Computer-Assisted Retrospective Clinical Activities Statistics (CARCAS) Program

Mark Donaldson, John Hope and Peter Jewesson

ABSTRACT

Clinical pharmacy services have been demonstrated to have a positive impact on patient care in the hospital setting. Accurate and complete documentation of interventions aimed at improving drug use is essential to assess workload characteristics, determine the impact of pharmacist activities, justify current programs and predict future clinical staffing requirements.

The need for an improved system of collecting and analyzing clinical workload statistics led to the development of a Computer-Assisted Retrospective Clinical Activities Statistics (CARCAS) Program in our department. Using a pre-defined clinical activity coding system, pharmacist activities were efficiently documented on a daily basis using an existing distributional computer system. Training requirements and data entry time were minimal. The CARCAS Program appeared to capture more clinical pharmacist activities than the earlier manual system.

The flexibility of the CARCAS Program should permit adaptation to other hospitals with similar computer systems regardless of the nature of their clinical programs.

Key Words: *CARCAS, clinical, computer, workload statistics*

Can J Hosp Pharm 1993;46:17–22

RÉSUMÉ

On a démontré que les services de pharmacie clinique ont une incidence positive sur les soins prodigués aux malades, en milieu hospitalier. Il est essentiel de rassembler une documentation exacte et complète sur les interventions qui visent à améliorer la pharmacothérapie pour mieux établir les particularités de la charge de travail, préciser l'impact des activités du pharmacien, justifier les programmes existants et prévoir les besoins ultérieurs de dotation en clinique.

La recherche d'un meilleur système de collecte et d'analyse des données sur la charge de travail clinique a débouché sur la création d'un programme statistique d'analyse rétrospective des activités cliniques assistée par ordinateur (CARCAS — Computer-Assisted Retrospective Clinical Activities Statistics). Grâce à une codification des activités cliniques, on est parvenu à bien documenter les tâches quotidiennes du pharmacien avec le système informatisé de distribution déjà existant. L'utilisation du programme n'exige qu'une formation rudimentaire et il faut peu de temps pour entrer des données. Le programme CARCAS semble relever plus d'activités de pharmacie clinique que le système manuel antérieur.

La souplesse du programme devrait en permettre l'adaptation à d'autres hôpitaux dotés d'un système informatique similaire, quelle que soit la nature des programmes cliniques.

Mots clés: *CARCAS, clinique, ordinateur, statistiques sur la charge de travail*

Mark Donaldson, B.Sc.(Pharm), is a member of the Department of Pharmacy, Vancouver General Hospital.
John Hope, B.Sc.(Pharm), is Director of the Department of Pharmacy, Burnaby Hospital.
Peter Jewesson, Ph.D.(Pharm. Sciences) is Director of the Department of Pharmacy, Vancouver General Hospital and Associate Professor, Faculty of Pharmaceutical Sciences, University of British Columbia and Clinical Instructor, Division of Infectious Diseases, Department of Medicine, Vancouver General Hospital.
Address correspondence to: Dr. Peter Jewesson, Vancouver General Hospital, Pharmacy Services, 855 West 12th Avenue, Vancouver, BC, V5Z 1M9.
Presented in poster form at the 1992 Professional Practice Conference, Canadian Society of Hospital Pharmacists, February 1992

INTRODUCTION

Clinical pharmacy services have been demonstrated to have a positive impact on patient care in the hospital setting.[1-6] Accurate and complete documentation of interventions aimed at improving drug use is essential to assess workload characteristics, determine the impact of pharmacist activities, justify current programs and predict future clinical staffing requirements.[7-11]

Manual documentation systems (e.g., maintaining daily written diaries) are typically used to document clinical activities.[3,7-12] Limitations to these systems include inefficiency, poor pharmacist compliance and variability in data interpretation. This can be a particularly significant problem in large centres with active clinical programs involving many pharmacists. To overcome this difficulty, some authors recommend the use of a computerized database system.[13-15]

The Pharmacy Department at Vancouver General Hospital, a 1000-bed tertiary care hospital, is responsible for a Regionalized Clinical Pharmacy Services Pro-

gram in which over thirty baccalaureate and doctoral pharmacists performed a variety of clinical functions on a rotational basis, seven days per week. Prior to this study, the Department used a manual system of workload documentation for the clinical program. A review of the manual data collected in 1990 revealed significant variability in the pharmacists' interpretation and documentation of interventions. Pharmacist discontent with the manual system was also identified. These problems were also documented by others.[3,7-12] It was apparent that a modification of the clinical workload documentation system at this hospital was required.

