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A BUNDLED PAYMENT PROFILE FOR HEAD & NECK CANCER: DESCRIPTIVE STATISTICS, RISK ASSESSMENT, AND PRICING RECOMMENDATIONS FOR 1 YEAR TREATMENT BUNDLES USING A LARGE NATIONAL CLAIMS DATABASE

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by

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Alexis Barboza Guzman, BS, MBA, PhD
2019

DEDICATION

To my parents, husband, and daughter

A BUNDLED PAYMENT PROFILE FOR HEAD & NECK CANCER: DESCRIPTIVE STATISTICS,
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Presented to the Faculty of The University of Texas

School of Public Health

in Partial Fulfillment

of the Requirements

for the Degree of

DOCTOR OF PHILOSOPHY

THE UNIVERSITY OF TEXAS
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Houston, Texas
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PREFACE

This dissertation was motivated by the rising cost of cancer care and my previous bundled payment work at the University of Texas MD Anderson Cancer Center. I hope to use what I have learned through this experience to continue to improve cancer care access to all seeking life-saving treatment.

I would like to express my deepest appreciation to my committee chair Professor Frances Lee Revere. Without her guidance and support, this dissertation would not have been possible. I would like to thank my committee members, Professor Osama Mikhail and Jose-Miguel Yamal for helping provide critical feedback that helped improve my methodology and discussion. A special thanks to my external committee member, Yu-ting Huang, for all your support over the years.

Thank you to all my mentors, colleagues, graduate students, research collaborators, family and friends for their continuous guidance and support. I have benefited tremendously from our healthcare discussions. Lastly, a special thanks to Dr. Thomas Feeley for the opportunities to learn and advance the value agenda in healthcare.

ACKNOWLEDGEMENTS

To my parents, who have been a great source love and support, thank you for raising me to be the woman I am today. Your dedication and sacrifice inspires me to always follow my dreams. I hope I make you proud each and every day.

To my dear husband, thank you for your love and support. You show me dreams can come true. I love you to the moon and back.

To my daughter Julia, you are my happiness and life's purpose. I thank God for picking me to be your mother.

To my brothers, family, and friends, you have given me a lifetime of love, laughter, and support. Thank you for enriching my life.

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Bundled payments have the opportunity to promote care standardization and coordination while incentivizing efficiency and value-based healthcare delivery. However, bundled payments have been scrutinized due to challenges with defining the bundled lengths (also known as the episode of care period), limited inclusion/exclusion criteria, the absence of IT systems to support new payment models, and the lack of federal support. The objective of this study was to develop a profile for head and neck cancer, including descriptive statistics, risk assessment and bundled payment pricing recommendations using a large national claims database. The ability to assess pricing risks associated with head and neck cancer bundled payments across the US from a large claims database can provide evidence to either support or discredit the feasibility of bundled payment reform.

The results of the study highlighted the total episode costs for head and neck cancer from start of treatment and a transparent bundled payment methodology. The results are as follows: 1) head and neck episode cancer costs on average \$164,332 with

a standard deviation of \$106,500, and median episode costs of \$143,806; 2) bundled payments were developed using a complete-linked hierarchical clustering analysis of 2 possible bundling approaches of either 3 bundled payment groups or 4 bundled payment groups; 3) a monte carlo simulation resulted in recommendations that pricing negotiations not start at the 50th percentile of the bundled payment group cost as suggested by previous studies but rather at the 75th percentile; 4) study aims were summarized and displayed in a visual framework to provide a practical 'how-to guide' for organizations looking to start modeling bundled payments.

This analysis proves bundled payment grouping is feasible and viability, albeit dependent on an organization's ability to control healthcare spending costs and negotiate bundled payment prices above costs. The results of this work demonstrate the use of statistical and financial models to support price models and sensitivity analyses. Healthcare leaders can use these models to better understand their expected costs/ profits and leverage their negotiations; however, it should be noted that this research does not suggest all bundled payment methodologies are profitable.

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IV. BACKGROUND

Bundled Payments in the US

In November 2018, US Secretary of Health and Human Services (HHS), Alex M. Azar II, identified value-based transformation as a top priority in Value Based Care and mandatory participation in episode-based bundling in radiation oncology (CMS, 2018). Several years prior, past former US Secretary of the HHS, Sylvia Burwell, launched an alternative payment initiative and set a goal of having 30% of all Medicare provider payments as alternative payments or bundled payments by 2016, and 50% of all Medicare payments in alternative payment models by 2018 (Burwell, 2015). More recently, former US Secretary of the HHS, Tom Price, cancelled and delayed the previously proposed expansion of bundled payments program in an effort to test new innovative models across in-patient and acute care settings (Centers of Medicare and Medicaid, 2017). Bundled payments are supported by some patient advocacy groups which are urging the Centers of Medicare and Medicaid Services (CMS) to require bundled price transparency. This will reflect the total cost of care for proposed services rather than the price per unit or Diagnosis Related Group (DRG) price. A bundled payment for the total episode of care – based on services or length of stay or time – will help patients determine their out of pocket financial responsibility. For the purposes of this study, the definition of a bundled payment in cancer care is a single comprehensive payment made for all services during a pre-defined episode of care, regardless of the actual services utilized (Centers for Medicare and Medicaid Innovation, 2017).

Bundled payments have the opportunity to promote care standardization and coordination while incentivizing efficiency and value-based healthcare delivery (Kaplan

& Porter, 2011; Porter & Lee, 2013). However, bundled payments have been scrutinized due to challenges with defining the bundled lengths (also known as the episode of care period), limited inclusion/exclusion criteria, and the absence of IT systems to support new payment models, and the lack of federal support. (Mechanic, 2011).

Bundled payments have been proposed as a more viable (alternative) payment system to existing Accountable Care Organizations (ACOs), Medical Homes, and Population-based payment models like capitations, because bundled payments tie “reimbursement to predictable costs of an episode of care, resulting in gains to providers if costs are lower than predicted, and losses if they are higher” (Abecassis, Jackson, & Walsh, 2015). Cost measurement and variability are essential for predicting the viability of bundled payments in oncology. Medicare cancer costs variability has been attributed to factors unrelated to patient characteristics- provider, hospital, and region cost differences (Paravati et al., 2015). These factors may be explained by inefficiencies in the system and may not be attributed to the patient. To build a case for widespread adoption of bundled payments in oncology, it is necessary to assess cost variation and risk across geographic regions.

Cancer Costs

The cost of cancer care in the U.S. is estimated to increase by 39% from 2010 to 2020 (Mariotto, Robin Yabroff, Shao, Feuer, & Brown, 2011). Policy makers have suggested alternative payment methods as a strategy for reducing the cost of cancer in the US, given the estimation of \$173 billion in health care costs attributable to cancer, in

2020. CMS has several federal programs targeting alternative and bundled payments in cancer care.

Cancer care is expensive and costs related to the disease feature as high cost in healthcare spending categories in the US (Basch, 2017). The 10 dedicated cancer centers in the US, known as the Alliance of Dedicated Cancer Centers (ADCC), are specialty hospitals dedicated to cancer treatment only. These hospitals provide multidisciplinary cancer care and champion access, advanced treatment discoveries, outcome measurement, and reimbursement models in cancer care. The ADCC are CMS Prospective Payment System exempt as they do not bill based on DRGs like the majority of other cancer treating hospitals. These dedicated cancer hospitals are often excluded from other reimbursement programs based on the DRG system as well. Bundled payments has been identified as a reimbursement strategy agnostic to the current payment system, further supporting why bundled payments could be a viable alternative payment model in cancer care.

The Oncology Care Model (OCM) and the Quality Payment Programs Alternative Payment Models (QPP- APMs) are CMS programs that are voluntary and small, localized efforts to test alternative payments and bundled payments in specific cancer disease sites. There are several bundled payment proposals being considered by the HHS. To further support federal policy efforts to reduce cancer care costs, private payers are now testing bundled payments faster and with lower risk than CMS programs (Newcomer, 2014). The literature review below provides a detailed description of the national and private payer bundled payment efforts across the US.

Literature Review

National Bundled Payment Efforts

The Oncology Care Model

The Oncology Care Model (OCM) was created by CMS to realign incentives and enforce value-driven oncology care; this model was authorized under Section 3021 of the Affordable Care Act (Centers for Medicare and Medicaid Innovation, 2017). The initiative was charged with developing episode based chemotherapy price bundles and quality measurement accountability. OCM started with 196 physician practices and 17 payer participants in 2016 and has since reduced to 176 physician practices and 11 payer participants in 2019. It aims to develop per-beneficiary-per-month and performance-based payments using clinical quality measures, communication and care coordination, patient centered experience and outcome measurement, and efficient and cost effective care transformations. Currently, one of the more notable activities, is the ongoing testing for price bundles for chemotherapy. The bundled episodes start at first administration of chemotherapy and ended six months after the start of the treatment. OCM has made headway in bundled payment development but participating institutions have expressed some opportunities for improvement (Thomas & Ward, 2016). Private payers have partnered with OCM to test bundled payments in the 65+ cancer population but no specific literature related to the program was found.

Quality Payment Program- Alternative Payment Models

The Medicare Access and CHIP Reauthorization Act (MACRA) of 2015 outlined a new Quality Payment Program (QPP) that allows providers to participate in either of two programs: the Alternative Payment Models (QPP-APP) or Merit-based Incentive

Payment System (QPP-MIPS). The QPP-APM has approximately 70,000 to 120,000 projected clinicians since 2017. The program allows providers to participate in bundled payments or ACOs for specific clinical conditions, disease sites, and/ or chronic conditions. The bundled payment program under QPP-MIPS is called Bundled Payments for Care Improvement Advancement Models (BPCI). BPCI consists of inpatient stay bundles, retrospective bundles, and comprehensive prospective bundles. The first phase of BPCI resulted in 90-day clinical bundle periods for 29 inpatient clinical episodes and three outpatient clinical episodes with bundled payments tied to quality measures. At the end of the first phase, there were a total of 1100 participants in the QPP-APM BPCI program, with 226 being financially rewarded and 874 who initiated the program (Centers of Medicare and Medicaid, 2018; Curtin, Russell, & Odum, 2017).

HHS Bundled Payment Proposals

The HHS Physician Focused Payment Model Technical Advisory Committee (PTAC) have received proposals to develop 1) Oncology Bundled Payment Programs using Cota Nodal Address (CNA) system-guided care (Physician Focused Payment Model Technical Advisory Committee, 2017); 2) comprehensive colonoscopy for colorectal cancer screening, diagnosis, and surveillance (HHS Physician-Focused Payment Model Technical Advisory Committee, 2016); 3) episodic payment for radiation oncology (A. C. of R. Oncology, 2016); 4) radiation oncology total cost of care (A. S. for R. Oncology, 2016); 5) and comprehensive cancer care delivery models (Alliance, 2017).

The Oncology Bundled Payment Program Using Cota Nodal Address (CNA)-Guided Care proposed a 12 month bundled payment episode based on historical 12 month average cost per cancer type with quality reporting for all medical, surgical, and

radiation oncologists at Hackensack Meridian Health in New Jersey (Physician Focused Payment Model Technical Advisory Committee, 2017). COTA Inc. developed and patented a CNA system to capture “digital expression of all attributes specific to the patient and their disease that affect clinical outcomes and total cost of care” (PFPMTAC, 2017). Using big data analysis, this system promises to identify and understand clinical variation for patients with the same CNA and subsequently reduce unnecessary variation. This proposal would further support CMS’ effort of value over volume and provide evidence for the feasibility of bundled payments in cancer care.

The ‘Digestive Health Network for a Comprehensive Colonoscopy Advanced Alternative Payment Model for Colorectal Cancer Screening, Diagnosis and Surveillance’ proposed a 12 month bundle to include all outpatient services for colorectal screening, diagnosis or surveillance (HHS Physician-Focused Payment Model Technical Advisory Committee, 2016). The impact of this proposal, if expanded to scale, could impact over 11,500 gastroenterologists, 3,500 colorectal surgeons, 6,000 endoscopic surgeons, and thousands of other general surgeons, anesthesiologists, certified registered nurse anesthetists, pathologists, and primary care physicians. The Comprehensive Colonoscopy proposal was adapted from a previous retrospective upside-only risk model by Horizon Blue Cross Blue Shield of New Jersey; it’s especially notable this model allows single providers and small practices to participate. The proposal was later withdrawn.

Two radiation oncology bundled payment proposals were submitted in 2016. The American College of Radiation Oncology (ACRO) letter of intent proposed three-

month radiation treatment bundles for 15 primary disease groups(A. C. of R. Oncology, 2016). The American Society of Radiation Oncology (ASTRO) submitted the more comprehensive of the two bundles. ASTRO proposed a radiation oncology total cost of care Physician Focused Payment Model. The episode starts from treatment planning and ends 90-days after the last radiation therapy treatment. (A. S. for R. Oncology, 2016). This comprehensive bundle was later referenced by HHS secretary Azar in 2018 as a model for future mandatory models in radiation oncology. (CMS, 2018).

The Community of Oncology Alliance (COA) proposed an End of Life bundled payment program in 2017 called The Comprehensive Cancer Care Delivery Model. The bundled payment program is initiated by treatment and is followed through survivorship and/or end-of-life care(Alliance, 2017). To accelerate value-driven oncology care, further demonstrations of bundled payment methodologies and risk assessments need to be analyzed across payers, geographic regions and different types of cancers.

A summary of all Medicare and HHS bundled payment proposals are summarized below in Table 1 with program overview, participants, and bundled definition.

Table 1: CMS Bundled Payment Programs and HHS PTAC Bundled Payment Proposals

<u>Agency/ Organization/ Hospital</u>	<u>Program Name</u>	<u>Program Years</u>	<u>No. of Participants</u>	<u>Bundle Definition</u>
CMS	Oncology Care model (OCM)	2016-2021	196 practices and 17 payers	Chemotherapy 6 month bundles starting on date of first chemo administration
CMS	Quality Payment Program-Alternative Payment	2017-2019	1100 participants, 226 awardees	Model 1: Inpatient Stay in acute care hospitals Model 2 & 3: retrospective bundled payment

	Models (QPP-APM) Bundled Payments for Care Improvement Advanced Models (BPCI)		and 874 episode initiators	Model 4: Comprehensive prospective bundled payments
COTA + Hackensack Meridian Health	Oncology Bundled Payment Program Using CNA-Guided Care	2017 pilot	0	Medical, surgical, and radiation oncologists at Hackensack Meridian Health; 12 month bundle period based on historical 12 month average cost per cancer type with quality reporting
Digestive Health Network	Comprehensive Colonoscopy Advanced Alternative Payment Model for Colorectal Cancer Screening, Diagnosis and Surveillance	Proposal Withdrawn	0	12 month bundle including all outpatient services for colorectal screening, diagnosis or surveillance
ACRO	Episodic Payments for Radiation Oncology	Letter of intent submitted 2016	0	3 month radiation treatment bundle for 15 primary disease groups
ASTRO	Radiation Oncology Total Cost of Care Physician Focused Payment Model	Letter of intent submitted 2016	0	Bundle starts at treatment planning and ends 90-days after last radiation therapy treatment
COA	Comprehensive Cancer Care Delivery Model	Letter of intent submitted 2017	0	Starts with treatment followed through survivorship and/or end-of-life care.

Private Payer Bundled Payment Programs

In an effort to support national policy efforts around bundled payments and to understand the financial risks associated with the same, private payers have launched

their own bundled payment programs in cancer care(Newcomer, Gould, Page, Donelan, & Perkins, 2014). For example, Horizon Blue Cross Blue Shield of New Jersey, Anthem Blue Cross of California, and UnitedHealthcare have all launched oncology bundled payment programs before a Medicare mandate was released. Horizon Blue Cross Blue Shield of New Jersey started testing bundled payments under their Episode-of-Care Payment program in 2014 (Butcher, 2017). The program is designed to create an innovative care model that promotes multiple stakeholder care teams with high-quality care, outcomes driven, and cost transparent goals. The program currently focuses on breast and prostate cancer. The breast program has 94 New Jersey providers while the prostate program has over 100 New Jersey providers participating in the program(Butcher, 2017). All claims related to these two disease sites are being migrated from fee-for-service to alternative payments. No published data about the number of patients or results was found in the literature.

In 2016, Anthem Blue Cross of California widely published its first bundled payment program in breast cancer treatment. The bundled payment program included 1 radiotherapy physician group (Castellucci, 2016). Patients with Stage 1-3 breast cancer who required radiation therapy only were included in their first program. The bundled price varied based on treatment duration. The aims of the program were to create long-term pricing agreements and better predict the cost of breast cancer treatment.

In 2009, UnitedHealthcare began its first bundled payment pilot program in medical oncology around lung, breast, and colon cancers (UnitedHealthcare, 2014). The three-

year pilot program covered over 810 patients and resulted in a 34% reduction in healthcare costs. Five medical oncologist groups were paid a single payment for chemotherapy between October, 2009 and December, 2012. The predicted cost of care was much higher than the actual cost of care delivered with no difference between groups based on quality measures (Newcomer et al., 2014). This bundled payments pilot program of chemotherapy drugs was to eliminate financial incentives for increasing the use of high-cost, low-value chemotherapy drugs (Porter & Lee, 2013).

Building upon UnitedHealthcare's first bundled payment pilot in chemotherapy, The University of Texas MD Anderson Cancer Center and UnitedHealthcare developed a comprehensive cancer treatment bundled payment for head and neck cancer including chemotherapy, surgical and radiotherapy cancer treatments. MD Anderson and United Healthcare chose to focus on head and neck cancer care because head and neck cancer has well defined end points and requires multimodality treatment options (Spinks, Guzman, Lee, & et al, 2017). According to the National Cancer Institute, more than 65,000 people were diagnosed with head and neck cancers in the US in 2017, accounting for approximately 4% of all cancers in the United States (The National Cancer Institute, 2017). Head and neck cancer is the sixth most common cancer in the world with annual US healthcare costs of \$71,151 per patient for commercially insured patients, \$35,890 for Medicare patients, and \$44,541 for Medicaid patients.

By choosing to focus on a small cancer disease site like head and neck cancer, the protocol for MD Anderson's proposed bundled payment program allowed for more manageable risk and administrative burden. The three-year MD Anderson bundled

payment program tested the feasibility of bundled prices for a 1-year of care from start of cancer treatment. Patients were grouped into 8 bundled payments based on a retrospective cost analysis. The bundles were actually 4 different treatment modality clusters with a price modifier for patients with more than two co-morbidities based on the Charleston Co-Morbidity Index (Feeley, Spinks, & Guzman, 2015; Lee et al., 2016; Spinks et al., 2017). Total enrollment equated to 88 patients over a two-year enrollment period, November 2014 to October 2016. Initial results concluded the need for more information technology to automate the bundled payment processes of identification, enrollment, billing and payment (Spinks et al., 2017).

UnitedHealthcare’s third bundled payment program, in partnership with Moffitt Cancer Center, focused on early stage surgical and radiation therapy lung cancer only (Moffitt Cancer Center, 2016). This program aimed to reduce care variation through clinical pathway compliance. The pilot started on October 1, 2016 and there is no published data regarding this program.

A Private Payor Bundled Payment Program Summary was provided below in Table 2 with program specific details, start date, and estimated number of impacted patients.

Table 2: Private Payer Bundle Payment Program Summary

<u>Payer</u>	<u>Provider(s)</u>	<u>Disease Site(s)</u>	<u>Tx Modalities</u>	<u>Start Date</u>	<u>Est. # Pts</u>
Horizon Blue Cross Blue Shield of New Jersey	Regional Cancer Care Associates	Breast & Prostate	--	10/2014	--

Anthem Blue Cross of California	Valley Radiotherapy Associates Medical Group	Stage 1-3 breast cancer	Radiation Therapy	05/2016	--
UnitedHealthcare	5 Medical Oncology Groups	Lung, breast, and colon cancers	Medical Oncology	10/2009	810
	UT MD Anderson Cancer Center	Head & Neck	Surgery, Radiation Therapy, Medical Oncology	11/2014	88
	Moffitt Cancer Center	Early Stage Lung Cancer	Surgery and Radiation Therapy	10/2016	--

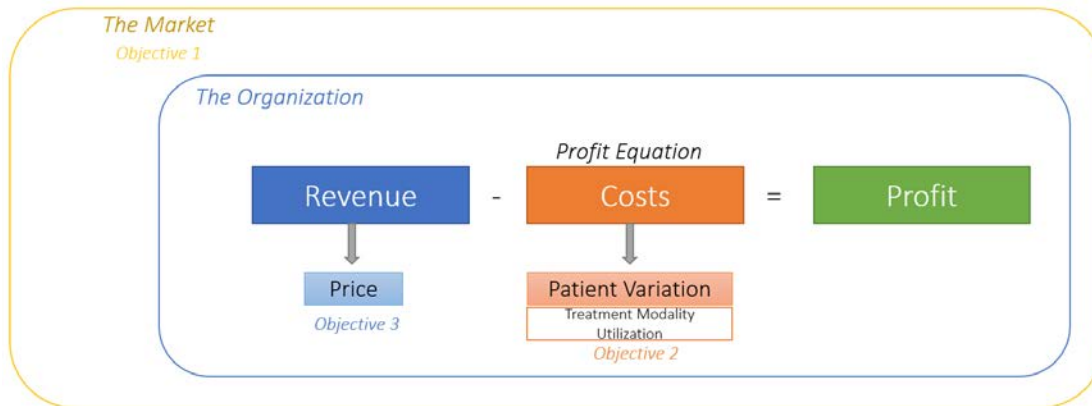
This dissertation will replicate The University of Texas MD Anderson Cancer Center and UnitedHealthcare’s bundled payment program, in that it will use the same disease site of head and neck, the same bundled payment episode period of 1 year from start of treatment, and will similarly bundle patients based on cancer treatment modalities (surgery, chemotherapy and radiation therapy). The objective of this study is to develop a profile for head and neck cancer, including descriptive statistics, risk assessment and bundled payment pricing recommendations using a large national claims database. The ability to assess pricing risks associated with head and neck cancer bundled payments across the US from a large claims database can provide evidence to either support or discredit the feasibility of bundled payment reform.

Conceptual Model

In theory, bundled payments create financial incentives to reduce healthcare costs by promoting efficient and effective care without compromising on quality. Healthcare

providers have the discretion over the type and number of services to provide but are also held accountable for the outcomes and quality of the services rendered. The conceptual model builds upon the financial profit equation. The profit equation simply states that all organizations quantify ‘profit’ from the total ‘revenue’ minus the total ‘costs’ (Porter & Lee, 2013). The revenue derived is based on the prices set by the organization and the costs are variable depending on the patient treatment modality utilization outlined by the patient’s cancer treatment plan. These factors can be compared to the ‘market’ to benchmark pricing. A graphical depiction of the conceptual model is presented as Figure 1.

Figure 1: Profit Equation Conceptual Model



This dissertation conceptually describes the bundled payment ‘market’ in Objective 1. Objective 1 describes the US head and neck cancer population by volume, cost, and treatment modality using privately insured allowable amounts for costs between 2011 and 2017 from administrative in-network claims. Objective 2 aims to create bundled payments by treatment modality to analyze the associated cost variation by treatment modality. The ‘revenue’ component of the profit equation will be analyzed in Objective

3. Objective 3 develops a methodology for organizations to use when determining financial feasibility of bundled payments, using a Monte Carlo pricing simulation.

Public Health Significance

This dissertation has the ability to validate a bundled payment pricing methodology and further impact the cancer payment reform in the US, subsequently affecting an estimated 18.2 million Americans (1 in 19) who will be cancer patients or survivors by 2020 (Butcher, 2008). The Institute for Health Improvement (IHI) outlined a 'Triple Aim' framework to help health care systems optimize their performance. The triple aim consists of "improving the patient experience of care, improving the health of populations, and reducing the per capita cost of health care" (Institute for Healthcare Improvement, 2016). The US healthcare system is presently unsustainable and accounts for 17% of the gross domestic product (Centers of Medicare and Medicaid, 2012), with this rate expected to rise by 2020. Cancer care costs account for approximately 5% of total direct US health care cost. A study reported the financial burden of cancer as, "the direct costs of cancer diagnosis and treatment for the United States at \$27.4 billion in 1990, with an additional \$9.9 billion in morbidity costs and \$58.7 billion in mortality costs" (Brown & Fireman, 1995). Efforts in healthcare reform aim to transform the current healthcare payment system – which rewards volume and intensity of services – to a system where payment is rendered for value. (Porter, 2010). The current strategies outlined to combat the cost crisis in the US are to create new delivery models, new reimbursement models, and to invest in comparable effectiveness research (Kaplan & Porter, 2011). This dissertation will support the Triple Aim's focus to reduce the cost of

healthcare in the US by studying a new reimbursement model promising to reduce the cost of cancer care.

V. RESEARCH AIMS

- a. Aim 1: To describe US Head and Neck Cancer by volume, cost, and treatment modality using privately insured allowable amounts for costs from 2011- 2017 administrative claims for feasibility study.
- b. Aim 2: To group patient-level treatment modalities by costs and describe the bundle-level volume and costs variation between bundles.
- c. Aim 3: To develop a methodology for organizations to use when determining financially feasible of bundled payments, using a Monte Carlo simulation of 10,000 trials of 100 annual patient costs based on statistics from Aim 1.
- d. Aim 4: To develop a recommendation for head and neck bundled payment groupings by treatment modality and pricing based on probabilistic results from Aims 1-3.

VI. METHODOLOGY

Administrative payor claims from the University of Texas (UT) Center for Healthcare Data was used in this study. The claims database contains over 40 million patients, more than 4,000 hospitals, more than 750,000 physicians across the country as of 2013 with claim-specific clinical utilization level with data from inpatient, outpatient,

drug, and other services included. This data includes UnitedHealthcare Group claims from large employers, health plans and government and public organizations. Although this data does not include actual cost of care utilization, it does contain standardized allowable amounts that are more generalizable. This dissertation will define patient costs by total allowable amounts from administrative claims data.

More specifically, only claims for patients with a primary diagnosis of head and neck cancer, specifically lip and oral cavity, larynx, oropharynx, and salivary gland disease sites, from 2011-2016 with no previous history of head and neck cancer in the preceding 12 months were requested, along with continuous insurance coverage 12 months before and after the initial head and neck cancer diagnosis. The initial head and neck diagnosis was defined using a list of ICD 9 and ICD 10 codes and is outlined in Appendix A. All enrollment, procedure, inpatient, outpatient, and look-up data tables claims associated with the patient population of interest were requested.

Once the data was received, the patient population was further limited to only patients greater than 18 years and less than 63 years of age at the time of initial head and neck diagnosis. Only patients with Preferred Provider Organization (PPO) or Provider Point of Service (POS) insurance coverage plan types were included, which ensures that the patients' claims are in-network and are more comparable across different providers. The data was filtered to only include non-pediatric and non-Medicare eligible ages (Age 18-63) due to the different payment structure of pediatric hospitals and patient possible eligible for Medicare. Study subjects were also excluded if they had cancer treatment 3 months prior to the study period, based on the claims

information. Patients with concurrent cancer, recurrent cancer, or metastatic cancer disease were also excluded from the study due to variability of cancer treatment, use of off-label cancer treatment options, and sometime patient preference for additional treatment. This patient population is the same as The University of Texas MD Anderson Cancer Center and UnitedHealthcare's bundled payment program (Feeley et al., 2015) patient inclusion criteria.

For Aim 1, some of the variables of interest are treatment modality and total costs at the patient-level. All of other variables are controls or covariates- age, sex, plan type, and geographic region. Age was calculated by subtracting the patient's birth year from the date of initial head and neck cancer diagnosis. 'Age' was further summarized into 2 categories 18-44 or 45-63 years of age. As defined in the database, 'Sex' was categorized as male, female, or missing. The 'plan types' were summarized as either Preferred Provider Organization (PPO) or Point of Service (POS) insurance coverage plan types. Patients that received cancer treatment out of network, were excluded from the study. The patient's geographic region was categorized by using the provided 5-digit zip codes to categorize whether the patient was geographically located in a metropolitan statistical area (MSA) or other, non-metropolitan geographic region. The US Census Bureau's zip code to county code crosswalk and US Department of Economic Research's MSA county crosswalk tables were utilized to identify if the patient is geographically located in a MSA based on their 5-digit zip code. The patient's 'geographic location' was further categorized into either 'metropolitan' or 'other' for statistical purposes. Lastly, the patient-level allowable amounts were summated to represent total 'costs' from

cancer diagnosis through 1 year of total healthcare utilization- as seen below in Figure 2.

A complete list of Aim 1 study variables are shown below in Table 3.

Figure 2: Bundled Payment Grouping Methodology

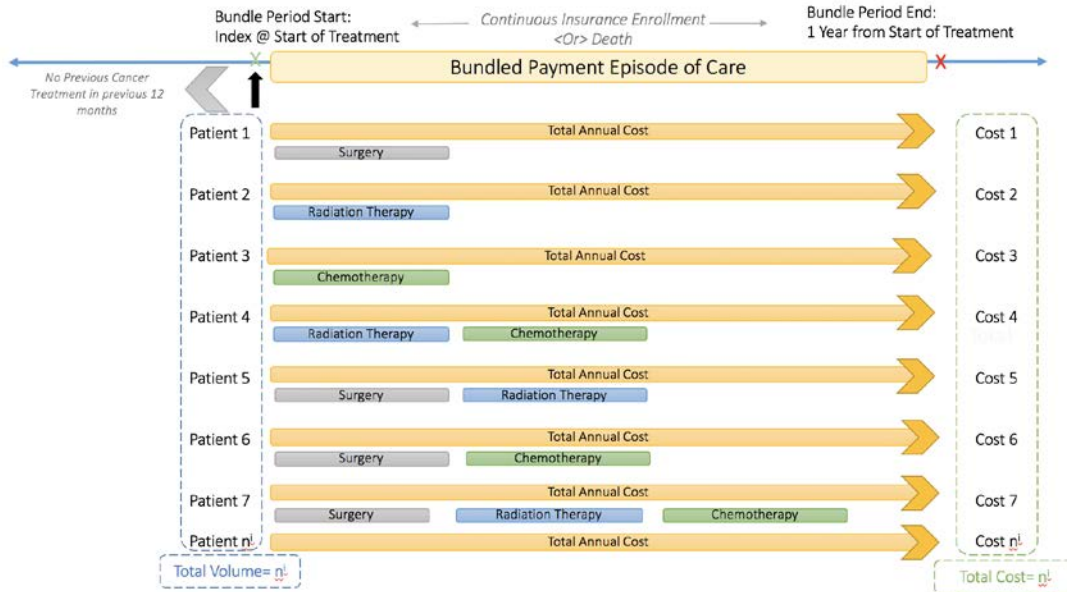


Table 3: Data Variable Matrix

Variable	Inclusion/ Exclusion	Type	Details
Analytic patient identifier	Exclude any claims with missing identifier	Continuous Variable	Used to link patient claims across data tables
Birth Date	Include patients >18 and <63 years of age at time of treatment start	Continuous Variable	Non- pediatric and Non- Medicare eligible patients
Sex	Keep patients regardless if missing data exists	Binary Variable	Summarized in Aim #1
Plan Type	US Commercial- Preferred Provider Organization (PPO) or Provider Point of Service (POS)	Categorical Variable	Used to limit data
Service Date	Include patient service dates from first head & neck cancer diagnosis	Continuous Variable	Used to identify trigger event and all claims to

	(January 1, 2011-December 31, 2016) and all service dates 1 year after diagnosis		include in episode period
Provider Place of Service	Include only office visit, hospital inpatient, hospital outpatient, ambulatory surgical center, hospital outpatient department, and emergency center claim locations	Categorical Variable	Used to limit data
Diagnosis Codes	Include patient with a primary diagnosis of lip and oral cavity, larynx, oropharynx, or salivary gland ICD-9-CM & ICD-10 Diagnosis Code in Appendix A; Exclude patients who develop a secondary cancer diagnosis during the treatment bundle period	Categorical Variable	Used to identify patient population of interest
Procedure Codes	Include patients with cancer treatment claims from 2011-2016	Categorical Variable	Used to assess patient's cancer treatment modality
Provider Zip Code	Crosswalk to MSA geographic regions	Binary Variable	'Metropolitan' or 'Other'
Allowed Amounts	Sum of 1-year of allowed amounts from start of cancer diagnosis	Continuous Variable	All costs inflated to 2017 values.

All patient claims were evaluated to categorize the patient based on cancer treatment modality- surgery, chemotherapy, radiation therapy and/or a combination of more than one possibility. The claim procedure codes were cross-walked using Appendices A, B, C to identify the patient's cancer treatment modality by inpatient and outpatient procedure codes. There were seven possible treatment modality categories for this population: surgery (S), chemotherapy (C), radiation therapy (R), surgery &

chemotherapy (SC), surgery & radiation therapy (SR), chemotherapy & radiation therapy (CR), chemotherapy & radiation therapy & surgery (CRS). Any patient who had a head and neck cancer diagnosis but had no treatment identified was excluded from the study. Also, patients with experimental cancer treatments, proton radiation therapy and immunotherapy were excluded due to the limited facilities providing this type of care and the high variability of costs amongst those who do provide this treatment. While this study did not following previous bundled payment methodology, it did mirror the patient inclusion criteria and bundling by treatment modality of the University of Texas MD Anderson Cancer Center and UnitedHealthcare’s bundled payments for head and neck cancer by treatment modality is depicted in Figure 3. (Spinks et al., 2017).

