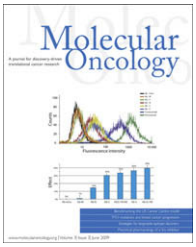
MOLECULAR ONCOLOGY 3 (2009) 192–203

available at www.sciencedirect.com

ScienceDirect

www.elsevier.com/locate/molonc



# Has the US Cancer Centre model been 'successful'? Lessons for the European cancer community☆

*Richard Sullivan*[a,b,*]

[a]*Kings College London, Integrated Cancer Centre, Guy's Hospital, Bermondsey Wing, Great Maze Pond, London SE1 9RT, UK*

[b]*European Cancer Research Managers Foundation for the study of the social and political policy of cancer (Oncopolicy), UK*

ARTICLE INFO

*Article history:*
Received 14 March 2009
Accepted 18 March 2009
Available online 1 April 2009

*Keywords:*
Cancer
NCI
Evidence
Geography
Funding
Bibliometrics
Policy

ABSTRACT

The US model of Cancer Centres created by the National Cancer Act in 1971 has been one of the most tried and tested models of organised disease-specific scientific endeavors in the world. With many countries, particularly those in Europe now looking to develop the research arms of their National Cancer Control Programmes through the development of similar Cancer Centres the time is correct to consider the success and limitations of the US effort to date. Here we described the salient features of both US Cancer Centres and Networks, including their funding and evaluation with socio-political analysis on the learning points for Europe. In particular we highlight issues around sustainable funding, training and network development. New data highlighting deficiencies in the US model around prevention, health promotion, health inequalities in cancer outcomes, and clinical research provide key learning points and opportunities for the European model developed.



## 1. Introduction

In 1938 the distinguished pathologist James Ewing presciently noted, "*Many experienced observers believe that it is time to inquire critically whether the public interest in cancer is intelligent and is being directed along sound lines or whether it is largely emotional and uncritical, whether the resources that are being poured into this field with increasing liberality are well controlled or largely wasted, and whether the medical profession is wisely organised for its work, or comparatively disorganized as some critics assert, and whether the present state of knowledge of cancer and of the sciences on which that knowledge depends justifies the large hopes and urgent demands for sensational progress which the public are now indulging*" (Ewing, 1938). As a result of the huge spend on cancer research along with the increasing public health burden of cancer critical evaluation of global approaches to National Cancer Control Programmes is needed more than ever.

Since 1971, when Congress legislated to create the NCI, the US Cancer Centre model has remained one of the most enduring and long tested exemplars of organised disease-specific science in the world. Strategic documents, reviews and the editorials on the NCI cancer centres could fill a library. The model is complex, complicated and highly politicised with numerous direct and indirect actors. In policy terms the model

☆ This work was supported by European Cancer Research Managers Foundation. The MS Excel macros used to perform the geographical analysis of the papers were written by Dr Philip Roe. Prof Grant Lewison, Evalumetrics and University College London, UK provided the analysis for Figures 2, 3 and 4. Part of this research was conducted whilst RS was at Cancer Research UK.

* Kings College London, Integrated Cancer Centre, Guy's Hospital, Bermondsey Wing, Great Maze Pond, London SE1 9RT, UK. Tel.: +44 7720398401.
E-mail address: rsullivan@doctors.org.uk

1574-7891/$ – see front matter © 2009 Federation of European Biochemical Societies. Published by Elsevier B.V. All rights reserved.
doi:10.1016/j.molonc.2009.03.002

oscillates in a dynamic state between Pulitzer's ''iron triangle''and Heclo's ''network of influence'', with the former over time giving way to the latter in recent years (Overman and Simonton, 1986). However, the ''iron triangle'' has been the dominant structure of biomedical funding in the USA leading to an almost perfect 'balance' in terms of research outputs with the US relative commitment to cancer as measured by bibliometrics near to unity (Figure 2).

The cancer centres' program of NCI was set up to facilitate the integration of academic and research institutions in order to provide a broad, co-ordinated and interdisciplinary approach to all aspects of cancer research. Specifically, cancer centres were expected to:

- Fully integrate the full range of capabilities within an institution to enable the translational of clinical observations to the laboratory, and to develop clinical and public health intervention strategies from basic scientific discoveries.
- Act as a local, regional and national resource for the development of cancer education and preventative methods, and provide a means of disseminating these methods to the local community.
- Where possible, provide the highest quality of medical treatments and diagnosis of cancer.

The 'vision' of the US model of cancer centres can be articulated in terms of three interconnected thematic strands.

1. *Laboratory research*. Centres should display a breadth of interactive scientific and technical personnel, laboratory facilities and financial support dedicated to basic research, and should utilise this base as a means to promote multidisciplinary interactions between scientists.
2. *Clinical research*. Centres should serve as a major source of innovative clinical studies that can later be exported. These studies should attempt to utilise laboratory research findings.
3. *Prevention, control and population research*. Centres deemed to be conducting cancer control studies should conduct basic and applied research in behavioral, social and population sciences that reduces cancer risk, incidence, morbidity and mortality. Prevention research analyses healthy populations and those at high/low risk, as well as those with precancerous conditions, or survivors. This would ultimately provide information on preclinical, clinical and health behaviours.

In light of the European Cancer Centres accreditation initiative led by the Organisation of European Cancer Institutes (OECI), as well as global developments in such transitional countries as India (where cancer will pose a particular problem for policymakers in terms of the double burden of disease), it is essential that lessons are learnt from the US Cancer Centre model both in terms of their success and their shortcomings. In spite of the fundamentally different systems for delivering healthcare around the world the universal aim of controlling and curing cancer, as well as the globalisation of research (knowledge) provides the common reference point for social and political policy research in this area.

## 2. Classification and characteristics of cancer centres

There are two broad types of organisations that constitute the US Cancer Centre model.

