

Lack of deprivation-specific life tables in France and evaluation of the social gradient in cancer net survival

⇒ A sensitivity analysis of the previous French study on “Social environment and cancer survival” based on the French Network of Cancer Registries (FRANCIM) data



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Socioeconomic environment and disparities in cancer survival for 19 solid tumor sites: An analysis of the French Network of Cancer Registries (FRANCIM) data

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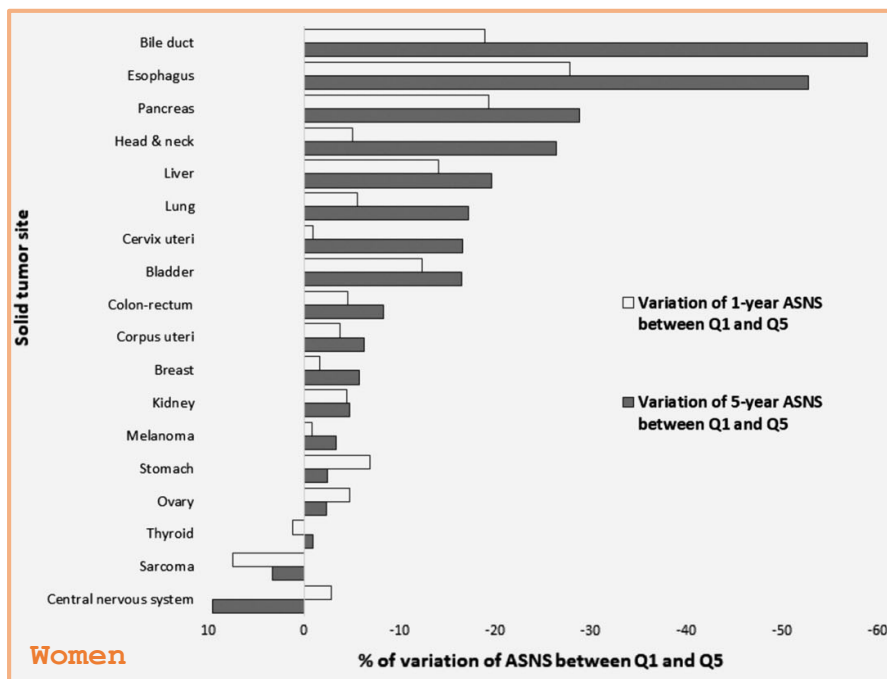
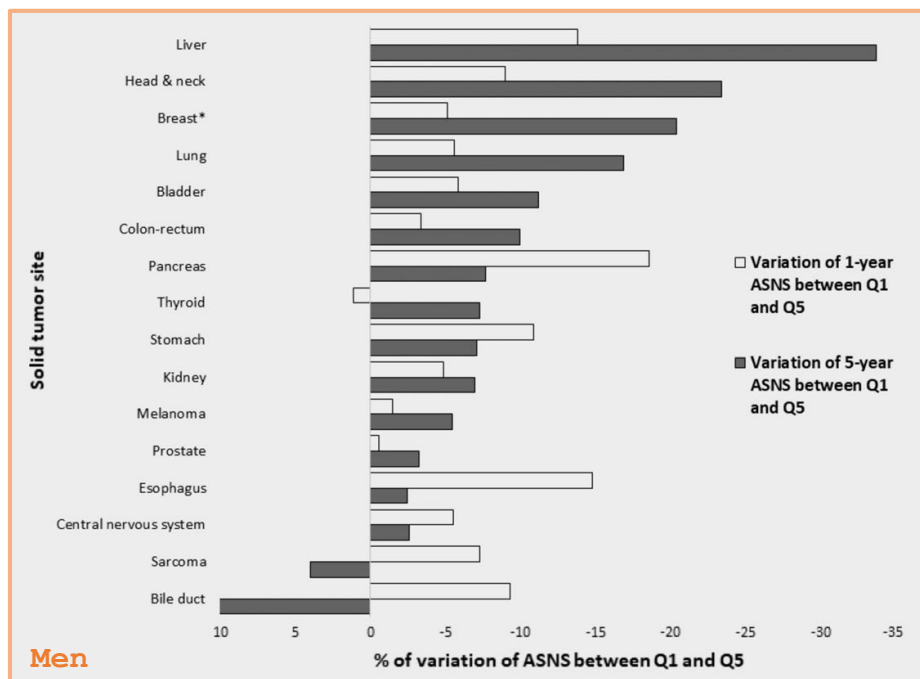
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Context : deprivation, cancer net survival & life tables

Social gradient in cancer survival in the international literature

Rachet et al., 2008, Ito et al., 2014, Hagedoorn et al., 2018

⇒ recently highlighted in France *Tron et al., 2019 & GRELL 2018*



Variation of 1- and 5-years age-standardized net survival (ASNS) between the least (Q1) and the most (Q5) deprived quintile, by cancer site.

