Cancer by migrant background in Belgium

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Chapter 2

Cancer mortality by migrant background in Belgium during the 2000s:

Patterns and social determinants

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Abstract

The aim of this study is to map and compare site-specific cancer mortality for Belgians and five of the largest immigrant groups in Belgium, and to look into the role of socioeconomic position (SEP) and urbanisation.

We use linked Belgian census and register data for the period 2001-2011. Mortality from common cancer sites is studied for Belgians and individuals with a migrant background from Italy, France, the Netherlands, Morocco and Turkey aged 40 to 69. We use indirect standardisation and Poisson regression modelling, taking into account the effect of age, urbanisation and SEP. First- (FG) and second-generation (SG) immigrants are included.

The results revealed a marked diversity in cancer mortality levels by migrant background, with oft-lower levels for FG Moroccan and Turkish immigrants, and levels usually closer to those of Belgians for European immigrants. Small increases are commonly observed by generation, although less clearly so for stomach and liver cancer. SEP plays an important role in the patterning of cancer mortality by migrant background.

We conclude that migrant background is associated with differences in site-specific cancer mortality levels in Belgium. The observed role of SEP warrants special attention to the most vulnerable socioeconomic groups.

2.1 Introduction

Studies on cancer mortality in immigrants have recently gained recognition in Europe [7]. Such examinations can identify cancer-related healthcare needs of immigrants, and inform on cancer aetiology [144]. With growing shares of migrants and their descendants across Europe these questions become more acute. In Belgium, 20% of the population had foreign origins in 2016 [145]. Common countries of origin include neighbouring countries like France and the Netherlands, but also countries from which labour migrants were recruited in the 1950s and 1960s like Italy, Turkey and Morocco [33].

Common theories on differential mortality between immigrants and natives are based on the observation that mortality appears lower for adult immigrants from less industrialised countries to more industrialised ones [146]. Some authors explain this through selective re-emigration of unhealthy migrants (the *salmon-bias*) [7,146]. In contrast, others assign good physical and mental health for immigrants to selection processes before immigration *(*the *'healthy migrant' effect)* [79,146]. However, advantages are thought to decrease over time due to *acculturation* to the host country lifestyle [121,122,147,148].

It has been shown that adult immigrants from less industrialised countries settling in the EU have lower all-cancer mortality compared with natives, but with site-specific diversity [7]. Overall, these immigrants are more prone to infection-related cancers such as liver, cervical, and stomach cancer. In contrast, they are less likely to die from cancers related to a western lifestyle, e.g. colorectal, breast and lung cancer [7]. Belgian cause-specific mortality research in first-generation (FG) immigrants aged 25-54 during the 1990s pointed to lower breast and lung cancer mortality in immigrants from less industrialised countries compared with Belgians [39]. Mortality from cancer of the digestive tract was lower for Sub-Saharan Africans, Italians, Spaniards, and Moroccans. A recent study taking into account duration of residence and immigrant

generation shows increased all-cancer and lung cancer mortality with longer residence in Belgium and in the second generation (SG) [41]. Additionally, socioeconomic position (SEP) and urbanisation contribute to site-specific cancer mortality levels for all groups [41].

The evidence base on cancer mortality in immigrants is growing, but often suffers from a small scale of study [7]. Few analyses include migrants from more industrialised countries, SEP is rarely considered, research barely focuses on various cancer sites, and FG and SG migrants are unfrequently studied simultaneously. This paper aims to address these gaps by, firstly, mapping out differences in cancer mortality for FG and SG migrants of different origins and the native Belgian population for a variety of cancer types for the period 2001-2011. Secondly, we aim to probe into the determinants of the observed patterns by accounting for urbanisation and SEP.

2.2 Materials and methods

We use an individual linkage between the Belgian 2001 census and follow-up data from the population and mortality register for the period 2001-2011. A variety of sociodemographic and -economic variables is available at baseline. We selected all official inhabitants aged 40-69 of Belgian descent (N=4,464,475) and of five common immigrant groups: Italians (N=170,121), the French (N=87,792), Dutch (N=75,742), Moroccans (N=79,004) and Turks (N=43,224). We refer to Morocco and Turkey as less industrialised, whereas Italy, France and the Netherlands are more industrialised countries.

Migrant background is operationalised through country of origin and migrant generation. The first is based on nationality at birth of the individual or his/her parents, the second on country of birth. Individuals born abroad with a foreign country of origin

are classified as FG immigrants. Belgian born individuals with foreign origin are SG immigrants.

Mortality from a selection of common causes of cancer death in Belgium is studied [143], using the underlying cause of death coded through the tenth revision of the International Classification of Diseases (ICD-10) in order to identify mortality from all cancers combined (C00-C95); cancer of the head and neck (C00-C14, C30-C32); stomach (C16); colorectal (C18-C20); liver (C22); lung, bronchus and trachea (C33-C34); breast (C50); and prostate cancer (C61).

