Pharmacy Practice

Computer-Assisted Retrospective Clinical Activities Statistics (CARCAS): Three Years of Experience

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INTRODUCTION

All health care disciplines are being closely scrutinized to justify their roles within the health care system. To assist the transition from traditional clinical practice to pharmaceutical care, accurate and complete documentation of patient-related activities is needed.[1-3] This documentation can also be used to characterize workload, justify and assess clinical programs, estimate cost avoidance, and assist in continuous quality improvement programs.[3-9]

Many institutions are changing from manual to computer-assisted documentation systems which have been found to be convenient, accurate, and an effective method of documenting clinical activities.[6-10] Those who use computers for this purpose have adopted a variety of documentation techniques including the use of bar code scanners, menu-driven, Windows-based PC programs, light-pen operated menu systems, and programs integrated into the hospital's mainframe computer.[6-11] At this 1000-bed, tertiary care, teaching hospital, the Computer-Assisted Retrospective Clinical Activities Statistics (CARCAS) program was implemented to address the need for efficient documentation of clinical pharmacy activities.[6]

The pharmacy department provides decentralized clinical pharmacy services to all the wards in the hospital seven days per week. Clinical services are provided by more than 30 baccalaureate and doctoral pharmacists on a rotational basis, and approximately eight clinical pharmacists practice throughout the hospital on any given day. The clinical program has evolved from target drug monitoring to a combination of target and comprehensive drug monitoring depending on the patient care area and resources available. Drug distribution functions are performed in a central pharmacy with support from three satellite pharmacies and one outpatient pharmacy.

CARCAS utilizes the existing pharmacy drug distribution computer system which operates independently from other hospital computer systems. In the first CARCAS program report, the program implementation and the process of clinical activity documentation were described.[6] In the present study, our objectives were to assess the CARCAS program as a tool for retrieving and analysing clinical activity data, and to characterize the clinical pharmacy activities in our hospital over a three-year period.

PROGRAM DESCRIPTION

The previously described CARCAS program was first developed in 1990 to replace a manual clinical activity documentation system.[6] CARCAS operates within the framework of the pharmacy drug distribution computer program (BDM Systems Solution I / Model 600, 1991). For drug distribution purposes, the pharmacy computer system is used to create and maintain patient medication profiles and drug inventory. For the purpose of CARCAS, a 'pharmacist ward' is created and each clinical pharmacist is considered to be an 'inpatient'. The clinical activities are documented as 'medications' in the medication profile according to predefined activity codes. Appendix A lists the drug and drug classes targeted under the program. The decentralized clinical pharmacists enter their clinical activity data into one of 18 computer terminals located throughout the primary and satellite pharmacies. Each medication-specific clinical activity entry consists of four components: 1) drug or drug class;

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2) information source from which the medication-related problem (MRP) was identified; 3) nature of the medication-related problem, and 4) the therapeutic recommendation outcome. Non-medication-specific clinical activities are also entered according to predefined codes and include patient counselling, patient rounds, and general drug information. Each clinical activity entry also includes an automatic date of entry and a hospital location field to identify when and where the activity took place.

Clinical activities performed by the dispensary pharmacists, students, and clinical pharmacy specialists are not documented into the CARCAS program. Clinical pharmacy specialists are pharmacists with advanced degrees who act as consultants to the rotating clinical pharmacists and practice in specialized care areas (e.g., intensive care unit, cardiac care unit, solid organ transplant, and infectious diseases) in the hospital. These individuals did not document clinical activities prior to the introduction of CARCAS.

CARCAS Program Definitions and Assumptions

During data entry, pharmacists documented clinical activities as 'episodes' of activities. An 'episode' was defined as a single event (e.g., pharmacist intervention on a significant drug interaction) or one activity comprising several events (e.g., patient rounds on 15 patients) as defined by the activity code (see Appendix A). For each episode, neither the clinical significance nor the time needed to perform a particular activity were documented. It was assumed that the episodes documented represented all the clinical activities performed by the pharmacists involved during the study period.

