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A systematic review of work sampling



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A systematic review of work sampling

Duration of project

September-December 2003

Search period

Depending on database (see below) to 3rd October 2003

Key words searched

Work sampling; Processing time; Time studies, Motion studies, Observation method, Work patterns, Work activities, Activity sampling, Work measurement, Workload measurement, Dispensing time, Work observation.

Databases searched

Medline from 1966; EMBASE: Excerpta Medica from 1988; CINAHL (Cumulative index to nursing and allied health) from 1982; INSPEC from 1969; PsycINFO from 1892; Science Direct from 1967; Emerald Fulltext from commencement of the database; ABI/Inform (ProQuest, including ProQuest Computing; ProQuest Medical Library) from commencement of the database; and IBSS (International Bibliography of the Social Sciences) from 1990.

Criteria applied

We determined the following criteria to be essential for a selection of articles: sample size, specified work task categories used, observation techniques (self-reporting/observer), random/specific intervals, frequency of observation, observation duration, total observations, setting of the study, and professional group observed.

Articles that met the criteria were included in the analysis. An annotated bibliography including reference and abstract of these articles is presented on the next pages.

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Adler, N. J. and M. L. Icenhour (1993). "Analysis through work sampling of the role of the emergency nurse." *Journal of Emergency Nursing* 19(1): 28-33.

Abstract: In an every-5-minute sampling of the work of emergency nurses at a large teaching hospital, the most commonly observed activities were laboratory specimen collection and IV therapy. Such tasks as tracking patients and their charts and photocopying charts were also noted to be quite time-consuming.

Allen, J. M. (1983). "Work sampling: a means of determining physiotherapy activities and reviewing caseloads." *Physiotherapy Canada* 35(1): 31-35.

Abstract: Work sampling is a tool used to examine the activities involved in performing a job. A work sampling study was designed to examine the components of physiotherapy care in a 350-bed teaching hospital. The components were related to a physiotherapist's activities and included an examination of the time related to patient treatment, attendance at meetings, record-keeping and preparation, travel, teaching, continuing education (in-service), talking to colleagues (doctors, occupational therapists), and other activities. The purpose of the study was to quantify a therapist's nontreatment activities, and to compare observations concerning treatment with the work sampling data obtained in compliance with the Canadian Schedule of Unit Values and, in particular, its weighted units. The study showed that there was no difference between the "observed" time (sampling time in percentage of total time) spent in direct patient contact, and the weighted units, when the latter was converted to a percentage of time. The Nova Scotia government's standard of 50 000 work units per year was found to be useful in justifying staffing levels; a useful indicator of productivity was also developed using weighted units expressed as a percentage of worked or paid hours. Work sampling would thus appear to be a useful tool for physiotherapy department managers.

Barsness, F. R. and C. E. Trinca (1978). "Activity analysis and cost study of clinical pharmacists practicing in a university medical center: comparison with previously established criteria." *Drug Intelligence & Clinical Pharmacy* 12(5): 284-94.

Abstract: The activities of three staff clinical pharmacists practicing in a university medical center hospital were studied using work sampling direct observation techniques. The results of the activity analysis were compared with the functional criteria of the Task Force on the Pharmacist's Clinical Role. It was found that the clinical pharmacists devoted a large portion (72.36 percent) of their total practice time to accomplishing professional activities. A very low percentage (2.27) of time was observed to be spent in nonproductive idle time. The cost to provide clinical pharmacy services to the 165.23 average census of inpatients supported by the clinical pharmacists was calculated to be \$1.18 per patient per day. It was concluded that the observed pharmacists were highly motivated and

provided a wide variety and extensive amount of professional clinical pharmacy services. Recommendations were made calling for research of other clinical pharmacy practice models, standardization of pharmacy activity terminology, determination of clinical pharmacy outcomes and identification of motivational factors present in the study model environment.

Beech, E. F. and N. D. Barber (1993). "The Development of a Self-reporting Multidimensional Work Sampling Measure to Study Ward Pharmacy Services in the United Kingdom." *Journal of Social and Administrative Pharmacy* 10(4): 157-162.

Abstract: A self-reporting two dimensional work sampling measure was developed to study clinical pharmacist work at ward level in the UK. Six ward pharmacists recorded their work, at random intervals, during 51 visits to six wards. 417 samples were recorded in two dimensions, activity and contact, using a credit card sized bar code reader. Ward pharmacists spent approximately half of their time on clinical pharmacy activities, 16.6% on activities relating to stock control and 14.2% on travel. Ward pharmacists spent 10.3% of their time with patients. Pharmacists found the work sampling measure fast and easy to use. This method has many applications in both hospital and community in the evaluation of new work practices and technologies in the delivery of pharmaceutical care.

Bell, H. M., J. C. McElnay and C. M. Hughes (1999). "A self-reported work sampling study in community pharmacy practice." *Pharmacy World & Science* 21(5): 210-216.

Abstract: Lack of time to implement pharmaceutical care has been cited as a barrier to the routine provision of this extended patient-care service. Using self-reported work sampling methodology, this study investigated how community pharmacists utilise their time. Pharmacists working in community pharmacies in the Greater Belfast area were found to spend approximately 49% of their time engaged in professional activities, 29% in semi-professional activities and 22% involved in non-professional activities. The activity to which pharmacists devoted the majority of their time was product assembly and labelling, this being a task which can be performed by trained technical staff. Only 9.5% of community pharmacists' time was devoted to counselling patients on their prescription medicines. Wide variation in the amount of time apportioned to each activity was observed between the participating community pharmacists (n=30). Staffing levels within the community pharmacy were found to significantly influence pharmacists' involvement in a number of activities, with pharmacists who worked in pharmacies employing multiple pharmacists devoting more time to the assembly and labelling of products and less time to administrative tasks, non-professional encounters and to miscellaneous professional activities. Pharmacists working in pharmacies with a high prescription turnover were found to devote significantly less time to counselling patients regarding OTC products and in responding to patient symptoms.

Birchall, R. and K. R. Waters (1996). "What do elderly people do in hospital?" *Journal of Clinical Nursing* 5: 171-176.

