The relative risk of second primary cancers in Switzerland

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1. Background

- Currently, more people are living with a history of cancer than ever before and this increasing trend is likely to continue: one of the consequences of surviving cancer is the risk of being diagnosed with a second cancer.
- Previous studies showed that cancer survivors have an increased risk for being diagnosed with a second primary cancer (SPC) [1-4].
- The only systematic investigation of SPC risks in Switzerland is outdated and based on data from a single canton cancer registry covering less than 10% of the Swiss population [5].

2. Aim

- This study aims to investigate the relative risk of SPCs in cancer survivors in Switzerland combining data from all Swiss cantonal cancer registries with at least 15 years of consecutive incidence data.

3. Methods

Data source

- This study used population-based cancer registry data from nine Swiss cantonal registries (incidence years 1981-2009) with a minimum survival of 6 months and a potential follow-up until the end of 2014 allowing a minimum of five years after initial diagnosis to ascertain the occurrence of a SPC ($N_{initial\ cancers}$=310,113 ,N_{SPCs}=33,793)

Second primary tumour

- A second primary tumour was defined as first subsequent primary cancer occurring at least 6 months after the first cancer. The definition of primary cancers followed the rules defined by the IACR/IARC.

Statistical analyses

- Incomplete or missing follow-up was addressed using multiple imputation with 25 imputations.
- The risk of second primary cancers was quantified using standardized incidence ratios (SIRs) for risk comparison with the general population.