Figure 3: MD Anderson Cancer Center and UnitedHealthcare’s Head and Neck Bundled Payment Groupings

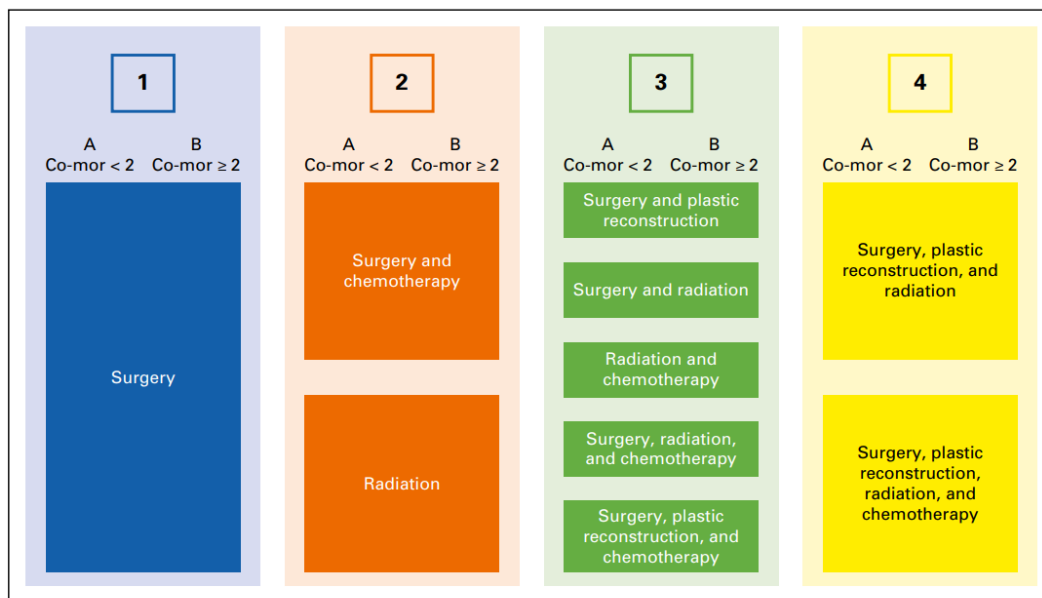


Fig. Head and neck bundled payment pilot: four risk-adjusted bundles. The risk-adjusted payment bundles for head and neck cancer are shown with treatment plans included in each bundle. Co-mor, comorbidity (per the Charlson comorbidity index).

Treatment modalities are patient- dependent, provider-dependent, and often based on the patient’s tumort type. Treatment modalities are an appropriate bundling characteristic because little has changed according to treatment modality guidelines. According to the National Comprehensive Cancer Network Guidelines (version 1.2016), there have been no new cancer treatment modality changes resulting in the need for the additional treatment modality groups (National Comprehensive Cancer Network, 2016). Lastly, all data was cleaned and analyzed using SAS version 9.0 (SAS Institute Inc, 2016) and STATA version 14.0 (*StataCorp*, 2011) for Windows. Additional screening took place to evaluate outliers or extreme cases (Campbell, Sokal, & Rohlf, 2006; Rosner, 2011) . Extreme cases were manually reviewed and if the care provided was not associated with cancer or cancer toxicities, it was removed from the analysis. All variable categorization are further summarized below in Table 4.

Table 4: Variable Categorization

<u>Variable</u>	<u>Variable Type</u>	<u>Categorization</u>
Age	Categorical	18-44 45-63
Sex	Binary	0=female 1=males
Geographic Location	Categorical	Metropolitan Other
Treatment Modality	Categorical	C=Chemotherapy R=Radiation therapy S= Surgery CR= Chemotherapy & Radiation Therapy CS= Chemotherapy & Surgery RS= Radiation Therapy & Surgery CRS= Chemotherapy, Radiation Therapy & Surgery
Costs	Continuous	Allowed Amounts Inflated to CY 2017 dollars using The Bureau of Labor Statistics inflation rates

For Aim 2, the treatment modalities were categorized into the minimum number of bundled payments based on their mean costs similar to previous bundled payment programs (Lee et al., 2016). The University of Texas MD Anderson Cancer Center and UnitedHealthcare head and neck bundled payment program used a proprietary bundling approach not published in the literature with no statistical documentation published to support their bundled payment categorization (Feeley et al., 2015). This dissertation took a statistical approach to defining the minimum number of bundled payments groups for cost analysis and will further provide a guide to help others execute a bundled payment analysis across cancer populations.

Bundled payment groups with similar mean costs were clustered using a hierarchical clustering method. A hierarchical clustering approach measures the distance between treatment modality group means, also called the Euclidean distance. This approach standardizes the distance between group means then graphically represents the Euclidean distance using a dendrogram. A dendrogram is the easiest way to graph similarities amongst groups. The dendrogram branches identify similar groups and the height of the branches, also called 'trees', indicates the orders of the groups being joined. The groupings are dependent on the algorithm used to measure distance (Heller & Ghahramani, 2006; Johnson, 1967). A complex linkage cluster analyses calculated the maximum distance between the clusters and computes all pairwise dissimilarities between treatment modalities and only records the largest dissimilarity only (Ziegel, 2009). This test is most appropriate for this grouping because each treatment modality can only be clustered one time, giving each treatment modality a

unique cluster or bundled payment group. The complex linkage algorithm calculates the Euclidean distance for each group on its own then combines the groups into larger clusters until all groups are clustered within one another (Kamvar, Klein, & Manning, 2002; Ziegel, 2009). This approach supports the development of the minimum number of bundled payments groups. The final number of bundled payments are determined by visually identifying a 'cutoff' point for cluster groups. The 'cutoff' points are naturally distinct groupings of clusters. The minimum number of the bundles will be the bottom branches of the dendrogram. If the groupings are close, more than one bundled payment groupings will be analyzed.

To validate the previous analysis, a one-way analysis of variance test (ANOVA), with a Bonferroni Type Adjustment, was used to identify the treatment modality groups that are statistically different, opposite of the clustering analysis. ANOVA is a level of measurement used to evaluate possible differences across more than two group means; the Bonferroni Adjustment Type (pair-wise t-test) corrects for additional possible Type I error from testing more than two groups. The Bonferroni Adjustment tests the error levels separately rather than all together at one time like other test adjustments (Judd, McClelland, & Ryan, 2018; Rosner, 2011).

The ANOVA null hypothesis exams the population means, in this case the bundled payment groups, that are equal to one another ($H_0: \mu_1 = \mu_2 = \mu_3 = \dots = \mu_k$ where k is the number of bundled payment groups). The alternative hypothesis assumes the opposite, at least one of the population means differs from one of the others ($H_a: \mu_1 \neq \mu_2 \neq \mu_3 \neq \dots \neq \mu_k$ where k is the number of bundled payment groups) (Rosner, 2011).

There are several statistical assumptions required to conclude the ANOVA test results are valid: 1) the populations must be independent from each other, 2) the dependent variable residuals must be normally distributed, the samples within the populations must be random samples across and within the populations, and 3) the population variances is assumed to be heteroskedastic – equal, homogenous variances across the groups(Agresti, 2002; Rosner, 2011). An understanding of the claims and cost summary is essential to confirm the first ANOVA assumption.

- Assumption 1: The total episode costs must be independent from one another, and in this case no patient can have more than 1 overlapping cost episode with one designated treatment modality categorization due to the patient population definition of no concurrent, no recurrent, nor metastatic cancer diagnoses. If the costs were related a ANOVA test would not be appropriate and a repeated measures ANOVA test should be conducted instead(Rosner, 2011).

- Assumption 2: The Shapiro-Wilk test was used to exam the second ANOVA assumption of normal data distribution. The Shapiro-Wilk test exhibiting high power to account for the small number of observations in our episode bundled payment groupings and is the appropriate normality test in the study. The Shapiro-Wilk null hypothesis assumes the sample of (size n) comes from a normal distribution and the alternative hypothesis assumes the sample (of size n) does not come from a normal distribution (Rosner, 2011). The test probability value must be greater than the alpha of 0.05 error level to accept the null hypothesis and assume normal distribution. The acceptance of the null hypothesis would assume the second ANOVA assumption has been met.

The data was not normally distributed, therefore a square root data transformation was required. Data transformations replaces a variable by the function of that same variable to change the shape of the variable distribution or relationship (Rosner, 2011). Data is often transformed to reduce skewness, equal the spread of the variance, to create a linear relationship, or create an additive relationship. In this case, roots or logarithms are necessary to reduce right skewness and squares or cubes can reduce left skewness (Judd et al., 2018; Ziegel, 2009).

- Assumption 3: The third and last ANOVA assumption requires homogeneity of variances. The Levene's Test exams for homogeneity across the bundle payment cost variances. The Levene's null hypothesis assumes all bundled payment groups have similar population variances. The alternative hypothesis assumes there is at least one bundled payment group has unequal variances. If the null hypothesis is accepted, there is enough evidence to assume all assumptions are met to conduct the ANOVA test (Judd et al., 2018; Rosner, 2011; Ziegel, 2009).

The Complete Linkage Hierarchical Clustering Analysis was used to assign and confirm the treatment modalities are grouped into similar, minimum number of bundled payment groups. After confirming the grouping of bundled payment groups, an ANOVA will be retested with bundled payment groups rather than treatment modalities. Also, all ANOVA test assumptions will need to be confirmed before proceeding with bundled payment modeling and financial analyses in Aim 3.

In Aim 3, a Monte Carlo simulation was used to analyze risk and sensitivity associated with bundled payment methodology. The simulation summarized 10,000

trials of 100 randomly generated patient costs based on descriptive statistics from Aim

1. As noted from the literature, simulation modeling is used by healthcare payers to assess the risk exposure based on claim probability of distribution (Mao, 1997). A report published by Zhirong Mao, data analyst from Blue Cross Blue Shield of California, stated that Monte Carlo simulation is “approach is extensible to risk management, insurance product pricing and provider network development” (Mao, 1997). Claims risk management using simulated distributions can give a visual assessment of the probability distribution of risk under a new payment methodology such as bundled payments. This method of analysis estimates values using inferences, often called inferential statistics(Dimov, 2008). Inferential statistics includes a known population and a random sample of the population with the same properties of the known population.

A Monte Carlo risk simulation is a technique used in business and management to determine how independent variables impact dependent variables under certain assumptions; this technique is commonly called a simulation or what-if analysis (Zhu, Carlo, & Carlo, 2011). This business approach is often used in scenario analysis with projecting future financial states, such as bond prices or profit margin analyses. A Monte Carlo risk simulation defines the pricing risk associated with developing bundled payments with double sided risk sharing between providers and payers. Monte Carlo simulation analysis is a robust, flexible computer generated risk simulation technique to model ‘real world’ situations with a desired degree of precision (Richter & Mauskopf, 1998). This technique “accommodates complex relationships and depend less on

simplifying assumptions and standardized probability distributions” associated with option pricing (Zhu et al., 2011).

Microsoft® Excel Random Number Generator Add-in Software was used to develop the random sample of 100 patients for each of the 10,000 trials statistical summaries (from Aim 1) for each bundled payment group (from Aim 2) (Microsoft Corporation, 2018). Because the original cost distribution was not normally distributed, a Poisson distribution was used to generate the random sample population. The Poisson distribution used the average mean costs from the original cost data per bundle (from Aim 1). The random sample population was developed for the Monte Carlo simulation and pricing analysis.

The mean expected loss per patient (X_{ij}) was summarized and used to provide statistical probabilities for risk (loss) associated with bundled payments. and summarized below in Equation 1.

Equation 1: Average Expected Loss (\$)Per Bundled Payment Group

$$X_i * X_j = X_{ij}$$

Where i = the average episode cost per trial, j = the probability of patient incurring a cost greater than desired percentile

Each trial was summarized at the patient-level and bundled payment levels. The mean episode cost per trial (X_i) and probability of a patient incurring a cost greater than the 50th percentile (from Aim 2), 75th percentile (from Aim 2), and 95th percentile (from Aim2) (X_j) was calculated to compute the probability the costs incurred will exceed the negotiated price levels at each percentile.

Last, the profitability of the bundled payment groupings A versus B were assessed by computing the expected net profit or loss. The net revenue, or expected value $E(V)$, is the difference from the expected bundled payment costs (\$) per bundle group minus the expected revenue (X_{ij}) from Monte Carlo simulation results. The monte carlo simulation consisted of 10,000 trials of 100 annual patients to estimate the expected net revenue profit or loss in each bundled payment grouping. . The net revenue/loss per bundled payment group will provide evidence to either support or unsubstantiated the bundled payment methodology. All summary findings from Aim 3 will be used to provide pricing negotiation recommendations in Aim 4.

The final aim summarizes and provides organizations a guide for approaching bundled payment modeling based on results from Aims 1-3. The ‘how-to’ guide provides high-level instructions on how to organize claims data for bundled payment analyses, instructions to group treatment modalities into bundled payment, and recommendations for financial and risk analyses for determining optimal bundled payment pricing for payor and provider negotiations. The end result is a depiction of the methodology used in Aims 1-3. A summary of all four aims are below in Table 5 with output, methodology and software for each aim.

Table 5: Aim Summary

		<u>Output</u>	<u>Methodology</u>	<u>Software</u>
<i>Aim 1</i>	To describe US Head and Neck Cancer by volume, cost, and treatment modality using privately insured allowable amounts for costs for a feasibility study.	Summary Tables	Descriptive Statistics	SAS Analytics Software & Solutions (SAS

				Institute Inc, 2016)
<i>Aim 2</i>	To group patient-level treatment modalities by costs and describe the bundle-level volume and costs variation between bundles.	Statistical Analysis and Summary Tables	One-way ANOVA with Bonferroni Adjustment Type	STATA Statistical Software Package (<i>StataCorp</i> , 2011)
<i>Aim 3</i>	To develop pricing scenarios for bundled payment groups, using a Monte Carlo simulation of 10,000 trials of 100 annual patient costs based on statistics from Aim 1.	Summary Tables	Monte Carlo Simulation	Microsoft Excel Random Number Generator (Microsoft Corporation, 2018)
<i>Aim 4</i>	To develop a guide for approaching head and neck bundled payments based on results from Aims 1-3.	Figure	How-to-Guide	Microsoft Word

VII. ANALYSIS

As described in the methodology section, the first aim describes the newly diagnosed US Head and Neck Cancer by volume, cost, and treatment modality using privately insured allowable amounts for costs. The frequencies and percentages were calculated for the categorical variables, such as gender and treatment modality. Means, medians, quartiles, standard deviations, coefficient of variations, standard errors, and confidence intervals were calculated for costs

There were a total of 220 newly diagnosed head and neck cancer patients identified according the criteria for eligibility outlines earlier. As noted above, the newly diagnosed head and neck patients had no cancer diagnosis in the prior 12 months, and/or no concurrent, recurrent, or metastatic disease during the bundled payment

episode. The majority of patients were between the age of 45 and 63 years at episode index or at first head and neck cancer diagnosis; there were 200 patients ages 45-63 years (91%) of age and 20 patients ages 18-44 years of age (9%). There were 155 males (91%) and 65 females (9%) with 159 patients from metropolitan statistical areas (72%) and 61 patients from other non-metropolitan statistical areas, either micropolitan or rural areas. Most of the patient's insurance plan types were Point of Service (POS) type plans; there were 213 patients with POS plan types (97%) and 7 patients with Preferred Provider Organization (PPO) (3%) plan types. Head and neck cancer patients were treated with Surgery (S), Chemotherapy (C), or Radiation Therapy (R) treatment modalities. These three treatment types give a total of seven possible treatment modality combinations. In this case, 46 patients (21%) received surgery only; 44 patients received chemotherapy and radiation therapy (20%); 44 patients received chemotherapy, radiation therapy and surgery (20%); 37 patients received chemotherapy (16%); 19 patients received radiation therapy and surgery (9%); 17 patients received radiation therapy (8%); and 13 patients received chemotherapy and surgery treatment (6%). The treatment modality categorization is the independent variable of interest in this analysis.

The dependent variable in this analysis is the patient's total bundled episode costs. The patients' total bundled episode costs are the costs for 12 months after the initial primary head and neck diagnosis. The 220 patients had an average episode costs of \$164,332 with a standard deviation of \$106,500, median episode costs of \$143,806, a confidence interval around the mean of \$28,302, and the standardized measure of

dispersion of a probability distribution, also known as the co-efficient of variation (CV), of 0.65. The CV for costs is greater than 0.50 indicating a larger dispersion of the standard deviation relative to the mean. The costs of a head and neck cancer episode range from \$5,547 (minimum value) to \$548,201 (maximum value) with the 5th percentile at \$19,137 and the 95th percentile at \$504,797. The interquartile range of episode costs is \$429,102 (Q3-Q1). A summary of all variables are below in Table 6.

Table 6: Descriptive Variable Summary

	(N)	(%)
Age		
18-44 years	20	9%
45-63 years	200	91%
Gender		
Female (0)	65	30%
Male (1)	155	70%
Geographic Region		
Metropolitan Area	159	72%
Other	61	28%
Plan Type		
Preferred Provider Organization (PPO)	7	3%
Point of Service (POS)	213	97%
Treatment Modalities		
Surgery (S)	46	21%
Radiation Therapy (R)	17	8%
Chemotherapy (C)	37	16%
Chemotherapy & Surgery (CS)	13	6%
Radiation Therapy & Surgery(RS)	19	9%
Chemotherapy & Radiation (CR)	44	20%
Chemotherapy & Radiation Therapy & Surgery (CRS)	44	20%
Total Patients	220	100%
Costs		
Minimum Value (Min)	\$5,547	
5th Percentile (Lower Limit)	\$19,137	
25th Percentile (Q1)	\$24,065	
50th Percentile (median)	\$143,806	
75th Percentile (Q3)	\$453,167	
95th Percentile (Upper Limit)	\$504,797	
Maximum Value (Max)	\$548,201	

Average (mean)	\$164,332	
Standard Deviation (SD)	\$106,500	
Coefficient of Variation (CV)	0.65	

The average cost of an episode for patients treated with surgery is \$107,971 (SD= \$93,376) with a median episode cost of \$87,759. The surgery treatment modality episode costs range from \$5,548 to \$453,167 with an interquartile range of \$63,450 (Q1= \$55,178, Q3= \$118,628).

The average cost of an episode for patients treated with radiation therapy is \$142,544 (SD= \$78,410) with a median episode cost of \$137,177. The radiation therapy treatment modality episode costs range from \$19,137 to \$338,261 with interquartile range of \$83,935 (Q1= \$93,237, Q3= \$177,172).

The average cost of an episode for patients treated with chemotherapy is \$145,872 (SD= \$106,440) with a median episode cost of \$115,742. The chemotherapy treatment modality episode costs range from \$24,065 to \$425,383 with interquartile range of \$112,702(Q1= \$62,593, Q3= \$175,295).

The average cost of an episode for patients treated with chemotherapy and surgery is \$148,965 (SD= \$78,532) with a median episode cost of \$149,308. The chemotherapy and surgery treatment modality episode costs range from \$24,065 to \$253,471 with interquartile range of \$139,677 (Q1= \$100,362, Q3= \$240,039).

The average cost of an episode for patients treated with radiation therapy and surgery is \$165,219 (SD= \$67,778) with a median episode cost of \$149,229. The radiation therapy and surgery treatment modality episode costs range from \$66,134 to \$302,431 with interquartile range of \$102,078 (Q1= \$118,257, Q3= \$220,335).

The average cost of an episode for patients treated with chemotherapy and radiation therapy is \$181,855 (SD= \$86,090) with a median episode cost of \$167,227. The chemotherapy and radiation therapy treatment modality episode costs range from \$21,695 to \$413,352 with interquartile range of \$97,389 (Q1= \$124,058, Q3= \$221,447).

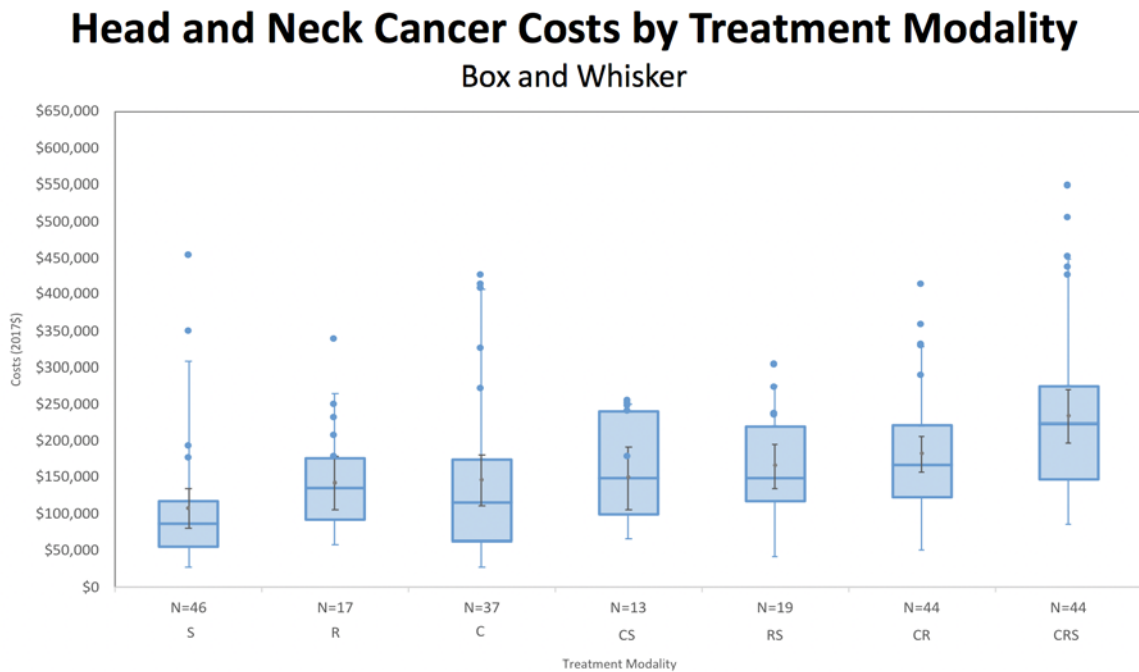
Chemotherapy, Radiation Therapy, and Surgery are the treatment modalities with the highest cost. The average cost of an episode for patients treated with all three treatment modalities is \$233,829 (SD= \$123,369) with a median episode cost of \$223,453. The chemotherapy and radiation therapy treatment modality episode costs range from \$30,965 to \$548,201 with interquartile range of \$127,532 (Q1= \$148,095, Q3= \$275,627). A summary of all treatment modality categories by cost are below in Table 7.

Table 7: Head and Neck Cancer Costs by Treatment Modality Summary Statistics

Treatment Modality	S	R	C	CS	RS	CR	CRS
Number of Patients (N/%)	46/ 21%	17/ 8%	37/ 16%	13/ 6%	19/ 9%	44/ 20%	44/ 20%
Minimum Value (Min)	\$5,548	\$19,137	\$24,065	\$28,843	\$66,134	\$21,695	\$30,965
5th Percentile	\$27,252	\$34,883	\$34,392	\$34,231	\$75,670	\$72,546	\$62,719
25th Percentile (Q1)	\$55,178	\$93,237	\$62,593	\$100,362	\$118,257	\$124,058	\$148,095
50th Percentile (median)	\$87,759	\$137,177	\$115,742	\$149,308	\$149,229	\$167,227	\$223,453
75th Percentile (Q3)	\$118,628	\$177,172	\$175,295	\$240,039	\$220,335	\$221,447	\$275,627
95th Percentile	\$308,900	\$265,840	\$407,949	\$251,060	\$276,021	\$329,474	\$449,518
Maximum Value (Max)	\$453,167	\$338,261	\$425,383	\$253,471	\$302,431	\$413,352	\$548,201
Average (Mean)	\$107,971	\$142,544	\$145,872	\$148,965	\$165,219	\$181,855	\$233,829
Standard Deviation (SD)	\$93,376	\$78,410	\$106,440	\$78,532	\$67,778	\$86,090	\$123,369
Coefficient of Variation (CV)	0.86	0.55	0.73	0.53	0.41	0.47	0.53

The treatment modality episode costs were graphed in a box and whisker plot shown below in Figure 4. The lower and upper blue whiskers depict a Type I error rate of 0.05 (represented by the 5th to 95th percentiles) with outliers represented as blue dots. The average episode cost per treatment modality is represented by a gray dot with gray whiskers representing the confidence interval around the mean. All Aim 1 descriptive summary statistics were conducted using SAS statistical software (SAS Institute Inc, 2016).

Figure 4: Head and Neck Cancer Episode Costs by Treatment Modality Box & Whisker



The first step in defining bundled payment groups is to define or confirm the normal distribution of the episode costs per patient. A histogram was used to plot the head and neck cancer episode costs to visually depict a cost curve; the curve was not in a normally distributed shape further confirmed by the median (\$143,806) not centered around the mean (\$164,332, SD= \$106,500) from Aim 1. Next, a Shapiro-Wilks Test was analyzed to validate the histogram output. The Shapiro-Wilk Test concluded a statistically significant p-value of less than the Type I error level and alpha level of 0.05 ($W= 0.94822, Z= 4.749, p<=0.05$). There was sufficient evidence to reject the null hypothesis of normality and conclude the treatment modality costs are not normally distributed. The cost curve histogram is found below in Figure 5 and the Shapiro-Wilk test results are found below in Table 8.

Figure 5: Head and Neck Cancer Episode Costs Histogram

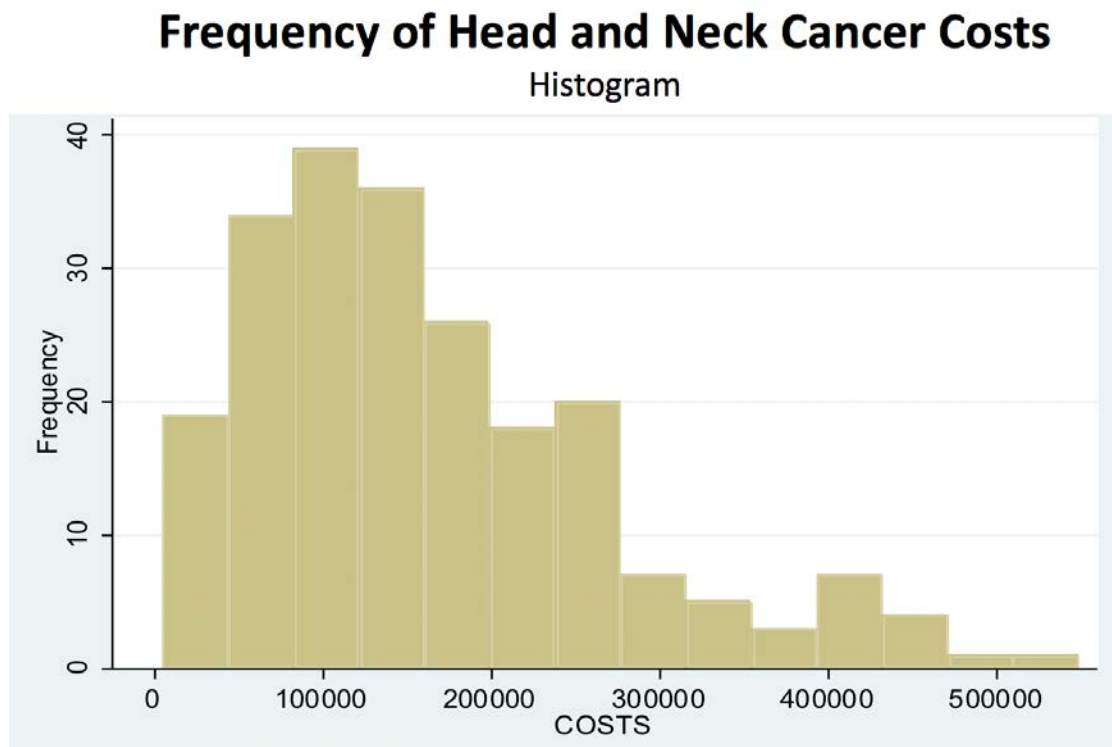


Table 8: Shapiro-Wilk Normality Test Results for Un-Transformed Cost Data

Variable	Obs.	W	V	Z	Prob>z
Costs (\$2017)	204	0.94822	7.860	4.749	<0.05

To correct the right skewness of the cost curve found in the Figure 5, a square root transformation was conducted to convert the data to a normal distribution. A square root transformation ($t = x^2$) has a moderate effect on distribution shape (Rosner, 2011). After the transformation, the histogram and Shapiro-Wilks normality test were re-tested. The results are as follows: the histogram curve was normally shaped and the Shapiro-Wilks Test found insufficient evidence to reject the null hypothesis. The Shapiro-Wilks probability value was greater than the Type I error level of 0.05 to conclude the square root cost distribution is normally distributed ($W = 0.99396$, $Z = -0.199$, $P\text{-value} = 0.5788$). The transformed cost curve histogram is found below in Figure 6 and the Shapiro-Wilk test results are found below in Table 9.

Figure 6: Transformed Head and Neck Cancer Episode Costs Histogram

Frequency of Transformed Head and Neck Cancer Costs Histogram

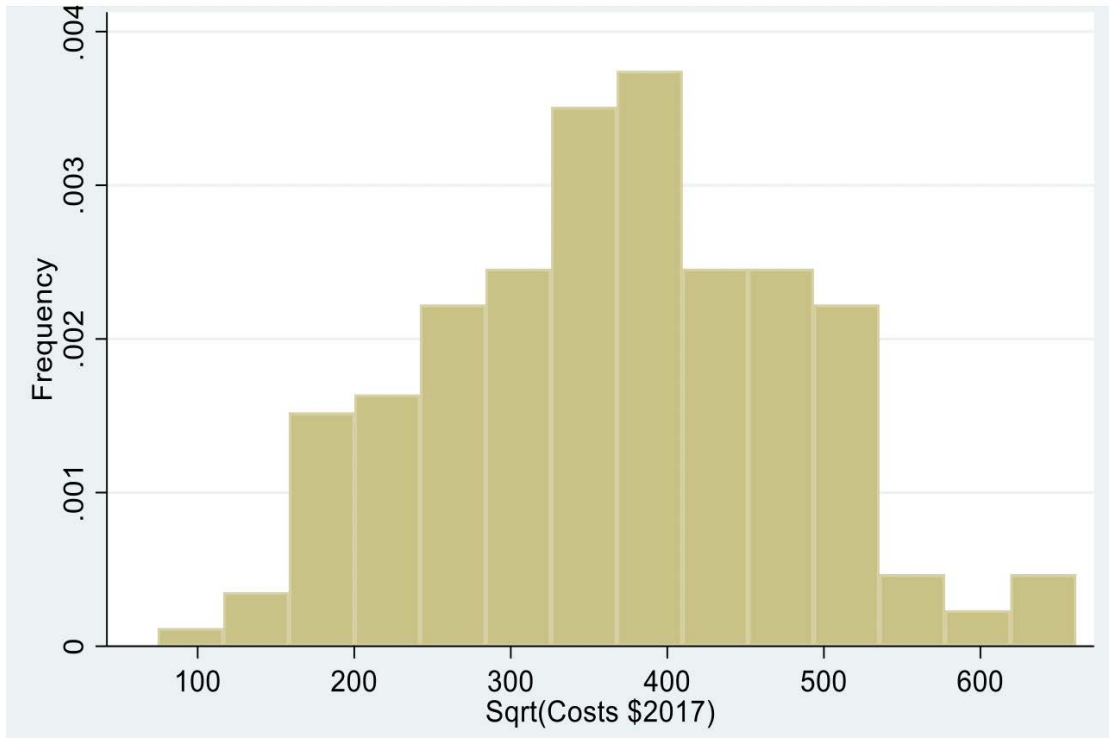


Table 9: Shapiro-Wilk Normality Test Results for Transformed Cost Data

Variable	Obs.	W	V	Z	Prob>z
Sqrt Costs (\$2017)	204	0.99396	0.917	-0.199	0.5788

Next, a Complete-Linkage Hierarchical Clustering Analysis was conducted to identify bundled payment groupings of treatment modalities with similar mean costs (Ziegel, 2009). Theoretically, these bundled payment groups would be paid one price. Clustering analysis result in dendrograms with branches representing similar groups. In this case, the Hierarchical Cluster dendrogram analyzed similar treatment modality

groups with similar square root transformed mean costs. The results of the dendrogram are below in Figure 7 below. The dendrogram depicts 5 bundled payment groupings at the lowest branching level: Surgery only (1); Radiation Therapy (3) & Chemotherapy and Surgery (5); Chemotherapy only (2); Radiation Therapy and Surgery (6) & Chemotherapy and Radiation Therapy (4); and Chemotherapy, Radiation Therapy, and Surgery (7). As supported in the literature, a minimum number of bundled payments results in greater administrative efficiency. Next, a next-highest grouping of bundled payment groups would result in a minimal bundled payment groups and less administrative burden. Two different groupings were used to analyze bundled payments.

The bundled payment groups resulted as such: Group A Bundled Payment Groupings (A1) Surgery only, (A2) Radiation Therapy, Chemotherapy, Chemotherapy & Radiation Therapy, Chemotherapy & Surgery, and Radiation Therapy & Surgery, (A3) Chemotherapy, Radiation Therapy & Surgery; Group B Bundled Payment Groupings (B1) Surgery only, (B2) Radiation Therapy, Chemotherapy, Chemotherapy & Radiation Therapy, (B3) Chemotherapy & Surgery, and Radiation Therapy & Surgery, and (B4) Chemotherapy, Radiation Therapy & Surgery. The Bundled Payment Grouping results from the Hierarchical Clustering analysis are below in Table 10.

