

Supplemental Tables

Table S1. Inclusion criteria for lung, breast, colorectal, ovarian, bladder, and prostate cancer

Conventional classification	WHO classification	Patient criteria
True primary lung cancer in this study*		
Lung tumor	Tumors of the lung	
Epithelial tumor	Epithelial tumors	
Adenocarcinoma	Adenocarcinoma	Inclusion as non-small cell carcinoma (excluding atypical adenomatoid familial of pre-invasive lesions)
Squamous cell carcinoma	Squamous cell carcinoma	Inclusion as non-small cell carcinoma (excluding atypia of pre-invasive lesions)
Neuroendocrine tumors	Neuroendocrine tumors	
Small cell carcinoma	Small cell carcinoma	Inclusion as small cell cancer
Large cell neuroendocarcinoma	Large cell neuroendocrine carcinoma	Exclusion
Carcinoid tumor	Carcinoid tumors	Exclusion
Pre-invasive lesion	Preinvasive lesion	Exclusion
Large cell carcinoma	Large cell carcinoma	Inclusion as non-small cell carcinoma
Adenosquamous carcinoma	Adenosquamous carcinoma	Inclusion as non-small cell carcinoma
Sarcomatoid carcinoma	Sarcomatoid carcinoma	Inclusion as non-small cell carcinoma
Unclassified carcinoma	Other and unclassified carcinoma	Exclusion
Salivary gland type tumor	Salivary gland-type tumors	Exclusion
Papilloma	Papillomas	Exclusion
Adenoma	Adenomas	Exclusion
Mesenchymal tumor	Mesenchymal tumors	Exclusion
Lymphohistiocytic tumor	Lymphohistiocytic tumors	Exclusion
Tumors of ectopic origin	Tumors of ectopic origin	Exclusion

Lung metastases	Metastases to the lung	Exclusion
Pleural tumor	Tumor of the pleura	
Mesothelial tumor	Mesothelial tumors	Exclusion
Lymphoproliferative disorders	Lymphoproliferative disorders	Exclusion
Mesenchymal tumor	Mesenchymal tumors	Exclusion
True primary breast cancer in this study[#]		
Mammary gland tumor		
Epithelial tumor	Epithelial tumors	
Benign tumor	Benign tumors	Exclusion
Malignant tumor	Malignant tumors (carcinomas)	
Noninfiltrating carcinoma	Noninvasive carcinoma	Exclusion
Microinvasive carcinoma	Microinvasive carcinoma	Inclusion
Invasive carcinoma	Invasive breast carcinoma	Inclusion
Paget's disease	Paget's disease of the nipple	Exclusion
Mixed connective and epithelial tumors	Mixed connective tissue and epithelial tumors	Exclusion
Nonepithelial tumor	Nonepithelial tumors	Exclusion
Other	Others	Exclusion
So-called mammary gland disease	So-called mastopathy	Exclusion
Hamartoma	Hamartoma	Exclusion
Inflammatory lesions	Inflammatory lesion	Exclusion
Mammary fibrosis	Fibrous disease	Exclusion
Gynecomastia	Gynecomastia	Exclusion
Accessory milk	Accessory mammary gland	Exclusion
Metastatic tumors	Metastatic tumor	Exclusion
Other	Others	Exclusion
True primary colorectal cancer in this study[†]		
Benign epithelial tumor		Exclusion
Malignant epithelial tumor		
Adenocarcinoma (adenocarcinoma)		Inclusion

Adenosquamous carcinoma (adenosquamous carcinoma)		Inclusion
Squamous cell carcinoma (squamous carcinoma)		Inclusion
Carcinoid tumour (carcinoid tumor)		Exclusion
Endocrine carcinoma (endocrine cell carcinoma)		Exclusion
Miscellaneous (miscellaneous histological types of malignant epithelial tumors)		Exclusion
Nonepithelial tumor		Exclusion
Lymphoma (lymphoma)		Exclusion
Unclassifiable tumor		Exclusion
Metastatic tumors		Exclusion
Tumor-like lesions		Exclusion
Hereditary neoplasms and gastrointestinal polyposis		Exclusion
Appendix		Exclusion
Anal canal (including perianal skin)		Exclusion
True primary ovarian cancer in this study[‡]		
Ovarian tumor	Ovarian tumors	
Epithelial tumor	Epithelial tumors	
Serous tumor	Serous tumors	
Benign	Benign	Exclusion
Borderline malignancy	Borderline	Exclusion
Malignant	Malignant	Inclusion
Mucinous neoplasms	Mucinous tumors	
Benign	Benign	Exclusion
Borderline malignancy	Borderline	Exclusion
Malignant	Malignant	Inclusion

Endometrioid tumor	Endometrioid tumors	
Benign	Benign	Exclusion
Borderline malignancy	Borderline	Exclusion
Malignant	Malignant	Inclusion
Clear cell tumors	Clear cell tumors	
Benign	Benign	Exclusion
Borderline malignancy	Borderline	Exclusion
Malignant	Malignant	Inclusion
Brenner's tumor	Brenner tumors	
Benign	Benign	Exclusion
Borderline malignancy	Borderline	Exclusion
Malignant	Malignant	Inclusion
Seromucosal tumor	Seromucinous tumors	
Benign	Benign	Exclusion
Borderline malignancy	Borderline	Exclusion
Malignant	Malignant	Inclusion
Anaplastic Carcinoma	Undifferentiated carcinoma	Inclusion
Mesenchymal tumor	Mesenchymal tumors	Exclusion
Mixed epithelial mesenchymal tumor	Mixed epithelial and Mesenchymal tumors	Exclusion
Sex cord–stromal tumor	Sex cord–stromal tumors	Exclusion
Mixed sex cord–stromal tumor	Mixed sex cord–stromal tumors	Exclusion
Germ cell tumor	Germ cell tumors	Exclusion
Somatic tumors associated with monodermal teratomas and dermoid cysts	Monodermal teratoma and somatic-type tumors arising from dermoid cyst	Exclusion
Germ cell and policy stromal tumors	Germ cell–sex cord–stromal tumors	Exclusion
Other tumors	Miscellaneous tumors	Exclusion
Mesothelial tumor	Mesothelial tumors	Exclusion

