

Forecasting Denosumab

Tony Lim

Introduction

Executive Summary



Denosumab

- Fully human monoclonal antibody by Amgen
- Originally designed to treat osteoporosis
 - Launched as Prolia
 - 60 mg dose injection every six months
- Later used in oncology (to prevent and treat bone metastases)
 - Launched as Xgeva
 - 120 mg dose injection every four weeks

Key Issues



Market Analysis

- What are the current treatments on market for osteoporosis and bone metastases?
- How does denosumab compare to its competitors?



Demand/Revenue Forecasting

- How do we accurately calculate the expected demand for denosumab?
- What is the expected revenue from sales?

Osteoporosis Market Overview

Treatment Option	Company	Launch Date	Description	Frequency	Sales
Exercise	—	—	<ul style="list-style-type: none"> Slows the progress of bone erosion Most important exercises: walking, jogging, stair climbing, weight lifting 		—
Dietary supplements	—	—	<ul style="list-style-type: none"> Calcium and vitamin D supplements 	Once-daily ¹	—
Bisphosphonates					
Fosamax (alendronate)	Merck	1995	<ul style="list-style-type: none"> Taken orally in the morning and then fast and remain upright for 30-60 minutes Positive trial results when compared to placebo 	Once-daily Once-a-week (2010)	\$3.1B global sales by 2006
Actonel (risedronate)	Procter & Gamble Sold to Warner Chilcott in 2009	2000	<ul style="list-style-type: none"> Similar to Fosamax in efficacy and safety and comparable in trial results 	Once-daily Once-weekly (most took weekly)	\$1.4B global sales for FY June 20, 2009
Boniva (ibandronate)	Partnership between Roche and GlaxoSmithKline (GSK)	2003	<ul style="list-style-type: none"> Aggressively used DTC marketing along with physician detailing 	Once-daily Monthly (2005)	\$600M U.S. sales in 2008
Reclast (zoledronic acid)	Novartis	2007	<ul style="list-style-type: none"> Fifteen-minute infusion at specialized infusion center Only FDA-approved once-per-year product for post-menopausal osteoporosis In clinical studies, shown to be more effective than oral bisphosphonates 	Once-per-year Once-per-two-years (2009)	\$579M U.S. sales in 2010
Evista (raloxifene)	Eli Lilly	1999	<ul style="list-style-type: none"> Selective estrogen receptor modulator (SERM) Tablet form Side effects (clots and strokes) 	Once-daily	> \$1B global sales in 2009 \$682M U.S. sales in 2009
Forteo (teriparatide)	Eli Lilly	2002	<ul style="list-style-type: none"> Synthetic parathyroid Patients self-administered injection Physicians sometimes used in conjunction with bisphosphonate Side effects (cancer) Patients can't remain on drug for more than 2 years 	Daily	\$817M global sales in 2009 \$518M U.S. sales in 2009
Prolia (denosumab)	Amgen	2010	<ul style="list-style-type: none"> First biologic product approved for osteoporosis RANK ligand inhibitor Injection 	Once-per-six-months	N/A