Limitation : French life tables not stratified by deprivation

Problem : risk of bias, overestimation of social gradient in net survival

Net survival framework :

$$\lambda_{observed}(t) = \lambda_{expected}(t) + \lambda_{excess}(t)$$

Social gradient in cancer net survival ?

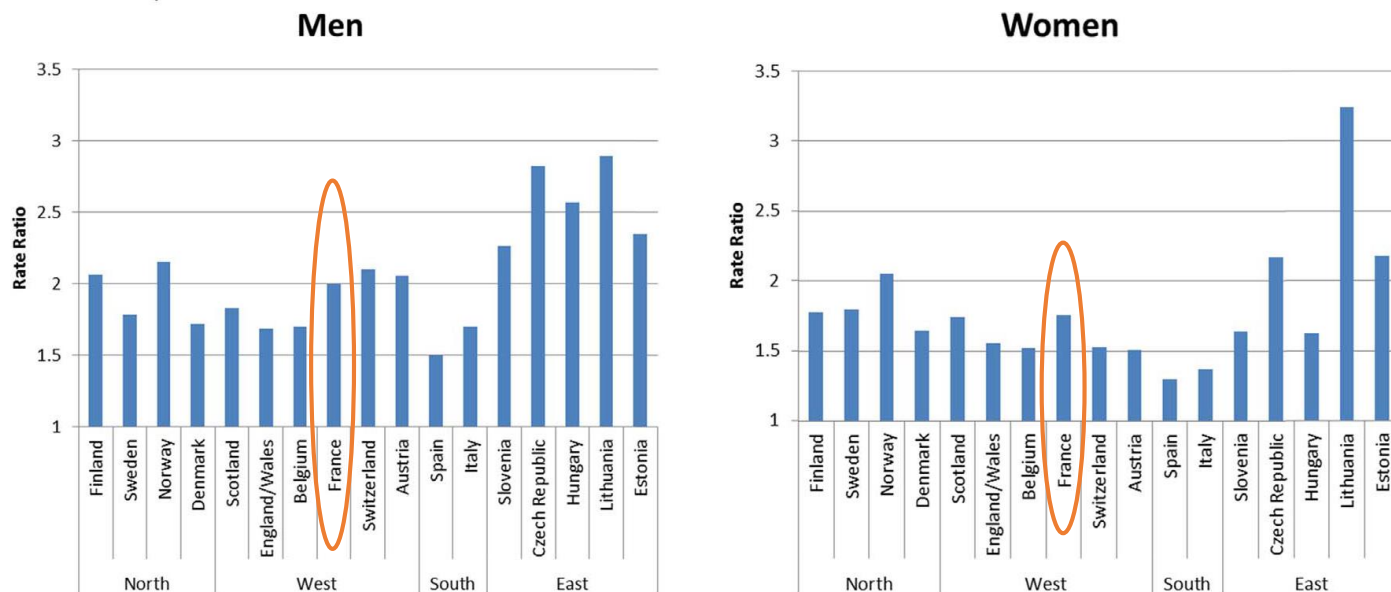
Difference according to deprivation

✓ data from cancer registries (Francim)

⚠ data from life tables, general population (stratified by year, sex, age and department in France)

But mortality in the general population is socially differentiated

Rate Ratio of age-standardized mortality among 'low' as compared to 'high' educated Mackenbach et al., 2017 Health & Place



Available French life tables (produced by INSEE) ignore the social gradient in background mortality observed in the general population

The social gradient in excess mortality might be overestimated

What can we do to check for this possible bias?

⇒ Simulate deprivation-specific life tables & sensitivity analyses Ito et al., 2014, Antunes et al., 2016

⇒ Correction methods ?