Abstract: Current health-care reforms have sharpened the focus on efficiency of bed usage; one useful method of exploring this concept is to determine how patients spend their time in hospital. This small study explored how 23 elderly patients spent their time on two elderly care wards. A time-sampling study, patient-focused, structured observation method was employed to observe the patients. The most commonly observed activity was eating and drinking. The findings, in keeping with previous work, suggest that therapeutic activities occupy a minimal proportion of the patient's day. Reasons for inactivity are explored and recommendations made for further research.

Bobdey, C. S., M. S. Sandhu, A. C. Urmil and T. Dayakar (1992). "Activity sampling of nurses of a sub-acute ward of a large hospital." *Journal - Academy of Hospital Administration*. 4(2): 3-7.

Abstract: A study was conducted in a 43 bedded subacute family ward of a large hospital to find out the adequacy and efficiency of its nursing service. Activity analysis in respect of nurses was carried out by Activity Sampling Technique. The study revealed that out of 334 activities, observed, 78 (23.3%) were non-productive, whereas 256 (76.7%) were productive. Out of the productive activities, 148 (44.3%) were for direct patient care mainly comprising of 46 (31.1% for carrying out technical procedures, 36 (24.32%) for determining patients' needs, 20 (13.15%) for preparing patients for various procedures and 15 (10.14%) for assisting in technical procedures. Number wise the nurses were found to be adequate.

Boyd, R., W. A. Parker and D. K. Yung (1982). "Characterization of pharmacy workload and pharmacist activities in a Canadian community pharmacy." *Contemporary Pharmacy Practice* 5(4): 219-225.

Abstract: The present study was undertaken to obtain data which would characterize pharmacist activities and prescription workload in a community pharmacy. Data on pharmacist activities were obtained by using a work sampling methodology. The proportion of time spent on each of 44 activities was obtained, and it was found that the proportion of time spent on professional activities (17.6 percent) was notably less than the time spent on nonprofessional activities (82.4 percent). Data on prescription workload were obtained by the design of a data sheet which was to be completed by each pharmacist for every prescription dispensed. The collected data characterized the number of prescriptions dispensed, which were related to the time of day and day of the week; they also provided information on the types of prescriptions dispensed, the age of patients (e.g., pediatric, geriatric), and the methods of payment.

Brock, D. M., C. S. Scott, T. W. Pendergrass and S. C. MacDonald (1990). "Sampling clinicians' activities using electronic pagers." *Evaluation & the Health Professions* 13(3): 315-42.

Abstract: Pager-based activity sampling (PAS) is described as a cost-effective and unobtrusive method for sampling residents' activities in clinical settings. A sample program evaluation is presented using residents in an urban children's hospital resident-training program. The purposes of the program evaluation were: (a) to establish a behavioral baseline that would help clinical faculty understand how residents were using their time, and (b) to determine whether alterations in the way residents were assigned within the hospital resulted in desired changes to time spent. The primary rationale for changing resident-assignment policies were: (a) to decrease the time residents were spending in transit between various locations within the hospital, and (b) to increase the time spent by residents in educational activities and in direct contact with patients and their families. This PAS application demonstrates that the technique can produce statistically supportable conclusions, at minimal cost, without unduly disrupting either the residents or their patients. PAS is compared with other time-sampling methods, its limitations are discussed, and suggestions for future applications are provided.

Buchan, I. C. and I. M. Richardson (1972). "Receptionists at work. A time study in general practice." *The Journal of The Royal College of General Practitioners* 22(118): 331-334.

Abstract: Analysis of the activities of health service staff with a view to improving the quality and efficiency of service to patients is an expanding field of study. There is remarkably little quantified information on the work of secretary-receptionists in general practice, a deficiency we hope to remedy. The results of our work sampling study show that filing-sorting was the most common activity (42%), followed by phone (15%) and writing (13%). In this sample of work only one tenth of the average receptionist's time was spent face-to-face with patients, usually making appointments. Even less time went on direct contact with practice staff and most of it involved other receptionists.

Buchholz, B., V. Paquet, L. Punnett, D. Lee and S. Moir (1996). "PATH: A work sampling-based approach to ergonomic job analysis for construction and other non-repetitive work." *Applied Ergonomics* 27(3): 177-187.

Abstract: A high prevalence and incidence of work-related musculoskeletal disorders have been reported in construction work. Unlike industrial production-line activity, construction work, as well as work in many other occupations (e.g. agriculture, mining), is non-repetitive in nature; job tasks are non-cyclic, or consist of long or irregular cycles. PATH (Posture, Activity, Tools and Handling), a work sampling-based approach, was developed to characterize the ergonomic hazards of construction and other non-repetitive work. The posture codes in the

PATH method are based on the Ovako Work Posture Analysing System (OWAS), with other codes included for describing worker activity, tool use, loads handled and grasp type. For heavy highway construction, observations are stratified by construction stage and operation, using a taxonomy developed specifically for this purpose. Observers can code the physical characteristics of the job reliably after about 30 h of training. A pilot study of six construction laborers during four road construction operations suggests that laborers spend large proportions of time in non-neutral trunk postures and spend approximately 20% of their time performing manual material handling tasks. These results demonstrate how the PATH method can be used to identify specific construction operations and tasks that are ergonomically hazardous.

Conine, T. A. and D. L. Hopper (1978). "Work sampling: a tool in management." American Journal of Occupational Therapy 32(5): 301-304.

Abstract: "Work sampling" was used to determine the productivity of the employees of a small occupational therapy department and the nature and extent of the activities in which they were involved. Twelve general categories of activities were identified--peak loads occurred on Wednesday each week between 9:10 to 11:30 a.m., and daily between 1:40 to 3:20 p.m. It was found that the therapists spent more of their working hours productively compared to an aide's productive time. "Work sampling" is a convenient and inexpensive technique that may be used by small or large departments to justify staff size, hours of work, and assignments on the basis of activities and productivity.

Domenech, M. A., O. Payton, J. Hill and R. K. Shukla (1983). "Utilization of physical therapy personnel in one hospital: A work sampling study." Physical Therapy 63(7): 1108-12.

