Portfolio title: Cancer Pain

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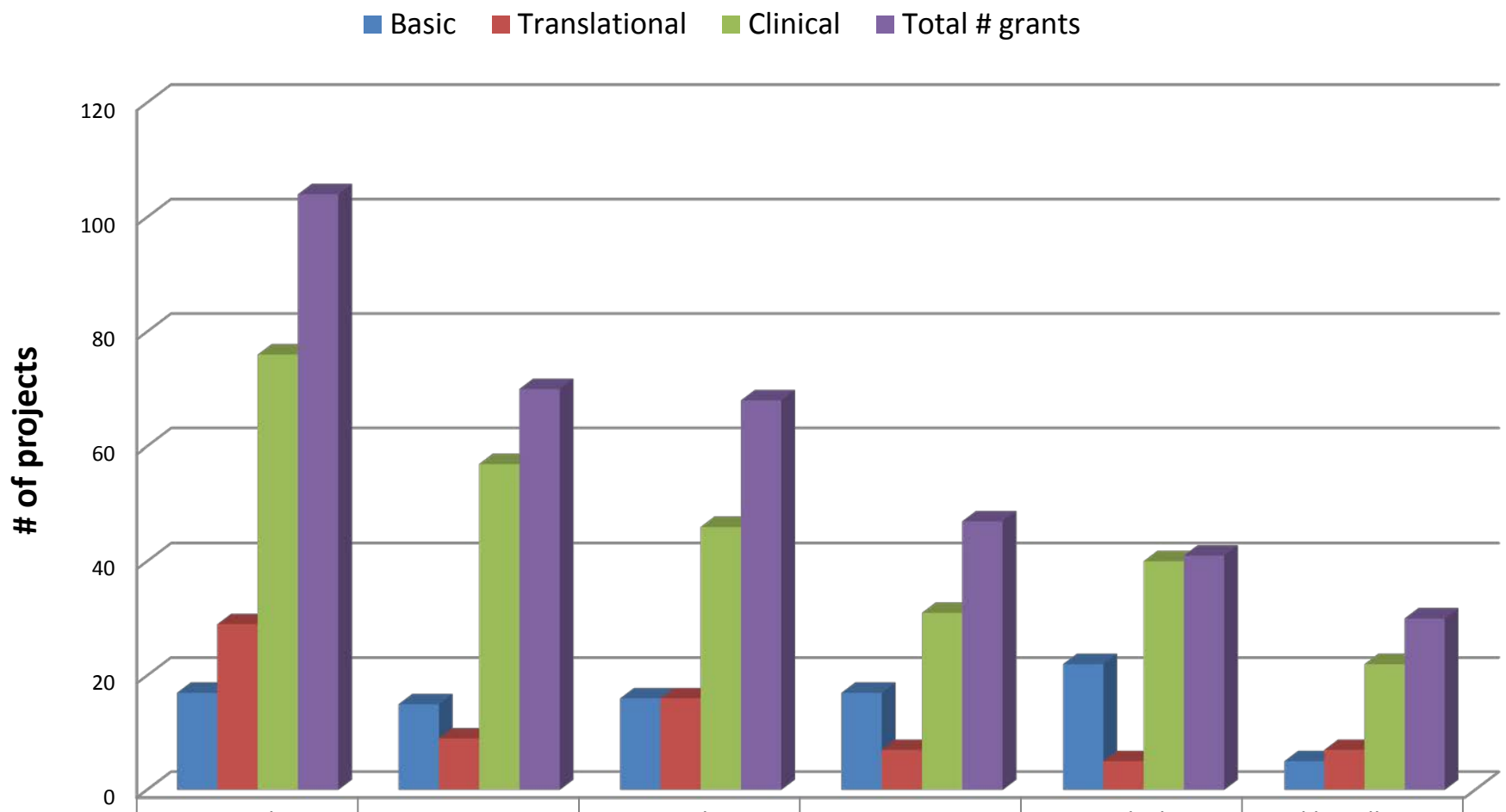
Unique Aspects of Cancer Pain

- Prevalence
  - 30% to 50% of patients on active treatment
  - 80% to 90% of terminally ill patients
  - 30% to 40% of cancer survivors
- Unrelieved pain is the most feared symptom associated with a cancer diagnosis
- Cancer pain has unique characteristics
  - Numerous etiologies including the disease itself and its treatment
  - Mechanisms that underlie various types of cancer pain are unique
  - Oncology patients can experience multiple types of cancer and non-cancer pain

