



UNC
GILLINGS SCHOOL OF
GLOBAL PUBLIC HEALTH

Clinical research participation and adoption of clinical innovations:

SEER-Medicare Analysis of innovation diffusion in the NCI Community Clinical Oncology Program

**William R Carpenter PhD MHA, and
Bryan J Weiner, PhD**

Dept. of Health Policy and Management, Gillings School of Global Public Health
University of North Carolina, Chapel Hill, North Carolina, USA

Background

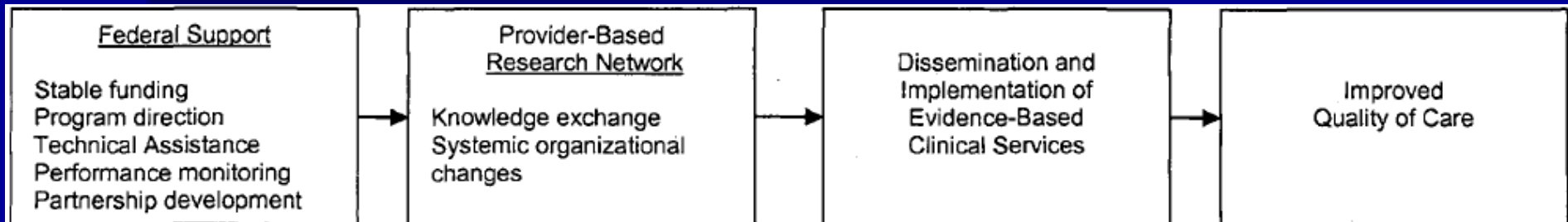
- UNC Lineberger Comprehensive Cancer Center
 - This project aligns with Dissemination Core's goals, and informs:
- UNC Cecil Sheps Center for Health Services Research
 - UNC-BWH DEcIDE Cancer Comparative Effectiveness Consortium (AHRQ)
 - Developing new data resources to addressing current shortcomings in data systems

Background

- How to improve the translation of research into evidence-based practice?
 - Diffusion: 17 years
 - IOM Reports:
 - “Between the quality we have and the quality we need lies not a gap, but a chasm”
- Clinical research *is* the practice of state-of-the-art medicine
- Provider Based Research Networks (PBRNs)
 - Substantial anecdotal evidence, limited empirical evidence

Logic Model

- PBRNs: Knowledge exchange through community-based provider participation in research
 - A two-way exchange of information between researchers and community practitioners
 - Researchers
 - Better insight into practical/logistical requirements
 - Tacit, practice-based knowledge in community practices
 - Practitioners
 - Trust and ownership by virtue of being integral to the process
 - Acceptance of clinical trials results
 - Strengthened commitment to acting on research findings
 - Systemic, structural changes to support research
 - Organizational infrastructure that supports research and an organizational culture that values scientifically based practice



Study: Innovation diffusion in the NCI Community Clinical Oncology Program

■ Hypotheses:

- Organizations (and physicians) involved in the research have an enhanced knowledge of the state-of-the art, are more likely to be aware of new science and subsequent changes in treatment options, are more comfortable embracing research results, and thus are likely to adopt innovations more quickly than others.
- Individuals receiving care by CCOP physicians and hospitals are more likely to be offered, and thus receive, innovative treatments.

R01: Implementing Systemic Interventions to Close the Discovery-Delivery Gap

PI: Bryan Weiner, UNC (NCI R01 CA124402)

Specific Aims:

1. Identify factors contributing to the effective implementation of a federally funded national PBRN (Weiner)
2. Examine the impact of a federally funded national PBRN in promoting the use of evidence-based clinical services (Carpenter)
3. Assess the organizational, network, and environmental factors associated with sustainability of a federally funded national PBRN (Carpenter)
4. Develop a model and produce practical tools for provider organizations to evaluate the business case for participating in a federally funded national PBRN (Weiner)

Impact Aim:

- Compare innovation adoption among CCOPs compared with non-CCOP community hospitals and physicians
- Extend work done earlier examining innovation diffusion among CCOPs vs. non-CCOPs to understand:
 - Different Disease sites:
 - Breast, Colon, Lung, Prostate, Pancreas, Kidney
 - Different populations
 - Male / Female, White / Black
 - Different treatment types
 - Surgery, Radiation Therapy, Chemotherapy/Hormone Therapy

SEER Registries & CCOPs

~ 20 CCOPs, ~ 100 CCOP Hospitals, ~ 400 Physicians

Washington

- Virginia Mason
- Northwest CCOP

California

- Bay Area
- Santa Rosa
- Central LA

Arizona

- Western Regional CCOP
- Scottsdale CCOP

Iowa

- Cedar Rapids
- Iowa Onc. Research Assoc

Louisiana

- Oschner
- LSU

Atlanta GA

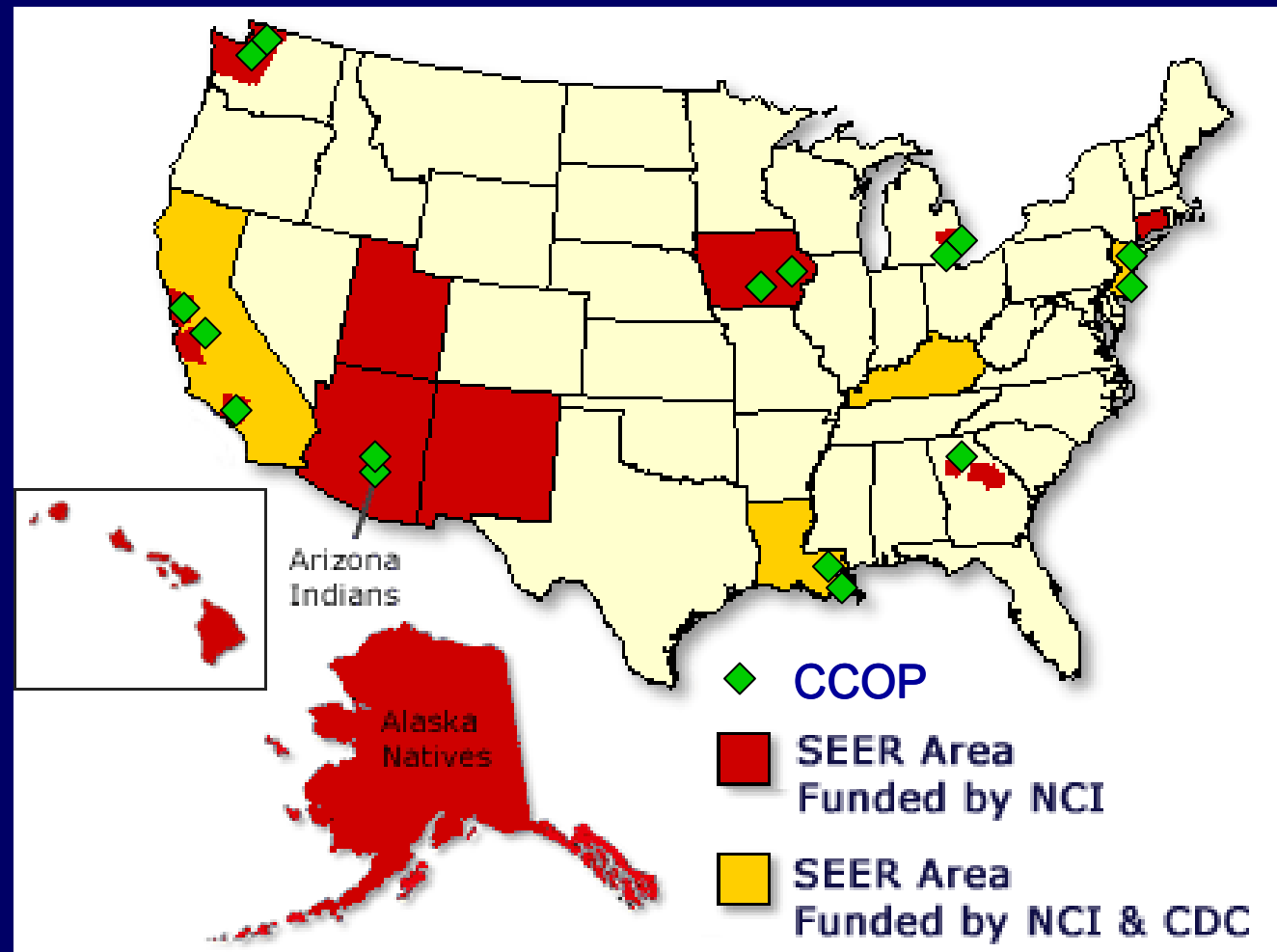
- Atlanta Regional CCOP

Detroit MI

- Reaumont CCOP
- Michigan Ca Res Consortium

New Jersey

- Northern NJ Ca Ctr
- New Jersey CCOP
- Tri-County CCOP



Data sets

- **Step 1: Identifying CCOPs:**
 - Through Sustainability Aim, reviewing CCOP progress reports (1991-2007) cataloging participating / accruing hospitals and physicians.
- **Step 2: SEER-Medicare Data**
 - Cases: 1991-2005
 - Claims: 1991-2007

Data, in brief

■ Patient Characteristics

- Demographic
 - Geographic location
 - Race
 - Education
 - Income
 - Marital status
- Clinical characteristics
 - Cancer type and sequence
 - Stage and grade
 - Date of diagnosis
 - Comorbidities

■ Hospital organizational characteristics

- Size
- Teaching Status
- Urban/rural
- Number of RB Affiliations
- ACOSOG Accreditation

■ Physician Characteristics

- Demographics
- Years in practice
- Specialty type
- CCOP affiliation