To account for the role of SEP in cancer mortality [12,15,41], we include educational level, housing status and employment status. Because immigrants do not settle in Belgium randomly [33], urbanisation is included as a categorical variable describing the area of settlement [41,149]. The number of children and age at first childbearing are included in the breast cancer analyses due to their known role as risk factors [45,150]. Because missing data is known to vary by migrant background [41], we include categories for missing values on the abovementioned variables.

We assess cancer-specific mortality of different migrant background groups by calculating indirectly standardised mortality rates (ISMRs), adjusted to age-specific rates of the native population [12]. Poisson regression models are fitted separately for men and women to calculate cancer mortality rate ratios (MRRs). The number of cancer deaths is the dependent variable, person-years at risk the offset, and migrant background the independent variable. A first series of models adjusts for age. In a second series, we take urbanisation and SEP into account. The original data set was expanded by 5-year age groups in order to account for attained age [151].

2.3 Results

2.3.1 Study population

Table 2.1 describes the study population. FG Moroccan and Turkish migrants generally live in urban areas, have lower educational and employment levels, and are more likely to rent low comfort housing. FG Italian migrants have lower educational levels and employment as well. The proportion of missing information is highest for FG and SG migrants from less industrialised countries.

2.3.2 Cancer mortality by migrant background: patterns

Table 2.2 and 2.3 show ISMRs per 100,000 person years by migrant background and cancer site. FG Moroccan and Turks of both sexes have the lowest ISMRs for all-cancer, colorectal cancer, and cancer of the head and neck. Among women, their lung and breast cancer mortality is also lowest. In contrast, stomach cancer mortality for these groups is highest as well as for FG Italians. FG Italians also have the highest liver cancer ISMR (men: 15.6, 95% CI 12.2-19.6; women: 5.6, 95% CI 3.5-8.5) but a low ISMR for cancer of the head and neck (men: 7.8, 95% CI 5.4-10.9; women: 1.9, 95% CI 0.7-3.9). High all-cancer, lung, liver cancer and cancer of the head and neck ISMRs are observed for FG French migrants.

The SG Moroccan men's all-cancer ISMR is strongly increased (475.0, 95% CI 215.4-905.6), and also high for SG French migrants of both sexes (men: 413.6, 95% CI 360.5-472.4; women: 264.3, 95% CI 226.3-306.9). SG French female mortality from lung and colorectal cancer is higher than for the FG. We observed but few cancer deaths for SG Moroccans and Turks for site-specific cancer.

The abovementioned patterns are visible in relative terms in model 1 of Tables 2.4 and 2.5, showing age-adjusted MRRs and 95% CIs for all origin groups by cancer type compared to Belgians for men and women. MRRs for groups from more industrialised

countries lie closer to Belgian natives' cancer mortality, and often increase with generation.

Table 2.1 Background characteristics: Percentages for urbanisation, educational level, housing comfort, and employment status by migrant background and total numbers

	Belgian	FG FR	SG FR	FG DU	SG DU
Urbanicity					
Urban	24.4	36.3	31.7	17.6	26.5
Urban agglomeration	11.8	10.1	12.0	10.2	12.7
Banlieu	15.2	10.3	13.0	19.4	19.4
Rural	21.9	14.5	16.0	20.0	18.5
Other	26.8	28.8	27.6	32.8	22.8
Educational level					
(Pre)primary	17.0	22.2	14.6	13.1	13.8
Lower secondary	25.3	23.9	24.0	25.0	22.9
Higher secondary	26.8	20.2	27.1	27.3	30.3
Tertiary	24.7	19.3	25.7	26.8	26.7
Missing	6.3	14.5	8.7	7.9	6.3
Housing comfort					
Tenant/low comfort	8.9	15.6	15.6	7.9	9.7
Tenant/mid comfort	5.5	7.9	7.9	7.5	7.2
Tenant/high comfort	4.8	9.3	6.5	10.1	6.3
Owner/low comfort	21.3	18.5	20.5	11.8	16.8
Owner/mid comfort	17.7	11.5	13.7	15.2	16.6
Owner/high comfort	33.4	21.5	24.6	37.7	34.5
Missing	8.5	15.7	11.3	9.9	9.0
Employment status					
Job	58.6	48.7	62.9	54.3	68.2
No Job	38.1	42.6	31.7	40.1	28.3
Missing	3.3	8.7	5.4	5.7	3.6
Total number(N)	4,464,475	61,523	26,269	52,690	23,052

FG: First generation; SG: Second generation; FR: French, DU:Dutch

Table 2.1 (Continued)

