ACCP Official Position Statement

Prospectus on the Economic Value of Clinical Pharmacy Services

A Position Statement of the American College of Clinical Pharmacy

Michael S. Willett, Pharm.D., Karen E. Bertch, Pharm.D.,
Darryl S. Rich, Pharm.D., and Larry Ereshefsky, Pharm.D.

A prospectus is a formal summary or brief of a proposed venture. The purpose of this document is therefore to present an overview of the current documentation available to support the economic value of clinical pharmacy services, and to propose a course of action for future documentation of such value based on need. Although much overlap often exists among clinical, distributive, and administrative pharmacy services, this document addresses only those areas in which the predominant service provided is clinical. It was prepared by members of the Clinical Practice Affairs Committee of the ACCP and approved by the Board of Regents on April 10, 1988.

Definitions

A number of economic terms that incorporate the word "cost" appear in the pharmacy literature, such as cost effectiveness, cost benefit, cost justification, cost containment, cost impact, cost analysis, cost savings, and cost avoidance. Various authors define these terms differently, and some use them interchangeably and often inappropriately. As a result, confusion exists with regard to their proper use.[1]

An economic evaluation is defined as a comparative analysis of two or more alternative services or treatments that examines both their costs and consequences.[2-4] The evaluation can be one of four types: cost effectiveness, cost benefit, cost minimization, and cost utility.[2-4] A cost-effectiveness analysis quantifies all costs of providing a service or treatment in monetary terms, while measuring health outcomes in nonmonetary terms, such as length of hospital stay, lives saved, or treatment success or failure. Since health outcomes are measured in nonmonetary terms, however, the cost-effective alternative is not always the least costly. Rather, it is the one that best achieves the desired health outcome at a minimum, acceptable cost.[1-8]

A cost-benefit analysis differs in that it quantifies both costs and health outcomes or benefits in monetary terms. Therefore, it requires that outcomes such as lives saved or years of life gained be measured in dollars. A cost-benefit analysis has the advantage over a cost-effectiveness analysis of allowing one to calculate a net benefit or value in dollars for each service. However, assigning a dollar value to human lives has its limitations and is objectionable to some clinicians.[2-8]

A cost-minimization analysis differs only slightly from a cost-effectiveness analysis. In the former, the health outcomes achieved by two or more services are first compared. If found to be identical, the preferable alternative becomes the one that is least costly. In the latter, health outcomes are achieved to varying extents and alternative services are compared by expressing cost per unit of health effect.[2, 3]

Cost-utility analysis quantifies difficult-to-measure outcomes such as quality of life by using utility values such as quality-adjusted life-years.[2, 3, 9] It has only recently been applied to health care services, and has not yet been used to evaluate clinical pharmacy services.[2, 3, 10]

Several other economic terms incorporate the word "cost" and should be correctly defined. A cost analysis compares only the costs of alternative services. Thus, it is only a partial and not a full economic evaluation, since it does not measure the health consequences of alternative services.[2, 3] Many studies in the pharmacy literature are cost analyses that measure cost savings or cost avoidance, often with respect to drug costs. These two terms have subtle difference in meaning. Cost savings result when dollars that were previously spent are no longer spent. Cost avoidance means

From the Wesley Long Community Hospital, Greensboro, North Carolina (Dr. Willett); the University of Illinois College of Pharmacy, Chicago, Illinois (Dr. Bertch); the Rhode Island Hospital, Providence, Rhode Island (Dr. Rich); and the University of Texas College of Pharmacy, University of Texas Health Science Center at San Antonio, Texas.

Address reprint requests to Robert M. Elenbaas, Pharm.D., Executive Secretary, American College of Clinical Pharmacy, 3101 Broadway, Suite 350, Kansas City, MO 64111.

that dollars are not spent from the outset. Whether dollars are saved or avoided is often subject to one's interpretation; as a result, it is difficult to distinguish between the two terms in many studies.

Cost justification, cost containment, and cost impact are general, often ill-defined terms that are sometimes used interchangeably and inappropriately with other economic terms. They can be a source of confusion as they fail to define the specific methodology used to evaluate a particular service. Thus, when describing the economic value of clinical pharmacy services, using more closely defined economic terms, such as cost effectiveness, cost benefit, or cost utility, is more specific and preferable.

Needs Assessment for Documenting the Economic Value of Clinical Pharmacy Services

In this era of rising health care costs, the economic value of each new and existing service is being closely scrutinized as society attempts to allocate limited health care resources wisely and judiciously. Like many other services, clinical pharmacy services will continue to be closely examined in this regard. For new and existing services to survive, clinical pharmacists will have to demonstrate that they provide quality health care at an acceptable cost to society.

Documenting the Economic Value of Clinical Pharmacy Services

Several review articles have described the economic value and acceptance of clinical pharmacy services as well as methods to justify them.[11–14, 74] Appendix I summarizes the literature that has attempted to document the economic value of these services to date.[15–73] It includes studies that are partial or full economic evaluations, but excludes those in which no comparisons were made between alternative services or in which no cost data were provided. Similarly, studies that documented clinical pharmacy services' contributions to the quality of health care, but did not address costs, are not included. The Appendix does reference some studies in which hypothetical comparisons were made, in which patients served as their own controls. Several studies incorrectly labeled as cost-benefit analyses by their authors are correctly labeled as cost analyses in the Appendix.

While a considerable volume of literature has attempted to address the issue, the number of full economic evaluations is limited. Many of the studies are partial evaluations that document cost savings or cost avoidance but fail to quantify all costs or measure health outcomes. Those that are full evaluations still failed to address the costs of such things as adverse drug reactions or therapeutic failures.

The extent to which clinical services are tied to drug-distribution systems is difficult to ascertain in some studies. For example, most of the ones evaluating clinical pharmacy services in the emergency room used drug-distribution functions to determine the economic value and justify the existence of the clinical pharmacy service.

Many of the studies have been based in family practice, ambulatory care, and long-term care.[49–51, 68–72] Only recently, as a result of new financial incentives and pressures, has the subject been addressed in the hospital environment. Three areas that have received attention are drug therapy monitoring, pharmacokinetic dosing, and primary care services.

Drug Therapy Monitoring

Drug therapy monitoring involves (1) selective monitoring of patients' drug therapy, (2) evaluating it against predetermined criteria, and (3) consulting with the prescribing physician to alter therapy when criteria are not met. While a great deal of literature exists in this area, most of it covers cost analyses or partial economic evaluations. An obvious limitation is that, because patient outcomes are not assessed, the cost effectiveness, cost benefit, and cost utility of these services cannot be determined.