- *Cancer centres*

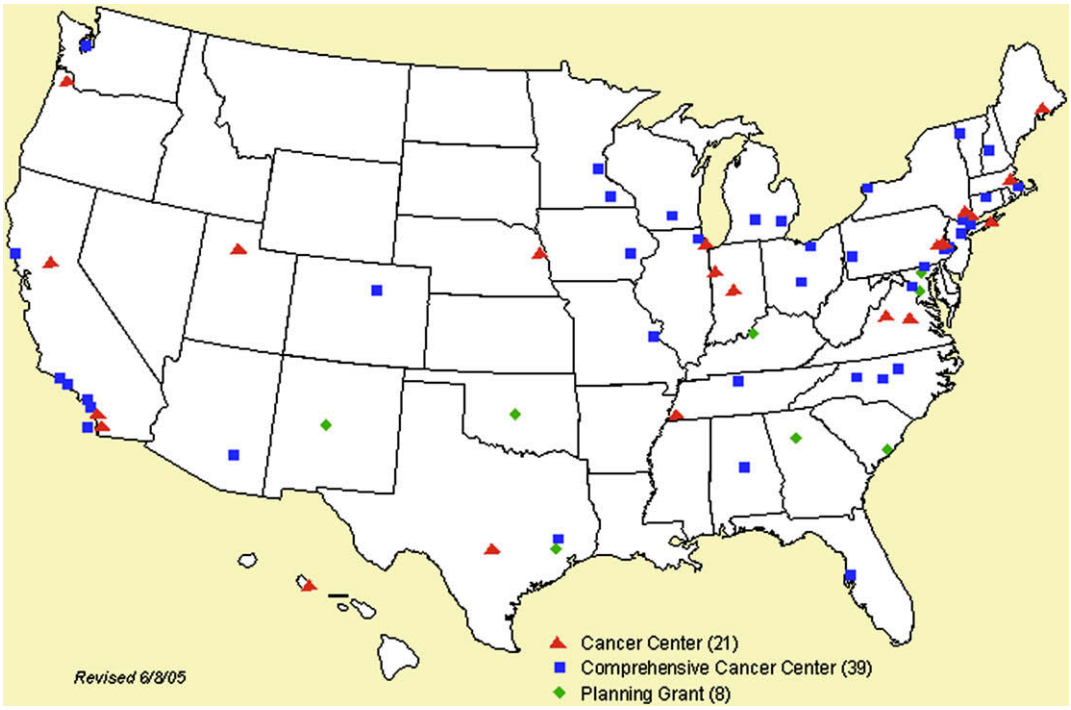



**Figure 1 – Map of NCI cancer centres (designations as of 2005/2006).**

6. *Centre director*. The director should be a highly qualified scientist and administrator with leadership experience, and should be given the authority to control:
   - Appointments to the centre.
   - Specific research and resource space/equipment.
   - Inpatient and outpatient facilities.
   - Discretionary funds.

**Table 1 – Chronology of NCI cancer centre development.**

| | |
|---|---|
| 1960 | NIH establishes the General Clinical Research Centre Grants to provide an opportunity for universities to construct facilities for clinical cancer research |
| 1961 | NCI announces three new grant programs; the Cancer Research facilities Grant (CRFG) to enable construction of cancer research buildings; the Program Project Grants (PO1s) for cancer research; and Cancer Clinical Research Centre Grants (PO2s) to fund collaborative clinical cancer research |
| 1963 | NCI funds a well defined but informal Cancer Centre Program at 12 institutions. Little effort is made to define or organise the centres |
| 1968 | National Cancer Advisory Board (NCAB) provides guidelines for cancer centres, and introduces the concept of planning or exploratory grants<br>Congress recommends that geography be considered in establishment of new cancer centres |
| 1971 | National Cancer Act authorises $1.5 billion for National Cancer Program; the Act results in the establishment of the cancer centre's branch of the NCI |
| 1973 | NCI publishes information and guidelines for the Cancer Centre Support Grant (CCSG) and described two classes of centre: comprehensive and specialised<br>Eight centres are designated NCI Comprehensive Cancer Centres. |
| 1978 | National Cancer Act reauthorisation urges centres to engage in public information programs |
| 1985 | The Health research Extension Act removes annual limitations on funding for NCI cancer centres and extends period of funding from 3 to 5 years<br>Centres reclassified into basic, clinical and comprehensive cancer centres |
| 1990 | New guidelines are issued by the NCI defining the concept and criteria for comprehensive centres |
| 1991 | Request for applications for the P20 Planning Grant Program to develop cancer centres issued; 12 centres are funded |
| 1992 | NCI cancer centres become ''institutional'', integrating research programs and consolidating NCI support grants into one centre grant<br>NCI establish the Specialised Program of Research Excellence (SPORE) grant to promote interdisciplinary translational research. |

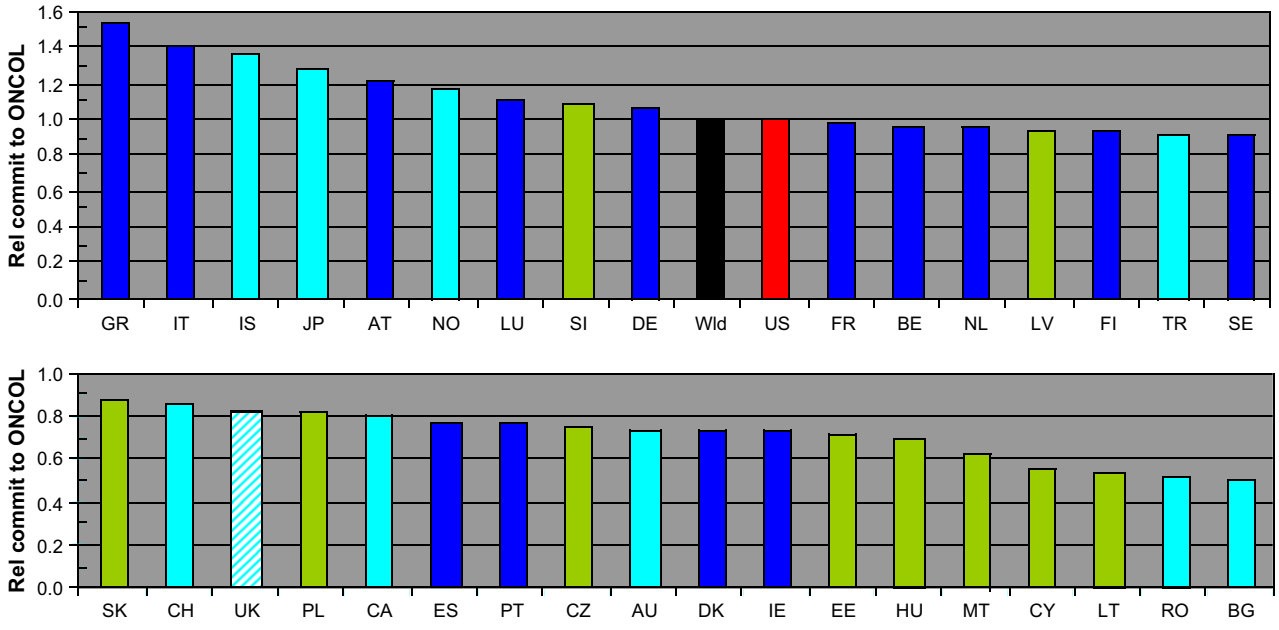



**Figure 2 – Relative commitment of countries to cancer research (2006/2007).**

The US model thus gives considerable depth and prioritisation to the organisational aspects of its cancer centres, whilst recognising that there will be some centres of excellence that are not comprehensive but nevertheless key parts of the overall network (Simone, 2002). The Quality Manual proposed by the OECI accreditation project provides a similar focus but necessarily goes beyond the internal organisational framework to engage with the wide and complex variety of external stakeholders (Saghatchian et al., 2008). In particular the diverse array of external funding agencies (both governmental and philanthropic) is a major difference in the development of the European model of cancer centres compared to the US. There is also a trend in Europe towards a more meritocartic, distributed model of Centre governance and direction setting, both in terms of the authority of the centre Directors and the overarching strategy-setting/budget controlling committees. The danger of too meritocratic a system, particularly when dealing with large, complex organisations is a stifling of creativity and slowing of innovation, however, this has to be set against the danger of 'dictatorship' at the other extreme. From an anthropological perspective our work (Eckhouse and Sullivan, 2006) and others have shown that a course needs to set somewhere between these two extremes where focused direction 'captains' a core leadership team.