	FG IT	SG IT	FG MO	SG MO	FG TU	SG TU
Urbanicity						
Urban	36.3	30.1	80.8	78.2	62.4	55.6
Urban agglomeration	28.1	27.8	6.7	8.8	8.0	9.2
Banlieu	9.7	12.8	3.1	4.0	3.2	4.2
Rural	9.0	11.5	4.4	4.9	8.8	10.2
Other	16.9	17.8	5.1	4.2	17.5	20.7
Educational level						
(Pre)primary	39.1	11.1	43.9	5.6	49.5	8.6
Lower secondary	25.5	31.6	15.6	26.4	17.5	32.4
Higher secondary	14.2	31.8	14.8	36.7	13.3	37.0
Tertiary	6.4	18.1	9.5	17.8	4.5	12.5
Missing	14.8	7.4	16.3	13.5	15.2	9.5
Housing comfort						
Tenant/low comfort	10.5	11.8	24.3	25.3	14.8	18.5
Tenant/mid comfort	5.0	6.1	10.6	13.1	6.2	8.3
Tenant/high comfort	3.8	4.6	6.8	7.3	5.0	5.9
Owner/low comfort	22.4	19.3	16.1	12.3	23.3	18.5
Owner/mid comfort	19.0	18.6	9.1	8.5	12.6	12.3
Owner/high comfort	27.7	29.5	15.7	13.1	22.2	20.0
Missing	11.6	10.2	17.5	20.4	15.8	16.6
Employment status						
Job	37.0	66.4	34.1	54.8	30.6	54.7
No Job	57.2	28.7	56.0	33.8	58.6	36.8
Missing	5.8	4.8	9.9	11.4	10.8	8.5
Total number(N)	85,974	84,147	70,878	8,126	40,070	3,154

FG: First generation; SG: Second generation; IT: Italian, MO: Moroccan, TU: Turkish

2.3.3 Cancer mortality by migrant background: determinants

Model 2 in Tables 2.4 and 2.5 shows MRRs after inclusion of SEP and urbanisation. MRRs decrease for all origins, except FG Dutch migrants. Male MRRs show sharper decreases as do FG Moroccan and Turkish MRRs compared with MRRs for females and individuals from more industrialised countries. We also observe a strong decline for lung cancer in both sexes and cancer of the head and neck for men. However, the abovementioned patterns remain visible. For breast cancer, adding reproductive factors to the model does not substantially change the results.

Table 2.2 Indirectly standardized cancer mortality rates per 100,000 person years, 95% confidence intervals and observed numbers of deaths by migrant background for men aged 40-69

	All cancers		Lung cancer		Colorectal cancer		Stomach cancer	
	ISMR [95% CI]	N	ISMR [95% CI]	N	ISMR [95% CI]	N	ISMR [95% CI]	N
Belgian	301.4 [298.8-304.1]	50,752	109.4 [107.8-111.0]	18,420	25.2 [24.4-26.0]	4,243	9.0 [8.5-9.4]	1,512
FG FR	357.5 [332.4-384.0]	751	137.9 [122.5-154.7]	290	23.0 [17.0-30.6]	48	7.6 [4.4-12.4]	16
SG FR	413.6 [360.5-472.4]	218	153.7 [121.5-191.9]	78	29.8 [16.6-49.3]	15	11.1 [4.0-24.2]	6
FG DU	230.9 [210.8-252.5]	481	70.2 [59.3-82.5]	147	25.2 [18.9-33.0]	53	6.3 [3.3-10.8]	13
SG DU	276.3 [238.8-318.1]	194	97.2 [75.3-123.5]	67	23.2 [13.2-37.8]	16	11.2 [4.8-22.2]	8
FG IT	253.2 [238.8-268.3]	1,147	97.2 [88.4-106.7]	446	23.6 [19.3-28.5]	108	9.2 [6.6-12.4]	41
SG IT	271.4 [246.0-298.7]	419	99.0 [83.4-116.7]	142	24.5 [16.9-34.3]	34	9.2 [5.1-15.2]	15
FG MO	208.7 [190.2-228.1]	487	90.9 [79.0-104.1]	209	10.4 [6.6-15.5]	24	17.3 [12.4-23.5]	41
SG MO	475.0 [215.4-905.6]	9	366.6 [115.7-862.3]	5	no deaths	0	no deaths	0
FG TU	214.0 [187.5-243.3]	234	93.9 [76.4-114.3]	100	6.6 [2.6-13.7]	7	8.9 [4.3-16.5]	10
SG TU	458.2 [119.0-1184.8]	<5	no deaths	0	no deaths	0	94.9 [0.0-544.0]	<5