Touraine et al., 2019, Rubio et al., 2019, Goungounga et al., 2019

Objective : question the validity of our study

Our aim was to :

1 Simulate deprivation-specific French life tables

⇒ Using similar methodology as in previous studies

Ito et al., 2014, Ellis et al., 2014, Antunes et al., 2016, Schaffar et al., 2017

and

2 Compare results of analyses of cancer net survival by deprivation, using original life tables versus simulated life tables

⇒ Using same methodology as in Tron et al., 2019

STEP 1

STEP 2



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→ Question findings from Tron et al., 2019
By testing the effect of “introducing” a social gradient in background mortality in French life tables, on results regarding social gradient in cancer net survival

Methods : sensitivity analyses using simulated deprivation-specific life tables

STEP 1

Simulate deprivation-specific French life tables

➤ 2 set of simulated deprivation-specific French life tables based on **external sources** :

(1) **French mortality rates stratified by income**, Permanent Demographic Sample (EDP)

(2) **England deprivation-specific life tables**

Couet et al., 2006, Blanpain et al., 2018

Di Carlo et al., LSHTM website

	(1) French EDP	(2) England Life Tables
Stratification of the mortality rates in the data base		
<u>Sex</u>	male, female	
<u>Year</u>	data combined for period 2012-2016	each year between 1981 and 2011
<u>Age</u>	0 to 99, 1-year units	
<u>Social situation</u>	Net income per consumption unit	Income domain of the Index of Multiple Deprivation (IMD 2004)
Social situation		
<u>Type of measure</u>	Single indicator at the individual level	Aggregated, ecological index
<u>Categorization</u> (i.e. categories for which mortality rates were available)	Quintiles of net income per consumption unit (derived from 20 th centiles)	National quintiles of IMD income domain

➤ In both cases:

Smoothed expected mortality rates λ_i according to 5 levels of deprivation (i , 1 to 5) from external source

Estimation of mortality rate ratios between each of these 5 levels and overall general mortality rate
 $RR_i = \lambda_i / \lambda_{ref}$

Mortality rate ratios RR_i from external sources applied to the original French life tables
 for each sex/age/year/department $\lambda_i = \lambda_{ref} * RR_i$

Simulated French life tables stratified by:
 Sex, age, year, department and **deprivation**

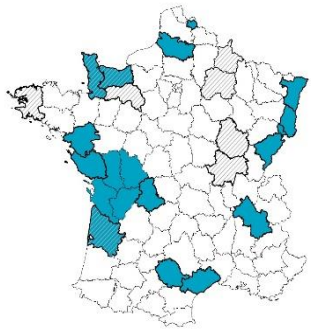
Methods : sensitivity analyses using simulated deprivation-specific life tables

STEP 2

Compare results of analyses of cancer net survival by deprivation, using original life tables *versus* simulated life tables

➤ Data

French Network of Cancer Registries (Francim)



Survival data (Francim-HCL)

Cancer diagnoses 2006-2009
End of follow-up 30-06-2013

- Sex, Date of birth
- Date of cancer diagnosis
- Date of last information
- Vital status
- Topography/morphology codes > ICD-O-3

Social environment data (U1086 Anticipe, MapInMed)

Geolocalization of patients' addresses

- Small geographic unit : IRIS
- **European Deprivation Index** *Pornet et al., 2012*
 - Continuous score
 - Categorized into national quintiles**Q1 : least deprived, Q5 : most deprived**

- ✓ **32 cancers (solid tumors and hematologic malignancies)**
- ✓ **≈ 210,000 cases**

➤ Analyses

■ **Non-parametric**

5-years age-standardized net survival (ASNS) – *Pohar Perme et al., 2012*

- For each cancer site, sex* and deprivation quintile

Deprivation Gap : $DG = ASNS_{Q1} - ASNS_{Q5}$

■ **Flexible modelling** Cf. Marie Poiseuil's poster

Excess mortality hazard models using multidimensional penalized splines – *Remontet et al., 2019, Fauvernier et al., 2019*

- For each cancer site and sex*

EDI significance and choice of best modelling (AIC)
Excess mortality hazard ratios according to deprivation