Analyses in the acute care environment primarily address drug costs; some include personnel and overhead, but many do not. The costs of adverse drug reactions or therapeutic failures have largely been overlooked. In the cost analyses conducted to date, the largest drug cost savings or avoidance has been demonstrated with the more expensive drugs, particularly antibiotics and albumin, for which projected savings have been as high as $85,000 to $200,000 annually.[17, 26]

Several analyses in home health care have documented substantial patient or third-party payor savings through shorter hospitalizations.[52–58] Most of these assumed equivalent efficacy and did not actually compare or document patient outcome data; thus they were not full economic evaluations. Studies on the use of psychiatric drugs and total parenteral nutrition (TPN) are stronger in that they have documented cost-effectiveness to some extent.[35, 36, 38–40] In many TPN studies, however, intermediate outcomes, such as weight gain, were assessed rather than final outcomes, such as morbidity and mortality. Analyses in family practice and long-term care are the strongest, having addressed drug and personnel costs as well as patient outcomes.[45–51] Several documented the cost-benefit or cost-effectiveness of these services using simplified models.[45, 47, 48, 51]

Pharmacokinetic Dosing

Numerous investigations have been conducted on the economic value of clinical pharmacokinetic services, but most suffer from some methodologic flaws. Some have shown decreased "costs" of serum drug levels based on laboratory charges rather than actual costs.[60, 64–66]

A detailed retrospective economic evaluation assessed an individualized aminoglycoside dosing

service in burn patients with gram-negative septicemia.[59] Decreased mortality was documented in the study population, and the results convincingly demonstrated the cost benefit of the service to patients and society. Another study noted the cost-effectiveness of a service that monitored digoxin levels, showing patient savings as well as decreased digoxin toxicity and length of hospital stay.[63] Of interest, an evaluation of a theophylline dosing service actually revealed longer hospital stay, increased number of drug level measurements, and no improvement in quality of care.[64] The remaining studies were cost analyses, and thus were not designed to address patient outcome indicators such as drug toxicity, length of stay, or clinical outcome.[60, 62, 65, 66]

Primary Care Services

The economic value of clinical pharmacists as primary care providers was investigated using simplified cost-benefit or cost-effectiveness models.[68–72] The results point to the economic value of clinical pharmacists as quality primary care providers in a number of settings, such as skilled nursing facilities, hypertension clinics, and anticoagulation clinics. While such results are encouraging, future studies in these and other areas must determine costs and final patient outcomes more thoroughly.

Services in which some documentation of economic value exists, but that lack sufficient documentation in the form of full economic evaluations, include ambulatory patient counseling/compliance monitoring, discharge patient counseling, emergency room services, formulary monitoring and drug review, home health care services, in-service education, medical rounds participation, and patient teaching programs. Services for which there is a total lack of publications on their economic value include cardiopulmonary resuscitation response participation, drug/poison information services, and patient medication histories.

Documenting the Reimbursement of Clinical Pharmacy Services

Reimbursement for clinical pharmacy services in hospitals has been given little attention since the advent of prospective payment programs. It has been pointed out that securing such reimbursement will not increase hospital revenue from third-party payors under many current guidelines. Instead, efforts to justify these services should be directed at the institution rather than at third-party payors.[75]

Reimbursement does, however, play a key role in justifying clinical pharmacy services outside the hospital environment (e.g., family practice, ambulatory care, long-term care facilities) as well as for hospital revenue received from nonthird-party payors (e.g., literature searches for law firms, etc.). Clinical pharmacy services may be less likely to be eliminated or reduced if reimbursed directly rather than indirectly under a supplemental drug charge. If they were directly reimbursed, however, they would be more visible to administrators and might conceivably be more likely to be cut if their economic value were not supported. The following major categories of clinical pharmacy services have been documented in the literature as receiving reimbursement[76–82]: cardiac rehabilitation unit participation; clinical pharmacokinetic services; CPR response participation; drug information services (partial reimbursement); formal education of students (various health professions including pharmacy students); inpatient admission interviews (medication histories); inpatient discharge counseling; patient teaching programs for self-administering medications; TPN or intravenous therapy team participation; and written drug therapy consultations.

Prevalence of Clinical Pharmacy Services

Based on recent national surveys,[83, 84] the percentage of hospitals that provide various clinical pharmacy services is estimated to be as follows: drug therapy monitoring 44–94%; drug information service 75%; in-service education 88–93%; drug therapy consultations 68%; CPR response participation 25–35%; clinical pharmacokinetic services 18–50%; discharge patient counseling 17–46%; medical rounds participation 9–56%; and admission medication histories 5–17%.

The accuracy of these data can be questioned because the published surveys did not target only clinical pharmacy services, and definitions differ among surveys. Also, different reports show widely variant prevalence of some services, possibly due to differences in definitions of services or in the size of the institutions being studied. It is difficult to determine the prevalence of clinical pharmacy services in nonhospital settings due to lack of national surveys.

Future Strategies

Future documentation of the economic value of clinical pharmacy services should be based on need. This means that highly prevalent services whose value is not documented should receive the highest priority for subsequent evaluation. This approach will enable the profession to allocate personnel and financial resources toward those services that have the greatest economic value. The need to continue services that are shown to be of little economic value should be reexamined taking this information into consideration.

It is important to document the economic value of a number of clinical pharmacy services, especially those in the acute care setting. The following should be given the highest priority: drug information services; home health care services; medical rounds participation; CPR response participation; discharge/ambulatory patient counseling; and in-service education.

While a large volume of literature has reported on economic evaluations of such services as drug therapy monitoring and consultation or clinical phar-

macokinetic services, the majority of these studies are only partial or incomplete full evaluations. Comprehensive, full evaluations are required in both areas, although the priority is less than for those services listed above.

Documentation is strongest in the areas of clinical pharmacy services in ambulatory care settings, family practice centers, and long-term care facilities; however, it is not comprehensive, and more data are required. In addition, the economic value of clinical pharmacists as primary care providers in ambulatory settings will probably have to be addressed separately for each specific setting.