Osteoporosis Market Assessment



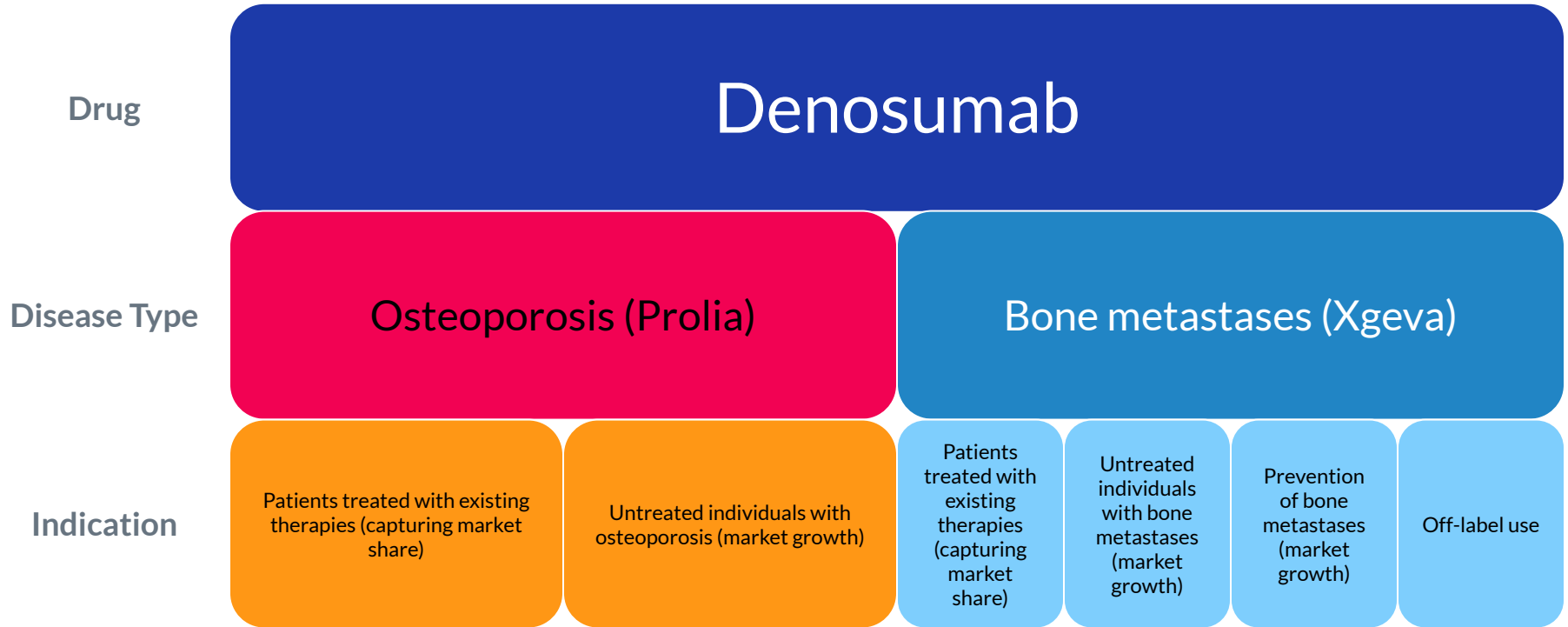
Bone Metastases Market Overview

Treatment Option	Company	Launch Date	Description	Frequency	Sales
Zometa (zoledronic acid)	Novartis	2001	<ul style="list-style-type: none"> • Bisphosphonate infusion (15 minute procedure, longer for nurses) • Physicians considered it the standard of care for patients with bone metastasis • > 100 clinical trials with positive results • \$840/dose • \$10,900/year if given every four weeks 	4 mg dose every three to four weeks	\$1.5B global sales in 2010 \$800M U.S. sales
Xgeva (denosumab)	Amgen	2010	<ul style="list-style-type: none"> • Injection • Two studies showed Xgeva was superior to Zometa in patients with advanced breast cancer and advanced prostate cancer in delaying SREs • \$1,650/month • \$19,800/year 	120 mg dose every four weeks	N/A

Bone Metastases Market Assessment



Multi-Level Segmentation



Product, Price, and Place

	Product	Price	Place
Prolia	<ul style="list-style-type: none">• 60 mg dose injection every six months• New mechanism of action (RANK ligand inhibitor)• More efficacious compared to placebo (Study 216) and to Fosamax (Study 234)	<ul style="list-style-type: none">• \$825/injection• \$1,650/year	<ul style="list-style-type: none">• PCPs' office<ul style="list-style-type: none">◦ "Buy and bill" model◦ Purchase and maintain inventory• Specialists' office
Xgeva	<ul style="list-style-type: none">• 120 mg dose injection every four weeks• Superior to Zometa when looking at patients with advanced breast cancer and advanced prostate cancer	<ul style="list-style-type: none">• \$1,650/month• \$19,800/year	<ul style="list-style-type: none">• Oncologists' office• Urologists' office

Competitive Assessment - Prolia

Points of Parity

FDA-approved

Improves bone health

Points of Differentiation

Different mechanism of action (blocked the activation of osteoclast cells)

Prolia is the first and only RANK ligand inhibitor approved by FDA

Bone mineral density (BMD) increase with denosumab statistically superior compared to placebo (Study 216) or Fosamax (Study 234)

Patients prefer the six-month injection for denosumab compared to weekly pills for Fosamax (Study 141)

Competitive Assessment - Xgeva

Points of Parity

FDA-approved

Reduce the risk of skeletal-related events (SREs)

