Effectiveness and efficiency of nurse-given cancer patient education

By Heather B. Porter

Abstract

Increasing health care costs make it imperative that nurse-given cancer education programs be evaluated according to their economic effectiveness and efficiency. The purpose of this research was the comparison of two programs of nurse-given education at a Canadian cancer centre examining patients' knowledge of chemotherapy and associated side effects, the number of self-care behaviours for side effects, the degree of extra health resource utilization, patient and nurse satisfaction with teaching programs, and the nursing time needed for teaching. Results show that the experimental intervention is more effective and more efficient than the usual well-organized patient education program at this centre. These study findings begin to address the knowledge gap regarding the cost-effectiveness of a critical component of ambulatory cancer nursing.

Introduction

Nurses are major health care providers. Nursing activities, however, have a reputation for being labour-intensive and hard to assess in terms of economically understandable results. While high quality care is still an expectation of the health delivery process, the concepts of effectiveness and efficiency are being applied more and more to service and professional activities. Nursing encompasses both the effectiveness of nursing care which relates to its quality and appropriateness, and the efficiency of care which is the production of nursing output with minimal resource waste (Fry, 1983; Harris, 1991; Patterson, 1992).

Patient education is an essential dimension of ambulatory oncology nursing practice. This nursing activity is particularly necessary for cancer patients undergoing

Heather Porter

chemotherapy in the outpatient setting (Ashley & Cross-Skinner, 1992). For their safety and well-being, such patients should clearly understand their disease and drug therapy. Also, they must be prepared in advance for the effects of the treatment regimen, so they can safely manage self-care at home, rather than be hospitalized for their cancer treatment complications (Dodd, 1997; Porter, 1995b). However, programs of patient education are very time-consuming and, as budgeting constraints tighten, are being carefully scrutinized. It is imperative therefore that oncology patient education programs be evaluated according to their effectiveness and their efficiency so that appropriate care is given with the resources available despite increased patient populations and decreasing numbers of health care providers.

It is important when effectiveness and efficiency of patient education programs are being explored that patient satisfaction with that dimension of ambulatory oncology nursing practice be assessed. Indeed, any evaluation of such outcomes would be deficient without examining those outcomes as they are understood by patients. In this way, the quality of nursing care can also be addressed from the patient perspective (Oberst, 1984; Poroch, 1995).

Literature review

There is growing evidence in the literature of the effectiveness of nurse-given patient education on increase in knowledge acquisition and promotion of self-care behaviours (Derdarian, 1989; Dodd, 1981, 1982a, 1982b, 1983, 1984a, 1984b, 1984c, 1987, 1988a, 1988b; Dodd et al, 1996; Graydon et al, 1997; Luker et al, 1995; Nettles-Carlson, Field, Friedman & Smith, 1988; Thomas & Dodd, 1992; Weintraub & Hagopian, 1990). Also, the need to study the cost-effectiveness of nursing care has been identified by a number of authors (Henry et al, 1987; Hermansdorfer, Henry, Moody & Smyth, 1990; Ingersoll, Hoffart & Schultz, 1990). Although some descriptive studies have been conducted in recent years on nursing productivity and costs in hospitals (Atwood, Hinshaw & Chance, 1986; Newhouse & Potter, 1990; Sovie & Smyth, 1986; Strasen, 1987) little definitive research on the effectiveness and efficiency of nursing in ambulatory care is available as yet. In particular, no studies have measured the effect of nurse-given patient education in ambulatory care on health resource utilization. Further, no studies have been documented which compare the amount of time spent by nurses in teaching activities and their satisfaction with the time spent in these activities.

The purpose of this research was to compare the effects of two programs of nurse-given patient education on patients' knowledge of the drugs and associated side effects of their cancer chemotherapy, the number of self-care behaviours for side effects instituted by patients while on chemotherapy, and the degree of health resource utilization required by patients on a chemotherapy protocol. The time nurses spend in teaching patients and families and their satisfaction with this time and the satisfaction patients experience with the nursing care they receive are also described.

