

# Incidence, Duration, Costs and Deaths from Chemoradiation Toxic Mucositis in the USA: Health economic outcome of current anti-mucositis regimens



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## INTRODUCTION

### The Problem

There are no oncology-wide estimates of the incidence, duration, costs and deaths associated with toxic mucositis caused by chemoradiation treatment.

### Background

Chemoradiation toxic mucositis (CRTM) affecting the oropharynx, esophagus and distal GI tract is an urgent medical condition disrupting self-alimentation, nutrition and survival of cancer treatment patients. Three treatment modalities that give rise to CRTM - chemotherapy, radiation & human stem cell transplantation, but fragmented US health care system impede direct approximation of burden.

### Aims

Estimate the oncology-wide burden of toxic mucositis in cancer patients. Qualitative comparison of health economic outcome of 7 FDA approved anti-mucositis agents

## APPROACH & METHODS

### ► Approach to Task of Approximating US CRTM Burden

- There are three factors contributing to the incidence, severity and deaths of CRTM:
  - (1) treatment intent of practitioner - curative vs palliative
  - (2) dosing and combination of modalities used to accomplish intent
  - (3) tumor type, anatomical location and overall encumbrance (local vs metastatic)
- Treatment intent is a binary decision - curative vs palliative. However assortment of presentations in tumor type, location and grading, creates a complex range of dosing & treatment combinations each with a distinct burden of CRTM.
- Unplanned treatment breaks => Reduced dose density => Reduced 5 year survival (14)

### ► Methods used to Approximate

- Accept HSCT data as representative of all HSCT Burden (15,16)
- Accept data from myelosuppressive chemo as representative of all chemotherapeutic burden (17)
- Accept data from head neck cancer patients as representative of all radiation therapy burden (18,19)
- Use published insurance actuarial data on chemotherapy to extrapolate hospital-based CRTM burden to all individuals newly diagnosed with cancer (10,19)

### Method Disadvantages

- Underestimation of true CRTM burden
- Imprecise

### Method Advantages

- US-wide Estimation of CRTM burden
- Oncology-wide scope of CRTM
- Provide Outcome measures to benchmark FDA Approved Agents

## RESULTS

### Duration in Days

Treatment Modality	Mucositis Days	Percent Patients with CRTM	References
Chemo-radiation and HSCT	ASSUMED 14-28 days	100%	NCI & Payer Policy Statements (15)
<b>ACTUAL</b>			
Myeloablative HSCT	46 - 60 days	1.6%	Stiff et al (14); Kushner et al (15)
Radiation +/- Chemotherapy	70 - 84 days	14.8%	Elting et al (16,17)
Multi-Cycle Chemotherapy	68 -102 days	84.6%	Chi et al (18)

### Incidence, Costs and Deaths

Modality	Total Patients	Toxic Mucositis	Incremental Costs	Premature Deaths
Chemotherapy	442,061	163,563 (37%)	\$2.900 Billion (1)	38,881 (23.8%)
Radiation HNC	59,230	52,230 (89%)	\$0.755 Billion (8,19)	5,809 (11%)
Human SCT	20,875	18,266 (88%)	\$0.644 Billion (16,19)	2,009 (11%)
<b>Totals</b>	<b>522,166</b>	<b>234,059 (44.8%)</b>	<b>\$4.299 Billion</b>	<b>46,699 (19.9%)</b>

### Additional Incidence & Costs: CINV & CID

Toxic Mucositis GI Tract	Total Patients	Toxic Mucositis	Incremental Costs
Chemo Induced Nausea Vomiting (CINV)	442,061	287,339 (65%)	\$6.93 billion (28-22)
Chemo Induced Diarrhea (CID)	442,061	221,031 (50%)	\$1.46 billion (23-27)
<b>Totals Affected by CINV and CID</b>	<b>442,061</b>	<b>375,753 (85%)</b>	<b>\$8.39 billion</b>

## Annual Recurring Oncology-wide Toxic Mucositis Burden

- 1.6 million Diagnosed with Cancer
- 522,166 undergo Chemoradiation
- 44.8% (234,059) develop Toxic Mucositis
  - Lasts 60, 84, 102 days depending on cancer therapy
  - Costing \$4.299 billion dollars
  - Associated CINV/CID Costs of \$8.39 billion
  - Resulting in 46,699 deaths (20% of all CRTM)

## Health Economic Benchmarks

↓  
Decrease Morbidity  
Decrease Costs  
Eliminate Premature Deaths  
to achieve meaningful benefit