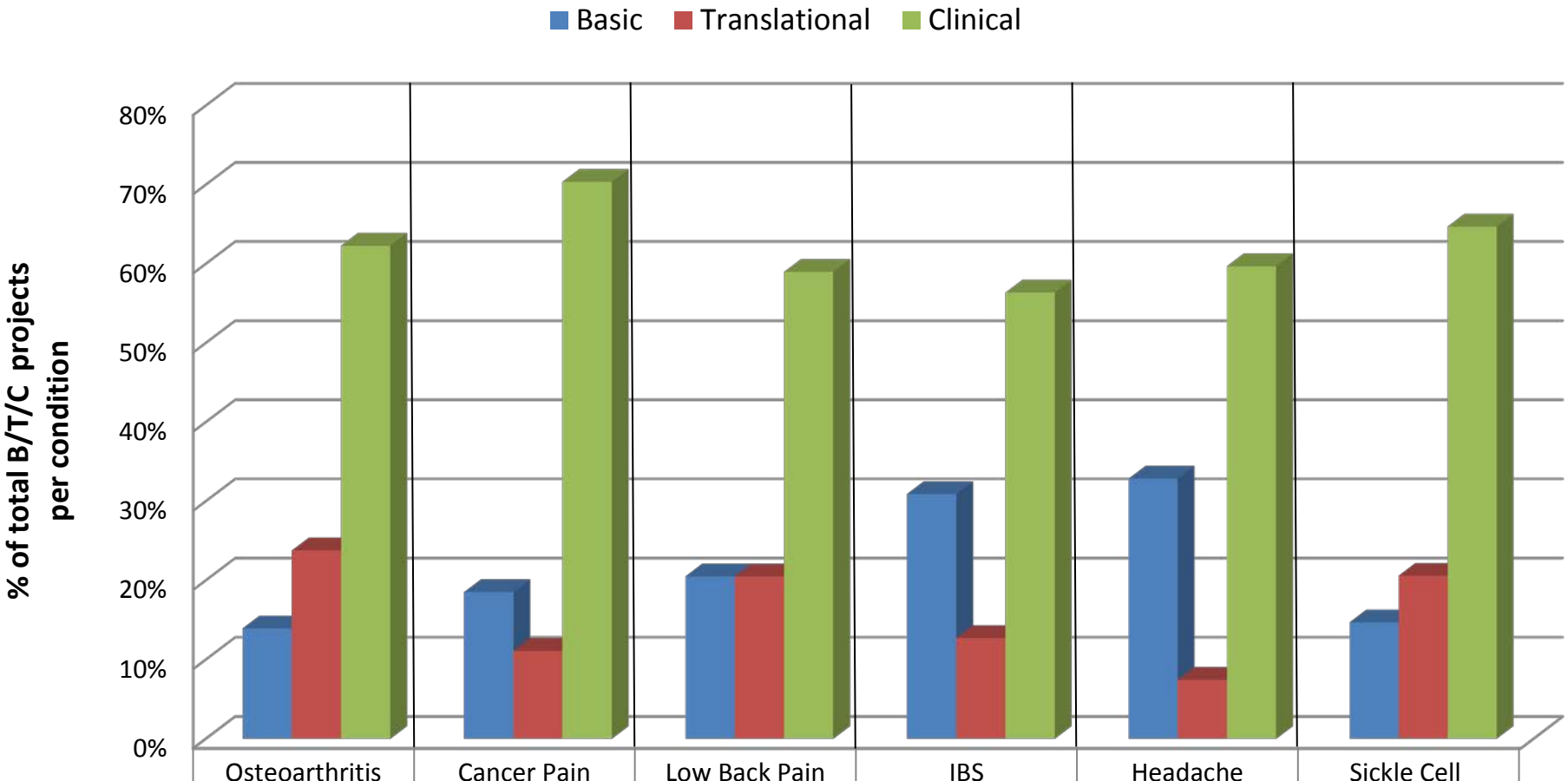
To compare number of projects in basic, translational or clinical research for each top condition



