CANADIAN RADIATION ONCOLOGISTS

Manpower Study Report

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Introduction

The total number of radiation oncologists licensed to practice in Canada is small. In spite of this, Radiation Oncology has played a pivotal role in the management of patients diagnosed with cancer in Canada. Forty to forty-five per cent of patients with cancer will receive radiotherapy at some time during their illness. Sixty per cent of these treatments will be given with the aim of cure, with this objective achieved two thirds of the time. Forty per cent of treatments will be given with palliative intent to relieve a variety of symptoms.

To provide radiotherapy services efficiently and effectively, it is important that there be appropriate resources available to meet the needs of the population. Radiation oncologists are an important component of the resource requirement.

There are many challenges that need to be addressed to ensure adequate provision of professional services by radiation oncologists. These include the instability and unpredictability of funding levels to provincial cancer agencies, a seven year lead time for the training of radiation

oncologists and the lack of a workload staffing standard for radiation oncologists. With projected increases in cancer caseload, an accurate and realistic assessment tool to help manage physician resources is needed.

The provision of health care in Canada is a provincial responsibility. In most provinces, the provision of radiation oncology services is the responsibility of provincial cancer agencies and boards. The mandate of individual agencies and boards varies with respect to responsibilities for research, teaching and administration. Practice patterns vary between rural and urban populations and according to the demographics in each province. Thus, a national standard cannot be applied to all provinces in Canada. However, we have developed a methodology which we believe to be a reasonable framework for the provision of safe, high quality radiation oncology services to guide provincial cancer agencies and radiation oncology departments in future manpower planning. The following report has been endorsed by the Board of Directors of the Canadian Association of Radiation Oncologists (CARO).

Project Committee Members

The principle consultant from Agnew Peckham and Associates was Dr. Peter Hawrlyshyn from Ontario.

Committee members from CARO participating in the project were:

- Dr. Ida Ackerman, Ontario;
- Dr. Jean-Paul Bahary, Quebec;
- Dr. John Carson, New Brunswick;
- Dr. Peter Dixon, Ontario;
- Dr. Alex Hammond, Ontario;
- Dr. Bill Mackillop, Ontario;
- Dr. Matthew Parliament, Alberta;
- Dr. Bob Pearcey, Alberta;
- Dr. George Shonouda, Quebec;
- Dr. Richard Tsang, Ontario; and,
- Dr. Frances Wong, British Columbia.

Goals and Objectives

Agnew Peckham and Associates (APA) was retained by the Canadian Association of Radiation Oncologists (CARO) to develop a methodology for projecting manpower requirements for radiation oncologists in Canada.

The terms of reference for the study were to:

- review previous manpower planning guidelines for radiation oncologists;
- develop a methodology or tool for projecting radiation oncology manpower requirements;
- undertake data collection and analysis to permit application of the methodology; and,
- define realistic staffing guidelines for radiation oncology manpower requirements.

The growth in demand for radiation therapy across Canada has made the need to predict manpower requirements more crucial than ever before. A flexible model which can adapt to the changing and complex nature of the practice of radiation oncology is needed.

Background

The Practice of Radiation Oncology

Radiation oncology has been defined as a clinical medical specialty whose members have completed accredited training and certification for the treatment of neoplastic diseases with emphasis on the therapeutic uses of ionizing radiation. While medical oncologists, who treat neoplastic diseases with chemotherapy can provide their services in a private practice setting, radiation oncologists require tertiary services and equipment traditionally located in regional cancer centres which are provincially controlled and funded.

The following functional description of radiation oncology proposed by Dr. Fairey of the British Columbia Cancer Agency (1993), groups services into four accepted categories which include: 1) clinical patient care services; 2) clinical administration; 3) teaching and education; and 4) research.

Clinical patient care services include:

- primary consultation;
- primary treatment;
- follow up care;
- disease progression or relapse treatment; and,
- other expert patient care.

Fundamental to the concept of patient care service is the concept of a "new patient". Although such a definition at first glance, appears intuitively obvious, controversy exists as to what constitutes a "new patient". Is it a patient first seen by a radiation oncologist or by a medical oncologist? Must it only include patients receiving treatment or can it include patients seen only in consultation? For the purpose of this report, a "new patient" is any patient with a neoplastic disorder who visits a radiation oncologist for the first time, irrespective of whether the patient has previously consulted a medical oncologist or will receive any treatment.

Clinical administration includes:

- participation in patient care related committees;
- participation in special function committees;
- participation in provincial, national or international committees or associations; and,
- participation in agency tumour groups.

Unlike many other medical specialties, both radiation and medical oncology necessitate a significant involvement in clinical administration. This not only involves participation in hospital or cancer centre committees (e.g., pharmacy, medical records, discharge planning, radiation protection), but also representation on various agency tumour groups and provincial and national committees involved with the establishment and implementation of radiation therapy policies. Such activities are of paramount importance to quality assurance and management of the practice of radiation oncology. The significant time requirement for committee involvement necessitates the consideration of committee involvement in any methodology or tool designed to define staffing.

Teaching and education includes:

- undergraduate medical students;
- post graduate medical residents;
- post fellowship clinical fellows;
- allied health professional para-medical trainees and staff – radiation therapy, nursing, etc.
- continuing medical education for other medical professionals; and,
- general public.

The teaching responsibilities associated with the first three categories are usually the responsibility of the radiation oncologists with university

appointments. All radiation oncologists have responsibility for the teaching activities associated with the latter three categories.

Research includes:

- clinical trials (most common research activity);
- basic science;
- translational research;
- health policy or health care delivery research and development; and,
- treatment technique development.

Teaching and research are two activities of importance to the practice of radiation oncology. Unfortunately, the pressure and demand for treatment of patients at understaffed cancer centres often results in insufficient time for these activities. The Report by the Radiation Oncology Commission in Ontario (1990) recommended that 30 per cent time be protected for academic activities (research and education). A study by the British Columbia Cancer Agency (BCCA) in 1994 recommended providing up to 25 per cent protected academic time. Unfortunately, this is now often impossible at many regional cancer centres. It has been shown that the academic output of radiation oncologists decreases in response to increases in clinical workload.

The Training of Radiation Oncologists

The radiation oncology residency training program is a post-graduate program of five years duration. Residents must pass the Royal College fellowship examination before they are allowed to practice radiation oncology. Most successful candidates take an extra year or two of training in a specialized area before being appointed as staff radiation oncologists in cancer treatment centres.

During the 1980's, radiation oncology training programs were expanded because of an anticipated shortfall in staffing. However, fiscal restraints during the 1990's prevented the creation of any new funded positions, resulting in an apparent excess of trainees without jobs. Many trainees transferred out of radiation oncology programs. The demand for radiation therapy has increased, with the result that many provinces now have a manpower shortage and inadequate facilities resulting in unacceptably long waiting lists and/or having to send patients to American treatment facilities (British Columbia and Ontario). Accurate projections of staffing requirements and appropriate funding levels to support the projections will be critical to ensuring the provision of adequate radiation therapy services into the next millennium.

Previous Manpower Studies

There have been few well-defined staffing guidelines or standards published for radiation oncology. Prior studies conducted by radiation oncologists have been criticized as being self-serving and lacking in terms of objectivity or external peer review. Very few studies provide objective evidence or a clinical basis for recommendations made. Comparisons with European or American centres have not been possible because of differences in funding and staffing patterns. For several years, CARO has proposed a credible and realistic method for the development of staffing standards that would meet the required need and would be endorsed by provincial funding agencies in Canada. These initiatives have culminated in this report.

Most earlier reports focused on new patients (NP) per radiation oncologist (RO) per year. Few studies differentiated between academic and non-academic centres, and the additional time required for academic and administrative activities. Earlier recommendations are summarized in Table 1. The basis for the earliest studies was a comparison of historical workload against FTE staffing complements. Later studies relied on such ratios as treatment courses or fractions per patient, often reflecting the workload capacity of existing radiotherapy facilities.

Most authorities recommended between 200-250 NP/RO/year during the late 1980's and early 1990's. Advances in technology and treatment protocols during the past decade have increased the probability for a cure and reduced side effects. This has increased the complexity of treatment protocols and has placed a greater demand on services and physician resources, which is not reflected in the earlier workload standards. Despite such limitations, many of the earlier workload or staffing standards are still being quoted. There is no official acceptance of any of these standards by provincial cancer agencies in Canada.

Table 1: Previous RO Staffing Recommendations

Source	Date	NP/RO
DHHS (USA)	1982	120-233
Health Council (Ontario)	1983	average of 206
Holland	1984	230[a]
RCR (England)	1986	average of 360 NP per "team"
ISCRO (USA)	1986	average of 200-250[a]
CARO (Canada)	1988	average of 200[a]
RCPSC/CMA	1988	average of 190
ROC (Ontario)	1990	140-200
APA (Ontario)	1991	average of 200
ACB (Alberta)	1992	average of 250

[a] Excludes teaching & research.

Legend:
NP: New Patient.
RO: Radiation Oncologist.

The above table clearly reaffirms the inconsistencies in definitions. There is no accepted Canadian staffing guideline. A guideline of 200 new patients/RO is used in Saskatchewan, while British Columbia uses 200 first course treatments/RO. Although differences in practice patterns can be expected and a national standard or guideline cannot be applied to all provinces, it is recommended that a uniform methodology be adopted to project staffing standards for radiation oncologists across Canada using similar terminology and definitions. Such a common methodology would permit allowances for varying patterns of practice, thereby developing standards appropriate to each province.

