effects and drug interactions and socioeconomic factors among different patient populations such as diabetes mellitus, prostate cancer, ischemic heart disease and others. [(16)]

In a study done by Gawde et al, it was found that the average total cost per prescription for rheumatoid arthritis (RA) was Rs. 763.39 (US$ 14), whereas basic hospital and miscellaneous expense were found to be Rs. 281.12 (US$ 5) and Rs. 482.88 (US$ 9) respectively. It was also seen that the major expenses were paid by the patient and that there was an increase in the total expense due to the treatment of ADRs.[(17)] Similarly, the study done by Shini et al showed the direct medical cost of treatment of RA per month to be Rs. 696.57 ($ 15.92). The most cost effective combination of DMARDs was found to be methotrexate + hydroxychloroquine, which are the most commonly prescribed drugs in India. Also the study supported the findings that combined therapy with DMARDs and low dose corticosteroids can control the disease progression with profitable treatment and minimum side effects. [(18)]

Guidelines for conducting a pharmacoeconomic research: In the year 1999, the "Dutch guidelines for pharmacoeconomic research" was published by the Health Care Insurance Board. In 2005, these guidelines were updated and published as guidelines for pharmacoeconomic research. [19]

The perspective of the pharmacoeconomic analysis

The perspective from which a pharmacoeconomic evaluation is conducted should be from that of a society in which all the benefits and costs will be included irrespective of who actually bears the costs or receives the benefits.[20]

Choice of standard treatment/ approaches

To evaluate pharmacoeconomics between two or more drugs or treatment approaches, the drug of interest should be compared with the standard drug or treatment. The first choice of drug used in daily practice by a clinician or a physician based on literature or proven results from clinical trials can be considered as standard treatment.

Analytical method

In order to analyze the method that has to be employed in selecting a pharmacoeconomic model, various factors have to be taken into account. If the drug being assessed improves the standard of being in a patient, then it is crucial to carry out cost utility analysis. If that's not the case, cost effectiveness model has to be chosen to find out the drugs therapeutic value, if any. If the researcher does not expect an added therapeutic value from the drug, cost minimization model can be carried out provided the therapeutic efficacy is the same for the drug being assessed and the standard treatment.

Time frame

The time allotted for a pharmacoeconomic evaluation should be such that reliable and valuable results regarding costs, benefits, side effects and adverse effects can be stated.[21]

Measuring QALY'S

If the drug being assessed improves the quality of life in a patient, then it is important to carry out cost utility analysis. During cost-utility analysis, the 'quality-adjusted life-years' (QALYs) has to be calculated in order to assess the health status of the patient. The two components in QALY are health status and survival data. It has to be stated clearly and separately.[22]

Outline

The outline of a pharmacoeconomic evaluation should be based on peer reviewed publications. It has to be transparent, simple and include all the important steps.

Incremental analysis or Average cost effectiveness ratio

The results obtained from a cost effectiveness model can be expressed by reporting the incremental effects or average cost effectiveness ratio. This is done by comparing the total costs of the treatment with the clinical outcome.

Discounting costs and benefits

If the benefits and costs are analyzed for more than one year, then benefits and costs need to be discounted after the first year. [(23)] Costs should be discounted at the rate of 3-5% range and future benefits at the rate of 1.5%.

Uncertainty analysis

Pharmacoeconomic evaluation consists of a number of parameters such as costs, effects, benefits etc, In order to reflect the uncertainty margins, a sensitivity analysis has to be done keeping an upper and lower limit for each estimate. [(24)]During a multivariate sensitivity analysis, various variables and their alterations can be examined taking into account the correlation between these variables. If the chance distribution is known, new estimate for each parameter can be estimated.

Opinion of expert panel

The results from a pharmacoeconomic evaluation should be provided to the expert panel where consensus can be reached within the panel. Finally the data should be clearly documented by the expert panel for decision making, changing policies, reimbursement and others. [(25)]

Perspectives:

The key point for any economic evaluation is the perspective from which the evaluation is conducted. It can be from the health service perspective or the societal perspective. The outcome varies while evaluating from both the perspectives. For example in the pharmacoeconomic analysis of back pain therapy, cost is additional and benefit is restricted from the service aspect. However, the perspective from the society has more benefits as it reduces the working hours of the workers thereby enhancing their working ability. [(1)]

Types of costs:

Pharmacoeconomic costs can be divided in two, direct cost and indirect cost. Intangible cost is type of cost which is expressed in terms of fear, anxiety and pain. However it cannot be converted into monetary terms. The initial stages in cost analysis are to identify different types of costs.