Assessment of CARCAS Program Data

Several steps were performed by the investigators to retrieve and convert the clinical data into an analysable format. Initially, CARCAS pharmacist 'profiles' were downloaded (in ASCII format) onto a personal computer. These files were then uploaded into a computer word processing program (WordPerfect for Windows, Version 5.2, 1992) to permit conversion to a tab-delimited ASCII file format compatible with relational database software (SPSS for Windows, Version 6.0, 1993). Following this procedure, the data were reviewed by the investigators to eliminate any obvious data entry errors and to address interpretation problems. The downloaded database consisted of 21 variables. Of these, seven variables contained CARCAS clinical activity information including pharmacist entry code, clinical activity/source of problem identification code, date of entry, activity episode value, activity episode value multiplier, clinical practice site code, and MRP/therapeutic recommendation outcome code. The seven CARCAS variables were then screened for potential data retrieval errors and pharmacist entry discrepancies.

To facilitate analysis, the CARCAS database was then stratified according to year and several parameters as outlined in Figure 1. For the purpose of this report, no analysis of data stratified by clinical area and pharmacist was undertaken. Finally, stratified data were reorganized into a spreadsheet software program (Microsoft Excel, Version 4.0 for Windows, 1994) for further analysis.

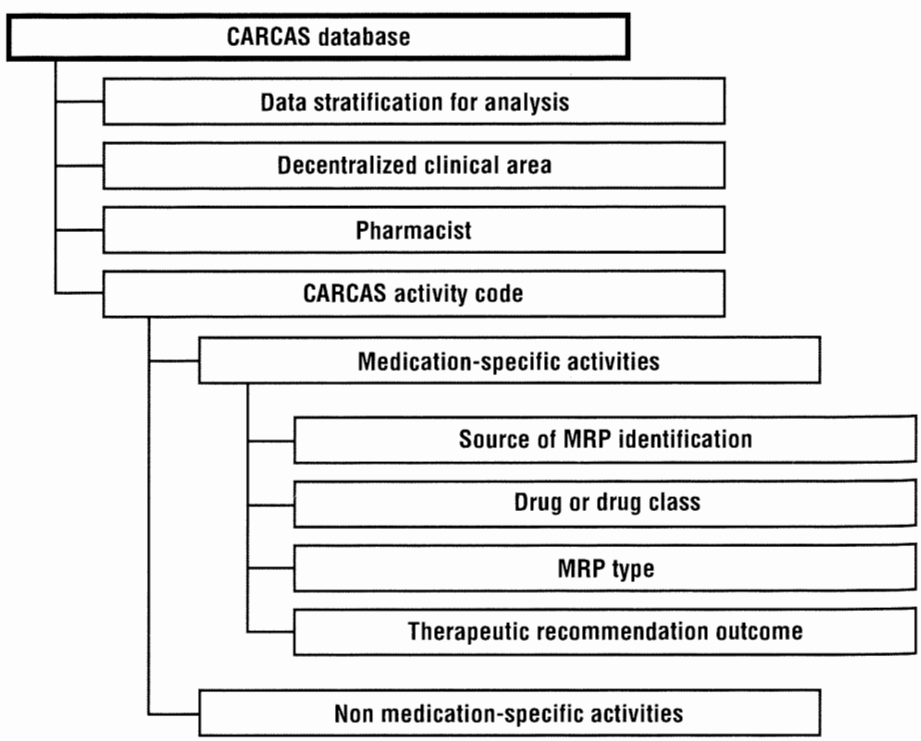


Figure 1: Data Stratification for Purposes of Analysis by Date (year)

PROGRAM EVALUATION

CARCAS Program Data Retrieval and Verification

During the tenure of this study, 51 pharmacists were intermittently involved in documenting clinical activities via the CARCAS program. A total of 51,475 pharmacist entries were recorded, which reflected 121,652 episodes of clinical activities. For each pharmacist entry, there were seven interpretable variables for a total of 360,325 fields of information.

Approximately one-third of the medication-specific episodes recorded lacked a MRP code. The data verification process also revealed some pharmacist entry discrepancies attributed to varied interpretation of the CARCAS activity codes for some non-medication-specific activities. Technical difficulties resulted in the loss of one month of data in 1993.

CARCAS Program Data Stratification and Analysis: Medication-Specific Activities

The majority of the 121,652 episodes of clinical activities documented were medication-specific (87,291 or 72%). From 1992 to 1994, the number of medication-specific activities increased 13% from 27,256 to 30,734 episodes (Figure 2).

Source of Medication-Related Problem (MRP) Identification

Under the CARCAS program, there were eight possible codes available for documenting the source of a MRP (Appendix A). The most frequently utilized source was the pharmacy computer target drug monitoring reports (44%) followed by communication with dispensary pharmacists (19%), patient Kardex reviews (11%), laboratory serum drug concentration reports (8%), health record reviews (7%), communication with ward personnel (i.e., nursing staff and physicians) (7%), and the creatinine clearance reports (4%).