Current Radiation Oncology Staffing Levels in Canada

CARO conducted an independent survey of radiation oncology staffing positions at Canadian cancer centres. The results are summarized in Table 2 and illustrate funded staffing levels for 1999 and 2000 for some Canadian cancer centres. Not all centres in Ontario responded to the survey. The expected staffing levels are estimates for 2001 and 2002 made by department heads of positions likely to be approved by provincial cancer agencies. They do not reflect actual manpower needs, nor actual funding available. Some department heads did not report on expected staffing levels because of the unpredictability of provincial funding approvals. The current number of residents in training will barely fill the "expected" vacancies. Many residents who have recently passed the Canadian fellowship examinations have decided to work in the United States, decreasing the number of newly qualified radiation

oncologists available. Over the past ten years (1989-1999), forty-four Canadian graduates undertook postgraduate fellowships in the USA. Of these, eleven (or 25 per cent) did not return to Canada (Source: CARO). Training radiation oncologists will require a minimum lag time of six to seven years. This underscores the importance for provincial cancer agencies to link residency training positions with a commitment to fund staffing, based on accurate staffing projections.

Table 2: Radiation Oncology Positions in Canada

Province	Centre	Funded in January 1999	Funded in January 2000	Expected 2001	Expected 2002
British Columbia	BCCA	46.0	48.0	49.0	51.0
Alberta	Cross	12.0	13.0	13.0	13.0
	Tom Baker	10.0	10.0	10.0	10.0
Saskatchewan	Alan Blair	5.0	6.0	7.0	8.0
	Saskatoon	6.0	6.0	7.0	8.0
Ontario	Northeastern	4.5	6.5	6.5	6.5
	Northwestern	–	–	2.8	3.8
	Hamilton	16.0	18.0	20.0	22.0
	PMH	29.0	29.0	30.0	31.0
	Ottawa	12.4	14.7	15.1	16.1
	Kingston	8.0	9.0	9.0	9.0
New Brunswick	St. John Reg.	5.0	5.0	5.0	5.0
	LROC - Moncton	4.0	4.0	5.0	5.0
Quebec	Montreal General	–	–	10.0	12.0
	HMR Radio-Onc.	–	–	–	–
	Jewish General	–	–	–	–
	CUSE-Fleurimont	2.0	2.0	3.0	3.0
	Sagamie	–	–	–	–
	Hotel-Dieu	9.0	8.0	8.0	10.0
	CHUM	9.0	9.0	10.0	11.0

Source: 1999 CARO Annual Survey

Methodology

For this report, a radiation oncologist is defined as a specialty trained physician proficient in the use of radiation therapy. The definition was further subdivided into:

- ***RCC Radiation Oncologists:*** radiation oncologists at regional cancer centres (RCC) who provide clinical radiation therapy services.

- ***Fellows/Residents:*** postgraduate medical students in recognized radiation oncology training programs.

- ***Assistants:*** physicians or other professional health staff who are not radiation oncologists, but assist radiation oncologists by performing various patient-related activities.

It is important to note that the study focused primarily on radiation oncologists at regional cancer centres (RCC's). Because most RCC's are affiliated with a university, the majority of radiation oncologists work in an academic setting, and are therefore expected to participate in academic activities such as education, research and outcomes analysis.

However, the level at which the majority of radiation oncologists can participate in these activities has been hampered due to the excess demands of clinical care activity. This study was undertaken to objectively demonstrate and establish reasonable standards that can allow time to meet these other expectations. Fellows, residents or assistants were not surveyed; their contributions to manpower requirements have not been analyzed in this report.

The questionnaire that was used is included in Appendix A. It consisted of two parts. The first section, the **Daily Activity Log,** was designed as a time measurement tool for radiation oncologists. Activities were subdivided into nine major groups based on broad categories approved by the Project Steering Committee. Physicians were asked to detail their daily activities, in five minute intervals, for a one week period. Time spent on each activity was recorded for each working day. Most surveys were completed during May and June of 1998. The following definitions were provided for each activity:

Direct Patient Care: referred to consultations (new or repeat patients), continuing care visits, treatment visits, long term follow-up visits and clinic visits at peripheral clinics. This could be further subdivided into direct outpatient and inpatient care.

Indirect Patient Care: referred to coordination of patient care with other health care providers, treatment team conferences or review meetings, communication with other physicians, family discussions, patient-related correspondence, dictating and signing off patient charts.

Treatment Planning: referred to activities of clinical markup, simulation (conventional or CT) for external beam therapy and brachytherapy, and review of and documentation of treatment plans or films.

Quality Assurance (QA): referred to quality assurance activities including local QA policy development, membership attendance at local, provincial or national tumour site boards and audit of radiotherapy process or patient outcome.

Clinical Administration: referred to administrative activities such as committee, departmental or staff meetings at the cancer centre, host hospital, university, provincial cancer agency or national and international cancer care bodies.

Research: referred to clinical research and basic laboratory research. Clinical research referred to activities such as protocol development, protocol review and outcome analysis and meetings with study groups/representatives.

Teaching: referred to educational activities such as preparation for or attendance at lectures, seminars, grand rounds, pathology rounds, informal teaching including ward rounds, case presentations and discussions in clinics. Although it also included continuing self-education (CME), this activity was not documented consistently on all surveys.

Other: referred to other activities such as traveling between hospitals or peripheral clinics, meetings with drug representatives, lunch/coffee breaks, general correspondence, mail and office activities.

The "total day" for each physician was defined by the arrival time and by the departure time at the Centre. As such, some portions of the day were left blank or unrecorded. Activities performed after hours or at home were reported but excluded from the "normal working day", as were after hours or weekend on-call activities.

The second section of the questionnaire was a **Patient Log** which recorded the exact time-in and time-out for specific direct patient care visits. This was later used to determine the "average visit times" for specific direct patient care visits for specific tumour sites. The following definitions were provided for each activity:

Direct outpatient visits were classified as initial consultations, second opinion consultations, repeat consultations, first treatment visits, weekly review visits, follow-up visits and continuing care visits.

Direct inpatient visits were classified as consultations or daily review visits.

Treatment planning visits were classified as clinical mark-up, conventional planning, conventional simulation, CT/virtual simulation, and brachytherapy. A descriptor or comment field was also provided for each patient visit. Physicians were asked to record specific visit times for a representative sample of patients attending clinics or treatment sessions.

Completed questionnaires were obtained from 55 radiation oncologists. Data were subdivided by tumour site and type of visit for over 2,000 patient contacts. Standard statistical analyses (mean and standard deviation) were performed.

A Canadian expert was identified for each of seven major tumour site groupings. Each expert was asked to develop a prototype management protocol for their respective tumour site according to current practice patterns. This indicated the proportion of patients requiring treatment, the intensity and duration of radiation therapy visits, and the frequency and duration of follow-up visits. By applying the average visit times, calculated from the Patient Logs, to the expert management protocols, a "patient activity index" was developed for each major tumour site. This index defines, on average, the total direct patient care time (in hours) required for each new patient. The "patient activity indices", when combined with the average work week results from the daily activity logs, permitted derivation of staffing ratios which reflect current radiation oncology practice patterns.

These ratios are used to project annual new patient caseloads per radiation oncologist which can then be related to the number of new cancer cases at a designated regional cancer centre to project manpower requirements for the designated centre. The methodology will allow provinces to modify basic assumptions specific to their individual provincial radiation therapy practice patterns, and thereby define staffing guidelines specific to their region or province. A model is presented for Ontario using 1996/97 incidence and patient workload data from Cancer Care Ontario.

Results

The data from the weekly activity logs of 55 radiation oncologists is summarized in Tables A1 and A2 in Appendix A. Data from another eight respondents was incomplete (missing one or more days) and was therefore excluded. The average total weekly hours worked by all 55 radiation oncologists was 47.2 hours (S.D. = 4.1 hrs) or about 9.5 hours per day.

When data were grouped according to province, sample sizes were too small to permit meaningful provincial averages to be calculated. All further data analyses used the entire sample to define a Canadian norm. Results were also subdivided by *clinical, administrative* and dedicated or protected *research* radiation oncologists. The chiefs and assistant chiefs of the department of radiation oncology were included in the *administrative* group. Typically, directors have little clinical duties and were not in the study.

There were 43 radiation oncologists in the *clinical* group. The average total weekly hours worked by the group was 46.6 hours (S.D. = 3.5 hrs). Of this, 23.6 hours (S.D. = 3.8 hrs) were devoted to direct patient care and 7.2 hours (S.D. = 3.3 hrs) were devoted to indirect patient care.

This represents 50.6 and 15.4 per cent respectively of total hours worked. Total patient care amounted to 30.5 hrs (S.D. = 5.1 hrs) representing 65.9 per cent of total hours worked.

The next most significant workload or activity was clinical administration encompassing an average of 5.6 hours per week (12 per cent of total hours). Teaching activities required 3.3 hours per week on average, while research activities accounted for an average of 4.4 hours per week. In total, teaching and research comprised 7.7 hours per week (or 16.5 per cent of total hours worked). This survey was done in June which is the end of an academic year. The recorded teaching activities may be an underestimation of activities carried out in university affiliated centres.

A separate analysis was performed for "administrators" with significant administrative responsibility at each centre. Typically, this was the chief or assistant chief of radiation oncology at each centre. Based on a sample size of eight administrators, the average hours worked per week was 48.8 hours (S.D. = 5.9) of which 12.7 hours (S.D. = 3.3 hrs) or 26 per cent of total work hours was devoted to clinical administration. This represented the minimum time required for clinical administration as clinician – administrators often place patient care activities before administration requirements. The research radiation oncologists had a variable amount of time dedicated to research. The sample size was too small for separate analysis.

Visit times from the Patient Logs were grouped according to several major tumour sites, permitting calculation of average times for breast, lung, prostate, lymphomas and other tumour groups. The results are summarized in Table 3. The first four groups typically account for over 60 per cent of radiation therapy workload. There were no statistically significant differences in the average visit times among tumour groups. Visit times are influenced by booking schedules in clinics. The results suggest that consultations are most often booked for 45 to 60 minutes, and follow-up visits are generally booked for 10 to 15 minutes. These booking times may have to change if patient demand changes. As such, individual booking practices in a province or clinic may necessitate modification of the methodology.