The theoretical framework for this research is based on General System Theory (Boulding, 1968) which states that a system is a set of interconnected elements: inputs, processes and outputs. In this study, **inputs** were cancer patients' need for knowledge of chemotherapy and associated side effects to enable self-care; **processes** were nurse-given patient education programs; and **outputs** were patients' knowledge, self-care, health resources use,

Heather B. Porter, RN, MS, PhD, is health services consultant and adjunct assistant professor, School of Nursing, Faculty of Health Sciences, University of Western Ontario, London, Ontario.

satisfaction and nurse time and satisfaction. The Self-Care Deficit Nursing Theory (Orem, 1991) was additional theoretical underpinning to this research.

In addition, this study, as with recent research projects conducted (Porter, 1995a; Porter, 1995b), was built upon two major economic concepts, effectiveness and efficiency. The relationship of these concepts to a major outcome of health care, the use of health resources, has been the main objective of these studies.

Effectiveness is the extent to which the output (e.g., patient self-care behaviours) satisfies program objectives (patient education). **Efficiency** concerns the ratio of inputs (patients' need for knowledge) to outputs (e.g., patients' knowledge of treatment) (Cleland, 1990; Donovan & Lewis, 1987; Ehrat, 1987; Drummond, Stoddart & Torrance, 1987; Evans, 1984). **Health resource utilization** (HRU) is defined as the consumption of health services and materials to meet health care needs defined by the patient or the health care provider.

The link among the concepts, effectiveness, efficiency and health resource utilization is shown in the following example: The effectiveness of a chemotherapy education program in an ambulatory care setting is influenced by the amount and type of ambulatory nursing services provided; in turn, the type and scope of those services may affect the economic efficiency of the program as measured by the time nurses require to deliver that program and by the patients' use of selected health resources during their participation in that program.

Methods

A three-month study period was selected since clinical experience by this author, and previous research by the consultant to this study, have shown that problematic side effects from chemotherapy occur during the first two- to three-month cycles of a protocol.

Hypotheses

Effectiveness

Hypothesis One: Participants in the experimental group will display knowledge of a greater number of chemotherapeutic drugs and associated side effects than will the control group at the end of the three-month study period.

Hypothesis Two: The experimental group will report more self-care behaviours than will the control group at the conclusion of the three-month study period.

Hypothesis Three: There will be a difference in the nurses' satisfaction with the time spent in patient teaching between the two study groups.

Hypothesis Four: There will be a difference in patient satisfaction with nursing care between the study groups.

Efficiency

Hypothesis Five: There will be a difference between the experimental and the control groups in the number of telephone calls, extra clinic appointments, emergency room visits, treatment-related hospital days and home care visits required by cancer patients on chemotherapy at the end of the three-month study period.

Hypothesis Six: There will be a difference in time spent in teaching activities with patients and families between the control and the experimental groups.

Design, setting and sample

A two-group prospective, quasi-experimental design was chosen for this research project. The setting for the study was the Windsor Regional Cancer Centre (WRCC), which is an ambulatory centre in Windsor, Ontario. The convenience sample

(n=240) consisted of adult cancer patients attending the WRCC to receive first-time chemotherapy treatment for cure or control of disease. Eligibility criteria included ability to speak and read English, and residency in the community served by the centre/clinic.

Intervention

Program One (Control): The present program of nurse-given education for new patients starting their first chemotherapy protocol at the WRCC consists of explanation of how chemotherapy works to treat the disease, a description of the specific protocol selected for the patient including each drug and its particular side effects, and precautions to be aware of while on this regimen. Appropriate hand-outs from the Canadian Cancer Society and individual drug sheets created by the WRCC are provided to the patient. Encouragement to call the clinic if problems occur is given. A pilot study with seven WRCC oncology nurses showed that this program takes an average of 45 minutes to complete for each patient (Dorion & Porter, 1998).

