Appendix B. Summary tables of results

TABLE 1. Data extracted from quantitative studies

MEDICAL SCIENCES					
Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
Ahern et al. 2008	Ecological cross-sectional n=59 census districts	Accessibility Public services Urban design	Physical activity Surveillance	All cancer types (mortality)	Assess patterns of cancer mortality by census district in New York City. Negative binomial models were fitted to model mortality rates by neighbourhood features. Those census districts with unkempt sidewalks, low quality of public schools, high unemployment, and lower SES status had elevated rates of cancer mortality compared to other census districts. Policies that focus on improving neighbourhood environments through action taken by local community offices could reduce mortality rates. + poor urban design, maintenance, public services and low SES correlate with higher cancer mortality
Akinyemiju et al. 2015	Ecological cross-sectional n=47586 cases nested into 18 SEER population groups	Accessibility Housing	Alcohol use Genomics	Breast cancer (incidence)	Associations examined between census tract level SES and incidence of breast cancer. Age-adjusted incidence rates per 100,000 women were calculated by ethnicity. Residence in a higher SES area correlated with increased incidence rates for hormonal receptor-based breast cancer. However, lower SES correlated with non-hormone receptor-based breast cancer. These results suggest potential primary prevention pathways for lower SES communities (ie. alcohol consumption), and understanding epigenetic drivers of risk for higher SES communities. + SES tends to correlate with increased incidence of certain breast cancer subtypes
Alcaraz et al. 2009	Individual cross-sectional n=6648 individuals	Accessibility Public services Transportation	Screening	Mammography (methods)	Kiosks with information about mammography procedures were placed in a variety of public and private community locations (laundromats, salons, churches, health centres, social services, libraries, fairs). User home addresses were recorded, and then the mean distance between kiosk location and residence was calculated to determine variance by setting. Laundromats and libraries tended to have more localized populations, followed by social service agencies and health centres. The results of this study could be used to

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					inform the best local engagement strategies for cancer screening programs.
Anderson et al. 2014	Ecological cross-sectional n=139 playgrounds in 6 parks	Greenspace Housing Urban design	UV radiation	Skin cancer (risk)	Parks in the Sydney metropolitan area were audited for their shade infrastructure, and estimated shade coverage of play and eating areas on site. The socioeconomic score for the area surrounding each park was compared with shade score. Shade coverage was 34% lower than the highest areas for the lowest SES classified areas. This result places low SES populations, particularly children at higher risk of skin cancer. + lower SES areas tend to have lower shade coverage of their play and eating areas in public parks.
Andres et al. 1996	Individual cross-sectional n=4189 cases	Accessibility Housing Public services Transportation	Screening Surveillance	Breast cancer (mortality)	Mortality rates over a five-year period were calculated for breast cancer cases in 37 neighbourhoods of Colorado, Denver. Residents within the clinic service area tended to have advanced tumors, while increased neighbourhood socioeconomic status contributed to lower mortality rates. Understanding the variations in mortality rates and tumor stages by neighbourhoods can be used to better target screening efforts. - higher SES associated with lower breast cancer mortality rates
Apelberg et al. 2005	Ecological cross-sectional n=1210 census tracts	Accessibility Housing	Air quality	Estimated cancer risk (incidence)	Annual aggregate cancer risk from air toxics was calculated for each census tract in Maryland. A linear regression model was used to calculate the changes in estimated cancer risk given a change in neighborhood SES or ethnic composition. Tracts with the highest concentration of African-Americans were three times more at risk of overall cancer incidence. Further, low SES areas were 10-100 times more at risk, with considerable disparities in exposure to on-road and area source emissions from surrounding transportation corridors and industrial land uses. + higher concentrations of African-Americans is associated with higher overall risk of cancer + lower tract-level SES is associated with greater disparities in overall cancer risk from air toxics