Radiation oncologists defined a model and management scheme for seven tumour groupings. This was based on current practice, including the frequency and type of patient encounters. Conceptually, from the total number of cancer cases in a given region, a fixed percentage will be

referred to the cancer centre (i.e., the referral rate). Of these, some will be referred for radiation oncology. The model assumes 100 such referred patients. Of these, some will only be seen in consultation, some will receive radical radiation therapy, and a third group will receive only palliative radiation therapy treatment. Of the patients seen in consultation or of those who receive radical therapy, a percentage will subsequently relapse with recurrent or metastatic disease requiring further palliative radiation therapy. By defining the percentage of patients in each of these groups who will relapse and the type and frequency of patient visits for each group, the radiation therapy workload attributable to each tumour site can be determined (see Appendix B).

Table 3: Average Patient Visit Times (minutes)

	Breast		Lung		Prostate		Lymphoma		Other		Total All Sites	
	Minutes	Pts.	Minutes	Pts.	Minutes	Pts	Minutes	Pts.	Minutes	Pts.	Minutes	Pts.
Inpatient												
Inpatient consultation	46.67	(3)	56.23	(4)	75.00	(1)	42.50	(10)	47.20	(23)	47.6 ± 17.1	(41)
Review/ward visit	14.76	(21)	14.04	(47)	22.78	(9)	17.78	(9)	16.38	(112)	16.0 ± 9.7	(198)
Outpatient												
Consultation	50.51	(79)	51.18	(51)	62.58	(31)	46.00	(30)	43.78	(144)	48.4 ± 19.3	(335)
Weekly treatment visit	9.92	(128)	14.17	(30)	9.17	(48)	10.57	(35)	11.22	(171)	10.7 ± 5.8	(412)
Follow-up visit	17.21	(131)	18.86	(57)	17.47	(97)	15.20	(75)	16.38	(316)	15.8 ± 8.0	(676)
Repeat consultation	31.25	(20)	55.00	(4)	37.50	(6)	21.67	(3)	30.60	(25)	32.8 ± 12.0	(58)
Continuing care visit	14.09	(22)	19.41	(17)	22.89	(19)	15.94	(16)	17.43	(35)	17.8 ± 10.2	(109)
Treatment Planning												
Conventional simulation	34.64	(56)	27.84	(44)	36.11	(18)	38.08	(13)	28.76	(101)	31.1 ± 13.7	(232)
Brachytherapy	–		–		27.50	(6)	–		26.79	(14)	27.0 ± 14.5	(20)
CT planning	–		23.75	(8)	37.50	(2)	30.00	(9)	27.78	(18)	28.0 ±17.7	(37)
CT simulation	–		21.43	(7)	30.83	(6)	40.00	(3)	33.75	(8)	29.6 ± 15.0	(24)
Clinical markup	21.25	(12)	16.00	(5)	12.50	(2)	26.00	(5)	17.83	(23)	19.1 ± 11.4	(47)

Note: Figures in brackets represent the number of patients in each group.

Workload/Staffing Standards

Staffing or workload standards are only as useful as the accuracy of the assumptions upon which they are based. During recent contractual negotiations across Canada, several different conceptual models have been discussed: an incident case workload standard, a referred case workload standard, a consultative case workload standard and a first case treated workload standard. Each of these concepts has its proponents and dissidents. At a regional or provincial level, an incident or referred case workload standard is preferable as it `addresses the radiation therapy requirements for an entire region or population. At an operational level for a cancer centre, a consultative or first case treated workload standard is preferable as it most accurately defines funding for every treated case at the centre, but neglects those patients unable to access treatment at the centre due to insufficient resources. The methodology proposed in this report can be modified and/or adapted for use with any of the four preceding models.

It is also important to recognize the differences in practice patterns between medical and radiation oncology, as these impact the applicability of staffing standards. At issue are who first sees a patient, the implications of treatment planning, and the use of clinical associates.

From a planning perspective, the type of specialist who first sees a patient is irrelevant. Where a patient is seen appropriately in consultation by both medical and radiation oncology, each specialty must receive credit for the workload. Unlike medical oncology, radiation therapy requires considerable treatment planning and simulation, which must be reflected in any staffing standards. Whereas clinical associates often play an important role in medical oncology and can be introduced using an "equivalency factor" for a medical oncologist, their role in radiation oncology has been limited to helping in follow-up clinics at some regional cancer centres.

The weekly Activity Logs indicate that radiation oncologists work an average of 46.6 hours per week. This excludes an average of 3 after-hours and 5 weekend hours of service per week. Despite the fact that most contractual funding assumes a 37.5 to 40.0 work week, many radiation oncologists work a 55 hour week. **Given the demand for services, it is recommended that a 45 hour work week serve as the basis for the planning methodology.** This assumes that contractual funding will support a "longer" work week. Allowing for statutory holidays, paid holiday and conference leave, most radiation oncologists are on-site at cancer centres an average of 45 weeks per year. **Assuming 45 hours per week, this equates to 2025 paid hours per year per radiation oncologist.**

The results of the weekly Activity Logs indicate that, on average, radiation oncologists spend 45 per cent of their time on direct outpatient care which includes treatment planning or outpatient visits; 5 per cent on inpatient care; and, 15 per cent on indirect patient care. Of the remainder, 11 per cent of their time is spent on clinical administration, 16 per cent on education and/or research, and 8 per cent on other activities.

The 45 per cent of time attributable to direct outpatient care (treatment planning and outpatient follow-up visits) is comparable to activities calculated for the patient workload indices from the management protocols (See Appendix B). That is, about 920 paid hours per year are available per radiation oncologist for such direct outpatient care. Inpatient care and indirect patient care activities are excluded from the management protocols.

The patient workload indices from Appendix B can be converted into recommended staffing standards, as shown in Table 4.

Table 4: Workload Staffing Standards

Tumour Site	Workload Hours per Patient	New Patients per RO per Year
Breast	5.4	170
Lung	4.2	219
Prostate	5.7	160
Gastrointestinal	3.4	270
Gynaecologic	4.5	203
Lymphoma	5.4	170
Larynx	8.1	113

Differences in the patient workload among various tumour sites are primarily a reflection of different treatment protocols and varying follow-up protocols. The number of treatment visits per patient reflects the complexities and differences in treatment standards for various tumour sites. The frequency of follow-up visits per patient per year also reflects differences in the attrition or mortality rates for various tumour sites.

Increasing use of computerized records and cross-linkage of databases in some provinces has allowed for a comparison of incidence with clinical practice data. Table 5 compares the ratio for follow-up visits per new radiation oncology patient for seven major tumour site groupings in Ontario (1997/98) at seven regional cancer centres to the ratio derived from the management protocols. The management protocols correspond well with reported practice data.

Table 5: Comparison of Follow-up Visits Per New Patients

Tumour Site	Ontario New RO Cases	Ontario Follow-up Visits	Ontario Observed Follow-up visits per new patient	Management Protocol Follow up visits per new patient
Breast	3,124	18,012	5.8	9.6
Lung	2,245	9,937	4.4	4.4
Prostate	2,068	15,576	7.5	4.5
Gastrointestinal	1,410	5,963	4.2	3.5
Gynaecologic	742	6,674	9.0	9.0
Haematology	745	3,329	4.5	8.3
Larynx	516	5,365	10.3	21.4
Subtotal – 7 Sites	(10,850)	(64,856)		
Total – All Sites	14,226	81,057	5.7	

The observed or recorded follow-up visit/new patient (FUV/NP) ratio ranged from 4.2 for gastrointestinal (GI) cancers to 10.3 for larynx (subgroup of Head and Neck) with an average for all tumour sites of 6.0. The management protocol FUV/NP ratio reflects the standard of care at different cancer centres. Differences between the ratio derived from management protocols and the observed Ontario FUV/NP ratio may reflect less frequent follow-up due to staffing constraints or patients being referred back to the community for follow-up care. This applies to the prostate and GI sites where the management protocols were generated in British Columbia.

It is important to note the relative amount of time ascribed to follow-up visits in each of the management protocols. This varies from about 25 per cent for lung cancer to 45-55 per cent for breast, lymphoma and gynaecologic cancers. The frequency of follow-up visits can vary from 1 to 2, to 3 to 5 per year for up to 5 to 10 years. In some instances, given the natural progression of the disease and the possibility for curing relapses, more aggressive follow-up is warranted. However, there are no standards regarding the effectiveness of follow-up care for particular types of patients and for how long the follow-up should occur. In some European countries, selected follow-up care is provided by highly trained nurse practitioners.

One might be tempted to curtail follow-up visits to of radiation oncologists as a remedy to the manpower shortage. However, this would be a short-sighted solution, as follow-up visits are essential for patient care and to assess long term outcomes. This activity is crucial to:

- audit treatment outcomes in terms of tumour response and normal tissue complications (i.e., for the purpose of quality assurance and improvement);
- detect curable early recurrences (e.g. larynx, cervix) through special examination skills;
- improve patients' quality of life by instituting appropriate investigations and management of symptomatic disease as the availability of trained palliative physicians in the community varies;
- teach residents and students the variable pattern of disease progression and treatment outcome as there is no substitution for bed-side experience; and,
- participate in clinical trials which mandate specific follow-up activities.

Further comparisons are possible from a summary of key staffing and workload indicators for 17 Canadian cancer centres surveyed by CARO presented in Table 6. It is readily apparent that significant differences exist in a number of ratios such as new patients per full time equivalent (FTE) radiation oncologist, follow-up visits per new patient, etc. The number of new patients (NP) per FTE ranged from 219 to 451. The number of first course treatments per FTE ranged from 148 to 431. The number of follow-up visits (FUV) per new patient (NP) ranged from 1.9 to 7.3. These differences likely reflect reporting inconsistencies, varying treatment protocols and differences in referral patterns among provinces, but may also represent understaffing in some provinces.