## 3. Funding the US Cancer Centre model

The CCSG is a P30 Centre Core Grant which forms the backbone of the Centre's model funding structure, with a narrow focus in that it supports the research infrastructure of the cancer centre. Such support is related to the peer-reviewed research base of the centre, and includes the program leaders, centre administration, shared resources/services and developmental/flexible funds for new initiatives. The CCSG does not support individual research projects; rather it provides a means by which centres can conduct interdisciplinary and collaborative research.

As the CCSG provides infrastructure support, the level of funding is small compared to the total funding obtained by the cancer centre. In 2001 the average CCSG for a cancer centre was $1.8M–2.6M, and for a comprehensive centre was $3.3M per year. This represents between 0.5 and 10% of the total funded research in the centre.

Analysis of NCI Fact Books over the years finds two key funding trends.

1. Percentage share of total NCI dollars for the cancer centres has remained relatively stable at 5.2% level (accounting for around 454M USD in fiscal year 2005/2006 (from a historical level of 192.1M USD in 2000/2001 which gives a cumulative growth of around 33%).
2. For the P50/P20 SPORE grants the biggest appropriations were for prostate and breast (these are the major 'network' grants).

The CCSG provides costs to cover the variety of activities that support the conduct of the research within the cancer centre.

- *Program leaders*. Senior and Program leaders in pivotal positions within the centre are eligible for salary support through the CCSG. Investigators with a proven track record and a clear contribution to the activities of the centre are also eligible for salary support. The criteria for these individuals are that they must be a principle investigator (PI) or co-PI on at least one peer-reviewed research project.
- *Centre administration*. Funding covers the costs of the administration of resources and services within the centre, and the financial management of these resources. This support

may therefore cover the salaries of the administrative staff. Cost not covered include public relations, fundraising and grant preparation.

- *Shared resources*. The CCSG will cover the costs associated with shared resources and services that are not dedicated to project specific functions, or paid for by research project grants. The list of shared resources covers a range of activities including animal work, microarrays, clinical data management and histology.
- *Planning and evaluation*. Funding would cover such things as the support of external advisory committees, use of scientific and technical consultants or retreats designed to stimulate interaction. This funding would not extend to internal evaluation processes, such as committees.
- *Developmental funds*. These funds are the major source of flexibility within the CCSG and allow the centre to strengthen areas and support new research ideas. This covers 5 main areas.
  - *Recruitment of investigators*. A temporary recruitment package, covering salaries of staff (e.g., technicians, post-docs) and research costs, which supports new investigators and helps initiate and establish the research program. Eligible investigators are those who are new to the institute, or investigators who are entering the field of cancer research as principle investigators for the first time.
  - *Interim salary and research support*. Provides partial support to investigators who have temporarily lost funding and have a reasonable chance of regaining support. The period of support is for a maximum of 18 months.
  - *Pilot projects*. Funding of pilot studies or feasibility studies that will lay the groundwork for an application for independent support. Such support is awarded to both new and established investigators and will enable them to explore new avenues within a program, test new ideas or investigate an unconventional hypothesis.
  - *Technology/Methodology development projects*. Funding for the development of new procedures, instrumentation, analytical tools or reagents that address problems in cancer research. This includes areas such as imaging, model development, drug discovery and delivery, survey development and tumour targeting.
  - *Development of shared resources*. Developmental funds can be used to develop new or unique components in existing resources.
- *Protocol review and monitoring system (PRMS)*. The CCSG supports the mechanism by which the PRMS and its internal review committee oversee all clinical protocols involving cancer patients within the centre. The PRMS monitors the scientific merit, priority and progress of the protocol, and has the authority to close those that are failing.
- *Protocol specific research*. The CCSG can support a core group of research nurses and data managers that are solely dedicated to innovative feasibility or proof of principle clinical trials. Such trials should be of 1–2 years in duration, and should be the basis for entry into phase II/II trials.

Centre directors have a great deal of flexibility with the CCSG, and have the authority to move funds between budgetary areas by up to 25% over the level set during the review of the application, without prior NCI approval. The areas to which funds are being moved must have been rated excellent during the review of the application.

*How are the Centre Grants Reviewed?* The role of the review is to determine the extent to which the centre has promoted, or is likely to promote excellence in research that may lead to a reduction in the incidence, mortality and morbidity of cancer. The review thus focuses on the science, and so seeks to address a number of issues.

- What is the overall quality of the science within the centre?
- What is the impact of the centre on the scientific quality, productivity of the scientists and the interdisciplinary activities of the institution?
- How has the centre contributed to the development of effective prevention, diagnosis and treatment of cancer?
- Does the centre add value over the individual research efforts?
- How does the separate cancer related themes within the parent institution fit together in the centre
- Has the choice of investigators within the centre resulted in a creditable group of researchers?

A full site review is required for new applications, centres changing directors and centres wishing to increase their level of funding by more than 10%. A separate administrative review is also conducted during this visit. Limited site visits are required for centres that have no significant change, or are requesting a budget increase of less than 10%. This involves a site visit to evaluate the administrative and financial setup of the centre, followed by assessment of the application by the NCI Initial Review Group.

Specific issues addressed by full and limited reviews include:

- Scientific quality of the programs
- Essential characteristics of the centre
- Budgetary coverage and developmental fund allocation
- Centre administration
- Comprehensiveness – assessed first during the site visit (to determine the centre's fulfilment of the scientific requirements), then through a written report of the centre's outreach, education and information efforts.

In overall terms the funding provided to support the US centres model is modest (around 5% of overall NCI spend, excluding the cancer centre's own philanthropic efforts, commercial income, and non-Federal income this figure is likely to be below 1% in real terms), however, it provides the 'rationale' and backbone for the accreditation and development of the US Cancer Centre model. Overall funding of the research in the US has become a major issue. In particular the mismatch between the public and research community expectations and the political reality of delivering year-on-year growth in spend in a fiscally challenged environment has been starkly elucidated by John Niederhuber (2007). Analysis reveals that the core funding and political message sent out by the doubling of the NIH budget with an almost 80% increase in the NCI budget from fiscal year 1999 triggered a huge surge

in applications for research grants and new investigators, as well as growth in existing commitments particularly to the cancer centres. The 'demand momentum' was dramatically underestimated and surged ahead of the inevitable slowing of annual appropriations. There was no soft landing and instead the flat budgets essentially caused a 'crash'. Much of the impact of accelerated and flat growth's in the NCI budget is as yet to be properly dissected. Funding streams, appropriations process and allocation mechanisms are extremely complex, perhaps too complex. What is clear, however, is that the overall NCI has diminished in real terms by about 3% per annum over the last five years (NCI, 2009).