**whenever possible based on number of deaths and cases, otherwise Men + Women analyzed together*

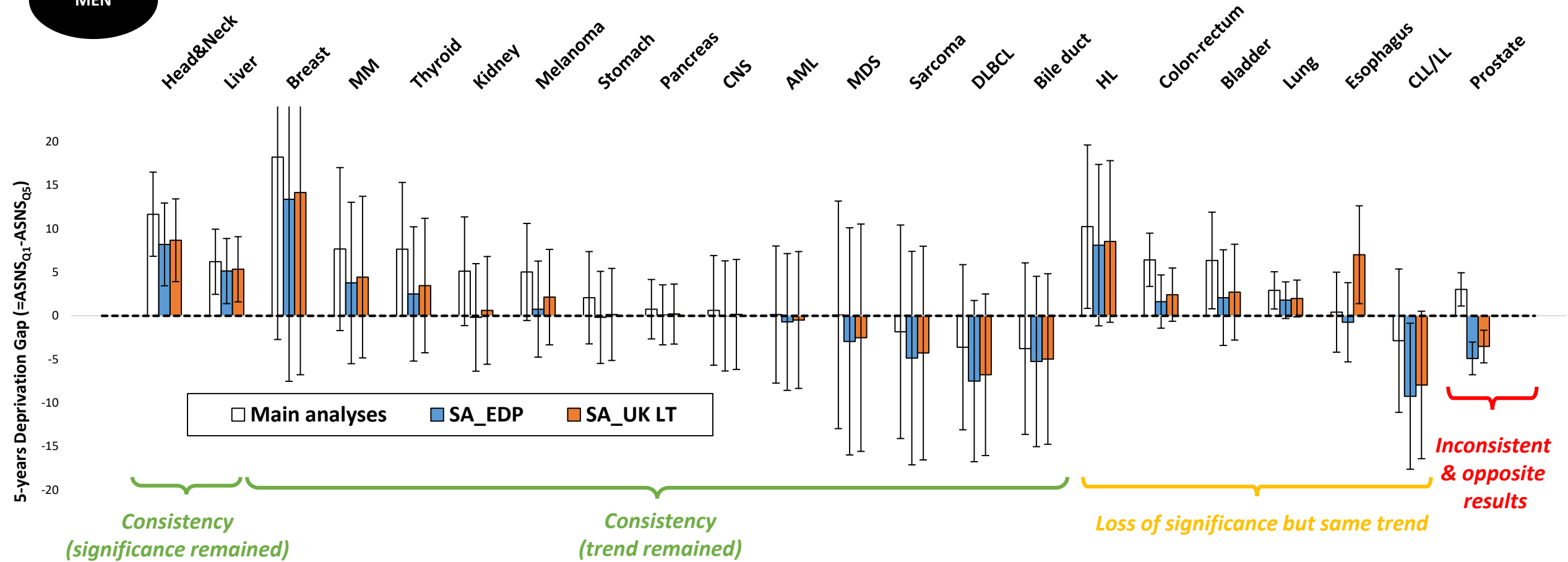
Comparison of results from 3 analyses:

- ❑ *Main analyses:* original French life tables
- ❑ *Sensitivity analyses (1):* simulated life tables based on EDP
- ❑ *Sensitivity analyses (2):* simulated life tables based on England life tables

Results : non-parametric analyses

Difference in 5-years age-standardized net survival* (ASNS) between men living in least deprived environment (Q1) and men living in most deprived environment (Q5), by cancer localisation, according to main analyses and sensitivity analyses