Soft tissue	Soft tissue tumors	Exclusion
Neoplastic lesions	Tumor-like lesions	Exclusion
Lymphoid and myeloid neoplasms	Lymphoid and myeloid tumors	Exclusion
Secondary tumors	Secondary tumors	Exclusion
Tubal tumor	Tubal tumors	Inclusion
Peritoneal tumor	Peritoneal tumors	Inclusion
Epithelial tumor	Epithelial tumors	Inclusion*
Mesothelial tumor	Mesothelial tumors	Exclusion
Smooth muscle tumors	Smooth muscle tumors	Exclusion
Tumors of unknown origin	Tumors of uncertain origin	Exclusion
Other primary tumors	Miscellaneous primary tumors	Exclusion
Secondary tumors	Secondary tumors	Exclusion
True primary prostate cancer in this study[£]		
Malignant tumor		
Adenocarcinoma	Adenocarcinoma	Inclusion
Rare adenocarcinoma	Adenocarcinoma rare type	Inclusion
Urothelial carcinoma	Urothelial carcinoma	Inclusion
Squamous cell carcinoma	Squamous carcinoma	Inclusion
Adenosquamous carcinoma	Adenosquamous carcinoma	Inclusion
Basal cell carcinoma	Basal cell carcinoma	Inclusion
Small cell carcinoma	Small cell carcinoma	Inclusion
Anaplastic carcinoma	Undifferentiated carcinoma	Inclusion
Other malignant tumors	Other malignant tumors	
Sarcoma	Sarcoma	Exclusion
Metastatic tumors	Metastatic tumor	Exclusion
Tumor unclassifiable	Unclassified tumor	Exclusion
Borderline and associated lesions		Exclusion

True primary prostate cancer in this study		
Malignant tumor		
Adenocarcinoma	Adenocarcinoma	Inclusion
Rare adenocarcinoma	Adenocarcinoma rare type	Inclusion
Urothelial carcinoma	Urothelial carcinoma	Inclusion
Squamous cell carcinoma	Squamous carcinoma	Inclusion
Adenosquamous carcinoma	Adenosquamous carcinoma	Inclusion
Basal cell carcinoma	Basal cell carcinoma	Inclusion
Small cell carcinoma	Small cell carcinoma	Inclusion
Anaplastic carcinoma	Undifferentiated carcinoma	Inclusion
Other malignant tumors	Other malignant tumors	
Sarcoma	Sarcoma	Exclusion
Metastatic tumors	Metastatic tumor	Exclusion
Tumor unclassifiable	Unclassified tumor	Exclusion
Borderline and associated lesions		Exclusion
True primary bladder cancer in this study		
Bladder cancer		
Urothelial tumors		
Noninvasive flat urothelial carcinoma in situ (urothelial carcinoma in situ)		Exclusion
Papillary urothelial carcinoma in situ (noninvasive papillary urothelial carcinoma)		Exclusion
Invasive urothelial carcinoma (invasive urothelial carcinoma)		Inclusion
Squamous cell neoplasia		Inclusion
Glandular tumors		Inclusion
Tumors related to the ureteral membrane		Inclusion
Neuroendocrine tumors		Exclusion

Anaplastic carcinoma		Exclusion
Pigmented tumor		Exclusion
Mesenchymal tumor		Exclusion
Lymphohematopoietic tumors		Exclusion

*For true primary lung cancer, based on the classification tables (p70-73) of the 8th edition of the Clinical/Pathological Handling Code of the Japanese Lung Cancer Society (original publication 2016).

#For true primary breast cancer, based on the histological classification table (p24-25) of the 18th Edition of the Clinical and Pathological Handling Code of the Japanese Breast Cancer Society " (Gold Original Publication 2018) and the comparison table (P65-67) between the WHO classification and the handling conventional classification of the year of publication.

†For true primary colorectal cancers, based on the classification tables (p30-31) of the 9th edition of the Clinical/Pathological Handling Code (original publication 2018) of the Colon Cancer Study Group

‡For true primary ovarian cancers, based on the classification tables (p22-27) of the first edition of the Clinical and Pathological Handling Code (original publication 2016) of the Japanese Society of Obstetrics and Gynecology/Japanese Society of Pathology

‡For true primary prostate cancer, based on the classification table (p.61) of the Japanese Society of Urological Sciences/Japan Society of Pathology/Japan Society of Medical Radiology, 4th edition of the Covenant on Clinical and Pathological Handling (Kanehara Publishing, 2010).