The purpose of this paper is to describe the development, implementation and evaluation of a new clinical workload documentation system which uses a computer-based program to facilitate data collection and analysis.

METHODS

Historical Statistics

In February 1990, the Regionalized Clinical Pharmacy Services (RCPS) Program was instituted by the Department of Pharmacy. Through this program, clinical pharmacists performed a variety of clinical functions throughout the hospital including patient, clinic and Kardex rounds, pharmacokinetic monitoring, selective drug monitoring, medication histories, patient counselling and others. Approximately 12 baccalaureate and doctoral pharmacists were scheduled for clinical work five days weekly and one pharmacist was available during the weekend. At the beginning of this study, clinical workload statistics were recorded manually. Pharmacists were responsible for documenting the patients reviewed and the "Drug Review Episodes (DRE)" performed according to drug type. A DRE was defined as a review of a health record to assess a potential therapeutic problem for a drug for an individual patient. For example, a pharmacokinetic assessment of digoxin and a review of potassium supplementation in a given patient would qualify as two DRE.

Development of a Computer Program (CARCAS)

Drug distribution is assisted by a computerized program (BDM Systems Solution 1/Model 600, 1991, Saskatoon, Saskatchewan) which generated a general demographics and medication profile for all patients. Since the pharmacists were very familiar with the distributional computer and multiple terminals were available for data input, we elected to use this system as the template for the development of a Computer-Assisted Retrospective Clinical Activities Statistics (CARCAS) Program.

The concept behind the CARCAS Program was that computerized BDM patient medication profiles could also serve as a clinical workload data collection system. This permitted the clinical pharmacist to enter workload statistics at any terminal at any time and avoided the use of the manual Clinical Activities Form. Under the CARCAS Program, a "pharmacist ward" was created and beds were "occupied" by our clinical pharmacists. Each pharmacist had a patient medication profile identical to that of an actual inpatient. Existing patient and drug data fields were modified to reflect clinical activities. Patient identity was converted to pharmacist name, medication fields corresponded to clinical activities, the physician field was the specific region in the RCPS and each entry reflected one or more DRE. Activity codes were developed by the investigators to enhance the user-friendliness of the system (Appendix A). These codes closely mimicked the existing formulary codes and were used to designate specific clinical pharmacy activities, thus, minimizing subjective interpretation. The four-part activity codes reflected the nature of the drug (or service), the source of the problem (i.e., method of screening used to identify the potential problem), the nature of the problem and the outcome of any intervention which ensued.

Pre-Implementation Survey

Prior to their introduction to CARCAS, the baccalaureate clinical pharmacists were surveyed to determine their impressions of various issues pertaining to the clinical program and the existing manual system for collecting clinical workload statistics. A standardized 24-item written questionnaire was developed and administered to these pharmacists. Questions were designed to solicit impressions of the manual system, suggestions for improvement, and comments on the potential role of computerization. Surveys were completed by the pharmacists independently and collected by one investigator (MD) within seven days of distribution.

Implementation of Trial CARCAS Program

At the time of this study, the hospital was divided into four geographically-based clinical pharmacy regions. Three of these regions were identified for the sequential trial implementation of the CARCAS Program. One region was excluded from the initial trial due to involvement with other program development activities. During the period November 9, 1990 through May 10, 1991, clinical pharmacists assigned to these trial regions were given 30-minute training sessions by one investigator (MD). This investigator was also available on a daily basis to provide additional

support to the trainees. The clinical pharmacists then employed the CARCAS program during a three-week introductory period in the trial regions.