What lessons can there be for Europe? Clearly the first is the need for a politically independent funding mechanism to support accreditation and European cancer centre development. Whilst the need to belong may provide an initial impetus for accreditation the lack of a fiscal bonding would be a serious, and even potentially fatal omission. Secondly there is a real and urgent need for individual Member States to provide diverse and adequate sources of public funding to support cancer research (Eckhouse et al., 2008). In many Member States this is an acute deficit and without addressing this fundamental issue major 'backbone' initiatives such as the European Cancer Centres will trigger an unsustainable momentum. Europe needs to carefully craft funding mechanism(s) that meet specific needs whilst avoiding the trap the US fell into of an unsustainable momentum. As Democratic Representative David Obey pointed out, ''*Congress and the Administration have been engaging in a misguided political race to show who cares most about cancer…*'', but in the process failed to make the funding sustainable (Editorial, 1976).

Europe can also learn from the professionalism of the approach to reviewing and sustaining the US Cancer Centre model. With clear criteria and diverse, flexible uses for the core grant there are strong learning opportunities. However, the European model needs to ensure that accreditation is linked to a review process that is proportional and intelligent. Furthermore a wider review faculty would also bring a more global perspective to European Cancer Centre benchmarking.

## 4. Networking the US Cancer Centre model: the role of the specialised program of research excellence (SPORE)

The SPORE grant program is supported through the P50 (Specialised centre) grant mechanism, and is intended to promote the conduct of translational research on the prevention, aetiology, screening, diagnosis and treatment of cancers at specific organ sites. To date there are 61 SPORE funded projects covering 13 organ sites: brain (4), breast (10), GI (5), genitourinary (2), gynaecological (2), head and neck (4), leukaemia (1), lung (7), lymphoma (3), myeloma (1), ovarian (5), pancreatic (3), prostate (11), skin (3).

SPOREs differ from program project (P01) grants in that they exclusively support translational research, support pilot projects and career development programs, and give the investigator more flexibility in starting and stopping projects. In budget terms the NCI spend on P50/P20 accounts for less than 5% of total obligations (Figure 8). The maximum level of support requested for a SPORE is $1.75M in annual direct costs and $2.75M in annual total costs. Funding can be requested for up to five years, and an institution can hold multiple SPORE's. This is demonstrated by the fact that 41 of the 61 SPORE's currently awarded have been distributed between 13 comprehensive cancer centres.

SPORE's have a number of characteristics.

- *Translational research focus*. All SPOREs conduct research that uses basic scientific knowledge to develop and test the cancer interventions in humans, or determine the biological basis of observations in cancer patients.
- *Collaborative design and implementation of research*. Each project is collaboratively designed and conducted by scientists, clinicians and population scientists.
- *Flexibility to change research direction*. Investigators are able to halt projects demonstrating little translational significance and initiate newer ones.
- *Sharing information*. SPOREs should readily share information with groups within their organ site and with other SPORE programs.

In terms of eligibility the NCI has set out a number of key criteria.

- *Minimum research base*. The SPORE application must include a minimum of four principle investigators successful in obtaining peer-reviewed research grants directly related to the cancer being investigated, and who as a group, have expertise in both laboratory and clinical research.
- *Cancer patient population*. Each SPORE application must have access to a patient population related to the organ/site of interest, or provide assurance that the tissues required are readily available.
- *Statement of institutional commitment*. A statement of commitment from the host institution that addresses how the SPORE will be given high priority relative to other research efforts, such as through support for recruitment of researchers or assignment of specialised research space.
- *Research projects*. A SPORE must contain at least four research projects that represent a balanced and diverse approach to translational research; at least one project must focus on detection, screening, prevention or population science, which must be maintained throughout the term of the award. Only early Phase I/II clinical trials are supported by the SPORE grant.

Each project must be designed to test the importance/relevance of the research to human cancer within the five-year term of the award.

- *Shared resources*: each SPORE must have a dedicated resource for the collection, storage and distribution of cancer specific tissue.
- *Development research program*: each SPORE must allocate funds to support pilot projects. Such projects will replace full projects that are failing, and this program must therefore be maintained throughout the term of the award.
- *Career development program*: the SPORE must contain a program that supports the salary and research costs of candidates (post-docs, faculty or established investigators) who

wish to focus on translational research. This program must be maintained throughout the term of the award.

Turning to the review process research projects are evaluated according to five criteria: significance of the research objective and its likelihood of completion; approach and adequacy of the experimental design; innovation and originality of the experimental design; the appropriateness of the principle investigators; the scientific environment in which the translational research will be conducted.

The tissue and shared resources, career development program, developmental research program and overall program organisation are also evaluated according to past performance, future direction and overall effectiveness. Each component of the SPORE application is given a score, and then an overall score is given for the proposal. This is based primarily on the science within the proposal, however consideration is also given to the extent of interdisciplinary interaction, potential for impacting on disease and institutional commitment. The score is thus weighed as follows:

- 60% on the scientific merit of the translational research
- 15% on the evidence of multidisciplinary approach to translational research
- 15% on the potential of the success of the research to impact on the disease
- 10% on the institutional commitment

With 35% of the world share in cancer research outputs the US Cancer Model framework through the CCSG and SPORE grants can be seen as a qualified success (Figure 3), in the face of greater world-wide competition as evidenced by a decline in relative output and influence of publications between 1988 and 2003 (Hill et al., 2007). However, despite the political rhetoric the funding and research effort has seen only a very modest swing to a more clinically/applied output from an already high research level (Figure 4). Essentially the closer the Research Level number is to '4' of the publication(s) the more 'basic' the output. Whilst the SPORE network grants and Clinical Co-operative grant systems aim to promote more applied research the overall level of funding has been very modest when compared to the more basic research grants which dominate the NCI funding envelope (Figure 8). Furthermore because of the political momentum around network grants driven by former NCI Director Richard Klausner (from 1997 onwards) critical concerns around the evaluation of interdisciplinary and transdsiciplinary team science were only dealt with rather late in their genesis (Croyle, 2008). The need for a balance to be struck between basic and applied cancer research has not been a recent occurrence (Rauscher, 1975) but clearly both internal and external factors have favoured the former over the latter. Late in the day policymakers in the US have recognised the severe fiscal and structural disincentives to the conduct of clinical cancer research, particularly clinical trials which need to be urgently addressed (Lewin Group, 2006).

