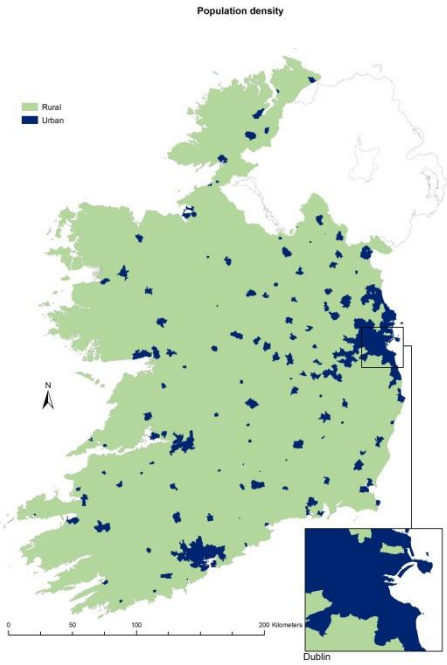
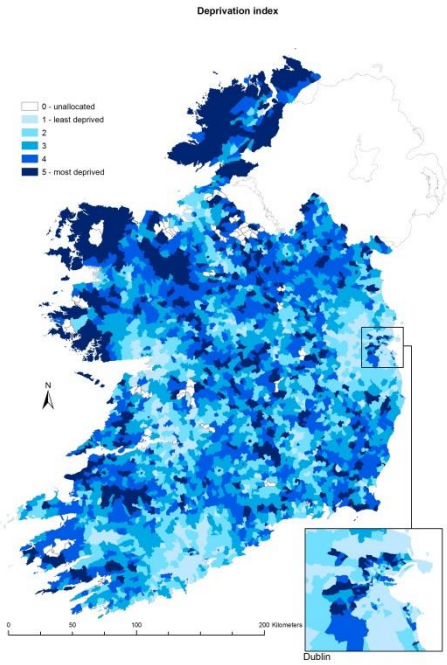
Cancer inequalities in Ireland by deprivation, urban/rural status and age: a National Cancer Registry report





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Cancer inequalities in Ireland by deprivation, urban/rural status and age: a National Cancer Registry report

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KEY FINDINGS

This report assesses inequalities by urban/rural status, social/socioeconomic deprivation, and age in incidence, survival, stage, treatment and comorbidity for cancer patients in Ireland during the years 2008-2012. Findings are presented for invasive cancer as a whole and for nine major cancer types – stomach, colorectal, lung, female breast, cervical and prostate cancers, melanoma of skin, lymphoma and leukaemia.

Strong patterns of inequality by deprivation and age are documented for most of the measures examined, and the influence of age is particularly striking. These patterns were often applicable across a range of cancer types, although the patterns shown by different cancers could differ markedly or, for some cancers, the evidence was less strong. Variation by urban/rural status was less pronounced but some differences in deprivation effect were evident between urban and rural cases.

Particularly notable (and statistically significant) findings included:

- *By urban/rural status*:
  - Higher cancer incidence in urban than in rural populations, overall (invasive cancers as a whole) and for six of the nine specific cancer types examined in further detail: stomach, lung, male colorectal, female breast and cervical cancers, and melanoma.
  - A tendency towards lower proportions of patients treated in urban compared with rural populations.

- *By deprivation status*:
  - Higher incidence of cancer in more deprived populations, overall and for stomach, lung and cervical cancers, but the opposite trend (lower incidence in more deprived populations) for breast cancer and melanoma.
  - Opposite patterns of incidence in relation to deprivation for urban and rural prostate cancer and male leukaemia patients (higher incidence in more deprived rural areas, but lower incidence in more deprived urban areas) and stronger patterns of increasing incidence with increased deprivation for lung cancer and male colorectal cancer.
  - Lower survival of cancer patients from more deprived populations, overall and for six cancer types: stomach, colorectal, lung, breast and prostate cancers, and lymphoma.
  - Lower proportions of early-stage or higher proportions of later-stage cancers among more deprived populations for stomach, breast and prostate cancers and melanoma.
  - Lower proportions of patients surgically treated in more deprived populations, overall and for stomach, colorectal, lung, breast and prostate cancers.
  - Higher prevalence of comorbidities (other serious health conditions) in cancer patients from more deprived populations, overall and for lung and breast cancers and lymphoma.

- *By age:*
  - Markedly higher incidence in the oldest patients, overall and for most major cancers, but weaker trends by age for breast and prostate cancers and the opposite pattern for cervical cancer.
  - Markedly poorer cancer-specific survival among the oldest patients, overall and for all nine major cancers,
  - Older patients for some cancers (notably melanoma, breast, cervical and prostate cancers) tended to present at more advanced stage, but the opposite pattern was seen for colorectal and lung cancers, which appeared to present at less advanced stage in the elderly.
  - Substantially lower proportions of the oldest patients having active treatment for their cancer, overall and for all nine major cancers, with the exception of hormonal therapy for breast and prostate cancers (higher use in the elderly).
  - Substantially higher prevalence of comorbidities among the oldest cancer patients, for all nine major cancers.

A fuller summary of results is given below, including visual representations of inequalities by urban/rural status, deprivation and age in *Summary Tables 1-3*. The latter tables are scaled to allow direct comparison between different factors influencing inequality and between different cancers, and highlight in particular the magnitude and scope of inequalities by age.

Summary Table 1. Influence of **urban status** on cancer in Ireland, 2008-2012: urban v rural patients

Urban status	Incidence[a]	Survival[b]	Early stage[c]	Late stage[d]	Treatment[e]	Comorbidity[f]
All cancers ex NMSC	M↑ F↑	↓M↓ F=			R↓ C↓ H↓	↑M↑ F↑
Stomach cancer	M↑ F↑	=	=	III↑ IV=	R↓ TSC=	=
Colorectal cancer	M↑	=	=	=	S↓ C↓ TR=	=
Lung cancer	M↑ F↑	↑	I↑ II=	III↓ IV=	=	=
Melanoma of skin	M↑ F↑	↑	=	IV↓ III=	T↓ C↓ SR=	=
Female breast cancer	↑	=	I↑ II=	III↓ IV=	C↓ H↓ TSR=	=
Cervical cancer	↑	=	=	=	C↑ TSR=	=
Prostate cancer	=	↓	=	IV↑ III=	T↓S↑R↓H↓	=
Lymphoma	=	=	=	=	S↑ TSRC=	=
Leukaemia	=	=			R↑ TC=	↓