Table 6: CARO Workload Statistics And Ratios

Province	Cancer Centre	FTE in Jan. 1999	New Consults	PT Review Visits	First Courses	Total Courses	New Patients per FTE	First Courses per FTE	Follow Up Visits Per NP
BC	BCCA	43.0	10,020	27,000	6,700	8,670	233	156	2.5
Alberta	Cross	12.0	–	6,404	2,236	2,958	–	160	–
	Tom Baker	8.0	2,659	–	1,983	12,300	332	–	2.4
Saskatchewan	Alan Blair	4.0	1,008	2,025	1,065	1,836	252	266	2.4
	Saskatoon	6.0	1,230	2,734	890	1,178	187	148	4.5
Ontario	Northeastern	4.5	1,375	5,349	–	1,381	306	–	5.7
	Hamilton	16.0	3,903	6,928	3,874	–	244	242	3.5
	PMH	26.0	–	–	4,960	6,200	–	191	6.4
	Ottawa	11,5	3,166	7,332	–	–	278	–	6.7
	Kingston	7.0	1,658	6,096	1,333	2,018	237	190	7.3
N.B	St. John Reg.	5.0	1,093	–	863	1,187	219	173	4.4
	LROC-Moncton	3.0	1,162	2,162	860	1,054	387	287	5.6
Quebec	Montreal General	6.0	2,232	6,132	1,650	2,206	372	275	4.5
	HMR Radio-Onc	–	–	–	–	–	–	–	–
	Jewish General	–	–	–	–	–	–	–	–
	Fleurimont	2.0	–	–	–	–	–	–	–
	Sagamie	–	–	–	–	–	–	–	–
	Hotel-Dieu	8.0	2,651	12,743	2,476	2,997	331	310	2.8
	CHUM	9.0	4,110	10,018	3,882	4,879	451	431	1.9

Source: CARO, 1999 Survey of Annual Workload at Canadian Cancer Centres.

An example of the staffing methodology applied to a regional cancer centre is illustrated in Table 7. Data was obtained for 1996/97 from the ALR database from Cancer Care Ontario. The total number of incident cases and total number of new cases registered at all cancer treatment facilities demonstrated the referral rate of cancer patients. However,

only some of these are referred to radiation oncologists. Using data for the Regional Cancer Centre (RCC), the referral rate to radiation oncology varied from about 40 per cent for gastrointestinal cancers, to over 95 per cent for head and neck cancers. By applying the patient workload factor (hours per patient) to the number of new patients attending the centre for radiation oncology, the total workload, expressed in hours, can be determined, which can be translated into staffing requirements. **This is the most accurate application of the staffing methodology.**

Table 7: Sample Model of Staffing Methodology - Ontario Regional Cancer Centre (1996/97)

Tumour Site	RCC New Pt	RO New Pt	% Ref to RO	Hours per Pt	Total Hours
Breast	823	620	75.3%	5.4	3,348
Lung	564	445	78.9%	4.2	1,869
Prostate	425	359	84.5%	5.7	2,047
Gastrointestinal	551	222	40.1%	3.4	755
Gynaecologic	261	207	79.3%	4.5	932
Lymphoma	240	145	60.4%	5.4	783
Larynx	144	140	98.0%	8.1	1,134
TOTAL HOURS					10,868
X 1.15 (assumes + 15% workload factor for other tumour sites)					12,499
Number FTE's (assume 920 Hrs/FTE for Direct Patient Care)					13.6 FTE

Historically, there has been an attempt to over-simplify staffing requirements to a generic expression of "new patients/radiation oncologist/year". Although simple to use, such an expression is highly unreliable and inaccurate due to differences in referral patterns and practice patterns between regional cancer centres, and most importantly, the differences in patient care requirements between tumor sites.

A simplified expression for calculating radiation oncologists (RO's) staffing requirements can be expressed as:

Let: A_i = number of cases/year for tumor site "i"
B_i = total number of cases for tumor site "i" that an RO can see or treat in one year

Then the number of required radiation oncologists can be expressed as:
$\sum_n(A_n/B_n)$ = Total RO's

Then the average number of mixed cases that one radiation oncologist can see is:

$$\frac{\sum A_n}{\text{Total RO's}}$$

Applying these calculations to the 1997/98 data for Ontario in Tables 4 and 5 yields:
Breast = 3,124/170, Lung = 2,245/219, and so on and ultimately
$10{,}850 \div 59.1 \cong 184$ patients/RO/year.

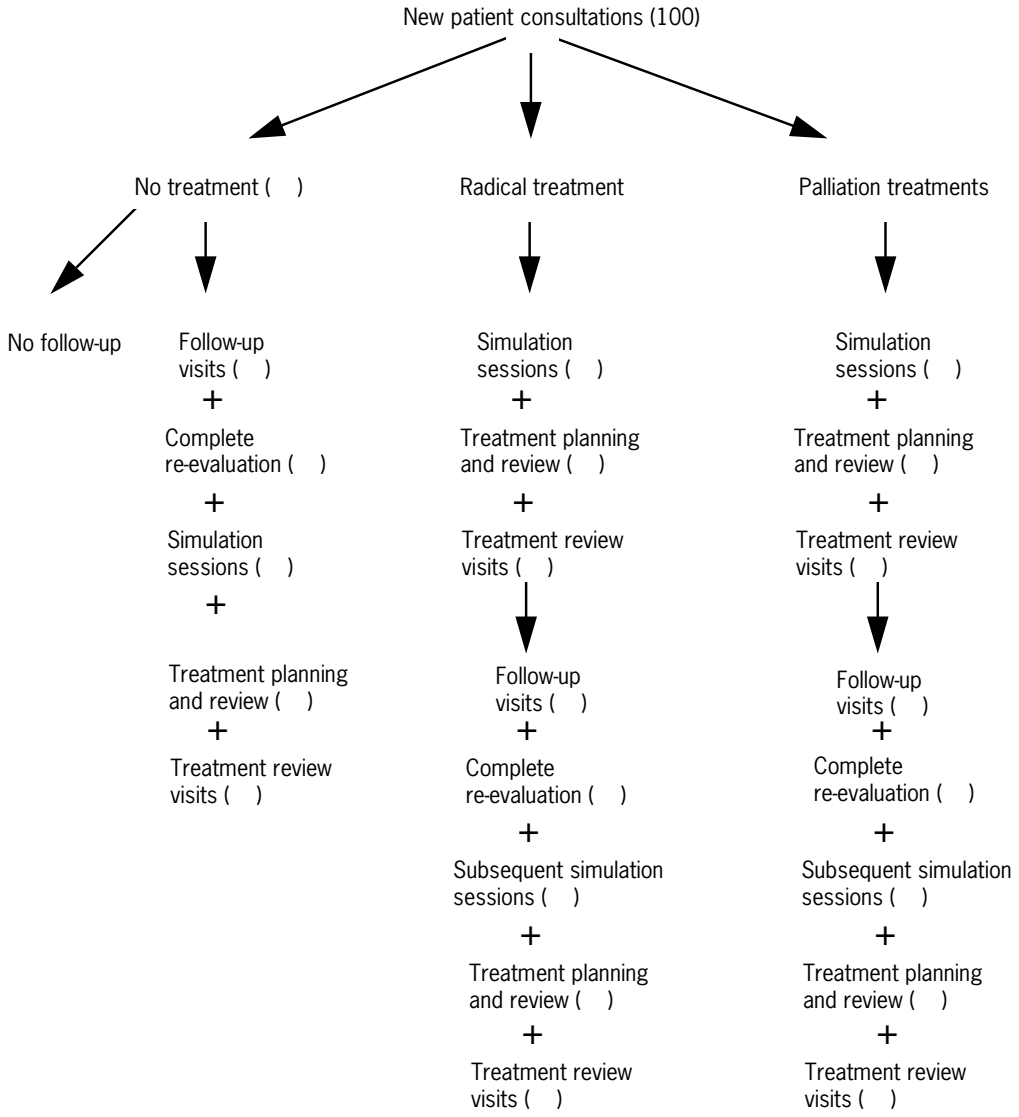
By comparison, the Ontario provincial average for new RO patients per FTE in 1999 was 259. Each province would have to apply their mix of tumor site workload, to determine their appropriate staffing standards.

Conclusions

This report proposes a methodology to project staffing requirements for radiation oncologists based upon a model of patient care needs for seven major tumour site groupings. Because it is dependent upon specific referral patterns and treatment protocols for specific tumour sites, each province must apply their own standards to reflect regional practice patterns. The methodology is based on new patients referred to radiation oncology annually (see Figure 1).

The need for accurate planning of future radiation oncology staffing requirements cannot be over-emphasized as illustrated by current staffing shortages in several provinces. Future radiation oncology staffing will need to increase as a result of regional population growth, demographic shifts to an older population, an increase in the prevalence of cancer with age and technologic advancements. The first three factors will affect the number of incident cases referred to regional cancer centres. Future changes in practice patterns can be incorporated into the proposed methodology to continually improve and update staffing projections.

Figure 1: Template of Management Protocol for Calculation of Workload Index



Patient workload Hours per patient = (45 min. x 100) + (30 min. x total # complete re-evaluation)
+ (15 min. x total # follow-up visits) + (30 min. x total # simulation)
+ (5 min. x total # treatment planning and review) + (10 min. x total # treatment review visits)

In summary, the fixed components of the methodology include:

- number of hours per radiation oncologist per year for direct patient care (920 hours); and,
- average time/visit, dependent on the purpose or type of visit.