Such experience provides a Europe with both learning points and opportunities. Firstly the development of Centres should not be at the expense of the network, nor should they be accredited with unevenly weighted metrics

| *Country* | *ISO* | *N* | *%* | *Country* | *ISO* | *N* | *%* |
|---|---|---|---|---|---|---|---|
| | World | 34671 | 100 | Sweden | SE | 649 | 1.9 |
| USA | **US** | **12352** | **35.6** | Spain | ES | 606 | 1.7 |
| | EU15 | 12252 | 35.3 | Australia | AU | 571 | 1.6 |
| | **EU25** | **12670** | **36.5** | Switzerland | CH | 404 | 1.2 |
| Japan | JP | 4076 | 11.8 | Austria | AT | 355 | 1.0 |
| Germany | DE | 2479 | 7.1 | Belgium | BE | 349 | 1.0 |
| UK | UK | 2361 | 6.8 | Finland | FI | 296 | 0.85 |
| Italy | IT | 1901 | 5.5 | Denmark | DK | 255 | 0.74 |
| France | FR | 1734 | 5.0 | Greece | GR | 227 | 0.65 |
| Canada | CA | 1028 | 3.0 | Norway | NO | 211 | 0.61 |
| Netherlands | NL | 922 | 2.7 | Turkey | TR | 199 | 0.57 |

**Figure 3 – US 'share' of the world cancer research (fractional count: 1994–2003).**

that 'favour' basic research. If this is about patients then the applied/clinical pillar should be of equal prominence. The network of Centres proposed as the solution to European critical mass can be, must be, inclusive of such clinically focused initiatives as the EORTC NOCI (Ringborg et al., 2008). Integrating early structural and political support for clinical cancer research would provide Europe with a much needed competitive 'edge' which it could rapidly capitalise on the expanding need for complex, phase IV cancer studies and the increasing pipeline of new molecular agents.

## 5. Planning grants for US Cancer Centre status

Institutions that have expressed an interest in becoming an NCI cancer centre, but lacked the resources to submit a direct application for a CCSG had been encouraged to apply for a P20 Planning grant. This award would support planning for new programs, expansion or modification of existing resources, and various feasibility studies. Since 1992 NCI has funded 25 P20 planning grant awards. Six of these awards are still active while seven centres have made the successful transition to a P30 CCSG grant. Eleven centres holding P20 grants failed to make the transition to a CCSG, including two centres that received two P20 grants.

Several centres have successfully received CCSG awards without first holding a P20 grant. Following the P30/P50 Working Group review of CCSG funding in 2003, it was recommended that the P20 planning grant should be phased out.

The US Cancer Centre model is now mature and the need for additional Centres has probably long past. However, in light of the diverse nature of European Cancer Centres there will be a need to provide some form of development grant if the aim is to promote the European model along the same lines as the provision of healthcare, i.e. equitable access and outcomes.

## 6. Training the next generation: continuing umbrella of research experience (CURE) program

The CURE program is an NCI strategy aimed at providing opportunities for training and career development for under-

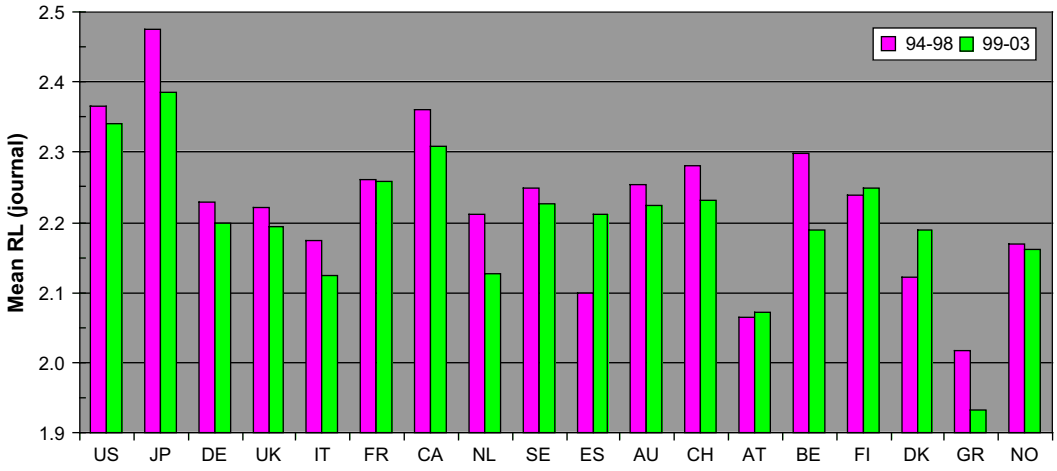



**Figure 4 – Changes in research level by country (1994–1998 compared to 1999–2003).**

represented minorities in cancer research. Supplements are available that provide opportunities for minorities at high school, undergraduate, predoctoral, postdoctoral and junior investigators level to enter into, and continue in careers in cancer research. Cancer centres can participate in this program by applying for administrative supplements to the CCSG to train promising high school and undergraduate students.

The supplement covers the salary costs of an administrative co-ordinator of the program, and the stipends for the students. High school students of high aptitude and with a demonstrable interest in science can receive an annual stipend of up to $4000, with part time work costs of up to $6 per hour. Undergraduates, including those already affiliated with the centre, may receive an annual stipend of up to $6000 with part time work costs of up to $8 per hour. Total direct costs may not exceed $75,000 per year for undergraduates, or $60,000 per year for undergraduates. The Centre director is responsible for the success of the program, and must therefore ensure that students are placed in an environment that provides them with sufficient exposure to research and its challenges.

Whilst the National Cancer Act Amendment of 1974 gave the NCI authority for clinical training, the funding of the next generation of clinical and non-clinical cancer researchers in the US is through a broad church of Federal (not just NCI) and non-Federal (e.g. American Cancer Society) organisations (Rauscher, 1975).

The European focus has rightly championed the central position of training and mobility, including education within the framework of cancer centre accreditation (Lombardo et al., 2008). However, it too will have to contend with multiple funding organisations and different views on the 'right' way to train. In reality each individual ploughs a unique path through their life as a cancer researcher, with no two people the same. Understanding the individuality of this path is critical to providing a flexible framework of funding, support and mentorship capable of absorbing and dealing with the vagaries that life inevitably throws up. Versatility and generous support of training fellows of whatever professional discipline should be one of the most important pillars on the European Cancer Centre model.

## 7. Future direction of the US Cancer model: implications for the European process

In 2003 a P30/P50 Working Group was convened to examine the award mechanisms of the CCSG and SPORE grants and how they should function in the future, to continue to facilitate the production of translational research, despite the potential for a slow down in the expansion of the NCI budget over the forthcoming years. This Working Group made several recommendations, some of which have been implemented.

*Recommendation 1.* The CCSG and SPORE programs are vital components of the NCI efforts to increase translational research, and as such, must be sustained.