Table S2. Outcome definitions

Outcome	Definition	
A. Primary lung cancer	A1	<ul style="list-style-type: none"> Definitive diagnosis of lung cancer (ICD-10: C340, C341, C342, C343, or C349) recorded between 2014 and 2018 in DPC data. Primary diagnosis, admission-precipitating diagnosis, or most resource-consuming diagnosis.
	A2	<ul style="list-style-type: none"> Definitive diagnosis of lung cancer (ICD-10: C340, C341, C342, C343, or C349) recorded between 2014 and 2018 in EMR data.
	A3	<ul style="list-style-type: none"> Diagnosis of lung cancer (Japanese original diagnostic code: 1629003) recorded between 2014 and 2018 in EMR data.
	A4	<ul style="list-style-type: none"> Definitions written in A1 and specimen examination for laboratory diagnosis (Japanese original procedural code: 160060170, 160060270, 160171470, 160185110, 160214310, 160209750, 160214710, 160214810, 160190270, 160190370, 160190470, 160190570, 160214470, 160214970, or 160062310) recorded between 2014 and 2018 in claims data.
B. Non-small cell lung cancer	B1	<ul style="list-style-type: none"> Diagnosis of non-small cell lung cancer (Japanese original diagnostic code: 8847272, 8847732, 8849238, 8847598, 8847637, 8847664, or 8842053) recorded between 2014 and 2018 in EMR data.
	B2	<ul style="list-style-type: none"> Diagnosis of non-small cell lung cancer (Japanese original diagnostic code: 8842835, 8847676, 8847677, 8847678, 8847679, 8835493, 8847634, 8847635, 8847636, 8847637, 8837666, 8847661, 8847662,

Outcome	Definition	
		8847663, 8847664, 8831458, 8847595, 8847596, 8847597, 8847598, 8833932, 1629003, 1629006, 1629009, 8838805, 8838844, 8838852, 8838898, 8838901, 8842053, 8842831, 8842832, 8842833, 8842834, 8847272, 8847732, 8849238, 8849788, or 2312002) recorded between 2014 and 2018 in EMR data.
C. Small cell lung cancer	C1	<ul style="list-style-type: none"> Diagnosis of small cell lung cancer (Japanese original diagnostic code: 8847594, 8842185, 8847633, 8847660, or 8847675) recorded between 2014 and 2018 in EMR data.
α. Primary breast cancer	α 1	<ul style="list-style-type: none"> Definitive diagnosis of breast cancer (ICD-10: C500, 501, 502, 503, 504, 505, 506, 508, 509, or D059) recorded between 2014 and 2018 in DPC data. Primary diagnosis, admission-precipitating diagnosis, or most resource-consuming diagnosis.
	α 2	<ul style="list-style-type: none"> Definitive diagnosis of breast cancer (ICD-10: C500, 501, 502, 503, 504, 505, 506, 508, 509, or D059) recorded between 2014 and 2018 in EMR data.
	α 3	<ul style="list-style-type: none"> Diagnosis of breast cancer (Japanese original diagnostic code: 8849699) recorded between 2014 and 2018 in EMR data.
β. Primary colorectal cancer	β 1	<ul style="list-style-type: none"> Definitive diagnosis of colorectal cancer (ICD-10: C179, C182, C184, C186, C187, C189, C19, or C20) recorded between 2014 and 2018 in DPC data. Primary diagnosis, admission-precipitating diagnosis, or most resource-consuming diagnosis.

Outcome	Definition	
	$\beta 2$	<ul style="list-style-type: none"> Definitive diagnosis of colorectal cancer (ICD-10: C179, C182, C184, C186, C187, C189, C19, or C20) recorded between 2014 and 2018 in EMR data.
	$\beta 3$	<ul style="list-style-type: none"> Diagnosis of breast cancer (Japanese original diagnostic code: 8847915 or 8847916) recorded between 2014 and 2018 in EMR data.
γ. Primary ovarian cancer	$\gamma 1$	<ul style="list-style-type: none"> Definitive diagnosis of ovarian cancer (ICD-10: C56, C799, C570, or C482) recorded between 2014 and 2018 in DPC data. Primary diagnosis, admission-precipitating diagnosis, or most resource-consuming diagnosis.
	$\gamma 2$	<ul style="list-style-type: none"> Definitive diagnosis of ovarian cancer (ICD-10: C56, C799, C570, or C482) recorded between 2014 and 2018 in EMR data.
ϵ. Primary bladder cancer	$\epsilon 1$	<ul style="list-style-type: none"> Definitive diagnosis of bladder cancer (ICD-10: C670, C671, C672, C673, C674, C675, C676, or C679) recorded between 2014 and 2018 in DPC data. Primary diagnosis, admission-precipitating diagnosis, or most resource-consuming diagnosis.
	$\epsilon 2$	<ul style="list-style-type: none"> Definitive diagnosis of bladder cancer (ICD-10: C670, C671, C672, C673, C674, C675, C676, or C679) recorded between 2014 and 2018 in EMR data.
δ. Primary prostate cancer	$\delta 1$	<ul style="list-style-type: none"> Definitive diagnosis of prostate cancer (ICD-10: C61 or Z988) recorded between 2009 and 2018 in DPC data. Primary diagnosis, admission-precipitating diagnosis, or most resource-consuming diagnosis.

Outcome	Definition	
	δ2	<ul style="list-style-type: none"> Definitive diagnosis of prostate cancer (ICD-10: C61 or Z988) recorded between 2009 and 2018 in EMR data.
D. Performance status 2 or higher at the start of chemotherapy	D1	Medical treatment of rehabilitation for cancer patients (Japanese original diagnostic code: 180033110) recorded between 2014 and 2018 in claims data, given in the same index month as the prescription month of the therapeutic drug described in Table S3.
	D2	<ul style="list-style-type: none"> Medical treatment of rehabilitation for disuse syndrome (Japanese original diagnostic code: H001-02, 180044610, 180044710, 180044810, 180044910, 180045010, 180045110, 180045210, 180045310, 180045410, 180045530, 180045630, 180045730, 180051530, 180051630, 180051730, 180051830, 180051930, 180052030, 180052130, 180052230, 180052330, 180052430, 180052530, or 180052630) recorded between 2014 and 2018 in claims data, given in the same index month as the prescription month of the therapeutic drug described in Table S3.
E. Death	E1	<ul style="list-style-type: none"> Date of death in EMR data.
	E2	<ul style="list-style-type: none"> Date of death in DPC data.
	E3	<ul style="list-style-type: none"> Medical treatment of death for patients (Japanese original diagnostic code: 114007270, 114018670, or 114019970) recorded between 2014 and 2018 in claims data.
	E4	<ul style="list-style-type: none"> 30 days before and after definitions written in E1.