Abstract: The purpose of this study was to illustrate the adaptability and use of work sampling, an industrial engineering technique, as a dependable method for collecting personnel utilization data in the physical therapy department of a general hospital and to demonstrate the concept of work sampling to physical therapy supervisors and personnel unfamiliar with this approach. Over a six-week period, a total of 5,824 observations were made at randomly selected 15-minute intervals during the 40-hour work week. Percentages of total time used in observed activities for all physical therapy personnel were divided as follows: 1) direct care, 20.38 percent; 2) indirect care, 11.18 percent; 3) administration, 2.27 percent; 4) communication, 3.28 percent; 5) clerical, 9.56 percent; 6) personal time, 24.60 percent; and 7) out-of-department, 28.72 percent. Physical therapists were most likely to be involved in personal duties from 8 AM to 9 AM (35%) and from 4 PM to 4:30 PM (41%). They showed greatest productivity from 9 AM to 10 AM (59%) and spent time in out-of-department activities rather consistently throughout the day. A conclusion of this study was that work sampling may be used successfully to collect personnel utilization data in a physical therapy department.

Dresselhaus, T., J. Luck, B. Wright, R. Spragg, M. Lee and S. Bozette (1998). "Analyzing the time and value of housestaff inpatient work." *Journal of General Internal Medicine* 13: 534-540.

Abstract: Objective: To determine time allocation and the perceived value to education and patient care of the weekday activities of internal medicine housestaff on inpatient rotations and to compare the work activities of interns and residents. Design: a work sampling study was conducted. We classified activities along five dimensions (association, location, activity, time, and value). Measurements and main results: Housestaff provided complete responses to 3,812 of 3,992 prompts by a median of 11 seconds; 93% of responses were logically consistent across the measured dimensions. Housestaff spent more time in indirect patient care (56%) than in direct patient care (14%) or educational activities (45%). Formal educational activities had the highest educational value (66 on 0-100 scale), and direct care had the highest educational value to patient care (81). Over 30% of time was spent in administrative activities, which had low educational value (40). Compared with residents, interns allocated significantly less time to educational activities (37% vs 57%) and more time to lower-value activities such as documentation (19% vs 12%). Conclusions: Improved data collection methods demonstrate that house staff in our program, particularly interns, spend much of their workday in activities that are low in educational and patient care value. Selective elimination or delegation of such activities would preserve higher-value experiences during reductions in overall inpatient training time. Planners can use automated random sampling to guide the rational redesign of housestaff work.

Duffield, C., L. M. Wood, H. Franks and P. Brisley (2001). "The role of nursing unit managers in educating nurses." *Contemporary Nurse: a Journal for the Australian Nursing Profession* 10(3-4): 244-250.

Abstract: This paper presents the findings of a work sampling study undertaken in New South Wales (Australia) to ascertain the amount of time spent by nursing unit managers directly educating nurses. The results indicate that they spend very little time in teaching, traditionally one of their role tasks. It is argued that their teaching at unit level should focus on their role as leader, mentor, preceptor and coach. This role shift needs to be articulated to managers and nurses to minimise confusion over the role and to ensure that direct teaching is placed into the hands of expert clinicians.

Dupclay, L. J., M. T. Rupp, R. W. Bennett and T. M. Jarnagin (1999). "Analysis of grocery chain pharmacists' work-related behaviors." *Journal of the American Pharmaceutical Association* 39(1): 74-81; quiz 105-106.

Abstract: OBJECTIVE: To measure grocery chain pharmacists' work-related behaviors to assess the impact of a Pharmaceutical Care Certificate Program

(PCCP) and other future interventions intended to alter pharmacists' practice behaviors. DESIGN: This study used multidimensional work sampling (MWS), a work measurement methodology that breaks "work" into three components: activity (what was done), contact (with whom the activity was performed), and function (the purpose or objective of the activity). Pharmacists were signaled at random intervals during the workday by a random signal generator. A selection was made from a list of items in each of the three dimensions of work to form an activity-contact-function combination code that described the work-related behavior at that point in time. SETTING AND PARTICIPANTS: Pharmacists in 15 grocery chain stores in the Indianapolis area; 20 pharmacists were enrolled in Purdue University's PCCP and 10 served as controls. Data were collected for a period of six weeks during April through June 1997 before the beginning of the PCCP program. MAIN OUTCOME MEASURES: Pharmacists' work-related behaviors. RESULTS: Writing/keyboarding was the most frequently recorded activity (22%), followed by one-to-one meetings (21.6%), and drug preparation (18%). Pharmacists spent most of their time working alone (62.9%), while a smaller but still substantial proportion of time was spent interacting with patients (17.9%). The most frequently recorded purpose (i.e., function) of pharmacists' activities was drug distribution (23.9%), followed by personal time (12.4%), receiving or transferring a medication order (10.2%), and patient counseling (6.6%). Out of a possible, 1,760 activity-contact-function combinations, 10 accounted for 46.3% of all reported observations, with "Prepare drug-Self-Drug distribution" representing the most frequently recorded activity-contact-function combination (15.7%). CONCLUSION: MWS is useful in helping grocery chain management better understand how pharmacy personnel are currently being utilized. This study provides a baseline for evaluating the impact of training programs or other alterations in the practice environment on pharmacists' work-related behaviors.

Fisher, C. M., O. I. Corrigan and M. C. Henman (1991). "A study of community pharmacy practice. I. Pharmacists' work patterns." *Journal of Social & Administrative Pharmacy* 8(1): 15-24.

Abstract: The utilisation of pharmacists' time was examined in a work study of community pharmacists. Pharmacists' activities were analysed using an observer work measurement technique to gather data on the range and frequency of their activities. A total of 4000 observations were made of 47 pharmacists working in 40 community pharmacies in Dublin city and county in the Republic of Ireland. The results of the study showed that pharmacists spent, on average, one third each of their time on professional, business and non-productive activities. While no statistical differences were found between pharmacists when classified by age, sex or job-title, there were significant differences between young and middle-aged proprietor-pharmacists in their work patterns. Young proprietor-pharmacists spent a higher proportion of their time on professional activities and less on non-productive work than middle-aged proprietor-pharmacists.