MEN



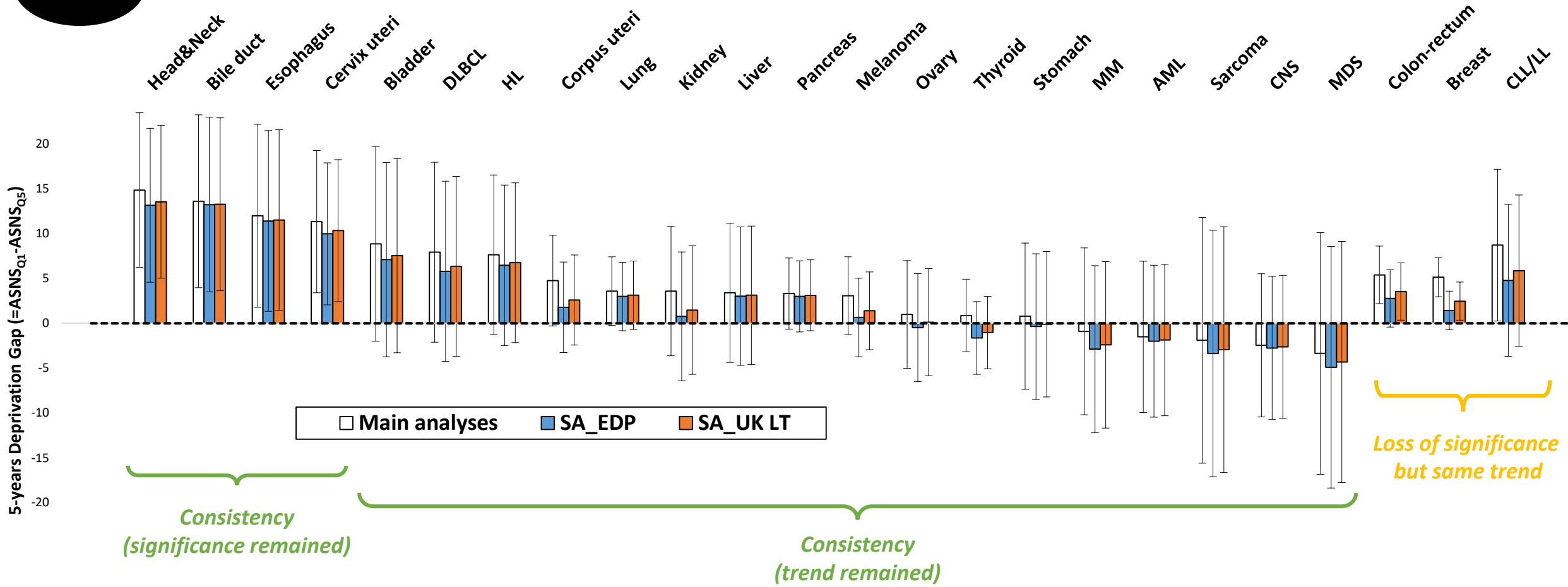
* non-parametric (Pohar-Perme method)

AML : acute myeloid leukemia ; ASNS : age-standardized net survival ; CLL/LL : chronic lymphoid leukemia/lymphocytic lymphoma ; CNS : central nervous system ; DLBCL : diffuse large B-cell lymphoma ; HL : Hodgkin lymphoma ; MDS : myelodysplastic syndromes ; MM : multiple myeloma ; SA_EDP : sensitivity analyses based on EDP data ; SA_UK LT : sensitivity analyses based on Engand Life Tables

Results : non-parametric analyses

Difference in 5-years age-standardized net survival* (ASNS) between women living in least deprived environment (Q1) and women living in most deprived environment (Q5), by cancer localisation, according to main analyses and sensitivity analyses

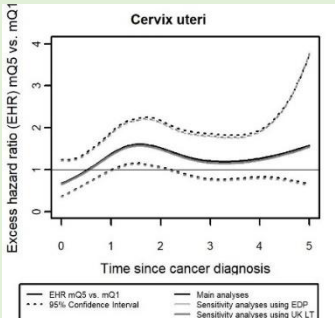
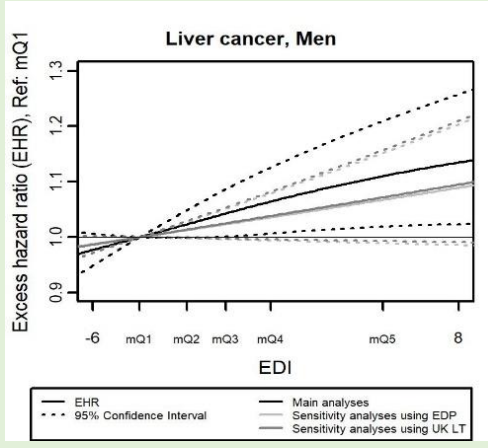
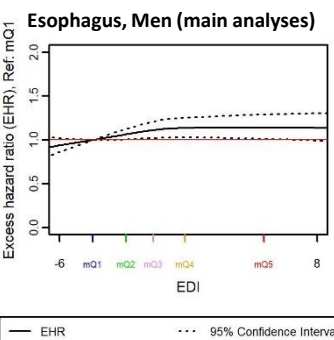
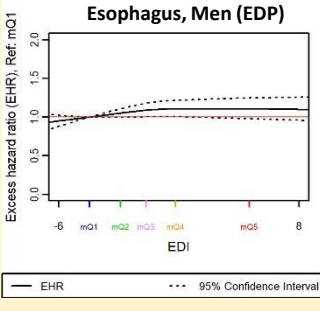
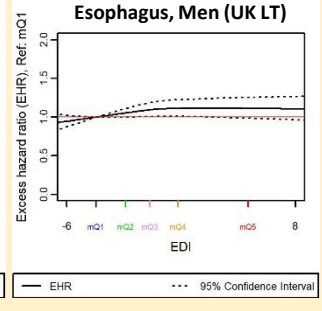
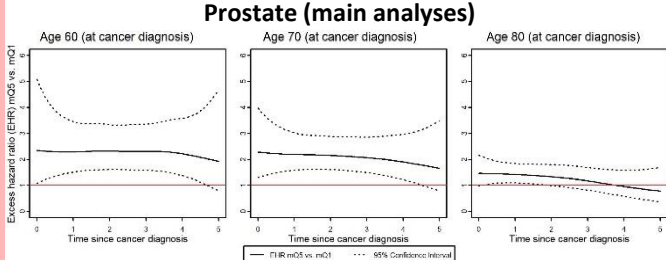
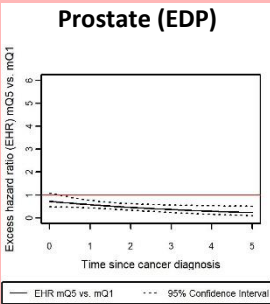
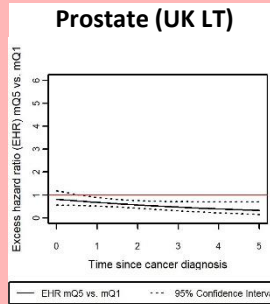
WOMEN