Outcome	Definition	
	E5	<ul style="list-style-type: none"> 30 days before and after definitions written in E2.
	E6	<ul style="list-style-type: none"> 30 days before and after definitions written in E3.
F. First recurrence/progression	F1	<ul style="list-style-type: none"> Date of disease name with "recurrence" as a modifier in Japanese original diagnostic code.
	F2	<ul style="list-style-type: none"> Second specimen examination for laboratory diagnosis (Japanese original procedural code: 160060170, 160060270, 160171470, 160185110, 160214310, 160209750, 160214710, 160214810, 160190270, 160190370, 160190470, 160190570, 160214470, 160214970, or 160062310) recorded between 2014 and 2018 in claims data.
	F3	<ul style="list-style-type: none"> Definitions written in F2 and patients with no history of surgery for the purpose of excision (with or without surgery for the purpose of examination).
	F4	<ul style="list-style-type: none"> Month of definitions written in F1.
	F5	<ul style="list-style-type: none"> Month of definitions written in F2.
	F6	<ul style="list-style-type: none"> Month of definitions written in F3.
G. Second recurrence/progression	G1	<ul style="list-style-type: none"> Date of administration of the drug described in Appendix 2 after definitions written in F1.
	G2	<ul style="list-style-type: none"> Third specimen examination for laboratory diagnosis (Japanese original procedural code: 160060170, 160060270, 160171470, 160185110, 160214310, 160209750, 160214710, 160214810, 160190270, 160190370, 160190470, 160190570, 160214470, 160214970, or 160062310) recorded between 2014 and

Outcome	Definition	
		2018 in claims data.
	G3	• Month of definitions written in G1.
	G4	• Month of definitions written in G2.
H. Third recurrence/progression	H1	• Date of administration of the drug described in Appendix 2 after G1.
	H2	• Forth specimen examination for laboratory diagnosis (Japanese original procedural code: 160060170, 160060270, 160171470, 160185110, 160214310, 160209750, 160214710, 160214810, 160190270, 160190370, 160190470, 160190570, 160214470, 160214970, or 160062310) recorded between 2014 and 2018 in claims data.
	H3	• Month of definitions written in H1.
	H4	• Month of definitions written in H2.
Adverse events		
I. Interstitial pneumonia	I1	• Definitive diagnosis of interstitial pneumonia (ICD-10: J702, J703, J704, J841 or J849) recorded in EMR data and Medical treatment (ATC code: H02AB04 or H02AB06 [excludes topical drugs]).
	I2	• Definitive diagnosis of interstitial pneumonia (ICD-10: J448, J700, J701, J702, J704, J82, J841, J849, or M0510) recorded in EMR data.
	I3	• Definitions written in I2 plus prescription of methylprednisolone (ATC code: H02AB04) or prednisolone

Outcome	Definition	
		(ATC code: H02AB06 with exception of external medicine) recorded in claims data.
J. Hepatic failure	J1	<ul style="list-style-type: none"> Definitive diagnosis of hepatic failure (ICD-10: K720, K712, or K713) recorded in EMR data plus prescription of methylprednisolone (ATC code: H02AB04) or prednisolone (ATC code: H02AB06 with exception of external medicine) recorded in claims data.
	J2	<ul style="list-style-type: none"> Laboratory data abnormality in EMR data plus prescription of methylprednisolone (ATC code: H02AB04) or prednisolone (ATC code: H02AB06 with exception of external medicine) recorded in claims data.
	J3	<ul style="list-style-type: none"> Definitive diagnosis of hepatic failure (ICD-10: K710, K711, K712, K716, K717, K718, K719, K720, K729, K739, K740, K741, K743, K744, K745, K746, K750, K751, K752, K753, K754, K758, K759, K760, K761, K762, K763, K764, K765, K767, K768, K769, R18, R609, R945, or S361) recorded in EMR data.
	J4	<ul style="list-style-type: none"> Definitions written in J3 plus prescription of medical treatment (ATC code: H02AB04, H02AB06, A05AA02, or A05BA08) recorded in claims data.
K. Colitis • diarrhea	K1	<ul style="list-style-type: none"> Definitive diagnosis of colitis • diarrhea (ICD-10: A090 or A099) recorded in EMR data plus prescription of methylprednisolone (ATC code: H02AB04) or prednisolone (ATC code: H02AB06 with exception of external medicine) recorded in claims data.