Delivery every four weeks

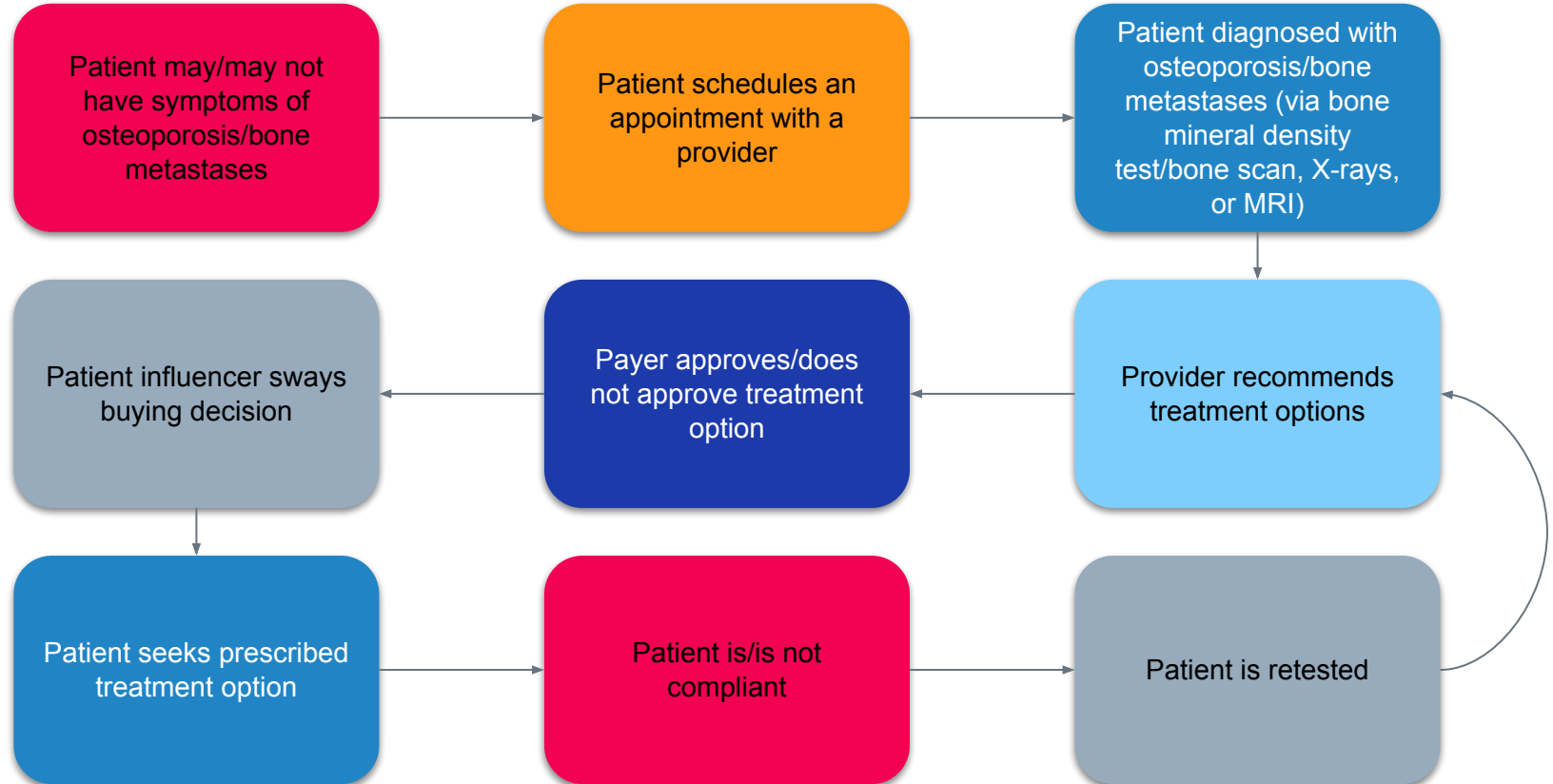
Points of Differentiation

Xgeva superior to Zometa in patients with advanced breast cancer and advanced prostate cancer in delaying SREs