 - Hi/Med/Low accruing
 - Leadership role
 - Within CCOP
 - National committees

■ Treatment information

- Procedure-level diagnostic and treatment information

Innovations for Study

Treatment	Summary of Patient Eligibility Criteria	Primary Means of Identification in Claims*
Breast Cancer		
Utilization of HER-2 Testing	Stage IV BrCa, for HER-2 overexpression (Herceptin appropriateness)	C: 88342
Trastuzumab (Herceptin)	HER2-positive Metastatic	H: J9355
Differential use of SLNB vs. ALND in surgery for early stage	Stage I, II	-Forthcoming-
Colon/Rectal Cancer		
5-FU + Leucovorin	Stage III	H: J9190 + J0640
Irinotecan in Multiagent therapy; Oxaliplatin	Stage IV	H: J9206 (Irinotecan) H: J9263, C9205 (Oxaliplatin)
Post Surgical Chemoradiation	Stagell-III rectal ca.	I: 9925 (Chem) + 9221-9229 (RT) C: 96400-96549, J9000-J9999, Q0083-Q0085 (Chem) + 77401-77499 (RT) R: 0331, 0332, 0335 (Chem) + 0330-0333(RT) ³⁹
Lung Cancer		
Addition of Radiation Therapy to use of Chemotherapy	LS-SCLC	I: 9925 (Chem) + 9221-9229 (RT) C: 96400-96549, J9000-J9999, Q0083-Q0085 (Chem) + 77401-77499 (RT) R: 0331, 0332, 0335 (Chem) + 0330-0333(RT) ³⁹
Chemotherapy and Radiation	Stage III NSCLC	I: 9925 (Chem) + 9221-9229 (RT) C: 96400-96549, J9000-J9999, Q0083-Q0085 (Chem) + 77401-77499 (RT) R: 0331, 0332, 0335 (Chem) + 0330-0333(RT) ³⁹
Prostate Cancer		
Lupron/Leuprolide, Goseriline; as alternative to Orchiectomy	Stage IV	H: (J9217, J9218, J9219) + J9202 (Rx); C: 56318, 54535, 54530, 54520 (Sx)
Renal Cell Carcinoma Cancer		
Emerging therapies for RCC – molecular targeted agents: sorafenib, sunitinib, temsirolimus, and everolimus; bevacizumab	Stage IV	- Forthcoming -