Gagnon, A. J. and K. Waghorn (1996). "Supportive care by maternity nurses: a work sampling study in an intrapartum unit." *Birth* 23(1): 1-6.

Abstract: Background: This work sampling study examined how much time intrapartum unit nurses spend providing supportive care overall and during weekday and weekend shifts, and by patient and staff characteristics at a university hospital with 4000 births per year in Montreal, Quebec. Methods: Four-hour observation periods were randomly selected to represent each shift and day of the week. Within each period, eight 15-minute observation times were randomly selected. Observers located each nurse assigned to the unit at that time and recorded her activity. Supportive activities included physical comfort, emotional support, instruction, and advocacy. Results: The percentage of time spent in supportive care was 6.1 percent (95% confidence interval 5.3%, 6.9%), based on 3367 observations. The time providing supportive care was similar for weekday and weekend shifts. Nurses with less than seven years of intrapartum experience spent 2.7 percent (0.9, 4.5) more time providing supportive care than nurses with seven years of experience or more. Supportive care was 9.2 percent (0.7, 17.7) greater for nulliparous than for parous women, and supportive care of women with epidural anesthesia was similar to those without it. Conclusions: We concluded that intrapartum unit nurses spent a small amount of time providing supportive care to women in labor. This suggests the need for perinatal caregivers and hospital administrators to reexamine how nurses spend their time, given the evidence from randomized trials showing the beneficial effects of continuous support on labor and birth outcomes.

Gale, J., F. Fothergill-Bourbonnais and M. Chamberlain (2001). "Measuring nursing support during childbirth." *American Journal of Maternal Child Nursing* 26(5): 264-71.

Abstract: PURPOSE: To examine the amount of support being provided by nurses to women during childbirth and factors that influence the provision of support. STUDY DESIGN: Exploratory, descriptive. METHODS: Work sampling method was used to determine the percentage of time nurses spend in supportive care activities. Twelve nurses were observed over six nonconsecutive day shifts on a birthing unit of a Canadian teaching hospital in Quebec. A total of 404 observations were made. Nurses were also interviewed to determine their perceptions of what constitutes supportive nursing care and the factors that facilitate or inhibit the provision of this care. RESULTS: Nurses spent only 12.4% of their total time providing supportive care to laboring women. Interviews with nurses suggested that perceptions of the components of supportive care were comparable to this study's operational definition of support, namely: physical, emotional, and instructional/informational support and advocacy. Barriers to providing support identified by nurses included lack of time and insufficient staff. However, further content analysis of the interview data revealed that healthcare providers had a pervasive sense of control over laboring women and their

partners. **CLINICAL IMPLICATIONS:** Although nursing support has been identified as an important aspect of nursing care in childbirth, this study demonstrated an incongruity between what nurses perceived as being supportive care and the amount of support that was actually provided. Barriers to the provision of supportive care in the practice setting as well as suggestions for its enhancement are discussed.

Guarisco, S., E. Oddone and D. Simel (1994). "Time analysis of a general medicine service: Results from a random work sampling study." *Journal of General Internal Medicine* 9(5): 272-277.

Abstract: Objective: To describe a novel method of time analysis for health care settings by quantifying internal medicine housestaff's work activities and contacts. Design: Observational work sampling study based on random sampling technique. Setting: General medicine service in a university hospital. Participants: All housestaff (18 interns, 18 residents) rotating through the general medicine service during a 12-week period. Main outcome measures: Proportion of time spent doing 22 work activities and proportion of time spent with 13 work contacts, reported separately for interns and residents and for on-call days and off-call days. Results: The authors sampled 6,599 unique time observations (3,533 from on-call days, 3,066 from off-call days) during 193 housestaff workdays. The housestaff spent a majority of their time engaged in direct patient care activities (81% of the interns' workdays, and 64.5% of the residents' workdays), primarily in patient evaluation and follow-up (48% of the interns' and 39% of the residents' workdays). Compared with the interns, the residents spent relatively more time in direct educational activities (conferences, reading, teaching): 27% of the residents' workdays versus 10% of the interns' workdays. Analysis of work contacts showed that the housestaff spent a large portion of the workday alone: 27% of the residents' and 34% of the interns' workdays. The housestaff also spent a large portion of the workday with attending physicians: 23% of the residents' and 11% of the interns' workdays. This translates into 21 hours/week of attending supervision for the residents and 10 hours/week for the interns. Conclusions: Using random work sampling, the authors found that the vast majority of the houseofficer's workday was spent in direct patient care. This method of time analysis may be used to describe housestaff training and supervision, as well as to evaluate administrative interventions designed to change housestaff work experience.

Hadsall, R. S., D. R. Gourley, J. A. Haggerty, R. J. Anderson, P. Yih, M. J. Windle and L. Ohri (1982). "Work sampling in contemporary pharmacy practice: a multidimensional approach." *Topics in Hospital Pharmacy Management*(November): 15-26.

Abstract: The proportion of pharmacist's time devoted to teaching activities, including the teaching activities, including the teaching of pharmacy students, patients, physicians and nurses, should be identified. The proportion of time

spent in administrative functions should be measured. There are three administrative areas: the pharmacy, the clinical and the College of Pharmacy. The clinic pharmacist recorded a total of 908 observations covering all aspects of her daily activities. Administrative activities account for 27.3% of the pharmacist's time; the pharmacist is therefore outside of direct patient care activities a significant portion of the time. The amount of time spent in the clinic environment is considerably less than expected (49.5%). Many of this person's job-related activities take place away from the service (patient care) site. The activity dimension indicates that 39.5% of the pharmacist's time is spent in meetings.

Harpole, L. H., K. M. Stechuchak, C. D. Saur, D. C. Steffens, J. Unutzer and E. Oddone (2003). "Implementing a disease management intervention for depression in primary care: a random work sampling study." *General Hospital Psychiatry* 25(4): 238-245.