Post-Implementation Survey

At the completion of each three-week CARCAS Program introductory period, the baccalaureate pharmacists were administered a second written questionnaire. This survey was comprised of four identical questions extracted from the initial survey. These questions pertained to general impressions of the CARCAS Program. The results of this follow-up survey were then compared to those of the initial survey to assess the acceptance of the CARCAS Program by the pharmacists.

CARCAS Data Entry Assessment

To determine the typical data entry time required when using the CARCAS Program, one investigator (MD) used a digital watch to record the time required to enter workload statistics. The first five pharmacists to participate in the program were selected for observation from November 12-30, 1990. These pharmacists were instructed to enter their data at the end of each working day on a daily basis for one week, followed by data entry every second day for one week and finally, once weekly for their final week.

To compare data collection methods, these five pharmacists were also requested to concurrently collect manual statistics during the three week introduction period. The DRE per five day week recorded by each pharmacist was then determined for the trial period.

Non-parametric data were analyzed using the Fisher Exact test (two-tailed) and chi-square (with Yates correction). Parametric data were analyzed using Student's *t* Test. Correlations between continuous variables were determined using the Pearson Product Moment Correlation procedure. Significance was set at $p < 0.05$.

RESULTS

Historical Statistics

During 1990, the RCPS Program reviewed 6,629 patients and recorded 15,420 DRE. An average of 2.3 DRE per patient was recorded with pharmacist interventions occurring in over 40% of DRE. The acceptance rate for recommendations made was 82%.

Survey Responses and Analysis

Twenty-four baccalaureate clinical pharmacists completed the pre- and post-implementation surveys. Responses to the survey questions are shown in Figures 1-4.

On a 10-point scale, the respondents mean rating of the accuracy of the manual clinical workload statistics system was 6 (range 1-9; Figure 1). Using the same scale, the clinical pharmacists graded the accuracy and ease of use of the existing form with a mean rating of 6.3 (range 1-9) and 5.9 (range 2-9), respectively. A significant relationship between impressions of the overall accuracy of the system and both the accuracy and ease of use of these Clinical Activities Forms was observed ($p = 0.001$).

Respondents estimated that they spent a mean of 12% (range 1%-60%) of their time manually collecting and documenting clinical