* non-parametric (Pohar-Perme method)

AML : acute myeloid leukemia ; ASNS : age-standardized net survival ; CLL/LL : chronic lymphoid leukemia/lymphocytic lymphoma ; CNS : central nervous system ; DLBCL : diffuse large B-cell lymphoma ; HL : Hodgkin lymphoma ; MDS : myelodysplastic syndromes ; MM : multiple myeloma ; SA_EDP : sensitivity analyses based on EDP data ; SA_UK LT : sensitivity analyses based on England Life Tables

Results : flexible modelling

Consistent results between main and sensitivity analyses		Loss of significance but same trend	Inconsistent results between main and sensitivity analyses
Very similar results	Attenuated results		
Head & neck (M, W) Esophagus (W) Stomach (W) Bile ducts (M) Liver (W) Lung (M, W) Ovary (W) Cervix uteri (W) Corpus uteri (W) CNS (M, W) Kidney (W) Sarcoma (M, W) Hodgkin Lymphoma (M+W) DLBCL (M, W) CML (M+W) NK/TCL (M+W)	Colon-rectum (M, W) Pancreas (M, W) Stomach (M) Bile ducts (W) Liver (M) Breast (W) Melanoma (M) CLL/LL (W) MDS (M, W) CMPD (M+W) Thyroid (M+W)	Bladder (M, W) Esophagus (M) Melanoma (W) LPL/WM (M+W) Follicular Lymphoma (M+W)	Prostate (M) Kidney (M) CLL/LL (M) MZL (M+W)
		  	  

* non-parametric (Pohar-Perme method)

AML : acute myeloid leukemia ; CLL/LL : chronic lymphoid leukemia/lymphocytic lymphoma ; CML : chronic myeloid leukemia ; CMPD : chronic myeloproliferative disorder ; CNS : central nervous system ; DLBCL : diffuse large B-cell lymphoma ; FL : follicular lymphoma ; HL : Hodgkin lymphoma ; LPL/WM : lymphoplasmacytic lymphoma/Waldenstrom macroglobulinemia ; M: men; MCL : mantle cell lymphoma ; MDS : myelodysplastic syndromes ; MM : multiple myeloma ; MZL : marginal zone lymphoma ; NK/TCL : NK/T-cell lymphoma ; W : women

Conclusions : overall validation but proper French life tables still needed !

Limitations



- ✗ Individual measure of social situation in sensitivity analyses (1) based on EDP
- ✗ Aggregated ecological measure of social situation in sensitivity analyses (2) but based on different context than in France (England)
→ probably not the « worst case scenario » (cf. Lithuania ?) *Mackenbach et al., 2017*

- For most cancers, the **social gradient in survival remained or was attenuated**, highlighting the **importance** of taking into account the **social gradient in background mortality**
- **Some inconsistencies** for prostate cancer, kidney cancer and some hematologic malignancies
 - ❑ Remain to be explained
 - ❑ Hypotheses for **prostate cancer** ?

Indicating how *true deprivation-specific life tables in France are crucial to accurately assess social gradient in cancer net survival*

Perspectives (U1086): construction of French life tables, stratified by EDI, using data from EDP ?

GRELL 2022 ?

Thank you very much for your attention

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