Abstract: We describe the daily work activities of 13 Depression Clinical Specialists (DCSs) at 7 national sites who served as care managers in an effective multisite randomized trial of a disease management model for depression in primary care. DCSs carried portable random-reminder beepers for a total of 147 consecutive workdays and recorded 4,030 work activities. Patient care activity comprised the largest percentage of the workday, 49.4% (95% confidence interval [CI], 42.0 to 56.7%), followed by research-related activity, 18.3 % (95% CI, 14.7 to 21.9%), administrative work, 17.9% (95% CI, 12.2 to 23.7%), personal time, 9.4% (95% CI, 5.4 to 13.4%), and time in transit, 5.1% (95% CI, 2.8 to 7.4%). The DCSs delivered 19.2% (95% CI, 14.4 to 24.1%) of direct patient care by telephone. The DCSs spent a significant portion of the day alone 48.7% (95% CI, 43.3 to 54.1%), followed by time spent with patients, 37.5% (95% CI, 31.6 to 43.3%). Less than 10% (7.8%) (95% CI, 5.1 to 10.6%) of their time was spent with local study staff. Less than 4% of their time was spent with other health care providers. Our results demonstrate that the DCSs' time was primarily devoted to clinical care, a significant portion of which was delivered by telephone. They functioned independently, making efficient use of the limited amount of time that they interacted with other health care providers. This information will be helpful to those who may wish to implement this disease management strategy.

Homan, M. M. and T. J. Armstrong (2003). "Evaluation of three methodologies for assessing work activity during computer use." *AIHA Journal: a Journal for the Science of Occupational & Environmental Health & Safety* 64(1): 48-55.

Abstract: The overall goal of this study was to evaluate three separate methodologies for gathering work activity information among computer users. These methodologies included worker self-report, work sampling, and activity monitoring. A repeated measures design was employed whereby data were collected simultaneously on each subject (n = 51) across three consecutive

workdays. Exposure information gathered included keying time, mouse usage, and time spent performing various work tasks (i.e., writing, proofreading, handling documents). Subjects were recruited to represent a wide range of keyboard activity and mouse usage. The study found that worker self-reports overestimated actual keyboard usage by a factor of approximately 1.5 for workers using the keyboard an average of 4 hours per day to a factor of 4 for workers using the keyboard an average of 30 min per day. On average, there was an approximate twofold difference between worker self-reported keying time and that obtained via activity monitoring and work sampling. This trend was similar with regard to time spent using the computer mouse. Worker self-reported mouse usage was approximately twofold higher than that obtained via activity monitoring or work sampling. Self-reported exposure information not only resulted in different estimates, but showed greater variance compared with the other methodologies. The results of this study suggest that the use of worker self-reported exposure information on keying time and mouse usage may not represent an accurate account of time spent performing these tasks. In the context of epidemiological studies work sampling and/or activity monitoring would be more suitable methodologies for obtaining such information.

Jenkins, D., C. Cairns and N. Barber (1992). "How do ward pharmacists spend their time? An activity sampling study." *International Journal of Pharmacy Practice* 1: 148-151.

Abstract: A regular pharmacy service to wards is well established in Britain, yet there has been little practice research in this area. In this study, we established how pharmacists distribute their time between different activities on all the wards. All 28 pharmacists in two London hospitals were observed. The observer recorded their activities at one minute intervals and categorised the activity. Thirty-three hours and five minutes of observations were made. The pharmacists visited a total of 55 wards, and checked 982 drug charts. The major activities were prescription monitoring, which accounted for 31%, of the time, travel to wards 21%, stock control 12%, transcription 8% and clinical monitoring 7%. The proportion of time spent on each activity was very similar between the two sites, except for the category transcription, which took 11% of the time in one hospital, where all discharge prescriptions were transcribed onto ward pharmacy sheets, and 3% at the other site, in which they were not transcribed. These results demonstrate that, when on the ward, pharmacists spend the majority of their time in a clinical role. The methodology is simple to use and appears reproducible. This work, if repeated locally, could be used to highlight areas of inefficiency, and could be used to test and predict the impact of other methods of delivery of clinical pharmacy.

Magana, A. E. and B. W. Niebel (1976). "How do academic administrators spend and think they spend their time?" *Engineering Education* 67(2): 195-197.

Abstract: With large numbers of different activities that occupy administrators of engineering education, it is difficult to determine how much time should be allotted each activity in order to maintain high overall efficiency and performance. In order to find out how the typical engineering education administrator thinks he distributes his time and how these values compare with actuality, a study was undertaken. A questionnaire was completed by a group of administrators and a work sampling study was carried out. The study revealed that on the average, the eight administrators with administrative assistants were spending more time on research, thesis supervision, teaching, and professional writing than the eight administrators who did not have assistants. It was revealed that administrators without an assistant are spending more time on advising and have less time to participate in university meetings and course participation. In summary, it can be concluded that many administrators in engineering departments do not have a realistic idea of how much of their time is being spent on the various duties, responsibilities, and functions related to their positions. A technique that can provide them with factual information on how they are spending their time is work sampling.

Marasovic, C., C. Kenney, D. Elliott and D. Sindhusake (1997). "A comparison of nursing activities associated with manual and automated documentation in an Australian intensive care unit." *Computers in Nursing* 15(4): 205-11.

Abstract: This article describes a comparative study that examined the frequencies of nursing activities, when using a clinical information system (CIS) and a paper-based documentation system in an Australian intensive care unit. The study unit had half the beds equipped with a CIS, and the remaining beds used paper documentation. Work sampling methodology was used to observe nurses working with both systems. Though there were differences for all activities between the environments and the directions of the differences were logical, none were statistically significant using a chi-square test ($P = .11-0.65$), probably because of the small sample size. This study established that work sampling methodology using a random timer is a valid and relatively easy method to capture work activity in the clinical area. Although this article does not provide definitive information regarding the benefits of a CIS over manual documentation, a number of important methodological issues are discussed, including the study design, procedure, use of dedicated observers, and the distinction between basic versus fully optioned systems. Future research should evaluate the efficiency, impact on patient outcomes and nursing practice, and cost effectiveness of fully optioned systems.

Mastin, J. P. and E. S. Farrell (1964). "Applications of work sampling in a hospital cafeteria." *Hospitals* 38(March 1): 93-100.