The variable components which may differ among regions and over time include:

- cancer incidence, by tumour site; and,
- number of visits in the protocol, by tumour site.

The survey of daily activities performed by radiation oncologists reflected differences dependent on job descriptions, provincial funding arrangements and workload demands. Many radiation oncologists are now working over 50 hours per week and have insufficient time for academic responsibilities. To define a national staffing standard, the methodology assumes a 45 hour work week, for 45 weeks per year (total of 2,025 hours/year). The assumed average distribution of activities is:

- direct outpatient care (treatment, planning and follow-up) – 45 per cent;
- direct inpatient care – 5 per cent;
- indirect patient care – 15 per cent;
- clinical administration – 10 per cent;
- academic education and research – 20 per cent; and,
- other activities – 5 per cent.

Based upon the current practice management protocols and the calculation described in the text for Ontario, the average weighted clinical staffing caseload per radiation oncologist is 184 new patients. The overall staffing formula also has to take into account the administrative requirements of heads of radiation oncology and the additional educational requirements of university affiliated centres. It is recommended that CARO assist provincial radiation oncology associations to calculate a local staffing formula for each province based on agreed upon treatment practice guidelines and referral patterns.

It is recommended that CARO participate in the development of nationally agreed upon treatment practice guidelines, based on decisions of consensus panels and monitor changes in practice patterns for radiation oncologists in Canada to facilitate revisions to the methodology over time.

An important contributor to patient workload for radiation oncologists is patient follow-up. This function should remain an integral component of the role provided by radiation oncologists. The frequency and duration of patient follow-up will be dependent on community resources and evolving interactions with other physicians at regional cancer centres.

The proposed methodology for projecting staffing requirements is a powerful tool, which can be applied to specific provinces or regional catchment populations for regional cancer centres. When applied to population-specific incidence rates and local practice patterns for specific tumour sites, it will accurately project staffing requirements for radiation oncology.

Executive Summary

Projected increases in the incidence of cancer make the need for a sound methodology for accurately estimating manpower needs for radiation oncology more crucial than ever. A number of factors have contributed to the current manpower shortage including instability and lack of predictability of funding levels to cancer agencies, the seven year lead time required for training of radiation oncologists and lack of national or provincial guidelines to standardize annual patient volume per radiation oncologist.

This report, prepared by Agnew Peckham and Associates, which has been endorsed by the Canadian Association of Radiation Oncologists (CARO), was commissioned to:

1 review previous established manpower planning guidelines for radiation oncologists;
2 develop a methodology for projecting radiation oncology manpower requirements, including realistic guidelines;
3 collect and analyze data upon which to base the methodology; and,
4 apply/test the methodology on data obtained from a cancer centre.

It is important to note that the analyses undertaken focused primarily on radiation oncologists at regional cancer centres with responsibility for both clinical and academic activities. Three types of data were collected and analyzed to develop the methodology.

First, radiation oncologists were asked to submit daily activity logs for a one week period to permit calculation of average hours worked per week and to determine the proportion of time spent on various types of activity such as clinical, administrative, teaching and research duties. Based on responses from 55 radiation oncologists, it was determined that the average total hours worked per week was 46.6, leading to a recommendation that a 45 hour work week be included in the methodology. Combining this guideline with an average of 45 weeks worked per year (allowing for vacation, conference time, etc.), each radiation oncologist has 2025 hours available per year. Of this, the average radiation oncologist spends 45 percent of his/her time (920 hours) on direct outpatient care. Another 15 per cent was spent on indirect patient care and 5 per cent was spent on inpatient care. Therefore, in total 65 per cent of his/her time was spent on "patient care".

Second, patient logs were distributed, requesting physicians to record exact times for patient visits for a representative sample of patients attending clinics or treatment sessions. The results from over 2,000 patient encounters, which were subdivided by type of visit and tumour site, demonstrated that consultations are generally booked for 45 to 60 minutes and follow-up visits are generally booked for 10 to 15 minutes, with no significant difference by tumour site.

Third, an expert identified for each of the seven tumour sites was asked to document a prototype management protocol highlighting the proportion of patients requiring specified types of treatment and the frequency and duration of each type of visit/treatment.

The average visit times were combined with these protocols to calculate "patient care hours" for each tumour site. These patient care hours can then be applied to the hours per full time equivalent (FTE) available for direct patient care to calculate standards or guidelines for the number of new patients per radiation oncologist per year for each tumour site. These ratios of new patients per oncologist (by tumour site) can be applied to the referral patterns for a given region to project manpower requirements for a given population, based on the cancer incidence rate for that region.

One of the advantages of the proposed methodology is its flexibility to adapt to regional variations or to changes over time. The components of the methodology which are fixed and should apply regardless of geographic locale are: 1) number of hours per radiation oncologist per year available for direct patient care (920 hours); and 2) average time per visit, dependent on the type of visit. The variable components which may be adapted to accommodate differences among regions or over time include: 1) cancer incidence, by tumour site, by region; and 2) protocols/practice patterns resulting from regional variation and/or technological advancements.

Based on the guidelines incorporated into the methodology, it is recommended that the maximum annual caseload per radiation oncologist not exceed 185 patients. It is further recommended that CARO: 1) assist individual provinces to calculate local staffing formulae based on agreed upon treatment protocols in each province; 2) participate in the development of nationally agreed upon practice guidelines (based on consensus panel recommendations); and 3) monitor change in future practice patterns in Canada to facilitate revisions to the methodology over time.

Appendix A - Survey Questionnaires and Results

PATIENT LOG

TIME IN	TIME OUT	Tumor Site	Direct Outpt	Direct T-P	Direct In-Pt	Comments/Description

DIRECT OUT PT:

- IC - Initial Consultation
- S2C - 2nd Opinion Consultation
- RC - Repeat Consultation
- T1V - 1st Treatment Visit

TREATMENT PLANNING:

- CM - Clinical Markup
- BT - Brachytherapy
- CTP - CT Planning

DIRECT IN PT:

- IC - Initial consultation RV - Review Visit (Daily)
- ICR - Initial Consultation with Resident
- TWV - Weekly Treatment Visit
- CCV - Continuing Care Visit
- FV - Follow Up Visis
- RV - Review Visit

- CS - Conventional Simulation

- CTS - CT Simulation/Virtual Simulation

DAILY ACTIVITY LOG

NAME: _____ CENTRE: _____ DATE: _____

TIME	Direct Inpt	Direct Outpt	Direct TP	Indirect PT Care	QA	Admin	Educ	Research	Other	Comments/ Description
07:00-07:14										
07:15-07.29										
07:30-07:44										
07:45-07:59										
08:00-08:14										
08:15-08:29										
08:30-08:44										
08:45-08:59										
09:00-09:14										
09:15-09.29										
09:30-09:44										
09:45-09:59										
10:00-10:14										
10:15-10.29										
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16:45-16:59										
17:00-17:14										
17:15-17.29										
17:30-17:44										
17:45-17:59										
18:00-18:14										
18:15-18.29										
18:30-18:44										
18:45-18:59										

After-hours Activities:

Table A1: Results Daily Activity Logs (Hours per Activity)

Name	D-InPt	D-OPt	D-TP	Ind-PC	QA	Admin	Educ	Res	Other	Total HRS
MD										
#1	2.0	17.0	3.3	6.8	–	5.0	4.3	0.8	3.0	42.0
#2	3.0	21.0	2.8	6.3	3.0	7.0	3.8	0.8	1.8	49.3
#3	5.5	15.0	6.5	9.3	–	1.5	5.6	1.6	2.5	47.5
#4	1.0	19.0	2.0	4.0	0.3	7.6	3.0	2.3	2.6	41.8
#5	7.4	20.9	2.1	12.9	–	1.4	1.0	2.1	4.5	52.3
#6	0.8	14.8	1.8	7.3	–	14.5	2.3	–	6.0	47.3
#7	3.6	14.9	12.0	10.8	–	1.8	–	2.3	3.0	48.3
#8	3.3	16.3	3.5	8.9	–	4.1	2.3	2.3	3.3	43.8
#9	3.3	15.1	5.6	12.8	–	1.3	1.1	–	1.9	41.0
#10	4.0	19.0	1.0	9.0	–	8.8	0.3	3.5	2.3	47.8
#11	1.8	12.9	2.9	5.4	0.3	13.3	5.0	0.1	8.0	49.5
#12	–	9.5	5.5	10.3	–	8.3	5.0	–	5.3	43.8
#13	–	10.8	10.8	7.6	1.5	1.1	5.9	5.4	4.0	47.0
#14	2.3	10.8	5.8	9.5	–	3.8	3.8	7.5	4.5	47.8
#15	2.8	12.5	9.3	7.5	1.0	6.8	1.0	7.8	2.5	51.0
#16	1.5	19.0	2.5	4.0	–	7.3	3.8	1.0	5.5	44.5
#17	0.1	19.8	4.9	8.3	–	0.9	2.8	0.1	6.5	43.3
#18	0.8	11.5	2.8	–	2.5	3.5	5.0	14.0	2.5	42.5
#19	2.8	15.8	7.0	9.5	–	8.8	–	–	3.3	47.0
#20	5.0	12.3	7.0	5.0	1.0	3.0	2.3	1.5	3.3	40.3
#21	1.5	9.0	9.8	10.0	1.0	8.8	1.0	6.0	2.5	49.5
#22	0.5	11.0	5.3	2.0	1.1	10.3	5.1	10.0	4.3	49.5
#23	2.0	19.3	0.5	6.9	0.9	4.5	2.8	6.8	4.0	47.5
#24	2.5	17.0	3.0	6.8	–	6.0	2.5	6.3	4.5	48.5
#25	–	12.3	3.3	18.0	0.8	3.0	1.3	–	2.0	40.5
#26	4.0	21.3	2.3	8.3	–	3.0	2.5	7.5	1.3	50.0
#27	3.3	19.4	3.5	3.4	0.8	2.0	1.0	6.8	5.8	45.8
#28	3.0	6.3	6.0	4.5	–	9.8	7.3	2.8	5.5	45.0
#29	1.5	18.8	1.5	4.6	0.9	10.3	3.5	–	7.0	48.0
#30	1.5	15.5	13.8	9.5	1.8	2.3	1.5	–	2.0	47.8
#31	6.5	20.8	7.5	10.4	0.5	1.3	0.8	–	1.1	48.8
#32	2.4	16.1	5.4	4.4	2.4	11.4	–	–	6.8	48.8
#33	–	13.0	4.8	2.5	–	6.3	9.3	6.5	2.8	45.0
#34	1.0	26.4	5.8	4.1	–	–	0.8	9.8	1.5	49.3
#35	2.3	16.0	5.8	2.3	3.3	6.3	3.5	6.0	5.5	50.8
#36	4.3	13.0	7.0	8.0	1.3	5.0	7.3	2.3	1.3	49.3
#37	1.5	16.6	6.4	7.3	2.8	3.3	2.0	5.5	5.5	50.8
#38	7.0	9.3	11.5	3.8	1.3	3.5	2.3	0.5	7.8	46.8
#39	5.3	17.8	6.5	4.5	–	–	3.0	–	3.0	40.0
#40	0.8	15.6	1.5	7.9	0.3	13.3	2.5	–	10.8	52.5
#41	5.5	7.0	7.3	5.8	–	3.0	5.0	–	9.0	42.5
#42	1.0	15.3	7.3	8.8	–	3.3	6.0	5.3	2.0	48.8
#43	3.5	10.0	11.5	2.5	–	3.0	5.3	0.5	4.3	40.5
Average	2.9	15.2	5.5	7.2	1.3	5.6	3.3	4.4	4.4	46.6
Std Dev	1.9	4.3	3.3	3.3	0.9	3.7	2.1	3.5	3.5	3.5