Figure 7: Complete-Linked Hierarchical Clustering Dendrogram

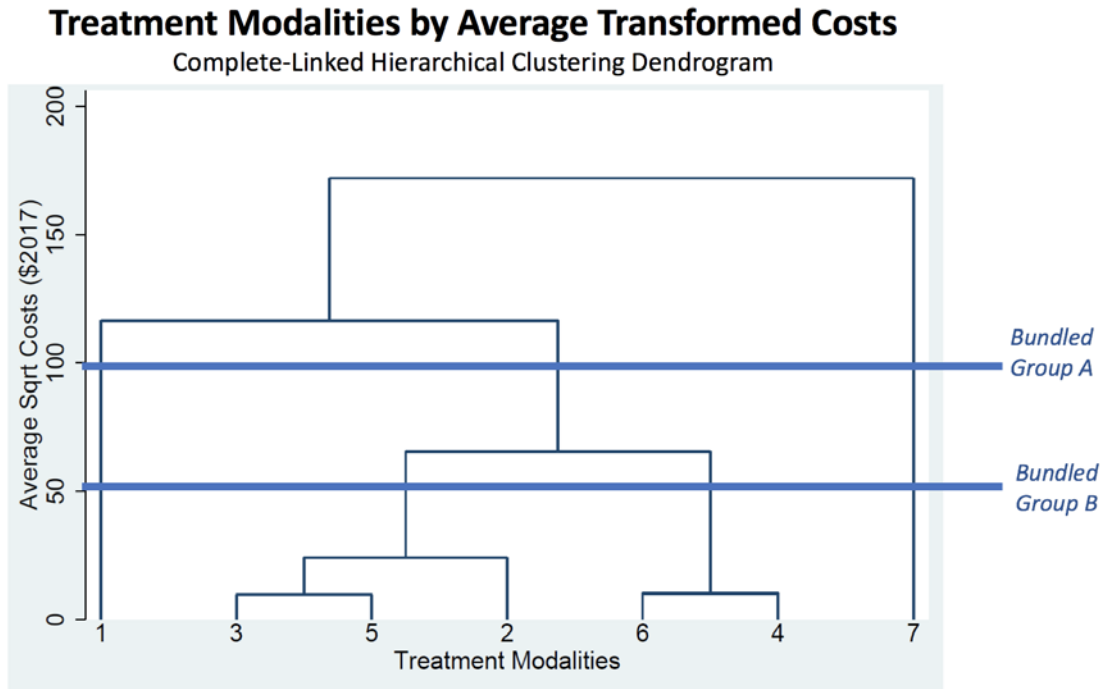


Table 10: Bundled Payment Groupings from Hierarchical Clustering Analysis with Monte Carlo Simulation Results

Bundle Group	Bundle Number	Treatment Modalities
A	A1	Surgery
	A2	Radiation Therapy, Chemotherapy, Chemotherapy & Radiation Therapy, Chemotherapy & Surgery, Radiation Therapy & Surgery
	A3	Chemotherapy, Radiation Therapy & Surgery
B	B1	Surgery
	B2	Radiation Therapy, Chemotherapy, Chemotherapy & Surgery
	B3	Radiation Therapy & Surgery, Chemotherapy & Radiation Therapy
	B4	Chemotherapy, Radiation Therapy & Surgery

Subsequently, a One-way ANOVA was conducted to validate the results from the Hierarchical Clustering Analysis. An ANOVA is a statistical test that generalizes a t-test for more than two groups by reducing the Type 1 errors (Judd et al., 2018; Rosner, 2011). The ANOVA null hypothesis tests all treatment modality groups for equal means ($H_0: \mu_1 = \mu_2 = \mu_3 = \dots = \mu_n$), where μ is the treatment modality group mean cost and n is the number of treatment modality groups or bundled payment groups. The analysis resulted in significant evidence to reject the null hypothesis and conclude there is a difference in mean costs between the treatment modality groups at p-value less than the Type I error level of 0.05 [$F(6,197)=12.46, p < 0.05$], as seen in Appendix G. This result further validates that more than one bundled payment group is appropriate for all next steps. If the ANOVA test had resulted in a failure to reject the null, then only one bundled payment would be appropriate for pricing. Next, an ANOVA Bonferroni Adjustment Type was used to examine specific treatment modalities differences between one another to validate bundled payment groupings. Each of the treatment modalities are tested against one another and the probability values are displayed in a grid below in Appendix G. Only three treatment modality combinations result in p-values less than 0.05, concluding eighteen out of the twenty-one possible treatment combinations failed to reject the null hypothesis. Therefore, further validating that statistically different population means. It is with confidence, the results of the complete-linked Hierarchy Clustering Analysis are valid.

In summary, there are two bundled payment groups: A and B. Bundled payment group A has 3 unique bundles while bundled payment group B has 4 unique bundles.

Bundled payment groups A1 and A3 are made up of single treatment modalities (S and SCR) already summarized above. Bundled payment group A2 is made up of five treatment modalities (R, C, CR, CS, and RS) with a mean episode cost of \$86,330 (SD= \$73,079). Bundle A2's minimum value is \$19,137, maximum value is \$327,998 with IQR of \$241,932. Bundled payment group B2 is made up of three treatment modalities (R, C, and CS), making up 30% (N= 62) of the overall episode group, with mean episode cost of \$127,758 (SD= \$72,221). Bundle payment group B2's minimum value is \$19,137, maximum value is \$324,409 with IQR of \$214,131. Bundled payment group B3 is made up of three treatment modalities (RS and CR), making up 29% (N= 59) of the overall episode group, with mean episode cost of \$165,027 (SD= \$69,567). Bundle B3's minimum value is \$21,695, maximum value is \$327,998 with IQR of \$220,437. Bundled payment groups A and B are summarized in Tables 11 and 12 and visually depicted in box and whisker plots in Figures 8 and 9.

Table 11: Bundled group A Descriptive Summary

Bundled payment group A	1 S	2 R, C, CR,CS,RS	3 SCR
Number of Patients (N/%)	43/ 21%	121/ 59%	40/ 20%
Minimum Value (Min)	\$5,548	\$19,137	\$54,884
5th Percentile (Lower Bound)	\$26,722	\$34,589	\$67,408
25th Percentile (Q1)	\$50,741	\$88,843	\$147,636
50th Percentile (median)	\$82,885	\$141,012	\$209,539
75th Percentile (Q3)	\$113,809	\$203,889	\$268,832
95th Percentile (Upper Bound)	\$164,311	\$276,521	\$418,891
Maximum Value (Max)	\$191,208	\$327,998	\$437,037
Average (mean)	\$86,330	\$145,931	\$218,819
Standard Deviation (SD)	\$44,971	\$73,079	\$101,246

Figure 8: Bundled group A Box and Whisker Plot

Head and Neck Cancer Costs by 3 Bundled Groups

Box and Whisker

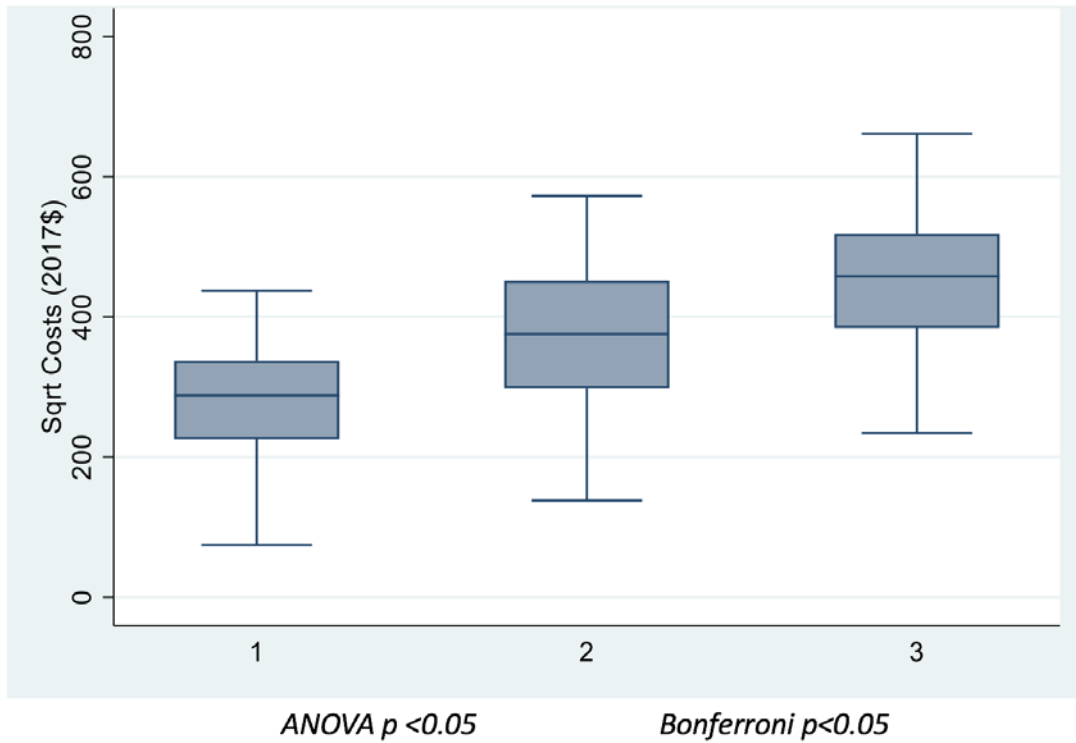


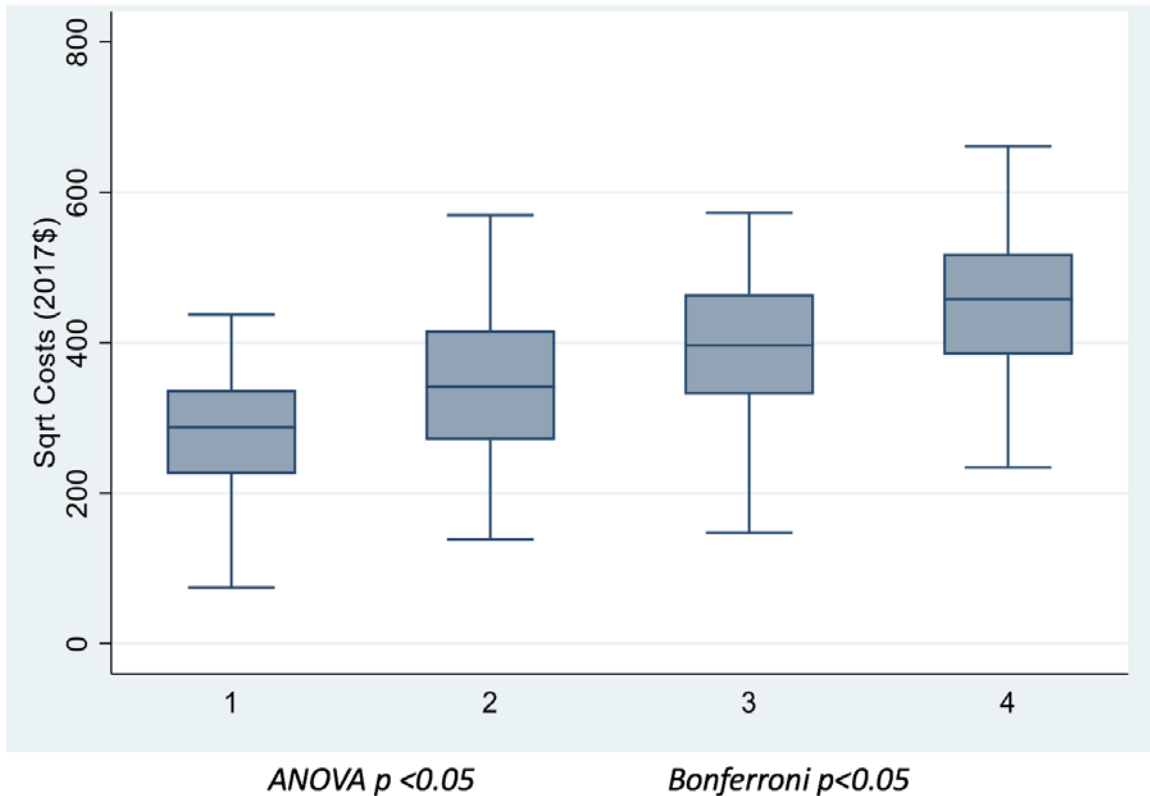
Table 12: Bundled group B Descriptive Summary

Bundled payment group B	1 S	2 R, C, CS	3 RS, CR	4 SCR
Number of Patients (N/%)	43/ 21%	62/ 30%	59/ 29%	40/ 20%
Minimum Value (Min)	\$5,548	\$19,137	\$21,695	\$54,884
5th Percentile (Lower Bound)	\$26,722	\$33,603	\$66,134	\$67,408
25th Percentile (Q1)	\$50,741	\$73,318	\$109,760	\$147,636
50th Percentile (median)	\$82,885	\$116,848	\$157,150	\$209,539
75th Percentile (Q3)	\$113,809	\$173,606	\$215,728	\$268,832
95th Percentile (Upper Bound)	\$164,311	\$247,734	\$286,571	\$418,891
Maximum Value (Max)	\$191,208	\$324,409	\$327,998	\$437,037
Average (mean)	\$86,330	\$127,758	\$165,027	\$218,819
Standard Deviation (SD)	\$44,971	\$72,221	\$69,567	\$101,246

Figure 9: Bundled group B Box and Whisker Plot

Head and Neck Cancer Costs by 4 Bundled Groups

Box and Whisker



Bundled payment group A and B was re-tested using a One-way ANOVA with Bonferroni Adjustment Type. The results further confirmed the initial treatment modality bundling tests. Bundled payment group A and B resulted in all bundled payment groups statistically different from one another with probability values less than Type I error level 0.05. The ANOVA with Bonferroni adjustment type test results are in Appendix H (Group A) and Appendix I (Group B).

The Levene's homogeneity tests the null hypothesis that all bundled payment groups have equal population variances. The alternative hypothesis assumes there is at least one bundled payment group has unequal variances. The results of bundled

payment groups A and B found insufficient evidence (p -value > 0.05) to reject the null hypothesis. All One-Way ANOVA assumptions were confirmed and both Levene’s test summary tables are in Appendix J.

A Monte Carlo simulation was created to quantify the risk associated with bundled payment methodology. The simulation measures the probability of a bundled payment group cost above the 50th, 75th, and 95th cost percentile per bundle. The 100 patients per 10,000 trials were simulated using the Microsoft Excel Random Number Generator Add-in Application(Microsoft Corporation, 2018). The random numbers were generated using a Poisson distribution with lambda equal to the bundled payment groups average cost per bundle. Each trial was summarized at the trial-level and per bundled payment group. A sample of Bundled Payment Group A’s summary sheet per trial are below in Appendix K. Each trial’s minimum value, average value, median value, maximum value and standard deviation were calculated per trials. A summary of the total average value, standard deviation, and range of values are below in Table 13.

Table 13: Bundled Payment Groupings with Monte Carlo Simulation Results

Bundle Group	Bundle Number	Treatment Modalities	Average (SD)	Range
A	A1	Surgery	\$86,251 (\$10,029)	\$63,417- \$114,191
	A2	Radiation Therapy, Chemotherapy , Chemotherapy & Radiation Therapy, Chemotherapy & Surgery,	\$146,315 (\$14,877)	\$111,546 - \$186,912

		Radiation Therapy & Surgery		
	A3	Chemotherapy , Radiation Therapy & Surgery	\$219,294 (\$20,176)	\$171,845 - \$274,228
B	B1	Surgery	\$86,251 (\$10,029)	\$63,417- \$114,191
	B2	Radiation Therapy, Chemotherapy , Chemotherapy & Surgery	\$128,123 (\$13,443)	\$96,735- \$164,718
	B3	Radiation Therapy & Surgery, Chemotherapy & Radiation Therapy	\$165,429 (\$16,301)	\$127,234- \$209,747
	B4	Chemotherapy , Radiation Therapy & Surgery	\$219,294 (\$20,176)	\$171,845 - \$274,228

Negotiating bundled payment prices to cover expenses or costs will determine the success or failure of bundled payments in a particular disease site or modality. The financial risk associated with pricing at the 50th, 75th, or 95th percentile of each bundled payment group A and B was calculated below in Appendix L and M. The results are as follows: If each Group A bundles were price at the 50th percentile of its bundled average cost, about 49-50% of each bundle would result in a financial loss. More specifically, if the price were at 50% percentile of the bundled average, 50% of the patients in Bundle A1 would result in an average of \$8,281 loss over all patients with pricing at the 50th

percentile. Bundled payment A2 and A3 would realize a financial loss of \$12,647 or \$16,578 per patient with approximately 49 or 50% of its patient population greater than the 50th percentile.

If bundles A1-A3 were priced at the 75th percentile, the financial risk of this type of bundled payment arrangement reduces by approximately 50 percent. In bundle simulation A1, if pricing was set at the 75th percentile, about 0.85% would have cost greater than the price. For the 0.85% above the 75th percentile price, there would be an approximate \$4,087 loss for each patient. For bundles A2 and A3 priced at the 75th percentile, approximately 2.6-6.1% would lose about \$6,894- \$9,486 for each patient.

In an ideal world, if pricing were at the 95th percentile of the average bundle cost, the financial risk would be minimal. The simulation modeled found approximately 0.0003-0.0004% patients in bundles A1-A3 would realize a financial loss. A summary of all Group A Monte Carlo pricing financial risk analyses are below in Appendix L.

The same analysis was conducted for bundled payment group B with the 4 bundled payment groups. Bundles A1 and A4 were similar to the previous analysis findings for the corresponding treatment modality bundled payment groups. If the Bundles A2 and A3 were priced at the 50th percentile of each bundle payment group, approximately 80% of Bundle A2 and 68% of Bundle A3 costs would be greater than the price resulting in a financial loss of approximately \$15,871 to \$16,699 per all patients.

The financial risk reduces dramatically when the bundled price is set at the 75th percentile of the bundled price. For bundle A2, only 0.115% of the patients simulated a cost greater than the price and would incur a financial loss of approximately \$4,799 for

each patient. Bundle 3A has a similar financial profile for pricing at the 75th percentile; approximately 0.237% of patient would have a cost higher than the price and result in a financial loss of approximately \$6,277 per all patients. There is minimal risk associated with the bundles A2 and A3 priced at the 95th percentile; approximately 0.0004% of patients would incur a financial loss of \$57,384 and \$122,825 for all patients.

A comprehensive financial summary of the average expected loss per patient for pricing at the 50th, 75th, and 95th percentile based on the probability of each bundle occurring per 10,000 trials are summarized below in Appendix N. If the bundled payment groups were priced at the 50th percentile, there are approximately \$6,171 (A) or \$9,642 (B) per patient at financial risk. The risk decreases as the price increases. At the 75th percentile, \$229 (A) or \$129 (B) per patient was potentially at risk. In an ideal pricing scenario, at the 95th percentile, only about \$6 per patient is at financial risk.

Lastly, the average expected profitability for 100 Head and Neck Cancer patients per bundled group at the 50th, 75th, and 95th pricing percentiles was analyzed to provide an overall estimate of financial viability. The expected revenue by bundled group for 100 Head and Neck patients was calculated based on the average cost and probability of bundled occurrence from the Monte Carlo analysis in Aim 3. The expected cost was calculated from the bundled payment mean costs summary from the data analysis in Aim1. The profit or loss is the difference of the revenue minus costs. The net profit/loss was calculated for the 100 patient population and per patient in Table 14.

Table 14: Expected Profitability at Pricing Percentiles for 100 Head and Neck Cancer Patients By Bundled Payment Group

<u>Bundle Group</u>	<u>Pricing Percentiles</u>	<u>Revenue</u>	<u>Costs</u>	<u>Profit/Loss</u>	<u>Profit/Loss Per Patient</u>
A	50%	\$14,251,073	\$14,799,241	(\$548,168)	(\$5,482)
	75%	\$19,796,080	\$14,799,241	\$4,996,839	\$49,968
	95%	\$28,143,090	\$14,799,241	\$13,343,849	\$133,438
B	50%	\$13,994,155	\$14,807,833	(\$813,678)	(\$8,137)
	75%	\$19,230,921	\$14,807,833	\$4,423,088	\$44,231
	95%	\$27,570,930	\$14,807,833	\$12,763,097	\$127,631

The expected profitability analysis concluded that pricing at the 50th percentile of the bundled payment group costs is not profitable and resulted in a net loss of \$548,168 for Bundle Group A (\$5,482 loss per patient) and \$813,678 for Bundle Group B (\$8,137 per patient). The expected profitability analysis concluded that pricing at the 75th percentile of the bundled payment group costs is profitable and resulted in a net revenue of \$4,996,839 for Bundle Group A (\$49,968 profit per patient) and \$4,423,088 for Bundle Group B \$44,231 profit per patient). The expected profitability analysis concluded that pricing at the 95th percentile of the bundled payment group costs is very profitable and resulted in a net revenue of \$13,343,849 for Bundle Group A (\$133,438 profit per patient) and \$12,763,097 for Bundle Group B (\$127,631 profit per patient).

In conclusion, the financial risk of bundled payment is dependent on pricing negotiations and manageable if sufficient simulation modeling is conducted prior to pricing negotiations. Price modeling can provide expected financial results based on previous patient data. In this analysis, the number of bundled payment groups does impact the expected profitability. As supported by previous studies (Feeley et al., 2015), a minimum number of bundled payments helps diversify risk as long as the price point

cover the expected costs per bundled payment treatment group. Furthermore, risk can be more strictly managed by increasing the number of bundled payment groups and minimizing the variation within groups. More importantly, grouping the treatment modalities in the correct bundled payments reduces the variability between groups and further provide a transparent model for bundled payments and future price negotiations.

Finally, the last aim is a summary of all the previous aims in figure form. This figure is a 5-step visual framework to help organizations develop a bundled payment in cancer care. This aim will fill a gap in the current literature by providing a simplified approach for organizing the data, defining bundled payment groups, and recommendations for financial analyses.

The first step in the bundled payment framework is to ‘define cancer patient criteria’ of interest. The patient criteria defined in Aim 1 is for newly diagnosed head and neck cancer patients. This framework could be used for other non- head and neck cancer disease sites, concurrent, recurrent, or metastatic cancer patients. This framework can be used by other cancer populations as long the treatment modalities are within a pre-defined period of time.

The second step in the bundled payment framework is to ‘prepare the data for analyses. The statistical tests in the analyses require the observations, in this case, the bundled payment 1-year episodes to be independent and unique. They must not be influenced or affected by other observations. If these assumptions are met, then it is acceptable to identify the independent and dependent variables for all analyses. The

dependent variables are the total episode costs per patient calculated in Aim 1. In this analyses, each newly diagnosed patient will have only one episode. For other scenarios, it is possible for patients to have more than one episode. Next, the independent variables are the defined treatment modalities per episode. Patients cannot have more than 1 treatment modality combination or it will not meet the above assumption of unique observations. Steps 1 and 2 describe Aim 1 and are essential before proceeding forward.

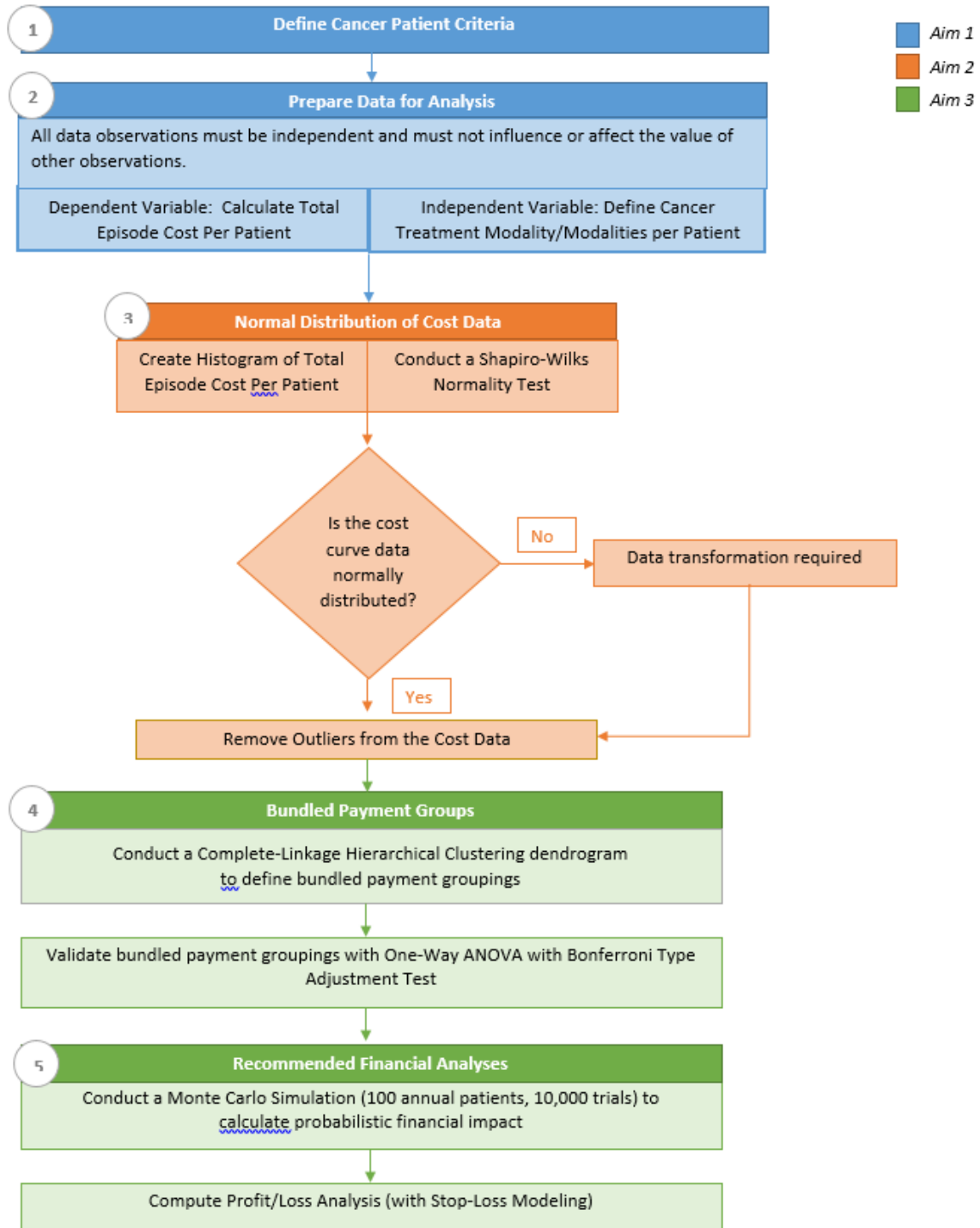
The third step in the bundled payment framework is to confirm the normal distribution of the curve. There are 2 possible ways to confirm the data is normally distributed: 1) create a histogram of the dependent variable, the episode costs, and visually confirm the cost curve is normally distributed; and/or 2) conduct a Shapiro-Wilks Normality Tests. The null hypothesis and outcome instructions are described above. If the cost curve is not normally distributed, a data transformation will be required to convert the cost curve to a normal distribution. In this analysis, a square root transformation was used. The last phase of the third step is to remove all outliers from the data before proceeding forward with step four. Step Three is a description of Aim 2 above.

The fourth step in the bundled payment framework is to define, bundle, and confirm the bundled payments by treatment modality. A Complete-Linked Hierarchical Clustering analysis is required to identify the treatment modalities with similar mean costs. The output of the clustering is a dendrogram that will provide a visual branching diagram of the treatment modality bundled groups. To confirm the bundled groupings

are correctly bundled, a One-Way ANOVA with Bonferroni Adjustment Type tests can be conducted to determine with bundled payment groups are statistically different. This test will help identify that statistically significant treatment modalities are not bundled together.

The fifth and final step in the 'how-to' guide includes recommendations for financial analyses. These recommendations include a simulation and pricing profitability analyses with stop-loss modeling if appropriate. These types of analyses will provide insights on how many bundles to create and where pricing negotiations should be targeted to be profitable for either the payor or provider. Although stop-loss modeling was not conducted in this study, it has been recommended in previous bundled payment methodologies(Feeley et al., 2015). The fourth and fifth steps reflect the previous analyses in Aim 3. The visual cancer bundled payment guide is below in Figure 10.

Figure 10: Cancer Bundled Payment Guide



VIII. DISCUSSION

The continuous expansion of bundled payment programs amongst the private payors and CMS suggests this alternative payment model is viable and profitable. Comprehensive cancer bundling methodology is absent from the literature. This missing literature is giving rise to single cancer treatment modality bundles. This analysis provides and supports transparent comprehensive bundled payment methodology. Furthermore, the proposed framework can help organizations and the government develop treatment modality based bundled payment methods.

This research introduced one dependent and one independent variables; however, this framework would still be applicable if future studies introduced more than one independent variable. The changes necessary would be the use an alternative analysis to confirm the differences between bundled payments. For example, hospitals or provider organizations may want to include cancer tumor registry data if available, bundles could be clustered by tumor stage with or without treatment modality combinations. As long as tumor stages were independent and unique, the bundling framework is still applicable to guide bundled payment modeling.

The bundled payment episode period is not consistent in the literature. Bundled payment programs with single treatment modality bundles have implemented shorter-term bundled payment episode of 90-180 days from start of treatment. Larger multi-modality treatment bundles have implemented 180 day to 1 year episodes. As suggested by the literature, a 12-month bundled payment episode is sufficient time for completion of all cancer treatment with appropriate time to assess immediate quality

outcomes. The OCM has implemented 6 month chemotherapy bundled payments (Thomas & Ward, 2016). Further research is necessary the financial risk and non-cancer utilization between 6 and 12-month past single cancer treatment modality.

Additionally, further research is needed to evaluate the administrative burden of implementing and managing bundled payments with different bundled episodes.

An important recommendation highlighted in step five of the bundled payment framework is the modeling of a stop-loss agreement during pricing negotiations. As defined by the Health Care Administrators Association, “a specific stop-loss is a form of excess risk coverage that provides protection for the employer against a high claim on any one individual. This is protection against abnormal severity of a single claim rather than abnormal frequency of claims in total” (Health Care Administrators Association, 2019). A stop loss coverage can further protect against unforeseen financial loss. The MD Anderson head and neck bundled payment program negotiated a stop loss(Feeley et al., 2015). A stop loss analysis coupled with pricing analyses can further enhanced the profitability of this type of payment arrangement.

As CMS moves forward with mandatory single treatment modality bundles, researchers have speculated other, more complex, bundles are projected for the future. This analysis provides a transparent approach for CMS and other payors and providers to develop more comprehensive multi-modality treatment bundles. CMS’s rationale for their proposed mandatory radiation therapy bundles is to incentivize value-based cancer treatment delivery. Radiation therapy is expensive and research would suggest more radiation treatment is not necessary efficient in some cancers (Paravati et al.,

2015). This type of alternative payment model creates incentives for providers to provide the highest quality care without the incremental disincentive of paying for volume that exists in current payment systems. In the current payment system, the fee-for-service system, providers would be paid more for additional cycles of radiation treatments and could be financially incentivized to provide more cycles with disregard for the quality implications of radiation toxicities.

CMS QPP-MIPS program introduced new episode-based cost measures. The approach is similar to bundled payments. QPP-MIPS episode-based cost measurers calculate the national total cost of care for a specific procedure and sets provider cost benchmarks with financial incentives or penalties. This program incentives decreases in cost of care delivery. There is currently only one cancer diagnostic procedure in the 2019 QPP-MIPS episode cost measure program. There is a surgical breast cancer episode based cost measure proposed for 2020. This bundled payment approach can be used to assess and model an organizations QPP-MIPS episode based cost category.

It's important to note there is strong opposition against bundled payments in the literature. Critics suggest bundled payments is only viable amongst providers who practice in integrated practice units (Deloitte Center for Health Solutions, 2017), where providers and hospital service lines are able to appropriately allocate costs and disperse bundled payment savings (Porter & Teisberg, 2006). The majority of the cancer delivered in the US is not within a comprehensive cancer center organized in this fashion. The second opposition against bundled payments is the unpredictability of new, high cost cancer drugs and treatment technologies (Deloitte Center for Health

Solutions, 2017). Under a bundled payment arrangement, providers would be disincentivized to provide new treatment innovations. Critics have stated that the shorter term bundled payment incentives do not reflect the real long-term incentives needed to reduce costs of treatment modalities in cancer care. Lastly, bundled payments does not address other cost drivers of cancer care spending (Basch, 2017; Thomas & Ward, 2016). This type of alternative payments does not solve the inaccuracy and misdiagnosis problem that currently exists. Future research is encouraged to address each of these critiques to help reduce the cost of cancer care delivery through alternative payments, like bundled payments.

IX. LIMITATIONS

Administrative claims bundled payment research can provide evidence to support or dismiss alternative payment models in healthcare. Due to the nature and limitation of the data, there are several limitations. The data validity and reliability is as accurate as the contractual payment audit processes and provider documentation currently used by hospitals and providers. All claims have undergone the typical billing audit and are deemed reliable but limitations may exist if the documentation errors or medical billing errors were present and not caught by the medical billing audit process. The administrative claims databased used in this research does not have unique provider or hospital information. This limits the ability to analyze data by provider therefore the data was summarized at the patient, treatment-modality, and bundled payment group level only.

The 'costs' analyzed in this study are actually payor allowed amounts and geographically standardized across regions. This limitation does not allow for geographic costs comparison analyses nor longitudinal studies by provider. It's also important to note the allowed amounts are not correlated nor do they reflect actual provider costs. The allowed amounts are contractual limits negotiated between provider and payors. This study assumes provider costs are below allowed amounts. Therefore only those providers who can make a profit will stay sustainable in the long run under bundled payment methodology.

This study will not examine the head and neck cancer cost drivers nor the cost of cancer care for other non-newly diagnosed patients. This research is proposing a bundled payment methodology for newly diagnosed payment. Future is necessary to validate this bundled payment approach under bundled payment scenarios and patient populations.

Next, the use of a Monte Carlo simulation introduces several limitations. A Monte Carlo simulation is a type of analysis that provides a distribution of results to allow organizations to assess risk on their own behalf (Dimov, 2008; Gao, 1999; Mao, 1997; Perrott, 2004; Richter & Mauskopf, 1998; Rodina-Theocharaki, Bliznakova, & Pallikarakis, 2012; Zhu et al., 2011). A Monte Carlo simulation requires a Random number generator to create data based on data statistics. The simulations are dependent on the validity and reliability of the administrative claims data and the bundled payment grouping approach. Depending on the distribution of future studies,

the random number generator may need to use a different algorithm than the one used in this study.