ISMR: indirectly standardized mortality rate, CI: confidence interval, N: observed number of deaths; FG: First generation; SG: Second generation; FR: French, DU: Dutch, IT: Italian, MO: Moroccan, TU: Turkish

Table 2.2 (Continued)

	Cancer head & neck		Liver cancer		Prostate cancer	
	ISMR [95% CI]	N	ISMR [95% CI]	N	ISMR [95% CI]	N
Belgian	21.6 [20.9-22.3]	3,632	8.8 [8.3-9.2]	1,477	11.0 [10.5-11.5]	1,846
FG FR	34.3 [27.0-43.1]	74	20.9 [15.2-28.0]	44	10.4 [6.4-15.8]	21
SG FR	36.6 [22.9-55.5]	22	14.0 [5.6-29.1]	7	9.4 [2.4-24.2]	<5
FG DU	11.4 [7.2-17.1]	23	6.6 [3.6-11.2]	14	11.2 [7.1-16.6]	24
SG DU	16.1 [8.3-28.3]	12	1.5 [0.0-8.4]	<5	14.0 [6.3-26.6]	9
FG IT	7.8 [5.4-10.9]	34	15.6 [12.2-19.6]	72	5.1 [3.2-7.5]	24
SG IT	11.2 [7.1-16.8]	23	10.3 [5.6-17.3]	14	15.4 [8.4-25.9]	14
FG MO	5.0 [2.6-8.8]	12	9.2 [5.7-14.1]	21	8.9 [5.5-13.8]	20
SG MO	no deaths	0	no deaths	0	no deaths	0
FG TU	4.2 [1.3-9.8]	5	6.7 [2.6-13.9]	7	8.3 [3.6-16.5]	8
SG TU	no deaths	0	no deaths	0	no deaths	0

ISMR: indirectly standardized mortality rate, CI: confidence interval, N: observed number of deaths; FG: First generation; SG: Second generation; FR: French, DU: Dutch, IT: Italian, MO: Moroccan, TU: Turkish

Table 2.3 Indirectly standardized cancer mortality rates per 100,000 person years, 95% confidence intervals and observed numbers of deaths by migrant background for women aged 40-69

	All cancers		Lung cancer		Colorectal cancer		Stomach cancer	
	ISMR [95% CI]	N	ISMR [95% CI]	N	ISMR [95% CI]	N	ISMR [95% CI]	N
Belgian	201.0 [198.8-203.1]	34,529	36.8 [35.9-37.7]	6,317	16.3 [15.7-16.9]	2,795	3.6 [3.3-3.9]	613
FG FR	206.9 [189.2-225.7]	505	36.5 [29.4-44.9]	90	14.4 [10.1-20.1]	35	3.3 [1.4-6.5]	8
SG FR	264.3 [226.3-306.9]	172	73.4 [54.1-97.4]	48	25.5 [14.5-41.5]	16	3.1 [0.3-11.5]	<5
FG DU	187.3 [168.9-207.0]	382	46.2 [37.4-56.6]	94	14.6 [9.8-20.8]	30	4.4 [2.0-8.4]	9
SG DU	177.1 [143.4-216.3]	96	37.0 [22.6-57.3]	20	11.4 [4.1-25.0]	6	3.7 [0.4-13.7]	<5
FG IT	157.5 [145.1-170.1]	594	19.7 [15.5-24.8]	74	14.9 [11.3-19.3]	58	6.8 [4.4-10.0]	26
SG IT	203.0 [182.4-225.2]	355	37.2 [28.9-47.2]	68	15.2 [9.6-22.8]	23	7.4 [3.8-12.9]	12
FG MO	136.4 [120.3-154.1]	260	11.9 [7.6-17.9]	23	12.7 [8.0-19.0]	23	8.6 [4.9-14.0]	16
SG MO	240.3 [95.2-497.8]	7	80.4 [7.6-295.6]	<5	51.0 [0.0-292.1]	<5	no deaths	0
FG TU	123.8 [103.8-146.6]	135	13.6 [7.6-22.5]	15	3.9 [1.0-10.0]	<5	10.4 [5.2-18.6]	11
SG TU	no deaths	0	no deaths	0	no deaths	0	no deaths	0

ISMR: indirectly standardized mortality rate, CI: confidence interval, N: observed number of deaths; FG: First generation; SG: Second generation; FR: French, DU: Dutch, IT: Italian, MO: Moroccan, TU: Turkish

Table 2.3 (Continued)