Direct costs are considered from the health care funder's perspective. It includes doctors' fees, cost of medication and cost of treating an adverse drug reaction.

Indirect costs are from societal aspect as a whole. It includes the productivity loss of the patient as well as the care giver, cost due to loss of pay, travel.

Intangible costs includes pain, worry, anxiety which a patient or caregiver experiences. However it may be impossible to measure it in monetary terms, but are used for the measurement of quality of life.

The cost can be measured in following ways:

• Cost / unit

• Cost / treatment

• Cost / person

• Cost / person / year

• Cost / case prevented

• Cost / life saved

• Cost / DALY (disability-adjusted life year)

Methods of pharmacoeconomic analysis:

A cost-minimization analysis (CMA) is suitable when more than two drugs having similar therapeutic efficacy produce similar consequences. Both safety and efficacy is taken into consideration. In this model, the least costly alternative should be identified.[(26)]CMA is considered an easy and straightforward method for evaluating two or more treatment approaches considering their therapeutic efficacy to be the same. If there is unavailability of such data, a more thorough and complete method such as cost effectiveness model should be used.

A cost-effective analysis (CEA) denotes to a particular type of evaluation, in which the health benefits are defined and measured in natural units. It is one of the most routinely employed economic evaluations seen in the published writings and texts.[(27)] In this analysis, multiple drug treatment for the same medical condition can be evaluated. In CEA, the effectiveness is expressed in terms of money that outlines the aims such as lives saved, reduction in the number of days with ailment and sick persons treated. The results are expressed as Average Cost Effectiveness Ratio (ACER), which is obtained by dividing the treatment costs by its clinical outcome. The results are expressed in terms of rupee or dollar per specific clinical outcome gained. In order to express the results from this model, cost and outcome is converted into a single unit. Physicians can choose the alternative with least cost per outcome obtained.[(28)]

It is calculated by the formula:

ACER= Healthcare cost in dollars(direct+indirect cost)

Clinical outcome gained

A cost-utility analysis (CUA) measures the consequences in terms of quantity and quality of life. It is similar to cost effective analysis but has an additional aspect of certain point of view, most likely that of a patient. In CUA, Utilities are elicited on a scale of 0 (reflecting death) to 1 (reflecting perfect health) using EQ-5D-5L instrument. Thus obtained quality of life value is then multiplied by the time period for which the health benefits lasts and this will generate quality-adjusted life years (QALY). The results for each medication are expressed as cost per QALY (28). Example for calculating the quality of life adjusted years for groups with and without treatment is given in **Figure 2**

CBA is the most complete and arduous of all economic evaluation techniques. In this technique, the benefits are assigned a monetary value so that costs and benefits can be easily compared. Cost benefit analysis (CBA) recognizes compares and measures the costs as well as the benefits of a treatment. The benefits recognized are compared with the costs incurred by the treatment. The costs and benefits are measured and transformed into dollars in the year in which they will occur. The costs and benefits for the future are assumed and it will be discounted or diminished to their current value. The most strenuous and challenging part of CBA lies in calculating the benefits in economic terms. Benefits are always not easy to convert as they require subjective judgment. CBA ignores gains such as pain, anxiety, fear which are arduous to demonstrate in monetary units. [29]

Figure 2

With treatment X	**Without treatment X**
Estimated survival = 10 years	Estimated survival = 5 years
Estimated quality of life (relative to 'perfect health') = 0.7	Estimated quality of life (relative to 'perfect health') = 0.5
QALYs = (10 X 0.7) = 7.0	QALYs = (5 X 0.5) = 2.5

QALY gain from treatment X = 7 - 2.5 = 4.5 QALYs

If the cost of treatment X is £18,000 then the cost per QALY is £4,000 per QALY (£18,000 divided between 4.5 additional QALY's)