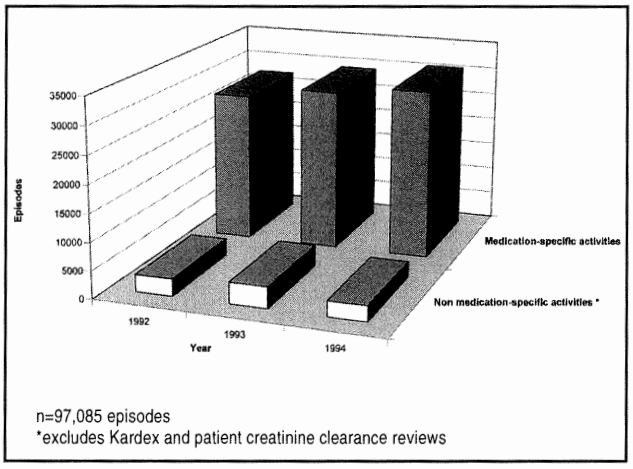
Drug Class

Anti-infectives, as a drug class, accounted for 53,932 (62%) of medication-specific episodes recorded (Figure 3). Rank order across drug classes was similar for all three years. Within the class of anti-infectives, aminoglycosides, general anti-infective agents, vancomycin, and Reserved Antimicrobial Drugs (ciprofloxacin IV, ceftazidime, ceftriaxone and imipenem) accounted for 31%, 29%, 23%, and 17% of the medication-specific episodes recorded, respectively. After anti-infectives, the next most frequently cited drug classes were miscellaneous and cardiovascular drugs which accounted for 16% and 7% of the recorded episodes, respectively. Drug classes that consisted of 5% or less of the total medication-specific episodes include gastrointestinal, central nervous system, anticonvulsants and respiratory-related drugs.

Medication-Related Problem Type

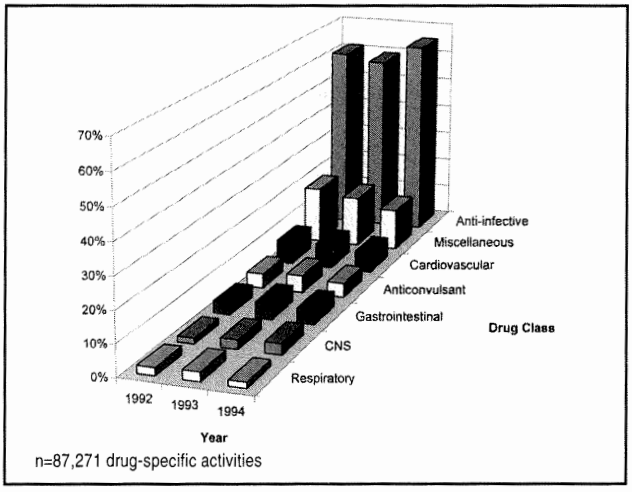
The most common MRP type involved drug regimens which comprised 36,572 (60%) of documented medication-specific activities (Figure 4). The rank order across MRP type was similar in all three years of the analysis. The two next most common MRP types were clinical activities that involved a combination of two or more MRP types (18%), and those that involved serum drug concentration (13%). Drug indications (6.3%), drug interactions (2.5%), and adverse drug reactions (0.4%) accounted for less than 10% of the total MRP types observed.

Figure 2: Medication-Specific and Non Medication-Specific Activities According to Year



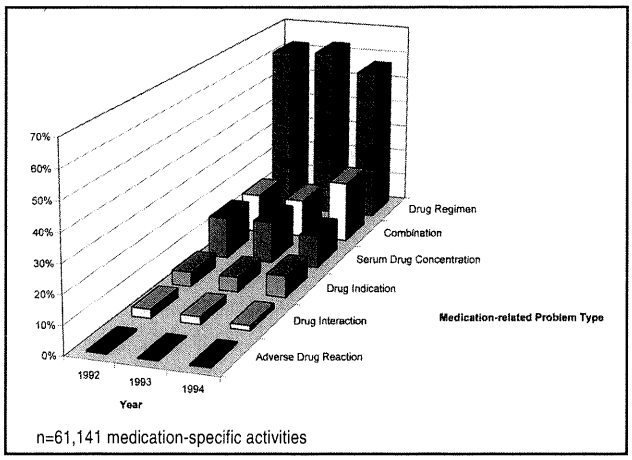
n=97,085 episodes
*excludes Kardex and patient creatinine clearance reviews