Lastly, the bundling of treatment modalities into payment groups based on historical costs may not be appropriate for all future bundled payment analyses. Treatment modalities are usually depending on the cancer patient's disease status (cancer tumor and stage), patient preference, or access to appropriate treatment types. This research does not attempt to access appropriate access to care or scarcity of treatment options. In the future, if patient level tumor registry data were available with administrative claims, a better appropriate to bundling would be by tumor stage or clinical pathways.

X. HUMAN SUBJECTS AND DATA VALIDITY

The University of Texas School of Public Health (UTSPH) has access to Optum[®] Life Sciences Database administrative claims data; no clinical data is available for members in their database. Administrative claims data are contractual agreements between the provider and payors (insurance carriers) that require the collection of data for business and reporting purposes only. There are patient sensitive data (date of birth, gender, and zip code) available in the member claims database. No persons were harmed in the collection of this data. Providers initiated the data collection in an effort to request of payment for services rendered by patients. Payors collect and store data upon receipt for transaction business purposes. It is presumed data in this database are validate and acceptable for costs analyses.

Both parties conduct claim audits to ensure that the validity of the information in the claims reported is accurate; audits help protect the legal and financial obligations

under the contract. Many providers perform independent, internal audits to catch errors in the reporting process to ensure that the claims submitted to insurance carriers are accurate; errors claims submissions could trigger additional audits from external agents and dismissal of reimbursement for such claims. Errors can also jeopardize business affairs and potentially result in termination of contractual agreements. The University Of Texas School Of Public Health has also taken measures to protect administrative claims data. No security breaches or compromises have been reported. In conclusion, the data is assumed to be valid and reliable.

A formal data request will be submitted in January 2019 to gain access to head and neck patient claims for 2011- 2017. All data extracted was stored on a UTSPH secured servers and only accessed using a secure VPN and under password protection. The study was reviewed by the 'Committee of the Protection of Human Subjects' to ensure the methods and measures described above protect the privacy and safety of patient's data. No data extraction or analyses were conducted until exempt study approval letter were submitted to the UTSPH Data Center. A copy of the approved letter are available in Appendix G and H.

XI. CONCLUSION

Bundled payments, along with other alternative payments, have the ability to curb the healthcare cost curve in the US. There is evidence to suggest bundled payments can reduce the cost of care by incentivizing quality cancer care delivery and penalizing inefficiencies in the delivery systems. Currently, there are no transparent, multi-cancer treatment modality bundled payment methodologies to support comprehensive

bundled payments in the US. This research fills a gap in the literature by providing a transparent, feasible approach to bundling chemotherapy, radiation therapy, and surgery cancer treatment modalities. Additionally, this research provides a framework for approaching cancer bundles which is currently missing in the literature. While, this analysis focused on newly diagnosed cancer treatment bundles, the framework can be used to model all other treatment modality bundles; for example, concurrent, recurrent, and metastatic are proposed future bundles using this same framework. Lastly, this analysis proves bundled payment grouping is feasible and viability, albeit dependent on an organization's ability to control healthcare spending costs and negotiate bundled payment prices above costs. The results of this work demonstrate the use of statistical and financial models to support price models and sensitivity analyses. Healthcare leaders can use these models to better understand their expected costs/ profits and leverage their negotiations; however, it should be noted that this research does not suggest all bundled payment methodologies are profitable. Future studies, using this framework and institutional level costs, are needed to validate and potentially improve the proposed methodology.

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XIII. APPENDICES

Appendix A: Head & Neck Primary Cancer Diagnosis Codes

<u>Code Type</u>	<u>Code</u>	<u>Diagnosis Description</u>
ICD-9 CM	140.0	Malignant neoplasm of upper lip, vermilion border
ICD-9 CM	140.1	Malignant neoplasm of lower lip, vermilion border
ICD-9 CM	140.3	Malignant neoplasm of upper lip, inner aspect
ICD-9 CM	140.4	Malignant neoplasm of lower lip, inner aspect
ICD-9 CM	140.5	Malignant neoplasm of lip, unspecified, inner aspect
ICD-9 CM	140.6	Malignant neoplasm of commissure of lip
ICD-9 CM	140.8	Malignant neoplasm of other sites of lip
ICD-9 CM	140.9	Malignant neoplasm of lip, unspecified, vermilion border
ICD-9 CM	141.0	Malignant neoplasm of base of tongue
ICD-9 CM	141.1	Malignant neoplasm of dorsal surface of tongue
ICD-9 CM	141.2	Malignant neoplasm of tip and lateral border of tongue
ICD-9 CM	141.3	Malignant neoplasm of ventral surface of tongue
ICD-9 CM	141.4	Malignant neoplasm of anterior two-thirds of tongue, part unspecified
ICD-9 CM	141.5	Malignant neoplasm of junctional zone of tongue
ICD-9 CM	141.6	Malignant neoplasm of lingual tonsil
ICD-9 CM	141.8	Malignant neoplasm of other sites of tongue
ICD-9 CM	141.9	Malignant neoplasm of tongue, unspecified
ICD-9 CM	142.0	Malignant neoplasm of parotid gland
ICD-9 CM	142.1	Malignant neoplasm of submandibular gland
ICD-9 CM	142.2	Malignant neoplasm of sublingual gland
ICD-9 CM	142.8	Malignant neoplasm of other major salivary glands
ICD-9 CM	142.9	Malignant neoplasm of salivary gland, unspecified
ICD-9 CM	143.0	Malignant neoplasm of upper gum
ICD-9 CM	143.1	Malignant neoplasm of lower gum
ICD-9 CM	143.8	Malignant neoplasm of other sites of gum
ICD-9 CM	143.9	Malignant neoplasm of gum, unspecified
ICD-9 CM	144.0	Malignant neoplasm of anterior portion of floor of mouth
ICD-9 CM	144.1	Malignant neoplasm of lateral portion of floor of mouth
ICD-9 CM	144.8	Malignant neoplasm of other sites of floor of mouth

ICD-9 CM	144.9	Malignant neoplasm of floor of mouth, part unspecified
ICD-9 CM	145.0	Malignant neoplasm of cheek mucosa
ICD-9 CM	145.1	Malignant neoplasm of vestibule of mouth
ICD-9 CM	145.2	Malignant neoplasm of hard palate
ICD-9 CM	145.3	Malignant neoplasm of soft palate
ICD-9 CM	145.4	Malignant neoplasm of uvula
ICD-9 CM	145.5	Malignant neoplasm of palate, unspecified
ICD-9 CM	145.6	Malignant neoplasm of retromolar area
ICD-9 CM	145.8	Malignant neoplasm of other specified parts of mouth
ICD-9 CM	145.9	Malignant neoplasm of mouth, unspecified
ICD-9 CM	146.0	Malignant neoplasm of tonsil
ICD-9 CM	146.1	Malignant neoplasm of tonsillar fossa
ICD-9 CM	146.2	Malignant neoplasm of tonsillar pillars (anterior) (posterior)
ICD-9 CM	146.3	Malignant neoplasm of vallecula epiglottica
ICD-9 CM	146.4	Malignant neoplasm of anterior aspect of epiglottis
ICD-9 CM	146.5	Malignant neoplasm of junctional region of oropharynx
ICD-9 CM	146.6	Malignant neoplasm of lateral wall of oropharynx
ICD-9 CM	146.7	Malignant neoplasm of posterior wall of oropharynx
ICD-9 CM	146.8	Malignant neoplasm of other specified sites of oropharynx
ICD-9 CM	146.9	Malignant neoplasm of oropharynx, unspecified site
ICD-9 CM	149.0	Malignant neoplasm of pharynx, unspecified
ICD-9 CM	149.1	Malignant neoplasm of waldeyer's ring
ICD-9 CM	149.8	Malignant neoplasm of other sites within the lip and oral cavity
ICD-9 CM	149.9	Malignant neoplasm of ill-defined sites within the lip and oral cavity
ICD-9 CM	161.0	Malignant neoplasm of glottis
ICD-9 CM	161.1	Malignant neoplasm of supraglottis
ICD-9 CM	161.2	Malignant neoplasm of subglottis
ICD-9 CM	161.3	Malignant neoplasm of laryngeal cartilages
ICD-9 CM	161.8	Malignant neoplasm of other specified sites of larynx
ICD-9 CM	161.9	Malignant neoplasm of larynx, unspecified
ICD-10 CM	C00.0	Malignant neoplasm of external upper lip
ICD-10 CM	C00.1	Malignant neoplasm of external lower lip
ICD-10 CM	C00.2	Malignant neoplasm of external lip, unspecified

ICD-10 CM	C00.3	Malignant neoplasm of upper lip, inner aspect
ICD-10 CM	C00.4	Malignant neoplasm of lower lip, inner aspect
ICD-10 CM	C00.5	Malignant neoplasm of lip, unspecified, inner aspect
ICD-10 CM	C00.6	Malignant neoplasm of commissure of lip, unspecified
ICD-10 CM	C00.8	Malignant neoplasm of overlapping sites of lip
ICD-10 CM	C00.9	Malignant neoplasm of lip, unspecified
ICD-10 CM	C01	Malignant neoplasm of base of tongue
ICD-10 CM	C02.0	Malignant neoplasm of dorsal surface of tongue
ICD-10 CM	C02.1	Malignant neoplasm of border of tongue
ICD-10 CM	C02.2	Malignant neoplasm of ventral surface of tongue
ICD-10 CM	C02.3	Malignant neoplasm of anterior two-thirds of tongue, part unspecified
ICD-10 CM	C02.4	Malignant neoplasm of lingual tonsil
ICD-10 CM	C02.8	Malignant neoplasm of overlapping sites of tongue
ICD-10 CM	C02.9	Malignant neoplasm of tongue, unspecified
ICD-10 CM	C03.0	Malignant neoplasm of upper gum
ICD-10 CM	C03.1	Malignant neoplasm of lower gum
ICD-10 CM	C03.9	Malignant neoplasm of gum, unspecified
ICD-10 CM	C04.0	Malignant neoplasm of anterior floor of mouth
ICD-10 CM	C04.1	Malignant neoplasm of lateral floor of mouth
ICD-10 CM	C04.8	Malignant neoplasm of overlapping sites of floor of mouth
ICD-10 CM	C04.9	Malignant neoplasm of floor of mouth, unspecified
ICD-10 CM	C05.0	Malignant neoplasm of hard palate
ICD-10 CM	C05.1	Malignant neoplasm of soft palate
ICD-10 CM	C05.2	Malignant neoplasm of uvula
ICD-10 CM	C05.8	Malignant neoplasm of overlapping sites of palate
ICD-10 CM	C05.9	Malignant neoplasm of palate, unspecified
ICD-10 CM	C06.0	Malignant neoplasm of cheek mucosa
ICD-10 CM	C06.1	Malignant neoplasm of vestibule of mouth
ICD-10 CM	C06.2	Malignant neoplasm of retromolar area
ICD-10 CM	C06.80	Malignant neoplasm of overlapping sites of unspecified parts of mouth
ICD-10 CM	C06.89	Malignant neoplasm of overlapping sites of other parts of mouth
ICD-10 CM	C06.9	Malignant neoplasm of mouth, unspecified
ICD-10 CM	C07	Malignant neoplasm of parotid gland

ICD-10 CM	C08.0	Malignant neoplasm of submandibular gland
ICD-10 CM	C08.1	Malignant neoplasm of sublingual gland
ICD-10 CM	C08.9	Malignant neoplasm of major salivary gland, unspecified
ICD-10 CM	C09.0	Malignant neoplasm of tonsillar fossa
ICD-10 CM	C09.1	Malignant neoplasm of tonsillar pillar (anterior) (posterior)
ICD-10 CM	C09.8	Malignant neoplasm of overlapping sites of tonsil
ICD-10 CM	C09.9	Malignant neoplasm of tonsil, unspecified
ICD-10 CM	C10.0	Malignant neoplasm of vallecula
ICD-10 CM	C10.1	Malignant neoplasm of anterior surface of epiglottis
ICD-10 CM	C10.2	Malignant neoplasm of lateral wall of oropharynx
ICD-10 CM	C10.3	Malignant neoplasm of posterior wall of oropharynx
ICD-10 CM	C10.4	Malignant neoplasm of branchial cleft
ICD-10 CM	C10.8	Malignant neoplasm of overlapping sites of oropharynx
ICD-10 CM	C10.9	Malignant neoplasm of oropharynx, unspecified
ICD-10 CM	C14.0	Malignant neoplasm of pharynx, unspecified
ICD-10 CM	C14.2	Malignant neoplasm of Waldeyer's ring
ICD-10 CM	C14.8	Malignant neoplasm of overlapping sites of lip, oral cavity and pharynx

Appendix B: Surgery Procedure Codes

CODE	PROCEDURE DESCRIPTION	CODE TYPE	SERVICE CATEGORY DESCRIPTION
31300	LARYNGOTOMY W/RMVL TUMOR/LARYNGOCELE CORDECTOMY	CPT-4	RESPIRATORY SYSTEM - LARYNX - EXCISION
31320	LARYNGOTOMY THYROTOMY LARYNGOFISSURE DX	CPT-4	RESPIRATORY SYSTEM - LARYNX - EXCISION
31360	LARYNGECTOMY TOTAL W/O RADICAL NECK DISSECTION	CPT-4	RESPIRATORY SYSTEM - LARYNX - EXCISION
31364	BRONCHOSCOPY, RIGID OR FLEXIBLE, INCLUDING FLUOR	CPT-4	RESPIRATORY SYSTEM - LARYNX - EXCISION
31365	LARYNGECTOMY TOTAL W/RADICAL NECK DISSECTION	CPT-4	RESPIRATORY SYSTEM - LARYNX - EXCISION
31367	LARYNGECTOMY STOT SUPRAGLOTTIC W/O RAD NECK DSJ	CPT-4	RESPIRATORY SYSTEM - LARYNX - EXCISION
31368	LARYNGECTOMY STOT SUPRAGLOTTIC W/RAD NCK DSJ	CPT-4	RESPIRATORY SYSTEM - LARYNX - EXCISION
31370	PARTIAL LARYNGECTOMY HEMILARYGECTOMY HORIZONTAL	CPT-4	RESPIRATORY SYSTEM - LARYNX - EXCISION
31375	PARTIAL LARYNGECTOMY HEMILARYNG LATEROVERTICAL	CPT-4	RESPIRATORY SYSTEM - LARYNX - EXCISION
31380	PARTIAL LARYNGECTOMY HEMILARYNG ANTEROVERTICAL	CPT-4	RESPIRATORY SYSTEM - LARYNX - EXCISION
31382	PARTIAL LARYNG HEMILARYNG ANTERO-LATERO-VERTICAL	CPT-4	RESPIRATORY SYSTEM - LARYNX - EXCISION
31390	PHARYNGOLARYNGECTOMY W/RAD NECK DSJ W/O RCNSTJ	CPT-4	RESPIRATORY SYSTEM - LARYNX - EXCISION
31395	PHARYNGOLARYNGECTOMY W/RAD NECK DSJ W/RCNSTJ	CPT-4	RESPIRATORY SYSTEM - LARYNX - EXCISION
31400	ARYTENOIDECTOMY/ARYTENOIDOPEXY XTRNL APPROACH	CPT-4	RESPIRATORY SYSTEM - LARYNX - EXCISION
31420	EPIGLOTTIDECTOMY	CPT-4	RESPIRATORY SYSTEM - LARYNX - EXCISION
31500	INTUBATION ENDOTRACHEAL EMERGENCY PROCEDURE	CPT-4	RESPIRATORY SYSTEM - LARYNX - INTRODUCTION

31502	TRACHEOTOMY TUBE CHANGE PRIOR TO FISTULA TRACT	CPT-4	RESPIRATORY SYSTEM - LARYNX - INTRODUCTION
31505	LARYNGOSCOPY INDIRECT DIAGNOSTIC SPX	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31510	LARYNGOSCOPY INDIRECT W/BIOPSY	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31511	LARYNGOSCOPY INDIRECT W/REMOVAL FOREIGN BODY	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31512	LARYNGOSCOPY INDIRECT W/REMOVAL LESION	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31513	LARYNGOSCOPY INDIRECT W/VOCAL CORD INJECTION	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31515	LARYNGOSCOPY W/WO TRACHEOSCOPY ASPIRATION	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31525	LARYNGOSCOPY W/WO TRACHEOSCOPY DX EXCEPT NEWBORN	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31526	LARYNGOSCOPY W/WO TRACHEOSCOPY W/MICRO/TELESCOPE	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31527	LARYNGOSCOPY W/WO TRACHEOSCOPY INSERT OBTURATOR	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31528	LARYNGOSCOPY W/WO TRACHEOSCOPY W/DILATION IN	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31529	LARYNGOSCOPY W/WO TRACHEOSCOPY DILATION SUBSQ	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31530	LARYNGOSCOPY W/FOREIGN BODY REMOVAL	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31531	LARYNGOSCOPY FOREIGN BODY RMVL MICRO/TELESCOPE	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31535	LARYNGOSCOPY DIRECT OPERATIVE W/BIOPSY	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31536	LARYNGOSCOPY W/BIOPSY MICROSCOPE/TELESCOPE	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31540	LARYNGOSCOPY EXC TUM&/STRIPPING CORDS/EPIGLOTT	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31541	LARGSC EXC TUM&/STRPG CORDS/EPIGL MCRSCP/TLSCP	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31545	LARGSC MICRO/TELESCOPE RMVL LES VOCAL CORD FLAP	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31546	LARGSC MICRO/TELESCOPE RMVL LES VOCAL CORD GRAFT	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY

31551	LARYNGOPLASTY LARYNGEAL STEN W/O STENT < 12 YRS	CPT-4	RESPIRATORY SYSTEM - LARYNX - REPAIR
31552	LARYNGOPLASTY LARYNGEAL STEN W/O STENT 12 YRS >	CPT-4	RESPIRATORY SYSTEM - LARYNX - REPAIR
31553	LARYNGOPLASTY LARYNGEAL STEN W/STENT < 12 YRS	CPT-4	RESPIRATORY SYSTEM - LARYNX - REPAIR
31554	LARYNGOPLASTY LARYNGEAL STEN W/STENT 12 YRS >	CPT-4	RESPIRATORY SYSTEM - LARYNX - REPAIR
31560	LARYNGOSCOPY DIRECT OPERATIVE W/ARYTENOIDECTOMY	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31561	LARGSC ARYTENOIDECTOMY MICROSCOPE/TELESCOPE	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31570	LARYNGOSCOPE INJECTION VOCAL CORD THERAPEUTIC	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31571	LARGSC W/NJX VOCAL CORD THER W/MICRO/TELESCOPE	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31572	LARYNGOSCOPY FLEXIBLE ABLATJ DESTJ LESION(S) UNI	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31573	LARYNGOSCOPY FLEXIBLE THERAPEUTIC INJECTION UNI	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31574	LARYNGOSCOPY FLEXIBLE W/INJECTION AGMNTJ UNI	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31575	LARYNGOSCOPY FLEXIBLE DIAGNOSTIC	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31576	LARYNGOSCOPY FLEXIBLE W/BIOPSY(IES)	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31577	LARYNGOSCOPY FLX RMVL FOREIGN BODY(S)	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31578	LARYNGOSCOPY FLEXIBLE RMVL LESION(S) NON-LASER	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31579	LARYNGOSCOPY FLX/RGD TELESCOPIC W/STROBOSCOPY	CPT-4	RESPIRATORY SYSTEM - LARYNX - ENDOSCOPY
31580	LARYNGOPLASTY LARYN WEB W/KEEL STENT INSERTION	CPT-4	RESPIRATORY SYSTEM - LARYNX - REPAIR
31582	LARYNGP LARYN STENOSIS GRF/CORE MOLD W/TRACHT	CPT-4	RESPIRATORY SYSTEM - LARYNX - REPAIR
31584	LARYNGOPLASTY W/OPEN REDUCTION FRACTURE W/TRACHS	CPT-4	RESPIRATORY SYSTEM - LARYNX - REPAIR
31587	LARYNGOPLASTY CRICOID SPLIT W/O GRAFT PLACEMENT	CPT-4	RESPIRATORY SYSTEM - LARYNX - REPAIR
31588	LARYNGOPLASTY NOT OTHERWISE SPECIFIED	CPT-4	RESPIRATORY SYSTEM - LARYNX - REPAIR

31590	LARYNGEAL REINNERVATION NEUROMUSCULAR PEDICLE	CPT-4	RESPIRATORY SYSTEM - LARYNX - REPAIR
31591	LARYNGOPLASTY MEDIALIZATION UNLIATERAL	CPT-4	RESPIRATORY SYSTEM - LARYNX - REPAIR
31592	CRICOTRACHEAL RESECTION	CPT-4	RESPIRATORY SYSTEM - LARYNX - REPAIR
31595	SECTION RECURRENT LARYNGEAL NERVE THER UNI SPX	CPT-4	RESPIRATORY SYSTEM - LARYNX - DESTRUCTION
31599	UNLISTED PROCEDURE LARYNX	CPT-4	RESPIRATORY SYSTEM - LARYNX - OTHER PROCEDURES
40500	VERMILIONECTOMY LIP SHV W/MUCOSAL ADVMNT	CPT-4	DIGESTIVE SYSTEM - LIPS - EXCISION
40510	EXC LIP TRANSVRS WEDGE EXC W/PRIM CLSR	CPT-4	DIGESTIVE SYSTEM - LIPS - EXCISION
40520	EXC LIP V-EXC W/PRIM DIR LINR CLSR	CPT-4	DIGESTIVE SYSTEM - LIPS - EXCISION
40525	EXC LIP FULL THKNS RCNSTJ W/LOCAL FLAP	CPT-4	DIGESTIVE SYSTEM - LIPS - EXCISION
40527	EXC LIP FULL THKNS RCNSTJ W/CROSS LIP FLAP	CPT-4	DIGESTIVE SYSTEM - LIPS - EXCISION
40530	RESCJ LIP > ONE-FOURTH W/O RCNSTJ	CPT-4	DIGESTIVE SYSTEM - LIPS - EXCISION
41100	BIOPSY TONGUE ANTERIOR TWO-THIRDS	CPT-4	DIGESTIVE SYSTEM - TONGUE FLOOR OF MOUTH - EXCISION
41105	BIOPSY TONGUE POSTERIOR ONE-THIRD	CPT-4	DIGESTIVE SYSTEM - TONGUE FLOOR OF MOUTH - EXCISION
41108	BIOPSY FLOOR MOUTH	CPT-4	DIGESTIVE SYSTEM - TONGUE FLOOR OF MOUTH - EXCISION
41110	EXCISION LESION TONGUE W/O CLOSURE	CPT-4	DIGESTIVE SYSTEM - TONGUE FLOOR OF MOUTH - EXCISION
41112	EXC LESION TONGUE W/CLSR ANTERIOR TWO-THIRDS	CPT-4	DIGESTIVE SYSTEM - TONGUE FLOOR OF MOUTH - EXCISION
41113	EXC LESION TONGUE W/CLSR POSTERIOR ONE-THIRD	CPT-4	DIGESTIVE SYSTEM - TONGUE FLOOR OF MOUTH - EXCISION
41114	EXC LESION TONGUE W/CLSR W/LOCAL TONGUE FLAP	CPT-4	DIGESTIVE SYSTEM - TONGUE FLOOR OF MOUTH - EXCISION
41115	EXCISION LINGUAL FRENUM FRENECTOMY	CPT-4	DIGESTIVE SYSTEM - TONGUE FLOOR OF MOUTH - EXCISION
41116	EXCISION LESION FLOOR MOUTH	CPT-4	DIGESTIVE SYSTEM - TONGUE FLOOR OF MOUTH - EXCISION
41120	GLOSSECTOMY <ONE-HALF TONGUE	CPT-4	DIGESTIVE SYSTEM - TONGUE FLOOR OF MOUTH - EXCISION

41130	GLOSSECTOMY HEMIGLOSSECTOMY	CPT-4	DIGESTIVE SYSTEM - TONGUE FLOOR OF MOUTH - EXCISION
41135	GLOSSECTOMY PRTL W/UNI RADICAL NECK DSJ	CPT-4	DIGESTIVE SYSTEM - TONGUE FLOOR OF MOUTH - EXCISION
41140	GLSSC COMPL/TOT W/WOTRACHS W/O RAD NECK DSJ	CPT-4	DIGESTIVE SYSTEM - TONGUE FLOOR OF MOUTH - EXCISION
41145	GLSSC COMPL/TOT W/WO TRACHS W/UNI RAD NECK DSJ	CPT-4	DIGESTIVE SYSTEM - TONGUE FLOOR OF MOUTH - EXCISION
41150	GLSSC COMPOSIT W/RESCJ FLOOR & MANDIBULAR RESCJ	CPT-4	DIGESTIVE SYSTEM - TONGUE FLOOR OF MOUTH - EXCISION
42100	BIOPSY PALATE UVULA	CPT-4	DIGESTIVE SYSTEM - PALATE UVULA - EXCISION DESTRUCTION
42104	EXC LESION PALATE UVULA W/O CLOSURE	CPT-4	DIGESTIVE SYSTEM - PALATE UVULA - EXCISION DESTRUCTION
42106	EXC LESION PALATE UVULA W/SMPL PRIM CLOSURE	CPT-4	DIGESTIVE SYSTEM - PALATE UVULA - EXCISION DESTRUCTION
42107	EXC LESION PALATE UVULA W/LOCAL FLAP CLOSURE	CPT-4	DIGESTIVE SYSTEM - PALATE UVULA - EXCISION DESTRUCTION
42120	RESCJ PALATE/EXTENSIVE RESCJ LESION	CPT-4	DIGESTIVE SYSTEM - PALATE UVULA - EXCISION DESTRUCTION
42400	BIOPSY SALIVARY GLAND NEEDLE	CPT-4	DIGESTIVE SYSTEM - SALIVARY GLAND/DUCTS - EXCISION
42405	BIOPSY SALIVARY GLAND INCISIONAL	CPT-4	DIGESTIVE SYSTEM - SALIVARY GLAND/DUCTS - EXCISION
42408	EXC SUBLINGUAL SALIVARY CYST RANULA	CPT-4	DIGESTIVE SYSTEM - SALIVARY GLAND/DUCTS - EXCISION
42409	MARSUPIALIZATION SUBLNGL SALIVARY CST RANULA	CPT-4	DIGESTIVE SYSTEM - SALIVARY GLAND/DUCTS - EXCISION
42410	EXC PRTD TUM/PRTD GLND LAT LOBE W/O NRV DSJ	CPT-4	DIGESTIVE SYSTEM - SALIVARY GLAND/DUCTS - EXCISION
42415	EXC PRTD TUM/PRTD GLND LAT DSJ&PRSRV FACIAL NR	CPT-4	DIGESTIVE SYSTEM - SALIVARY GLAND/DUCTS - EXCISION
42420	EXC PRTD TUM/PRTD GLND TOT DSJ&PRSRV FACIAL NR	CPT-4	DIGESTIVE SYSTEM - SALIVARY GLAND/DUCTS - EXCISION
42425	EXCISION PAROTID TUMOR/GLAND TOTAL EN BLOC RMVL	CPT-4	DIGESTIVE SYSTEM - SALIVARY GLAND/DUCTS - EXCISION
42426	EXC PRTD TUM/PRTD GLND TOT W/UNI RAD NCK DSJ	CPT-4	DIGESTIVE SYSTEM - SALIVARY GLAND/DUCTS - EXCISION
42440	EXCISION SUBMANDIBULAR SUBMAXILLARY GLAND	CPT-4	DIGESTIVE SYSTEM - SALIVARY GLAND/DUCTS - EXCISION
42450	EXISION OF SUBLINGUAL GLAND	CPT-4	DIGESTIVE SYSTEM - SALIVARY GLAND/DUCTS - EXCISION

42700	I&D ABSCESS PERITONSILLAR	CPT-4	DIGESTIVE SYSTEM - PHARYNX ADENOIDS AND TONSILS - INCISION
42720	I&D ABSC RTRPHRNGL/PARAPHARYNGEAL INTRAORAL	CPT-4	DIGESTIVE SYSTEM - PHARYNX ADENOIDS AND TONSILS - INCISION
42725	I&D ABSC RTRPHRNGL/PARAPHARYNGEAL XTRNL APPR	CPT-4	DIGESTIVE SYSTEM - PHARYNX ADENOIDS AND TONSILS - INCISION
42800	BIOPSY OROPHARYNX	CPT-4	DIGESTIVE SYSTEM - PHARYNX ADENOIDS AND TONSILS - EXCISION DESTRUCTION - OTHER
42802	BX HYPOPHARYNX	CPT-4	DIGESTIVE SYSTEM - PHARYNX ADENOIDS AND TONSILS - EXCISION DESTRUCTION - OTHER
42808	EXCISION/DESTRUCTION LESION PHARYNX ANY METHOD	CPT-4	DIGESTIVE SYSTEM - PHARYNX ADENOIDS AND TONSILS - EXCISION DESTRUCTION - OTHER
42809	REMOVAL FOREIGN BODY PHARYNX	CPT-4	DIGESTIVE SYSTEM - PHARYNX ADENOIDS AND TONSILS - EXCISION DESTRUCTION - OTHER
42810	EXC BRANCHIAL CLEFT CYST CONFINED SKN&SUBQ TIS	CPT-4	DIGESTIVE SYSTEM - PHARYNX ADENOIDS AND TONSILS - EXCISION DESTRUCTION - OTHER
42815	EXC BRANCHIAL CLEFT CYST BELOW SUBQ TISS&/PHRYNX	CPT-4	DIGESTIVE SYSTEM - PHARYNX ADENOIDS AND TONSILS - EXCISION DESTRUCTION - OTHER
42821	TONSILLECTOMY&ADENOIDECTIONY AGE 12/>	CPT-4	TONSILLECTOMY AND ADENOIDECTIONY; AGE 12 OR OVER
42826	TONSILLECTOMY PRIMARY/SECONDARY AGE 12/>	CPT-4	TONSILLECTOMY PRIMARY OR SECONDARY; AGE 12 OR OVER
42831	ADENOIDECTIONY PRIMARY AGE 12/>	CPT-4	ADENOIDECTIONY PRIMARY; AGE 12 OR OVER
42836	ADENOIDECTIONY SECONDARY AGE 12/>	CPT-4	ADENOIDECTIONY SECONDARY; AGE 12 OR OVER
42870	EXC/DSTRJ LINGUAL TONSIL ANY METHOD SPX	CPT-4	DIGESTIVE SYSTEM - PHARYNX ADENOIDS AND TONSILS - EXCISION DESTRUCTION - OTHER

Appendix C: Radiation Therapy Procedure Codes

CODE	PROCEDURE DESCRIPTION	CODE TYPE
0073T	COMPNSTR-BASED BEAM MODLJ TX DLVR INVERSE 3> FLD	CPT-4
0182T	HDR ELECTRONIC BRACHYTHERAPY PER FRACTION	CPT-4
0190T	INTRAOCULAR RADIATION SRC APPLICATOR PLACEMENT	CPT-4
0197T	LOCLZJ&TRACKING TARGET/PT MOTION DEL RADJ THER	CPT-4
0301T	DEST/REDUC MALIG BRST TUMR W/US THRMORX GUIDANCE	CPT-4
0394T	HDR ELECTRONIC BRACHYTHERAPY SKIN SURFACE	CPT-4
0395T	HDR ELECTRONIC BRACHYTHERAPY NTRSTL/INTRCAV	CPT-4
19296	PLMT EXPANDABLE CATH BRST FOLLOWING PRTL MAST	CPT-4
19297	PLMT EXPANDABLE CATH BRST CONCURRENT PRTL MAST	CPT-4
19298	PLMT RADTHX BRACHYTX BRST FOLLOWING PRTL MAST	CPT-4
32553	PLMT NTRSTL DEV RADJ THX GID PRQ INTRATHRC 1/MLT	CPT-4
32701	THORAX STEREOTACTIC RADIATION TARGET W/TX COURSE	CPT-4
41019	PLACEMENT NEEDLE HEAD/NECK RADIOELEMENT APPLICAT	CPT-4
49327	LAPS W/INSERTION NTRSTL DEV W/IMG GUID 1/MLT	CPT-4
49411	INTERSTITIAL DEV PLMT RADIATION THERAPY 1/MLT	CPT-4
49412	PLACEMENT INTRSTL DEV OPN W/IMG GUID 1/MLT	CPT-4
55875	TRANSPERINEAL PLMT NDL/CATHS PROSTATE RADJ INSJ	CPT-4
55876	PLMT INTERSTITIAL DEV RADIAT TX PROSTATE 1/MULT	CPT-4
55920	PLACEMENT NEEDLE PELVIC ORGAN RADIOELEMENT APPL	CPT-4
57155	INSERTION UTERINE TANDEM&/VAGINAL OVOIDS	CPT-4
57156	INSERTION VAGINAL RADIATION DEVICE	CPT-4
58346	INSERTION HEYMAN CAPSULES CLINICAL BRACHYTHERAPY	CPT-4
61770	STRCTC LOCLZJ INSJ CATH/PRB PLMT RADJ SRC	CPT-4
67218	DSTRJ LESION RETINA 1/> SESS RADJ IMPLTJ	CPT-4
76873	US TRANSRCT PRSTATE VOL BRACHYTX PLNNING SPX	CPT-4
76950	US PLMT RADJ THER FLDS	CPT-4