Table A1: Results Daily Activity Logs (Hours per Activity) (Cont'd)

Name	D-InPt	D-OPt	D-TP	Ind-PC	QA	Admin	Educ	Res	Other	Total HRS
ADMINISTRATIVE										
#1	6.0	11.3	12.3	1.5	3.0	12.5	1.8	2.0	6.5	56.8
#2	3.6	11.3	0.3	6.9	0.8	10.3	7.3	5.5	1.8	47.5
#3	1.0	10.8	5.0	3.0	5.0	12.3	4.5	6.5	1.3	49.3
#4	4.0	16.1	7.8	10.6	–	13.5	1.5	1.3	0.8	55.5
#5	1.3	17.9	4.6	5.5	–	17.8	0.8	1.3	1.5	50.5
#6	5.0	12.3	6.0	3.0	–	8.3	0.5	–	4.8	39.8
#7	3.5	20.0	6.5	5.8	–	10.3	3.3	–	0.3	49.5
#8	–	5.5	5.5	3.5	–	16.8	–	–	10.8	42.0
Average	3.5	13.1	6.0	5.0	2.9	12.7	2.7	3.3	3.3	48.8
Std Dev	1.8	4.6	3.4	2.9	2.1	3.3	2.4	2.5	2.5	5.9
RESEARCH										
#1	2.3	10.8	2.8	10.3	–	6.0	7.1	1.3	3.4	43.8
#2	2.8	11.8	4.3	5.5	1.3	4.8	8.5	12.8	1.5	53.0
#3	0.3	13.5	0.5	11.0	3.5	12.8	6.8	1.5	3.5	53.3
#4	–	7.0	7.8	7.5	1.0	9.5	2.0	10.5	6.5	51.8
Average	1.8	10.8	3.8	8.6	1.9	8.3	6.1	6.5	3.7	50.4
Std Dev	1.3	2.7	3.0	2.5	1.4	3.6	2.8	6.0	2.1	4.5

D-Inpt - Direct Inpatient
D-Opt - Direct Outpatient
D-TP - Direct Treatment Planning
Ind-PC - Indirect Patient Care
Admin - Clinical Administration
Res - Research

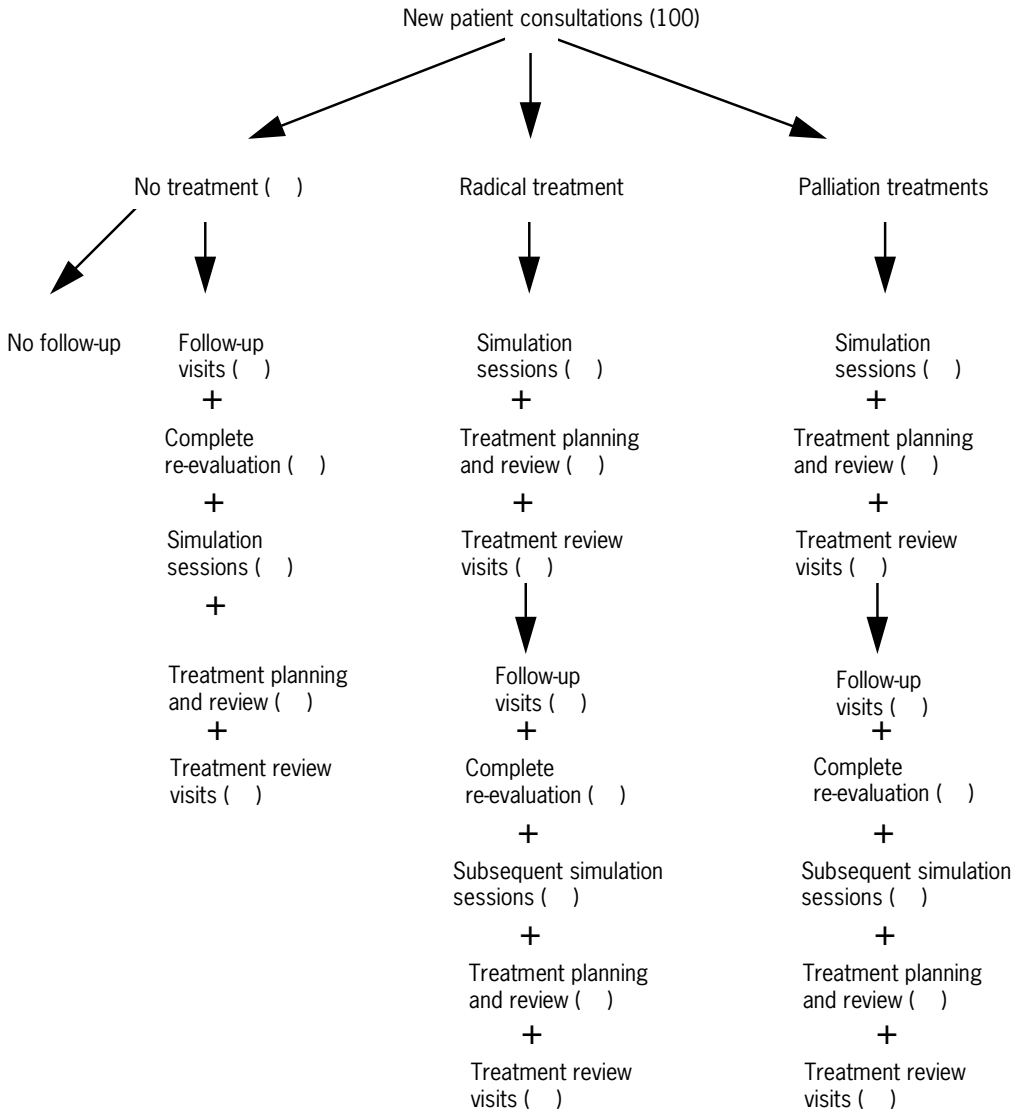
Table A2: Results Daily Activity Logs (% Time per Activity)