	Osteoarthritis	Cancer Pain	Low Back Pain	IBS	Headache	Sickle Cell Pain
Basic	17	15	16	17	22	5
Translational	29	9	16	7	5	7
Clinical	76	57	46	31	40	22
Total # grants	104	70	68	47	41	30

*Total # grants does not equal basic + translational + clinical because one grant can belong to more than one category

To compare basic, translational and clinical research *within* each top condition by percentage of total B/T/C projects



	Osteoarthritis	Cancer Pain	Low Back Pain	IBS	Headache	Sickle Cell
Basic	14%	19%	21%	31%	33%	15%
Translational	24%	11%	21%	13%	7%	21%
Clinical	62%	70%	59%	56%	60%	65%

Overview of the portfolio - 1

- Grants can be classified into five broad areas
  - Preclinical descriptive studies (n=9)
  - Clinical descriptive studies (n=7)
  - Preclinical intervention studies (n=4)
  - Clinical intervention studies (n=21)
  - Provider education studies (n=6)
- Preclinical descriptive studies (n=9)
  - Focused on evaluation of interactions between cancer cells and sensory neurons that result in algesic or inhibit analgesic responses
  - Models – bone pain, prostate cancer, pancreatic cancer, stromal cell environment
  - Mechanistic targets – chemokines, capsaicin, endocannabinoid signalling, vallinoid receptor

Overview of the portfolio - 2

- Clinical descriptive studies (n=7)
  - Five studies are focused on the elucidation of the biological basis for multiple symptoms in oncology patients
    - Inflammation or sickness behavior
    - Symptom cluster
    - Pain is one of many symptoms withing the clusters
  - Two studies are focused on optimizing PROs (one in adults, one in pediatrics)
- Preclinical intervention studies (n=4 on disparate topics)
  - Development of a spinal delivery system for gene therapy
  - Preclinical evaluation of a herbal treatment for cancer pain
  - Evaluation of cannabinoid CB2 agonists for bone pain
  - Evaluation of anti-NGF and TrkA blockers for bone pain

Overview of the portfolio - 3

- Clinical intervention studies (n=21)
  - Cancer pain specific intervention studies (n=5)
    - Ultrasound ablation for metastatic bone cancer
    - Botulinum toxin for painful cutaneous leiomyomas
    - Biobehavioral interventions to improve cancer pain management (n=3)
- Intervention studies for multiple symptoms in oncology patients (n=8)
  - Reduce inflammatory mediators
  - Pain is one of many symptoms being evaluated
- Multiple symptoms and/or end of life outcomes (n=8)
  - Main focus is on the provision of palliative care services
- Note – only one intervention study in pediatrics, elderly, cancer survivors, family caregivers

Overview of the portfolio - 4

- Provider education studies (n=6)
  - Four grants focused on palliative care education (3 adults, 1 pediatrics)
  - One grant focused on education of social workers on the psychosocial health needs of pediatric and adult oncology patients
  - One grant is focused on the development of a multimedia training program to teach cognitive behavioral approaches for pain management to providers who care for Native American communities

Highlights of the portfolio

- Highly innovative areas that have the potential to advance the field
  - Development of preclinical models of cancer pain
    - Bone pain
    - Pancreatic pain
    - Oral cancer pain
  - Cancer cell and sensory neuron interactions
  - Elucidation of mechanisms for multiple symptoms in oncology patients

Relevance to other pain conditions and opportunities to collaborate

- Preclinical studies
  - Do cancer pain mechanisms provide insights for other pain conditions?
  - Behavioral models can be used in other pain conditions
- Clinical studies
  - Biological basis of symptom clusters may apply to other chronic medical conditions
  - Biobehavioral interventions that are effective in cancer pain management may be useful in other chronic pain conditions

Potential overlap or shared interests among agencies or NIH institutes

- Cancer cell – sensory neuron interactions
- Symptom clusters in oncology patients
- Provision of palliative care services
  - "Lessons learned" from this initiative in how to stimulate research in other areas

Gaps & Opportunities: Research areas needed or untapped

- Analysis of secondary codes
  - 24 of 29 areas = 0
  - Maximum percentage was 14% for unique populations