76965	US GUIDANCE INTERSTITIAL RADIOELEMENT APPLICATION	CPT-4
77014	CT GUIDANCE RADIATION THERAPY FLDS PLACEMENT	CPT-4
77261	THERAPEUTIC RADIOLOGY TX PLANNING SIMPLE	CPT-4
77262	THERAPEUTIC RADIOLOGY TX PLANNING INTERMEDIATE	CPT-4
77263	THERAPEUTIC RADIOLOGY TX PLANNING COMPLEX	CPT-4
77280	THER RAD SIMULAJ-AIDED FIELD SETTING SIMPLE	CPT-4
77285	THER RAD SIMULAJ-AIDED FIELD SETTING INTERMED	CPT-4
77290	THER RAD SIMULAJ-AIDED FIELD SETTING COMPLEX	CPT-4
77295	3-D RADIOTHERAPY PLAN DOSE-VOLUME HISTOGRAMS	CPT-4
77300	BASIC RADIATION DOSIMETRY CALCULATION	CPT-4
77301	NTSTY MODUL RADTHX PLN DOSE-VOL HISTOS	CPT-4
77306	TELETHX ISODOSE PLN SMPL W/DOSIMETRY CALCULATION	CPT-4
77307	TELETHX ISODOSE PLN CPLX W/BASIC DOSIMETRY	CPT-4
77316	BRACHYTX ISODOSE PLN SMPL W/DOSIMETRY CAL	CPT-4
77317	BRACHYTX ISODOSE PLN INTERMED W/DOSIMETRY CAL	CPT-4
77318	BRACHYTX ISODOSE PLN CPLX W/DOSIMETRY CAL	CPT-4
77321	SPEC TELETHX PORT PLN PARTS HEMIBDY TOT BDY	CPT-4
77326	BRACHYTX ISODOSE PLN SMPL	CPT-4
77327	BRACHYTX ISODOSE PLN INTRM	CPT-4
77328	BRACHYTX ISODOSE PLN CPLX	CPT-4
77331	SPEC DOSIM ONLY PRESCRIBED TREATING PHYS	CPT-4
77332	TX DEVICES DESIGN & CONSTRUCTION SIMPLE	CPT-4
77333	TX DEVICES DESIGN & CONSTRUCTION INTERMEDIATE	CPT-4
77336	CONTINUING MEDICAL PHYSICS CONSLTJ PR WK	CPT-4
77338	MLC IMRT DESIGN & CONSTRUCTION PER IMRT PLAN	CPT-4
77370	SPEC MEDICAL RADJ PHYSICS CONSLTJ	CPT-4
77371	RADIATION DELIVERY STEREOTACTIC CRANIAL COBALT	CPT-4
77372	RADIATION DELIVERY STEREOTACTIC CRANIAL LINEAR	CPT-4
77373	STEREOTACTIC BODY RADIATION DELIVERY	CPT-4

77385	INTENSITY MODULATED RADIATION TX DLVR SIMPLE	CPT-4
77386	INTENSITY MODULATED RADIATION TX DLVR COMPLEX	CPT-4
77387	GUIDANCE FOR LOC OF TARGET VOL RADIAJ TX DLVR	CPT-4
77399	UNLIS MEDICAL RADJ DOSIM TX DEV SPEC SVCS	CPT-4
77401	RADIATION TX DELIVERY SUPERFICIAL&/ORTHO VOLTA	CPT-4
77402	RADIATION TREATMENT DELIVERY 1 MEV+ SIMPLE	CPT-4
77403	RADJ DLVR 1 AREA 1/PRLL OPSD PORTS SMPL 6-10MEV	CPT-4
77404	RADJ DLVR 1 AREA 1/PRLL OPSD PORTS SMPL 11-19MEV	CPT-4
77405	UNKNOWN PROCEDURE	UNKN
77406	RADJ DLVR 1 AREA 1/PRLL OPSD PORTS SMPL 20MEV/<	CPT-4
77407	RADIATION TX DELIVERY 1 MEV => INTERMEDIATE	CPT-4
77408	RADJ DLVR 2 AREAS 3/>PORTS 1 MLT BLKS 6-1MEV	CPT-4
77409	RADJ DLVR 2 AREAS 3/>PORTS 1 MLT BLKS 11-19MEV	CPT-4
77411	RADJ DLVR 2 AREAS 3/> PORTS 1 TX AREA 20 MEV/<	CPT-4
77412	RADIATION TREATMENT DELIVERY 1 MEV => COMPLEX	CPT-4
77413	RADJ DLVR 3/> AREAS CUSTOM BLKING 6-10MEV	CPT-4
77414	RADJ DLVR 3/> AREAS CUSTOM BLKING 11-19MEV	CPT-4
77416	RADJ DLVR 3/> AREAS CUSTOM BLKING 20MEV/<	CPT-4
77417	THERAPEUTIC RADIOLOGY PORT IMAGES(S)	CPT-4
77418	NTSTY MODUL DLVR 1/MLT FLDS/ARCS PR TX SESSION	CPT-4
77421	STRSC X-RAY GDN LOCLZJ TARGET VOL DLVR RADJ THER	CPT-4
77422	HIGH ENERGY NEUTRON RADJ TX DLVR 1 TX AREA	CPT-4
77423	HIGH ENERGY NEUTRON RADJ TX DLVR 1/> ISOCENTER	CPT-4
77424	INTRAOP RADIAJ TX DELIVER XRAY SINGLE TX SESSION	CPT-4
77425	INTRAOP RADIAJ TX DELIVER ELECTRONS SNGL TX SESS	CPT-4
77427	RADIATION TREATMENT MANAGEMENT 5 TREATMENTS	CPT-4
77431	RADIATION THERAPY MGMT 1/2 FRACTIONS ONLY	CPT-4
77432	STERETCTC RADIATION TX MANAGEMENT CRANIAL LESION	CPT-4
77435	STEREOTACTIC BODY RADIATION MANAGEMENT	CPT-4

77469	INTRAOPERATIVE RADIATION TREATMENT MANAGEMENT	CPT-4
77470	SPECIAL TREATMENT PROCEDURE	CPT-4
77499	UNLISTED PROCEDURE THERAPEUTIC RADIOLOGY TX MGMT	CPT-4
77520	PROTON TX DELIVERY SIMPLE W/O COMPENSATION	CPT-4
77522	PROTON TX DELIVERY SIMPLE W/COMPENSATION	CPT-4
77523	PROTON TX DELIVERY INTERMEDIATE	CPT-4
77525	PROTON TX DELIVERY COMPLEX	CPT-4
77600	HYPERTHERMIA EXTERNAL GENERATED SUPERFICIAL	CPT-4
77605	HYPERTHERMIA EXTERNAL GENERATED DEEP	CPT-4
77610	HYPERTHERMIA INTERSTITIAL PROBE 5/< APPLICATORS	CPT-4
77615	HYPERTHERMIA INTERSTITIAL PROBE 5/> APPLICATORS	CPT-4
77620	HYPERTHERMIA INTRACAVITARY PROBES	CPT-4
77750	NFS/INSTLJ RADIOELMNT SLN 3 MO FOLLOW-UP CARE	CPT-4
77761	INTRACAVITARY RADIATION SOURCE APPLIC SIMPLE	CPT-4
77762	INTRACAVITARY RADIATION SOURCE APPLIC INTERMED	CPT-4
77763	INTRACAVITARY RADIATION SOURCE APPLIC COMPLEX	CPT-4
77767	HDR RDNCL SKN SURF BRACHYTX LES </2CM/1 CHAN	CPT-4
77768	HDR RDNCL SK SRF BRCHYTX LES >2CM&2CHAN/MLT LES	CPT-4
77770	HDR RDNCL NTRSTL/INTRCAV BRACHYTX 1 CHANNEL	CPT-4
77771	HDR RDNCL NTRSTL/INTRCAV BRACHYTX 2-12 CHANNEL	CPT-4
77772	HDR RDNCL NTRSTL/INTRCAV BRACHYTX >12 CHANNELS	CPT-4
77776	INTERSTITIAL RADIATION SOURCE APPLIC SIMPLE	CPT-4
77777	INTERSTITIAL RADIATION SOURCE APPLIC INTERMED	CPT-4
77778	INTERSTITIAL RADIATION SOURCE APPLIC COMPLEX	CPT-4
77785	REMOTE AFTLD RADIONUCLIDE BRACHYTX 1 CHANNEL	CPT-4
77786	REMOTE AFTLD RADIONUCLIDE BRACHYTX 2-12 CHANNEL	CPT-4
77789	SURFACE APPLIC LOW DOSE RATE RADIONUCLIDE SOURCE	CPT-4
77790	SUPERVISION HANDLING LOADING RADIATION SOURCE	CPT-4
77799	UNLISTED PROCEDURE CLINICAL BRACHYTHERAPY	CPT-4

G6001	ULTRASONIC GUID PLACEMENT RADIATION TX FIELDS	HCPCS
G6002	STEREOSCOPIC X-RAY GUID LOCALIZ TRG VOL DEL RT	HCPCS
G6003	RAD TX DEL 2 TX AREA PORT/PL OPP PORTS:TO 5 MEV	HCPCS
G6004	RAD TX DEL 1 TX AREA PORT/PL OPP PORTS: 6-10 MEV	HCPCS
G6005	RAD TX DEL 1 TX AREA PORT/PL OPP PORTS: 11-19 ME	HCPCS
G6006	RAD TX DEL 1 TX AREA PORT/PL OPP PORTS: 20 ME/>	HCPCS
G6007	RT DEL 2 SEP AR 3/> PT 1 TX AR MX BLKS:TO 5 MEV	HCPCS
G6008	RT DEL 2 SEP AR 3/> PT 1 TX AR MX BLKS:6-10 MEV	HCPCS
G6009	RT DEL 2 SEP AR 3/> PT 1 TX AR MX BLKS:11-19 MEV	HCPCS
G6010	RT DEL 2 SEP AR 3/> PT 1 TX AR MX BLKS:20 MEV/>	HCPCS
G6011	RAD TX DEL 3/> SEP TX AR CSTM BLOCKING; TO 5 MEV	HCPCS
G6012	RAD TX DEL 3/> SEP TX AR CSTM BLOCKING; 6-10 MEV	HCPCS
G6013	RAD TX DEL 3/> SEP TX AR CSTM BLOCKING;11-19 MEV	HCPCS
G6014	RAD TX DEL 3/> SEP TX AR CSTM BLOCKING;20 MEV/>	HCPCS
G6015	INTENSITY MODULATED TX DEL 1/MX FLDS PER TX SESS	HCPCS
G6016	COMP-BASED BEAM MOD TX DEL I PLND TX 3 > HR SESS	HCPCS
G6017	INTRA-FRAC LOC & TRACKING TARGET/PT M EA FRAC TX	HCPCS

Appendix D: Chemotherapy Procedure Codes

CODE	PROCEDURE DESCRIPTION	Code Type
96413	CHEMO, IV INFUSION, 1 HR	CPT-4
96415	CHEMO, IV INFUSION, ADDL HR	CPT-4
96416	CHEMO PROLONG INFUSE W/PUMP	CPT-4
96417	CHEMO IV INFUS EACH ADDL SEQ	CPT-4
96409	INFUSION OF CHEMOTHERAPY INTO VEIN	CPT-4
96411	INFUSION OF DIFFERENT CHEMOTHERAPY DRUG OR SUBSTANCE INTO VEIN	CPT-4
96420	INJECTION OF CHEMOTHERAPY USING PUSH TECHNIQUE	CPT-4
96422	INFUSION OF CHEMOTHERAPY INTO ARTERY UP TO 1 HR	CPT-4
96423	INFUSION OF CHEMOTERHAPY INTO ARTERY	CPT-4
J2405	INJECTION ONDANSETRON HCL PER 1 MG	CPT-4
J2765	INJ METOCLOPRAMIDE HCL TO 10 MG	CPT-4
J9045	INJECTION CARBOPLATIN 50 MG	CPT-4
J9055	INJECTION CETUXIMAB 10 MG	CPT-4
J9190	INJECTION FLUOROURACIL 500 MG	CPT-4
J9267	INJECTION PACLITAXEL 1 MG	CPT-4
J9355	INJECTION TRASTUZUMAB 10 MG	CPT-4
96425	PROLONGED CHEMOTHERAPY INFUSION INTO ARTERY BY PORTABLE OR IMPLANTABLE PUMP, MORE THAN 8 HRS	CPT-4
96549	CHEMOTHERAPY PROCEDURE	CPT-4

Appendix E: Other Oncology Procedure Codes

<u>CODE TYPE</u>	<u>CODE</u>	<u>DIAGNOSIS DESCRIPTION</u>
ICD-9 CM	147.0	Malignant neoplasm of superior wall of nasopharynx
ICD-9 CM	147.1	Malignant neoplasm of posterior wall of nasopharynx
ICD-9 CM	147.2	Malignant neoplasm of lateral wall of nasopharynx
ICD-9 CM	147.3	Malignant neoplasm of anterior wall of nasopharynx
ICD-9 CM	147.8	Malignant neoplasm of other specified sites of nasopharynx
ICD-9 CM	147.9	Malignant neoplasm of nasopharynx, unspecified site
ICD-9 CM	148.0	Malignant neoplasm of postcricoid region of hypopharynx
ICD-9 CM	148.1	Malignant neoplasm of pyriform sinus
ICD-9 CM	148.2	Malignant neoplasm of aryepiglottic fold, hypopharyngeal aspect
ICD-9 CM	148.3	Malignant neoplasm of posterior hypopharyngeal wall
ICD-9 CM	148.8	Malignant neoplasm of other specified sites of hypopharynx
ICD-9 CM	148.9	Malignant neoplasm of hypopharynx, unspecified site
ICD-9 CM	149.0	Malignant neoplasm of pharynx, unspecified
ICD-9 CM	149.1	Malignant neoplasm of waldeyer's ring
ICD-9 CM	149.8	Malignant neoplasm of other sites within the lip and oral cavity
ICD-9 CM	149.9	Malignant neoplasm of ill-defined sites within the lip and oral cavity
ICD-9 CM	150.0	Malignant neoplasm of cervical esophagus
ICD-9 CM	150.1	Malignant neoplasm of thoracic esophagus
ICD-9 CM	150.2	Malignant neoplasm of abdominal esophagus
ICD-9 CM	150.3	Malignant neoplasm of upper third of esophagus
ICD-9 CM	150.4	Malignant neoplasm of middle third of esophagus
ICD-9 CM	150.5	Malignant neoplasm of lower third of esophagus
ICD-9 CM	150.8	Malignant neoplasm of other specified part of esophagus
ICD-9 CM	150.9	Malignant neoplasm of esophagus, unspecified site

ICD-9 CM	151.0	Malignant neoplasm of cardia
ICD-9 CM	151.1	Malignant neoplasm of pylorus
ICD-9 CM	151.2	Malignant neoplasm of pyloric antrum
ICD-9 CM	151.3	Malignant neoplasm of fundus of stomach
ICD-9 CM	151.4	Malignant neoplasm of body of stomach
ICD-9 CM	151.5	Malignant neoplasm of lesser curvature of stomach, unspecified
ICD-9 CM	151.6	Malignant neoplasm of greater curvature of stomach, unspecified
ICD-9 CM	151.8	Malignant neoplasm of other specified sites of stomach
ICD-9 CM	151.9	Malignant neoplasm of stomach, unspecified site
ICD-9 CM	152.0	Malignant neoplasm of duodenum
ICD-9 CM	152.1	Malignant neoplasm of jejunum
ICD-9 CM	152.2	Malignant neoplasm of ileum
ICD-9 CM	152.3	Malignant neoplasm of Meckel's diverticulum
ICD-9 CM	152.8	Malignant neoplasm of other specified sites of small intestine
ICD-9 CM	152.9	Malignant neoplasm of small intestine, unspecified site
ICD-9 CM	153.0	Malignant neoplasm of hepatic flexure
ICD-9 CM	153.1	Malignant neoplasm of transverse colon
ICD-9 CM	153.2	Malignant neoplasm of descending colon
ICD-9 CM	153.3	Malignant neoplasm of sigmoid colon
ICD-9 CM	153.4	Malignant neoplasm of cecum
ICD-9 CM	153.5	Malignant neoplasm of appendix vermiformis
ICD-9 CM	153.6	Malignant neoplasm of ascending colon
ICD-9 CM	153.7	Malignant neoplasm of splenic flexure
ICD-9 CM	153.8	Malignant neoplasm of other specified sites of large intestine
ICD-9 CM	153.9	Malignant neoplasm of colon, unspecified site
ICD-9 CM	154.0	Malignant neoplasm of rectosigmoid junction
ICD-9 CM	154.1	Malignant neoplasm of rectum

ICD-9 CM	154.2	Malignant neoplasm of anal canal
ICD-9 CM	154.3	Malignant neoplasm of anus, unspecified site
ICD-9 CM	154.8	Malignant neoplasm of other sites of rectum, rectosigmoid junction, and anus
ICD-9 CM	155.0	Malignant neoplasm of liver, primary
ICD-9 CM	155.1	Malignant neoplasm of intrahepatic bile ducts
ICD-9 CM	155.2	Malignant neoplasm of liver, not specified as primary or secondary
ICD-9 CM	156.0	Malignant neoplasm of gallbladder
ICD-9 CM	156.1	Malignant neoplasm of extrahepatic bile ducts
ICD-9 CM	156.2	Malignant neoplasm of ampulla of vater
ICD-9 CM	156.8	Malignant neoplasm of other specified sites of gallbladder and extrahepatic bile ducts
ICD-9 CM	156.9	Malignant neoplasm of biliary tract, part unspecified site
ICD-9 CM	157.0	Malignant neoplasm of head of pancreas
ICD-9 CM	157.1	Malignant neoplasm of body of pancreas
ICD-9 CM	157.2	Malignant neoplasm of tail of pancreas
ICD-9 CM	157.3	Malignant neoplasm of pancreatic duct
ICD-9 CM	157.4	Malignant neoplasm of islets of langerhans
ICD-9 CM	157.8	Malignant neoplasm of other specified sites of pancreas
ICD-9 CM	157.9	Malignant neoplasm of pancreas, part unspecified
ICD-9 CM	158.0	Malignant neoplasm of retroperitoneum
ICD-9 CM	158.8	Malignant neoplasm of specified parts of peritoneum
ICD-9 CM	158.9	Malignant neoplasm of peritoneum, unspecified
ICD-9 CM	159.0	Malignant neoplasm of intestinal tract, part unspecified
ICD-9 CM	159.1	Malignant neoplasm of spleen, not elsewhere classified
ICD-9 CM	159.8	Malignant neoplasm of other sites of digestive system and intra-abdominal organs
ICD-9 CM	159.9	Malignant neoplasm of ill-defined sites within the digestive organs and peritoneum

ICD-9 CM	160.0	Malignant neoplasm of nasal cavities
ICD-9 CM	160.1	Malignant neoplasm of auditory tube, middle ear, and mastoid air cells
ICD-9 CM	160.2	Malignant neoplasm of maxillary sinus
ICD-9 CM	160.3	Malignant neoplasm of ethmoidal sinus
ICD-9 CM	160.4	Malignant neoplasm of frontal sinus
ICD-9 CM	160.5	Malignant neoplasm of sphenoidal sinus
ICD-9 CM	160.8	Malignant neoplasm of other accessory sinuses
ICD-9 CM	160.9	Malignant neoplasm of accessory sinus, unspecified
ICD-9 CM	161.0	Malignant neoplasm of glottis
ICD-9 CM	161.1	Malignant neoplasm of supraglottis
ICD-9 CM	161.2	Malignant neoplasm of subglottis
ICD-9 CM	162.0	Malignant neoplasm of trachea
ICD-9 CM	162.2	Malignant neoplasm of main bronchus
ICD-9 CM	162.3	Malignant neoplasm of upper lobe, bronchus or lung
ICD-9 CM	162.4	Malignant neoplasm of middle lobe, bronchus or lung
ICD-9 CM	162.5	Malignant neoplasm of lower lobe, bronchus or lung
ICD-9 CM	162.8	Malignant neoplasm of other parts of bronchus or lung
ICD-9 CM	162.9	Malignant neoplasm of bronchus and lung, unspecified
ICD-9 CM	163.0	Malignant neoplasm of parietal pleura
ICD-9 CM	163.1	Malignant neoplasm of visceral pleura
ICD-9 CM	163.8	Malignant neoplasm of other specified sites of pleura
ICD-9 CM	163.9	Malignant neoplasm of pleura, unspecified
ICD-9 CM	164.0	Malignant neoplasm of thymus
ICD-9 CM	164.1	Malignant neoplasm of heart
ICD-9 CM	164.2	Malignant neoplasm of anterior mediastinum
ICD-9 CM	164.3	Malignant neoplasm of posterior mediastinum
ICD-9 CM	164.8	Malignant neoplasm of other parts of mediastinum

ICD-9 CM	164.9	Malignant neoplasm of mediastinum, part unspecified
ICD-9 CM	165.0	Malignant neoplasm of upper respiratory tract, part unspecified
ICD-9 CM	165.8	Malignant neoplasm of other sites within the respiratory system and intrathoracic organs
ICD-9 CM	165.9	Malignant neoplasm of ill-defined sites within the respiratory system
ICD-9 CM	170.0	Malignant neoplasm of bones of skull and face, except mandible
ICD-9 CM	170.1	Malignant neoplasm of mandible
ICD-9 CM	170.2	Malignant neoplasm of vertebral column, excluding sacrum and coccyx
ICD-9 CM	170.3	Malignant neoplasm of ribs, sternum, and clavicle
ICD-9 CM	170.4	Malignant neoplasm of scapula and long bones of upper limb
ICD-9 CM	170.5	Malignant neoplasm of short bones of upper limb
ICD-9 CM	170.6	Malignant neoplasm of pelvic bones, sacrum, and coccyx
ICD-9 CM	170.7	Malignant neoplasm of long bones of lower limb
ICD-9 CM	170.8	Malignant neoplasm of short bones of lower limb
ICD-9 CM	170.9	Malignant neoplasm of bone and articular cartilage, site unspecified
ICD-9 CM	171.0	Malignant neoplasm of connective and other soft tissue of head, face, and neck
ICD-9 CM	171.2	Malignant neoplasm of connective and other soft tissue of upper limb, including shoulder
ICD-9 CM	171.3	Malignant neoplasm of connective and other soft tissue of lower limb, including hip
ICD-9 CM	171.4	Malignant neoplasm of connective and other soft tissue of thorax
ICD-9 CM	171.5	Malignant neoplasm of connective and other soft tissue of abdomen
ICD-9 CM	171.6	Malignant neoplasm of connective and other soft tissue of pelvis
ICD-9 CM	171.7	Malignant neoplasm of connective and other soft tissue of trunk, unspecified
ICD-9 CM	171.8	Malignant neoplasm of other specified sites of connective and other soft tissue
ICD-9 CM	171.9	Malignant neoplasm of connective and other soft tissue, site unspecified
ICD-9 CM	173.00	Unspecified malignant neoplasm of skin of lip

ICD-9 CM	173.01	Basal cell carcinoma of skin of lip
ICD-9 CM	173.02	Squamous cell carcinoma of skin of lip
ICD-9 CM	173.09	Other specified malignant neoplasm of skin of lip
ICD-9 CM	173.10	Unspecified malignant neoplasm of eyelid, including canthus
ICD-9 CM	173.11	Basal cell carcinoma of eyelid, including canthus
ICD-9 CM	173.12	Squamous cell carcinoma of eyelid, including canthus
ICD-9 CM	173.19	Other specified malignant neoplasm of eyelid, including canthus
ICD-9 CM	173.20	Unspecified malignant neoplasm of skin of ear and external auditory canal
ICD-9 CM	173.21	Basal cell carcinoma of skin of ear and external auditory canal
ICD-9 CM	173.22	Squamous cell carcinoma of skin of ear and external auditory canal
ICD-9 CM	173.29	Other specified malignant neoplasm of skin of ear and external auditory canal
ICD-9 CM	173.30	Unspecified malignant neoplasm of skin of other and unspecified parts of face
ICD-9 CM	173.31	Basal cell carcinoma of skin of other and unspecified parts of face
ICD-9 CM	173.32	Squamous cell carcinoma of skin of other and unspecified parts of face
ICD-9 CM	173.39	Other specified malignant neoplasm of skin of other and unspecified parts of face
ICD-9 CM	173.40	Unspecified malignant neoplasm of scalp and skin of neck
ICD-9 CM	173.41	Basal cell carcinoma of scalp and skin of neck
ICD-9 CM	173.42	Squamous cell carcinoma of scalp and skin of neck
ICD-9 CM	173.49	Other specified malignant neoplasm of scalp and skin of neck
ICD-9 CM	173.50	Unspecified malignant neoplasm of skin of trunk, except scrotum
ICD-9 CM	173.51	Basal cell carcinoma of skin of trunk, except scrotum
ICD-9 CM	173.52	Squamous cell carcinoma of skin of trunk, except scrotum
ICD-9 CM	173.59	Other specified malignant neoplasm of skin of trunk, except scrotum
ICD-9 CM	173.60	Unspecified malignant neoplasm of skin of upper limb, including shoulder
ICD-9 CM	173.61	Basal cell carcinoma of skin of upper limb, including shoulder
ICD-9 CM	173.62	Squamous cell carcinoma of skin of upper limb, including shoulder

ICD-9 CM	173.69	Other specified malignant neoplasm of skin of upper limb, including shoulder
ICD-9 CM	173.70	Unspecified malignant neoplasm of skin of lower limb, including hip
ICD-9 CM	173.71	Basal cell carcinoma of skin of lower limb, including hip
ICD-9 CM	173.72	Squamous cell carcinoma of skin of lower limb, including hip
ICD-9 CM	173.79	Other specified malignant neoplasm of skin of lower limb, including hip
ICD-9 CM	173.80	Unspecified malignant neoplasm of other specified sites of skin
ICD-9 CM	173.81	Basal cell carcinoma of other specified sites of skin
ICD-9 CM	173.82	Squamous cell carcinoma of other specified sites of skin
ICD-9 CM	173.89	Other specified malignant neoplasm of other specified sites of skin
ICD-9 CM	173.90	Unspecified malignant neoplasm of skin, site unspecified
ICD-9 CM	173.91	Basal cell carcinoma of skin, site unspecified
ICD-9 CM	173.92	Squamous cell carcinoma of skin, site unspecified
ICD-9 CM	173.99	Other specified malignant neoplasm of skin, site unspecified
ICD-9 CM	174.0	Malignant neoplasm of nipple and areola of female breast
ICD-9 CM	174.1	Malignant neoplasm of central portion of female breast
ICD-9 CM	174.2	Malignant neoplasm of upper-inner quadrant of female breast
ICD-9 CM	174.3	Malignant neoplasm of lower-inner quadrant of female breast
ICD-9 CM	174.4	Malignant neoplasm of upper-outer quadrant of female breast
ICD-9 CM	174.5	Malignant neoplasm of lower-outer quadrant of female breast
ICD-9 CM	174.6	Malignant neoplasm of axillary tail of female breast
ICD-9 CM	174.8	Malignant neoplasm of other specified sites of female breast
ICD-9 CM	174.9	Malignant neoplasm of breast (female), unspecified
ICD-9 CM	175.0	Malignant neoplasm of nipple and areola of male breast
ICD-9 CM	175.9	Malignant neoplasm of other and unspecified sites of male breast
ICD-9 CM	179	Malignant neoplasm of uterus, part unspecified
ICD-9 CM	180.0	Malignant neoplasm of endocervix
ICD-9 CM	180.1	Malignant neoplasm of exocervix

ICD-9 CM	180.8	Malignant neoplasm of other specified sites of cervix
ICD-9 CM	180.9	Malignant neoplasm of cervix uteri, unspecified site
ICD-9 CM	181	Malignant neoplasm of placenta
ICD-9 CM	182.0	Malignant neoplasm of corpus uteri, except isthmus
ICD-9 CM	182.1	Malignant neoplasm of isthmus
ICD-9 CM	182.8	Malignant neoplasm of other specified sites of body of uterus
ICD-9 CM	183.0	Malignant neoplasm of ovary
ICD-9 CM	183.2	Malignant neoplasm of fallopian tube
ICD-9 CM	183.3	Malignant neoplasm of broad ligament of uterus
ICD-9 CM	183.4	Malignant neoplasm of parametrium
ICD-9 CM	183.5	Malignant neoplasm of round ligament of uterus
ICD-9 CM	183.8	Malignant neoplasm of other specified sites of uterine adnexa
ICD-9 CM	183.9	Malignant neoplasm of uterine adnexa, unspecified site
ICD-9 CM	184.0	Malignant neoplasm of vagina
ICD-9 CM	184.1	Malignant neoplasm of labia majora
ICD-9 CM	184.2	Malignant neoplasm of labia minora
ICD-9 CM	184.3	Malignant neoplasm of clitoris
ICD-9 CM	184.4	Malignant neoplasm of vulva, unspecified site
ICD-9 CM	184.8	Malignant neoplasm of other specified sites of female genital organs
ICD-9 CM	184.9	Malignant neoplasm of female genital organ, site unspecified
ICD-9 CM	185	Malignant neoplasm of prostate
ICD-9 CM	186.0	Malignant neoplasm of undescended testis
ICD-9 CM	186.9	Malignant neoplasm of other and unspecified testis
ICD-9 CM	187.1	Malignant neoplasm of prepuce
ICD-9 CM	187.2	Malignant neoplasm of glans penis
ICD-9 CM	187.3	Malignant neoplasm of body of penis
ICD-9 CM	187.4	Malignant neoplasm of penis, part unspecified

ICD-9 CM	187.5	Malignant neoplasm of epididymis
ICD-9 CM	187.6	Malignant neoplasm of spermatic cord
ICD-9 CM	187.7	Malignant neoplasm of scrotum
ICD-9 CM	187.8	Malignant neoplasm of other specified sites of male genital organs
ICD-9 CM	187.9	Malignant neoplasm of male genital organ, site unspecified
ICD-9 CM	188.0	Malignant neoplasm of trigone of urinary bladder
ICD-9 CM	188.1	Malignant neoplasm of dome of urinary bladder
ICD-9 CM	188.2	Malignant neoplasm of lateral wall of urinary bladder
ICD-9 CM	188.3	Malignant neoplasm of anterior wall of urinary bladder
ICD-9 CM	188.4	Malignant neoplasm of posterior wall of urinary bladder
ICD-9 CM	188.5	Malignant neoplasm of bladder neck
ICD-9 CM	188.6	Malignant neoplasm of ureteric orifice
ICD-9 CM	188.7	Malignant neoplasm of urachus
ICD-9 CM	188.8	Malignant neoplasm of other specified sites of bladder
ICD-9 CM	188.9	Malignant neoplasm of bladder, part unspecified
ICD-9 CM	189.0	Malignant neoplasm of kidney, except pelvis
ICD-9 CM	189.1	Malignant neoplasm of renal pelvis
ICD-9 CM	189.2	Malignant neoplasm of ureter
ICD-9 CM	189.3	Malignant neoplasm of urethra
ICD-9 CM	189.4	Malignant neoplasm of paraurethral glands
ICD-9 CM	189.8	Malignant neoplasm of other specified sites of urinary organs
ICD-9 CM	189.9	Malignant neoplasm of urinary organ, site unspecified
ICD-9 CM	190.0	Malignant neoplasm of eyeball, except conjunctiva, cornea, retina, and choroid
ICD-9 CM	190.1	Malignant neoplasm of orbit
ICD-9 CM	190.2	Malignant neoplasm of lacrimal gland
ICD-9 CM	190.3	Malignant neoplasm of conjunctiva
ICD-9 CM	190.4	Malignant neoplasm of cornea

ICD-9 CM	190.5	Malignant neoplasm of retina
ICD-9 CM	190.6	Malignant neoplasm of choroid
ICD-9 CM	190.7	Malignant neoplasm of lacrimal duct
ICD-9 CM	190.8	Malignant neoplasm of other specified sites of eye
ICD-9 CM	190.9	Malignant neoplasm of eye, part unspecified
ICD-9 CM	191.0	Malignant neoplasm of cerebrum, except lobes and ventricles
ICD-9 CM	191.1	Malignant neoplasm of frontal lobe
ICD-9 CM	191.2	Malignant neoplasm of temporal lobe
ICD-9 CM	191.3	Malignant neoplasm of parietal lobe
ICD-9 CM	191.4	Malignant neoplasm of occipital lobe
ICD-9 CM	191.5	Malignant neoplasm of ventricles
ICD-9 CM	191.6	Malignant neoplasm of cerebellum nos
ICD-9 CM	191.7	Malignant neoplasm of brain stem
ICD-9 CM	191.8	Malignant neoplasm of other parts of brain
ICD-9 CM	191.9	Malignant neoplasm of brain, unspecified
ICD-9 CM	192.0	Malignant neoplasm of cranial nerves
ICD-9 CM	192.1	Malignant neoplasm of cerebral meninges
ICD-9 CM	192.2	Malignant neoplasm of spinal cord
ICD-9 CM	192.3	Malignant neoplasm of spinal meninges
ICD-9 CM	192.8	Malignant neoplasm of other specified sites of nervous system
ICD-9 CM	192.9	Malignant neoplasm of nervous system, part unspecified
ICD-9 CM	193	Malignant neoplasm of thyroid gland
ICD-9 CM	194.0	Malignant neoplasm of adrenal gland
ICD-9 CM	194.1	Malignant neoplasm of parathyroid gland
ICD-9 CM	194.3	Malignant neoplasm of pituitary gland and craniopharyngeal duct
ICD-9 CM	194.4	Malignant neoplasm of pineal gland
ICD-9 CM	194.5	Malignant neoplasm of carotid body