Program Two (Experimental): This intervention consisted of individualized nurse-given patient education utilizing a teaching book titled **Managing the Side Effects of Chemotherapy and Radiation Therapy** (Dodd, 1996). This publication, developed for the lay public, contains information on the signs, symptoms and possible side effects of 48 commonly used drugs. In a separate section, each side effect is further explained followed by suggestions on symptom management which emphasize patient self-care behaviours. The information in this book was obtained from nursing and medical literature and reviewed by medical and radiation oncologists, oncology clinical nurse specialists and pharmacists. The content has been tested by the consultant to this project in a series of federally-funded studies investigating cancer patients' knowledge of their treatment (Dodd & Mood, 1981; Dodd, 1982a) and self-care behaviours (Dodd, 1982b, 1983, 1984a, 1984b, 1984c, 1987, 1988a, 1988b). This education program takes an average of 15 minutes for each patient (consultation with M.J. Dodd, June 1996; Dorion & Porter, 1998).

Procedure

Data collection was by the Chemotherapy Knowledge Questionnaire (CKQ) (Dodd, 1981; test-retest reliability 0.79) and the Patient Satisfaction Scale (Risser, 1975, alpha reliability = 0.92) at study entry and after three months. The Dodd Self-Care Behaviour Log (SCBL) which measures the intensity and distress of each recorded side effect, the self-care behaviours used and their effectiveness, was kept by patient participants for three months. Chart review was by the Patient Chart Questionnaire (PCQ) (Porter, 1993). The Nurses' Time Log was developed for this study and pilot tested at the WRCC (May/June 1995). Prior to the administration of their first chemotherapy, participants' functional status was measured by the Eastern Cooperative Oncology Group (ECOG) Performance Status Scale (Skeel, 1982).

Patients with cancer meeting the inclusion criteria were recruited by the investigator or the research associate (RA) trained for this study to receive either the usual nurse-given patient education (Program One) or the experimental intervention (Program Two) from the cancer centre nurses.

Because both patient education programs had to be given to participants in the two groups by the same oncology nurses, it was recognized that a threat to internal validity by cross-group contamination was possible. To minimize this threat, a quasi-experimental design was chosen (Figure One). In this design, consenting participants in the control group were

entered first. They were asked, in clinic, to complete the ECOG and CKQ, taught how to chart in the SCBL and asked to keep this log for three months. Prior to their first chemotherapy, **these participants received the usual nursing care (Program One)**. Three months from recruitment, each control group participant was asked by the investigator or RA to complete the post-test, the Risser scale and to return their SCBL.

A one-month interval followed data collection from the final control group participants to allow time to complete control group activities and orient clinic nurses to the experimental phase.

Accrual of consenting participants in the experimental group and data collection followed the same pattern as for the control group. Prior to the first chemotherapy treatment, **these participants received the experimental intervention (Program Two) from the clinic nurses. This intervention was reinforced, when feasible, at each subsequent patient visit.**

All participants were requested to record all visits or telephone calls made since their last regular appointment and the reasons for them. Participants were followed for three months through chart review by the RA to monitor health resource utilization (HRU). If HRU is not clearly cancer-related, advice was sought from the participant's oncologist.

All nurses in the WRCC systemic therapy department consented to take part in this study. Each day, using stop watches,

they timed and documented their patient teaching of study participants. This information was charted daily on the nurses' time log. For each teaching session, nurses rated their satisfaction with the time spent with a patient in teaching activities. Nurses also timed and recorded the length of time in minutes required for each telephone call made or received by the study participants (Dorion & Porter, 1998).

Data analyses used the SAS for independent t-tests, ANCOVA or parametric procedures when required. Because of the difference between the groups on ECOG, data were transformed and adjusted for ECOG through ANCOVA to assure that probability values were upheld. Previous research by Dodd (1981 to 1997) showed significant positive effects of a nursing education program on chemotherapy knowledge and performance of self-care behaviours. Therefore, hypotheses related to these variables were tested using one-tailed independent t-tests.

Results

A power analysis (Borenstein & Cohen, 1988) indicated that 95 participants were required to detect differences of significance (assumptions: alpha = 0.05; power = 0.80; moderate effect). A total of 125 individuals were entered in the control group (C). Of these,

13 expired, six had their chemotherapy stopped before three months, two were found to have received previous chemotherapy elsewhere and two participants were dropped due to missing data, leaving 102 control group participants with complete data. There was accrual of 120 persons to the experimental arm (E). Of these, three expired, four stopped chemotherapy before three months, two were too ill to continue the study, and seven were dropped due to missing data. This left 103 participants in the experimental group with complete data.