Abstract: In this article, the authors describe a work sampling study in the cafeteria of the University Hospital and Hillman Clinic of the University of

Alabama Medical Center, Birmingham. The work sampling observations of the activities of 36 cafeteria employees over a 14 day period were tabulated by data processing techniques, and the results were used in changing job descriptions and improving efficiency in cafeteria duties, according to the authors.

Mosberg, S. F. (1980). "Measuring circulation desk activities using a random alarm mechanism." *College and Research Libraries* 41(5): 437-444.

Abstract: Librarians frequently use circulation statistics, collection size, and other data to help justify needs, but they lack statistics on the percentage of time their staff actually spends on various activities. Such data have been almost impossible to obtain or complex service units that have a multiplicity of functions, lack of control over frequency and quantity of patron requests, and extended hours of staffing. Recent technological developments combined with work sampling techniques now make studies of such units feasible. This paper reports a methodology devised to gather meaningful management data relating to circulation desk activity.

Murray, M. D., B. Loos, W. Tu, G. J. Eckert, X. H. Zhou and W. M. Tierney (1999). "Work patterns of ambulatory care pharmacists with access to electronic guideline-based treatment suggestions." *American Journal of Health System Pharmacy* 56(3): 225-232.

Abstract: The effects of the electronic display of guideline-based, patient-specific treatment suggestions on pharmacist work patterns were studied. A total of 28 pharmacists at a hospital-based ambulatory care pharmacy were randomly assigned to intervention and control groups. The intervention group had access to electronic treatment suggestions for heart failure, ischemic heart disease, reactive airways disease, and uncomplicated hypertension, while the control group did not. Starting 9 and 19 months after the initial display of treatment suggestions, all pharmacists recorded the time they spent on a variety of activities, the purpose of each activity, and persons contacted during the activity; these observations were recorded in response to a pager-like device that randomly buzzed four times an hour. A total of 11,102 observations were recorded. Pharmacists in the intervention group spent significantly more of their time discussing information, advising and informing, and solving problems than pharmacists in the control group but significantly less of their time checking and filling prescriptions. Pharmacists in both groups completed a majority of their work alone, but pharmacists in the intervention group worked significantly less by themselves and significantly more with other pharmacy personnel, patients, and physicians and nurses than control-group pharmacists. The delivery of patient-specific information to pharmacists at the time of dispensing had a significant positive impact on pharmacist work patterns.

Murray, M. D., M. T. Rupp, J. M. Overhage, D. E. Ebbeler, J. W. Main and W. M. Tierney (1995). "Multidimensional work sampling in an outpatient pharmacy." *Pharmacy Practice Management Quarterly* 15(3): 44-56.

Abstract: Multidimensional work sampling was performed at a hospital-based outpatient pharmacy. Data were collected from nine full-time and five part-time pharmacists over a 45-day baseline period. Pharmacists wore silent, random-signal generators that permitted continuous work sampling. We introduced the concept of quick codes to allow pharmacists to record their work using a single letter for repetitive activities. Pharmacists recorded 4,687 observations, 90 percent using quick codes. The most common activity was checking prescriptions (36.2 percent). Detection and correction of prescribing errors was the most common reason for their work (39.4 percent). Most work-related activities were performed alone (80 percent) with little time in contact with patients or physicians. These baseline measures will be compared with future measures to assess the effect of the implementation of computerized prospective drug utilization review and clinical treatment guidelines on pharmacists' work. It is expected that these technologic and process changes will increase opportunities for pharmacists to educate patients and consult with physicians.

Nelson, A. A., D. R. Gourley and W. N. Rindall (1977). "Task analysis of a pharmacist's activities in a 45-bed rural hospital with comprehensive pharmaceutical services." *American Journal of Hospital Pharmacy* 34: 1063-1068.

Abstract: The work activities of a pharmacist providing comprehensive pharmaceutical services in a small rural hospital were studied. The objectives were to determine how the pharmacist's time was used, to calculate the portion of the work day spent in clinical pharmacy activities, to compare the allocation of time in this service with that of pharmacists in small hospitals with product-oriented systems, and to investigate the potential usefulness of supportive personnel to release a greater portion of the pharmacist's time for professional activities. Data were collected by trained observers at five-minute intervals during 18 randomly selected work days over a six month period. Activities were classified into 19 mutually exclusive and exhaustive categories. Data were tallied by time period in the work day as well as summary totals. The findings were compared with those of a previous study of five small hospitals. Almost one-third of the total work was spent in clinical pharmacy activities. A major distinction between the activities of the pharmacist offering comprehensive services and those providing product-oriented services was the difference in the nonproductive amount of time. The latter group averaged 52.1% of its day in nonproductive time while the pharmacist in this study was nonproductive only 15% of the time. The addition of a part-time technician seemed to be indicated for greater efficiency since approximately half of the pharmacist's time was occupied by activities that could have been performed by a nonprofessional.

Nickman, N. A., J. K. Schneider and K. A. Knick (1996). "Work activities at an ambulatory care pharmacy with an integrated model of pharmacy practice." *American Journal of Health System Pharmacy* 53(4): 397-402.

Abstract: Activities performed by pharmacists and technicians in an ambulatory care pharmacy were evaluated by work sampling to determine circumstances in which pharmacist time was used ineffectively. Over a two-week period, pharmacists and technicians in the outpatient pharmacy at University of Utah Hospitals and Clinics recorded their activities at random intervals during the workday. The data were analyzed by using descriptive statistics and an institution-specific index of pharmacist efficiency. During the study, 1565 pharmacist observations and 1465 technician observations of work activities were collected. Pharmacists spent 50% of their shifts on clinical and professional activities, while technicians spent 50% of their shifts processing prescriptions and 30% of their shifts directly supporting pharmacists clinical and professional activities. The efficiency with which pharmacists used the available work time for patient care was 56% (100% would mean that they spent all available work time on patient care activities). During a shift, 2.3 minutes per prescription per pharmacist was available for professional and clinical activities. Self-reported work sampling enabled the ambulatory care pharmacy staff to identify staff use of time.

Nolan, M., G. Grant and J. Nolan (1995). "Busy doing nothing: activity and interaction levels amongst differing populations of elderly patients." *Journal of Advanced Nursing* 22(3): 528-538.