Challenges

• Formulate standard guidelines for physicians or clinicians to use in their daily practice

• Funding to support pharmacoeconomic research [30]

• To train the practitioners, government officials and executives from private sector on this discipline

• Form a trained body of producers and consumers for pharmacoeconomic research. [5]

Conclusion:

Value for money is the main focus in today's era of rising medical costs. Hence there is a need to study the cost and consequence of a therapy from the perspective of the society and health care system. Pharmacoeconomics is the

branch of science that quantifies costs and outcomes of a therapy and aids in drawing a balance between health, humanistic and clinical outcomes. It is very important for a health care professional to take into account the interests of the patient. This can be done by applying the principles and methodologies of pharmacoeconomics into their daily practice. Applications of pharmacoeconomics are vast and it can be applied for managing formularies, individualizing patient treatment and forming policies .The perspective of a pharmacoeconomic research is most important because the study results depend on the perspective selected. Healthcare professionals as well as people from academics, government and industry should formulate strict guidelines for pharmacoeconomic evaluation. Such guidelines, once implemented will help in rational prescription of drug, reduce the economic burden and narrow the gap between patients and doctors.

Summary:

As there is an advancement of health care sector, the need to explore and develop the field of pharmacoeconomics is important. In this era of healthcare sector being industrialized, there are multifaceted dimensions to explore. Healthcare professionals as well as people from academics, government and industry should formulate strict guidelines for pharmacoeconomic evaluation. Such guidelines, once implemented will help in rational prescription of drug, reduce the economic burden and narrow the gap between patients and doctors. It connects society, patients and economy to drug therapy.

References:

1. G S.Gattani, B A.Patil, S S. Kushare, Pharmacoeconomics: a review. Asian journal 2009, Vol 2,pp15-26.
2. D. Bhowmik, S.Duraivel, A.Rajalakshmi, K P.Sampath, Pharmacoeconomics-A Review. Elixir Pharmacy 2014, Vol 69, pp672-75
3. JP. McEvoy, The costs of schizophrenia, J Clin Psychiatry 2007, Vol 68, pp4-7
4. General Internal Medicine | University of Pennsylvania Health System [Internet]. [cited 2017 Mar 18]. Available from: http://www.uphs.upenn.edu/dgimhsr/pres%20glick.htm#2005
5. S.Kumar, A. Baldi, Pharmacoeconomics: Principles, Methods and Economic Evaluation of Drug Therapies.PhTechMed 2013, Vol 2, pp362-69.
6. Z.Zhang,J. Zhai,Q. Wei, J. Qi, X. Guo, J. Zhao, Cost-effectiveness analysis of psychosocial intervention for early stage schizophrenia in China: a randomized, one-year study , BMC Psychiatry 2014, Vol 14,pp 212.