4. Selected Results

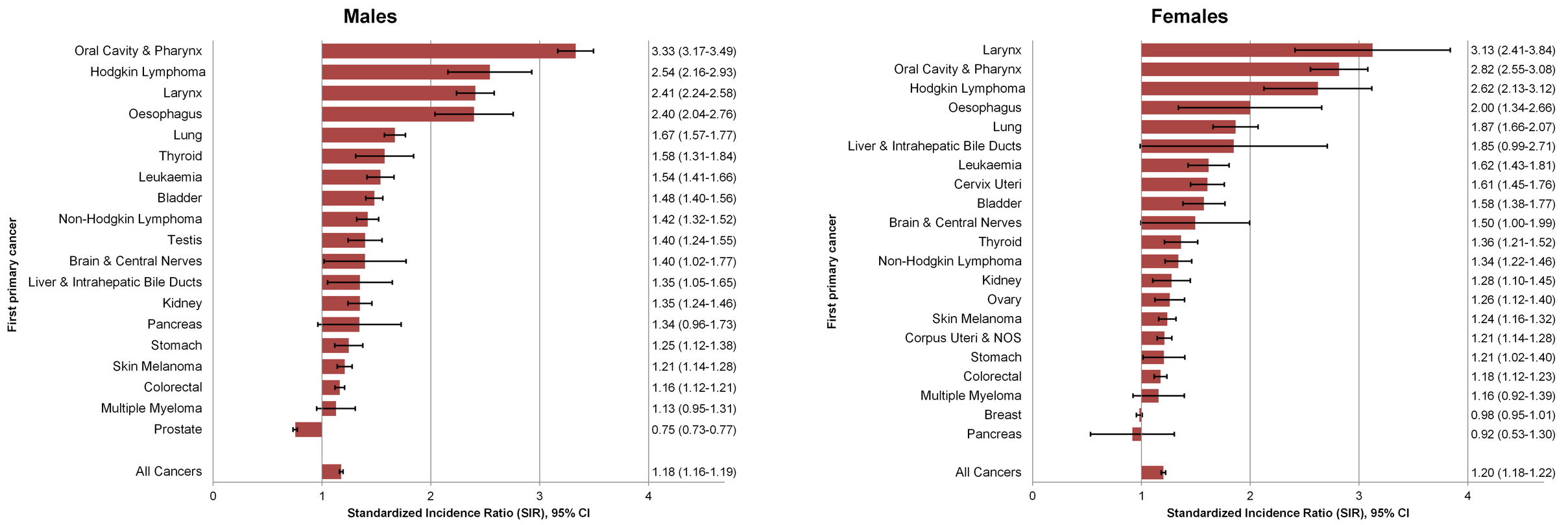

Fig. 1: Relative risk of second primary cancers by first primary cancer and sex

Table 1: Relative risk of second primary cancers by first primary cancer and age

First primary cancer	0-49 years			50-64 years			65+ years		
	O	SIR	95% CI	O	SIR	95% CI	O	SIR	95% CI
Oral Cavity & Pharynx	403	**6.61**	**(5.94-7.28)**	1103	**3.76**	**(3.54-3.99)**	665	**2.05**	**(1.89-2.21)**
Oesophagus	30	**8.03**	**(4.80-11.25)**	118	**2.89**	**(2.33-3.44)**	96	**1.57**	**(1.24-1.91)**
Stomach	49	**1.79**	**(1.24-2.34)**	205	**1.43**	**(1.22-1.63)**	317	1.09	(0.96-1.21)
Colorectal	251	**1.81**	**(1.58-2.04)**	1376	**1.27**	**(1.20-1.34)**	2814	**1.09**	**(1.05-1.13)**
Liver	17	**5.39**	**(2.40-8.37)**	44	**1.50**	**(1.01-1.99)**	62	**1.16**	**(0.85-1.47)**
Pancreas	4	1.14	(0.00-2.65)	37	**1.61**	**(1.03-2.18)**	51	0.97	(0.68-1.26)
Larynx	91	**3.56**	**(2.78-4.35)**	470	**2.94**	**(2.66-3.21)**	332	**1.88**	**(1.67-2.09)**
Lung	120	**3.00**	**(2.43-3.57)**	671	**1.98**	**(1.82-2.13)**	769	**1.44**	**(1.34-1.55)**
Skin Melanoma	386	**1.33**	**(1.19-1.46)**	807	**1.21**	**(1.12-1.29)**	1083	**1.20**	**(1.12-1.27)**
Breast female	748	0.98	(0.90-1.05)	2041	1.01	(0.96-1.05)	2356	0.96	(0.92-1.00)
Cervix Uteri	169	**1.63**	**(1.37-1.88)**	163	**1.75**	**(1.47-2.04)**	126	**1.43**	**(1.17-1.70)**
Corpus Uteri & NOS	90	**1.66**	**(1.29-2.03)**	581	**1.26**	**(1.16-1.37)**	650	**1.13**	**(1.04-1.22)**
Ovary	74	**1.56**	**(1.17-1.94)**	155	**1.30**	**(1.08-1.51)**	138	**1.11**	**(0.92-1.31)**
Prostate	17	1.15	(0.51-1.79)	1269	0.77	(0.72-0.81)	4352	0.75	(0.73-0.77)
Testis	239	**1.39**	**(1.21-1.58)**	86	**1.34**	**(1.03-1.64)**	22	**1.75**	**(0.91-2.59)**
Kidney	71	**1.69**	**(1.27-2.12)**	331	**1.38**	**(1.23-1.54)**	464	**1.25**	**(1.14-1.37)**
Bladder	68	**2.10**	**(1.56-2.64)**	588	**1.67**	**(1.53-1.81)**	1087	**1.39**	**(1.31-1.48)**
Brain & Central Nerves	51	**2.05**	**(1.43-2.66)**	43	1.24	(0.83-1.65)	19	0.99	(0.48-1.50)
Thyroid	152	**1.49**	**(1.24-1.74)**	191	**1.48**	**(1.26-1.70)**	158	**1.31**	**(1.09-1.53)**
Hodgkin Lymphoma	174	**3.31**	**(2.79-3.83)**	91	**2.27**	**(1.77-2.77)**	58	**1.77**	**(1.27-2.26)**
Non Hodgkin Lymphoma	162	**1.92**	**(1.61-2.23)**	472	**1.40**	**(1.27-1.53)**	689	**1.30**	**(1.20-1.40)**
Multiple Myeloma	14	1.30	(0.50-2.11)	85	1.14	(0.88-1.40)	194	**1.13**	**(0.96-1.30)**
Leukaemia	96	**2.43**	**(1.91-2.95)**	334	**1.70**	**(1.51-1.89)**	528	**1.40**	**(1.28-1.52)**
All Cancers	3783	**1.68**	**(1.62-1.73)**	11920	**1.32**	**(1.30-1.35)**	18090	**1.05**	**(1.04-1.07)**

O: Observed numbers of SPCs

Table 2: Relative risk of second primary cancers by first primary cancer and follow-up period