Outcome	Definition	
	K2	<ul style="list-style-type: none"> Definitive diagnosis of colitis • diarrhea (ICD-10: A099, K501, K509, K510, K512, K513, K515, K518, K519, K521, K522, K528, K529, K550, K551, K552, K559, K566, K591, K628, K638, K921, K922, M321, or R101) recorded in EMR data.
	K3	<ul style="list-style-type: none"> Definitions written in K2 plus prescription of medical treatment (ATC codes: H02AB04, H02AB06, A07A, A07F, A07E, A07D, or A07X) recorded in claims data.
L. Type 1 diabetes	L1	<ul style="list-style-type: none"> Prescription of medical treatment (ATC code: A10AB, A10AC, A10AD, or A10AE)
	L2	<ul style="list-style-type: none"> Definitive diagnosis of type 1 diabetes (ICD-10: E10, E100, E101, E102, E103, E104, E105, or E106) recorded in EMR data.
M. Encephalitis • meningitis	M1	<ul style="list-style-type: none"> Definitive diagnosis of encephalitis • meningitis (ICD-10: G040, G048, G049, or G934) recorded in EMR data.
	M2	<ul style="list-style-type: none"> Definitive diagnosis of encephalitis • meningitis (ICD-10: G040, G048, G049, or G934) recorded in EMR data plus prescription of methylprednisolone (ATC code: H02AB04) or prednisolone (ATC code: H02AB06 with exception of external medicine) recorded in claims data.
	M3	<ul style="list-style-type: none"> Definitive diagnosis of encephalitis. Meningitis (ICD-10: R291) recorded in EMR data.
	M4	<ul style="list-style-type: none"> Definitions written in M3 plus prescription Meningitis (ICD-10: R291) recorded in EMR data of medical

Outcome	Definition	
		treatment (ATC code: J05AB, J01, or J02A) recorded in claims data.
N. Nerve disorder (excludes paresthesia)	N1	<ul style="list-style-type: none"> Definitive diagnosis of nerve disorder (excludes paresthesia) (ICD-10: G500, G501, G508, G509, G511, G512, G513, G514, G518, G519, G520, G521, G522, G523, G527, G528, G529, G540, G541, G542, G543, G544, G545, G560, G561, G562, G563, G564, G568, G569, G570, G571, G572, G573, G574, G575, G576, G579, G580, G587, G588, G589, G603, G608, G609, G618, G620, G622, G629, G64, G723, G810, G811, G819, G820, G821, G822, G823, G824, G825, G830, G831, G832, G833, G839, G900, G902, G903, G904, G908, G909, H812, H919, H933, M7924, M7926, M7929, M8900, M998, R252, R253, or R258) recorded in EMR data.
	N2	<ul style="list-style-type: none"> Definitions written in N1 and medical treatment (ATC code H02AB04 or H02AB06) recorded in claims data.
O. Myasthenia gravis	O1	<ul style="list-style-type: none"> Definitive diagnosis of myasthenia gravis (ICD-10: G700) recorded in EMR data.
	O2	<ul style="list-style-type: none"> Definitive diagnosis of myasthenia gravis (ICD-10: G700) recorded in EMR data plus prescription of methylprednisolone (ATC code: H02AB04) or prednisolone (ATC code: H02AB06 with exception of external medicine) recorded in claims data.
	O3	<ul style="list-style-type: none"> Definitive diagnosis of myasthenia gravis (ICD-10: G700, G701, G709) recorded in EMR data.
	O4	<ul style="list-style-type: none"> Definitions written in O3 and medical treatment (ATC code: H02AB04, H02AB06, or H07AA02)

Outcome	Definition	
		recorded in claims data.
P. Guillain-Barré syndrome	P1	<ul style="list-style-type: none"> Definitive diagnosis of Guillain-Barré syndrome (ICD-10: G610) recorded in EMR data.
	P2	<ul style="list-style-type: none"> Definitions written in P1 plus prescription of methylprednisolone (ATC code: H02AB04) or prednisolone (ATC code: H02AB06 with exception of external medicine) recorded in claims data.
	P3	<ul style="list-style-type: none"> Definitions written in P1 plus prescription of methylprednisolone (ATC code: H02AB04), prednisolone (ATC code: H02AB06 with exception of external medicine), or immunoglobulin recorded in claims data.
	P4	<ul style="list-style-type: none"> Definitions written in P1 and medical treatment (ATC code: H02AB04, H02AB06, J06BA, J06BB, or J06BC) recorded in claims data.
Q. Skin disorders	Q1	<ul style="list-style-type: none"> Definitive diagnosis of skin disorders (ICD-10: H605, H738, I831, L00, L010, L011, L020, L021, L022, L023, L024, L028, L029, L030, L031, L032, L033, L038, L039, L080, L081, L089, L100, L101, L102, L103, L104, L105, L108, L109, L110, L111, L119, L120, L121, L123, L129, L130, L131, L138, L139, L200, L208, L210, L219, L233, L238, L239, L26, L270, L271, L279, L280, L281, L282, L290, L291, L292, L298, L299, L300, L301, L302, L303, L304, L305, L309, L400, L401, L402, L403, L404, L408, L409, L410, L411, L413, L414, L415, L418, L419, L42, L430, L431, L433, L438, L439, L440, L441, L442, L443, L449, L500, L501, L502, L504, L508, L509, L510, L511, L512, L518, L519, L52, L530, L531, L532, L538, L539, L560, L561, L562, L563, L564, L568, L570, L571, L572, L574, L578, L580,