Summary Table 2. Influence of **deprivation** on cancer in Ireland, 2008-2012: most deprived v least deprived patients

	Incidence[a]	Survival[b]	Early stage[c]	Late stage[d]	Treatment[e]	Comorbidity[f]
All cancers ex NMSC	M↑ F↑	↓M↓ F↓			S↓ H↑ TRC=	↑M↑ F↑
Stomach cancer	M↑ F↑	↓	=	IV↑ III=	S↓ TRC=	↑
Colorectal cancer	=	↓	=	IV↑ III=	T↓ S↓ RC=	=
Lung cancer	M↑ F↑	↓	II↑ I=	=	T↓ S↓ RC=	↑
Melanoma of skin	M↓ F↓	↓	II↑ I=	III↑ IV↓	R↑ C↑ TS=	↓
Female breast cancer	↓	↓	I↓ II=	IV↑ III=	S↓ H↑ TRC=	↑
Cervical cancer	↑	↓	=	III↑ IV=	C↑ TSR=	↑
Prostate cancer	=	↓	I↓ II↓	III↑ IV↑	T↑ S↓ R↑ C↑ H↑	↑
Lymphoma	=	↓	II↑ I=	=	R↑ TSC=	↑
Leukaemia	M↓ F=	↓			T↑ R↑ C↑	↑

Summary Table 3. Influence of **older age** on cancer in Ireland, 2008-2012: age 75+ v 45-54 (85+ v 55-64 for prostate)

	Incidence[a]	Survival[b]	Early stage[c]	Late stage[d]	Treatment[e]	Comorbidity[f]
All cancers ex NMSC	M↑ F↑	↓M↓F↓			T↓S↓R↓C↓H↑	↑M↑F↑
Stomach cancer	M↑ F↑	↓	I↑ II↓	III↓ IV↓	T↓S↓R↓C↓	↑
Colorectal cancer	M↑ F↑	↓	I↓ II↑	III↓ IV↓	T↓S↓R↓C↓	↑
Lung cancer	M↑ F↑	↓	I↑ II↑	III↓ IV↓	T↓S↓R↓C↓	↑
Melanoma of skin	M↑ F↑	↓	I↓II↑	III↑ IV↑	T↓S↓C↓R=	↑
Female breast cancer	↑	↓	I↓ II↓	III↑ IV↑	T↓S↓R↓C↓H↑	↑
Cervical cancer	↓	↓	I↓II↑	III↓ IV↑	T↓S↓C↓R=	↑
Prostate cancer	↑	↓	I↓ II↓	III↓ IV↑	T↓S↓R↓H↑C=	↑
Lymphoma	M↑ F↑	↓	I↓ II↓	III= IV=	T↓S↓C↓R=	↑
Leukaemia	M↑ F↑	↓			T↓R↓C↓	↑

Footnote/Key to Summary Tables 1-3: See overleaf.

Footnote to Summary Tables 1-3:

[a] Age-standardised incidence rate; M = males, F = females. [b] Age/sex-adjusted survival within 5 years of diagnosis. [c] Age/sex-adjusted stage proportions I = stage I, II = stage II. [d] III = stage III, IV = stage IV. [e] Age/sex/casemix-adjusted proportion of patients having tumour-directed treatment, T = any treatment, S = surgery, R = radiotherapy, C = chemotherapy / immunotherapy, H = hormone therapy. [f] Age/sex-adjusted proportion of patients with other significant health conditions.

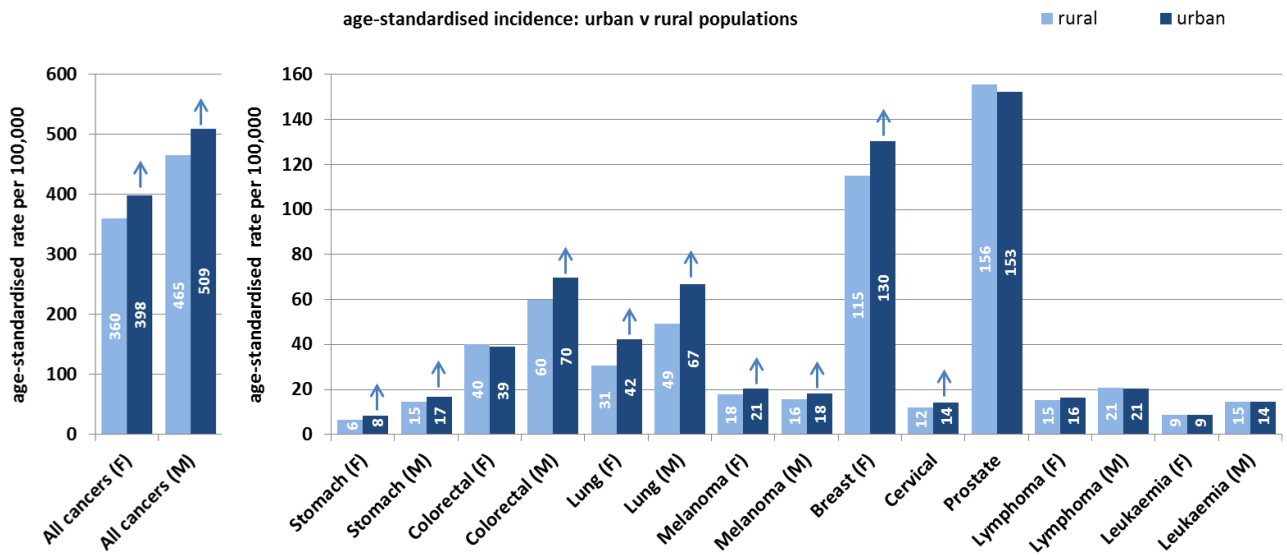
↑ significantly higher: relative risk or rate ratio <1.1↑, ≥1.1↑, ≥1.5↑, ≥2.0↑, ≥5.0↑ or ≥10.0↑ (or, for survival, mortality hazard significantly lower: hazard ratio >0.9, ≤0.9, ≤0.67, ≤0.5, ≤0.2 or ≤0.1 but shown as upward arrow).

↓ significantly lower: relative risk or rate ratio >0.9↓, ≤0.9↓, ≤0.67↓, ≤0.5↓, ≤0.2↓ or ≤0.1↓ (or, for survival, mortality hazard significantly lower: hazard ratio <1.1, ≥1.1, ≥1.5, ≥2.0, ≥5.0 or ≥10.0 but shown as downward arrow).