	Cancer head & neck		Liver cancer		Breast cancer	
	ISMR [95% CI]	N	ISMR [95% CI]	N	ISMR [95% CI]	N
Belgian	4.1 [3.8-4.4]	707	3.5 [3.2-3.8]	602	51.9 [50.8-53.0]	8,915
FG FR	6.9 [4.0-11.0]	17	5.4 [2.9-9.3]	13	52.9 [44.2-62.8]	130
SG FR	6.1 [1.6-15.8]	<5	1.6 [0.0-9.3]	<5	58.2 [41.4-79.6]	39
FG DU	2.9 [1.1-6.4]	6	2.9 [1.0-6.4]	6	43.5 [34.9-53.6]	88
SG DU	3.7 [0.4-13.7]	<5	1.9 [0.0-10.9]	<5	52.3 [35.0-75.1]	29
FG IT	1.9 [0.7-3.9]	7	5.6 [3.5-8.5]	22	31.6 [26.1-37.9]	116
SG IT	6.0 [3.0-10.8]	11	3.5 [1.1-8.2]	5	54.9 [45.0-66.4]	107
FG MO	1.6 [0.3-4.6]	<5	7.8 [4.3-13.1]	14	31.3 [24.0-40.2]	62
SG MO	no deaths	0	53.9 [0.0-308.9]	<5	54.8 [5.2-201.6]	<5
FG TU	0.9 [0.0-5.2]	<5	5.9 [2.1-12.9]	6	20.2 [12.8-30.4]	23
SG TU	no deaths	0	no deaths	0	no deaths	0

ISMR: indirectly standardized mortality rate, CI: confidence interval, N: observed number of deaths; FG: First generation; SG: Second generation; FR: French, DU: Dutch, IT: Italian, MO: Moroccan, TU: Turkish

Table 2.4 Cancer mortality rate ratios and 95% confidence intervals by migrant background for men aged 40-69

		Belgian	FG FR	SG FR	FG DU	SG DU	FG IT
All cancers	Model 1	1.00 (Ref.)	1.21 [1.12-1.30]	1.41 [1.23-1.61]	0.77 [0.70-0.84]	0.92 [0.80-1.06]	0.83 [0.78-0.88]
	Model 2	1.00 (Ref.)	1.03 [0.96-1.10]	1.19 [1.04-1.36]	0.82 [0.75-0.90]	0.90 [0.78-1.04]	0.70 [0.66-0.74]
Lung cancer	Model 1	1.00 (Ref.)	1.28 [1.14-1.44]	1.43 [1.15-1.79]	0.65 [0.55-0.76]	0.89 [0.70-1.14]	0.88 [0.80-0.96]
	Model 2	1.00 (Ref.)	1.04 [0.93-1.17]	1.17 [0.94-1.47]	0.70 [0.60-0.82]	0.86 [0.68-1.10]	0.70 [0.64-0.77]
Colorectal cancer	Model 1	1.00 (Ref.)	0.90 [0.73-1.12]	1.34 [0.94-1.91]	0.97 [0.78-1.20]	0.88 [0.58-1.34]	0.93 [0.80-1.09]
	Model 2	1.00 (Ref.)	0.84 [0.68-1.04]	1.27 [0.89-1.80]	0.98 [0.79-1.22]	0.87 [0.57-1.33]	0.89 [0.76-1.04]
Stomach cancer	Model 1	1.00 (Ref.)	0.86 [0.58-1.29]	1.10 [0.55-2.21]	0.86 [0.57-1.31]	1.30 [0.70-2.42]	1.28 [1.00-1.63]
	Model 2	1.00 (Ref.)	0.76 [0.51-1.14]	1.01 [0.50-2.02]	0.91 [0.60-1.38]	1.28 [0.69-2.39]	1.14 [0.89-1.46]
Cancer head & neck	Model 1	1.00 (Ref.)	1.56 [1.27-1.92]	1.65 [1.12-2.43]	0.57 [0.39-0.82]	0.87 [0.51-1.46]	0.39 [0.29-0.54]
	Model 2	1.00 (Ref.)	1.17 [0.95-1.43]	1.25 [0.85-1.84]	0.58 [0.41-0.84]	0.83 [0.49-1.40]	0.32 [0.24-0.44]
Liver cancer	Model 1	1.00 (Ref.)	2.09 [1.61-2.72]	1.19 [0.59-2.38]	0.79 [0.51-1.22]	0.27 [0.07-1.10]	1.77 [1.44-2.18]
	Model 2	1.00 (Ref.)	1.86 [1.43-2.42]	1.07 [0.53-2.14]	0.80 [0.51-1.24]	0.27 [0.07-1.07]	1.64 [1.33-2.02]
Prostate cancer	Model 1	1.00 (Ref.)	0.89 [0.58-1.38]	0.74 [0.28-1.98]	1.04 [0.70-1.56]	1.47 [0.76-2.82]	0.49 [0.33-0.73]
	Model 2	1.00 (Ref.)	0.82 [0.54-1.27]	0.70 [0.26-1.88]	1.05 [0.70-1.57]	1.44 [0.75-2.78]	0.48 [0.32-0.73]