ICD-9 CM	194.6	Malignant neoplasm of aortic body and other paraganglia
ICD-9 CM	194.8	Malignant neoplasm of other endocrine glands and related structures
ICD-9 CM	194.9	Malignant neoplasm of endocrine gland, site unspecified
ICD-9 CM	195.0	Malignant neoplasm of head, face, and neck
ICD-9 CM	195.1	Malignant neoplasm of thorax
ICD-9 CM	195.2	Malignant neoplasm of abdomen
ICD-9 CM	195.3	Malignant neoplasm of pelvis
ICD-9 CM	195.4	Malignant neoplasm of upper limb
ICD-9 CM	195.5	Malignant neoplasm of lower limb
ICD-9 CM	195.8	Malignant neoplasm of other specified sites
ICD-9 CM	196.0	Secondary and unspecified malignant neoplasm of lymph nodes of head, face, and neck
ICD-9 CM	196.1	Secondary and unspecified malignant neoplasm of intrathoracic lymph nodes
ICD-9 CM	196.2	Secondary and unspecified malignant neoplasm of intra-abdominal lymph nodes
ICD-9 CM	196.3	Secondary and unspecified malignant neoplasm of lymph nodes of axilla and upper limb
ICD-9 CM	196.5	Secondary and unspecified malignant neoplasm of lymph nodes of inguinal region and lower limb
ICD-9 CM	196.6	Secondary and unspecified malignant neoplasm of intrapelvic lymph nodes
ICD-9 CM	196.8	Secondary and unspecified malignant neoplasm of lymph nodes of multiple sites
ICD-9 CM	196.9	Secondary and unspecified malignant neoplasm of lymph nodes, site unspecified
ICD-9 CM	197.0	Secondary malignant neoplasm of lung
ICD-9 CM	197.1	Secondary malignant neoplasm of mediastinum
ICD-9 CM	197.2	Secondary malignant neoplasm of pleura
ICD-9 CM	197.3	Secondary malignant neoplasm of other respiratory organs
ICD-9 CM	197.4	Secondary malignant neoplasm of small intestine including duodenum
ICD-9 CM	197.5	Secondary malignant neoplasm of large intestine and rectum

ICD-9 CM	197.6	Secondary malignant neoplasm of retroperitoneum and peritoneum
ICD-9 CM	197.7	Malignant neoplasm of liver, secondary
ICD-9 CM	197.8	Secondary malignant neoplasm of other digestive organs and spleen
ICD-9 CM	198.0	Secondary malignant neoplasm of kidney
ICD-9 CM	198.1	Secondary malignant neoplasm of other urinary organs
ICD-9 CM	198.2	Secondary malignant neoplasm of skin
ICD-9 CM	198.3	Secondary malignant neoplasm of brain and spinal cord
ICD-9 CM	198.4	Secondary malignant neoplasm of other parts of nervous system
ICD-9 CM	198.5	Secondary malignant neoplasm of bone and bone marrow
ICD-9 CM	198.6	Secondary malignant neoplasm of ovary
ICD-9 CM	198.7	Secondary malignant neoplasm of adrenal gland
ICD-9 CM	198.81	Secondary malignant neoplasm of breast
ICD-9 CM	198.82	Secondary malignant neoplasm of genital organs
ICD-9 CM	198.89	Secondary malignant neoplasm of other specified sites
ICD-9 CM	199.0	Disseminated malignant neoplasm without specification of site
ICD-9 CM	199.1	Other malignant neoplasm without specification of site
ICD-9 CM	199.2	Malignant neoplasm associated with transplant organ
ICD-9 CM	202.80	Other malignant lymphomas, unspecified site, extranodal and solid organ sites
ICD-9 CM	202.81	Other malignant lymphomas, lymph nodes of head, face, and neck
ICD-9 CM	202.82	Other malignant lymphomas, intrathoracic lymph nodes
ICD-9 CM	202.83	Other malignant lymphomas, intra-abdominal lymph nodes
ICD-9 CM	202.84	Other malignant lymphomas, lymph nodes of axilla and upper limb
ICD-9 CM	202.85	Other malignant lymphomas, lymph nodes of inguinal region and lower limb
ICD-9 CM	202.86	Other malignant lymphomas, intrapelvic lymph nodes
ICD-9 CM	202.87	Other malignant lymphomas, spleen
ICD-9 CM	202.88	Other malignant lymphomas, lymph nodes of multiple sites

ICD-9 CM	202.90	Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, unspecified site, extranodal and solid organ sites
ICD-9 CM	202.91	Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, lymph nodes of head, face, and neck
ICD-9 CM	202.92	Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, intrathoracic lymph nodes
ICD-9 CM	202.93	Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, intra-abdominal lymph nodes
ICD-9 CM	202.94	Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, lymph nodes of axilla and upper limb
ICD-9 CM	202.95	Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, lymph nodes of inguinal region and lower limb
ICD-9 CM	202.96	Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, intrapelvic lymph nodes
ICD-9 CM	202.97	Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, spleen
ICD-9 CM	202.98	Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, lymph nodes of multiple sites
ICD-9 CM	203.80	Other immunoproliferative neoplasms, without mention of having achieved remission
ICD-9 CM	203.81	Other immunoproliferative neoplasms, in remission
ICD-9 CM	203.82	Other immunoproliferative neoplasms, in relapse
ICD-10 CM	C11.0	Malignant neoplasm of superior wall of nasopharynx
ICD-10 CM	C11.1	Malignant neoplasm of posterior wall of nasopharynx
ICD-10 CM	C11.2	Malignant neoplasm of lateral wall of nasopharynx
ICD-10 CM	C11.3	Malignant neoplasm of anterior wall of nasopharynx
ICD-10 CM	C11.8	Malignant neoplasm of overlapping sites of nasopharynx
ICD-10 CM	C11.9	Malignant neoplasm of nasopharynx, unspecified
ICD-10 CM	C12	Malignant neoplasm of pyriform sinus
ICD-10 CM	C13.0	Malignant neoplasm of postcricoid region
ICD-10 CM	C13.1	Malignant neoplasm of aryepiglottic fold, hypopharyngeal aspect

ICD-10 CM	C13.2	Malignant neoplasm of posterior wall of hypopharynx
ICD-10 CM	C13.8	Malignant neoplasm of overlapping sites of hypopharynx
ICD-10 CM	C13.9	Malignant neoplasm of hypopharynx, unspecified
ICD-10 CM	C15.3	Malignant neoplasm of upper third of esophagus
ICD-10 CM	C15.4	Malignant neoplasm of middle third of esophagus
ICD-10 CM	C15.5	Malignant neoplasm of lower third of esophagus
ICD-10 CM	C15.8	Malignant neoplasm of overlapping sites of esophagus
ICD-10 CM	C15.9	Malignant neoplasm of esophagus, unspecified
ICD-10 CM	C16.0	Malignant neoplasm of cardia
ICD-10 CM	C16.1	Malignant neoplasm of fundus of stomach
ICD-10 CM	C16.2	Malignant neoplasm of body of stomach
ICD-10 CM	C16.3	Malignant neoplasm of pyloric antrum
ICD-10 CM	C16.4	Malignant neoplasm of pylorus
ICD-10 CM	C16.5	Malignant neoplasm of lesser curvature of stomach, unspecified
ICD-10 CM	C16.6	Malignant neoplasm of greater curvature of stomach, unspecified
ICD-10 CM	C16.8	Malignant neoplasm of overlapping sites of stomach
ICD-10 CM	C16.9	Malignant neoplasm of stomach, unspecified
ICD-10 CM	C17.0	Malignant neoplasm of duodenum
ICD-10 CM	C17.1	Malignant neoplasm of jejunum
ICD-10 CM	C17.2	Malignant neoplasm of ileum
ICD-10 CM	C17.3	Meckel's diverticulum, malignant
ICD-10 CM	C17.8	Malignant neoplasm of overlapping sites of small intestine
ICD-10 CM	C17.9	Malignant neoplasm of small intestine, unspecified
ICD-10 CM	C18.0	Malignant neoplasm of cecum
ICD-10 CM	C18.1	Malignant neoplasm of appendix
ICD-10 CM	C18.2	Malignant neoplasm of ascending colon
ICD-10 CM	C18.3	Malignant neoplasm of hepatic flexure

ICD-10 CM	C18.4	Malignant neoplasm of transverse colon
ICD-10 CM	C18.5	Malignant neoplasm of splenic flexure
ICD-10 CM	C18.6	Malignant neoplasm of descending colon
ICD-10 CM	C18.7	Malignant neoplasm of sigmoid colon
ICD-10 CM	C18.8	Malignant neoplasm of overlapping sites of colon
ICD-10 CM	C18.9	Malignant neoplasm of colon, unspecified
ICD-10 CM	C19	Malignant neoplasm of rectosigmoid junction
ICD-10 CM	C20	Malignant neoplasm of rectum
ICD-10 CM	C21.0	Malignant neoplasm of anus, unspecified
ICD-10 CM	C21.1	Malignant neoplasm of anal canal
ICD-10 CM	C21.2	Malignant neoplasm of cloacogenic zone
ICD-10 CM	C21.8	Malignant neoplasm of overlapping sites of rectum, anus and anal canal
ICD-10 CM	C22.0	Liver cell carcinoma
ICD-10 CM	C22.1	Intrahepatic bile duct carcinoma
ICD-10 CM	C22.2	Hepatoblastoma
ICD-10 CM	C22.3	Angiosarcoma of liver
ICD-10 CM	C22.4	Other sarcomas of liver
ICD-10 CM	C22.7	Other specified carcinomas of liver
ICD-10 CM	C22.8	Malignant neoplasm of liver, primary, unspecified as to type
ICD-10 CM	C22.9	Malignant neoplasm of liver, not specified as primary or secondary
ICD-10 CM	C23	Malignant neoplasm of gallbladder
ICD-10 CM	C24.0	Malignant neoplasm of extrahepatic bile duct
ICD-10 CM	C24.1	Malignant neoplasm of ampulla of Vater
ICD-10 CM	C24.8	Malignant neoplasm of overlapping sites of biliary tract
ICD-10 CM	C24.9	Malignant neoplasm of biliary tract, unspecified
ICD-10 CM	C25.0	Malignant neoplasm of head of pancreas
ICD-10 CM	C25.1	Malignant neoplasm of body of pancreas

ICD-10 CM	C25.2	Malignant neoplasm of tail of pancreas
ICD-10 CM	C25.3	Malignant neoplasm of pancreatic duct
ICD-10 CM	C25.4	Malignant neoplasm of endocrine pancreas
ICD-10 CM	C25.7	Malignant neoplasm of other parts of pancreas
ICD-10 CM	C25.8	Malignant neoplasm of overlapping sites of pancreas
ICD-10 CM	C25.9	Malignant neoplasm of pancreas, unspecified
ICD-10 CM	C26.0	Malignant neoplasm of intestinal tract, part unspecified
ICD-10 CM	C26.1	Malignant neoplasm of spleen
ICD-10 CM	C26.9	Malignant neoplasm of ill-defined sites within the digestive system
ICD-10 CM	C30.0	Malignant neoplasm of nasal cavity
ICD-10 CM	C30.1	Malignant neoplasm of middle ear
ICD-10 CM	C31.0	Malignant neoplasm of maxillary sinus
ICD-10 CM	C31.1	Malignant neoplasm of ethmoidal sinus
ICD-10 CM	C31.2	Malignant neoplasm of frontal sinus
ICD-10 CM	C31.3	Malignant neoplasm of sphenoid sinus
ICD-10 CM	C31.8	Malignant neoplasm of overlapping sites of accessory sinuses
ICD-10 CM	C31.9	Malignant neoplasm of accessory sinus, unspecified
ICD-10 CM	C32.0	Malignant neoplasm of glottis
ICD-10 CM	C32.1	Malignant neoplasm of supraglottis
ICD-10 CM	C32.2	Malignant neoplasm of subglottis
ICD-10 CM	C32.3	Malignant neoplasm of laryngeal cartilage
ICD-10 CM	C33	Malignant neoplasm of trachea
ICD-10 CM	C34.00	Malignant neoplasm of unspecified main bronchus
ICD-10 CM	C34.01	Malignant neoplasm of right main bronchus
ICD-10 CM	C34.02	Malignant neoplasm of left main bronchus
ICD-10 CM	C34.10	Malignant neoplasm of upper lobe, unspecified bronchus or lung
ICD-10 CM	C34.11	Malignant neoplasm of upper lobe, right bronchus or lung

ICD-10 CM	C34.12	Malignant neoplasm of upper lobe, left bronchus or lung
ICD-10 CM	C34.2	Malignant neoplasm of middle lobe, bronchus or lung
ICD-10 CM	C34.30	Malignant neoplasm of lower lobe, unspecified bronchus or lung
ICD-10 CM	C34.31	Malignant neoplasm of lower lobe, right bronchus or lung
ICD-10 CM	C34.32	Malignant neoplasm of lower lobe, left bronchus or lung
ICD-10 CM	C34.80	Malignant neoplasm of overlapping sites of unspecified bronchus and lung
ICD-10 CM	C34.81	Malignant neoplasm of overlapping sites of right bronchus and lung
ICD-10 CM	C34.82	Malignant neoplasm of overlapping sites of left bronchus and lung
ICD-10 CM	C34.90	Malignant neoplasm of unspecified part of unspecified bronchus or lung
ICD-10 CM	C34.91	Malignant neoplasm of unspecified part of right bronchus or lung
ICD-10 CM	C34.92	Malignant neoplasm of unspecified part of left bronchus or lung
ICD-10 CM	C37	Malignant neoplasm of thymus
ICD-10 CM	C38.0	Malignant neoplasm of heart
ICD-10 CM	C38.1	Malignant neoplasm of anterior mediastinum
ICD-10 CM	C38.2	Malignant neoplasm of posterior mediastinum
ICD-10 CM	C38.3	Malignant neoplasm of mediastinum, part unspecified
ICD-10 CM	C38.4	Malignant neoplasm of pleura
ICD-10 CM	C38.8	Malignant neoplasm of overlapping sites of heart, mediastinum and pleura
ICD-10 CM	C39.0	Malignant neoplasm of upper respiratory tract, part unspecified
ICD-10 CM	C39.9	Malignant neoplasm of lower respiratory tract, part unspecified
ICD-10 CM	C40.00	Malignant neoplasm of scapula and long bones of unspecified upper limb
ICD-10 CM	C40.01	Malignant neoplasm of scapula and long bones of right upper limb
ICD-10 CM	C40.02	Malignant neoplasm of scapula and long bones of left upper limb
ICD-10 CM	C40.10	Malignant neoplasm of short bones of unspecified upper limb
ICD-10 CM	C40.11	Malignant neoplasm of short bones of right upper limb
ICD-10 CM	C40.12	Malignant neoplasm of short bones of left upper limb
ICD-10 CM	C40.20	Malignant neoplasm of long bones of unspecified lower limb

ICD-10 CM	C40.21	Malignant neoplasm of long bones of right lower limb
ICD-10 CM	C40.22	Malignant neoplasm of long bones of left lower limb
ICD-10 CM	C40.30	Malignant neoplasm of short bones of unspecified lower limb
ICD-10 CM	C40.31	Malignant neoplasm of short bones of right lower limb
ICD-10 CM	C40.32	Malignant neoplasm of short bones of left lower limb
ICD-10 CM	C40.80	Malignant neoplasm of overlapping sites of bone and articular cartilage of unspecified limb
ICD-10 CM	C40.81	Malignant neoplasm of overlapping sites of bone and articular cartilage of right limb
ICD-10 CM	C40.82	Malignant neoplasm of overlapping sites of bone and articular cartilage of left limb
ICD-10 CM	C40.90	Malignant neoplasm of unspecified bones and articular cartilage of unspecified limb
ICD-10 CM	C40.91	Malignant neoplasm of unspecified bones and articular cartilage of right limb
ICD-10 CM	C40.92	Malignant neoplasm of unspecified bones and articular cartilage of left limb
ICD-10 CM	C41.0	Malignant neoplasm of bones of skull and face
ICD-10 CM	C41.1	Malignant neoplasm of mandible
ICD-10 CM	C41.2	Malignant neoplasm of vertebral column
ICD-10 CM	C41.3	Malignant neoplasm of ribs, sternum and clavicle
ICD-10 CM	C41.4	Malignant neoplasm of pelvic bones, sacrum and coccyx
ICD-10 CM	C41.9	Malignant neoplasm of bone and articular cartilage, unspecified
ICD-10 CM	C44.00	Unspecified malignant neoplasm of skin of lip
ICD-10 CM	C44.01	Basal cell carcinoma of skin of lip
ICD-10 CM	C44.02	Squamous cell carcinoma of skin of lip
ICD-10 CM	C44.09	Other specified malignant neoplasm of skin of lip
ICD-10 CM	C44.101	Unspecified malignant neoplasm of skin of unspecified eyelid, including canthus
ICD-10 CM	C44.102	Unspecified malignant neoplasm of skin of right eyelid, including canthus
ICD-10 CM	C44.109	Unspecified malignant neoplasm of skin of left eyelid, including canthus

ICD-10 CM	C44.111	Basal cell carcinoma of skin of unspecified eyelid, including canthus
ICD-10 CM	C44.112	Basal cell carcinoma of skin of right eyelid, including canthus
ICD-10 CM	C44.119	Basal cell carcinoma of skin of left eyelid, including canthus
ICD-10 CM	C44.121	Squamous cell carcinoma of skin of unspecified eyelid, including canthus
ICD-10 CM	C44.122	Squamous cell carcinoma of skin of right eyelid, including canthus
ICD-10 CM	C44.129	Squamous cell carcinoma of skin of left eyelid, including canthus
ICD-10 CM	C44.191	Other specified malignant neoplasm of skin of unspecified eyelid, including canthus
ICD-10 CM	C44.192	Other specified malignant neoplasm of skin of right eyelid, including canthus
ICD-10 CM	C44.199	Other specified malignant neoplasm of skin of left eyelid, including canthus
ICD-10 CM	C44.201	Unspecified malignant neoplasm of skin of unspecified ear and external auricular canal
ICD-10 CM	C44.202	Unspecified malignant neoplasm of skin of right ear and external auricular canal
ICD-10 CM	C44.209	Unspecified malignant neoplasm of skin of left ear and external auricular canal
ICD-10 CM	C44.211	Basal cell carcinoma of skin of unspecified ear and external auricular canal
ICD-10 CM	C44.212	Basal cell carcinoma of skin of right ear and external auricular canal
ICD-10 CM	C44.219	Basal cell carcinoma of skin of left ear and external auricular canal
ICD-10 CM	C44.221	Squamous cell carcinoma of skin of unspecified ear and external auricular canal
ICD-10 CM	C44.222	Squamous cell carcinoma of skin of right ear and external auricular canal
ICD-10 CM	C44.229	Squamous cell carcinoma of skin of left ear and external auricular canal
ICD-10 CM	C44.291	Other specified malignant neoplasm of skin of unspecified ear and external auricular canal
ICD-10 CM	C44.292	Other specified malignant neoplasm of skin of right ear and external auricular canal
ICD-10 CM	C44.299	Other specified malignant neoplasm of skin of left ear and external auricular canal
ICD-10 CM	C44.300	Unspecified malignant neoplasm of skin of unspecified part of face

ICD-10 CM	C44.301	Unspecified malignant neoplasm of skin of nose
ICD-10 CM	C44.309	Unspecified malignant neoplasm of skin of other parts of face
ICD-10 CM	C44.310	Basal cell carcinoma of skin of unspecified parts of face
ICD-10 CM	C44.311	Basal cell carcinoma of skin of nose
ICD-10 CM	C44.319	Basal cell carcinoma of skin of other parts of face
ICD-10 CM	C44.320	Squamous cell carcinoma of skin of unspecified parts of face
ICD-10 CM	C44.321	Squamous cell carcinoma of skin of nose
ICD-10 CM	C44.329	Squamous cell carcinoma of skin of other parts of face
ICD-10 CM	C44.390	Other specified malignant neoplasm of skin of unspecified parts of face
ICD-10 CM	C44.391	Other specified malignant neoplasm of skin of nose
ICD-10 CM	C44.399	Other specified malignant neoplasm of skin of other parts of face
ICD-10 CM	C44.40	Unspecified malignant neoplasm of skin of scalp and neck
ICD-10 CM	C44.41	Basal cell carcinoma of skin of scalp and neck
ICD-10 CM	C44.42	Squamous cell carcinoma of skin of scalp and neck
ICD-10 CM	C44.49	Other specified malignant neoplasm of skin of scalp and neck
ICD-10 CM	C44.500	Unspecified malignant neoplasm of anal skin
ICD-10 CM	C44.501	Unspecified malignant neoplasm of skin of breast
ICD-10 CM	C44.509	Unspecified malignant neoplasm of skin of other part of trunk
ICD-10 CM	C44.510	Basal cell carcinoma of anal skin
ICD-10 CM	C44.511	Basal cell carcinoma of skin of breast
ICD-10 CM	C44.519	Basal cell carcinoma of skin of other part of trunk
ICD-10 CM	C44.520	Squamous cell carcinoma of anal skin
ICD-10 CM	C44.521	Squamous cell carcinoma of skin of breast
ICD-10 CM	C44.529	Squamous cell carcinoma of skin of other part of trunk
ICD-10 CM	C44.590	Other specified malignant neoplasm of anal skin
ICD-10 CM	C44.591	Other specified malignant neoplasm of skin of breast
ICD-10 CM	C44.599	Other specified malignant neoplasm of skin of other part of trunk

ICD-10 CM	C44.601	Unspecified malignant neoplasm of skin of unspecified upper limb, including shoulder
ICD-10 CM	C44.602	Unspecified malignant neoplasm of skin of right upper limb, including shoulder
ICD-10 CM	C44.609	Unspecified malignant neoplasm of skin of left upper limb, including shoulder
ICD-10 CM	C44.611	Basal cell carcinoma of skin of unspecified upper limb, including shoulder
ICD-10 CM	C44.612	Basal cell carcinoma of skin of right upper limb, including shoulder
ICD-10 CM	C44.619	Basal cell carcinoma of skin of left upper limb, including shoulder
ICD-10 CM	C44.621	Squamous cell carcinoma of skin of unspecified upper limb, including shoulder
ICD-10 CM	C44.622	Squamous cell carcinoma of skin of right upper limb, including shoulder
ICD-10 CM	C44.629	Squamous cell carcinoma of skin of left upper limb, including shoulder
ICD-10 CM	C44.691	Other specified malignant neoplasm of skin of unspecified upper limb, including shoulder
ICD-10 CM	C44.692	Other specified malignant neoplasm of skin of right upper limb, including shoulder
ICD-10 CM	C44.699	Other specified malignant neoplasm of skin of left upper limb, including shoulder
ICD-10 CM	C44.701	Unspecified malignant neoplasm of skin of unspecified lower limb, including hip
ICD-10 CM	C44.702	Unspecified malignant neoplasm of skin of right lower limb, including hip
ICD-10 CM	C44.709	Unspecified malignant neoplasm of skin of left lower limb, including hip
ICD-10 CM	C44.711	Basal cell carcinoma of skin of unspecified lower limb, including hip
ICD-10 CM	C44.712	Basal cell carcinoma of skin of right lower limb, including hip
ICD-10 CM	C44.719	Basal cell carcinoma of skin of left lower limb, including hip
ICD-10 CM	C44.721	Squamous cell carcinoma of skin of unspecified lower limb, including hip
ICD-10 CM	C44.722	Squamous cell carcinoma of skin of right lower limb, including hip
ICD-10 CM	C44.729	Squamous cell carcinoma of skin of left lower limb, including hip
ICD-10 CM	C44.791	Other specified malignant neoplasm of skin of unspecified lower limb, including hip

ICD-10 CM	C44.792	Other specified malignant neoplasm of skin of right lower limb, including hip
ICD-10 CM	C44.799	Other specified malignant neoplasm of skin of left lower limb, including hip
ICD-10 CM	C44.80	Unspecified malignant neoplasm of overlapping sites of skin
ICD-10 CM	C44.81	Basal cell carcinoma of overlapping sites of skin
ICD-10 CM	C44.82	Squamous cell carcinoma of overlapping sites of skin
ICD-10 CM	C44.89	Other specified malignant neoplasm of overlapping sites of skin
ICD-10 CM	C44.90	Unspecified malignant neoplasm of skin, unspecified
ICD-10 CM	C44.91	Basal cell carcinoma of skin, unspecified
ICD-10 CM	C44.92	Squamous cell carcinoma of skin, unspecified
ICD-10 CM	C44.99	Other specified malignant neoplasm of skin, unspecified
ICD-10 CM	C45.0	Mesothelioma of pleura
ICD-10 CM	C45.1	Mesothelioma of peritoneum
ICD-10 CM	C45.2	Mesothelioma of pericardium
ICD-10 CM	C45.7	Mesothelioma of other sites
ICD-10 CM	C45.9	Mesothelioma, unspecified
ICD-10 CM	C47.0	Malignant neoplasm of peripheral nerves of head, face and neck
ICD-10 CM	C47.10	Malignant neoplasm of peripheral nerves of unspecified upper limb, including shoulder
ICD-10 CM	C47.11	Malignant neoplasm of peripheral nerves of right upper limb, including shoulder
ICD-10 CM	C47.12	Malignant neoplasm of peripheral nerves of left upper limb, including shoulder
ICD-10 CM	C47.20	Malignant neoplasm of peripheral nerves of unspecified lower limb, including hip
ICD-10 CM	C47.21	Malignant neoplasm of peripheral nerves of right lower limb, including hip
ICD-10 CM	C47.22	Malignant neoplasm of peripheral nerves of left lower limb, including hip
ICD-10 CM	C47.3	Malignant neoplasm of peripheral nerves of thorax
ICD-10 CM	C47.4	Malignant neoplasm of peripheral nerves of abdomen
ICD-10 CM	C47.5	Malignant neoplasm of peripheral nerves of pelvis

ICD-10 CM	C47.6	Malignant neoplasm of peripheral nerves of trunk, unspecified
ICD-10 CM	C47.8	Malignant neoplasm of overlapping sites of peripheral nerves and autonomic nervous system
ICD-10 CM	C47.9	Malignant neoplasm of peripheral nerves and autonomic nervous system, unspecified
ICD-10 CM	C48.0	Malignant neoplasm of retroperitoneum
ICD-10 CM	C48.1	Malignant neoplasm of specified parts of peritoneum
ICD-10 CM	C48.2	Malignant neoplasm of peritoneum, unspecified
ICD-10 CM	C48.8	Malignant neoplasm of overlapping sites of retroperitoneum and peritoneum
ICD-10 CM	C49.0	Malignant neoplasm of connective and soft tissue of head, face and neck
ICD-10 CM	C49.10	Malignant neoplasm of connective and soft tissue of unspecified upper limb, including shoulder
ICD-10 CM	C49.11	Malignant neoplasm of connective and soft tissue of right upper limb, including shoulder
ICD-10 CM	C49.12	Malignant neoplasm of connective and soft tissue of left upper limb, including shoulder
ICD-10 CM	C49.20	Malignant neoplasm of connective and soft tissue of unspecified lower limb, including hip
ICD-10 CM	C49.21	Malignant neoplasm of connective and soft tissue of right lower limb, including hip
ICD-10 CM	C49.22	Malignant neoplasm of connective and soft tissue of left lower limb, including hip
ICD-10 CM	C49.3	Malignant neoplasm of connective and soft tissue of thorax
ICD-10 CM	C49.4	Malignant neoplasm of connective and soft tissue of abdomen
ICD-10 CM	C49.5	Malignant neoplasm of connective and soft tissue of pelvis
ICD-10 CM	C49.6	Malignant neoplasm of connective and soft tissue of trunk, unspecified
ICD-10 CM	C49.8	Malignant neoplasm of overlapping sites of connective and soft tissue
ICD-10 CM	C49.9	Malignant neoplasm of connective and soft tissue, unspecified
ICD-10 CM	C50.011	Malignant neoplasm of nipple and areola, right female breast
ICD-10 CM	C50.012	Malignant neoplasm of nipple and areola, left female breast

ICD-10 CM	C50.019	Malignant neoplasm of nipple and areola, unspecified female breast
ICD-10 CM	C50.021	Malignant neoplasm of nipple and areola, right male breast
ICD-10 CM	C50.022	Malignant neoplasm of nipple and areola, left male breast
ICD-10 CM	C50.029	Malignant neoplasm of nipple and areola, unspecified male breast
ICD-10 CM	C50.111	Malignant neoplasm of central portion of right female breast
ICD-10 CM	C50.112	Malignant neoplasm of central portion of left female breast
ICD-10 CM	C50.119	Malignant neoplasm of central portion of unspecified female breast
ICD-10 CM	C50.121	Malignant neoplasm of central portion of right male breast
ICD-10 CM	C50.122	Malignant neoplasm of central portion of left male breast
ICD-10 CM	C50.129	Malignant neoplasm of central portion of unspecified male breast
ICD-10 CM	C50.211	Malignant neoplasm of upper-inner quadrant of right female breast
ICD-10 CM	C50.212	Malignant neoplasm of upper-inner quadrant of left female breast
ICD-10 CM	C50.219	Malignant neoplasm of upper-inner quadrant of unspecified female breast
ICD-10 CM	C50.221	Malignant neoplasm of upper-inner quadrant of right male breast
ICD-10 CM	C50.222	Malignant neoplasm of upper-inner quadrant of left male breast
ICD-10 CM	C50.229	Malignant neoplasm of upper-inner quadrant of unspecified male breast
ICD-10 CM	C50.311	Malignant neoplasm of lower-inner quadrant of right female breast
ICD-10 CM	C50.312	Malignant neoplasm of lower-inner quadrant of left female breast
ICD-10 CM	C50.319	Malignant neoplasm of lower-inner quadrant of unspecified female breast
ICD-10 CM	C50.321	Malignant neoplasm of lower-inner quadrant of right male breast
ICD-10 CM	C50.322	Malignant neoplasm of lower-inner quadrant of left male breast
ICD-10 CM	C50.329	Malignant neoplasm of lower-inner quadrant of unspecified male breast
ICD-10 CM	C50.411	Malignant neoplasm of upper-outer quadrant of right female breast
ICD-10 CM	C50.412	Malignant neoplasm of upper-outer quadrant of left female breast
ICD-10 CM	C50.419	Malignant neoplasm of upper-outer quadrant of unspecified female breast
ICD-10 CM	C50.421	Malignant neoplasm of upper-outer quadrant of right male breast
ICD-10 CM	C50.422	Malignant neoplasm of upper-outer quadrant of left male breast

ICD-10 CM	C50.429	Malignant neoplasm of upper-outer quadrant of unspecified male breast
ICD-10 CM	C50.511	Malignant neoplasm of lower-outer quadrant of right female breast
ICD-10 CM	C50.512	Malignant neoplasm of lower-outer quadrant of left female breast
ICD-10 CM	C50.519	Malignant neoplasm of lower-outer quadrant of unspecified female breast
ICD-10 CM	C50.521	Malignant neoplasm of lower-outer quadrant of right male breast
ICD-10 CM	C50.522	Malignant neoplasm of lower-outer quadrant of left male breast
ICD-10 CM	C50.529	Malignant neoplasm of lower-outer quadrant of unspecified male breast
ICD-10 CM	C50.611	Malignant neoplasm of axillary tail of right female breast
ICD-10 CM	C50.612	Malignant neoplasm of axillary tail of left female breast
ICD-10 CM	C50.619	Malignant neoplasm of axillary tail of unspecified female breast
ICD-10 CM	C50.621	Malignant neoplasm of axillary tail of right male breast
ICD-10 CM	C50.622	Malignant neoplasm of axillary tail of left male breast
ICD-10 CM	C50.629	Malignant neoplasm of axillary tail of unspecified male breast
ICD-10 CM	C50.811	Malignant neoplasm of overlapping sites of right female breast
ICD-10 CM	C50.812	Malignant neoplasm of overlapping sites of left female breast
ICD-10 CM	C50.819	Malignant neoplasm of overlapping sites of unspecified female breast
ICD-10 CM	C50.821	Malignant neoplasm of overlapping sites of right male breast
ICD-10 CM	C50.822	Malignant neoplasm of overlapping sites of left male breast
ICD-10 CM	C50.829	Malignant neoplasm of overlapping sites of unspecified male breast
ICD-10 CM	C50.911	Malignant neoplasm of unspecified site of right female breast
ICD-10 CM	C50.912	Malignant neoplasm of unspecified site of left female breast
ICD-10 CM	C50.919	Malignant neoplasm of unspecified site of unspecified female breast
ICD-10 CM	C50.921	Malignant neoplasm of unspecified site of right male breast
ICD-10 CM	C50.922	Malignant neoplasm of unspecified site of left male breast
ICD-10 CM	C50.929	Malignant neoplasm of unspecified site of unspecified male breast
ICD-10 CM	C51.0	Malignant neoplasm of labium majus
ICD-10 CM	C51.1	Malignant neoplasm of labium minus

ICD-10 CM	C51.2	Malignant neoplasm of clitoris
ICD-10 CM	C51.8	Malignant neoplasm of overlapping sites of vulva
ICD-10 CM	C51.9	Malignant neoplasm of vulva, unspecified
ICD-10 CM	C52	Malignant neoplasm of vagina
ICD-10 CM	C53.0	Malignant neoplasm of endocervix
ICD-10 CM	C53.1	Malignant neoplasm of exocervix
ICD-10 CM	C53.8	Malignant neoplasm of overlapping sites of cervix uteri
ICD-10 CM	C53.9	Malignant neoplasm of cervix uteri, unspecified
ICD-10 CM	C54.0	Malignant neoplasm of isthmus uteri
ICD-10 CM	C54.1	Malignant neoplasm of endometrium
ICD-10 CM	C54.2	Malignant neoplasm of myometrium
ICD-10 CM	C54.3	Malignant neoplasm of fundus uteri
ICD-10 CM	C54.8	Malignant neoplasm of overlapping sites of corpus uteri
ICD-10 CM	C54.9	Malignant neoplasm of corpus uteri, unspecified
ICD-10 CM	C55	Malignant neoplasm of uterus, part unspecified
ICD-10 CM	C56.1	Malignant neoplasm of right ovary
ICD-10 CM	C56.2	Malignant neoplasm of left ovary
ICD-10 CM	C56.9	Malignant neoplasm of unspecified ovary
ICD-10 CM	C57.00	Malignant neoplasm of unspecified fallopian tube
ICD-10 CM	C57.01	Malignant neoplasm of right fallopian tube
ICD-10 CM	C57.02	Malignant neoplasm of left fallopian tube
ICD-10 CM	C57.10	Malignant neoplasm of unspecified broad ligament
ICD-10 CM	C57.11	Malignant neoplasm of right broad ligament
ICD-10 CM	C57.12	Malignant neoplasm of left broad ligament
ICD-10 CM	C57.20	Malignant neoplasm of unspecified round ligament
ICD-10 CM	C57.21	Malignant neoplasm of right round ligament
ICD-10 CM	C57.22	Malignant neoplasm of left round ligament