% of projects in a secondary code within top condition	Top Conditions					
Secondary Code	OA	Cancer	LBP	IBS	HA	SICKLE
1. Neurobiological/glial mechanisms of nociception and pain:	8%	12%	6%	19%	16%	9%
2. Genetics and genomics of nociception and pain:	1%	3%	0%	4%	3%	7%
3-Other "omics" of pain:	5%	1%	1%	5%	0%	2%
4. Mechanisms of and treatments for transitions in pain phases:	3%	2%	4%	5%	6%	0%
5. Development and validation of animal and human pain models:	1%	4%	4%	10%	11%	9%
6. Diagnosis/case definitions:	14%	0%	2%	0%	4%	2%
7. Pharmacological mechanisms and treatment:	4%	12%	3%	2%	5%	7%
8. Non-pharmacological mechanisms and treatment:	28%	12%	26%	5%	4%	4%
9. Biobehavioral and psychosocial mechanisms and treatment of pain:	7%	8%	13%	10%	3%	4%
10. Medical management of pain	0%	4%	3%	1%	0%	7%
a. Self management approaches (subcategories are all set to zero)	0%	0%	0%	0%	0%	0%
b. Team based treatment approaches	0%	0%	0%	0%	0%	0%
11. Analgesic development:	0%	0%	0%	0%	0%	4%
12. Development of device and therapy delivery systems:	1%	2%	0%	0%	1%	4%
13. Pain outcomes assessments and measures, and novel health information technology as tools for decision making support of pain management:	6%	2%	9%	5%	5%	13%
14. Development of informatics, data bases, and information technologies as tools for pain research:	1%	0%	3%	1%	0%	0%
15. Pain education	5%	11%	0%	0%	0%	5%
a. Health care provider education (subcategories are all set to zero)	0%	0%	0%	0%	0%	0%
b. Caregiver education	0%	0%	0%	0%	0%	0%
c. Patient education	0%	0%	0%	0%	0%	0%
d. Public education	0%	0%	0%	0%	0%	0%
16. Epidemiology of pain and pain disorders:	1%	1%	1%	2%	4%	0%
17. Health disparities in pain, pain management, and access to care:	1%	5%	0%	0%	0%	11%
18. Pain and women's and minority's health research	0%	2%	1%	4%	4%	7%
a. women (subcategories are all set to zero)	0%	0%	0%	0%	0%	0%
b. minorities	0%	0%	0%	0%	0%	0%
19. Unique populations	8%	14%	4%	5%	6%	0%
a. Pediatric (subcategories are all set to zero)	0%	0%	0%	0%	0%	0%
b. Elderly	0%	0%	0%	0%	0%	0%
c. end of life	0%	0%	0%	0%	0%	0%
d. Disabled	0%	0%	0%	0%	0%	0%
e. military	0%	0%	0%	0%	0%	0%
20. Sex and gender differences in pain	1%	0%	2%	3%	3%	0%
a. Male (subcategories are all set to zero)	0%	0%	0%	0%	0%	0%
b. female	0%	0%	0%	0%	0%	0%
21. Comparative effectiveness research:	0%	1%	8%	1%	3%	0%
22. Pain and substance use and abuse/addiction	0%	0%	1%	0%	0%	0%
23. Analgesic drug safety	0%	0%	0%	1%	0%	0%
24. Pain and trauma	1%	0%	0%	0%	0%	0%
25. Pain prevention	5%	1%	3%	2%	1%	0%
26. Chronic overlapping pain conditions in an individual	0%	0%	0%	1%	1%	0%
27. Pain and other non-pain comorbidities	1%	1%	1%	1%	9%	2%
28. Training in pain research	2%	2%	3%	9%	13%	4%
29. Health care utilization	0%	0%	3%	0%	0%	2%
	100%	100%	100%	100%	100%	100%

Gaps & Opportunities: Research areas needed or untapped

- Development of additional preclinical models
  - Post-surgical persistent pain
  - Mucositis
  - Musculoskeletal pain associated with AIs
- Appropriate animal models for cancer pain (i.e., with or without cancer)
- Detailed phenotyping and genotyping of common cancer pain syndromes
- Evaluation of how persistent pain impacts patients' treatment and survival (e.g. adherence, dose reductions)

Gaps & Opportunities: Research areas needed or untapped

- Evaluation of the impact of persistent pain on cancer survivors (adults and children)
- Impact of transitions in cancer care (e.g., from oncologist to primary care) on pain management
- Development of new mechanistically-based analgesics
- Studies of cancer pain in special populations (e.g., pediatrics, elderly, ethnically diverse patients, survivors)