- Funding for the CCSG can be stretched in the short term by limiting growth to slightly above that of RO1 research project grants, and by suspending the P20 planning grant.
- The SPORE program can be sustained by slowing its growth rate to not greater than that of RO1 project grants; lowering the average cost per award; allowing SPOREs to focus on pathway, mechanism or population research; fusing shared resources with those of the CCSG.

*Recommendation 2.* NCI should take advantage of the unique position of cancer centres, but also encourage their development. In particular NCI should:

- Include centre directors in NCI's strategic planning process to offer advice in developing new initiatives.
- Use centres to pilot new research programs.
- Allow salary support of clinical researchers who participate in clinical trials, in order to recognise their essential role.
- Revise the funding of CCSG shared resources to support critical and under funded areas such as tissue banks or data management.
- Encourage geographical distribution of cancer centres, by creating a category of cancer centre that allows

institutions unable to meet the requirements for a CCSG funding to associate with, and be funded through an existing NCI cancer centre.
- Modify the CCSG award to encourage the development of infrastructure and methods for the dissemination of knowledge in clinical, cancer control and early detection research.

*Recommendation* 3. NCI should improve the efficiency, effectiveness and evaluation of research in centres and SPOREs
- Limit the review of clinical trials previously supported by peer-reviewed funding to safety and regulatory issues.
- Streamline the CCSG review process by eliminating the need for some site visits.
- Adjust the CCSG review process to weight the activities in collaboration with SPOREs, as well as in community service, outreach and dissemination.
- Employ a two-tiered system of review for the SPORE program, with a parent committee reviewing the management of the program as a whole.
- Develop a process to describe and quantitative on an annual basis the overall contributions of the CCSG/SPORE programs.

In making these recommendations the Working group was asked to decide on what ideal characteristics would be required of the cancer centres and SPORE programs in the future. The recommendations they arrived at were, in summary for the Centres themselves:

- Should have a formal relationship with two or more institutions, including regional academic institutions that cannot qualify for CCSG grants.
- Should be the preferred test or launch sites for novel NCI programs, utilising the existing infrastructure.
- Should view and support clinician investigators as a critical resource in clinical trials.
- Should act as the ideal place to conduct high risk/novel projects that would be difficult to fund by traditional peer-review means.
- Should be reviewed on the basis of the written application, and site visit should be limited to issues such as new centres or directors, large increases in budget requirements or dramatic change in research productivity

And for the networking:

- Should flexibly fund diverse types of innovative research on both organ/site specific and themed areas, utilising information on common pathways.
- Could have as few as two research projects, with the funding adjusted accordingly.
- Should shift the responsibility of the core infrastructure to the host centre, enabling the SPORE to function more like a project grant for translational research.
- Should assist in public education and promotion of preventative methods through the success of initiatives developed through the program.
- Should utilise a two-tiered review system that will allow a parent committee to provide uniformity and balance across the SPORE network, while understanding the need for hypothesis generating as well as hypothesis testing studies.

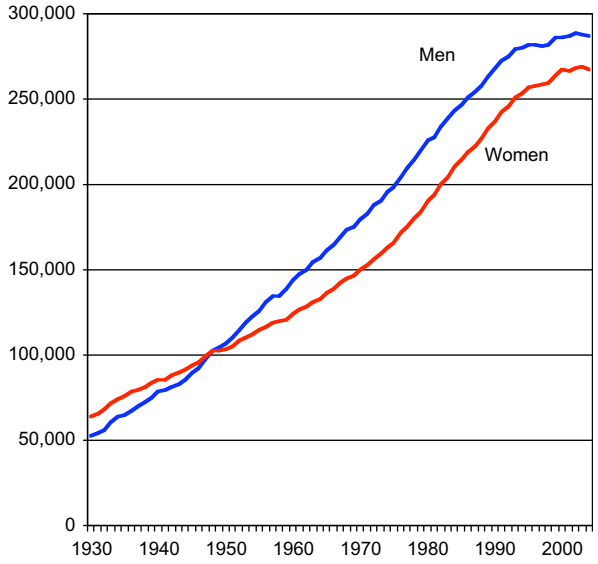



**Figure 5 – US trends in the number of cancer deaths in men and women (US Mortality Public Use Data Tape, 2004, National Centre for Health Statistics, Centres for Disease Control and Prevention, 2006).**

Re-planning the '*war on cancer*' is a perennial favourite. On the eve of the creation of the NCI Science proclaimed, somewhat tongue-in-cheek, that, ''*all of a sudden, everybody has a plan to lick cancer*'' (Editorial, 1971). Europe has so far avoided this knee jerk approach, although it has had

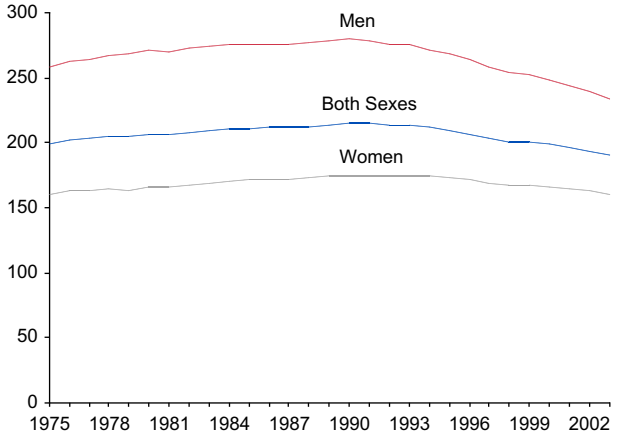



**Figure 6 – US cancer death rates, all sites, all races (*Age-adjusted to the 2000 US standard population. Source: Surveillance, Epidemiology, and End Results (SEER) Program (www.seer.cancer.gov) SEER*Stat Database: Mortality – All COD, Public-Use With State, Total U.S. (1969–2003), National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch, released April 2006). Underlying mortality data provided by NCHS (www.cdc.gov/nchs).**

many false starts and, some might argue too conservative approach. However, caution and careful, phased planning is required. The ''intellectual underpinnings of cancer research are radically different from the usual input–output mode of purely technological programs'' (Chubin and Studer, 1978). In socio-political terms the European model must learn from the US that the nexus of the policy problem is an imposition of 'unfit' social structures on the ongoing progress of cancer research. The European Cancer Centre model must avoid the trap of the 'one-size-fits-all' path.

The US Cancer Centre model has also struggled with unrealistic social expectations. Whilst overall mortality has inevitably increased, rates have been slowly decreasing (much of this due to tobacco control) (Figures 5 and 6) but accusations abound that the US Cancer Centres have not delivered real impact. The problem lies firstly in the model promoting itself as the standard bearer of cancer outcomes and second, of failing to see itself as a 'cog' in the global effort to cure and control cancer. Whilst the failure of outcome metrics cannot be fairly laid solely at the door of the US Cancer Centres the obesity epidemic (Figure 7) is a glaring reminder that whilst the US Centre model *talked* of health promotion and awareness it failed to follow through. The lessons for the European model are a need carve a careful path between hype and under-promotion, and a critical need to follow through on prevention, health awareness and outreach programmes.