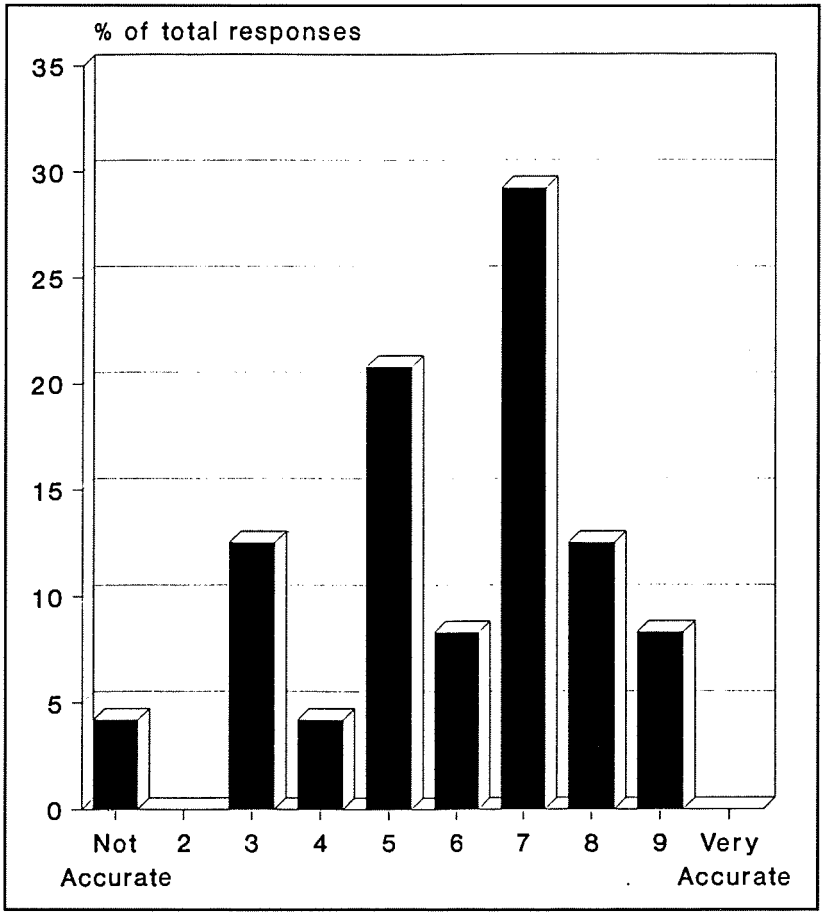

Figure 1. Question: "Do the Clinical Workload Statistics you currently submit accurately reflect your clinical workload?" (n = 24 pharmacists)

workload statistics (Figure 2). Conversely, respondents estimated that a mean of 7% (range 1%-60%) was appropriate for this function. A positive relationship between the percentage of clinical time that pharmacists estimated they should spend recording workload statistics and the percentage of clinical time they actually spent was observed ($p = 0.001$).

Most clinical pharmacists considered clinical workload statistics to be an important personal responsibility of all clinical pharmacists (10-point scale, mean = 8.0; range 2-10). Respondents also felt that clinical workload statistics were necessary to the department as a whole (10-point scale, mean = 8.9; range 6-10). A positive relationship between these responses was also observed ($p = 0.001$).

Over 80% of clinical pharmacists felt that the manual system should be changed (Figure 3). An equivalent portion of pharmacists felt that computerization would be beneficial. Although not statistically significant, the rate of positive responses was higher during the follow-up survey. Prior to their introduction to the CARCAS Program, only 62.5% of clinical pharmacists felt that the drug distribution computer system could be used for clinical workload statistics purposes. This increased to over 90% of respondents following the three-week introduction to the CARCAS Program ($p = 0.036$).

Factors identified by respondents as critical to the feasibility of using the drug distribution computer are shown in Figure 4. Most issues related to the user-friendliness of the system (e.g., ease of use and efficiency). Some concerns were expressed regarding the number of data entries required using the CARCAS Program and the accuracy of these data entries