H: HCPCs codes; I: ICD-9; C: CPT

Methods

- Dependent variable: Patient-level utilization of intervention of interest among eligible patients
- Two group, longitudinal design, multiple levels of analysis
 - **Region:** Urban/Rural; local health care facilities; local average income; proportion of population with health insurance; etc.
 - **Hospital:** CCOP, non-CCOP
 - Same geographic region, Comparable size/volume, ACOSOG accreditation, teaching status, RT services offered, etc.
 - **Physician:** CCOP, non-CCOP
 - Region, specialty, years in practice, board eligibility, etc.
 - **Patient and condition:**
 - Age, race, gender, stage, grade, comorbidities, etc.
- 10 SEER Regions, 21 CCOPs, 100 CCOP Hospitals, 425 CCOP Physicians
- Observation period:
 - Incident cases: 1991-2005, claims through 2007
 - Innovations: FDA approved/Medicare covered
 - Most 1999-2000s

Methods

- Outcome: Patient level utilization of treatment
- Covariates: Hospital, physician, patient, time

$$\text{logit}(\pi_{ij}) = X_{ij}^T \text{hospital} \alpha + X_{ij}^T \text{physician} \beta + X_{ij}^T \text{patient} \gamma + X_{ij}^T \text{time} \delta$$

- Generalized estimating equations (GEE): correlations of outcomes within physician and hospital
 - Exchangeable working correlation, sandwich variance estimator to provide protection from misspecification of the correlation structure

Complex phenomenon

- Multiple models: Balancing trade-offs, limitations, assumptions
 - Surgical/RT interventions may focus on model emphasizing organizational characteristics
 - Medical interventions may focus on model emphasizing physician characteristics
- Bahjat Quaquish: UNC Biostatistics co-investigator, writing special software / programming: [ftp.bios.unc.edu/pub/gee/blex](ftp://ftp.bios.unc.edu/pub/gee/blex)

Preliminary Analysis

Carson AP, Howard DL, Carpenter WR, et al. (Under review). "Trends and Racial Differences in the Utilization of Androgen Deprivation Therapy for Advanced Prostate Cancer."

- Topic: Leutenizing Hormone Releasing Hormone (LHRH) Agonists (Medical Management) vs. Orchiectomy (Surgery) for advanced Prostate Cancer
- Exploratory: Limited sample using existing SEER-Medicare data
 - Cases through 2002
 - NCI Affiliation: Organizational-level variable (Provider File) based on
 - Academic Medical Centers:
 - Those affiliated with NCI-designated Cancer Centers, vs. not
 - (Variables: Medical School Affiliation; NCI Designation)
 - Community hospital:
 - Those affiliated with NCI Cooperative Groups: vs. not
 - (Variables: e.g., CALGB, SWOG, etc.)
 - **Of patients getting LHRH or Orchi, what proportion was LHRH?**

Preliminary Analysis

Figure 1: Academic Centers: Proportion of Patients Receiving LHRH Agonist – Hormone Therapy (HT)