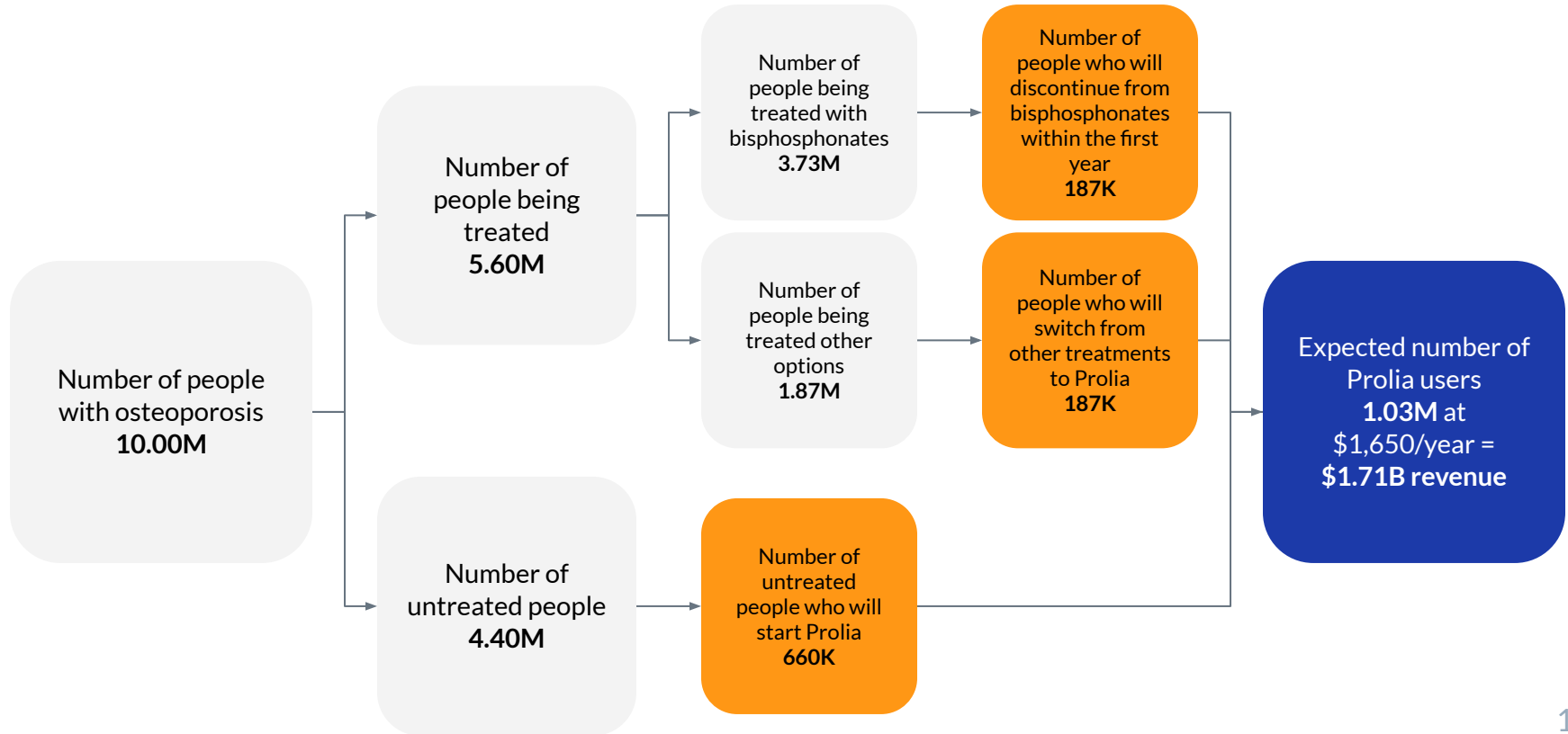
Different drug delivery process (infusion vs. injection)

Xgeva less time intensive (delivery process for Zometa takes at least 15 minutes)