ICD-10 CM	C57.3	Malignant neoplasm of parametrium
ICD-10 CM	C57.4	Malignant neoplasm of uterine adnexa, unspecified
ICD-10 CM	C57.7	Malignant neoplasm of other specified female genital organs
ICD-10 CM	C57.8	Malignant neoplasm of overlapping sites of female genital organs
ICD-10 CM	C57.9	Malignant neoplasm of female genital organ, unspecified
ICD-10 CM	C58	Malignant neoplasm of placenta
ICD-10 CM	C60.0	Malignant neoplasm of prepuce
ICD-10 CM	C60.1	Malignant neoplasm of glans penis
ICD-10 CM	C60.2	Malignant neoplasm of body of penis
ICD-10 CM	C60.8	Malignant neoplasm of overlapping sites of penis
ICD-10 CM	C60.9	Malignant neoplasm of penis, unspecified
ICD-10 CM	C61	Malignant neoplasm of prostate
ICD-10 CM	C62.00	Malignant neoplasm of unspecified undescended testis
ICD-10 CM	C62.01	Malignant neoplasm of undescended right testis
ICD-10 CM	C62.02	Malignant neoplasm of undescended left testis
ICD-10 CM	C62.10	Malignant neoplasm of unspecified descended testis
ICD-10 CM	C62.11	Malignant neoplasm of descended right testis
ICD-10 CM	C62.12	Malignant neoplasm of descended left testis
ICD-10 CM	C62.90	Malignant neoplasm of unspecified testis, unspecified whether descended or undescended
ICD-10 CM	C62.91	Malignant neoplasm of right testis, unspecified whether descended or undescended
ICD-10 CM	C62.92	Malignant neoplasm of left testis, unspecified whether descended or undescended
ICD-10 CM	C63.00	Malignant neoplasm of unspecified epididymis
ICD-10 CM	C63.01	Malignant neoplasm of right epididymis
ICD-10 CM	C63.02	Malignant neoplasm of left epididymis
ICD-10 CM	C63.10	Malignant neoplasm of unspecified spermatic cord
ICD-10 CM	C63.11	Malignant neoplasm of right spermatic cord

ICD-10 CM	C63.12	Malignant neoplasm of left spermatic cord
ICD-10 CM	C63.2	Malignant neoplasm of scrotum
ICD-10 CM	C63.7	Malignant neoplasm of other specified male genital organs
ICD-10 CM	C63.8	Malignant neoplasm of overlapping sites of male genital organs
ICD-10 CM	C63.9	Malignant neoplasm of male genital organ, unspecified
ICD-10 CM	C64.1	Malignant neoplasm of right kidney, except renal pelvis
ICD-10 CM	C64.2	Malignant neoplasm of left kidney, except renal pelvis
ICD-10 CM	C64.9	Malignant neoplasm of unspecified kidney, except renal pelvis
ICD-10 CM	C65.1	Malignant neoplasm of right renal pelvis
ICD-10 CM	C65.2	Malignant neoplasm of left renal pelvis
ICD-10 CM	C65.9	Malignant neoplasm of unspecified renal pelvis
ICD-10 CM	C66.1	Malignant neoplasm of right ureter
ICD-10 CM	C66.2	Malignant neoplasm of left ureter
ICD-10 CM	C66.9	Malignant neoplasm of unspecified ureter
ICD-10 CM	C67.0	Malignant neoplasm of trigone of bladder
ICD-10 CM	C67.1	Malignant neoplasm of dome of bladder
ICD-10 CM	C67.2	Malignant neoplasm of lateral wall of bladder
ICD-10 CM	C67.3	Malignant neoplasm of anterior wall of bladder
ICD-10 CM	C67.4	Malignant neoplasm of posterior wall of bladder
ICD-10 CM	C67.5	Malignant neoplasm of bladder neck
ICD-10 CM	C67.6	Malignant neoplasm of ureteric orifice
ICD-10 CM	C67.7	Malignant neoplasm of urachus
ICD-10 CM	C67.8	Malignant neoplasm of overlapping sites of bladder
ICD-10 CM	C67.9	Malignant neoplasm of bladder, unspecified
ICD-10 CM	C68.0	Malignant neoplasm of urethra
ICD-10 CM	C68.1	Malignant neoplasm of paraurethral glands
ICD-10 CM	C68.8	Malignant neoplasm of overlapping sites of urinary organs

ICD-10 CM	C68.9	Malignant neoplasm of urinary organ, unspecified
ICD-10 CM	C69.00	Malignant neoplasm of unspecified conjunctiva
ICD-10 CM	C69.01	Malignant neoplasm of right conjunctiva
ICD-10 CM	C69.02	Malignant neoplasm of left conjunctiva
ICD-10 CM	C69.10	Malignant neoplasm of unspecified cornea
ICD-10 CM	C69.11	Malignant neoplasm of right cornea
ICD-10 CM	C69.12	Malignant neoplasm of left cornea
ICD-10 CM	C69.20	Malignant neoplasm of unspecified retina
ICD-10 CM	C69.21	Malignant neoplasm of right retina
ICD-10 CM	C69.22	Malignant neoplasm of left retina
ICD-10 CM	C69.30	Malignant neoplasm of unspecified choroid
ICD-10 CM	C69.31	Malignant neoplasm of right choroid
ICD-10 CM	C69.32	Malignant neoplasm of left choroid
ICD-10 CM	C69.40	Malignant neoplasm of unspecified ciliary body
ICD-10 CM	C69.41	Malignant neoplasm of right ciliary body
ICD-10 CM	C69.42	Malignant neoplasm of left ciliary body
ICD-10 CM	C69.50	Malignant neoplasm of unspecified lacrimal gland and duct
ICD-10 CM	C69.51	Malignant neoplasm of right lacrimal gland and duct
ICD-10 CM	C69.52	Malignant neoplasm of left lacrimal gland and duct
ICD-10 CM	C69.60	Malignant neoplasm of unspecified orbit
ICD-10 CM	C69.61	Malignant neoplasm of right orbit
ICD-10 CM	C69.62	Malignant neoplasm of left orbit
ICD-10 CM	C69.80	Malignant neoplasm of overlapping sites of unspecified eye and adnexa
ICD-10 CM	C69.81	Malignant neoplasm of overlapping sites of right eye and adnexa
ICD-10 CM	C69.82	Malignant neoplasm of overlapping sites of left eye and adnexa
ICD-10 CM	C69.90	Malignant neoplasm of unspecified site of unspecified eye
ICD-10 CM	C69.91	Malignant neoplasm of unspecified site of right eye

ICD-10 CM	C69.92	Malignant neoplasm of unspecified site of left eye
ICD-10 CM	C70.0	Malignant neoplasm of cerebral meninges
ICD-10 CM	C70.1	Malignant neoplasm of spinal meninges
ICD-10 CM	C70.9	Malignant neoplasm of meninges, unspecified
ICD-10 CM	C71.0	Malignant neoplasm of cerebrum, except lobes and ventricles
ICD-10 CM	C71.1	Malignant neoplasm of frontal lobe
ICD-10 CM	C71.2	Malignant neoplasm of temporal lobe
ICD-10 CM	C71.3	Malignant neoplasm of parietal lobe
ICD-10 CM	C71.4	Malignant neoplasm of occipital lobe
ICD-10 CM	C71.5	Malignant neoplasm of cerebral ventricle
ICD-10 CM	C71.6	Malignant neoplasm of cerebellum
ICD-10 CM	C71.7	Malignant neoplasm of brain stem
ICD-10 CM	C71.8	Malignant neoplasm of overlapping sites of brain
ICD-10 CM	C71.9	Malignant neoplasm of brain, unspecified
ICD-10 CM	C72.0	Malignant neoplasm of spinal cord
ICD-10 CM	C72.1	Malignant neoplasm of cauda equina
ICD-10 CM	C72.20	Malignant neoplasm of unspecified olfactory nerve
ICD-10 CM	C72.21	Malignant neoplasm of right olfactory nerve
ICD-10 CM	C72.22	Malignant neoplasm of left olfactory nerve
ICD-10 CM	C72.30	Malignant neoplasm of unspecified optic nerve
ICD-10 CM	C72.31	Malignant neoplasm of right optic nerve
ICD-10 CM	C72.32	Malignant neoplasm of left optic nerve
ICD-10 CM	C72.40	Malignant neoplasm of unspecified acoustic nerve
ICD-10 CM	C72.41	Malignant neoplasm of right acoustic nerve
ICD-10 CM	C72.42	Malignant neoplasm of left acoustic nerve
ICD-10 CM	C72.50	Malignant neoplasm of unspecified cranial nerve
ICD-10 CM	C72.59	Malignant neoplasm of other cranial nerves

ICD-10 CM	C72.9	Malignant neoplasm of central nervous system, unspecified
ICD-10 CM	C73	Malignant neoplasm of thyroid gland
ICD-10 CM	C74.00	Malignant neoplasm of cortex of unspecified adrenal gland
ICD-10 CM	C74.01	Malignant neoplasm of cortex of right adrenal gland
ICD-10 CM	C74.02	Malignant neoplasm of cortex of left adrenal gland
ICD-10 CM	C74.10	Malignant neoplasm of medulla of unspecified adrenal gland
ICD-10 CM	C74.11	Malignant neoplasm of medulla of right adrenal gland
ICD-10 CM	C74.12	Malignant neoplasm of medulla of left adrenal gland
ICD-10 CM	C74.90	Malignant neoplasm of unspecified part of unspecified adrenal gland
ICD-10 CM	C74.91	Malignant neoplasm of unspecified part of right adrenal gland
ICD-10 CM	C74.92	Malignant neoplasm of unspecified part of left adrenal gland
ICD-10 CM	C75.0	Malignant neoplasm of parathyroid gland
ICD-10 CM	C75.1	Malignant neoplasm of pituitary gland
ICD-10 CM	C75.2	Malignant neoplasm of craniopharyngeal duct
ICD-10 CM	C75.3	Malignant neoplasm of pineal gland
ICD-10 CM	C75.4	Malignant neoplasm of carotid body
ICD-10 CM	C75.5	Malignant neoplasm of aortic body and other paraganglia
ICD-10 CM	C75.8	Malignant neoplasm with pluriglandular involvement, unspecified
ICD-10 CM	C75.9	Malignant neoplasm of endocrine gland, unspecified
ICD-10 CM	C76.0	Malignant neoplasm of head, face and neck
ICD-10 CM	C76.1	Malignant neoplasm of thorax
ICD-10 CM	C76.2	Malignant neoplasm of abdomen
ICD-10 CM	C76.3	Malignant neoplasm of pelvis
ICD-10 CM	C76.40	Malignant neoplasm of unspecified upper limb
ICD-10 CM	C76.41	Malignant neoplasm of right upper limb
ICD-10 CM	C76.42	Malignant neoplasm of left upper limb
ICD-10 CM	C76.50	Malignant neoplasm of unspecified lower limb

ICD-10 CM	C76.51	Malignant neoplasm of right lower limb
ICD-10 CM	C76.52	Malignant neoplasm of left lower limb
ICD-10 CM	C76.8	Malignant neoplasm of other specified ill-defined sites
ICD-10 CM	C77.0	Secondary and unspecified malignant neoplasm of lymph nodes of head, face and neck
ICD-10 CM	C77.1	Secondary and unspecified malignant neoplasm of intrathoracic lymph nodes
ICD-10 CM	C77.2	Secondary and unspecified malignant neoplasm of intra-abdominal lymph nodes
ICD-10 CM	C77.3	Secondary and unspecified malignant neoplasm of axilla and upper limb lymph nodes
ICD-10 CM	C77.4	Secondary and unspecified malignant neoplasm of inguinal and lower limb lymph nodes
ICD-10 CM	C77.5	Secondary and unspecified malignant neoplasm of intrapelvic lymph nodes
ICD-10 CM	C77.8	Secondary and unspecified malignant neoplasm of lymph nodes of multiple regions
ICD-10 CM	C77.9	Secondary and unspecified malignant neoplasm of lymph node, unspecified
ICD-10 CM	C78.00	Secondary malignant neoplasm of unspecified lung
ICD-10 CM	C78.01	Secondary malignant neoplasm of right lung
ICD-10 CM	C78.02	Secondary malignant neoplasm of left lung
ICD-10 CM	C78.1	Secondary malignant neoplasm of mediastinum
ICD-10 CM	C78.2	Secondary malignant neoplasm of pleura
ICD-10 CM	C78.30	Secondary malignant neoplasm of unspecified respiratory organ
ICD-10 CM	C78.39	Secondary malignant neoplasm of other respiratory organs
ICD-10 CM	C78.4	Secondary malignant neoplasm of small intestine
ICD-10 CM	C78.5	Secondary malignant neoplasm of large intestine and rectum
ICD-10 CM	C78.6	Secondary malignant neoplasm of retroperitoneum and peritoneum
ICD-10 CM	C78.7	Secondary malignant neoplasm of liver and intrahepatic bile duct
ICD-10 CM	C78.80	Secondary malignant neoplasm of unspecified digestive organ
ICD-10 CM	C78.89	Secondary malignant neoplasm of other digestive organs

ICD-10 CM	C79.00	Secondary malignant neoplasm of unspecified kidney and renal pelvis
ICD-10 CM	C79.01	Secondary malignant neoplasm of right kidney and renal pelvis
ICD-10 CM	C79.02	Secondary malignant neoplasm of left kidney and renal pelvis
ICD-10 CM	C79.10	Secondary malignant neoplasm of unspecified urinary organs
ICD-10 CM	C79.11	Secondary malignant neoplasm of bladder
ICD-10 CM	C79.19	Secondary malignant neoplasm of other urinary organs
ICD-10 CM	C79.2	Secondary malignant neoplasm of skin
ICD-10 CM	C79.31	Secondary malignant neoplasm of brain
ICD-10 CM	C79.32	Secondary malignant neoplasm of cerebral meninges
ICD-10 CM	C79.40	Secondary malignant neoplasm of unspecified part of nervous system
ICD-10 CM	C79.49	Secondary malignant neoplasm of other parts of nervous system
ICD-10 CM	C79.51	Secondary malignant neoplasm of bone
ICD-10 CM	C79.52	Secondary malignant neoplasm of bone marrow
ICD-10 CM	C79.60	Secondary malignant neoplasm of unspecified ovary
ICD-10 CM	C79.61	Secondary malignant neoplasm of right ovary
ICD-10 CM	C79.62	Secondary malignant neoplasm of left ovary
ICD-10 CM	C79.70	Secondary malignant neoplasm of unspecified adrenal gland
ICD-10 CM	C79.71	Secondary malignant neoplasm of right adrenal gland
ICD-10 CM	C79.72	Secondary malignant neoplasm of left adrenal gland
ICD-10 CM	C79.81	Secondary malignant neoplasm of breast
ICD-10 CM	C79.82	Secondary malignant neoplasm of genital organs
ICD-10 CM	C79.89	Secondary malignant neoplasm of other specified sites
ICD-10 CM	C79.9	Secondary malignant neoplasm of unspecified site
ICD-10 CM	C80.0	Disseminated malignant neoplasm, unspecified
ICD-10 CM	C80.1	Malignant (primary) neoplasm, unspecified
ICD-10 CM	C80.2	Malignant neoplasm associated with transplanted organ
ICD-10 CM	C82.50	Diffuse follicle center lymphoma, unspecified site

ICD-10 CM	C82.51	Diffuse follicle center lymphoma, lymph nodes of head, face, and neck
ICD-10 CM	C82.52	Diffuse follicle center lymphoma, intrathoracic lymph nodes
ICD-10 CM	C82.53	Diffuse follicle center lymphoma, intra-abdominal lymph nodes
ICD-10 CM	C82.54	Diffuse follicle center lymphoma, lymph nodes of axilla and upper limb
ICD-10 CM	C82.55	Diffuse follicle center lymphoma, lymph nodes of inguinal region and lower limb
ICD-10 CM	C82.56	Diffuse follicle center lymphoma, intrapelvic lymph nodes
ICD-10 CM	C82.57	Diffuse follicle center lymphoma, spleen
ICD-10 CM	C82.58	Diffuse follicle center lymphoma, lymph nodes of multiple sites
ICD-10 CM	C82.59	Diffuse follicle center lymphoma, extranodal and solid organ sites
ICD-10 CM	C84.90	Mature T/NK-cell lymphomas, unspecified, unspecified site
ICD-10 CM	C84.91	Mature T/NK-cell lymphomas, unspecified, lymph nodes of head, face, and neck
ICD-10 CM	C84.92	Mature T/NK-cell lymphomas, unspecified, intrathoracic lymph nodes
ICD-10 CM	C84.93	Mature T/NK-cell lymphomas, unspecified, intra-abdominal lymph nodes
ICD-10 CM	C84.94	Mature T/NK-cell lymphomas, unspecified, lymph nodes of axilla and upper limb
ICD-10 CM	C84.95	Mature T/NK-cell lymphomas, unspecified, lymph nodes of inguinal region and lower limb
ICD-10 CM	C84.96	Mature T/NK-cell lymphomas, unspecified, intrapelvic lymph nodes
ICD-10 CM	C84.97	Mature T/NK-cell lymphomas, unspecified, spleen
ICD-10 CM	C84.98	Mature T/NK-cell lymphomas, unspecified, lymph nodes of multiple sites
ICD-10 CM	C84.99	Mature T/NK-cell lymphomas, unspecified, extranodal and solid organ sites
ICD-10 CM	C84.A0	Cutaneous T-cell lymphoma, unspecified, unspecified site
ICD-10 CM	C84.A1	Cutaneous T-cell lymphoma, unspecified lymph nodes of head, face, and neck
ICD-10 CM	C84.A2	Cutaneous T-cell lymphoma, unspecified, intrathoracic lymph nodes
ICD-10 CM	C84.A3	Cutaneous T-cell lymphoma, unspecified, intra-abdominal lymph nodes
ICD-10 CM	C84.A4	Cutaneous T-cell lymphoma, unspecified, lymph nodes of axilla and upper limb

ICD-10 CM	C84.A5	Cutaneous T-cell lymphoma, unspecified, lymph nodes of inguinal region and lower limb
ICD-10 CM	C84.A6	Cutaneous T-cell lymphoma, unspecified, intrapelvic lymph nodes
ICD-10 CM	C84.A7	Cutaneous T-cell lymphoma, unspecified, spleen
ICD-10 CM	C84.A8	Cutaneous T-cell lymphoma, unspecified, lymph nodes of multiple sites
ICD-10 CM	C84.A9	Cutaneous T-cell lymphoma, unspecified, extranodal and solid organ sites
ICD-10 CM	C84.Z0	Other mature T/NK-cell lymphomas, unspecified site
ICD-10 CM	C84.Z1	Other mature T/NK-cell lymphomas, lymph nodes of head, face, and neck
ICD-10 CM	C84.Z2	Other mature T/NK-cell lymphomas, intrathoracic lymph nodes
ICD-10 CM	C84.Z3	Other mature T/NK-cell lymphomas, intra-abdominal lymph nodes
ICD-10 CM	C84.Z4	Other mature T/NK-cell lymphomas, lymph nodes of axilla and upper limb
ICD-10 CM	C84.Z5	Other mature T/NK-cell lymphomas, lymph nodes of inguinal region and lower limb
ICD-10 CM	C84.Z6	Other mature T/NK-cell lymphomas, intrapelvic lymph nodes
ICD-10 CM	C84.Z7	Other mature T/NK-cell lymphomas, spleen
ICD-10 CM	C84.Z8	Other mature T/NK-cell lymphomas, lymph nodes of multiple sites
ICD-10 CM	C84.Z9	Other mature T/NK-cell lymphomas, extranodal and solid organ sites
ICD-10 CM	C85.10	Unspecified B-cell lymphoma, unspecified site
ICD-10 CM	C85.11	Unspecified B-cell lymphoma, lymph nodes of head, face, and neck
ICD-10 CM	C85.12	Unspecified B-cell lymphoma, intrathoracic lymph nodes
ICD-10 CM	C85.13	Unspecified B-cell lymphoma, intra-abdominal lymph nodes
ICD-10 CM	C85.14	Unspecified B-cell lymphoma, lymph nodes of axilla and upper limb
ICD-10 CM	C85.15	Unspecified B-cell lymphoma, lymph nodes of inguinal region and lower limb
ICD-10 CM	C85.16	Unspecified B-cell lymphoma, intrapelvic lymph nodes
ICD-10 CM	C85.17	Unspecified B-cell lymphoma, spleen
ICD-10 CM	C85.18	Unspecified B-cell lymphoma, lymph nodes of multiple sites
ICD-10 CM	C85.19	Unspecified B-cell lymphoma, extranodal and solid organ sites
ICD-10 CM	C85.20	Mediastinal (thymic) large B-cell lymphoma, unspecified site

ICD-10 CM	C85.21	Mediastinal (thymic) large B-cell lymphoma, lymph nodes of head, face, and neck
ICD-10 CM	C85.22	Mediastinal (thymic) large B-cell lymphoma, intrathoracic lymph nodes
ICD-10 CM	C85.23	Mediastinal (thymic) large B-cell lymphoma, intra-abdominal lymph nodes
ICD-10 CM	C85.24	Mediastinal (thymic) large B-cell lymphoma, lymph nodes of axilla and upper limb
ICD-10 CM	C85.25	Mediastinal (thymic) large B-cell lymphoma, lymph nodes of inguinal region and lower limb
ICD-10 CM	C85.26	Mediastinal (thymic) large B-cell lymphoma, intrapelvic lymph nodes
ICD-10 CM	C85.27	Mediastinal (thymic) large B-cell lymphoma, spleen
ICD-10 CM	C85.28	Mediastinal (thymic) large B-cell lymphoma, lymph nodes of multiple sites
ICD-10 CM	C85.29	Mediastinal (thymic) large B-cell lymphoma, extranodal and solid organ sites
ICD-10 CM	C85.80	Other specified types of non-Hodgkin lymphoma, unspecified site
ICD-10 CM	C85.81	Other specified types of non-Hodgkin lymphoma, lymph nodes of head, face, and neck
ICD-10 CM	C85.82	Other specified types of non-Hodgkin lymphoma, intrathoracic lymph nodes
ICD-10 CM	C85.83	Other specified types of non-Hodgkin lymphoma, intra-abdominal lymph nodes
ICD-10 CM	C85.84	Other specified types of non-Hodgkin lymphoma, lymph nodes of axilla and upper limb
ICD-10 CM	C85.85	Other specified types of non-Hodgkin lymphoma, lymph nodes of inguinal region and lower limb
ICD-10 CM	C85.86	Other specified types of non-Hodgkin lymphoma, intrapelvic lymph nodes
ICD-10 CM	C85.87	Other specified types of non-Hodgkin lymphoma, spleen
ICD-10 CM	C85.88	Other specified types of non-Hodgkin lymphoma, lymph nodes of multiple sites
ICD-10 CM	C85.89	Other specified types of non-Hodgkin lymphoma, extranodal and solid organ sites
ICD-10 CM	C85.90	Non-Hodgkin lymphoma, unspecified, unspecified site
ICD-10 CM	C85.91	Non-Hodgkin lymphoma, unspecified, lymph nodes of head, face, and neck
ICD-10 CM	C85.92	Non-Hodgkin lymphoma, unspecified, intrathoracic lymph nodes

ICD-10 CM	C85.93	Non-Hodgkin lymphoma, unspecified, intra-abdominal lymph nodes
ICD-10 CM	C85.94	Non-Hodgkin lymphoma, unspecified, lymph nodes of axilla and upper limb
ICD-10 CM	C85.95	Non-Hodgkin lymphoma, unspecified, lymph nodes of inguinal region and lower limb
ICD-10 CM	C85.96	Non-Hodgkin lymphoma, unspecified, intrapelvic lymph nodes
ICD-10 CM	C85.97	Non-Hodgkin lymphoma, unspecified, spleen
ICD-10 CM	C85.98	Non-Hodgkin lymphoma, unspecified, lymph nodes of multiple sites
ICD-10 CM	C85.99	Non-Hodgkin lymphoma, unspecified, extranodal and solid organ sites
ICD-10 CM	C86.0	Extranodal NK/T-cell lymphoma, nasal type
ICD-10 CM	C86.1	Hepatosplenic T-cell lymphoma
ICD-10 CM	C86.2	Enteropathy-type (intestinal) T-cell lymphoma
ICD-10 CM	C86.3	Subcutaneous panniculitis-like T-cell lymphoma
ICD-10 CM	C86.4	Blastic NK-cell lymphoma
ICD-10 CM	C88.2	Heavy chain disease
ICD-10 CM	C88.3	Immunoproliferative small intestinal disease
ICD-10 CM	C88.8	Other malignant immunoproliferative diseases
ICD-10 CM	C88.9	Malignant immunoproliferative disease, unspecified
ICD-10 CM	C90.20	Extramedullary plasmacytoma not having achieved remission
ICD-10 CM	C90.21	Extramedullary plasmacytoma in remission
ICD-10 CM	C90.22	Extramedullary plasmacytoma in relapse
ICD-10 CM	C90.30	Solitary plasmacytoma not having achieved remission
ICD-10 CM	C90.31	Solitary plasmacytoma in remission
ICD-10 CM	C90.32	Solitary plasmacytoma in relapse
ICD-10 CM	C94.40	Acute panmyelosis with myelofibrosis not having achieved remission
ICD-10 CM	C94.41	Acute panmyelosis with myelofibrosis, in remission
ICD-10 CM	C94.42	Acute panmyelosis with myelofibrosis, in relapse
ICD-10 CM	C94.6	Myelodysplastic disease, not classified
ICD-10 CM	C96.4	Sarcoma of dendritic cells (accessory cells)

ICD-10 CM	C96.9	Malignant neoplasm of lymphoid, hematopoietic and related tissue, unspecified
ICD-10 CM	C96.Z	Other specified malignant neoplasms of lymphoid, hematopoietic and related tissue
ICD-9 CM	172	Malignant melanoma of skin
ICD-9 CM	176	Kaposi's sarcoma
ICD-9 CM	200	Malignant Neoplasm of Lymphatic and Hematopoietic Tissue
ICD-9 CM	201	Hodgkin Lymphoma
ICD-10 CM	C81	Hodgkin lymphoma
ICD-10 CM	C83	Non-follicular lymphoma
ICD-10 CM	C91	Lymphoid leukemia
ICD-10 CM	C92	Myeloid leukemia
ICD-10 CM	C93	Monocytic leukemia
ICD-10 CM	C95	Leukemia of unspecified cell type
ICD-10 CM	C46	Kaposi's sarcoma

Appendix F: Data Request

- Patients with a primary diagnosis of Head & Neck Lip and Oral Cavity, Oropharynx, Larynx, and Salivary Gland Cancers (See Appendix D) between 2011- 2017.
- Exclude patients under 18 years of age and above 64 years of age at first diagnosis of Head & Neck Cancer
- Exclude non-US Commercial HMO plans
- Exclude patients with break in payer coverage from start of diagnosis to 1 year, exclude secondary coverage plans
- Exclude patients with concurrent, recurrent cancers 1 years during 1 year after start of diagnosis and 3 months before start of diagnosis, using claims 2011-2017

Data Variables Requested Below:

<u>DATA TABLE</u>	<u>VARIABLE</u>	<u>DESCRIPTION</u>	<u>TYPE</u>	<u>FORMAT</u>
Member	PATID	An encrypted, system-generated number that identifies an individual across multiple groups/policies. This identifier is not derived from information about the individual, and is compliant with HIPAA §164.514c.	Num	19
Member	ASO	A code which identifies if the financial arrangement is Administrative Services Only (ASO). Values: Y = ASO, N = Not ASO	Char	\$1
Member	BUS	Identifies the type of business the product is intended to service.	Char	\$5
Member	CDHP	Consumer Driven Health Plan: Code that defines what a customer decides on in regards to the type of Health Plan.	Char	\$1
Member	ELIGEFF	The date this member coverage row of information is effective.	Num	YYMMDD10.
Member	ELIGEND	The date this member coverage row of information ended (or will end).	Num	YYMMDD10.
Member	GDR_CD	A code identifying the sex of the member M=male, F=female, U=unknown	Char	\$1
Member	GROUP_NBR	The number assigned to a healthcare entity, such as a plan, however not an individual, that has purchased products or services from our affiliate company.	Char	\$20
Member	HEALTH_EXCH	Identifies which type of health exchange	Char	\$1
Member	PRODUCT	The code commonly used by the health care industry to identify the product.	Char	\$5
Member	STATE	The two-character US Postal Service Abbreviation for the state name.	Char	\$2
Member	YRDOB	The member's year of birth, capped at 90 years.	Num	5
Member Detail	PATID	An encrypted, system-generated number that identifies an individual across multiple groups/policies. This identifier is not derived from information about the individual,	Num	19

		and is compliant with HIPAA §164.514c.		
Member Detail	PAT_PLANID	An encrypted, system-generated number that identifies an individual within in a group or policy. This identifier is not derived from or related to information about the individual, and is compliant with HIPAA §164.514(c)(1). If an individual is eligible for more than one type of insurance at a time (for example, a supplemental plan), then this variable links the claim to the correct plan.	Num	19
Member Detail	ASO	A code which identifies if the financial arrangement is Administrative Services Only (ASO).Values: Y = ASO, N = Not ASO	Char	\$1
Member Detail	BUS	Identifies the type of business the product is intended to service.	Char	\$5
Member Detail	CDHP	Code that defines what a customer decides on in regards to the type of Health Plan.	Char	\$1
Member Detail	ELIGEFF	The date this member coverage row of information is effective.	Num	YYMMDD10.
Member Detail	ELIGEND	The date this member coverage row of information ended (or will end).	Num	YYMMDD10.
Member Detail	GDR_CD	A code identifying the sex of the member M=male, F=female, U=unknown	Char	\$1
Member Detail	GROUP_NBR	The number assigned to a healthcare entity, such as a plan, however not an individual, that has purchased products or services from our affiliate company.	Char	\$20
Member Detail	HEALTH_EXCH	Identifies which type of health exchange	Char	\$1
Member Detail	LIS	Indicates whether member qualifies for Low Income Subsidy (LIS) available under Medicare Part D prescription drug program. Available on Medicare only.	Char	\$1
Member Detail	PRODUCT	The code commonly used by the health care industry to identify the product.	Char	\$5
Member Detail	STATE	The two-character US Postal Service Abbreviation for the state name.	Char	\$2
Member Detail	YRDOB	The member's year of birth, capped at 90 years.	Num	5
Medical	PATID	An encrypted, system-generated number that identifies an individual across multiple groups/policies. This identifier is not derived from information about the individual, and is compliant with HIPAA §164.514c.	Num	19
Medical	PAT_PLANID	An encrypted, system-generated number that identifies an individual within in a	Num	19

		group or policy. This identifier is not derived from or related to information about the individual, and is compliant with HIPAA §164.514(c)(1). If an individual is eligible for more than one type of insurance at a time (for example, a supplemental plan), then this variable links the claim to the correct plan.		
Medical	ADMIT_CHAN	This code identifies how the inpatient stay was initiated.	Char	\$16
Medical	ADMIT_TYPE	Identify the priority of the admission	Char	\$1
Medical	BILL_PROV	Billing Provider	Num	19
Medical	CHARGE	Amount the provider requested to be reimbursed for the service provided.	Num	11.2
Medical	CLMID	Encrypted Claim ID. A provider can bill multiple revenue codes for services rendered on one claim. Each revenue code will generate a claim line. Providers typically submit separate claim for each visit they have with a patient.	Char	\$19
Medical	CLMSEQ	Number assigned in the source system to the service within the claim. This field is used to distinguish between the detail records for a claim. Use with CLMID	Char	\$5
Medical	COB	The coordination of benefits code (COB) indicates if other insurance was considered as part of the payment determination.	Char	\$5
Medical	COINS	The amount (usually calculated as a percent of the provider's submitted charges) the member pays for a specific service as defined in their benefit plan. For example, 80% of the cost of an outpatient physical therapy visit.	Num	11.2
Medical	CONF_ID	Confinement Identifier. Used to identify claims records associated with an inpatient hospitalization. This data element is encrypted.	Char	\$21
Medical	COPAY	The fixed amount the member pays for a specific service as defined in their benefit plan. For example, \$10 for an office visit.	Num	11.2
Medical	DEDUCT	The set amount a member pays for services until they reach a specified limit (usually defined on an annual basis). After the limit is reached, the member's payment for services changes (often insurance pays 100% of the cost of services).	Num	11.2
Medical	DIAG1	Level 1 ICD-X as entered on the claim (without decimal point). ICD-X-CM is an accepted national standard for coding diagnostic and disease information. The Diagnosis Codes are sequenced in order of importance for the medical services.	Char	\$7
Medical	DIAG2	Level 2 ICD-X as entered on the claim (without decimal point). ICD-X-CM is an accepted national standard for coding diagnostic and disease information. The Diagnosis Codes are sequenced in order of importance for the medical services.	Char	\$7
Medical	DIAG3	Level 3 ICD-X as entered on the claim (without decimal point). ICD-X-CM is an accepted national standard for coding diagnostic and disease information. The Diagnosis Codes are sequenced in order of importance for the medical services.	Char	\$7

Medical	DIAG4	Level 4 ICD-X as entered on the claim (without decimal point). ICD-X-CM is an accepted national standard for coding diagnostic and disease information. The Diagnosis Codes are sequenced in order of importance for the medical services.	Char	\$7
Medical	DIAG5	Level 5 ICD-X as entered on the claim (without decimal point). ICD-X-CM is an accepted national standard for coding diagnostic and disease information. The Diagnosis Codes are sequenced in order of importance for the medical services.	Char	\$7
Medical	DIAG6	Level 6 ICD-X as entered on the claim (without decimal point). ICD-X-CM is an accepted national standard for coding diagnostic and disease information. The Diagnosis Codes are sequenced in order of importance for the medical services.	Char	\$7
Medical	DIAG7	Level 7 ICD-X as entered on the claim (without decimal point). ICD-X-CM is an accepted national standard for coding diagnostic and disease information. The Diagnosis Codes are sequenced in order of importance for the medical services.	Char	\$7
Medical	DIAG8	Level 8 ICD-X as entered on the claim (without decimal point). ICD-X-CM is an accepted national standard for coding diagnostic and disease information. The Diagnosis Codes are sequenced in order of importance for the medical services.	Char	\$7
Medical	DIAG9	Level 9 ICD-X as entered on the claim (without decimal point). ICD-X-CM is an accepted national standard for coding diagnostic and disease information. The Diagnosis Codes are sequenced in order of importance for the medical services.	Char	\$7
Medical	DIAG10	Level 10 ICD-X as entered on the claim (without decimal point). ICD-X-CM is an accepted national standard for coding diagnostic and disease information. The Diagnosis Codes are sequenced in order of importance for the medical services.	Char	\$7
Medical	DRG	The Diagnosis Related Group (DRG) Code assigned by the source system. A DRG classifies patients by diagnostic or surgical procedure into major diagnostic categories for the purpose of determining payment of hospitalization charges. Effective 10/1/2007, the Centers for Medicare and Medicaid Services (CMS) introduced the MS-DRG code set and retired the CMS-DRG set. The new code set refined the DRGs based on the presence of complications or co-morbidities. One affect of this change is that the MS-DRG descriptions are completely different from previous descriptions. The DRG code table contains historical CMS-DRGs as well as MS-DRG codes.	Char	\$5
Medical	DSTATUS	Discharge status code. Identifies the discharge status of the member's inpatient stay as of the last service date on the claim.	Char	\$2
Medical	ENCTR	Identifies if the service is fee-for-service or capitated.	Char	\$2
Medical	FST_DT	The beginning date for the service, event, or confinement being billed by the provider.	Num	YYMMDD10.