7. T. Einarson, M. Geitona, A. Chaidemenos, V.Karpouza, T. Mougiakos, P.Paterakiset al.Pharmacoeconomic analysis of paliperidonepalmitate for treating schizophrenia in Greece, Ann Gen Psychiatry 2012,Vol11, pp 18s.
8. T. Einarson, M. Geitona, A.Chaidemenos, V. Karpouza, T.Mougiakos, P.Paterakiset al, Pharmacoeconomic analysis of paliperidonepalmitate for treating schizophrenia in Greece, Ann Gen Psychiatry 2012, Vol11, pp18.
9. M.Bounthavong, MP. Okamoto , Decision analysis model evaluating the cost-effectiveness of risperidone, olanzapine and haloperidol in the treatment of schizophrenia, J Eval Clin Pract 2007, Vol 13,pp 453-60.
10. F. Kasteng, J. Eriksson, K. Sennfält,P. Lindgren, Metabolic effects and cost-effectiveness of aripiprazole versus olanzapine in schizophrenia and bipolar disorder, ActaPsychiatrScand 2011,Vol 124,pp 214-25.
11. M. Furiak, H.Ascher-Svanum, W. Klein, J. Smolen, H. Lawson, R. Conley et.al, Cost-effectiveness model comparing olanzapine and other oral atypical antipsychotics in the treatment of schizophrenia in the United States, Cost Effectiveness and Resource Allocation, 2009Vol **7.**
12. M. Jerrell , Cost-Effectiveness of Risperidone, Olanzapine, and Conventional Antipsychotic Medications, Schizophrenia Bulletin 2002,Vol 28,pp589-605.
13. CT. Su , HS. Nq, AL. Yang , CY. Lin, Psychometric evaluation of the short form 36 health survey (sf-36) and the world health organization quality of life scale brief version (whoqol-bref) for patients with schizophrenia, Psychol Assess 2014, Vol 26, pp980-9.
14. T.Mosanya, AO.Adelufosi, OT. Adebowale, A. Ogunwale, OK. Adebayo , Self-stigma, quality of life and schizophrenia: An outpatient clinic survey in Nigeria, Int J Soc Psychiatry 2013, Vol60,pp 377-86.
15. JG. Almeida , PE. Braga, F. LotufoNeto,CA. Pimenta, Chronic pain and quality of life in schizophrenic patients, Rev Bras Psiquiatr2013, Vol 35, pp13-20.
16. EG.Boyce, EM.Umland, Sildenafil citrate: A therapeutic update, Clinical Therapeutics 2001,Vol 23, pp 2-23.
17. SR.Gawde, YC.Shetty, C.Merchant, UJ.Kulkarni, MY.Nadkar, Drug Utilization Pattern and Cost Analysis in Rheumatoid Arthritis Patients – A Cross– Sectional Study in Tertiary Care Hospital, Mumbai. British Journal of Pharmaceutical Research 2013, Vol3, pp37-45.
18. VK.Shini, S. Aboobacker,S.Pahuja, KG.Revikumar, R.Bhasi, Pharmacoeconomic study of DMARDs in the management of rheumatoid arthritis, International Journal of Pharmaceutical Sciences Review and Research 2010, Vol 5,pp 148-54.

19. LM.Schrand, JM.Elliott, MB.Ross, EF.Bell, AH.Mutnick, Cost benefit analysis of RSV prophylaxis in high-risk infants, AnnPharmacother2001,Vol 35,pp 1186–1193.
20. Armstrong, E.P, D.Grauer,Lee,J,OdomT, Sensitivity analysis. Pharmacoeconomics and Outcomes, American College of Clinical Pharmacy, 2nd Ed. Kansas City, 2003, pp.231–245.
21. RJ.Milne, Evaluation of the pharmacoeconomic literature, Pharmaco-economics1994, Vol 6, pp337–345.
22. Barr,J.T, Schumacher GE: Using decision analysis to conduct pharmacoeconomic studies. Quality of Life and Pharmacoeconomics in Clinical Trials, 2nd Ed. Philadelphia: Lippincott-Raven,1996, pp.60-75.
23. Touchette D, Hartung D, Grauer D, Lee J, Odom T: Markov modeling. Pharmacoeconomics and Outcomes, 2nd Ed. Kansas City, MO: American College of Clinical Pharmacy, 2003, pp. 206–230.
24. WG.Bennett, Y.Inoue, JR. Beck . Estimates of the cost-effectiveness of a single course of interferon-α2b in patients with histologically mild chronic hepatitis C, Ann Intern Med 1997, Vol 127, pp855–865.
25. WR.Kim, JJ.Poterucha, JE.Hermans, Costeffectiveness of 6 and 12 months of interferon-α therapy for chronic hepatitis C, Ann Intern Med 1997, Vol 127, pp866–874.
26. HJavangula, An overview of pharmacoeconomics and outcomes research, Int. J. LifeSc. Bt& Pharm. Res 2012, Vol1, pp58-63.
27. JT.Lee, LA. Sanchez, Interpretation of cost effective and soundness of economic evaluations in the pharmacy literature, Am J Hosp Pharm 1991, Vol 48, pp2622–2627.
28. T.Walley, Pharmacoeconomics for migraine and headache researchers: basic concepts, methods and terminology, J Headache Pain 2004, Vol 5, pp217-23.
29. DA.Freund, RS.Dittus, Principles of pharmacoeconomic analysis of drug therapy, Pharmacoeconomics1992, Vol1, pp20–32.
30. A. Lyles, Recent trends in pharmacoeconomics: Needs and unmet needs, European journal of pharmaceutical sciences 2008, Vol 34, pp S7–S24.

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