Abstract: This paper considers the activity and interaction levels amongst three differing populations of elderly patients (long-stay, short-stay and respite). It begins with a consideration of the literature on staff-patient interactions in care environments for elderly patients, highlighting the virtual absence of planned, purposeful activity. Data are then presented which suggest that, despite the emphasis nurses place on communicating with their patients, many patients continue to spend most of their time inactive. It is suggested that if the quality of care elderly patients receive is to improve, nursing staff must see the provision of activity as an integral part of their role and function.

Norbergh, K., O. Hellzen, P. Sandman and K. Asplund (2002). "The relationship between organizational climate and the content of daily life for people with dementia living in a group-dwelling." *Journal of Clinical Nursing* 11(2): 237-46.

Abstract: 1. One factor influencing the outcome of care may be nursing staff's experience of the organizational work climate. The aim of the study was to investigate how people with dementia spend their time in group-dwelling units (GD) with either a creative or less creative organizational climate. 2. For the study, two GD units assessed as having a creative organizational climate and

two units assessed as having a less creative climate were selected. Eighteen residents living in the units assessed as creative and 20 residents living in the units assessed as less creative participated in the study. 3. For measuring the organizational climate the Creative Climate Questionnaire was used. Observations of residents' activities were classified according to the Patient Activity Classification. For measuring residents' functional ability the Multi-Dimensional Dementia Assessment Scale was used. Their cognitive capacity was measured with the Mini Mental State Examination. 4. Residents living in the units assessed as having a creative organizational climate spent 45.2% of the time with nursing staff, while those in the less creative climate spent 25.6% ($P < 0.001$). Time spent with fellow residents in the creative climate was 13.9% and in the less creative climate 31.3% ($P < 0.001$). There was no significant difference between the units according time spent with relatives and time spent alone. 5. Since the purpose of GD is to offer care adapted to the abilities and psychosocial needs of people suffering from dementia, a less creative climate can be a threat to the aims of GD. In order to maintain these, it is important for managers to be aware of the work climate and its impact on care for people with dementia.

Norbergh, K. G., K. Asplund, B. H. Rassmussen, G. Nordahl and P. O. Sandman (2001). "How patients with dementia spend their time in a psycho-geriatric unit." *Scandinavian Journal of Caring Sciences* 15(3): 215-221.

Abstract: This paper presents the findings of a work sampling study conducted at an assessment unit for patients with dementia at a university hospital in Northern Sweden. The aim of the study was to describe the activity of the demented patients' day at a psycho-geriatric unit, and to investigate the correlation between the patients' characteristics and time provided by nursing staff, in order to increase our knowledge of institutionalized demented patients situation. The sample consisted of 24 patients with dementia. The activities of patients were monitored at 10-min interval between 7.00 a.m. and 9.10 p.m. In total, 2024 activities were recorded. The findings showed that being demented and placed in a psycho-geriatric unit is a life in solitude for most of the time. The variation in time patients spent in solitude could partly be explained by their communication abilities. For patients with dementia, communion is essential for their well-being. In order to develop their well-being, it seems important to enhance our knowledge about the reasons, that influence the nursing staffs' perceptions of patients with dementia, to decrease their time in solitude.

Oddone, E., M. Weinberger, A. Hurder, W. Henderson and D. Simel (1995). "Measuring activities in clinical trials using random work sampling: implications for cost-effectiveness analysis and measurement of the intervention." *Journal of Clinical Epidemiology* 48(8): 1011-8.

Abstract: Determining research-related costs from intervention-related costs is important for both clinical and health services research. Often this task involves estimating what proportion of the workday personnel spend on a variety

of activities. We used a portable random reminder beeper to measure the daily work activities and contacts of study nurses within the context of a multi-site randomized trial designed to assess the effectiveness of primary care. Nurses recorded 4920 work activities over 140 consecutive workdays. Research-related activities consumed the largest proportion of the workday, 42.5% (95% CI, 38.1-46.7) followed by patient care, 28.8% (24.1-33.2), personal time 16.4% (12.0-20.7), and time spent in transit 12.5% (9.1-15.9). Because this research-related time is spent performing tasks specific to the enrollment of patients and measurement of outcome variables, we will use an adjusted annual salary for these nurses (from \$56,392-\$32,425) when attributing costs of the intervention in cost-effectiveness analyses and for future management projections. Work sampling is a flexible, inexpensive method that was well accepted by the nurses in this study. Our results provide important insights into the costs analysis of complex interventions involving health professionals and may allow us to explore why the intervention worked or did not work at individual sites.

Rafferty, M. (1998). "Prevention services in primary care: taking time, setting priorities." *The Western Journal of Medicine* 169(5): 269-275.

Abstract: Preventive services are delivered at rates far below recommended levels. Although lack of time has frequently been cited as an important factor, little is known about how much time primary care clinicians devote to prevention and how they prioritize that time. Work sampling was used to estimate the proportion of time spent on prevention during routine care of patients by primary care clinicians in two hospital-based clinics serving indigent patients. Clinicians were prompted by computer at random intervals to describe their current activity and, if the activity was prevention-related, to choose the specific activity from a list modified from the U.S. Preventive Services Task Force (USPSTF) recommendations. Proportions of time spent on prevention overall and by specific prevention activity were calculated, and the association between USPSTF ratings of specific prevention activities and proportion of time spent on those activities was examined using Kendall's Tau. Clinicians in these clinics spent just 11% of their time on prevention, or about 7 minutes per patient per year. Screening for just two diseases, breast cancer and cervical cancer, accounted for half of all prevention-related activity. There was no overall relation found between proportion of time by specific prevention activity and USPSTF ratings. Thus, the primary care clinicians spent little time on prevention and did not apportion that time according to USPSTF recommendations. If these results are representative, time constraints in actual practice may be too severe to deliver the full range of preventive services suggested by USPSTF.

Rascati, K. L., C. L. Kimberlin, P. T. Foley and R. B. Williams (1987). "Multidimensional work sampling to evaluate the effects of computerization in an outpatient pharmacy." *American Journal of Hospital Pharmacy* 44(9): 2060-2067.