Model 1: controlled for age; Model 2: controlled for age, urbanisation and SEP; FG: First generation; SG: Second generation; FR: French, DU: Dutch, IT: Italian

Table 2.4 (Continued)

		Belgian	SG IT	FG MO	SG MO	FG TU	SG TU
All cancers	Model 1	1.00 (Ref.)	0.94 [0.86-1.04]	0.69 [0.63-0.75]	2.20 [1.14-4.23]	0.73 [0.64-0.82]	2.04 [0.76-5.44]
	Model 2	1.00 (Ref.)	0.85 [0.77-0.94]	0.47 [0.43-0.52]	1.47 [0.77-2.83]	0.49 [0.43-0.56]	1.53 [0.57-4.08]
Lung cancer	Model 1	1.00 (Ref.)	0.95 [0.80-1.12]	0.83 [0.72-0.95]	4.51 [1.87-10.86]	0.88 [0.72-1.07]	no deaths
	Model 2	1.00 (Ref.)	0.84 [0.71-0.99]	0.52 [0.45-0.60]	2.91 [1.21-7.02]	0.55 [0.45-0.67]	no deaths
Colorectal cancer	Model 1	1.00 (Ref.)	1.00 [0.77-1.31]	0.55 [0.42-0.74]	no deaths	0.26 [0.14-0.47]	no deaths
	Model 2	1.00 (Ref.)	0.98 [0.75-1.27]	0.47 [0.35-0.63]	no deaths	0.22 [0.12-0.41]	no deaths
Stomach cancer	Model 1	1.00 (Ref.)	1.38 [0.94-2.02]	2.17 [1.67-2.83]	no deaths	1.58 [1.02-2.42]	no deaths
	Model 2	1.00 (Ref.)	1.34 [0.91-1.96]	1.59 [1.21-2.09]	no deaths	1.18 [0.77-1.83]	no deaths
Cancer head & neck	Model 1	1.00 (Ref.)	0.69 [0.49-0.97]	0.27 [0.16-0.45]	no deaths	0.21 [0.09-0.46]	No deaths
	Model 2	1.00 (Ref.)	0.58 [0.42-0.82]	0.15 [0.09-0.25]	no deaths	0.13 [0.06-0.28]	No deaths
Liver cancer	Model 1	1.00 (Ref.)	1.19 [0.75-1.87]	1.42 [1.01-1.98]	no deaths	1.05 [0.61-1.82]	no deaths
	Model 2	1.00 (Ref.)	1.11 [0.71-1.76]	1.08 [0.77-1.52]	no deaths	0.85 [0.49-1.47]	no deaths
Prostate cancer	Model 1	1.00 (Ref.)	1.53 [0.90-2.59]	0.96 [0.62-1.49]	no deaths	0.80 [0.40-1.61]	no deaths
	Model 2	1.00 (Ref.)	1.54 [0.91-2.61]	0.86 [0.55-1.34]	no deaths	0.75 [0.37-1.51]	no deaths

Model 1: controlled for age; Model 2: controlled for age, urbanisation and SEP; FG: First generation; SG: Second generation; IT: Italian, MO: Moroccan, TU: Turkish

Table 2.5 Cancer mortality rate ratios and 95% confidence intervals by migrant background for women aged 40-69