↑ non-significantly higher (but ratio ≥1.1), ↓ = non-significantly lower (but ratio ≤0.9) i.e. apparent difference not statistically significant at P<0.05 level.
= no significant difference (& <10% relative difference).

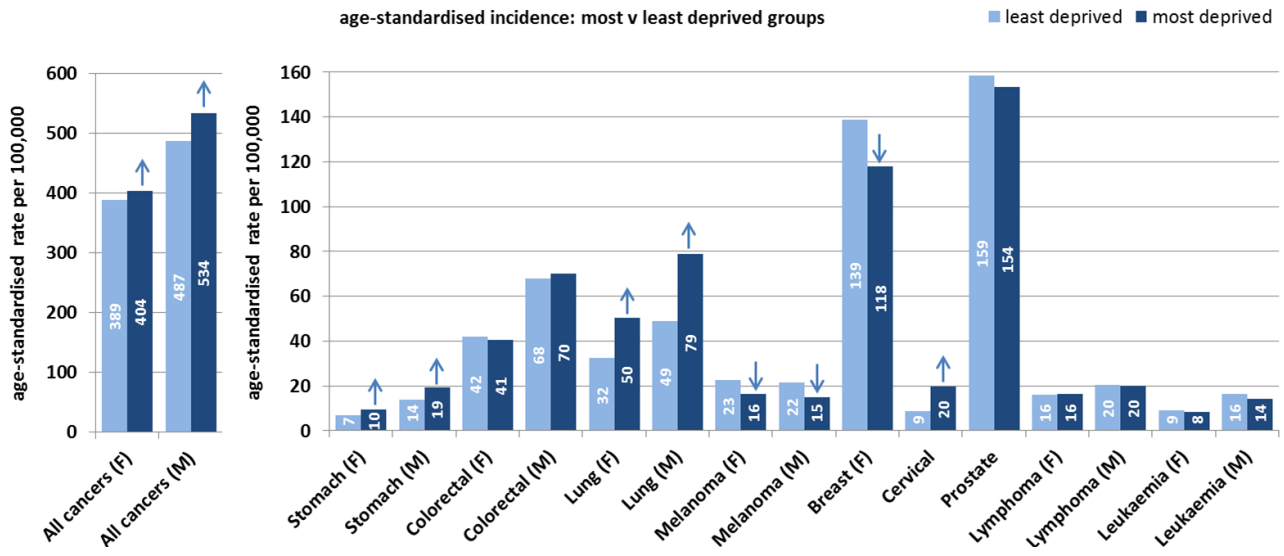
Incidence

By urban/rural status: Age-standardised incidence for six of the cancer types examined (stomach, lung, melanoma, male colorectal, female breast and cervical), and for cancer as a whole, was significantly higher among urban populations (defined on the basis of average population density ≥1 person/hectare) than among rural populations. For these cancers, urban rates were 13-38% higher, most notably for lung cancer (36-38% higher). For all cancers combined, urban rates were 10% (95% confidence interval 8-12%) higher for males and 11% (95% CI 8-12%) higher for females. For prostate cancer, lymphoma, leukaemia and female colorectal cancer there was no significant variation between urban and rural populations.



Summary Figure 1 Age-standardised cancer incidence, Ireland, 2008-2012: comparison between urban and rural populations. Arrows indicate significant differences. Note different scale for all-cancer graph.

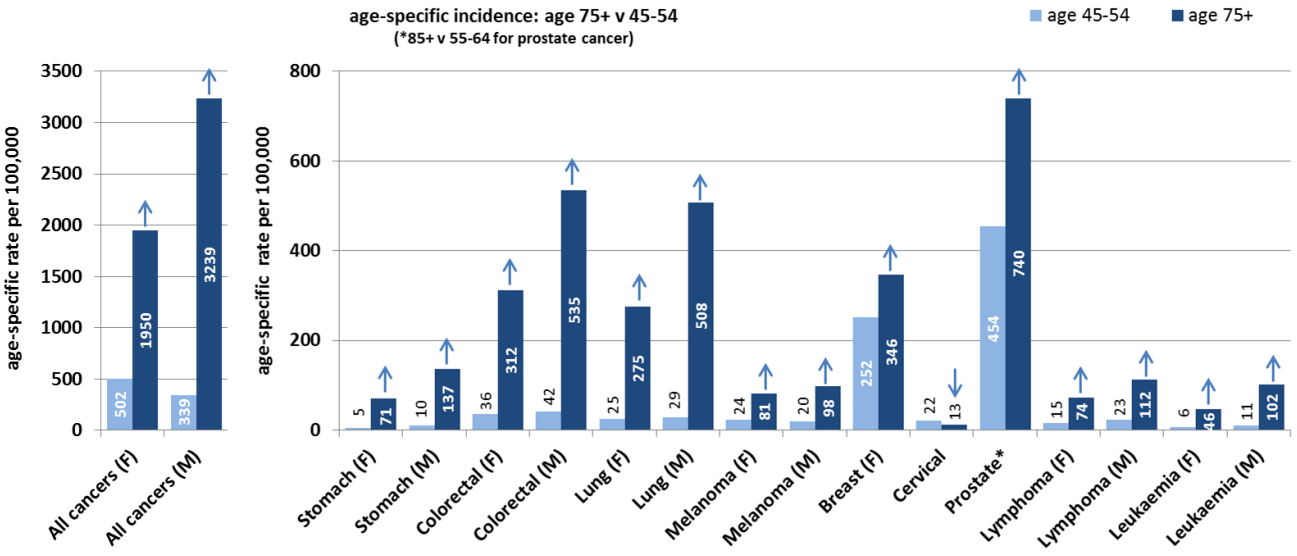
By deprivation: Overall cancer incidence was slightly but significantly higher in the most deprived 20% of the population, by about 10% (95% confidence interval 6-13%) for males and 4% (95% CI 1-7%) for females, having adjusted for age. Of the individual cancers examined, cervical, lung and stomach cancers showed strong patterns of increasing incidence with increasing deprivation, with age-standardised rates about 120%, 60% and 40% higher, respectively, in the most deprived compared with the least deprived fifth of the Irish population. Breast cancer and melanoma showed the opposite pattern, i.e. decreasing incidence with increasing deprivation, with age-standardised rates about 15% lower and 30% lower, respectively, in the most deprived populations. No clear patterns of incidence by deprivation were evident for colorectal or prostate cancers, lymphoma or leukaemia.



Summary Figure 2 Age-standardised cancer incidence, Ireland, 2008-2012: comparison between the most and the least deprived 20% of the population. Arrows indicate significant differences. Note different scale for all-cancer graph.