Sample characteristics

The participants in this study were in their middle 50s, high school graduates and there were more females than males. There were no significant differences on these characteristics. The major disease site for both groups was breast cancer (30% = C, 36% = E) with the next most frequent cancers being lung, bowel and lymphoma. Regarding stage of disease, the control group showed equal numbers of participants at stages II, III and IV while in the experimental group the majority were at stage II at the start of their first-time chemotherapy.

There was a significant difference between the groups only on physical activity at study entry showing that the control group was nearly at level 1 on ECOG which means they were restricted in their ability to perform normal activities at the start of chemotherapy, whereas the experimental group was in normal health at recruitment (ECOG = 0). Since people may learn less

quickly when they are not in normal health, results related to the nurse time for teaching adjusted for this difference.

The protocol each participant received was recorded according to the amount of supportive intervention needed (least, moderate, high) using guidelines developed by the WRCC nurses and pharmacists (Figure Two). Results showed that the majority of the control group received a protocol requiring the **least** amount of supportive intervention. However, the majority of the experimental participants needed a **moderate** amount of support because of their chemotherapy protocol.

Hypotheses testing

Effectiveness

Hypothesis One. There was a significant difference between the groups on drug knowledge as shown on the CKQ. The experimental intervention assisted patients to better remember their chemotherapy agents' names for the three-month study

Table Four: Patient satisfaction (with nursing care - Risser)

Variable	Control (n=102) mean (SD)	Experimental (n=103) mean (SD)	p value
Technical/professional	2.871 (0.402)	2.925 (0.383)	n/s
Educational	3.151 (0.388)	3.152 (0.364)	n/s
Trusting	2.823 (0.373)	2.888 (0.346)	n/s

Table Five: Health resource utilization (PCQ)

Variable	Control (n=102) mean	Experimental (n=103) mean	p value
Telephone calls	105.470	99.529	n/s
Extra clinic visits	104.117	100.882	n/s
Home care visits	96.852	107.198	0.0793
Emergency dept. visits	105.186	99.813	n/s
Hospital days	105.838	99.161	0.0925
Other health providers	105.794	99.205	n/s
Wilcoxon Scores			

Table Six: Nurses' time for patient teaching (nurses' log)

Variable	Test	Control (n=102) mean (SD)	Experimental (n=103) mean (SD)	p value
Teaching time	t test	26.107 (14.266)	17.252 (9.577)	0.0000
	Log Transformation	2.912 (1.369)	2.519 (1.277)	0.0347
	ANCOVA (ECOG = co-variate)			0.0129

Table One: Knowledge of chemotherapy and side effects (CKQ)

Variable	Control (n=102) mean (SD)	Experimental (n=103) mean (SD)	p value
Drug knowledge (# correct)	1.352 (1.216)	1.794 (1.146)	0.0083
Potential side effects (# correct)	9.637 (4.476)	9.882 (4.904)	n/s
Experienced side effects (# correct)	5.578 (3.782)	5.752 (3.879)	n/s

Table Two: Self-care behaviours (SCB log)

Variable	Control (n=102) mean (SD)	Experimental (n=103) mean (SD)	p value
# side effects (SE)	5.657 (3.782)	6.524 (3.801)	n/s
SE severity	1.669 (1.392)	1.976 (1.367)	n/s
SE distress	1.420 (1.279)	1.853 (1.401)	0.0223
# SCBs	4.196 (3.546)	4.941 (3.764)	n/s
Self-care effectiveness	12.872 (11.118)	16.077 (12.964)	0.0590

Table Three: Nurses' satisfaction with teaching time (nurses' log)

Variable	Control (n=89) mean (SD)	Experimental (n=90) mean (SD)	p value
Nurses' satisfaction	1.56 (0.64)	1.60 (0.42)	n/s

period. There was no significant difference in side effects knowledge (Table One).