Outcome	Definition	
		L589, L590, L598, L700, L701, L702, L703, L708, L709, L710, L711, L718, L719, L730, L731, L738, L739, L80, L810, L811, L812, L813, L814, L816, L817, L818, L819, L82, L83, L850, L851, L852, L853, L858, L859, L870, L871, L872, L879, L88, L890, L891, L892, L893, L899, L900, L906, L908, L909, L919, L920, L921, L928, L929, L930, L931, L932, L940, L941, L942, L943, L944, L945, L946, L950, L951, L97, L980, L981, L982, L983, L984, L985, L986, L988, R02, R21, R238, or T783) recorded in EMR data.
	Q2	<ul style="list-style-type: none"> Definitions written in Q1 and medical treatment (ATC codes: H02AB04, H02AB06, D04AA, or R01AC [excludes steroidal drugs]) recorded in claims data.
R. Rhabdomyolysis	R1	<ul style="list-style-type: none"> “Drug-induced rhabdomyolysis” or “rhabdomyolysis” in definitive diagnosis of rhabdomyolysis (ICD-10: M6289) recorded in EMR data.
	R2	<ul style="list-style-type: none"> Definitive diagnosis of rhabdomyolysis (ICD-10: D868, G718, G720, G722, G724, G729, M331, M332, M339, M353, M358, M6019, M6091, M6092, M6095, M6098, M6099, M6105, M6109, M6119, M6129, M6155, M6159, M6289, M7900, M7910, M7911, M7912, M7913, M7915, M7916, M7918, M7919, or M7979) recorded in EMR data.
	R3	<ul style="list-style-type: none"> Definitions written in R2 plus prescription of methylprednisolone (ATC code: H02AB04) or prednisolone (ATC code: H02AB06 with exception of external medicine) recorded in claims data.

Outcome	Definition	
S. Myocarditis	S1	<ul style="list-style-type: none"> Definitive diagnosis of myocarditis (ICD-10: I401, I408, I409, I514) recorded in EMR data.
	S2	<ul style="list-style-type: none"> Definitive diagnosis of myocarditis (ICD-10: I401, I408, I409, I514) recorded in EMR data plus prescription of methylprednisolone (ATC code: H02AB04) or prednisolone (ATC code: H02AB06 with exception of external medicine) recorded in claims data.
	S3	<ul style="list-style-type: none"> Definitive diagnosis of myocarditis (ICD-10: D868, E854, E888, E889, I010, I011, I012, I018, I019, I050, I051, I052, I058, I059, I060, I061, I062, I069, I070, I071, I072, I078, I079, I080, I081, I082, I083, I088, I089, I090, I091, I092, I099, I200, I201, I208, I209, I210, I211, I212, I213, I214, I219, I220, I221, I228, I229, I230, I231, I232, I233, I234, I235, I236, I238, I240, I241, I248, I249, I251, I252, I253, I254, I255, I256, I258, I259, I300, I308, I309, I319, I339, I340, I341, I342, I348, I350, I351, I352, I358, I359, I360, I361, I362, I369, I370, I371, I372, I379, I38, I401, I408, I409, I420, I421, I422, I423, I424, I425, I426, I427, I428, I429, I440, I441, I442, I443, I444, I445, I446, I447, I451, I452, I453, I454, I455, I456, I458, I459, I460, I461, I469, I470, I471, I472, I479, I480, I481, I482, I489, I490, I491, I492, I493, I494, I495, I498, I499, I500, I501, I509, I513, I514, I515, I518, I519, R000, R001, R008, R570, R571, R579, or R943) recorded in EMR data.
	S4	<ul style="list-style-type: none"> Definitions written in S3 plus prescription of methylprednisolone (ATC code: H02AB04) or prednisolone (ATC code: H02AB06 with exception of external medicine) recorded in claims data.

Outcome	Definition	
T. Gastrointestinal perforation	T1	<ul style="list-style-type: none"> Definitive diagnosis of gastrointestinal perforation (ICD-10: K255, K265, K631, K65S, or K639) recorded in EMR data.
U. Adrenal insufficiency	U1	<ul style="list-style-type: none"> Definitive diagnosis of adrenal insufficiency in Japanese original diagnostic code including the words “autoimmune adrenitis” recorded in claims data and “hypoadrenocorticism” plus medical treatment (ATC: code H02AB09) recorded in claims data.
	U2	<ul style="list-style-type: none"> Definitive diagnosis of adrenal insufficiency (ICD-10: E271, E272, E273, E274, E275 or E278) recorded in EMR data.
	U3	<ul style="list-style-type: none"> Definitions written in U2 plus medical treatment (ATC code H02AB09) recorded in claims data.
X. Febrile neutropenia	X1	<ul style="list-style-type: none"> Definitive diagnosis of febrile neutropenia (ICD-10: D70) recorded in EMR data and medical treatment (Table S3) recorded in claims data.

ATC, Anatomical Therapeutic Chemical; DPC, Diagnosis Procedure Combination; EMR, electronic medical record; ICD-10, ICD-10, International Classification of Diseases, 10th revision

Table S3. Drug codes

ATC code	Common name
L01XC32	Atezolizumab
L01XC17	Nivolumab
L01XC18	Pembrolizumab
L01XC31	Avelumab
L01XC28	Durvalumab
L01XC06	Cetuximab
L01XC08	Panitumumab
L01XE02	Gefitinib
L01XE35	Osimertinib
L01XE47	Dacomitinib
L01XE13	Afatinib
L01XE03	Erlotinib
L01XE36	Alectinib
L01XE44	Lorlatinib
L01XE28	Ceritinib
L01XE16	Crizotinib
L01XC07	Bevacizumab (includes related biosimilars)
L01XC13	Pertuzumab
L01XC14	Trastuzumab emtansine
L01XE07	Lapatinib
L01XE33	Palbociclib
L01XE50	Abemaciclib
L01XE10, L04AA18	Everolimus
L01XX46	Olaparib
L01XC08	Panitumumab
L01XE21	Regorafenib
L01	Anti-malignant tumor drugs excluding talaporfin sodium (620001918), porfimer sodium (620007468), anagrelide hydrochloride hydrate (622379001), and sterile talc (622293901)
L02	Hormone therapy