Clinical Group	Total Hours	After Hours	WkEnd Hours	% PT HRS	% Inpt	% Outpt	% TP	% IndPC	% Admin	% Res	% Educ	% QA
#1	51.0	–	6.5	62.7%	5.4%	24.5%	18.1%	14.7%	13.2%	15.2%	2.0%	2.0%
#2	44.5	–	–	60.7%	3.4%	42.7%	5.6%	9.0%	16.3%	2.2%	8.4%	0.0%
#3	43.3	–	–	76.3%	0.3%	45.7%	11.3%	19.1%	2.0%	0.3%	6.4%	0.0%
#4	42.5	–	–	35.3%	1.8%	27.1%	6.5%	0.0%	8.2%	32.9%	11.8%	5.9%
#5	47.8	0.3	–	59.2%	4.7%	22.5%	12.0%	19.9%	7.9%	15.7%	7.9%	0.0%
#6	49.3	–	–	67.0%	6.1%	42.6%	5.6%	12.7%	14.2%	1.5%	7.6%	6.1%
#7	47.5	2.5	3.5	76.3%	11.6%	31.6%	13.7%	19.5%	3.2%	3.4%	11.8%	0.0%
#8	41.8	–	–	62.3%	2.4%	45.5%	4.8%	9.6%	18.3%	5.4%	7.2%	0.6%
#9	52.3	3.5	–	82.8%	14.1%	40.0%	4.1%	24.6%	2.6%	4.1%	1.9%	0.0%
#10	47.3	2.0	–	51.9%	1.6%	31.2%	3.7%	15.3%	30.7%	0.0%	4.8%	0.0%
#11	48.3	–	–	85.5%	7.5%	30.8%	24.9%	22.3%	3.6%	4.7%	0.0%	0.0%
#12	43.8	–	–	72.9%	7.4%	37.1%	8.0%	20.3%	9.4%	5.1%	5.1%	0.0%
#13	41.0	–	–	89.6%	7.9%	36.9%	13.7%	31.1%	3.0%	0.0%	2.7%	0.0%
#14	47.8	–	–	69.1%	8.4%	39.8%	2.1%	18.8%	18.3%	7.3%	0.5%	0.0%
#15	49.5	0.3	1.0	46.2%	3.5%	26.0%	5.8%	10.9%	26.8%	0.3%	10.1%	0.5%
#16	43.8	–	–	57.7%	0.0%	21.7%	12.6%	23.4%	18.9%	0.0%	11.4%	0.0%
#17	47.0	–	–	62.0%	0.0%	22.9%	22.9%	16.2%	2.4%	11.4%	12.5%	3.2%
#18	42.0	–	–	69.0%	4.8%	40.5%	7.7%	16.1%	11.9%	1.8%	10.1%	0.0%
#19	40.3	1.3	–	72.7%	12.4%	30.4%	17.4%	12.4%	7.5%	3.7%	5.6%	2.5%
#20	46.8	–	8.0	67.4%	15.0%	19.8%	24.6%	8.0%	7.5%	1.1%	4.8%	2.7%
#21	40.0	–	–	85.0%	13.1%	44.4%	16.3%	11.3%	0.0%	0.0%	7.5%	0.0%
#22	52.5	7.5	2.0	49.0%	1.4%	29.8%	2.9%	15.0%	25.2%	0.0%	4.8%	0.5%
#23	42.5	–	14.0	60.0%	12.9%	16.5%	17.1%	13.5%	7.1%	0.0%	11.8%	0.0%
#24	48.8	–	4.0	66.2%	2.1%	31.3%	14.9%	17.9%	6.7%	10.8%	12.3%	0.0%
#25	40.5	–	–	67.9%	8.6%	24.7%	28.4%	6.2%	7.4%	1.2%	13.0%	0.0%
#26	49.5	4.8	2.5	61.1%	3.0%	18.2%	19.7%	20.2%	17.7%	12.1%	2.0%	2.0%
#27	49.5	2.0	1.5	37.9%	1.0%	22.2%	10.6%	4.0%	20.7%	10.4%	20.2%	2.3%
#28	47.5	4.8	8.8	60.3%	4.2%	40.5%	1.1%	14.5%	9.5%	14.2%	5.8%	1.8%
#29	48.5	1.3	3.5	60.3%	5.2%	35.1%	6.2%	13.9%	12.4%	12.9%	5.2%	0.0%
#30	40.5	–	–	82.7%	0.0%	30.2%	8.0%	44.4%	7.4%	0.0%	3.1%	1.9%
#31	50.0	1.0	2.0	71.5%	8.0%	42.5%	4.5%	16.5%	6.0%	15.0%	5.0%	0.0%
#32	45.8	–	–	64.5%	7.1%	42.3%	7.7%	7.4%	4.4%	14.8%	2.2%	1.6%
#33	45.0	3.8	–	43.9%	6.7%	13.9%	13.3%	10.0%	21.7%	6.1%	16.1%	0.0%
#34	48.0		3.5	54.9%	3.1%	39.1%	3.1%	9.6%	21.4%	0.0%	7.3%	1.8%
#35	47.8	2.4		84.3%	3.1%	32.5%	28.8%	19.9%	4.7%	0.0%	3.1%	3.7%
#36	48.8	5.3	9.2	92.6%	13.3%	42.6%	15.4%	21.3%	2.6%	0.0%	1.5%	1.0%
#37	48.8	2.0	–	57.9%	4.9%	33.1%	11.0%	9.0%	23.3%	0.0%	0.0%	4.9%
#38	45.0	2.0	–	45.0%	0.0%	28.9%	10.6%	5.6%	13.9%	20.6%	14.4%	0.0%
#39	49.3	3.5	3.0	75.6%	2.0%	53.6%	11.7%	8.4%	0.0%	19.8%	1.5%	0.0%
#40	50.8	–	–	51.7%	4.4%	31.5%	11.3%	4.4%	12.3%	11.8%	6.9%	6.4%
#41	49.3	–	–	65.5%	8.6%	26.4%	14.2%	16.2%	10.2%	4.6%	14.7%	2.5%
#42	50.8	–	–	62.6%	3.0%	32.8%	12.6%	14.3%	6.4%	10.8%	3.9%	5.4%
#43	47.0		1.8	74.5%	5.9%	33.5%	14.9%	20.2%	18.6%	0.0%	0.0%	0.0%
Average	46.6	3.5	4.7	65.9%	6.1%	32.6%	11.8%	15.4%	11.3%	6.8%	9.4%	2.9%
Std Dev	3.5	1.9	3.6	13.5%	4.3%	9.0%	7.0%	7.8%	7.8%	4.8%	7.5%	1.9%

PT HRS – Total Pt Hours
Inpt – Direct Inpatient
Outpt – Care Direct Outpatient
TP – Direct Treatment Planning
Ind PC – Indirect Patient
Admin – Clinical Administration
Res – Research
Educ – Education
QA – Quality Assurance

Appendix B - Management Protocols

Figure 1: Template of Management Protocol for Calculation of Workload Index



Patient workload Hours per patient = (45 min. x 100) + (30 min. x total # complete re-evaluation)
+ (15 min. x total # follow-up visits) + (30 min. x total # simulation)
+ (5 min. x total # treatment planning and review) + (10 min. x total # treatment review visits)

Management Protocol for Breast Cancer

Breast Cancer			Consultation Only			Node Negative		Node Positive		Local	Palliation		
		IC	RRT	Met	ART	Met	RRT	Met		RRT	Only	Total	
	No. Pts →	10			52		25			3	10	100 Pt's	
	# Sub Pts →		1	3		10		13					
		Visits	Per	Patient	Visits/	Patient	Visits/	Patient		V/Pt	V/Pt	Total	Ratio
Assessment	**Time (min)**											Visits	Visit/NP
Consultation	45	1			1		1			1	1	100	
Reassessment	30		1	1		1		1				27	
Follow-up Visits	15		12[a]	1	12[a]	1	12[a]	1		8	1	959	9.6
Radiation Therapy													
Simulation	30		1	3.5[b]	1	3.5[b]	1	3.5[b]		1	3.5[b]	123.5	2.5
CT Planning/Simulation (aggregated activity)	60											0	0
Port Films	5		1		1		1			1		78	1
Plan Review	5		1		1		1					78	1
Treatment Visits	10		5	3.5[b]	5	3.5[b]	5	3.5[b]		5	3.5[b]	435.5	4.4
Subtotal (Minutes)		450	300	555	16,380	1,850	7,875	2,405		750	2,000	32,565	
											Summary:	**5.4**	**Hrs /Pt**

[a] Two follow-up visits/year for 3 years, then 1 follow-up visit per year for 2 years, then follow-up in community.

[b] Each palliative course consists of 1 simulation visit & 1 treatment visit. Per 10 patients: 9 of 10 will need retreatment, 7 of 9 will have further retreatment, 5 of 7 will have yet further retreatment, and 3 of 5 will still have further retreatment; total 34 courses or average of 3.5 courses per patient.

Source: Dr. I. Ackerman – Sunnybrook Regional Cancer Centre, Ontario

Legend:

IC – Initial Consultation Only
RRT – Radical Radiotherapy
ART – Adjuvant Radiotherapy
Met – Metastatic/Relapse Treatment
V/Pt – Visits per Patient
Sub Pt – Number of patients within subgroup

Management Protocol for Lung Cancer

Lung Cancer		Non-Small Cell Lung Cancer					Small Cell Lung Cancer						
		No Rx	Palliative		Radical RT		No Rx	Palliative		Radical RT			
			Initial	Repeat	Initial	Repeat		Initial	Repeat	Initial	Repeat	Total	
	No. Pts →	4	70		1		1	13		11		100 Pt's	
	# Sub Pts →			60		1			5		5		
			Visits	Per	Patient			Visits	Per	Patient		Total	Ratio
Assessment	**Time (min)**											Visits	Visit/NP
Consultation	45	1	1		1		1	1		1		100	1
Rpt Assessment	30			1					1		1	70	0.7
Follow-up Visits	15		2	4 [a]	9	2 [b]		1	3 [c]	2	1	441	4.4
Radiation Therapy													
Simulation	30		1	2 [a]	1	1 [b]		1	1.5 [c]	1	1	226	2.7
CT Simulation												0	
Port Films	5		1	2	5	1		1	1.5	4	1	49	0.5
Plan Review	5		1	2	5	1		1	1.5	4	1	49	0.5
Treatment Visits	10		1	2 [a]	6	1 [b]		1	1.5 [c]	5	1	275	2.8
Sub Total (Minutes)			8,750	11,400	320	80	45	1,430	550	2,145	475	25,195	
											Summary:	**4.2**	**Hrs / Pt**

[a] 2 courses of treatment per patient with average of 2 follow-up visits per patient per treatment.
[b] 2 courses of treatment for 50 per cent of patients with average of 2 follow-up visits per patient per treatment.
[c] 1.5 courses of treatment per patient (i.e.-50 per cent receive retreatment) with average of 2 follow-up visits per treatment course.
Source: Dr. I. Ackerman – Sunnybrook Regional Cancer Centre, Ontario.