Better information also must be obtained as to the prevalence of clinical pharmacy services, especially in nonhospital environments. Such information may well alter the priority placed on documenting the economic value of a given service. Finally, more consistent, comprehensive, formal research methodologies must be applied when assessing the economic value of these services.[6, 13, 85, 86]

Methodologies

Formal research methodologies for conducting sound evaluations of health care services are described in the literature and can be applied to clinical pharmacy services.[2–9, 45, 59, 74, 87] In addition, the American Society of Hospital Pharmacists has provided funding to develop and validate a technique that can be applied universally to determine the cost impact of various institutional pharmacy services. It is hoped that the results of this study will be instrumental in developing a standard methodology. Finally, collaborative efforts between clinical pharmacists and various pharmacy faculty members, particularly pharmacy administration faculty, can facilitate the development and implementation of sound economic evaluations.

Methodologic Pitfalls in Past Studies

The following methodologic problems commonly appear in the economic evaluations conducted to date:

1. Lack of a concurrent control group. As a result, influential variables (i.e., the Hawthorne effect, certain patient demographics, seasonal variations in drug use, learning effect) are not identified or controlled.
2. Inconsistent definition or complete failure to define the service being evaluated.
3. Failure to specify the perspective from which the study is being conducted (i.e., patient, provider, third-party payor, society).
4. Use of patient charges as a measure of cost rather than determining economic costs, especially with regard to studies involving drug assays and drug charges. Most often, economic costs should be used rather than charges; however, the choice between them depends on the purpose and perspective of the study.
5. Failure to determine the cost of providing the service.
6. Improperly determining the cost of providing the service.
   a. Failure to determine or separate fixed and variable costs.
   b. Failure to include indirect costs (i.e., employee benefits in salary determinations).
   c. Failure to determine impact on other departments or health care providers.
7. Failure to determine actual as opposed to projected outcomes. As a result, studies can only postulate hypothetical impact rather than determine actual impact.
8. Not determining or incompletely determining effectiveness or benefit to patients in terms of clinically relevant outcome indicators.
9. Failure to analyze results using valid statistical tests.

Proposed Methodologies

The following are the major points to consider when developing sound economic evaluations of clinical pharmacy services:

1. Conduct a task analysis of the existing or proposed clinical pharmacy service, breaking down each task into its related components. This must consider components both internal and external to the service. Devise a method for determining the cost of each component; then report it separately so its applicability to other settings can be determined.
2. Predict how the service will influence the process and outcome of health care in the specific setting studied. Devise a method for relating the process and outcome to both economic values (dollars) and relevant, measurable health outcomes. Care should be exercised in determining the true economic costs to an institution. For example, if the frequency of a given procedure is reduced 10% by clinical pharmacy services, the reduction in cost is only the incremental (or variable) cost of the procedure and should not include fixed costs unless these are totally eliminated. Care should be used to differentiate between cost savings and cost avoidance.
3. Establish a concurrent control group, and randomly assign subjects to the control or experimental group if possible. Variability between the groups should be reduced as much as possible. Patient demographics should be similar. Patients should be followed by the same health care providers whenever possible, particularly physicians and clinical pharmacists. This eliminates the inconsistencies that naturally occur in interpreting results and making recommendations when several individuals from the two disciplines collaborate. All other pharmacy services should be provided consistently to both the study and control groups. In addition, a crossover effect where clinical pharmacy services are indirectly or inadvertently provided to the control group should be prevented.

4. If it is not feasible to establish a concurent control group, a preceding control period for the study can be used. This design suffers from the limitations of maturation and historical effects on the subjects; however, having a control period before the implementation of clinical pharmacy services is often more practical than using a concurrent control. Whichever one is chosen will depend on the setting, which variables can be controlled, and what is logistically possible.
5. Determine the evaluation protocol and evaluating researchers. The personnel and process involved should be least disruptive to the service, yet remove any bias or subjective determination of data.
6. Define the appropriate statistical tests to be used and establish the sample size necessary to ensure adequate statistical power.
7. Interpret the statistical and clinical significance of results and reach decisions regarding the impact of the clinical pharmacy service.

Proposed Plan

The following steps should be taken in response to the need for more studies to document the economic value of clinical pharmacy services:

1. Obtain a better estimate of the prevalence of clearly defined clinical pharmacy services currently provided in institutional, ambulatory, and home health care settings. Comprehensively identify services for which third-party reimbursement is or has been received.
2. Encourage presentation at professional meetings and subsequent publication of cost-benefit, cost-effectiveness, cost-minimization, and cost-utility analyses of clinical pharmacy services.
3. Designate specific research funds for such studies.
4. Publish guidelines for proper research methodologies to be used in the evaluations.
5. Encourage collaboration between clinical pharmacists and other researchers, such as pharmacy administration faculty, in designing and implementing studies.
6. Encourage schools of pharmacy to include sound economic evaluations of clinical pharmacy services in considering faculty for promotion and tenure.

Acknowledgments

The ACCP graciously acknowledges the following individuals for reviewing this prospectus: J. Lyle Bootman, Ph.D.; Elizabeth Chrischilles, Ph.D.; Frederic Curtiss, Ph.D.; David Knapp, Ph.D.; Deanne Knapp, Ph.D.; Linda MacKeigan, B.S. Pharm.; Dev Pathak, D.B.A.; and Michael Stolar, Ph.D. Their constructive, thought-provoking comments are greatly appreciated.