First primary cancer	6 month - 1 year			1 year – 5 years			5 years - 10 years			10+ years		
	O	SIR	95% CI	O	SIR	95% CI	O	SIR	95% CI	O	SIR	95% CI
Oral Cavity & Pharynx	166	**3.28**	**(2.75-3.80)**	971	**3.54**	**(3.31-3.77)**	636	**3.18**	**(2.93-3.44)**	398	**2.59**	**(2.33-2.86)**
Oesophagus	30	**1.78**	**(1.06-2.49)**	131	**2.51**	**(2.06-2.97)**	47	**1.97**	**(1.35-2.59)**	36	**2.82**	**(1.79-3.84)**
Stomach	46	0.98	(0.67-1.30)	205	1.09	(0.93-1.25)	163	**1.34**	**(1.12-1.55)**	157	**1.48**	**(1.24-1.73)**
Colorectal	280	1.08	(0.95-1.21)	1671	**1.10**	**(1.04-1.15)**	1332	**1.19**	**(1.13-1.26)**	1158	**1.29**	**(1.21-1.36)**
Liver	20	1.26	(0.62-1.89)	58	1.19	(0.85-1.52)	28	**1.77**	**(1.03-2.52)**	17	**3.13**	**(1.40-4.87)**
Pancreas	18	0.87	(0.40-1.33)	45	1.15	(0.78-1.52)	16	1.30	(0.56-2.05)	13	1.86	(0.66-3.06)
Larynx	53	**2.61**	**(1.84-3.37)**	361	**2.77**	**(2.47-3.06)**	256	**2.34**	**(2.04-2.63)**	223	**2.19**	**(1.89-2.50)**
Lung	201	**1.47**	**(1.26-1.69)**	642	**1.53**	**(1.41-1.65)**	411	**1.92**	**(1.73-2.11)**	306	**2.15**	**(1.90-2.40)**
Skin Melanoma	113	**1.28**	**(1.03-1.52)**	709	**1.12**	**(1.04-1.21)**	687	**1.22**	**(1.13-1.32)**	767	**1.32**	**(1.22-1.41)**
Breast female	197	0.78	(0.67-0.90)	1532	0.85	(0.80-0.89)	1632	1.01	(0.96-1.06)	1784	**1.14**	**(1.08-1.19)**
Cervix Uteri	16	1.31	(0.56-2.06)	108	**1.45**	**(1.16-1.74)**	124	**1.69**	**(1.38-2.01)**	210	**1.68**	**(1.44-1.92)**
Corpus Uteri & NOS	46	0.95	(0.65-1.25)	386	**1.15**	**(1.03-1.27)**	359	1.12	(1.00-1.24)	530	**1.37**	**(1.25-1.49)**
Ovary	20	0.86	(0.43-1.30)	105	0.93	(0.74-1.12)	102	**1.36**	**(1.08-1.65)**	140	**1.75**	**(1.44-2.05)**
Prostate	348	0.68	(0.61-0.76)	2423	0.71	(0.68-0.74)	1868	0.76	(0.72-0.79)	999	0.91	(0.85-0.97)
Testis	7	1.55	(0.10-3.00)	63	**1.60**	**(1.17-2.03)**	70	1.33	(0.99-1.67)	207	**1.36**	**(1.17-1.56)**
Kidney	65	**1.64**	**(1.21-2.07)**	318	**1.27**	**(1.12-1.41)**	243	**1.23**	**(1.07-1.39)**	240	**1.47**	**(1.27-1.66)**
Bladder	150	**1.77**	**(1.47-2.06)**	679	**1.43**	**(1.32-1.54)**	483	**1.43**	**(1.30-1.56)**	431	**1.62**	**(1.46-1.78)**
Brain & Central Nerves	15	1.52	(0.62-2.43)	38	1.27	(0.82-1.72)	25	1.26	(0.70-1.82)	35	**1.83**	**(1.15-2.50)**
Thyroid	20	1.46	(0.73-2.20)	151	**1.46**	**(1.22-1.71)**	125	1.20	(0.98-1.42)	205	**1.57**	**(1.34-1.80)**
Hodgkin Lymphoma	8	1.53	(0.21-2.85)	99	**2.89**	**(2.28-3.49)**	70	**2.09**	**(1.56-2.62)**	146	**2.78**	**(2.30-3.26)**
Non Hodgkin Lymphoma	81	1.26	(0.97-1.56)	494	**1.27**	**(1.16-1.39)**	401	**1.40**	**(1.26-1.54)**	347	**1.62**	**(1.44-1.79)**
Multiple Myeloma	21	0.75	(0.38-1.12)	145	1.04	(0.86-1.21)	91	**1.44**	**(1.13-1.76)**	36	1.38	(0.88-1.88)
Leukaemia	51	1.14	(0.80-1.48)	381	**1.43**	**(1.29-1.58)**	308	**1.68**	**(1.49-1.88)**	218	**1.83**	**(1.57-2.08)**
All Cancers	2098	**1.10**	**(1.06-1.15)**	12532	**1.11**	**(1.09-1.13)**	10011	**1.17**	**(1.15-1.19)**	9152	**1.36**	**(1.34-1.39)**

O: Observed numbers of SPCs

5. Novelty and Impact

- This is the first comprehensive investigation of SPC risks in Switzerland combining data from all longstanding Swiss cantonal cancer registries.
- Swiss cancer survivors have an increased risk of developing a SPC with the notable exception of patients with prostate cancer, female breast cancer and pancreatic cancer.
- Overall, the relative risk of SPCs is especially high in patients first diagnosed at younger ages (<50 years) and patients surviving 10 years or more.
- Overall, the relative risk of SPCs is similar for males and females.
- Cancer patients should remain under continued surveillance not only for recurrent cancers but also for new primary cancers.

6. References

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