Interaction between deprivation and urban/rural status: For lung cancer and male colorectal cancer, urban populations showed a significantly stronger pattern of higher incidence in more deprived areas than seen in rural populations. For prostate cancer and male leukaemia, urban and rural populations showed opposite (and significantly different) patterns of deprivation influence on incidence, i.e. higher incidence in more deprived rural areas but lower incidence in more deprived urban areas. Otherwise, the pattern of deprivation influence on incidence was broadly similar for urban and rural populations.

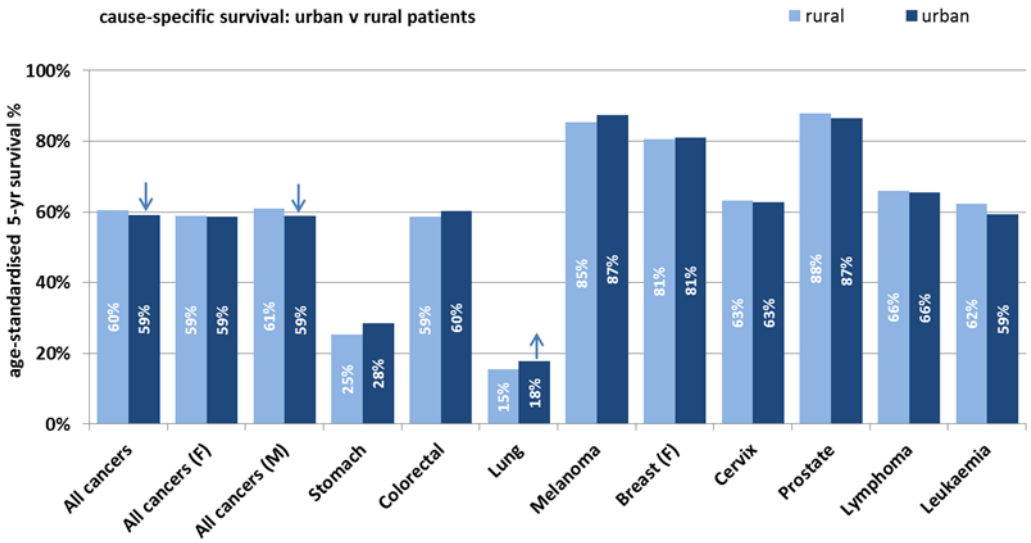
By age: Cancer as a whole and almost all of the specific cancer types examined showed significantly higher incidence rates at older ages, based on comparisons between age-groups 75+ and 45-54 (or 85+ and 55-64 for prostate cancer). Overall incidence rates were about ten times higher for males and four times higher for females in the oldest group (compared with 45-54). For eight of the nine specific cancers examined, male rates were 1.6-15 times higher and female rates 1.4-13 times higher in the oldest group. The biggest differences (more than 10-fold) were seen for stomach cancer, lung cancer and male colorectal cancer. For breast and prostate cancers the difference was relatively modest (1.4-fold and 1.6-fold differences, respectively). Only cervical cancer showed a pattern of significantly lower rates (42% lower) in the oldest group.



Summary Figure 3 Age-specific cancer incidence, Ireland, 2008-2012: age 75+ and 45-54 groups (or 85+ and 55-64 for prostate cancer). Arrows indicate significant differences. Note different scale for all-cancer graph.

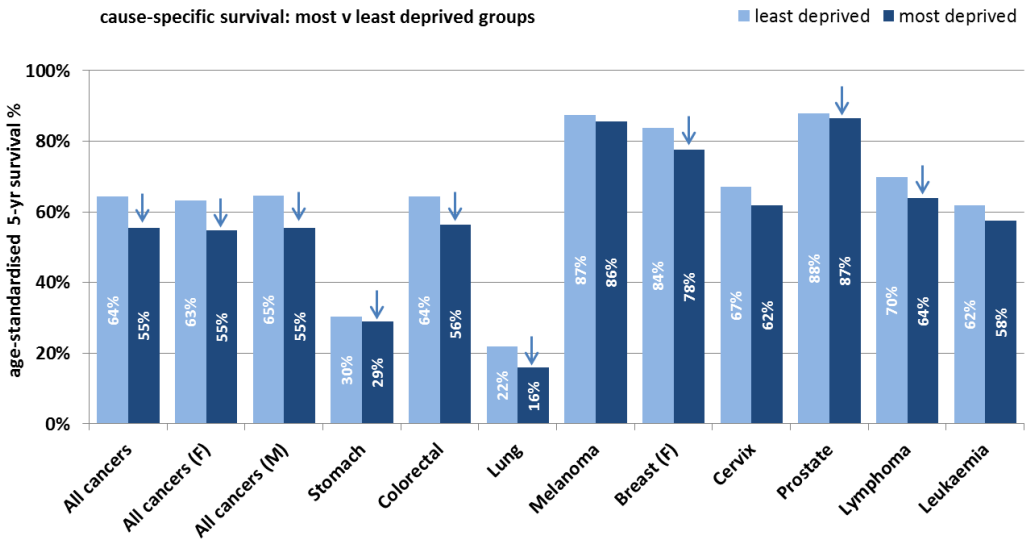
Survival

By urban/rural status: For all cancers combined, age-standardised survival was slightly but significantly lower among urban than among rural patients: mortality risk about 4% (95% confidence interval 2-7%) higher overall, 8% (95% CI 4-11%) higher for males but no significant difference for females. However, these differences were no longer significant after adjustment for casemix (cancer type), which is also influenced by urban/rural status (e.g. lung cancer make up a higher proportion of cancers in urban patients). Lung cancer survival was significantly higher in urban patients (mortality risk about 6% lower than for rural patients), but there was no difference after adjustment for stage. Otherwise urban status did not significantly influence survival for the specific cancers examined.



Summary Figure 4 Age-standardised cancer survival, Ireland, 2008-2012: comparison between urban and rural populations. Arrows indicate significant differences (after adjustment for age and sex).