References

1. **Doubilet P, Weinstein MC, McNeil BJ.** Use and misuse of the term "cost-effective" in medicine. N Engl J Med 1986;314:253–6.
2. **Department of Clinical Epidemiology and Biostatistics, McMasters University Health Sciences Center.** How to read clinical journals. VII. To understand an economic evaluation. Part A. Can Med Assoc J 1984;130:1428–34.
3. **Drummond MF, Stoddart GL, Torrance GW.** Methods for the economic evaluation of health care programmes. Oxford: Oxford University Press, 1987.
4. **Drummond MF.** Principles of economic appraisal in health care. Oxford: Oxford University Press, 1980.
5. **Warner KE, Luce BR.** Cost-benefit and cost-effectiveness analysis in health care. Ann Arbor, MI: Health Administration Press, 1982.
6. **Bootman JL, McGhan WF, Schondelmeyer SW.** Application of cost-benefit and cost-effectiveness analysis to clinical practice. Drug Intell Clin Pharm 1982;16:235–43.
7. **Weinstein MC, Stason WB.** Foundations of cost-effectiveness analysis for health and medical practices. N Engl J Med 1977;296:716–21.
8. **Weinstein MC.** Economic assessments of medical practices and technologies. Med Decis Making 1981;1:309–30.
9. **Weinstein MC.** Challenges for cost-effectiveness research. Med Decis Making 1986;6:194–8.
10. **Croog SH, Levine S, Testa MA, et al.** The effects of antihypertensive therapy on the quality of life. N Engl J Med 1986;314:1657–64.
11. **Kimelblatt BJ.** Establishing clinical pharmacy services. US Pharmacist 1984;9:H4–16.
12. **Perkins LD, Mason NA.** Justifying additional pharmacist staff in an era of cost reductions. Am J Hosp Pharm 1984;41:2033–6.
13. **McGhan WF, Rowland CR, Bootman JL.** Cost-benefit and cost-effectiveness: methodologies for evaluating innovative pharmaceutical services. Am J Hosp Pharm 1978;35:133–40.
14. **Hatoum HT, Catizone C, Hutchinson RA, Purohit A.** An eleven-year review of the pharmacy literature: documentation of the value and acceptance of clinical pharmacy. Drug Intell Clin Pharm 1986;20: 33–41.
15. **Ryan PB, Johnson CA, Rapp RP.** Economic justification of pharmacist involvement in patient medication consultation. Am J Hosp Pharm 1975;32:389–92.
16. **Stratton TP, Plachetka JR, Gaines JA.** Cost savings from hetastarch use in place of albumin on a cardiothoracic surgery service. Hosp Formul 1984;19:571–83.
17. **Alexander MR, Alexander B, Muston A, et al.** Therapeutic use of albumin. 2. JAMA 1982;247:831–4.
18. **Meisel S.** Cost-benefit analysis of clinical pharmacy services in a community hospital. Hosp Pharm 1985;20:904–6.
19. **Powers DA.** Antimicrobial surveillancce in a VAMC teaching hospital—resulting cost avoidance. Drug Intell Clin Pharm 1986;20:803–5.
20. **Abramowitz PW, Nold EG, Hatfield SM.** Use of clinical pharmacists to reduce cefamandole, cefoxitin and ticarcillin costs. Am J Hosp Pharm 1982;39:1176–80.
21. **Tsuyuki RT, Nakagowa RS.** The effect of pharmacy intervention on aminoglycoside costs. Can J Hosp Pharm 1987;40:51–6.
22. **Schwinghammer TL, Romano MJ, Wing EJ.** Cost savings associated with use of gentamicin versus tobramycin. Am J Hosp Pharm 1985; 42:1745–9.
23. **Fletcher CN, Giese RM, Rodman JH.** Pharmacist interventions to improve prescribing of vancomycin and tobramycin. Am J Hosp Pharm 1986;43:2198–2221.
24. **Britton HL, Schwinghammer TL, Romano MJ.** Cost containment through restriction of cephalosporins. Am J Hosp Pharm 1981;38: 1897–900.
25. **Suzuki NT, Pelham LD.** Cost-benefit of pharmacist concurrent monitoring of cefazolin prescribing. Am J Hosp Pharm 1983;40:1187–91.
26. **Abramowitz PW, Ludwig DJ, Mansur JM, et al.** Controlling moxalactam and cefotaxime use with a target drug program. Hosp Pharm 1983;18:416–20.
27. **Lawlor MC, Lucarotti RL.** Clinical pharmacist impact on parenteral cephalosporin prescribing. Hosp Formul 1983;(Apr):402–8.
28. **Sohn CA, Wolter HA, McSweeney GW.** Effectiveness of a cephalosporin education program—a pharmacy education program. Drug Intell Clin Pharm 1980;14:272–7.
29. **Peterson CD, Lake KD.** Prophylactic antibiotic costs in cardiovascular surgery: the role of the clinical pharmacist. Drug Intell Clin Pharm 1986;20:134–7.
30. **Dzierba SH, Reilly RT, Caselnova DA.** Cost savings achieved through a cephalosporin use review and restriction program. Am J Hosp Pharm 1986;43:2194–7.
31. **Self TH, Smith SL, Boswell RL, et al.** Medical education provided by a clinical pharmacist: impact on the use and cost of corticosteroid therapy in chronic obstructive pulmonary disease. Drug Intell Clin Pharm 1984;18:241–4.
32. **Adachi WD, Endo AY, Tanaka JY.** Controlling admixture waste through pharmacist monitoring. Am J Hosp Pharm 1984;41:883.
33. **Kelly KL, Covinsky JO, Fendler K, et al.** The impact of clinical pharmacist activity on intravenous fluid and medication administration. Drug Intell Clin Pharm 1980;14:516–20.
34. **Packer LA, Mahoney CD, Rich DS, et al.** Effect of pharmacists' clinical interventions on non-formulary drug use. Am J Hosp Pharm 1986; 43:1461–6.
35. **Gray DR, Nakimas EA, Sax MJ, et al.** Clinical pharmacists as allied

