

Supplementary Table 1: Clinical characteristics of mucinous ovarian tumor patient cohort

	Test set (n=155)				Validation cohort (n=205)			
	MBOT (n,%)		MC (n,%)		MBOT(n,%)		MC (n,%)	
Case numbers	50		105		46		159	
Stage I/II	36	72%	85	81%	44	96%	108	68%
Stage III/IV	2	4%	14	13%	1	2%	18	11%
Stage missing	12	24%	6	6%	1	2%	33	21%
Low-grade	50	100%	38	36%	46	100%	73	46%
High-grade	0	0%	62	59%	0	0%	59	37%
Grade missing	0	0%	5	5%	0	0%	27	17%
5 year overall survival rate	95%		67%		85%		75%	

Supplementary Table 2: Ovarian tumour study sites					
<i>Test set</i>					
Study	Name	Location	Years	Ascertainment of Patients and Clinical Data	Pathology Data and Review
AOV	Alberta Ovarian Tumor Types Study	Canada	1978-2010	Population-based Alberta Cancer Registry; annual updates are performed for vital statistics	Pathology reports and histological slides review by the study pathologist
WAG	Western Australia Group	Australia	2013-present	St John of God Hospital, Subiaco, WA and King Edward Memorial Hospital, Perth WA	Pathology reports and histological slides reviewed by study pathologist
<i>Validation cohort</i>					
BGS	Breakthrough Generations Study	UK	1988-2013	Follow-up of a national general population cohort study	Pathology reports
GER	Germany Ovarian Cancer Study	Germany	1993-1996	26 hospitals in the study regions	Pathology reports were requested from the respective pathology institutes. Tissue samples were provided by the tissue bank of the National Center for Tumor Diseases (NCT, Heidelberg, Germany) in accordance with the regulations of the tissue bank and the approval of the ethics committee of Heidelberg University and by other pathology institutes. Histological slides were reviewed by gynecologic pathologist at the University of Heidelberg
HAW	Hawaii Ovarian Cancer Study	US	1993-2008	Hawaii Tumor Registry and medical records	Pathology reports and histological slides reviewed by study pathologist
HOP	Hormones and Ovarian Cancer PrEdiction	US	2003-2009	Hospital registries and active surveillance of medical practices in Western PA, Northeastern OH, and Western NY	Medical chart review for all cases
HSA	Health Science Alliance Biobank	Australia	2012-present	Prince of Wales Hospital, Royal Hospital for Women, St George Hospital, Sydney NSW. Survival data Australian Institute of Health and Welfare	Pathology reports and histological slides reviewed by study pathologist
MAY	Mayo Clinic Ovarian Cancer Study	US	2000-2013	Mayo Clinic medical records and death certificates	Pathology reports and histologic slides reviewed by Mayo Clinic gynecologic pathologists
POC	Polish Ovarian Cancer Study	Poland	2000-2003	Hospital records and cancer registries serving Warsaw and Lodz	Histological slides reviewed by study pathologist
SEA	Study of Epidemiology and Risk Factors in Cancer Heredity	UK	1998-present	Eastern Region Cancer Intelligence Unit, West Midlands Cancer Intelligence Unit, and multiple cancer networks	Pathology reports and histological slides reviewed by study pathologist
SOC	Southampton Ovarian Cancer Study	UK	1993-1998	Hospitals in the Wessex region of southern England	Original pathology report

SWE	Sweden Western Region Ovarian Cancer Study	Sweden	2001-2016	Sahlgrenska University Hospital, medical records and the clinical cancer register in the western Sweden health care region and Swedish death register	Original pathology report. For specific studies i.e. Tissue-micro-arrays re-evaluated by gyno-pathologist
TVA	Ovarian Cancer in Alberta and British Columbia Study	Canada	2005-2011	Alberta Cancer Registry and affiliated hospitals	Pathology reports and histological slides reviewed by study pathologist (MK)
UKO	United Kingdom Ovarian Cancer Population study	UK	2006-2010	Ten major Gynecologic Oncology NHS centers in England, Wales and Northern Ireland; cancer registries; NHS Information Centre for Health and Social Care (England and Wales) and Central Services Agency (Northern Ireland)	Central review of pathology reports by gynecologic oncologist
VAN	Vancouver Ovarian Cancer Study	Canada	1984-2000	Ovarian Cancer Registry serving British Columbia and the Cheryl Brown Outcomes Unit	Central review of pathology reports and histological slides by University of British Columbia pathologists
WMH	Westmead Hospital, Gynaecological Oncology Biobank (GynBiobank)	Australia	1992-present	The Crown Princess Mary Cancer Centre and affiliated hospitals	Pathology reports and diagnostic slides reviewed by panel of gynecologic pathologists

Supplementary Table 3: Concordance of SATB2 expression using two different antibodies