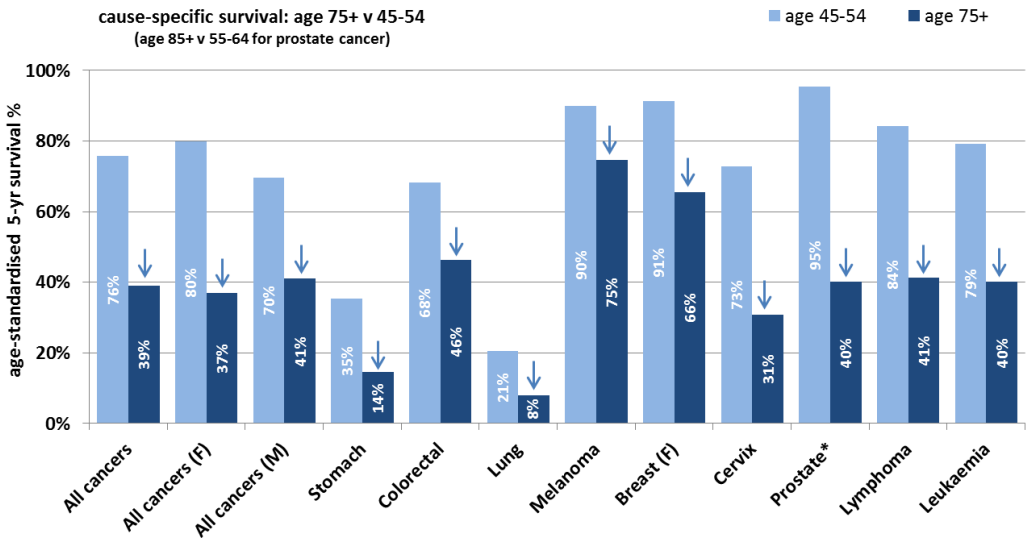
By deprivation: For all nine cancer types examined, and for cancers as a whole, there was evidence of poorer cancer-specific survival in patients from the most deprived compared with the least deprived areas. This was not statistically significant for melanoma, cervical cancer or leukaemia, but for the other cancers examined the age/sex-adjusted mortality risk among cancer patients was between 19% and 54% higher among patients from the most deprived areas. The greatest inequality seen was for breast cancer, the lowest for stomach cancer and melanoma. For all cancers combined, the mortality risk was 39% (95% confidence interval 34-45%) higher in the most deprived compared with the least deprived areas, having adjusted for age and sex, or 27% (95% CI 22-32%) higher if further adjusted for the cancer types involved (i.e. casemix may explain about a third of the survival variation by deprivation). Models adjusted for stage suggested that stage accounted for between one-fifth and two-fifths of the deprivation-related variation in survival for breast, cervical and prostate cancers but none of the variation for colorectal or lung cancers or lymphoma.



Summary Figure 5 Age-standardised cancer survival, Ireland, 2008-2012: comparison between the most and the least deprived 20% of the population. Arrows indicate significant differences (adjusted for age and sex).

Interaction between deprivation and urban/rural status: For cancer as a whole and for male colorectal cancer, patients from urban areas showed a significantly stronger pattern of poorer survival in the most deprived areas. For other cancer types the influence of deprivation on survival was broadly similar (or differences could not be statistically confirmed) between urban and rural patients.

By age: A very striking decline in average survival with increasing age was seen for all cancer types examined, even though cancer-specific survival was the outcome (thus mortality risk from non-cancer causes, which increase rapidly with age, was excluded). Overall, patients aged 75+ years were about four (3.8) times more likely to die from their cancer than patients aged 45-54, or about three (2.9) times more likely if adjustment is made for cancer type. For females, the disparity in survival by age was particularly high (mortality risk 5.2 times higher in the oldest group, compared with 2.6 times for the oldest males). For specific cancer types, survival disparities between ages 75+ and 45-54 ranged from about a two-fold difference (for stomach, colorectal and lung cancers) to a five-/six-fold difference or more (for breast and prostate cancers and lymphoma). Models adjusted for age suggested that stage differences by age accounted for a substantial proportion (perhaps 30-70%) of the age-related variation in survival for some cancers (breast, cervical, prostate, melanoma) but not for others (stomach, colorectal, lung cancers, lymphoma).

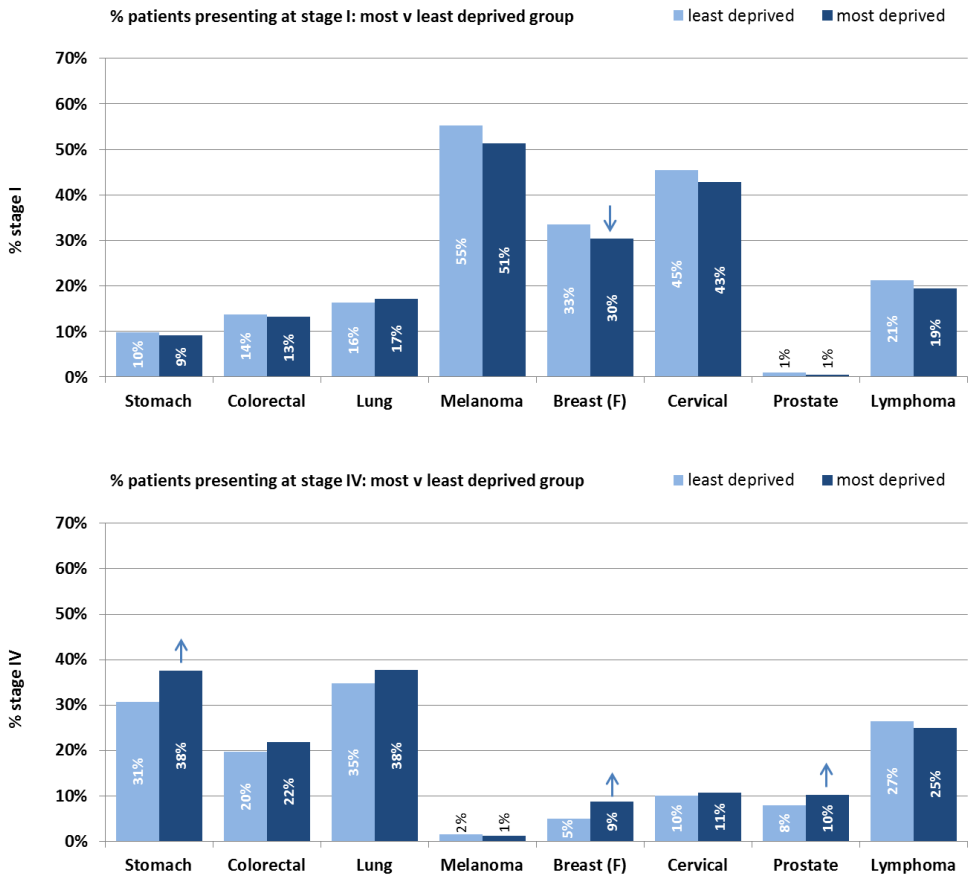


Summary Figure 6 Age-specific cancer survival, Ireland, 2008-2012: comparison between age 75+ and 45-54 groups (or 85+ and 55-64 for prostate cancer). Arrows indicate significant differences (adjusted for sex where relevant).