health care providers to psychiatric patients. Contemp Pharm Pract 1979;2:108–16.
36. **Saklad SR, Ereshefsky L, Jann MW, et al.** Clinical pharmacists' impact on prescribing in an acute adult psychiatric facility. Drug Intell Clin Pharm 1984;18:632–4.
37. **Self TH, Ellis RF, Davis HL, Lee MD.** Early use of oral theophylline in hospitalized chronic obstructive pulmonary disease patients: cost containment through medical education. Drug Intell Clin Pharm 1985;19:749–53.
38. **Dice JE, Burckart GJ, Woo JT, et al.** Standardized versus pharmacist-monitored individualized parenteral nutrition in low birth-weight infants. Am J Hosp Pharm 1981;38:1487–9.
39. **Mutchie KD, Smith KA, MacKay MW, et al.** Pharmacist monitoring of parenteral nutrition: clinical and cost-effectiveness. Am J Hosp Pharm 1979;36:785–7.
40. **Roberts MJ, Teasley KM, Roberts AW.** Pharmacy program to reduce parenteral nutrition costs. Am J Hosp Pharm 1981;38:1519–20.
41. **Herfindal ET, Bernstein LR, Kishi DT.** Effect of clinical pharmacy services on prescribing on an orthopedic unit. Am J Hosp Pharm 1983;40:1945–51.
42. **Herfindal ET, Bernstein LR, Kishi DT.** Impact of clinical pharmacy services on prescribing on a cardiothoracic/vascular surgical unit. Drug Intell Clin Pharm 1985;19:440–4.
43. **Covinsky JO, Hamburger SC, Kelly KL, et al.** The impact of the docent clinical pharmacist on treatment of streptococcal pneumonia. Drug Intell Clin Pharm 1982;16:587–91.
44. **Chamberlain MA, Stergachis A, Sachse-Bray B, et al.** Evaluation of an inpatient decentralized pharmacy team program in an HMO setting. Hosp Pharm 1986;21:742–7.
45. **Chrischilles EA, Helling DK, Rowland CR.** Cost-benefit analysis of clinical pharmacy services in three Iowa family practice offices. J Clin Hosp Pharm 1985;10:59–66.
46. **Nelson AA, Beno CE, Davis RE.** Task and cost analysis of integrated clinical pharmacy services in private family practice centers. J Fam Pract 1983;16:111–16.
47. **Williamson DH, Cooper JW, Kotzan JA, et al.** Consultant pharmacist impact on antihypertensive therapy in a geriatric long-term care facility. Hosp Formul 1984;19:123–4.
48. **Thompson J, Floyd R.** Cost-analysis of comprehensive consultant pharmacist services in the skilled nursing facility: a progress report. Calif Pharm 1978;26:22–6.
49. **Strandberg LR, et al.** Effect of comprehensive pharmaceutical services on drug use in long-term care facilities. Am J Hosp Pharm 1980;37:92.
50. **Cooper JW.** *Effect of initiation, termination, and reinitiation of consultant clinical pharmacist services in a geriatric long-term care facility.* Med Care 1985;23:84–8.
51. **Cheung A, Kane R.** An application of clinical pharmacy in extended care facilities. Calif Pharm 1975;23:22.
52. **Brakebill JI, Robb RA, Ivey MF, et al.** Pharmacy department costs and patient charges associated with a home parenteral nutrition program. Am J Hosp Pharm 1983;40:260–3.
53. **Wateska LP, Sattler LL, Steiger E.** Cost of a home parenteral nutrition program. JAMA 1980;244:2303–4.
54. **Pathak DS, Nold EG.** Cost-effectiveness of clinical pharmaceutical services: a follow-up report. Am J Hosp Pharm 1979;36:1527–9.
55. **Poretz DM, Eron LJ, Goldenberg RI, et al.** Intravenous antibiotic therapy in an outpatient setting. JAMA 1982;248:336–9.
56. **Swenson JP.** Training patients to administer intravenous antibiotics at home. Am J Hosp Pharm 1981;38:1480–3.
57. **Fudge RP, Vlasses PH.** Third-party reimbursement for pharmacist instruction about antihemophilic factor. Am J Hosp Pharm 1977;34: 831–4.
58. **Schad R, Schneider PJ, Nold EG.** Reimbursable pharmacy teaching program for adrenalectomy patients. Am J Hosp Pharm 1979; 36:1212–14.
59. **Bootman JL, Wertheimer AI, Zaske D, et al.** Individualizing gentamicin dosage regimens in burn patients with gram-negative septicemia: a cost-benefit analysis. J Pharm Sci 1979;68:267–72.
60. **Schloemer JH, Zagozen JJ.** Cost analysis of an aminoglycoside pharmacokinetic dosing program. Am J Hosp Pharm 1984;41: 2347–51.
61. **Kimelblatt BJ, Bradbury K, Chodoff L, et al.** Cost-benefit analysis of an aminoglycoside monitoring service. Am J Hosp Pharm 1986; 43:1205–9.
62. **Holt RJ.** Cost savings from kinetic services. Am J Hosp Pharm 1985;42:786–7.
63. **Horn JR, Christensen DB, deBlaquiere PA.** Evaluation of a digoxin pharmacokinetic monitoring service in a community hospital. Drug Intell Clin Pharm 1985;19:45–52.
64. **Lehmann CR, Leonard RG.** Effect of theophylline pharmacokinetic monitoring service on cost and quality of care. Am J Hosp Pharm 1982;39:1656–62.
65. **Elenbaas RM, Payne VW, Bauman JL.** Influence of clinical pharmacist consultations on the use of drug blood level tests. Am J Hosp Pharm 1980;37:61–4.
66. **Levin B, Cohen SS, Birmingham PH.** Effect of pharmacist intervention on the use of serum drug assays. Am J Hosp Pharm 1981; 38:845–51.
67. **Dick ML, Winship HW III, Wood GC.** A cost effectiveness comparison of a pharmacist using three methods for identifying possible drug-related problems. Drug Intell Clin Pharm 1975;9:257–62.
68. **Thompson JF, McGhan WF, Ruffalo RL, et al.** Clinical pharmacists prescribing drug therapy in a geriatric setting: outcome of a trial. J Am Geriatr Soc 1984;32:154–9.
69. **Bond CA, Monson R.** Sustained improvement in drug documentation, compliance and disease control: a four-year analysis of an ambulatory care model. Arch Intern Med 1984;144:1159–62.
70. **Davis S.** Evaluation of pharmacist management of streptococcal throat infections in a health maintenance organization. Am J Hosp Pharm 1978;35:561–6.
71. **D'Achille KM, Swanson LN, Hill WT Jr.** Pharmacist-managed patient assessment and medication refill clinic. Am J Hosp Pharm 1978;35: 66–70.
72. **Gray DR, Garabedian-Ruffalo SM, Chretien SD.** Cost-justification of a clinical pharmacist-managed anticoagulation clinic. Drug Intell Clin Pharm 1985;19:575–80.
73. **Munzenberger PJ, Swanson LN, Smith RE, et al.** A cost/impact analysis of selected clinical pharmacy functions in three hospitals. Am J Hosp Pharm 1974;31:947–53.
74. **MacKeigan LD, Bootman JL.** A review of cost-benefit and cost-effectiveness analyses of clinical pharmacy services. J Pharm Market Manage 1988 (in press.)
75. **Curtiss FR.** Time to reassess approaches to financing clinical pharmacy services. Am J Hosp Pharm 1983;40:1146.
76. **Sylvester KL.** Reimbursement for clinical pharmaceutical services in university hospitals. Am J Hosp Pharm 1982;39:642–3.
77. **Almond SN, Caiola SM, Huff PS.** *Pharmacist-managed allergy* desensitization program. Am J Hosp Pharm 1982;39:284–8.
78. **Conner CS, Sawyer BR, Sparbard JA, et al.** Consultations with lawyers as a funding source for drug information centers. Am J Hosp Pharm 1982;39:1311–13.
79. **Klepcyk JC, Billups NF, Hicks CJ.** Contract for educational services between a college of pharmacy and private hospitals. Am J Hosp Pharm 1984;41:2056–60.
80. **Oakley RS, McCormick WC.** Reimbursement for nondistributive pharmaceutical services in hospitals. Am J Hosp Pharm 1982;39: 594–9.
81. **Pathak D, Nold EG.** Developing reimbursable clinical pharmacy programs: a goal-oriented approach. Am J Hosp Pharm 1979;36: 1548–52.
82. **Nold EG, Pathak D.** Third-party reimbursement for clinical pharmacy services: philosophy and practice. Am J Hosp Pharm 1977;34:823–6.
83. **Stolar MH.** National survey of hospital pharmaceutical services. Am J Hosp Pharm 1985;42:2667–78.
84. **Deiner CH, ed.** Lilly hospital pharmacy survey 1987. Indianapolis: Eli Lilly & Co., 1987.
85. **Park GD, Ball WD.** Problems with evaluations of clinical pharmaceutical services. Am J Hosp Pharm 1980;37:1290–1.
86. **Phillips DJ, Hopkins LE.** Determining total cost-effectiveness of drug therapy. Am J Hosp Pharm 1987;44:67.
87. **Chrischilles EA, Helling DK, Rowland CR.** Model for cost-benefit analysis of clinical pharmacy in family practice. Am J Hosp Pharm 1982;39:992–8.