Figure 3: Medication-Specific Clinical Activities According to Drug Class and Year



n=87,271 drug-specific activities

Figure 4: Clinical Activities According to Medication-Related Problem Type and Year



During the three-year period, activities involving drug indication increased from 5% to 8%, a relative increase of 60%. Combination activities also showed a similar relative increase of 57% (from 14% to 22%). In contrast, medication-specific episodes related to drug regimen, drug interactions, adverse drug reactions, and serum drug concentrations all showed a relative decrease from 1992 to 1994 of 8%, 33%, 31%, and 20%, respectively.

Therapeutic Recommendation Outcome

Therapeutic recommendations were made to the prescriber or medical team in 19,322 (34%) of these medication-specific episodes. Of those therapeutic recommendations recorded, outcomes were unknown (i.e., those outcomes not documented or documented as pending) in 3,820 (20%) episodes. Of the 15,502 episodes with known recommendation outcomes, pharmacy advice was followed in 92% of the episodes. The rate of acceptance of recommendations was stable across the three years (range of 91% in 1992 to 93% in 1994).

When therapeutic recommendation outcome was stratified by drug class, no differences were observed in recommendations followed (range of 89% for respiratory drugs to 93% for both the anti-infectives and the miscellaneous drug group). Similarly, when the therapeutic recommendation outcome was stratified by MRP type, small differences with followed recommendations were observed among drug classes (range of 85% for drug indication and 97% for drug serum concentrations).

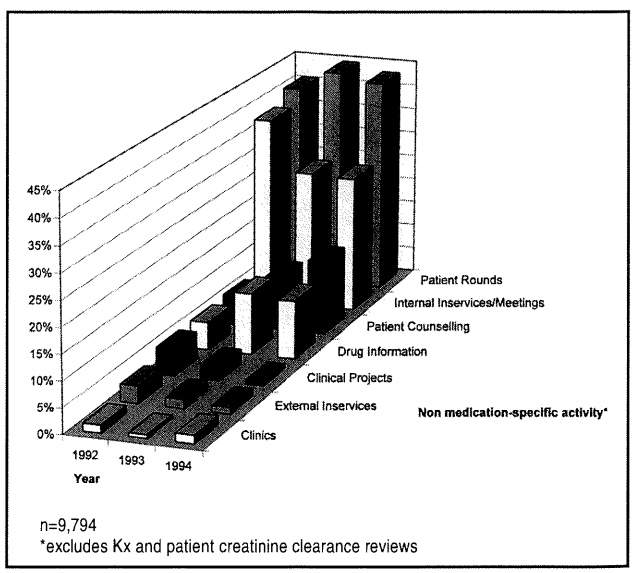
CARCAS Program Data Stratification and Analysis: Non Medication-Specific Activities

Of the 121,652 clinical episodes documented in the three-year CARCAS database, non medication-specific activities comprised 34,361 (28%) of these episodes. In contrast to medication-specific activities, non-medication-specific activities showed a decreasing trend from 1992 (n=3,131) to 1994 (n=2,809) (Figure 2).

A total of 16,692 patients were assessed in association with a Kardex review and 7,875 patients were assessed through review of the creatinine clearance report. From 1992 to 1994, the number of Kardex reviews decreased 56% from 8,547 patients to 3,759 patients. In contrast, patient assessments initiated by a review of creatinine clearance reports remained relatively stable during the three years of this study (range of 2,574 patients in 1994 to 2,721 patients in 1992).

Among the other seven non medication-specific activities documented (n=9,794), medical-team patient rounds, internal educational inservices/meetings and patient counselling were the three most frequent (Figure 5). The rank order across non medication-specific activities were essentially the same in all three years of the analysis. A relative increase of 8% was observed in patient rounds (from 40% to 43%) from 1992-1994. Patient counselling and drug information episodes also revealed relative increases over the study period of 150% (from 6% to 15%) and 100% (6% to 12%), respectively. In contrast, internal inservices or meetings, clinical projects and external inservices all displayed a relative decrease of 23%, 80%, and 67% respectively. Non medication-specific episodes involving clinics were stable from 1992-1994.