		Belgian	FG FR	SG FR	FG DU	SG DU	FG IT
All cancers	Model 1	1.00 (Ref.)	1.04 [0.96-1.14]	1.34 [1.16-1.56]	0.94 [0.85-1.04]	0.89 [0.73-1.09]	0.77 [0.71-0.84]
	Model 2	1.00 (Ref.)	0.93 [0.85-1.02]	1.22 [1.05-1.42]	0.93 [0.84-1.03]	0.86 [0.70-1.05]	0.69 [0.63-0.75]
Lung cancer	Model 1	1.00 (Ref.)	1.01 [0.82-1.24]	2.04 [1.53-2.71]	1.27 [1.03-1.55]	1.02 [0.66-1.58]	0.53 [0.42-0.67]
	Model 2	1.00 (Ref.)	0.81 [0.66-1.00]	1.69 [1.27-2.25]	1.27 [1.04-1.56]	0.94 [0.61-1.46]	0.42 [0.33-0.53]
Colorectal cancer	Model 1	1.00 (Ref.)	0.90 [0.65-1.26]	1.59 [0.98-2.61]	0.90 [0.63-1.29]	0.71 [0.32-1.57]	0.90 [0.70-1.17]
	Model 2	1.00 (Ref.)	0.84 [0.60-1.17]	1.51 [0.92-2.46]	0.91 [0.63-1.30]	0.70 [0.31-1.55]	0.86 [0.66-1.12]
Stomach cancer	Model 1	1.00 (Ref.)	0.94 [0.47-1.88]	0.89 [0.22-3.58]	1.25 [0.64-2.40]	1.06 [0.26-4.23]	1.88 [1.27-2.78]
	Model 2	1.00 (Ref.)	0.84 [0.42-1.68]	0.83 [0.21-3.32]	1.28 [0.66-2.47]	1.04 [0.26-4.17]	1.64 [1.10-2.44]
Cancer head & neck	Model 1	1.00 (Ref.)	1.69 [1.04-2.73]	1.51 [0.56-4.03]	0.72 [0.32-1.61]	0.91 [0.23-3.66]	0.45 [0.21-0.94]
	Model 2	1.00 (Ref.)	1.28 [0.79-2.07]	1.18 [0.44-2.17]	0.68 [0.31-1.53]	0.84 [0.21-3.37]	0.38 [0.18-0.79]
Liver cancer	Model 1	1.00 (Ref.)	1.57 [0.90-2.72]	0.47 [0.07-3.36]	0.83 [0.37-1.85]	0.55 [0.08-3.92]	1.57 [1.03-2.41]
	Model 2	1.00 (Ref.)	1.39 [0.80-2.41]	0.43 [0.06-3.06]	0.84 [0.38-1.88]	0.53 [0.08-3.80]	1.39 [0.90-2.14]
Breast cancer	Model 1	1.00 (Ref.)	1.03 [0.87-1.23]	1.15 [0.84-2.57]	0.85 [0.69-1.04]	1.02 [0.71-1.47]	0.60 [0.50-0.72]
	Model 2	1.00 (Ref.)	0.97 [0.82-1.15]	1.09 [0.80-1.50]	0.84 [0.68-1.04]	1.01 [0.70-1.45]	0.57 [0.47-0.68]
	Model 3	1.00 (Ref.)	0.97 [0.82-1.16]	1.08 [0.79-1.48]	0.81 [0.66-1.00]	0.98 [0.68-1.42]	0.59 [0.49-0.71]

Model 1: controlled for age; Model 2: controlled for age, urbanisation and SEP; Model 3: controlled for age, urbanisation, SEP, number of children and age at first childbearing; FG: First generation; SG: Second generation; FR: French, DU: Dutch, IT: Italian

Table 2.5 (Continued)

		Belgian	SG IT	FG MO	SG MO	FG TU	SG TU
All cancers	Model 1	1.00 (Ref.)	1.05 [0.95-1.17]	0.68 [0.61-0.77]	1.75 [0.84-3.68]	0.63 [0.53-0.74]	No deaths
	Model 2	1.00 (Ref.)	0.96 [0.87-1.07]	0.49 [0.43-0.55]	1.35 [0.64-2.84]	0.47 [0.40-0.56]	No deaths
Lung cancer	Model 1	1.00 (Ref.)	1.05 [0.83-1.34]	0.33 [0.22-0.49]	3.16 [0.79-12.68]	0.38 [0.23-0.63]	No deaths
	Model 2	1.00 (Ref.)	0.88 [0.69-1.12]	0.18 [0.12-0.27]	2.00 [0.50-8.04]	0.23 [0.14-0.39]	No deaths
Colorectal cancer	Model 1	1.00 (Ref.)	0.97 [0.65-1.47]	0.78 [0.52-1.18]	4.36 [0.61-31.11]	0.24 [0.09-0.65]	No deaths
	Model 2	1.00 (Ref.)	0.95 [0.63-1.43]	0.63 [0.42-0.96]	3.77 [0.53-26.92]	0.20 [0.08-0.54]	No deaths
Stomach cancer	Model 1	1.00 (Ref.)	2.12 [1.19-3.77]	2.41 [1.47-3.97]	No deaths	2.95 [1.62-5.36]	No deaths
	Model 2	1.00 (Ref.)	2.02 [1.13-3.59]	1.69 [1.01-2.82]	No deaths	2.11 [1.15-3.88]	No deaths
Cancer head & neck	Model 1	1.00 (Ref.)	1.52 [0.83-2.76]	0.38 [0.12-1.19]	No deaths	0.23 [0.03-1.60]	No deaths
	Model 2	1.00 (Ref.)	1.27 [0.70-2.32]	0.20 [0.06-0.63]	No deaths	0.13 [0.02-0.96]	No deaths
Liver cancer	Model 1	1.00 (Ref.)	1.07 [0.44-2.58]	2.25 [1.32-3.82]	22.78 [3.13-165.81]	1.71 [0.77-3.83]	No deaths
	Model 2	1.00 (Ref.)	0.98 [0.41-2.39]	1.53 [0.89-2.65]	18.03 [2.46-132.19]	1.23 [0.55-2.78]	No deaths
Breast cancer	Model 1	1.00 (Ref.)	1.09 [0.90-1.32]	0.61 [0.47-0.78]	1.54 [0.39-6.18]	0.40 [0.26-0.60]	No deaths
	Model 2	1.00 (Ref.)	1.05 [0.86-1.27]	0.49 [0.38-0.64]	1.32 [0.33-5.29]	0.33 [0.22-0.50]	No deaths
	Model 3	1.00 (Ref.)	1.04 [0.86-1.26]	0.54 [0.42-0.70]	1.31 [0.33-5.23]	0.37 [0.24-0.56]	No deaths