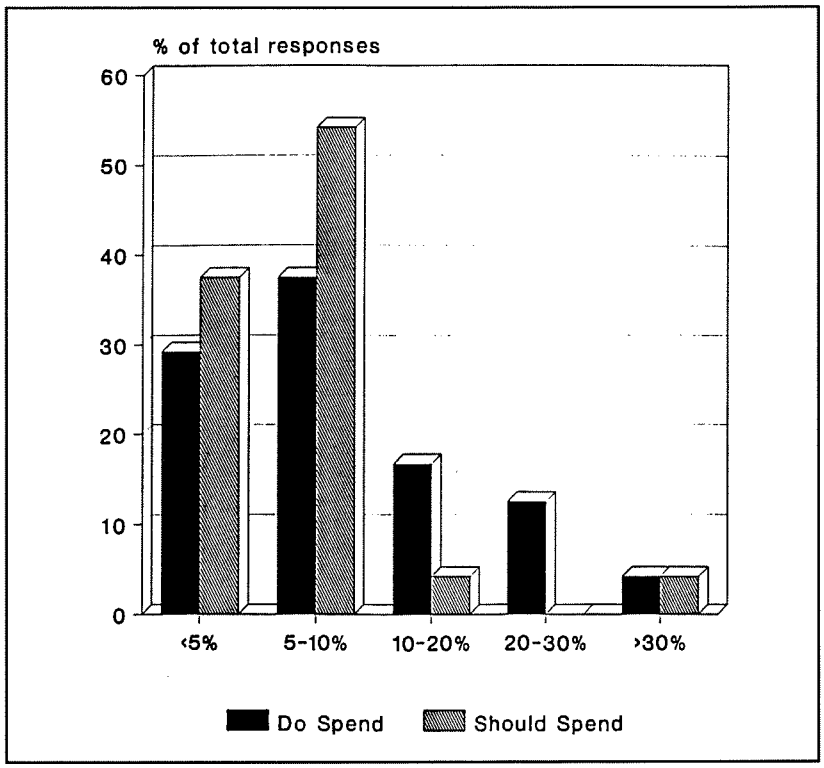

Figure 2. Question: "What percent of your clinical time do you/should you spend recording statistics?" (n = 24 pharmacists)

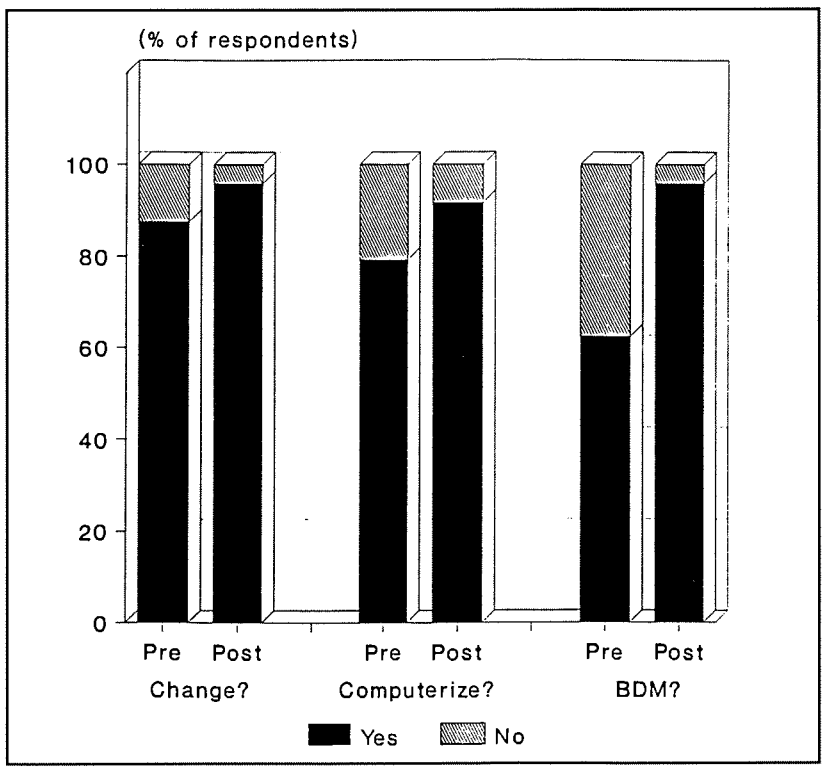

Figure 3. Question: "Should the current Clinical Workload statistics system be changed? Can a computer be utilized for this purpose? Would you prefer the BDM be used for this function?" (n = 24 pharmacists)