Stage

By urban/rural status: Urban patients with lung or breast cancer were significantly more likely to present at the least advanced stage (stage I), and less likely to present at an advanced stage (stage III), than rural patients, having adjusted for age and sex. Urban patients with prostate cancer were more likely to present at the most advanced stage (stage IV). For other cancers examined, the stage breakdown of cases did not vary significantly between urban and rural cases.

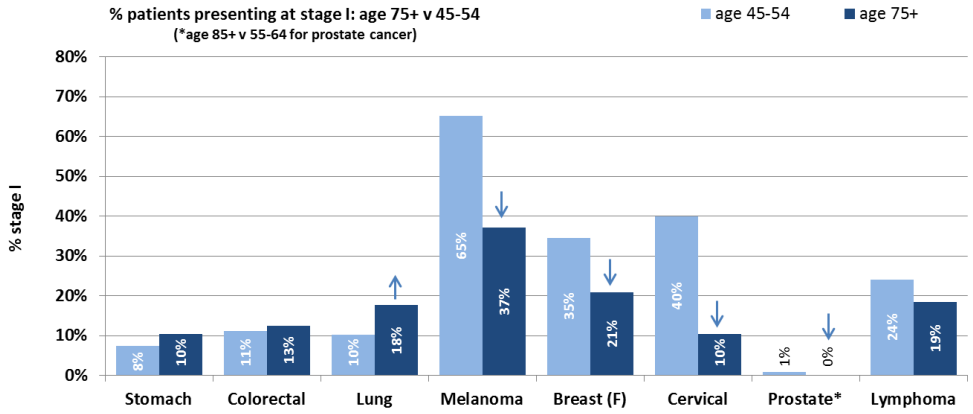
By deprivation: Patients from the most deprived areas were significantly less likely to present at an early stage for breast cancer (stage I) and prostate cancer (stage II), and more likely to present at an advanced stage for breast cancer (stage IV), prostate cancer (stages III and IV), stomach cancer (stage IV) and melanoma of skin (stage III), compared with patients from the least deprived areas. For lymphoma, the most deprived group were significantly less likely to present at stage II. These findings are adjusted for age and sex. See *Summary Figure 7* for stage I and stage IV comparisons.

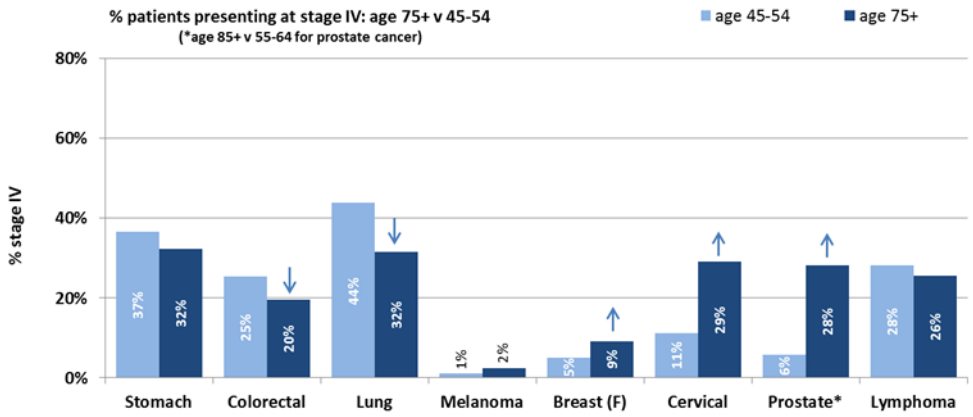


Summary Figure 7 Percentage of patients presenting at stages I and IV, Ireland, 2008-2012: comparison between the most and the least deprived 20% of the population. Arrows indicate significant differences (adjusted for age and sex).

Interaction between deprivation and urban/rural status: Influences of deprivation on the stage breakdown of cases differed significantly between urban and rural patients for stomach cancer (stages I, II and IV), colorectal cancer (stage IV) and lymphoma (stage III).

By age: The influence of age on stage breakdown of cases was striking but was not consistent across cancer types, and two broad patterns were seen. For colorectal and lung cancers, the oldest patients were significantly more likely to present at an earlier stage (stage II colorectal, I lung) and less likely to present at an advanced stage (III and IV for both). In contrast, for melanoma, breast, cervical and prostate cancers, the oldest patients were less likely to present at early stages (stage I melanoma, I and II breast, I cervical, II prostate) and more likely to present at advanced stages (stage III melanoma, III and IV breast, IV cervical and IV prostate). Older patients with stomach cancer were less likely to present at stage II or III, those with lymphoma less likely to present at stage I. See *Summary Figure 8* for stage I & stage IV comparisons.



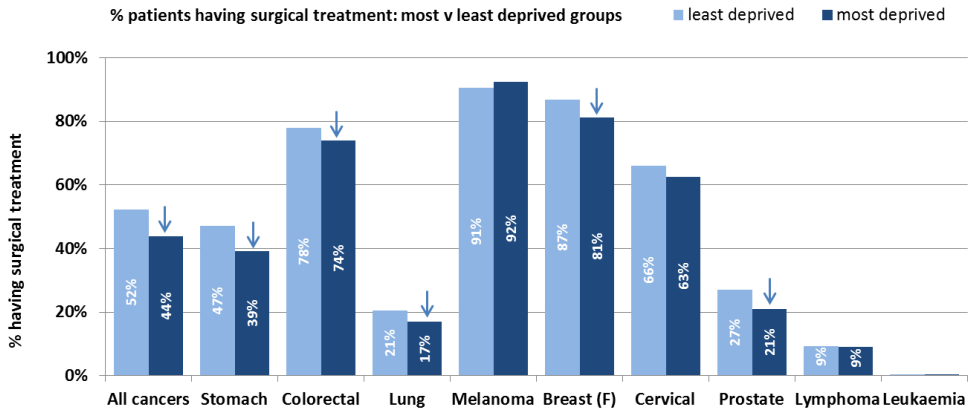


Summary Figure 8 Percentage of patients presenting at stages I and IV, Ireland, 2008-2012: comparison between the most and the least deprived 20% of the population. Arrows indicate significant differences (adjusted for age and sex).