One of the other issues of the US model has been a tendency to over plan research programs with only a cursory engagement with the broader church of cancer service and research activities outside core-NCI centres. The breadth and depth of European research outside cancer centres is a major strength and the accreditation of Cancer Centres should not see their development as a zero sum game and/or trade-off with these other networks/centres of activity. Europe must also avoid 'over-managing' its cancer research with a top-down approach from committees who have never engaged in research or patient care and thus have little tacit knowledge. Professionalism is required not 'businessification' for the very simple reason that most businesses are poor or mediocre.

A further learning point from the US model, which is arguably even more pertinent for Europe with its cost containment social healthcare model, is the failure of the their programme to take into account the delivery systems needed to take advantage of research activities. In part the current European efforts address this through much wider engagement but the relationship and influence with the

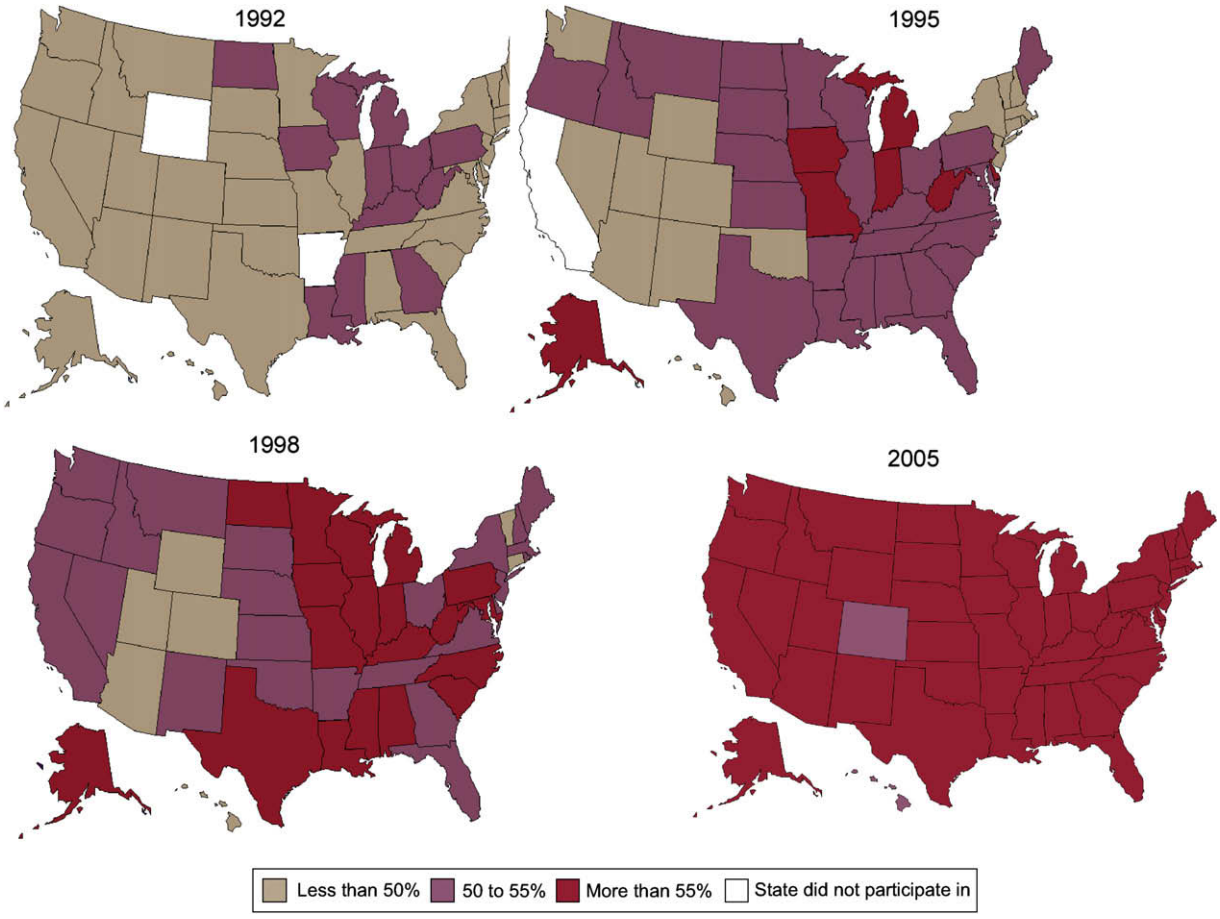



**Figure 7 – US trends in overweight prevalence (%), adults (Behavioral Risk Factor Surveillance System, CD-ROM (1984–1995, 1998) and Public Use Data Tape (2004, 2005), National Centre for Chronic Disease Prevention and Health Promotion, Centres for Disease Control and Prevention, 1997, 2000, 2005).**

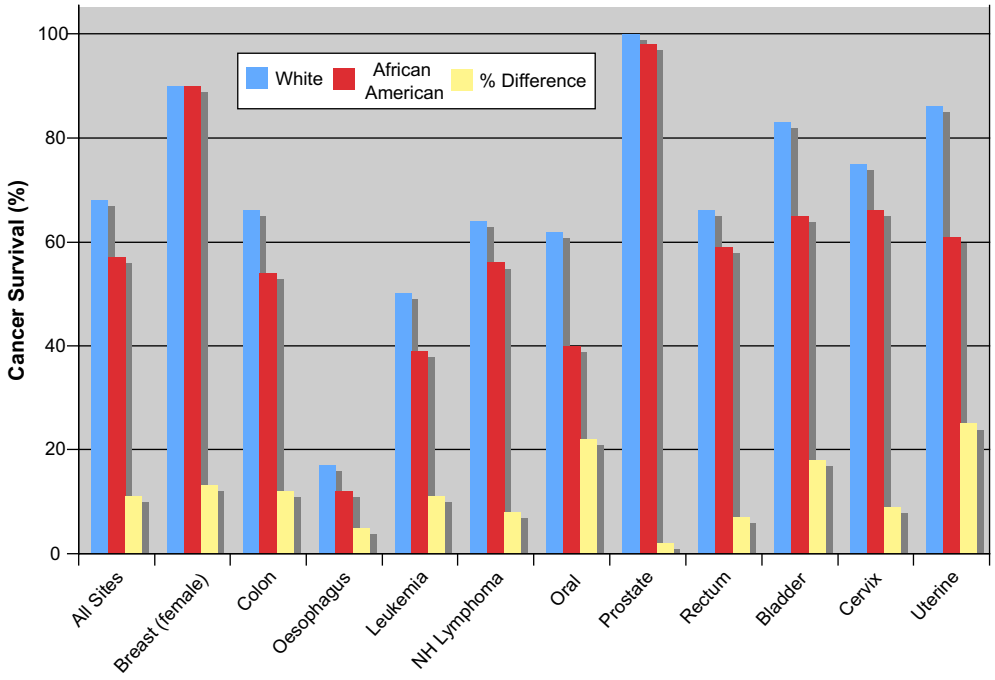



**Figure 8 – Cancer survival by race and site (1996–2002). (Five-year relative survival rates based on cancer patients diagnosed from 1996 to 2002 and followed through 2003. Source: Surveillance, Epidemiology, and End Results Program, 1975–2003, Division of Cancer Control and Population Sciences, National Cancer Institute, 2006).**

health policymakers at Member State level remains a political unknown.