Legend:
IC – Initial Consultation Only
RRT – Radical Radiotherapy
V / Pt – Visits per Patient
Sub Pt – number of patients within subgroup

Management Protocol for GI Cancers

GI Cancers		No Rx	Esophagus		Stomach		ColoRectal			
			RRT	PRT	RRT	PRT	RRT	PRT	Total	
	No. Pts→	16	18		12		54		100 Pt's	
	# Sub Pts→			8		2		8		
			Visits Per Patient		Visits Per Patient		Visits Per Patient		Total	Ratio
Assessment	Time (min)								Visits	Visit/NP
Consultation	45	1	1		1		1		100	1
Reassessment	30			1		1		1	10	0.1
Follow-up Visits[a]	15		4	1	4	1	4	1	354	3.5
Radiation Therapy										
Simulation	30		1.0	1	1		1	1	100	1
CT Simulation			0.3		0.3		0.1		16	0.2
Port Films	5		1.3	1	1		1	1	105	1.1
Plan Review	5		0.7	1	1		1	1	94	0.9
Treatment Visits	10		3	3	2	2	4	1	330	3.3
Brachytherapy	30			3		2			28	0.3
Subtotal (Minutes)		720	3,147	3,320	2,340	250	9,990	760	10,527	
								Summary:	**3.4**	**Hrs / Pt**

[a] Average of 4 follow-up visits per patients per RRT course, and 1 follow-up visit for palliative patients.

Source: Dr. F. Wong – British Columbia Cancer Agency.

Legend:

IC – Initial Consultation Only
RRT – Radical Radiotherapy
PRT – Palliative Radiotherapy
V/Pt – Visits per Patient
Sub Pt – number of patients within subgroup

Management Protocol for Lymphoma's

Lymphoma		Consultation Only			Hodgkin's Disease			Non-Hodgkin's Lym		Palliation[c]		
		IC	RRT	Salv RT	EFRT[b]	IFRT	Salv RT	IFRT	Salv RT	RT	Total	
	No. Pt's →	10			15	15		40		20	100 Pt's	
	# Sub Pt's →		1	2			3		8			
Assessment	**Time (min)**	Visits	Per	Patient	Visits	Per	Patient	Visits	Per	Patient	Total Visits	Ratio Visit/NP
Consultation	45	1			1	1		1		1	100	
Reassessment	30		1	1	1	1	1	1	1	1	26	
Follow-up Visits[a]	15		9	2	17[b]	9	2	9	2	2	705	8.3
Radiation Therapy												
Simulation	30		1	1	2			0.6	0.6	2.8	117.8	2.5
CT Planning/Simulation (aggregated activity)	60				1	1	1	0.4	0.4		52.2	0
Port Films	5		1	1	2	1	1	1	1	2.8	155	1
Plan Review	10		1	1	1	1	1	1	1	2.8	140	1
Treatment Visits	10		4	4	8	4	4	4	4	5.6	508	5.1
Subtotal (Minutes)		450	250	290	7,800	4,425	435	11,800	1,160	5,740	32,350	
										Summary:	**5.4**	**Hrs/Pt**

[a] Follow up frequency (shared with medical oncology): 2/yr for 2 yrs, then 1/yr for 3 yrs, then 1/yr for 3 yrs, then follow up in community ; for salvage patients total of 2 FU visits.

[b] For HD-EFRT, follow-up is only with radiation oncology.

[c] Each palliative course consists of 1 simulation visit and 2 treatment visits. Per 10 palliative patients, 8 of 10 will need retreatment, 6 of 8 will need further retreatment, and 4 of 6 will need further retreatment (total of 28 courses or average of 2.8 courses per patient).

Source: Dr. R. Tsang – Princess Margaret Hospital, Ontario.

Note: Leukemia is excluded. Multiple myeloma is included under Palliation (Pall'n)

Legend:

IC	–	Initial Consultation Only	EFRT	–	Extended Field Radiotherapy
RRT	–	Radical Radiotherapy	Pall'n	–	Palliative Radiotherapy
Salv RT	–	Salvage Radiotherapy for Recurrence	FRT	–	Involved Field Radiotherapy
Sub Pts	–	Number of patients within subgroup			

Management Protocol for Gyne/Uterine Cancer

Gyne Cancers		Uterus		Uterus-Stage 1 & 2		Uterus Advanced		Cervix- RRT		Cervix-Primary Surgery					Ovarian Cancer		Vulva/Vagina			
		IC Only	RRT	ART	PRT	RRT	Initial IC	PRT	RRT	PRT	RRT	Initial IC	ART	Recur	PRT	PRT	ART	RRT	Total 100 Pt's	
	No. Pts →	20[d]		18		4[c]	20			3	20	10					2	3		
	# Sub Pts →		2		2			5	3				2	1	1	6				
Assessment	**Time (min)**																		Visits	Visit/NP
Consultation	45	1		1	1	1			1	1	1	1					1	1	100	
Reassessment	30		1		1			1						1	1	1				
Follow-up Visits[a]	15		15	15	4	15			15	4	17		15	17		3	15	15	897	9.0
Radiation Therapy																				
Simulation	30		1	1	1	1		1	1	1	1		1	1	1	0.67	1	1	70.02	
CT Planning/Simulation (Aggregated)	60								1										3	
Port Films/CF's	5		1	1	1	1		1	3	1	1		1	1	1	0.67	1	1	76.02	
Treatment Reviews	10		5	5	1	5		8	6	1	5		5	7	1	0.67	5	7	336.02	
OR/Brachytherapy	60		1[b]	1		1					1								44	
OR/EUA	30										1								20	
Subtotal (Minutes)		900	830	7,470	360	1,660		725	1,305	450	9,500	450	620	390	75	631	710	1,125	27,201	

Summary: 4.5 Hrs / Pt

[a] Follow-up visits – 3/yr for 2 yrs, then 2/yr for 3 yrs, then 1/yr for 3 yrs, and then discharged. For palliative patients assumes 3 to 5 visits before transfer to palliative team.
[b] Assumes 6 of 18 patients get brachytherapy, each with 2 high dose and 1 low dose insertions.
[c] Assumes 4 patients referred with isolated pelvic recurrences treated with RRT.
[d] Includes 18 of 36 Stage 1&2 patients and 2 advanced/recurrent disease patients for whom no RRT is recommended.
Source: Dr. I. Ackerman – Sunnybrook Regional Cancer Centre, Ontario.

Legend:
IC – Initial Consultation Only
RRT – Radical Radiotherapy
ART – Adjuvant Radiotherapy

Management Protocol for Prostate Cancer

Prostate Cancer			Consultation Only			Radical RT		Adj Horm + RRT		NeoHorm + RRT		BRT		Palliative Treatment			
			IC	RRT	BRT	RRT	Relapse	AH+RRT	Relapse	NHRRT	Relapse		RRT	Relapse	Horm	Total	
		No. Pts→	5			20		30				15	20		10	110 Pt's	
		# Sub Pts→		2	3		10		20	10	4			7			
Assessment	Time (min)		Visits	Per	Patient	Visits Per	Patient	Visits Per	Patient	Visits Per	Patient		Visits	Per	Patient	Total Visits	Ratio Visit/NP
Consultation	45		1			1		1				1	1		1	110	
Reassessment	30			1	3[g]		1		1	1	1	3[g]		1		91	
Follow-up to 2 Yrs	15		5			5		5				5	1			420	4.2
Follow-up 3-5 Yrs	15			6	6	3[a]	6[b]	2[c]	4[d]	5	8	5	1	1		4,544	4.5
										3[e]							
Radiation Therapy																	
CT Planning/Simulation	60			1		1	1	1	1		0.75[f]		1	1		122	
(aggregated activity)										1							
BRT Planning	60				1							1				18	
Port Films	5					1		1								60	
Plan Review	10			1		1	1	1	1	1	0.75			1		102	
Treatment Visits	10			6		6	1	6	1	1	0.75[f]		2	1		452	4.5
OR/Brachytherapy	120				1					6		1				18	
1 Month Post BRT	30				1							1				18	
Subtotal (Minutes)			660	500	990	6,000	2,000	8,550	3,400		840	7,425	3,000	875	450	37,730	
										3,000							
															Summary:	5,7	Hrs/Pt

[a] Follow-up q 6 monthly x 3 yrs for 10 non-relapsing patients (6 visits each per 10 patients or "3 visits per 20 patients")
[b] Follow-up q 3 monthly x 2 yrs for 6 patients, and 4 patients with orchidectony discharged to community.
[c] Follow-up q 6 monthly x 3 yrs for 10 of 30 patients ("2 visits per 30 patients")
[d] Follow-up q 3 monthly x 2 yrs for 10 of 20 patients, with remaining 10 patients discharged to community.
[e] Follow-up q 6 monthly x 3 yrs for 6 of 10 patients.
[f] Assumes 3 of 4 patients will receive retreatment.
[g] Assumes 3 special visits: CT volume (20 min), consult JAC (45 min), and US volume (30 min).
Source: Dr. F. Wong – British Columbia Cancer Agency.

Legend:
IC – Initial Consultation Only
RRT – Radical Radiotherapy
BRT – Brachytherapy
Adj Horm – Adjuvant Hormonal Therapy

Management Protocol for Larynx Cancer

Larynx Cancer		No Rx	Palliative		Radical RT			
			Initial	Repeat	Initial	Repeat	Total	
	No. Pts→	1	4		95		100 Pt's	
	# Sub Pts→			0		2		
			Visits Per	Patient	Visits Per	Patient	Total	Ratio
Assessment	**Time (min)**						Visits	Visit/NP
Consultation	45	1	1		1		100	1
Reassessment	30			0		1	70	0.7
Follow-up Visits	15		4	0	22[a]	15	2,136	21.4
Radiation Therapy								
Simulation	30		1	0	1	1	101	2.7
CT Planning/Simulation (aggregated activity)	60				0.2		19	
Port Films	5		2	0	1	0	103	0.5
Plan Review	5		2	0	5	1	485	0.5
Treatment Visits	10		1	0	6	2	578	5.8
Subtotal (Minutes)			660	0	47,025	620	48,305	Total Min.
						Summary:	**8.1**	**Hrs/Pt**

[a] Assumes 36 per cent early deaths (average of 16 months) with 14 follow-up visits/patient and remaining long term survivors have 27 follow-up visits per patient.
Source: P. Wong – British Columbia Cancer Agency.