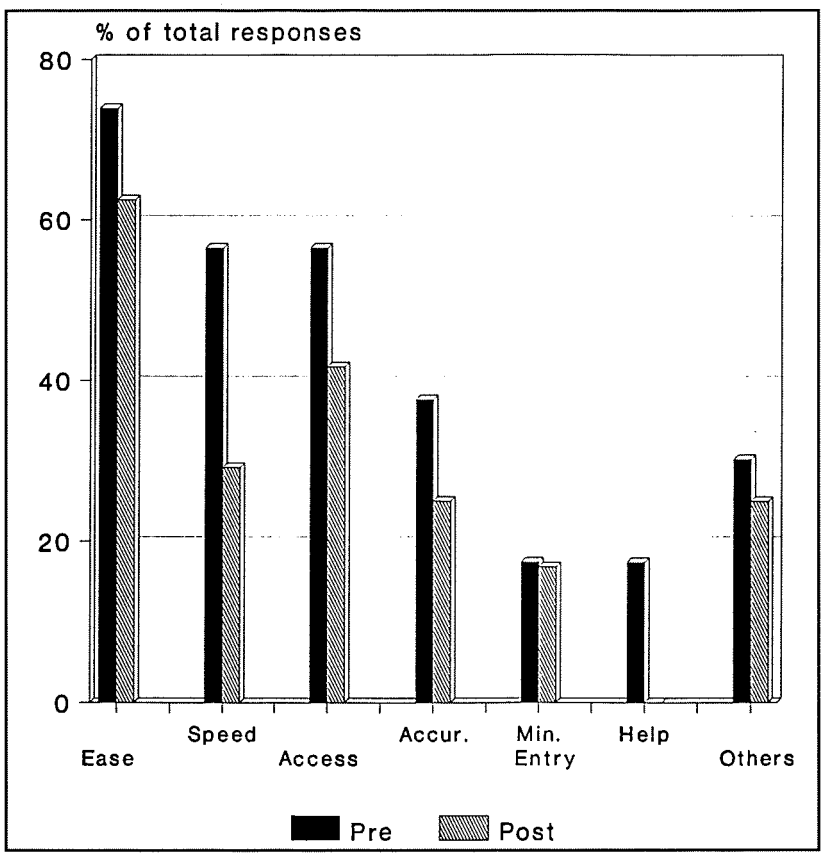

Figure 4. Question: "What factors do you consider important when determining the feasibility of using the BDM system for gathering Clinical Workload Statistics?" (n = 24 pharmacists)

as compared to a manual system. Following introduction to the CARCAS Program, these concerns were reduced.

CARCAS Data Entry Assessment

Mean data entry times per DRE using the CARCAS Program are shown in Table I. Data entry required about 40 seconds per DRE. While data entry times tended to decrease over the three-week evaluation period indicating pharmacist adaptation to the system, the close similarity between data entry times for daily versus weekly data entry suggests that these are equally efficient.

The mean number of recorded DRE per day via the manual system was 9.6 versus 12.3 for the concurrently adopted CARCAS Program. Pharmacists, thus, recorded 28% more DREs using the CARCAS Program. Approximately eight minutes of terminal use were required daily for data entry purposes.

Table I. Timed data entry using the CARCAS Program (n = 5 pharmacists)

Week	Frequency of Data Entry	Entry time/ DRE (minutes)
1	Daily	0.72
2	Every second day	0.68
3	Once a week	0.67

DISCUSSION

The need for an improved system of collecting clinical workload statistics led to our development and implementation of the CARCAS Program. To our knowledge, this is the first computerized system of this type in Canada. Using a defined clinical activity coding system, pharmacist activities were efficiently documented on a daily basis using an existing distributional computer system. Training requirements and data entry time were minimal. Although daily versus weekly data entry appeared to be equally efficient, we recommended daily entry to improve the accuracy of the information recorded. Activity codes were easily interpreted and the CARCAS Program appeared to capture more drug review episodes than that recorded using the earlier manual system.

In view of the success of the study and the pharmacist acceptance of this system, we expanded the use of the CARCAS Program to include the rest of the clinical regions in the hospital. Additional clinical activity codes were also created to reflect other forms of clinical intervention. We are now downloading the CARCAS Program data from the BDM system into a relational database (dBase IV, Version 1.4, Borland). With this latter database, which is also employed for Drug Use Evaluation purposes,[16] we are now capable of assessing trends in workload according to region and manpower, drug type and therapeutic problems. In addition, an assessment of the impact of the interventions on therapy can be done to help us determine which activities are "high yield" (i.e., result in change in therapy) and which are in need

of re-assessment to determine a future approach to the problem. We expect to publish the results of this analysis process in a future publication.

The flexibility of the CARCAS Program should permit adaptation to other hospitals with similar computer systems regardless of the nature of their clinical programs.