## A New Standard for Mucositis

### PROTHELIAL HIGH POTENCY POLYMERIZED CROSS LINKED SUCRALFATE

### Complete Prevention (28,29,30)

### Rapid Elimination (2-3 days)

### Sustained Elimination throughout chemoradiation

FDA Approved Therapy	Rapid Reversal Grade 1-4	Sustained Elimination Grade 1-4 during Chemoradiation	Prevention Grade 1, 2 Mucositis	Prevention Grade 3, 4 Mucositis	GI Mucositis	Patient Population
MuGard Oral Rinse (15k, 062795; HPCPS 46270)	No Reversal Only Fractional Pain Attenuation	No Sustained Elimination Fractional Pain Attenuation	None	None	Yes	No Adult/Pediatric
Gelclair Oral Rinse (15k, 013026; HPCPS 46270)	No Reversal Only Fractional Pain Attenuation	No Sustained Elimination Fractional Pain Attenuation	None	None	Yes	No Adult/Pediatric
Capthosol Oral Rinse (15k, 030602; HPCPS 49155)	No Reversal Only Fractional Pain Attenuation	No Sustained Elimination Fractional Pain Attenuation	None	None	Yes	No Adult/Pediatric
Epiall Oral Rinse (15k, 101769; HPCPS none)	No Reversal Only Fractional Pain Attenuation	No Sustained Elimination Fractional Pain Attenuation	None	None	Yes	No Adult/Pediatric
LLLT Low Level Laser Treatment (15k, 020657, 510k, 04159; HPCPS 58948)	Mild Reversal Moderate Pain Attenuation	Mild Sustained Elimination Moderate Pain Attenuation	None	10%	Yes	No Adult/Pediatric
Pallermis (15k, 066518-03; HPCPS 42425)	No Reversal No Pain Attenuation	Moderate Sustained Elimination Grade 3-4	None	45%	Yes	No Adult
ProThelial Oral Paste (15k, 123904; HPCPS 34940)	<b>Complete Reversal &amp; Pain Elimination in 12,300 doses</b>	<b>Complete Reversal &amp; Pain Elimination in 12,300 doses</b>	-100%	-100%	Yes	Yes Adult / Pediatric

## CONCLUSIONS

Using Insurance actuarial data and published literature an Oncology-wide estimate can be approximated

- Each year at least 234,059 develop CRTM
- Each year at insurers pay at least \$4.299 billion to treat CRTM
- Each year there are at least 46,699 mucositis associated deaths
- ProThelial is the only FDA approved therapy with meaningful health economic outcomes
  - reduced morbidity
  - reduced costs
  - reduced risk of premature mucositis-associated deaths

## References

- Elting LS et al. Cancer 2003; 98:1531-1539.
- Footo M. The Oncologist 1998; 3:3675-368
- Russo G et al. The Oncologist 2008; 13:846-898
- Herrmann T et al. Strahlenther Onkol 1994; 170:545-549.
- Center for International Blood and Marrow Transplant Research. 2014 Report
- Gratwohl A et al. Bone Marrow Transpl 2005; 36:757-769 ;
- Trotti A et al. Radiother Oncol 2003; 66:253-262.
- Elting LS et al. Int J Radiat Oncol Bio Phys 2007; 68(4): 1110-1120
- Surveillance, Epidemiology, and End Results (SEER) Program. Cancer Facts & Figures 2015.
- Hayes J et al. Amer J Manag Care 2015; 21(3): e189-e196
- Kolodziej M et al. J Oncol Pract 2011; 7(9):301-306
- National Cancer Institute at the National Institutes of Health. April 2014
- Stiff PJ, et al. J Clin Oncol 2006; 24:5186-5193
- Kushner JA et al. J Can Dent Assoc 2008; 74(1): 59a-59j
- Elting LS et al. Cancer 2008; 113:2704-13
- Elting LS et al. Biol Blood Marrow Transpl, 2007; 13:806-813.
- Chih KH et al. J Clin Oncol 1995; 13(10): 2620-2628.
- Nonzee NJ et al. Cancer 2008; 113(6):1446-1452.
- Sonis ST et al. J Clin Oncol. 2001;19(8):2201-5
- Craver C et al. J Med Econ. 2011;14(1):87-98.
- Burke TA et al. Support Care Cancer. 2011;19(1):131-40.]
- Escobar Y et al. Support Care Cancer. 2015; 23:2833-2840
- Kornblau S et al. J Pain Symptom Manage 2000; 19:118-129.
- Stein A et al. Ther Adv Med Oncol (2010) 2(1) 51-63.
- Elting LS et al. Support Care Cancer 2004;12:219-226
- Dranitsaris GI et al. Support Care Cancer 2005; 13: 318-324
- Dranitsaris GI et al. Can J Gastroenterol. 2005; 19(2):83-7
- McCullough RW. Support Care Cancer 2015; 23(suppl 1):S114-115
- McCullough RW. Brit J Med Res 2015; 10(2): 1-17
- McCullough RW. Eur J Oncol Pharm 2015; 9(2): 1-11