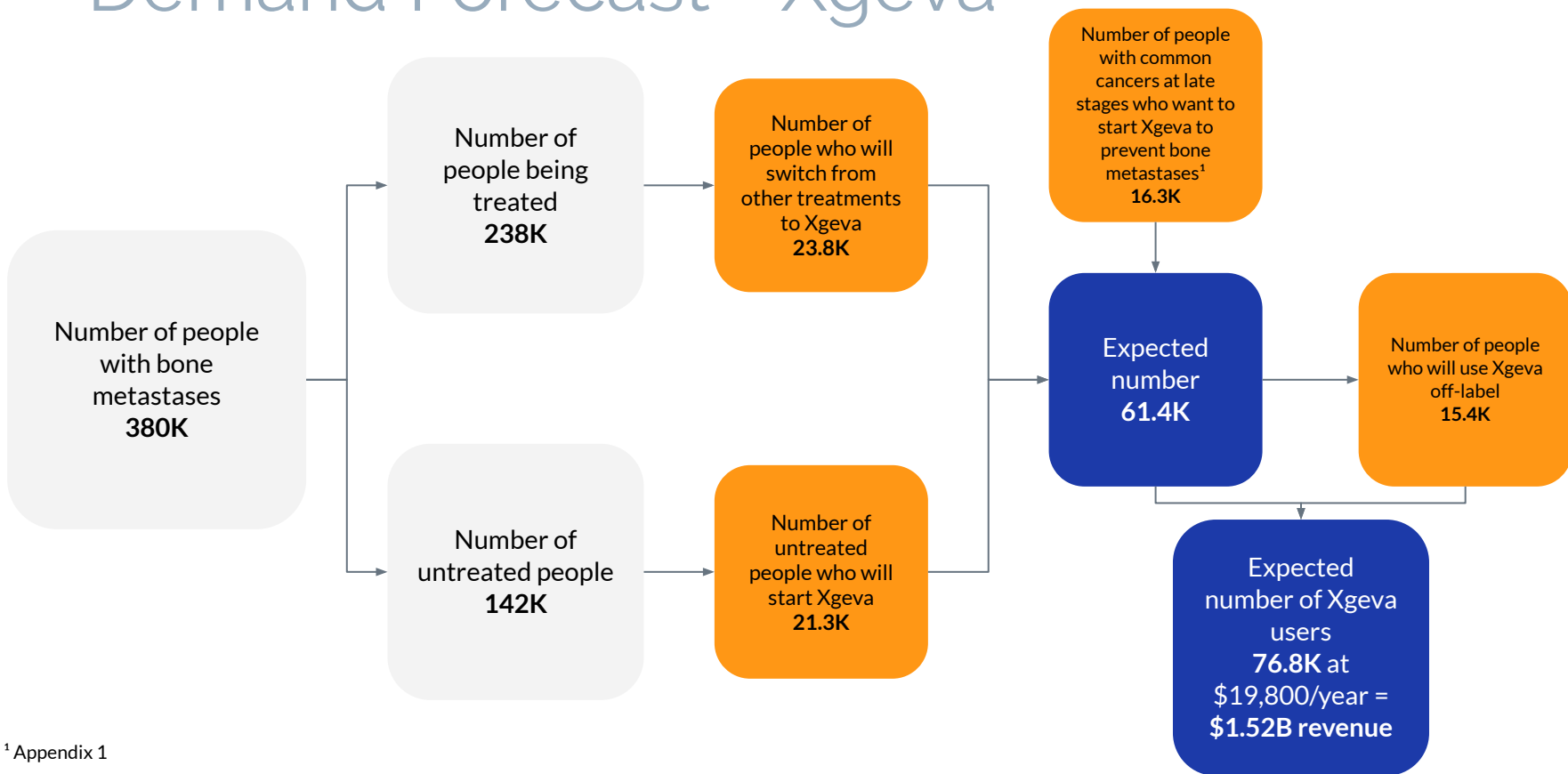
Buying Process



Demand Forecast - Prolia



Demand Forecast - Xgeva



Sensitivity Analysis

	Worst	Base	Best
Prolia	627K expected number of Prolia users \$1.03B expected revenue	1.03M expected number of Prolia users \$1.71B expected revenue	1.44M expected number of Prolia users \$2.38B expected revenue
Xgeva	41.1K expected number of Xgeva users \$814M expected revenue	76.8K expected number of Xgeva users \$1.52B expected revenue	115K expected number of Xgeva users \$2.28B expected revenue
Total	668K expected number of denosumab users \$1.85B expected revenue	1.11M expected number of denosumab users \$3.23B expected revenue	1.56M expected number of denosumab users \$4.66B expected revenue

Summary

By segmenting by disease type and indication, Amgen taps into both the osteoporosis market and the bone metastases market.

Although there have been successful treatment options in both markets, denosumab has unique points of differentiation which will allow it to succeed.

In a base-case scenario for 2015, Amgen can expect a total of **1.11M denosumab users**, generating an expected revenue of **\$3.23B**.

Appendix

Appendix 1: Number of people with common cancers at late stages

Number of people diagnosed with prostate cancer	217,730	
Number of people living with distant prostate cancer	17,201	7.9%
Number of people diagnosed with breast cancer	209,060	
Number of people living with regional/distant breast cancer	3,136	1.5%
Number of people diagnosed with lung cancer	222,520	
Number of people diagnosed with Stage III/IV lung cancer	142,858	64.2%
Total number of people diagnosed with the most common cancers at later stages	163,194	
Number of people with common cancers at late stages who want to start Xgeva to prevent bone metastases	16,319	10.0%