Appendix I. Studies on the Economic Value of Clinical Pharmacy Services

Clinical Pharmacy Service	Study Objective	Type of Economic Evaluation	Results Obtained	Comments
Discharge Counseling				
Ref. 15	To determine savings to patients as a result of discharge counseling	Cost analysis	Decr. discharge prescription charges to patients Savings in $/pharmacist hour	Cost of providing service not addressed
Drug Therapy Monitoring & Consultation (Acute Care)				
Drugs:				
Albumin				
Ref. 16	To examine cost savings to hospital by substituting hetastarch for albumin	Cost analysis	Drug cost savings from switch from albumin to hetastarch	Cost of providing service not addressed No bleeding w/ hetastarch
Ref. 17	To promote the appropriate use of albumin & determine cost savings as a result	Cost analysis	Drug cost savings and decr. inappropriate albumin use	Cost of service/alternate therapies not included Operating room albumin use not included
Ref. 18	To examine cost saving to hospital by substituting hetastarch for albumin	Cost analysis	Drug cost savings from incr. hetastarch/decr. albumin use	Personnel costs included Net cost savings lumped w/ all clinical services
Antibiotics (general)				
Ref. 19	To determine cost avoidance to hospital from antibiotic surveillance service	Cost analysis	Drug cost avoidance demonstrated	Cost of providing service not addressed
Antipseudomonal PCNs				
Ref. 20	To determine cost savings to hospital by using carbenicillin for ticarcillin	Cost analysis	Net cost savings demonstrated	Personnel costs included
Aminoglycosides				
Ref. 21	To determine cost savings to hospital by substituting gentamicin for tobramycin	Cost analysis	Drug cost savings from switch from tobramycin to gentamicin	Cost of providing service not addressed
Ref. 22	To determine cost savings to hospital by substituting gentamicin for tobramycin	Cost analysis	Drug cost savings from switch from tobramycin to gentamicin Decreased aminoglycoside use	Cost of pharmacist time & alternative drug (when aminoglycoside not used) not included
Ref. 23	To determine cost savings to hospital by substituting gentamicin for tobramycin	Cost analysis	Drug cost savings from switch from tobramycin to gentamicin Overall drug cost savings to personnel cost ratio >10:1	Personnel costs included
Cephalosporins				
Ref. 18	To examine cost savings to hospital by improving cefazolin dosing & decr. 2nd & 3rd generation ceph use	Cost analysis	Drug cost savings documented Net cost savings and revenue generated reported for all clinical services	Personnel costs included Cost of alternative drugs (in place of 2nd or 3rd gen. cephs.) not included
Ref. 20	To determine cost savings to hospital by substituting cefazolin for cefamandole or cefoxitin as appropriate	Cost analysis	Net cost savings demonstrated	Personnel costs included
Ref. 24	To determine cost savings to hospital by restricting the use of cephalosporins	Cost analysis	Net cost savings demonstrated	Personnel costs included

Appendix I. Studies on the Economic Value of Clinical Pharmacy Services (continued)

Clinical Pharmacy Service	Study Objective	Type of Economic Evaluation	Results Obtained	Comments
Ref. 25	To determine cost savings to hospital through appropriate cefazolin use	Cost analysis	Net cost savings demonstrated	All costs thoroughly addressed, including personnel costs
Ref. 26	To determine cost savings to hospital by reducing cefotaxime & moxalactam use	Cost analysis	Potential cost savings shown by decr. inappropriate use	Personnel costs included
Ref. 27	To determine impact on ceph. use & cost savings to hospital w/ no service vs. newsletter vs. clinical service	Cost analysis	Drug cost savings demonstrated with clinical service (direct pharmacist-physician interaction)	Cost of providing service not included Pharmacy newsletter had minimal impact
Ref. 28	To determine cost savings to hospital by substituting cefazolin for cephapirin	Cost analysis	Drug cost savings demonstrated	Pharmacist time involved not included
Ref. 29	To determine savings to patients and hospital by using cefuroxime for cefamandole in surgical prophylaxis	Cost-effectiveness analysis	Decr. patient drug charges Decr. drug purchases/ inventory Improved revenue vs. expenses Similar wound infection rates	Cost assessment included personnel costs except for clinical pharmacist's time
Ref. 30	To determine cost savings to hospital through cephalosporin review & restriction	Cost analysis	Net cost savings primarily by substituting cefazolin for cefamandole	Cost assessment included personnel costs except for clinical pharmacist's time
Corticosteroids				
Ref. 31	To evaluate the impact of medical education on use & cost of corticosteroids in acute COPD exacerbations	Cost analysis	Drug cost savings by reducing intravenous doses & converting to oral corticosteroids Decr. patient charges	Cost of pharmacist time on service not addressed Cost of monthly education by pharmacist included
Intravenous Therapy				
Ref. 32	To determine cost savings to hospital by discontinuing IV therapy when appropriate	Cost analysis	Drug & labor cost savings as a result of decr. IV admixture waste	Cost of providing service not addressed
Ref. 33	To determine cost savings to hospital & patient by reducing IV therapy use	Cost analysis	Decr. number, cost & duration of IV fluids & medications	Cost of providing service not addressed
Non-formulary Drug Use				
Ref. 34	To determine cost avoidance to hospital by reducing non-formulary drug use	Cost analysis	Cost avoidance (nonformulary-formulary drug costs) shown Decr. non-formulary drug use	Personnel costs included Decentralized services > success than centralized
Psychiatric Drugs				
Ref. 35	To determine the impact on quality and cost of health care to psychiatric patients in a day treatment center	Cost-effectiveness analysis	Quality of care ≥pre-study: same mental function; improved compliance; decr. ADR, # drugs Decr. drug & labor costs	Personnel costs included; additional costs thought to be minimal, but not measured
Ref. 36	To evaluate the impact on quality and cost of health care to psychiatric patients in an acute care facility	Cost-effectiveness analysis	Decr. # of drugs & doses used Decr. LOS, time on acute care unit, readmission rate over 1 year follow-up/patient	Cost savings appear substantial but costs incompletely assessed