ATC code	Common name
L04	Immunosuppressive drug
J01CR05	Tazobactam and piperacillin
J01DD02	Ceftazidime hydrate
J01DE03	Cefozopran hydrochloride
J01DE01	Cefepime dihydrochloride hydrate
J01DE02	Cefpirome sulfate
J01DH05	Biapenem
J01DH02	Meropenem hydrate
J01DH51	Imipenem hydrate, cilastatin sodium
J01DH04	Doripenem hydrate
J01DH55	Panipenem and betamipron

Table S4. Accuracy of diagnosis definitions

Outcome definition	True positives, n	False positives, n	True negatives, n	False negatives, n	Sensitivity, % (95% CI)	Specificity, % (95% CI)	PPV, % (95% CI)	NPV, % (95% CI)
Lung cancer								
Primary lung cancer								
A1	132	7	22,237	30	81.5 (74.6–87.1)	100.0 (99.9–100.0)	95.0 (89.9–98.0)	99.9 (99.8–99.9)
A2	162	38	22,206	0	100.0 (96.6–100.0)	99.8 (99.8–99.9)	81.0 (74.9–86.2)	100.0 (100.0–100.0)
A3	19	1	22,243	143	11.7 (7.2–17.7)	100.0 (100.0–100.0)	95.0 (75.1–99.9)	99.4 (99.2–99.5)
A4	128	7	22, 237	34	79.0 (71.8–85.0)	100.0 (99.9–100)	94.8 (89.6–97.9)	99.8 (99.8–99.9)
Non-small cell lung cancer								
B1	46	6	22,280	74	38.3 (29.6–47.6)	100.0 (99.9–100.0)	88.5 (76.6–95.6)	99.7 (99.6–99.7)
B2	46	6	22,280	74	38.3 (29.6–47.6)	100.0 (99.9–100.0)	88.5 (76.6–95.6)	99.7 (99.6–99.7)
Small cell lung cancer								
C1	10	0	22,395	1	90.9 (58.7–99.8)	100.0 (100.0–100.0)	100.0 (58.7–100.0)	100.0 (100.0–100.0)
Breast cancer								
Primary breast cancer								
α 1	93	18	45,036	55	62.8 (54.5–70.6)	100.0 (99.9–100.0)	83.8 (75.6–90.1)	99.9 (99.8–99.9)
α 2	148	52	45,002	0	100.0 (96.3–100.0)	99.9 (99.8–99.9)	74.0 (67.3–79.9)	100.0 (100.0–100.0)
α 3	0	0	45,054	148	0.0 (0.0–3.7)	100.0 (100.0–100.0)	NA	99.7 (99.6–99.7)
Colorectal cancer								
Primary colorectal cancer								

Outcome definition	True positives, n	False positives, n	True negatives, n	False negatives, n	Sensitivity, % (95% CI)	Specificity, % (95% CI)	PPV, % (95% CI)	NPV, % (95% CI)
β_1	108	8	28,340	53	67.1 (59.2–74.3)	100.0 (99.9–100.0)	93.1 (86.9–97.0)	99.8 (99.8–99.9)
β_2	161	39	28,309	0	100.0 (96.6–100.0)	99.9 (99.8–99.9)	80.5 (74.3–85.8)	100.0 (100.0–100.0)
β_3	0	0	28,348	161	0.0 (0.0–3.4)	100.0 (100.0–100.0)	NA	99.4 (99.3–99.5)
Ovarian cancer								
Primary ovarian cancer								
γ_1	44	14	11,692	5	89.8 (77.8–96.6)	99.9 (99.8–99.9)	75.9 (62.8–86.1)	100.0 (99.7–100.0)
γ_2	49	50	11,656	0	100.0 (89.4–100.0)	99.6 (99.4–99.7)	49.5 (39.3–59.7)	100.0 (100.0–100.0)
Bladder cancer								
Primary bladder cancer								
ϵ_1	33	16	44,206	9	78.6 (63.2–89.7)	100.0 (99.9–100.0)	67.3 (52.5–80.1)	100.0 (100.0–100.0)
ϵ_2	42	58	44,164	0	100.0 (87.7–100.0)	99.9 (99.8–99.9)	42.0 (32.2–52.3)	99.9 (99.8–99.9)
Prostate cancer								
Primary prostate cancer								
δ_1	17	0	11,676	62	21.5 (12.1–32.2)	100.0 (100.0–100.0)	100.0 (72.7–100.0)	99.5 (99.3–99.6)
δ_2	79	21	11,655	0	100.0 (93.2–100.0)	99.8 (99.7–99.9)	79.0 (69.7–86.5)	100.0 (100.0–100.0)

CI, confidence interval; NA, not available; NPV, negative predictive value; PPV, positive predictive value