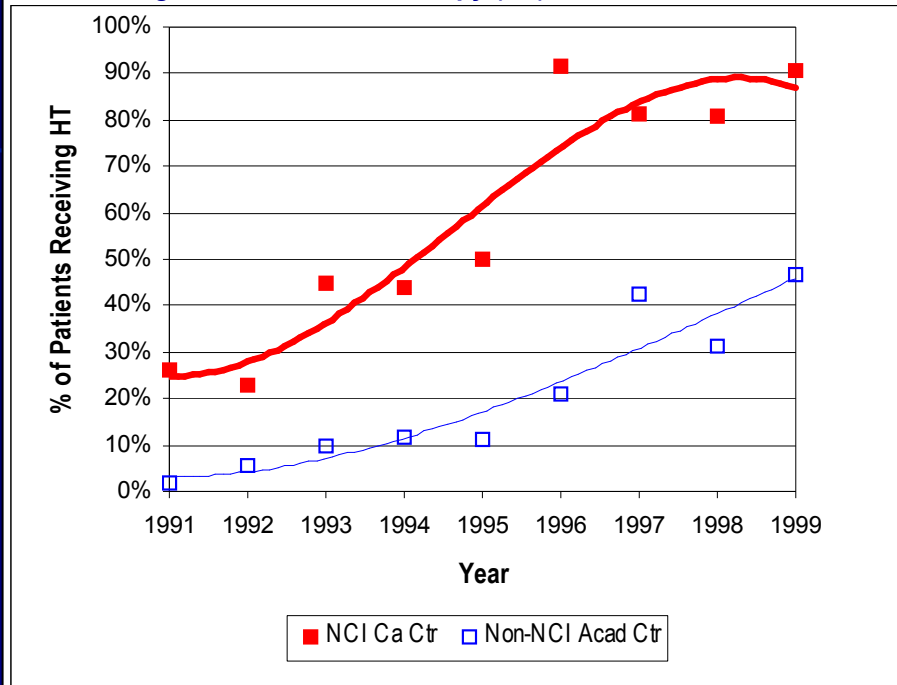
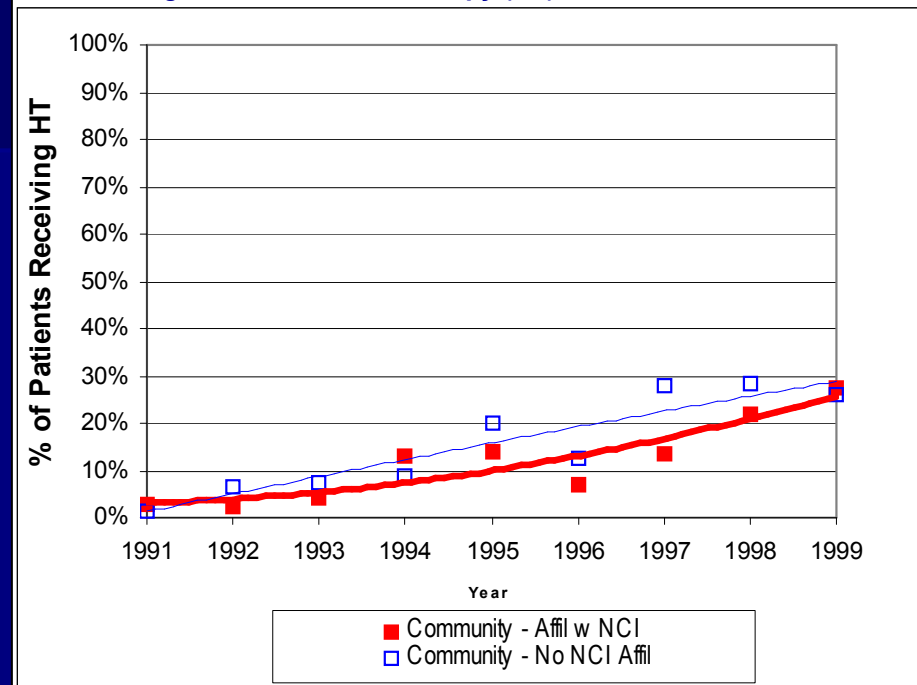


Figure 2: Community Centers: Proportion of Patients Receiving LHRH Agonist – Hormone Therapy (HT)