Medical	HCCC	Identifies an affiliated company's categorization of health care services.	Char	\$2
Medical	ICD_FLAG	ICD Version Code – will distinguish between ICD-9 and ICD-10 codes.	Char	\$2
Medical	LOC_CD	Identifies if the claim is a facility claim or a non-facility claim.	Char	\$1
Medical	LST_DT	The service date for the service, event, or confinement being billed by the provider	Num	YYMMD D10.
Medical	NDC	The unique code that identifies a drug product as defined by the National Drug Data File (all drug products regulated by the FDA must use an NDC).	Char	\$11
Medical	PAID_DT	The date the service, event, or confinement was paid.	Num	YYMMD D10.
Medical	PAID_STATUS	The payment determination of this service line.	Char	\$2
Medical	POA	Present on Admission Code provides the ability to indicate whether diagnosis codes on a claim were present on admission. POA is defined as present at the time the order for inpatient admission occurs -- conditions that develop during outpatient encounter, including emergency department, observation, or outpatient surgery, are considered POA. Corresponds to POA 1 - 18.	Char	\$50
Medical	POS	Identifies the place where the service was performed.	Char	\$5
Medical	PROC_CD	CPT/HCPCS Procedure code that describes the service provided.	Char	\$7
Medical	PROC1	Claim Level 1 ICD-X procedure code off of the header portion of the claim.	Char	\$7
Medical	PROC2	Claim Level 2 ICD-X procedure code off of the header portion of the claim.	Char	\$7
Medical	PROC3	Claim Level 3 ICD-X procedure code off of the header portion of the claim.	Char	\$7
Medical	PROC4	Claim Level 4 ICD-X procedure code off of the header portion of the claim.	Char	\$7
Medical	PROC5	Claim Level 5 ICD-X procedure code off of the header portion of the claim.	Char	\$7
Medical	PROC6	Claim Level 6 ICD-X procedure code off of the header portion of the claim.	Char	\$7
Medical	PROC7	Claim Level 7 ICD-X procedure code off of the header portion of the claim.	Char	\$7
Medical	PROC8	Claim Level 8 ICD-X procedure code off of the header portion of the claim.	Char	\$7
Medical	PROC9	Claim Level 9 ICD-X procedure code off of the header portion of the claim.	Char	\$7
Medical	PROC10	Claim Level 10 ICD-X procedure code off of the header portion of the claim.	Char	\$7
Medical	PROCMOD	Provides additional information on the PROC_CD referenced in the claim. Standard modifiers will now be used.	Char	\$5
Medical	PROV	A unique system-generated number that identified the provider. It is possible for a provider to have multiple IDs or an ID to point to multiple physicians, particularly in the case of group practice.	Num	19
Medical	PROV_PAR	Identifies if the servicing provider has a contract to provide services to affiliate members at agreed upon rates. These contracts may be either with affiliate or with a	Char	\$5

		customer.		
Medical	PROVCAT	Contains the four-character provider category code to indicate the type of provider for the provider responsible for the service.	Char	\$4
Medical	SERVICE_PROVIDER	Rendering Provider on Non-Facility Claim Attending Provider on Facility Claim	Num	19
Medical	STD_COST	An estimate of the allowed amount for the facility charges related to the confinement. Associated surgeon's fees are likely to be found in the medical table.	Num	15.2
Medical	STD_COST_YEAR	The year when standard cost is updated in our source system	Char	\$4
Medical	TOS_CD	Type of Service Code	Char	\$13
Medical	UNITS	The revised number of units of the service based on the reasonable number of units for that service type.	Num	8
Facility Detail	PATID	An encrypted, system-generated number that identifies an individual across multiple groups/policies. This identifier is not derived from information about the individual, and is compliant with HIPAA §164.514c.	Num	19
Facility Detail	PAT_PLANID	An encrypted, system-generated number that identifies an individual within in a group or policy. This identifier is not derived from or related to information about the individual, and is compliant with HIPAA §164.514(c)(1). If an individual is eligible for more than one type of insurance at a time (for example, a supplemental plan), then this variable links the claim to the correct plan.	Num	19
Facility Detail	CHARGE_ALL_OCC	Amount the provider requested to be reimbursed for the service provided.	Num	11.2
Facility Detail	CLMID	Encrypted Claim ID. A provider can bill multiple revenue codes for services rendered on one claim. Each revenue code will generate a claim line. Providers typically submit separate claim for each visit they have with a patient.	Char	\$19
Facility Detail	CLMSEQ	Number assigned in the source system to the service within the claim. This field is used to distinguish between the detail records for a claim. Use with CLMID	Char	\$5
Facility Detail	DETAIL_LINE_NUMBER	Sequential Number within CLMID / CLMSEQ	Char	\$2
Facility Detail	FST_DT	The beginning date for the service, event, or confinement being billed by the provider.	Num	YYMMDD10.
Facility Detail	PROC_CD	CPT/HCPCS Procedure code that describes the service provided.	Char	\$7
Facility	PROCMOD	Provides additional information on the PROC_CD referenced in the claim. Standard	Char	\$5

Detail		modifiers will now be used.		
Facility Detail	RVNU_CD	Identifies a specific accommodation, ancillary service or billing calculation for facility claims.	Char	\$4
Facility Detail	STD_COST_A LLOC	An estimate of the allowed amount for the facility charges related to the confinement. Associated surgeon's fees are likely to be found in the medical table.	Num	15.2
Facility Detail	STD_COST_Y R	The year when standard cost is updated in our source system	Char	\$4
Facility Detail	UNITS	The revised number of units of the service based on the reasonable number of units for that service type.	Num	8
Rx	PATID	An encrypted, system-generated number that identifies an individual across multiple groups/policies. This identifier is not derived from information about the individual, and is compliant with HIPAA §164.514c.	Num	19
Rx	PAT_PLANID	An encrypted, system-generated number that identifies an individual within in a group or policy. This identifier is not derived from or related to information about the individual, and is compliant with HIPAA §164.514(c)(1). If an individual is eligible for more than one type of insurance at a time (for example, a supplemental plan), then this variable links the claim to the correct plan.	Num	19
Rx	AHFSCLSS	A code that identifies therapeutic category of drug according to the American Hospital Formulary Service Classification system. *From NDC table	Char	\$8
Rx	AVGWHLSL	The average wholesale price is the average cost to the pharmacy for a dispensed drug.	Num	11.2
Rx	BRND_NM	Provides the drug name on the package label and frequently is a trademark name. For non-branded generic products, the description will usually be the generic name. *From NDC table	Char	\$30
Rx	CHARGE	Amount the pharmacy requested to be reimbursed for the service provided. This amount is what was entered into the source system and is also referred to as the claimed amount or billed charge amount.	Num	11.2
Rx	CLMID	Encrypted Claim ID. A provider can bill multiple revenue codes for services rendered on one claim. Each revenue code will generate a claim line. Providers typically submit s separate claim for each encounter they have with a patient.	Char	\$19
Rx	COPAY	The fixed amount the member pays for a specific service as defined in their benefit plan. For example, \$10 for an office visit.	Num	11.2
Rx	DEDUCT	The deductible is a set amount a member pays for services until a specific limit is reached (usually on an annual basis). After the limit is reached, the member's	Num	11.2

		payment for services changes (often insurance pays 100% of the cost of services).		
Rx	DISPFEE	Amount the pharmacy charged to fill the prescription.	Num	9.2
Rx	FILL_DT	Date the prescription was filled by the pharmacy.	Num	YYMMDD D10.
Rx	FORM_IND	Indicates if the drug being dispensed is on the formulary list or not.	Char	\$1
Rx	FORM_TYP	Type of formulary used to pay a claim. For example, open, closed, etc. NONE/NULL for Medicare.	Char	\$2
Rx	FST_FILL	Indicates if this is the first time a prescription is being filled.	Char	\$1
Rx	GNRC_IND	Indicates if the drug is multiple sourced. *From NDC table	Char	\$1
Rx	GNRC_NM	Contains the drug ingredient name for a specific drug as adopted by the United States Adopted Names. The chemical name is used when the USAN name is not available. *From NDC table	Char	\$50
Rx	MAIL_IND	Indicates if the type of pharmacy utilized to fill the prescription was Mail Order.	Char	\$1
Rx	NDC	The unique code that identifies a drug product as defined by the National Drug Data File (all drug products regulated by the FDA must use an NDC).	Char	\$11
Rx	NPI	The National Provider Identifier (NPI) was adopted as the standard unique health identifier for health care providers to carry out a requirement in the Health Insurance Portability and Accountability Act of 1996 (HIPAA) for the adoption of such a standard. This number is encrypted	Char	\$10
Rx	PHARM	An encryption of a number assigned by the National Council for Prescription Drug Programs (NCPDP) to uniquely identify a pharmacy.	Char	\$9
Rx	QUANTITY	The number of metric units of medication dispensed.	Num	12.3
Rx	RFL_NBR	Indicates if this is the first, second, or subsequent refill for the prescription.	Char	\$2
Rx	SPCLT_IND	Indicated if the pharmacy is a specialty pharmacy.	Char	\$1
Rx	SPECLSS	Description of First DataBank's low level classification of drugs. *From NDC table	Char	\$3
Rx	STD_COST	Standard price reflects the allowed payment for all provider services.	Num	15.2
Rx	STD_COST_YR	The year when standard cost is updated in our source system	Char	\$4
Rx	STRENGTH	Description of drug potency in units of grams, milligrams, percentage, and other terms. This field includes needle sizes, length of devices, and release rates of transdermal patches. *From NDC table	Char	\$10
Confinement	PATID	An encrypted, system-generated number that identifies an individual across multiple groups/policies. This identifier is not derived from information about the individual, and is compliant with HIPAA §164.514c.	Num	19

Confinement	PAT_PLANID	An encrypted, system-generated number that identifies an individual within in a group or policy. This identifier is not derived from or related to information about the individual, and is compliant with HIPAA §164.514(c)(1). If an individual is eligible for more than one type of insurance at a time (for example, a supplemental plan), then this variable links the claim to the correct plan.	Num	19
Confinement	ADMIT_DATE	Admission Date of Confinement (YYYYMMDD)	Num	YYMMD D10.
Confinement	CHARGE	Amount the provider requested to be reimbursed for the service provided.	Num	11.2
Confinement	COINS	The amount (usually calculated as a percent of the provider's submitted charges) the member pays for a specific service as defined in their benefit plan. For example, 80% of the cost of an outpatient physical therapy visit.	Num	11.2
Confinement	CONF_ID	Confinement Identifier. Used to identify claims records associated with an inpatient hospitalization. This data element is encrypted.	Char	\$21
Confinement	COPAY	The fixed amount the member pays for a specific service as defined in their benefit plan. For example, \$10 for an office visit.	Num	11.2
Confinement	DEDUCT	The set amount a member pays for services until they reach a specified limit (usually defined on an annual basis). After the limit is reached, the member's payment for services changes (often insurance pays 100% of the cost of services).	Num	11.2
Confinement	DIAG1	First ICD-X Diagnosis	Char	\$7
Confinement	DIAG2	Second ICD-X Diagnosis	Char	\$7
Confinement	DIAG3	Third ICD-X Diagnosis	Char	\$7
Confinement	DIAG4	Fourth ICD-X Diagnosis	Char	\$7
Confinement	DIAG5	Fifth ICD-X Diagnosis	Char	\$7
Confinement	DISCH_DATE	Discharge Date of Confinement (YYYYMMDD)	Num	YYMMD D10.
Confinement	DRG	The Diagnosis Related Group (DRG) Code assigned by the source system. A DRG classifies patients by diagnostic or surgical procedure into major diagnostic categories for the purpose of determining payment of hospitalization charges. Effective	Char	\$5

		10/1/2007, the Centers for Medicare and Medicaid Services (CMS) introduced the MS-DRG code set and retired the CMS-DRG set. The new code set refined the DRGs based on the presence of complications or co-morbidities. One affect of this change is that the MS-DRG descriptions are completely different from previous descriptions. The DRG code table contains historical CMS-DRGs as well as MS-DRG codes.		
Confinement	DSTATUS	Patient status code (01-99). Identifies the discharge status of the member's inpatient stay as of the last service date on the claim.(i.e., discharged to home; transferred to SNG, left against medical advice, expired)	Char	\$2
Confinement	ICD_FLAG	ICD Version Code – will distinguish between ICD-9 and ICD-10 codes.	Char	\$2
Confinement	IPSTATUS	Claims occurred in runout period (usually most recent three months) so there is a higher than usual chance of the confinement changing in the next build.	Char	\$1
Confinement	LOS	Length of Stay from start of first confinement record to end of last confinement record.	Num	5
Confinement	POS	Client-defined code identifying the place where the service was performed. Standard POS is now being used.	Char	\$5
Confinement	PROC1	First ICD-X Proc Code	Char	\$7
Confinement	PROC2	Second ICD-X Proc Code	Char	\$7
Confinement	PROC3	Third ICD-X Proc Code	Char	\$7
Confinement	PROC4	Fourth ICD-X Proc Code	Char	\$7
Confinement	PROC5	Fifth ICD-X Proc Code	Char	\$7
Confinement	PROV	A unique system-generated number to identify providers. A provider may have multiple provider IDs.	Num	19
Confinement	STD_COST	An estimate of the allowed amount for the facility charges related to the confinement. Associated surgeon's fees are likely to be found in the medical table.	Num	15.2
Confinement	STD_COST_YR	The year when standard cost is updated in our source system	Char	\$4
Confinement	TOS_CD	Type of Service Code	Char	\$13

Provider	PROV_UNIQUE	A unique system-generated number that identified the provider. It is possible for a provider to have multiple IDs or an ID to point to multiple physicians, particularly in the case of group practice.	Num	19
Provider	PROV_STATE	The state associated with the provider address.	Char	\$2
Provider	PROVCAT	Contains the four-character provider category code to indicate the type of provider for the provider responsible for the service.	Char	\$4
Diagnosis Lookup	DIAG_CD	ICD-10/IDC-9 (International Classification of Disease, 10th/9th Revision, Clinical Modification) as entered on the claim (without decimal point). ICD-10/IDC-9-CM is designed for the classification of morbidity and mortality information for statistical purposes and for the indexing of hospital records by disease and operations, for data storage retrieval. ICD-10/ID-9-CM is an accepted national standard for coding diagnostic and disease information.	Char	\$10
Diagnosis Lookup	DIAG_DESC	Describes the International Classification of Disease, 10th/9th Revision, Clinical Modification (ICD-9-CM/ICD-10-CM) code. ICD-9-CM/ICD-10-CM is designed for the classification of morbidity and mortality information for statistical purposes and for the indexing of hospital records by disease and operations, for data storage retrieval. ICD-9-CM/ICD-10-CM is an accepted national standard for coding diagnostic and disease information.	Char	\$100
Diagnosis Lookup	DIAG_FST3_CD	The first three characters of the International Classification of Disease, 9th Revision, Clinical Modification (ICD-9-CM/ICD-10-CM) code. This used for grouping ICD-9-CM/ICD-10-CM code together. ICD-9-CM/ICD-10-CM is designed for the classification of morbidity and mortality information for statistical purposes and for the indexing of hospital records by disease and operations, for data storage retrieval. ICD-9-CM/ICD-10-CM is an accepted national standard for coding diagnostic and disease information.	Char	\$3
Diagnosis Lookup	DIAG_FST3_DESC	Describes the first three characters of the International Classification of Disease, 9th Revision, Clinical Modification (ICD-9-CM/ICD-10-CM) code. This used for grouping ICD-9-CM/ICD-10-CM code together. ICD-9-CM/ICD-10-CM is designed for the classification of morbidity and mortality information for statistical purposes and for the indexing of hospital records by disease and operations, for data storage retrieval. ICD-9-CM/ICD-10-CM is an accepted national standard for coding diagnostic and disease information.	Char	\$35
Diagnosis Lookup	DIAG_FST4_CD	The first four characters of the International Classification of Disease, 9th Revision, Clinical Modification (ICD-9-CM/ICD-10-CM) code. This used for grouping ICD-9-CM/ICD-10-CM code together. ICD-9-CM/ICD-10-CM is designed for the classification	Char	\$4

		of morbidity and mortality information for statistical purposes and for the indexing of hospital records by disease and operations, for data storage retrieval. ICD-9-CM/ICD-10-CM is an accepted national standard for coding diagnostic and disease information		
Diagnosis Lookup	DIAG_FST4_D ESC	Describes the first four characters of the International Classification of Disease, 9th Revision, Clinical Modification (ICD-9-CM/ICD-10-CM) code. This used for grouping ICD-9-CM/ICD-10-CM code together. ICD-9-CM/ICD-10-CM is designed for the classification of morbidity and mortality information for statistical purposes and for the indexing of hospital records by disease and operations, for data storage retrieval. ICD-9-CM/ICD-10-CM is an accepted national standard for coding diagnostic and disease information	Char	\$35
Procedure Lookup	CATEGORY_D TL_CODE_DE SC	Describes the AHRQ (Agency for Healthcare Research and Quality) detailed grouping of procedure codes. For example, Glaucoma Procedures, Repair of Retinal Tear & Detachment.	Char	\$50
Procedure Lookup	CATEGORY_G ENL_CODE_D ESC	Describes the AHRQ (Agency for Healthcare Research and Quality) high-level grouping of procedure codes which is primarily by organ system.	Char	\$50
Procedure Lookup	PROC_CD	Procedure Code describes the type of procedure performed or service provided. This procedure code is usually a CPT© OR HCPCS Level II Code.	Char	\$10
Procedure Lookup	PROC_DESC	Describes a specific procedure performed or service provided. A procedure code can be an ICD9, CPT©, or HCPCS Level II code.	Char	\$100
Procedure Lookup	PROC_END_D ATE	The date that the procedure code was deleted from the Industry Standard Code listing.	Num	YYMMDD10.
Procedure Lookup	PROC_TYP_C D	Identifies the industry standard code set where the procedure code is defined. This will identify the code as a ICD9, CPT© or HCPCS Level II.	Char	\$5

Appendix G: Treatment Modality One-Way ANOVA and Bonferroni Test Results

Analysis of Variance

Source	SS	df	MS	F	Prob > F
Between groups	709327.038	6	118221.173	12.46	<0.05
In groups	1868578.4	197	9485.16953		
<i>TOTAL</i>	<i>2577905.43</i>	<i>203</i>	<i>12699.0416</i>		
<u>Bartlett's test for equal variances:</u> chi2(6) = 6.0077 Prob>chi2 = 0.422					

	C	CR	CRS	CS	R	RS
CR	0.089					
CRS	0.000	0.228				
CS	1.000	1.000	0.059			
R	1.000	1.000	0.006	1.000		
RS	1.000	1.000	0.381	1.000	1.000	
S	0.492	1.000	1.000	0.401	0.479	0.003

Appendix H: Bundled Group A One-Way ANOVA and Bonferroni Test Results

Analysis of Variance

Source	SS	df	MS	F	Prob > F
Between groups	614221.072	2	307110.536	31.44	<0.05
In groups	1963684.36	201	9769.57394		
<i>TOTAL</i>	<i>2577905.43</i>	<i>203</i>	<i>12699.0416</i>		

Bartlett's test for equal variances:

chi2(6) =
4.1613

Prob>chi2 =
0.125

	Bundle 1	Bundle 2
Bundle 2	<0.05	
Bundle 3	<0.05	<0.05

Appendix I: Bundled Group B One-Way ANOVA and Bonferroni Test Results

Analysis of Variance

Source	SS	df	MS	F	Prob > F
Between groups	702101.194	3	234033.731	24.95	<0.05
In groups	1875804.24	200	9379.02121		
<i>TOTAL</i>	<i>2577905.43</i>	<i>203</i>	<i>12699.0416</i>		
<u>Bartlett's test for equal variances:</u>					
chi2(6) = 5.0516					
Prob>chi2 = 0.168					
	Bundle 1	Bundle 2	Bundle 3		
Bundle 2	<0.05				
Bundle 3	<0.05	<0.05			
Bundle 4	<0.05	<0.05	<0.05		

Appendix J: Bundled Group A Levene's Test of Equal Variances Results

Group A	W0=	1.8438633	df(2, 201)	Pr > F = 0.16087096
	W50=	1.8167144	df(2, 201)	Pr > F = 0.165218
	W100=	1.8252850	df(2, 201)	Pr > F = 0.16383302
Group B	W0=	1.7165869	df(3, 200)	Pr > F = 0.164814
	W50=	1.7239884	df(3, 200)	Pr > F = 0.16329245
	W100=	1.7136061	df(3, 200)	Pr > F = 0.16543058

Appendix K: Bundled Group A Monte Carlo Simulation Summary Sample

BUNDLE A1

Trials (Xj)	Min	Average (Xi)	Median	Max	SD
1	\$64,009	\$86,130	\$87,025	\$114,921	\$10,621
2	\$63,001	\$88,104	\$87,025	\$115,600	\$9,657
3	\$67,600	\$88,681	\$87,616	\$111,556	\$10,435
4	\$60,516	\$87,796	\$87,915	\$114,244	\$11,573
5	\$56,169	\$85,717	\$85,264	\$121,104	\$11,415
...
9995	\$63,001	\$85,449	\$86,436	\$108,241	\$9,182
9996	\$66,564	\$87,724	\$86,436	\$119,716	\$9,682
9997	\$63,504	\$87,009	\$87,913	\$111,556	\$9,658
9998	\$64,516	\$85,692	\$83,521	\$108,900	\$8,898
9999	\$65,536	\$86,199	\$85,264	\$110,224	\$9,623
10000	\$64,009	\$86,844	\$85,849	\$114,921	\$10,779
Overall (Xij)	\$63,417	\$86,632	\$86,251	\$114,191	\$10,029

BUNDLE A2

Trials (Xj)	Min	Average (Xi)	Median	Max	SD
1	\$112,225	\$146,601	\$146,689	\$182,329	\$15,401
2	\$121,104	\$147,799	\$148,225	\$199,809	\$12,829
3	\$111,556	\$145,539	\$144,781	\$181,476	\$15,088
4	\$113,569	\$148,462	\$147,841	\$179,776	\$13,942
5	\$108,900	\$146,598	\$144,400	\$195,364	\$14,952
...
9995	\$113,569	\$143,626	\$142,507	\$179,776	\$12,690
9996	\$106,929	\$146,782	\$146,307	\$179,776	\$13,688
9997	\$110,889	\$145,489	\$147,073	\$188,356	\$15,964
9998	\$112,225	\$146,838	\$145,543	\$186,624	\$15,277
9999	\$113,569	\$146,826	\$146,307	\$189,225	\$16,688
10000	\$116,964	\$147,122	\$145,161	\$178,929	\$12,827
Overall (Xij)	\$111,546	\$146,315	\$145,811	\$186,912	\$14,877

BUNDLE A3

Trials (Xj)	Min	Average (Xi)	Median	Max	SD
1	\$176,400	\$223,068	\$223,729	\$268,324	\$20,374
2	\$184,041	\$221,380	\$219,961	\$281,961	\$17,410
3	\$163,216	\$215,294	\$214,370	\$263,169	\$20,289
4	\$173,889	\$217,784	\$219,493	\$268,324	\$18,192
5	\$171,396	\$216,008	\$216,225	\$265,225	\$19,499
...
9995	\$173,889	\$218,121	\$220,431	\$305,809	\$21,688
9996	\$183,184	\$217,517	\$217,160	\$274,576	\$20,605
9997	\$160,801	\$219,333	\$219,493	\$262,144	\$21,342

9998	\$164,025	\$213,772	\$212,521	\$259,081	\$19,913
9999	\$178,084	\$222,075	\$221,842	\$284,089	\$19,522
10000	\$175,561	\$216,853	\$216,225	\$266,256	\$18,782
<i>Overall (Xij)</i>	<i>\$171,845</i>	<i>\$219,294</i>	<i>\$218,673</i>	<i>\$274,228</i>	<i>\$20,176</i>

Appendix L: Bundled Group A Monte Carlo Risk Analysis for Pricing at Cost Percentiles

	Pricing @ 50 th Percentile of Episode Cost	Percent of Patients >50 th Percentile	Average Financial Loss per Patient >50 th Percentile
Bundle A1	\$82,885	50%	\$8,281
Bundle A2	\$141,012	49%	\$12,647
Bundle A3	\$209,539	50%	\$16,578

	Pricing @ 75 th Percentile Episode Cost	Percent of Patients >75 th Percentile	Average Financial Loss per Patient >75 th Percentile
Bundle A1	\$113,809	0.85%	\$4,087
Bundle A2	\$203,889	2.6%	\$6,894
Bundle A3	\$268,832	6.1%	\$9,486

	Pricing @ 95 th Percentile Episode Cost	Percent of Patients >95 th Percentile	Average Financial Loss per Patient >95 th Percentile
Bundle A1	\$164,311	0.0003%	\$4,087
Bundle A2	\$276,521	0.0004%	\$6,894
Bundle A3	\$418,891	0.0004%	\$1,466,060

Appendix M: Bundled Group B Monte Carlo Risk Analysis for Pricing at Cost Percentiles

	50 th Percentile Episode Cost	Percent of Patients >50 th Percentile	Average Financial Loss per Patient >50 th Percentile
Bundle 1	\$82,885	50%	\$8,281
Bundle 2	\$116,848	80%	\$15,871
Bundle 3	\$157,150	68.27%	\$16,699
Bundle 4	\$209,539	50%	\$16,578

	75 th Percentile Episode Cost	Percent of Patients >75 th Percentile	Average Financial Loss per Patient >75 th Percentile
Bundle 1	\$113,809	0.85%	\$4,087
Bundle 2	\$173,606	0.115%	\$4,799
Bundle 3	\$215,728	0.237%	\$6,277
Bundle 4	\$268,832	6.1%	\$9,486

	95 th Percentile Episode Cost	Percent of Patients >95 th Percentile	Average Financial Loss per Patient >95 th Percentile
Bundle 1	\$164,311	0.0003%	\$4,087
Bundle 2	\$247,734	0.0004%	\$57,384
Bundle 3	\$286,571	0.0004%	\$122,825
Bundle 4	\$418,891	0.0004%	\$1,466,060

Appendix N: Monte Carlo Financial Loss Summary at Cost Percentiles

GROUP A	Bundle 1	Bundle 2	Bundle 3	<i>Average Expected Loss Per Patient</i>
	21%	59%	20%	100%
>50th Percentile	\$876	\$3,631	\$1,664	\$6,171
>75th Percentile	\$7	\$106	\$115	\$229
>95% Percentile	\$0.13	\$0.82	\$4.70	\$5.65

GROUP B	Bundle 1	Bundle 2	Bundle 3	Bundle 4	<i>Average Expected Loss Per Patient</i>
	21%	30%	29%	20%	100%
>50th Percentile	\$870	\$3,809	\$3,306	\$1,658	\$9,642
>75th Percentile	\$7	\$2	\$4	\$116	\$129
>95% Percentile	\$0.00	\$0.07	\$0.14	\$5.86	\$6

Appendix O: UTHSC Committee for the Protection of Human Subjects Institutional Review Board Outcome Letter



Committee for the Protection of Human Subjects

6410 Fannin Street, Suite 1100
Houston, Texas 77030

Alexis Guzman
UT-H - SPH - Mgmt, Policy and Comm Health

November 16, 2018

HSC-SPH-18-0991 - A Bundled Payment Profile for Head & Neck Cancer: Descriptive Statistics, Risk Assessment, and Pricing Recommendations for 1 Year Treatment Bundles Using a Large National Claims Database

The above named project is determined to qualify for exempt status according to 45 CFR 46.101(b)

CATEGORY #4 : *Research, involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified directly or through identifiers linked to the subjects.*

CHANGES: Should you choose to make any changes to the protocol that would involve the inclusion of human subjects or identified data from humans, please submit the change via iRIS to the Committee for the Protection of Human Subjects for review.

INFORMED CONSENT DETERMINATION:

Waiver of Consent Granted

HEALTH INSURANCE PORTABILITY and ACCOUNTABILITY ACT (HIPAA):

Exempt from HIPAA

STUDY CLOSURES: Upon completion of your project, submission of a study closure report is required. The study closure report should be submitted once all data has been collected and analyzed.

Should you have any questions, please contact the Office of Research Support Committees at 713-500-7943.

Appendix P: UTHSC Committee for the Protection of Human Subjects Request for Changes Outcome Letter



Committee for the Protection of Human Subjects

6410 Fannin Street, Suite 1100
Houston, Texas 77030

NOTICE OF APPROVAL TO IMPLEMENT REQUESTED CHANGES

January 30, 2019

HSC-SPH-18-0991 - A Bundled Payment Profile for Head & Neck Cancer: Descriptive Statistics, Risk Assessment, and Pricing Recommendations for 1 Year Treatment Bundles Using a Large National Claims Database
PI: Dr. Alexis Guzman

Reference Number: 183246

PROVISIONS: Unless otherwise noted, this approval relates to the research to be conducted under the above referenced title and/or to any associated materials considered at this meeting, e.g. study documents, informed consent, etc.

APPROVED: By Expedited Review and Approval

CHANGE APPROVED: Change data source to Optum

REVIEW DATE: January 30, 2019

APPROVAL DATE: January 30, 2019

CHAIRPERSON: L. Maximilian Buja, MD

A handwritten signature in black ink that reads "L. Maximilian Buja".

Upon receipt of this letter, and subject to any provisions noted above, you may now implement the changes approved.

CHANGES: The principal investigator (PI) must receive approval from the CPHS before initiating any changes, including those required by the sponsor, which would affect human subjects, e.g. changes in methods or procedures, numbers or kinds of human subjects, or revisions to the informed consent document or procedures. The addition of co-investigators must also receive approval from the CPHS. **ALL PROTOCOL REVISIONS MUST BE SUBMITTED TO THE SPONSOR OF THE RESEARCH.**

INFORMED CONSENT: Informed consent must be obtained by the PI or designee(s), using the format and procedures approved by the CPHS. The PI is responsible to instruct the designee in the methods approved by the CPHS for the consent process. The individual obtaining informed consent must also sign the consent document. Please note that if revisions to the informed consent form were made and approved, then old blank copies of the ICF MUST be destroyed. Only copies of the appropriately dated, stamped approved informed consent form can be used when obtaining consent.

UNANTICIPATED RISK OR HARM, OR ADVERSE DRUG REACTIONS: The PI will immediately

inform the CPHS of any unanticipated problems involving risks to subjects or others, of any serious harm to subjects, and of any adverse drug reactions.

RECORDS: The PI will maintain adequate records, including signed consent documents if required, in a manner that ensures subject confidentiality.

Appendix Q: UTSPH Dissertation Proposal Approval Letter



Office of Academic Affairs and Student Services

MEMORANDUM

TO: Alexis ~~Barboza~~ Guzman

FROM: Nesh Aqrawi
Assistant Director for Academic Affairs

RE: Dissertation Proposal

DATE: December 4, 2018

TITLE: A Bundled Payment Profile for Head & Neck Cancer: Descriptive Statistics, Risk Assessment, and Pricing Recommendations for 1 Year Treatment Bundles Using a Large National Claims Database

Your proposal has been reviewed and approved by The University of Texas School of Public Health at Houston Office of Academic Affairs and Student Services. Your proposal was determined to be exempt by The University of Texas Health Science Center at Houston (~~UTHealth~~) Committee for the Protection of Human Subjects as study # HSC-SPH-18-0991. You may proceed with your research.

Cc: Frances Lee Revere, PhD
Osama Mikhail, PhD
Jose-Miguel Yamal, PhD

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