REFERENCES

1. Hatoum HT, Hutchinson RA, Witte KW, et al. Evaluation of the contribution of clinical pharmacists: Inpatient care and cost reduction. *Drug Intell Clin Pharm* 1988; 22:252-9.
2. Abramowitz PW. Controlling financial variables: Changing prescribing patterns. *Am J Hosp Pharm* 1984; 41:503-13.
3. Hatoum HT, Catizone C, Hutchinson RA, et al. An eleven year review of the pharmacy literature: Documentation of the value and acceptance of clinical pharmacy. *Drug Intell Clin Pharm* 1986; 20:33-48.
4. Perkins LD, Mason NA. Justifying additional pharmacist staff in an era of cost reductions. *Am J Hosp Pharm* 1984; 41:2033-6.
5. Miyagawa CI, Rivera JO. Effect of pharmacist interventions on drug therapy costs in a surgical intensive-care unit. *Am J Hosp Pharm* 1986; 43:3008-13.
6. 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.
7. Haslett TM, Kay BG, Weissfellner H. Documenting concurrent clinical pharmacy interventions. *Hosp Pharm* 1990; 25:351-9.
8. Gibson FM, Hyneck ML, Scherrer JJ. Documented effectiveness of clinical pharmacy services. *Am J Hosp Pharm* 1982; 39:1902-3.
9. Comer JB. Documenting pharmacists' interventions. *Am J Hosp Pharm* 1985; 42:625-6.
10. Clyne KE. Documentation of clinical services. *Hosp Pharm* 1985; 20:855.
11. Kolb KW, Dugger RW. Documenting clinical pharmacy activities. *Am J Hosp Pharm* 1987; 44:495-9.
12. Schumock GT, Leister KA, Edwards D, et al. Method for evaluating performance of clinical pharmacists. *Am J Hosp Pharm* 1990; 47:127-31.
13. Narducci WA, Norvell MJ. Development and use of an automated clinical pharmacy services documentation system. *Hosp Pharm* 1989; 24:184-204.
14. Rubino M. Distributive and clinical activity measurement using spreadsheet software. *Hosp Pharm* 1990; 25:731-5.
15. Huntress JD, Possidente CJ, Harry DJ. Documenting pharmacists' interventions on a hospital's mainframe computer system. *Am J Hosp Pharm* 1990; 47:2711-5.
16. Jewesson P. Facilitating drug-use evaluation with database and other software. *Am J Hosp Pharm* 1989; 46:1549.

Appendix A. CARCAS workload activity codes

Description	Code
1. DRUG/SERVICE	
a) Specific Drug	
Cimetidine	CIME
Cyclosporine	CYCA
Digoxin	DIGO
Miscellaneous (e.g., topicals)	MISC
Phenytoin	PHET
Vancomycin	VANC
b) Generic Drug Class	
Anticonvulsants (except PHET)	ACON
Antiinfectives (except AMIN, RADD & VANC)	AINF
Aminoglycosides	AMIN
Cardiovascular Drugs (except DIGO)	CVSD
Central Nervous System Drugs	CNSD
Gastrointestinal Drugs (except CIME)	GISD
Reserved Antimicrobial Drugs	RADD
Theophyllines	THEO
c) Services	
Clinics	CLIN
Counselling	COUN
Drug Information	DINF
Inservices	INSE
Meetings	MEET
Projects	PROJ
Rounds	ROUN
2. SOURCE OF PROBLEM IDENTIFICATION	
BDM Report	B
Creatinine Clearance Report	C
Doctor	D
Health Record	H
Kardex	K
Lab Report (levels)	L
Dispensary	P
Ward or Rounds Originated	W
3. NATURE OF THE THERAPEUTIC PROBLEM	
Adverse Drug Reaction	AD
A Combination of Activities	CO
Drug Interaction	DI
Indication or Duplication	ID
Regimen (route, dose, duration)	RE
Serum Level Interpretation (pharmacokinetics)	SL
4. INTERVENTION OUTCOME	
No Recommendation Made	NR
Recommendation Made but Not Accepted	YN
Recommendation Made but Acceptance Pending	YP
Recommendation Made & Accepted	YY