Treatment

By urban/rural status: Urban patients were significantly less likely than rural patients to have any treatment for melanoma (-2% relative) and prostate cancer (-4%); tumour-directed surgery for colorectal cancer (-3%); radiotherapy for any cancer (-4%) and prostate cancer (-9%); chemotherapy/immunotherapy for any cancer (-4%), colorectal cancer (-5%), melanoma (-26%) and breast cancer (-5%); and hormonal treatment for any cancer (-13%), breast cancer (-8%) and prostate cancer (-18%). However, urban patients were more likely to have surgery for prostate cancer (+12%). Analyses for cancer as a whole, colorectal cancer, lymphoma and leukaemia were adjusted for casemix (cancer type).

By deprivation: Patients from the most deprived populations were significantly less likely to have surgery for cancer, overall (-6% relative) and for stomach cancer (-13%), colorectal cancer (-4%), lung cancer (-7%), female breast cancer (-4%) and prostate cancer (-19%), compared with the least deprived group (*Summary Figure 9*); and less likely to have any treatment for colorectal cancer (-4%) and lung cancer (-21%). Patients from the most deprived populations were significantly more likely to have hormonal treatment, overall (+27%) and for breast cancer (+11%) and prostate cancer (+61%); and also any treatment (+8%), radiotherapy (+12%) or chemotherapy (+95%) for prostate cancer.

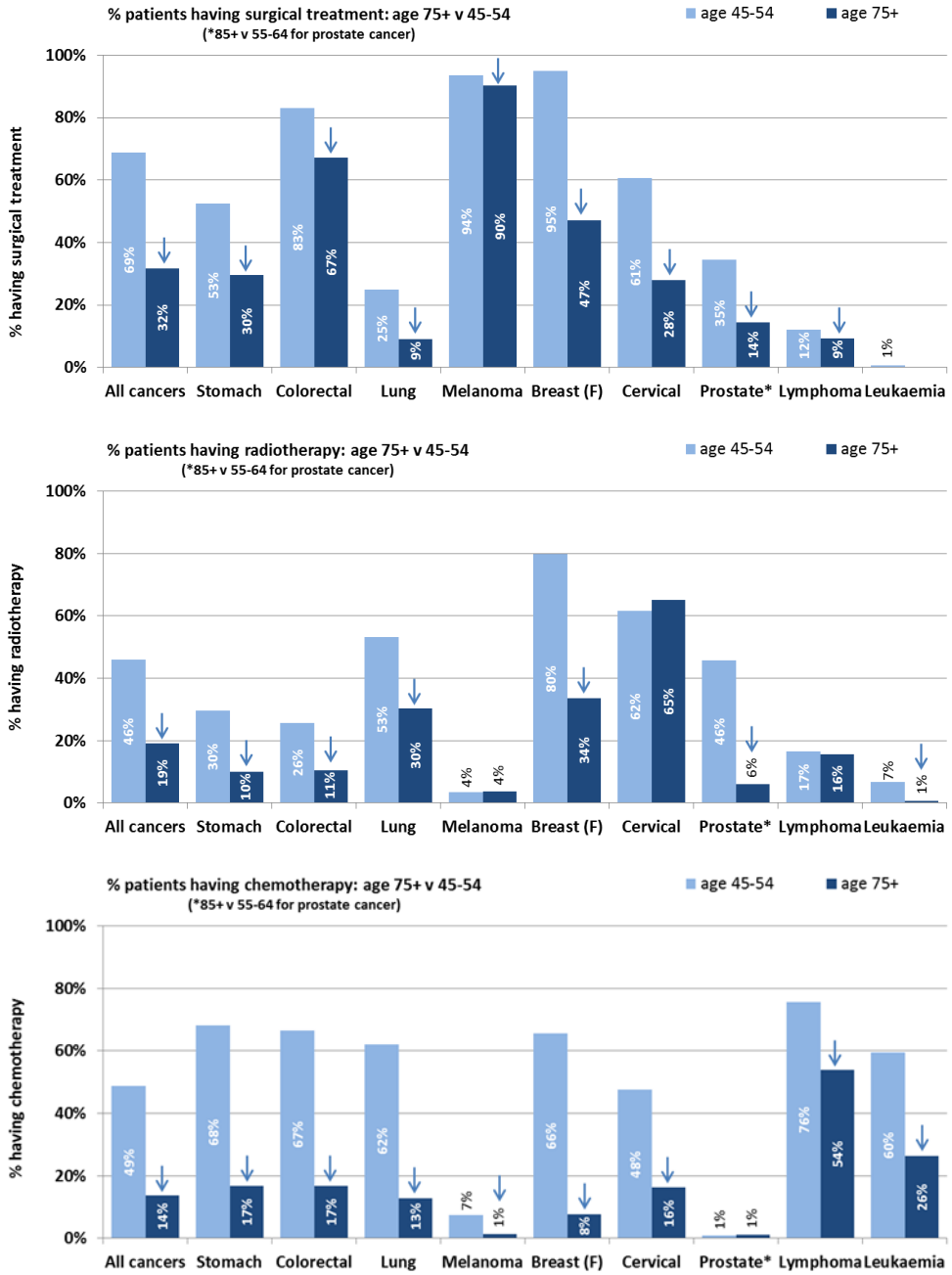


Summary Figure 9 Percentage of patients having tumour-directed surgery within a year of diagnosis, Ireland, 2008-2012: comparison between the most and the least deprived 20% of the population. Arrows indicate significant differences (after adjustment for age and sex).

Interaction between deprivation and urban/rural status: The influence of deprivation on treatment differed significantly between urban and rural patients for chemotherapy in breast cancer patients (stronger effect for rural patients), hormonal therapy in prostate cancer (stronger effect for urban patients), and chemotherapy in leukaemia (stronger effect for rural patients) – in each case, a higher proportion of patients in the most deprived group were treated.

By age: Very marked variation of treatment by age was seen, particularly in the use of chemotherapy, with (in general) a lower proportion of older patients having treatment (with the exception of hormonal treatment) (*Summary Figure 10*). For cancers as a whole, patients aged 75+ years were significantly less likely to have any treatment (-30% in relative terms), surgery (-21%), radiotherapy (-22%) or chemotherapy (-72%) but more likely to have hormonal treatment (+41%) than those aged 45-54. Across nine specific cancer types, use of any treatment was significantly lower in the oldest group for all (ranging from -4% for melanoma to -53% for leukaemia); use of surgery lower for eight cancers (-4% melanoma to -

63% lung cancer); use of radiotherapy lower for six cancers (-43% lung cancer to -91% leukaemia); use of chemotherapy or immunotherapy lower for eight cancers (-31% lymphoma to -88% breast cancer); but use of hormonal treatment higher for the oldest patients with breast cancer (+8%) and prostate cancer (+105%).