Abstract: The effectiveness of multidimensional work sampling versus direct observation in evaluating the effects of computerization in an outpatient pharmacy was studied. A direct-entry, self-reporting method of multidimensional work sampling was used to measure and compare the relative times spent on various tasks before and after computerization in the outpatient pharmacy of a 475-bed teaching hospital. Analysis of variance was used to evaluate differences in the types of functions performed, differences in functions among the five employees (two pharmacists, one pharmacy intern, and two technicians), and differences in functions on a week-to-week basis. Data obtained by multidimensional work sampling were compared with data obtained by direct observation to determine the level of agreement between the two methods. Also, a time clock method was used to measure and compare the time required for prescription processing before and after computerization. After computerization, the percentage of time spent on some clerical tasks decreased by 26.7%, but this decrease was offset by a significant increase of 27.7% in the percentage of time spent entering information into the computer. Time spent on clinical tasks did not change significantly. A significant difference among employees was found in the percentage of time spent on clinical functions. The differences in time spent on clinical or clerical functions from week to week were not significant. The time to process a set of prescriptions increased after computerization, primarily because of the time needed to enter information into the computer. However, computerization enabled the generation of patient profiles. Multidimensional work sampling is an accurate method of work measurement that may be more useful than direct observation in capturing clinical functions.

Roberts, J. (1994). "Work sampling in a one-person library." *Bulletin of the Medical Library Association* 82(2): 216-218.

Abstract: A work sampling study was conducted in one person library to determine whether an organisations' information requirements can be met by one person by identifying nature of activities and time spent on each. Analysis of the level of work showed that 10% of the observations involved activities that both a librarian and a library assistant might carry out; 45% involved activities that could be carried out by a library assistant; and 45% were activities that usually would be carried out by a librarian. An offer to expand the author's position to full-time was made shortly after the end of the study. Freeing up to 45% of the librarian's time for professional activity was more attractive to the author than adding extra hours. A half-time support position was approved.

Savage, I. T. (1996). "Observing pharmacists at work: Quantifying the Hawthorne effect." *Journal of Social & Administrative Pharmacy* 13(1): 8-19.

Abstract: This study attempted to quantify the effect of being observed (subject reactivity) on pharmacist behaviour using fixed interval work sampling. Four pharmacists working in two independent community pharmacies were observed over two weeks, with activities recorded every minute; 774 prescription

issues were observed. Two professionally sensitive areas of behaviour (one desirable, the other not) were studied: 1) verbal contact with prescription customers and 2) non-professional talk (gossip) and dispensary refreshment breaks. There were significant differences between pharmacists for both the frequency and content of verbal interactions with prescription customers, and the rates at which these behaviours changed in week 1 and 2 were different, providing some evidence for a reactive effect. However, changes were highly individual and it was not possible to define one experimental strategy to control for all of them. Gossiping and drinking in the dispensary were linked to customer workload and no reactive effect could be detected.

Shu, K., D. Boyle, C. Spurr, J. Horsky, H. Heiman, P. O'Connor, J. Lepore and D. W. Bates (2001). "Comparison of time spent writing orders on paper with computerized physician order entry." *Medinfo* 10(2): 1207-1211.

Abstract: Computerized physician order entry (CPOE) has been shown to improve quality, and to reduce resource utilization, but most available data suggest that it takes longer to enter orders using CPOE. We had previously implemented a CPOE system, and elected to evaluate its impact on physician time in the new setting. To do this, we performed a prospective study using random reminder methodology. Key findings were that interns spent 9% of their time ordering with CPOE, compared to 2.1% before, although CPOE saved them an additional 2% of time, so that the net difference was 5% of their total time. However, this is counterbalanced by decreased time for other personnel such as nursing and pharmacy, and by the quality and efficiency changes. We conclude that while CPOE has many benefits, it represents a major process change, and organizations must factor this in when they implement it.

Stevenson, J., S. Caverly, D. Srebnik and M. Hendryx (1999). "Using work sampling to investigate staff time allocation in community mental health centers." *Administration & Policy in Mental Health* 26(4): 291-295.

Abstract: Used work sampling techniques to examine the efficiency of staff time utilization in a sample of 6 community mental health centers in Washington state. 177 direct (DSP) and 100 indirect service personnel (ISP) participated in the study, in which they were asked to record their work activity for 4 consecutive days whenever they were electronically paged by research study personnel (2 times per day). 1,033 usable responses from DSP and 658 usable responses from ISP were obtained. The results showed that DSP spend about half of their time in direct client care and an additional 11% in supervision and training activities. About 19% of the staff time was devoted to documentation and treatment planning, activities that may support clinical services. And approximately 10% of DSP time was committed to travel and meeting and around 8% to other activities, most notably personal activities and management functions. ISP spent about half of their time in traditional support roles, such as preparing billing and clerical work. Their remaining work time was evenly split

between activities to improve the service system and those supporting the status quo.

Yoon, R., R. Chapman, D. R. Gourley, J. E. Murphy and E. S. Ward (1990). "Multidimensional work sampling to quantify a pharmacokinetics resident's duties." American Journal of Hospital Pharmacy 47(8): 1785-90.

Abstract: A multidimensional work-sampling technique was used to quantify a pharmacokinetics resident's duties. Four dimensions were measured: activity, contact, function, and location. A code list of 47 variables was developed to encompass all activities of the resident being observed. A combination of self-reporting and observer reporting was used to test the veracity of the resident's report and to determine whether differences in reporting occurred. Observation was done 20 times a day over a five-week period (24 working days). Random time periods separated the observation points. The observer and the resident recorded 260 and 220 observations, respectively, for a total of 480. The overall reliability measure was 78%, indicating good interobserver agreement. The resident spent about 36% of his time doing work related to pharmacokinetics consultations and 23% of his time attending meetings. He spent a large proportion of time (48.5%) working alone. Much of his remaining time was spent with the Pharm.D. students and the preceptors. Multidimensional work sampling based on a combination of self-reporting and observer reporting is a useful tool for quantifying the work practices of pharmacokinetics residents.