Table S5. Accuracy of death definitions

Outcome definition	True positives, n	False positives, n	True negatives, n	False negatives, n	Sensitivity, % (95% CI)	Specificity, % (95% CI)	PPV, % (95% CI)	NPV, % (95% CI)
Lung cancer								
E1	32	0	40	1	97.0 (84.2–99.9)	100.0 (87.1–100.0)	100.0 (84.2–100.0)	97.6 (87.1–99.9)
E2	9	0	40	24	27.3 (13.3–45.5)	100.0 (87.1–100.0)	100.0 (55.5–100.0)	62.5 (49.5–74.3)
E3	0	0	40	33	0.0 (0.0–15.3)	100.0 (87.1–100.0)	NA	54.8 (4.7–66.5)
E4	32	0	40	1	97.0 (84.2–99.9)	100.0 (87.1–100.0)	100.0 (84.2–100.0)	97.6 (87.1–99.9)
E5	9	0	40	24	27.3 (13.3–45.5)	100.0 (87.1–100.0)	100.0 (55.5–100.0)	62.5 (49.5–74.3)
E6	0	0	40	33	0.0 (0.0–15.3)	100.0 (87.1–100.0)	NA	54.8 (4.7–66.5)
Breast cancer								
E1	1	0	104	0	100.0 (1.3–100.0)	100.0 (94.8–100.0)	100.0 (1.3–100.0)	100.0 (94.8–100.0)
E2	0	0	104	1	0.0 (0.0–98.7)	100.0 (94.8–100.0)	NA	99.0 (94.8–100.0)
E3	0	0	104	1	0.0 (0.0–98.7)	100.0 (94.8–100.0)	NA	99.0 (94.8–100.0)
E4	1	0	104	0	100.0 (1.3–100.0)	100.0 (94.8–100.0)	100.0% (1.3–100.0)	100.0 (94.8–100.0)
E5	0	0	104	1	0.0 (0.0–98.7)	100.0 (94.8–100.0)	NA	99.0 (94.8–100.0)
E6	0	0	104	1	0.0 (0.0–98.7)	100.0 (94.8–100.0)	NA	99.0 (94.8–100.0)
Colorectal cancer								
E1	4	0	53	0	100.0 (28.4–100.0)	100.0 (90.1–100.0)	100.0 (28.4–100.0)	100.0 (90.1–100.0)
E2	2	0	53	2	50.0 (6.8–93.2)	100.0 (90.1–100.0)	100.0 (9.4–100.0)	96.4 (87.5–99.6)

Outcome definition	True positives, n	False positives, n	True negatives, n	False negatives, n	Sensitivity, % (95% CI)	Specificity, % (95% CI)	PPV, % (95% CI)	NPV, % (95% CI)
E3	0	0	53	4	0.0 (0.0–71.6)	100.0 (90.1–100.0)	NA	93.0 (83.0–98.1)
E4	4	0	53	0	100.0 (28.4–100.0)	100.0 (90.1–100.0)	100.0 (28.4–100.0)	100.0 (90.1–100.0)
E5	2	0	53	2	50.0 (6.8–93.2)	100.0 (90.1–100.0)	100.0 (9.4–100.0)	96.4 (87.5–99.6)
E6	0	0	53	4	0.0 (0.0–71.6)	100.0 (90.1–100.0)	NA	93.0 (83.0–98.1)
Ovarian cancer								
E1	5	0	16	0	100.0 (35.9–100.0)	100.0 (71.3–100.0)	100.0 (35.9–100.0)	100.0 (71.3–100.0)
E2	2	0	16	3	40.0 (5.3–85.3)	100.0 (71.3–100.0)	100.0 (9.4–100.0)	84.2 (60.4–96.6)
E3	0	0	16	5	0.0 (0.0–64.1)	100.0 (71.3–100.0)	NA	76.2 (52.8–91.8)
E4	5	0	16	0	100.0 (35.9–100.0)	100.0 (71.3–100.0)	100.0 (35.9–100.0)	100.0 (71.3–100.0)
E5	2	0	16	3	40.0 (5.3–85.3)	100.0 (71.3–100.0)	100.0 (9.4–100.0)	84.2 (60.4–96.6)
E6	0	0	16	5	0.0 (0.0–64.1)	100.0 (71.3–100.0)	NA	76.2 (52.8–91.8)
Bladder cancer								
E1	2	0	8	0	100.0 (9.4–100.0)	100.0 (51.8–100.0)	100.0 (9.4–100.0)	100.0 (51.8–100.0)
E2	1	0	8	1	50.0 (1.3–98.7)	100.0 (51.8–100.0)	100.0 (51.8–100.0)	100.0 (1.3–100.0)
E3	0	0	8	2	0.0 (0.0–90.6)	100.0 (51.8–100.0)	NA	80.0 (44.4–97.5)
E4	2	0	8	0	100.0 (9.4–100.0)	100.0 (51.8–100.0)	100.0 (9.4–100.0)	100.0 (51.8–100.0)
E5	1	0	8	1	50.0 (1.3–98.7)	100.0 (51.8–100.0)	100.0 (51.8–100.0)	100.0 (1.3–100.0)

Outcome definition	True positives, n	False positives, n	True negatives, n	False negatives, n	Sensitivity, % (95% CI)	Specificity, % (95% CI)	PPV, % (95% CI)	NPV, % (95% CI)
E6	0	0	8	2	0.0% (0.0–90.6)	100.0 (51.8–100.0)	NA	80.0 (44.4–97.5)
Prostate cancer								
E1	3	0	32	1	75.0 (19.4–99.4)	100.0 (94.2–100.0)	100.0 (19.4–100.0)	97.0 (84.2–99.9)
E2	0	0	32	4	0.0 (0.0–71.6)	100.0 (84.2–100.0)	NA	88.9 (73.9–96.9)
E3	0	0	32	4	0.0 (0.0–71.6)	100.0 (84.2–100.0)	NA	88.9 (73.9–96.9)
E4	3	0	32	1	75.0 (19.4–99.4)	100.0 (94.2–100.0)	100.0 (19.4–100.0)	97.0 (84.2–99.9)
E5	0	0	32	4	0.0 (0.0–71.6)	100.0 (84.2–100.0)	NA	88.9 (73.9–96.9)
E6	0	0	32	4	0.0 (0.0–71.6)	100.0 (84.2–100.0)	NA	88.9 (73.9–96.9)

CI, confidence interval; NA, not available; NPV, negative predictive value; PPV, positive predictive value