Hypothesis Two. There was no significant difference between the groups on number of experienced side effects and their severity, although the experimental group found their side effects significantly more distressing than did the control group. There was no difference between the groups on number of self-care behaviours (SCBs), but a difference that approached significance was found between the groups on effectiveness. The experimental group found the SCBs they used more effective than did the control group (Table Two).

Hypothesis Three. The comparisons made here were between the two teaching programs, so an average of all the nurses' logs was taken to obtain the results. There was no significant statistical difference in nurse satisfaction with the time spent teaching either patient education program (Table Three).

Hypothesis Four. There were no significant statistical differences between the control and experimental groups of participants regarding their satisfaction with the professional, educational and trusting roles of the oncology nurses (Table Four).

Efficiency

Hypothesis Five. Non-parametric tests were used here because of the non-normal distribution of the data. The experimental group needed more home care visits than did the control group, but the latter required more hospital days (Table Five).

Hypothesis Six. Statistical significance was reached for differences between the groups on nurse time for patient teaching. Because of unequal variances for these groups that could have nullified the significant difference, the data were transformed and retested. Since clinical experience suggests that persons in less than normal physical health can take longer to learn something new and there was a significant difference between the groups on ECOG, ANCOVA was performed with ECOG as co-variate. The significant difference between the groups was upheld showing the experimental intervention takes one-third less time to accomplish than the usual patient education program at the WRCC (Table Six).

Discussion

The experimental intervention, which through **Managing the Side Effects of Chemotherapy and Radiation Therapy** (Dodd, 1996) presents clear explanations of chemotherapeutic drugs at lay persons' reading comprehension level, the reasons for and duration of side effects and the ways in which patients can take control of their side effects experience through self-care measures, is equally effective for side effects knowledge and more effective for drug knowledge than the usual well-organized WRCC patient teaching program.

It was noted that the experimental participants found their side effects significantly more distressing than did the control participants. This may be related to the more aggressive chemotherapy protocol received by the experimental participants than that given the control group (Figure One). However, the experimental group found their self-care behaviours more effective for their more distressing side effects than did the control group for their less distressing symptoms. It was reassuring that both nurses and patients were equally satisfied with both teaching programs.

The experimental intervention was found to be more efficient, requiring one-third less time to accomplish than the usual patient teaching program. Also the participants who learned the experimental intervention needed fewer hospital

days, though more home care visits, than did those participants taught by the usual method. The greater number of home care visits by the experimental group may have occurred because most participants in this arm had stage II cancer and were being treated with granulocyte colony stimulating factor (GCSF) which requires patient teaching at home for self-administration of this substance. However, since hospital days are very much more expensive than home care visits, it is suggested that the experimental intervention is more cost-effective than the traditional teaching program at WRCC.

Conclusions

This research project has shown that the experimental intervention developed by Dodd (1996) is a more effective and more efficient method of patient education than the usual well-organized program at the Windsor Regional Cancer Centre, an ambulatory cancer care setting.

While this study supports the effectiveness of the intervention previously demonstrated by the research of Dr. Marylin Dodd, consultant to this study, it is the first research to show the efficiency of this effective patient education program. The intervention takes significantly less time to perform and results in less use of expensive extra health resources (more home care visits, fewer hospital days).

Presently these results may be generalized to other mid-sized cancer centres. However the study should be replicated in other ambulatory cancer care settings to extend the ability of this user-friendly teaching program to be generalized. It may be, however, that different patient and nurse populations and different environments would negatively influence these economic outcomes. Such results should be determined through research methodology before funds are spent acquiring "the Dodd book" for cancer patient teaching.

The implication for nursing practice at the WRCC is exciting. If this ambulatory cancer centre chooses to adopt the very effective and more efficient Dodd teaching method, the time saved could be used in other ways for the benefit of patients, staff and the WRCC organization. Seeing successful research results put into everyday practice to increase the efficacy of nursing work could encourage oncology nurses to become further involved in future research investigations of their nursing care systems toward cost and quality of care outcomes. ♡

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