The US model did recognise the need to plan around changing demographics. Whilst cancer centre planning around key outcome metrics (incidence, mortality, survival, health-related quality of life, etc) is essential understanding the European demographic changes over the next 20–50 years will be necessary for centres to plan capacity to deliver service and to dissect out the key research opportunities/needs. In particular the opportunities of cross-disease research should not be overlooked. Moreover the stark and growing inequalities present in the US healthcare system for patient outcomes, service delivery and research access should ring the loudest alarm bells for the development of the European process (Figure 8). Widening inequalities in patient outcomes must be addressed, indeed championed by the European initiative. Thus the European Cancer Centre model could be a global standard to demonstrate that 'success' does not have to come at the price of sacrificing fairness and equality (McIntyre, 2007) (Figure 9).

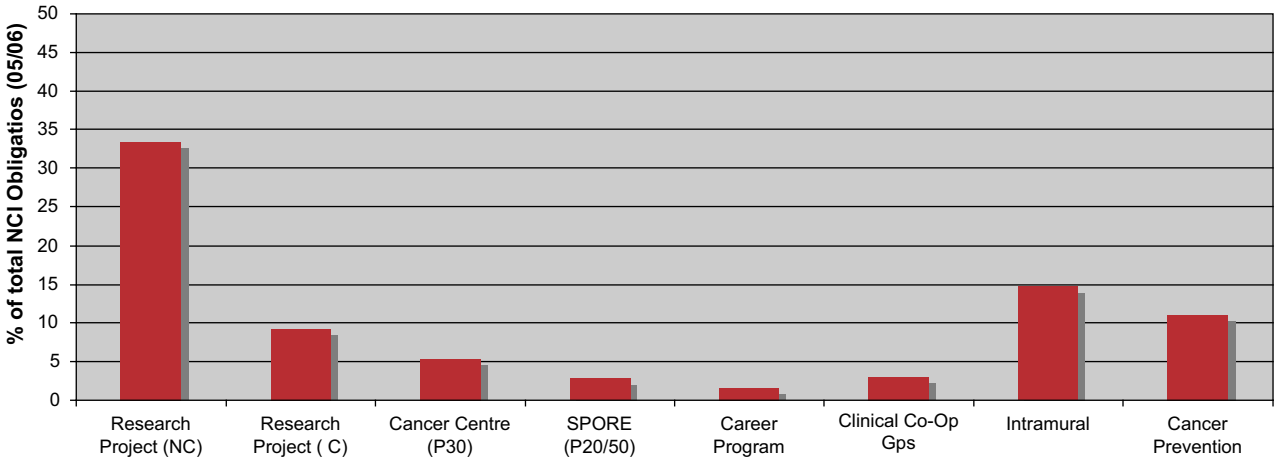



**Figure 9 – Percentage of NCI spend dedicated to specific research funding streams (2005/2006). (Key: NC = non-competing; C = competing). Source: NCI, 2005 Fact Book.**

REFERENCES

Chubin, D.E., Studer, K.E., 1978. The politics of cancer. Theory and Society 6, 55–74.
Croyle, R.T., 2008. The National Cancer Institute's transdisciplinary centers initiatives and the need for building a science of team science. American Journal of Preventive Medicine 35, S90–S93.
Eckhouse, S., Sullivan, R., 2006. A survey of public funding of cancer research in the European union. PLoS Medicine 3, e267.
Eckhouse, S., Lewison, G., Sullivan, R., 2008. Trends in the global funding and activity of cancer research. Molecular Oncology 2, 20–32.
Editorial, 1971. Cancer research goes political. Science News 99, 347–348.
Editorial, 1976. Congress looks harder at cancer. Science 191, 364.
Ewing, J., 1938. The public and the cancer problem. Science 87, 399–407.
Hill, D., Rapoport, A., Lehming, R., Bell, R., 2007. Changing U.S. Output of Scientific Articles: 1988–2003. National Science Foundation, Arlington, VA. Report no. NSF 07-320.
Lewin Group, 2006. Enhancing Cancer Treatment Through Improved Understanding of the Critical Components, Economics and Barriers of Cancer Clinical Trials. C-Change.
Lombardo, C., Albanese, D., Belardelli, F., d'Alessandro, F., Giacomini, M., Rondanina, T., Spagnoli, L.G., 2008. Training and mobility: a priority for the Organisation of the European Cancer Institutes. How a national mobility initiative could enhance EU cooperation in cancer research contributing to the development of an European Research Area: the example of The Italian Comprehensive Cancer Centers' Network ''Alleanza Contro il Cancro. Tumori 94, 147–153.
McIntyre, P., 2007. Rising tide of cancer poses global challenege. Cancer World, 14–22.
National Cancer Institute (NCI), 2009. Connecting the Nation's Cancer Community. An Annual Plan and Budget Proposal Fiscal Year 2010. NCI.
Niederhuber, J.E., 2007. A look inside the National Cancer Institute budget process: implications for 2007 and beyond. Cancer Research 67, 856–862.
Overman, S., Simonton, D., 1986. Iron triangles and issue networks for information policy. Public Administration Review 46, 584.
Rauscher Jr., F.J., 1975. Research and the National cancer program. Science 189, 115–119.
Ringborg, U., de Valeriola, D., van Harten, W., Bosch, A.L., Lombardo, C., Nilsson, K., Philip, T., Pierotti, M.A., Riegman, P., Saghatchian, M., Storme, G., Tursz, T., Verellen, D., 2008. Improvement of European translational cancer research. Collaboration between comprehensive cancer centers. Tumori 94, 143–146.
Saghatchian, M., Hummel, H., Otter, R., de Valeriola, D., Van Harten, W., Paradiso, A., Koot, B., Ringborg, U., Tursz, T., 2008. Towards quality, comprehensiveness and excellence. The accreditation project of the Organisation of European Cancer Institutes (OECI). Tumori 94, 164–171.
Simone, J.V., 2002. Understanding cancer centres. JCO 20, 4503–4507.