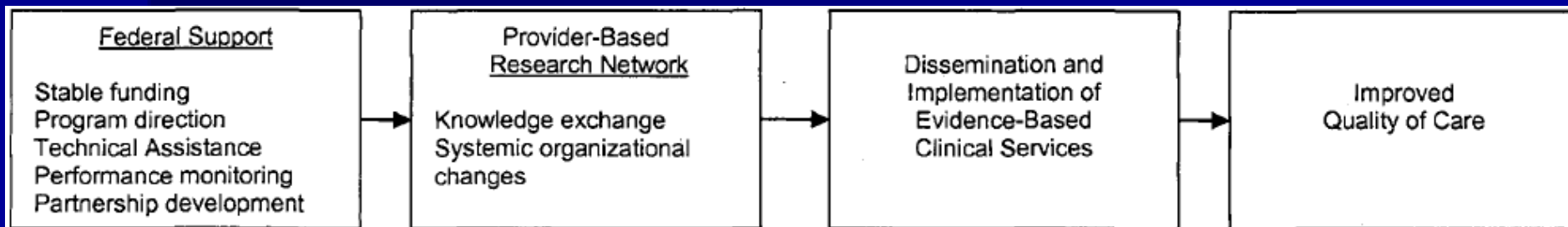
- Apparently difference in diffusion rates b/n academic groups...BUT...
- **Learning about Limitations:**
 - LHRH is medical therapy, overwhelmingly prescribed on outpatient basis;
 - AMCs may have integrated outpatient clinics (capture both surgery and medical);
 - Most community hospitals have no clinics; heterogeneity among AMCs
 - This likely captures a very limited subset of the community hospital population; likely confounding by indication in this population
 - Demonstrates need for characterizing hospitals and physicians, attention to demands of measuring medical interventions or medical vs. surgical alternatives.

Limitations and Issues we're working through...

- Characterizing and measuring "eligibility" for interventions
 - SEER-Medicare has limited ability to report test findings
 - Example: We will see if test was done; but don't know results
 - May confound studies such as Herceptin for Breast Ca.
- How do we characterize in the data the multiple actors on the stage
 - How so we handle patients who see multiple physicians
 - Focus on decision rules regarding those prescribing treatment...
 - How do we move beyond the CCOP vs. non-CCOP distinction variable
 - Leadership role
 - High/Med/Low accruing MD
- What about non-NCI trials?
- Others...