Figure 5: Clinical Activities According to Non Medication-Specific Activity Type and Year



DISCUSSION

The CARCAS program serves as a useful tool in providing vital information about our clinical pharmacy program. With the analysis of a three-year database, we have detected encouraging shifts in pharmacy practice along with some possible areas of improvement at our institution. The type of MRP identified suggests that the practice of pharmacy at our institution has shifted away from activities some may consider 'traditional' pharmacy-related activities. This is evidenced by a decrease in targeted drug activities such as serum drug concentration monitoring and an increase in the patient-focussed approach of pharmaceutical care. During the tenure of this study, the clinical program was evolving in terms of the number of clinical pharmacists as well as the nature and magnitude of activities performed. Accordingly, the database reflects a program in transition.

Similar to findings reported by Mason et al, clinical activities involving anti-infectives were the most commonly reported medication-specific activity at this institution.[7] This finding is not unexpected since the pharmacy department maintains several therapeutic initiatives aimed at improving anti-infective drug use.[12-14] We found that pharmacy-originated therapeutic recommendations were followed 92% of the time. Interestingly, this value is identical to the total intervention acceptance rate reported by Bajcar et al in their assessment of their workload documentation system.[5]

Despite the utility of the CARCAS program, it has some limitations. Variable interpretation of some activity codes by pharmacists was identified. We were also unable to verify whether the database represented all clinical functions performed by those responsible for recording their activities. In addition, clinical pharmacy specialists and dispensary pharmacists were not required to record their activities; therefore, the database cannot be considered all-inclusive. Since recorded clinical activities were not directly linked to a specific patient, interpretation of the data was limited. Finally, data retrieval, verification, and analysis was a cumbersome procedure.

To address these concerns, a new version of the CARCAS program (CARCAS II) has been designed and is currently being implemented at our institution. CARCAS II offers many advantages over its original version. Clinical activities will now be documented into a single clinical field directly on a patient medication profile by both clinical and dispensary pharmacists. Continuity of patient care is expected to be strengthened since communication between pharmacists in these two practice areas should be enhanced. Activity codes have also been modified to reflect standard pharmaceutical care drug-related problem categories.

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Appendix A: CARCAS Clinical Activity Codes[a]

Activity	Description	Code	Drug Class
Medication-specific	1. Drug / Drug Class:		
	Central nervous system drugs	CNSD	CNS
	Analgesics	ANAL	
	Anticonvulsants (except phenytoin)	ACON	Anticonvulsant
	Phenytoin	PHET	
	Respiratory drugs	RESP	Respiratory
	Theophylline	THEO	
	Cardiovascluar drugs (except digoxin)	CVSD	Cardiovascular
	Digoxin	DIGO	
	Gastrointestinal drugs (except cimetidine)	GISD	Gastrointestinal
	Cimetidine	CIME	
	Anti-infectives (except aminoglycosides, vancomycin, reserved antimicrobial drugs)	ANIF	Anti-infective
	Aminoglycosides	AMIN	
	Reserved antimicrobial drugs (ciprofloxacin IV, ceftazidime, imipenem, ceftriaxone)	RADD	
	Vancomycin	VANC	
	Immunosuppressant drugs	IMMU	
	Cyclosporine	CYCA	Miscellaneous
	Miscellaneous	MISC	
	2. Source of Problem Identification		
	Pharmacy computer system report review	B	
	Creatinine clearance report review	C	
	Physician consultation	D	
	Health record review	H	
	Kardex review	K	
	Lab report (drug serum concentration) review	L	
	Dispensary communication	P	
	Ward or rounds originated discussions	W	
	3. Nature of the medication-related problem		
	Adverse drug reaction	AD	
	Combination of activities	CO	
	Drug interaction	DI	
	Indication or duplication	ID	
	Regimen (route, dose, duration)	RE	
	Serum level interpretation (pharmacokinetics)	SL	
	4. Therapeutic recommendation outcome		
	No therapeutic recommendation made	NR	
	Therapeutic recommendation made but not followed	YN	
	Therapeutic recommendation made and outcome pending	YP	
	Therapeutic recommendation made and followed	YY	
Non medication-specific	Patient counselling	COUN	
	Creatinine rounds	ROUNC	
	Kardex rounds	ROUNK	
	Clinics	CLIN	
	Drug information	DINF	
	Inservices	INSE	
	Meetings	MEET	
	Projects	PROJ	
	Patient rounds	ROUN	

[a]Adapted from Donaldson et al.[7]