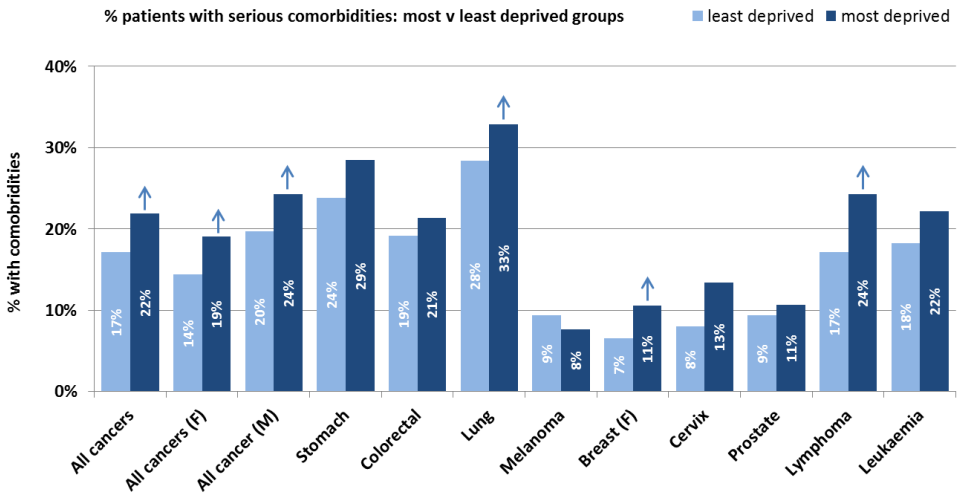


Summary Figure 10 Percentage of patients having tumour-directed surgery, radiotherapy or chemotherapy / immunotherapy within a year of diagnosis, Ireland, 2008-2012: comparison between age 75+ and 45-54 groups (or 85+ and 55-64 for prostate cancer). Arrows indicate significant differences (adjusted for sex where relevant).

Comorbidity

By urban/rural status: Cancer patients (as a whole) from urban areas were slightly but significantly more likely (about 6% more likely having adjusted for age and sex) to have other significant health conditions than those from rural areas, for both males and females. However, variation was not statistically significant for individual cancer types.

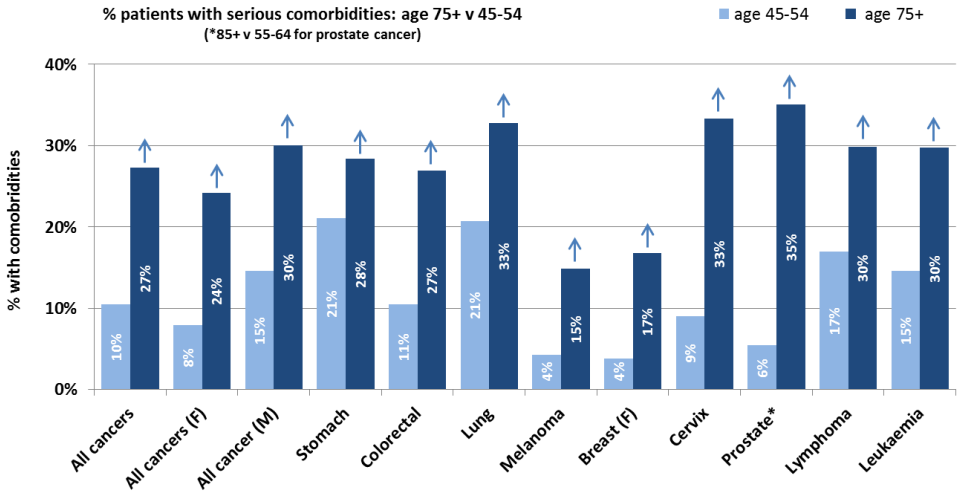
By deprivation: Cancer patients from the most deprived areas were significantly more likely to have serious comorbidities than those from the least deprived areas: about 20% more likely for cancer patients as a whole, or about 15% more likely for lung cancer, 40% more likely for breast cancer and 30% more likely for lymphoma patients (having adjusted for age and sex) (*Summary Figure 11*). Findings were broadly similar (but not statistically significant) for most other cancers examined.



Summary Figure 11 Percentage of cancer patients having serious comorbidities, Ireland, 2008-2012: comparison between the most the least deprived 20% of the population. Arrows indicate significant differences (adjusted for age and sex).

Interaction between deprivation and urban/rural status: For cancer patients as a whole (overall and for males), urban patients showed a significantly stronger pattern of higher levels of comorbidity in the most deprived group than seen for rural patients.

By age: For all cancer types examined, there was a significantly higher prevalence of non-cancer comorbidities in the oldest patients. Overall, cancer patients from the oldest group (75+) were 150% more likely (i.e. 2.5 times as likely) to have serious comorbidities, compared with ages 45-54; or 35%-350% more likely for individual cancers, highest (250-350% more likely) for melanoma, cervical cancer, prostate cancer and breast cancer. Overall, 27% of cancer patients aged 75+ years had known serious comorbidities, based on hospital inpatient data, highest (33%) for cervical and lung cancer patients, lowest (15-17%) for melanoma and breast cancer patients, and higher for males (34%) than for females (24%).



Summary Figure 12 Percentage of cancer patients having serious comorbidities, Ireland, 2008-2012: comparison between age-groups 75+ and 45-54 (85+ / 55-64 for prostate cancer). Arrows indicate significant differences (adjusted for sex where relevant).

Screen-detection status (for breast cancer)

By urban/rural status: In the age-group (50-64) initially targeted by the national breast screening programme (BreastCheck), breast cancers in women from urban populations were slightly (7%) but significantly more likely to have presented through screening than in rural women. The per-population incidence rate of screen-detected breast cancers was also higher (by about 20%) in urban populations, reflecting a combination of higher screen-detected proportion and higher overall incidence of breast cancer in urban populations.

By deprivation: The proportion of breast cancers at ages 50-64 that were screen-detected did not differ significantly by deprivation status, but the rate of screen-detected breast cancer was about 20% lower in the most deprived compared with the least deprived population group. This finding seems to reflect the overall influence of deprivation on breast cancer incidence more strongly than its influence on screening.