SATB2 (1)	SATB2 (2)			Total
	Absent	Focal	Diffuse	
Absent	136	3	6	145
Focal	4	28	9	41
Diffuse		2	186	188
Total	140	33	201	374

Concordance 94%

Supplementary Table 4: Expression of CK7/CK20/CDX2/SATB2/PAX8 by gastrointestinal histological subtypes

Subtype	Colorectal			Appendiceal			Total
	Total	Carcinoid	GCC	HGMN	LAMN	NMA	
N	123	20	39	12	24	12	107
	110	17	23	9	19	8	76
Absent (n, %)	89.4	85.0	59.0	75.0	79.2	66.7	71.0
	8	2	8	2	4	2	18
CK7 Focal (n, %)	6.5	10.0	20.5	16.7	16.7	16.7	16.8
	5	1	8	1	1	2	13
Diffuse (n, %)	4.1	5.0	20.5	8.3	4.2	16.7	12.1
Present (%)	10.6	15.0	41.0	25.0	20.8	33.3	29.0
	12	14	1	0	0	3	18
Absent (n, %)	9.8	70.0	2.6	0.0	0.0	25.0	16.8
	26	5	3	2	1	1	12
CK20 Focal (n, %)	21.1	25.0	7.7	16.7	4.2	8.3	11.2
	85	1	35	10	23	8	77
Diffuse (n, %)	69.1	5.0	89.7	83.3	95.8	66.7	72.0
Present (%)	90.2	30.0	97.4	100.0	100.0	75.0	83.2
	1	1	1	0	0	1	3
Absent (n, %)	0.8	5.0	2.6	0.0	0.0	8.3	2.8
	12	3	2	0	0	1	6
CDX2 Focal (n, %)	9.8	15.0	5.1	0.0	0.0	8.3	5.6
	110	16	36	12	24	10	98
Diffuse (n, %)	89.4	80.0	92.3	100.0	100.0	83.3	91.6
Present (%)	99.2	95.0	97.4	100.0	100.0	91.7	97.2
	10	2	5	3	1	2	13
Absent (n, %)	8.1	10.0	12.8	25.0	4.2	16.7	12.1
	19	2	2	0	0	0	4
SATB2 Focal (n, %)	15.4	10.0	5.1	0.0	0.0	0.0	3.7
	94	16	32	9	23	10	90
Diffuse (n, %)	76.4	80.0	82.1	75.0	95.8	83.3	84.1
Present (%)	91.9	90.0	87.2	75.0	95.8	83.3	87.9
	123	18	38	12	24	9	101
Absent (n, %)	100.0	90.0	97.4	100.0	100.0	75.0	94.4
	0	0	0	0	0	0	0
PAX8 Focal (n, %)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0	2	1	0	0	3	6
Diffuse (n, %)	0.0	10.0	2.6	0.0	0.0	25.0	5.6
Present (%)	0.0	10.0	2.6	0.0	0.0	25.0	5.6

GCC (goblet cell carcinoma); HGMN (high grade malignant neoplasm);

LAMN (low grade appendiceal malignant neoplasm); NMA (non-mucinous appendiceal)

Supplementary Table 5: Review of ovarian tumors with staining suggestive of lower GI metastases

OTTA ID	Abberant staining	Diagnosis	Year of study entry	Final status	FU month	Morphological features	SATB2	PAX8	Re-evaluation
TAOV20693	CK7 negative ovarian	MBOT	1999	alive	120				Ovarian primary consistent with long survival time
TAOV20804	CK7 negative ovarian	MBOT	2000	alive	120				Ovarian primary consistent with long survival time
TAOV20130	CK7 negative ovarian	MBOT	2010	alive	70				Ovarian primary consistent with long survival time
TAOV20975	CK7 negative ovarian	MC	2004	dead	9	Teratoma	Diffuse	absent	Ovarian primary based on associated teratoma
TAOV21174	SATB2 diffuse ovarian	MC	2009	dead	18	Teratoma	Diffuse	absent	Ovarian primary based on associated teratoma
TAOV20721	SATB2 diffuse ovarian	MBOT	1999	alive	120				Ovarian primary consistent with long survival time
TAOV20939	SATB2 diffuse ovarian	MC	2003	alive	120				Ovarian primary consistent with long survival time
TAOV20111	SATB2 diffuse ovarian	MBOT	2010	alive	65				Ovarian primary consistent with long survival time
TAOV21048	SATB2 diffuse ovarian	MC	2006	dead	14	anaplastic	Diffuse	present	Ovarian primary supported by PAX8 expression
TAOV20843	SATB2 diffuse ovarian	MC	2001	dead	16	multifocal destructive	Diffuse	present	Ovarian primary supported by PAX8 expression
TAOV21180	SATB2 diffuse ovarian	MC	2009	alive	22	suspicious	Diffuse	absent	Lower GI metastasis