Appendix I. Studies on the Economic Value of Clinical Pharmacy Services (continued)

Clinical Pharmacy Service	Study Objective	Type of Economic Evaluation	Results Obtained	Comments
Theophylline				
Ref. 37	To evaluate the impact of medical education on use & cost of theophylline in COPD	Cost analysis	Decr. length of IV therapy, drug & pump costs/charges from early switch to po theophylline	Personnel costs included
TPN				
Ref. 38	To evaluate the impact on quality and cost of TPN in a neonatal intensive-care unit	Cost-effectiveness analysis	Incr. total costs but decr. daily cost/gm of weight gain Improved nutr. status (wt gain)	Personnel costs included Final outcomes (morbidity, mortality) not assessed
Ref. 39	To evaluate the impact on quality and cost of TPN in pediatric patients	Cost-effectiveness analysis	Decr. TPN charges, waste Incr. monitoring charges Improved nutr. status (wt gain)	Fees used instead of costs Final outcomes not assessed
Ref. 40	To evaluate the impact on quality and cost of TPN by using standard TPN solutions	Cost-effectiveness analysis	Incr. # of patients on TPN Cost savings due to incr. use of standard TPN & decr. waste	Outcome data not presented but medical staff audit noted improved quality
Vancomycin				
Ref. 23	To determine cost savings to hospital by substituting nafcillin for vancomycin	Cost analysis	Drug cost savings from switch from vancomycin to nafcillin Overall drug cost savings to personnel costs ratio >10:1	Personnel costs included
Other:				
Orthopedic Unit				
Ref. 41	To determine the impact on cost of all drug therapy, antibiotic use, & on LOS	Cost-minimization analysis	Decr. drug costs (especially antibiotics); no difference in LOS (clinical outcome)	Cost of providing service not included Randomized/cross-sectional
Cardiothoracic/vasc unit				
Ref. 42	To determine the impact on cost of all drug therapy, antibiotic use, & on LOS	Cost-minimization analysis	Decr. drug costs (especially antibiotics); no difference in LOS (clinical outcome)	Cost of providing service not included Randomized/cross-sectional
Streptococcal pneumonia				
Ref. 43	To determine the impact on the management of pneumococcal pneumonia	Cost-effectiveness analysis	Decr. total antibiotic costs Decr. LOS postulated No readmissions in either group	Cost of providing service not included
Orthopedic/Oncology Units				
Ref. 44	To examine decentralized services' impact on communication patterns/hospital drug costs	Cost analysis	Decr. targeted drug costs Improved communication with nurses, physicians	Personnel costs included Involved aminoglycosides, cefazolin, metoclopramide
Drug Therapy Monitoring & Consultation (Family Practice)				
Ref. 45	To determine net benefit to patients using cost-benefit analysis model in 3 offices	Cost-benefit analysis	Decr. physician time spent, referrals Incr. quality of care, appt. compliance rate	Detailed application of cost-benefit model Benefit varied depending on assumed incr. in quality
Ref. 46	To conduct comparative task & cost (to patient) analysis of services provided in 3 offices	Cost analysis	Total costs per prescription plus net profit Rx prices comparable to national average	Clinical services can be implemented & still keep Rx prices competitive

Appendix I. Studies on the Economic Value of Clinical Pharmacy Services (continued)

Clinical Pharmacy Service	Study Objective	Type of Economic Evaluation	Results Obtained	Comments
Drug Therapy Monitoring & Consultation (Long Term Care)				
Ref. 47	To compare quality & cost of antiHTN drug therapy to patients before/after services	Cost-effectiveness analysis	Decr. antihypertensive drug costs, hypotensive readings, abnormal potassium levels	Cost of providing service not included AWP Rx price used
Ref. 48	To examine the impact on health care costs to patients in skilled nursing facility	Cost-effectiveness analysis	Net cost savings to 3rd party payers; decr. hospitalization due to ADRs, improved quality	Personnel & overhead costs included
Ref. 49	To examine the impact on drug use & costs to patients in LTCF over an 8-year period	Cost analysis	Decr. prescription and OTC drug use & costs (prices) to patients or 3rd party payers	Personnel costs not included; impact of clinical services not isolated
Ref. 50	To examine the effect of initiating/stopping/reinitiating services to LTCF patients	Cost analysis	Decr. # drugs/charges, adm/disch/death rate; incr. hosp. rate; usage patterns reversed without clinical services	Fee for service, Rx charges used; cause & effect for turnover rates & services not established
Ref. 51	To examine the impact on quality & cost of health care to patients in SNF	Cost-effectiveness analysis	Decr. # drugs/costs, med errors Estimated decr. ADRs, decr. hosp. rate/costs as a result	Cost of providing service not included
Drug Therapy Monitoring, Consultation & Patient Teaching (Home Care)				
TPN				
Ref. 52	To determine pharmacy costs & patient charges for TPN in home vs. hospital setting	Cost analysis	For home TPN, pharmacy costs (except implementation costs) recovered; net patient savings Hospital-days avoided	Direct & indirect pharmacy costs & patient charges fully assessed
Ref. 53	To determine hospital costs & patient charges for TPN in home vs. hospital setting	Cost analysis	Net savings to patient for home TPN compared to TPN in hospital; hosp-days avoided	Direct hospital costs & patient charges thoroughly assessed
Ref. 54	To study the cost- effectiveness of pharmacist-conducted home TPN training program	Cost-effectiveness analysis	Decr. estimated # hosp-days & charges; net estimated savings to patient & society measured	Pharmacy charges used "Improved care" = decr. # of hosp-days or clinic visits
Antibiotics				
Ref. 55	To determine the cost savings to patients for outpatient IV antibiotic therapy	Cost analysis	Net savings in patient or 3rd party payer charges; clinical successes/minimal complications; hosp-days avoided	Direct hosp. costs, patient & hospitalization charges measured; cost analysis & outcome description
Ref. 56	To describe the efficacy & determine cost savings to patients for home IV antibiotics	Cost analysis	Net savings in patient or 3rd party payer charges; treatment successful/no complications Hospital-days avoided	Actual patient charges vs potential hosp. charges compared; cost analysis & outcome description
Ref. 54	To study the cost- effectiveness of pharmacist-conducted training program in home self-administration of meds	Cost-effectiveness analysis	Decr. estimated # hosp-days & charges; net estimated savings to patient & society measured for various medications	Pharmacy charges used "Improved care" = decr. # of hospital-days or clinic visits