Model 1: controlled for age; Model 2: controlled for age, urbanisation and SEP; Model 3: controlled for age, urbanisation, SEP, number of children and age at first childbearing; FG: First generation; SG: Second generation; IT: Italian, MO: Moroccan, TU: Turkish

2.4 Discussion

This paper is among the first European studies on cancer mortality by migrant background and takes into account SEP, urbanisation, country of origin and migrant generation. Our study results show disparities in cancer mortality by country of origin, migrant generation, and the cancer site studied. Lung, colorectal, breast cancer and cancer of the head and neck mortality is lower among FG Moroccans and Turks. Individuals with migrant background from more industrialised countries show rates closer to those of Belgians. The distribution of SEP across migrant backgrounds plays a non-negligible role for cancer mortality.

Our results are in line with a review by Arnold, Razum & Coebergh (2010), claiming lower cancer mortality from lifestyle-related cancer for FG immigrants from less industrialised countries to the EU [7]. We find lower cancer mortality for FG Moroccans and Turks for lung, colorectal, head and neck, prostate and breast cancer. Findings broadly confirm patterns from Belgian studies including cancer of the digestive tract, lung and breast cancer [39,41]. For liver and stomach cancer the identified patterns for FG Moroccans and Turks are less clear. Although Arnold, Razum & Coebergh (2010) generally found immigrants from less industrialised countries more prone to infection-related cancers such as stomach, liver and cervical cancer [7], particular studies including Moroccan and Turkish immigrants did not always find a higher mortality level for stomach and liver cancer for both of these groups [71,73,131,152]. The lack of a clear pattern may be due to the fact that not all subsites of stomach cancer are infection-related [153], and liver cancer has infection- and lifestyle-related risk factors [154].

Cancer mortality for FG immigrants from more industrialised countries differs less from native Belgians', but nonetheless varies by country of origin. Mortality from cancer of the head and neck is highest in FG French immigrants. This corresponds to high mortality for this cancer in northern French regions [155], characterized by high

alcohol and tobacco consumption. Because French migrants generally settle along the border and high rates are observed in this area [156], some border crossing of these lifestyle traits is possible. Findings on lung cancer for FG Italians confirm Belgian research [39,41]. However, the comparably high liver and stomach cancer mortality in females is puzzling. Various factors may cause this, such as diet [49], alcohol consumption [154], and/or prevalence of viral infections [153,154]. Intermediate liver cancer incidence has been observed for southern Europeans [154], but there is a lack of other evidence to verify our findings. Information on the region of origin could shed more light on this [12].

SG migrants from more industrialised countries tend to have increased cancer mortality for all-cancer and lifestyle-related cancers compared to their FG counterparts. However, due to a low number of cases in SG Moroccans and Turks, we cannot replicate international results on these groups, which generally highlighted increases in cancer mortality as well [7]. Increased cancer mortality by generation may be due to adoption of the Belgian life style, such as uptake of smoking, changes in diet and in reproductive behaviour [131]. This process occurs quicker for particular lifestyle factors [157], and differs by gender and origin group [158,159].

Although country of birth is known, we use information on nationality in order to determine country of origin, because identification for SG migrants is otherwise incomplete [25]. Also, due to small numbers of cases a subdivision by duration of residence is impossible, despite its known role in migrant health research [41,131,160,161]. Finally, to date, we dispose only of mortality information. Processes related to incidence (e.g. risk factors, screening) and survival (e.g. treatment), which make up cancer mortality, remain a black box for most of the cancer sites included [49]. For migrants this information is essential as we may underestimate their cancer mortality due to selective return migration related to ill health or old age. A future record-linkage with the Belgian Cancer Registry (BCR) will allow more precise investigations of where observed disadvantages in cancer mortality originate from.

The role of SEP in our results encourages appropriately designed measures aimed at decreasing cancer risk for low SEP-groups of foreign and potentially native origin. Where early detection and treatment of cancer are concerned, access may be restricted for certain immigrants even though health insurance coverage in Belgium is almost universal, a fact of which policy makers and health care providers must be wary.