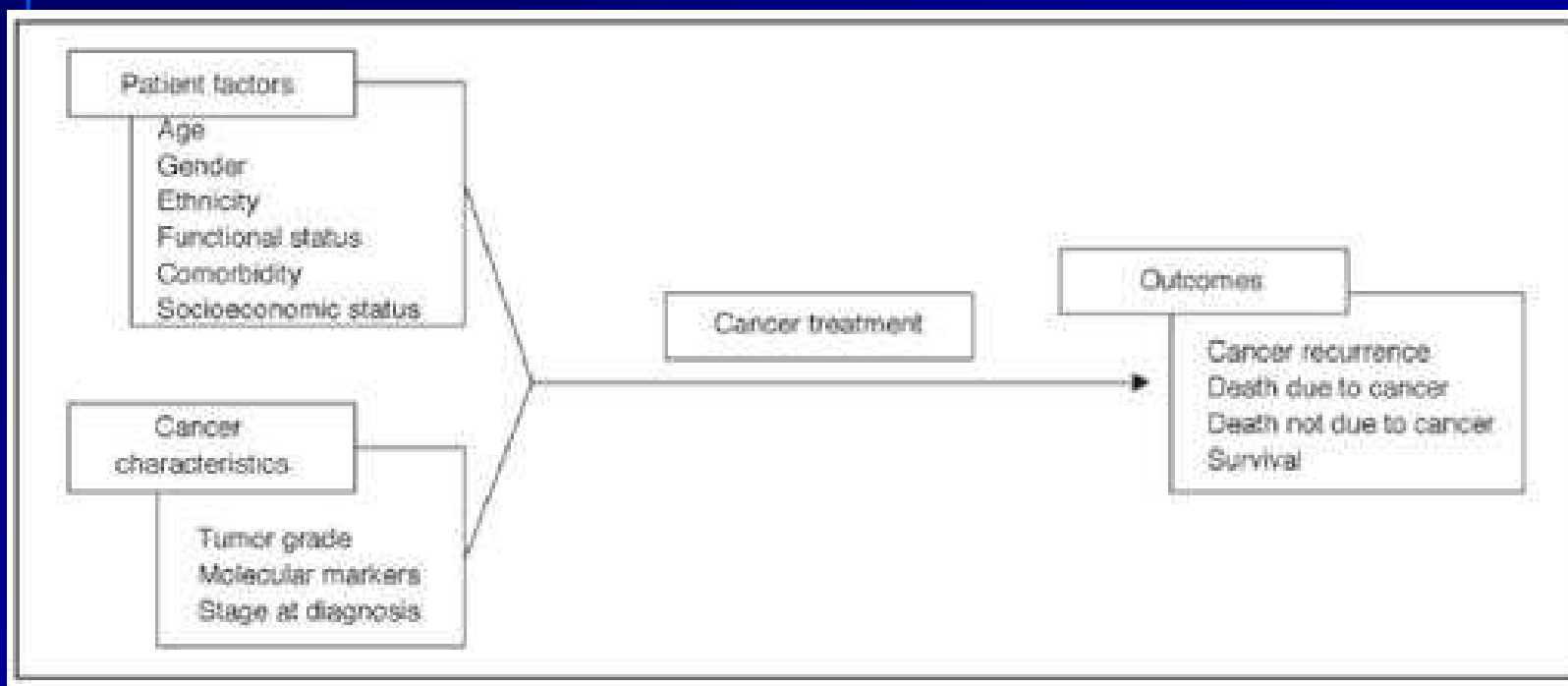
Future directions

- Comparing outcomes between CCOP providers and others
 - Examining quality and treatment effectiveness:
 - If patients do or don't get it sooner,...do they get it "better"?



Dissemination research to inform Comparative Effectiveness Research

A prevailing model of cancer, comorbidity, and outcomes:



Source: Geraci, JM, et al. (2005). "Comorbid Disease and Cancer: The Need for More Relevant Conceptual Models in Health Services Research." *Journal of Clinical Oncology*. 23(30):7399-404.

Patient Characteristics

- Age
- Gender
- Race/Ethnicity
- Functional Status
- Symptoms
- Physical Health Acuity
- Mental Health Acuity
- Comorbidity
- Socioeconomic Status
- Genetic Characteristics

Cancer Characteristics

- Tumor Stage
- Tumor Grade
- Molecular markers

Organizational/ Provider Characteristics

- Training and experience with patient population
- Exposure to/ Experience with specific therapies
- Specific care processes
- (Other)

Environmental Factors

- Environmental exposures
- Local disease burden
- Health resources
- Health/Social Norms
- (Other)

Time

- Year of Diagnosis (Extant norms and technologies)

Treatment

- 1st Line Treatment
 - Treatment timing/ completion
- 2nd line Treatment

Intermediate Outcomes

- Pt physical health acuity
- Pt mental health acuity
- Pt physical functioning
- Pt QOL
- Inpatient hospitalization
- ER Visits
- Quality of Life
- Diarrhea
- Nausea / Vomiting
- Dehydration
- Leukopenia
- Neutropenia
- Fever
- Proteinuria
- Congestive Heart Failure
- Bleeding
- Stomatitis
- Mucositis
- (Other)

Broader Outcomes

- Time to progression
- Recurrence
- Disease-specific survival
- Overall survival

Informing the development of the next generation of measures, models, and data for Comparative Effectiveness and Outcomes Research