Appendix I. Studies on the Economic Value of Clinical Pharmacy Services (continued)

Clinical Pharmacy Service	Study Objective	Type of Economic Evaluation	Results Obtained	Comments
Miscellaneous				
Ref. 57	To describe a pharmacist-conducted training program in home self-administration of antihemophilic factor (AHF)	Cost analysis	Net savings to patients & 3rd party payers for home AHF compared to previous situation No complications with home AHF	Cost of pharmacist time not included; other costs assessed; 3rd party reimbursement obtained
Ref. 58	To describe a pharmacist-conducted training program for adrenalectomy patients	Cost analysis	Decr. health care charges to patients &/or 3rd party payers	Cost of pharmacist time not included; 3rd party reimbursement obtained
Pharmacokinetic Service				
Aminoglycosides				
Ref. 59	To evaluate the impact of individualized gentamicin dosing on patient outcomes using cost-benefit analysis	Cost-benefit analysis	Kinetic group: decr. mortality incr. LOS, infection duration Benefit: cost ratio = 8.7: 1 using 6% discount rate	Detailed application of cost-benefit model Incr. quality/cost-benefit to patients & society Retrospective study
Ref. 60	To determine cost savings to patients and the hospital by individualized dosing service	Cost analysis	Decr. patient drug charges Savings to hospital by decr. personnel & supply costs	Personnel costs included Drug & lab charges used to calculate patient savings
Ref. 61	To evaluate the impact of aminoglycoside dosing to the hospital & patients using cost-benefit analysis	Cost-benefit analysis	Patient outcomes similar Benefit: cost ratio = 1.13: 1 Benefit mainly when switched from tobramycin to gentamicin	Simplified application of cost-benefit model Thorough cost assessment Prospective study
Ref. 62	To document the need for a computerized aminoglycoside dosing service	Cost analysis	Potential savings to patients Potential for more optimal use of serum drug level data	Conducted to illustrate need for a dosing service
Digoxin				
Ref. 63	To determine the impact of digoxin level monitoring on quality/cost of patient care	Cost-effectiveness analysis	Net cost savings to patients from decr. digoxin assays Decr. LOS, digoxin toxicity	Personnel costs included Decr. inappropriately drawn or unnecessary dig. assays
Ref. 64	To determine the effect of theophylline level monitoring on quality/cost of pt. care	Cost-effectiveness analysis	No improved quality of care Incr. LOS, # of drug levels, pt. charges in kinetic group	Personnel costs included Service not cost-effective under the study conditions
General				
Ref. 65	To determine the impact on the use & cost of serum drug level monitoring	Cost analysis	Decr. # of unnecessary drug levels Net patient charge savings	Personnel costs included Lab charges rather than costs used
Ref. 66	To determine the impact on the use & cost of serum drug level monitoring	Cost analysis	Appropriate use of serum drug levels incr. significantly Net patient charge savings	Personnel costs included Lab charges used; included physician education

Appendix I. Studies on the Economic Value of Clinical Pharmacy Services (continued)

Clinical Pharmacy Service	Study Objective	Type of Economic Evaluation	Results Obtained	Comments
Medical Rounds Participation				
Ref. 67	To conduct a cost-effectiveness analysis of 3 methods of identifying possible drug-related problems (PDRP)	Cost-effectiveness analysis	Cost/PDRP highest for rounding > chart review > pt. drug profiles; but more clinically sign. problems found on rounds	Personnel costs included More information obtained, better rapport established by rounding
Primary Care				
Ref. 68	To evaluate the impact of a clinical pharmacist prescriber on quality & cost of care in SNF patients	Cost-effectiveness analysis	Decr. mortality, hosp. rate, # of drugs; incr. discharges to home/lower levels of care Potential net patient savings	Personnel costs included Prescribing supervised by family practitioner
Ref. 69	To evaluate the impact of a clinical pharmacist & nurse clinician on quality/cost of care in ambulatory care clinic	Cost-effectiveness analysis	Significant improvement in BP control/medication compliance Decr. # of drugs, clinic visits Net patient savings	Personnel time included Involved rheumatology & renal clinics
Ref. 70	To evaluate clinical pharmacist's management of strep throat infections in an HMO	Cost-minimization analysis	Efficacy same, personnel time & cost per case less Potential savings to patient	Limited cost assessment Hypothetical manpower costs used
Ref. 71	To evaluate cost- effectiveness of clinical pharmacist in a medication refill clinic	Cost-effectiveness analysis	Correct refill decisions made (judged by physicians); cost per visit less than for MD	Personnel costs included Measured outcome = correct refill decision
Ref. 72	To conduct cost-benefit analysis of clinical pharmacist-managed anticoagulation clinic	Cost-benefit analysis	Incr. % therapeutic PT ratios Decr. admissions for bleeding or clotting; patient savings Benefit: cost ratio = 6.55: 1	Simplified cost-benefit model applied Justified clinical pharmacist position
Comprehensive clinical services				
Ref. 73	To conduct a comparative time and cost analysis of clinical services in 3 hospital settings	Cost analysis	Conducted more extensive adm medication histories than MDs Time & cost data varied depending on patients/hospital	Clinical activities: adm drug histories, drug therapy monitoring, drug info. & discharge consults

Abbreviations: adm = admission; ADRs = adverse drug reactions; AHF = antihemophilic factor; antiHTN = antihypertensive; appt = appointment; AWP = average wholesale price; BP = blood pressure; ceph = cephalosporins; COPD = chronic obstructive pulmonary disease; decr = decreased; dig = digoxin; disch = discharge; HMO = health maintenance organization; hosp = hospital or hospitalization; hosp-days = hospital-days; incr = increased; info = information; IV = intravenous; LOS = length of stay; LTCF = long-term care facility; med = medication; nutr = nutritional; PDRP = possible drug-related problems; po = oral; PT = prothrombin time; pt = patient; Rx = prescription; SNF = skilled nursing facility; TPN = total parenteral nutrition; w/ = with; wt = weight; 2nd &/or 3rd gen cephs = second &/or third generation cephalosporins.