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Arredondo et al. 2015	Protocol and baseline for a randomized control trial n=436 participants across 16 churches	Public services Urban design	Physical activity Screening	Overall cancer risk (methods)	Faith-based intervention designed to increase physical activity and improve cancer screening adherence. The study protocol will estimate the effects of the intervention delivered through motivational interviewing. The baseline results suggest Latino communities are influenced by their local environments, and have low physical activity due to poorly designed neighbourhoods, and poor screening adherence given a lack of access to health clinics.
Astell-Burt et al. 2014	Individual cross-sectional n=267000 participants	Greenspace	UV radiation	Skin cancer (odds ratio)	Examine the association between exposure to greenspace and skin cancer incidence. Greenspace exposure was calculated as the area of green space within 1km of a participant's primary residence. Skin cancer incidence was determined from self-reported diagnoses. A multi-level logit regression model was fitted, using time spent outdoors and physical activity as mediating factors of the relationship. Greenspace and skin cancer are positively associated, with those living in the highest quartile of greenspace availability with 9% higher odds of skin cancer. Physical activity and time spent outdoors only accounted for ~1% of the association in subsequent mediation analyses. + increased greenspace availability is associated with increased odds of skin cancer
Auluck et al. 2016	Ecological cross-sectional n=6378 cases nested within 6900 census dissemination areas	Accessibility Housing	Tobacco use Surveillance	Oral cancer (stage)	Exploration of disparities in oral cancer severity across British Columbia, Canada. Cases were geocoded by residence to a dissemination area, and then contrasted to the respective SES composite index (income, employment, education, single-parent households, and housing value) classification. Over half of the oral cancer cases were found in deprived neighbourhoods, with over half of the advanced cases displaying a similar trend. Further, deprived areas are estimated to have higher rates of tobacco use. These results could be used to improve dental care and screening in deprived areas.
Barranco et al. 2007	Ecological cross-sectional	Public services	Hazards	Prostate cancer (incidence and mortality)	Determine the associations between groundwater contamination and prostate cancer in Texas. Incidence and mortality rates were calculated for each state

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	n=24 watershed planning areas				watershed planning area, and then compared with the levels of boron and selenium in the groundwater using a linear regression model. Increased boron levels were correlated with a decrease in prostate cancer incidence, while no association was observed for selenium concentrations. - boron levels are correlated with decreased prostate cancer incidence and mortality Ø selenium levels have no observed relationship with prostate cancer incidence and mortality
Barrett et al. 2008	Individual cross-sectional n=21516 cases nested within 1137 census tracts	Accessibility Housing	Screening Surveillance	Breast cancer (stage)	Examination of variation in stage at diagnosis for breast cancer cases given neighbourhood characteristics in Cook County, Illinois. Multilevel logistic regression was used to calculate the likelihood of distant metastasis given an SES score composed of concentrated disadvantage, affluence, and immigration at the census tract level, while adjusting for demographic factors and change from 1990 to 2000. Results found a higher rate of distant metastasis in breast cancer cases with residence in a census tract with lower SES, higher concentration of African Americans, and an improved SES score between 1990 and 2000. + lower SES, high concentrations of African Americans, and an improving SES composition are correlated with higher rates of distant metastasis in breast cancer cases
Barry et al. 2012	Repeating individual cross-sectional n=12395 (1990), 17582 (2000) cases	Housing Public services	Screening Surveillance	Breast cancer (stage)	Repeating cross-section of breast cancer cases in Detroit, Atlanta, and San Francisco. Associations between residential factors characteristics and stage at diagnosis using logistic regression model coupled with a joint likelihood test to determine differences between the 1990 and 2000 cross-sections. Odds of late-stage diagnosis were elevated in cases residing in poor census tracts across all three cities. However, analysis of each city independently resulted in no significant associations for Atlanta, only elevated odds for moderately poor areas of San Francisco, and elevated odds for moderately and intensely poor areas of Detroit. In addition, an increased

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					supply of primary screening facilities was associated with decreased odds only in Detroit, but not in other cities. + elevated odds of advanced stage at diagnosis for breast cancer cases residing in poor census tracts Ø associations were not significant when breast cancer cases were disaggregated to the city-level, displaying variation in the effects of screening facility availability, and neighbourhood SES classification.
Best et al. 2001	Ecological cross-sectional n=not reported	Accessibility Land use Transportation	Air quality	Leukemia (methods)	Examine the effects of environmental benzene exposure in elevating the risk of leukemia occurrence in children of the Greater London, UK area. The Bayesian model found sensitivity in the analysis was dependent on neighbourhood size and controlling for spatial effects. No causal association could be determined from the analysis; however, the authors hypothesize a potential association given spatial patterning of exposure and outcomes in the results.
Bethea et al. 2016	Prospective cohort n=33625 participants	Housing	Tobacco use Diet Physical activity Surveillance	Overall cancer (mortality)	Prospective cohort of cancer mortality among Black women from 1995 to 2011 in the United States. Participants were followed from date of diagnosis to date of mortality, with their residence geocoded to the census tract level. A composite census tract SES score (income, housing value, rental income, education, occupation, and single-parent households) was created with principal components analysis. Lower neighbourhood SES was associated with an increased risk of cancer mortality among participants, after controlling for education, income and health status. + lower neighbourhood SES is associated with increased risk of cancer mortality
Beyer et al. 2016	Individual cross-sectional n=1265 participants	Public services Urban design	Screening	Breast and colorectal cancer screening (adherence)	Examination of neighbourhood influences on breast and colorectal cancer screening behaviour among women in Wisconsin. Perceived neighbourhood quality was collected from the sample, and then compared with screening adherence rates. A perception of being safe from crime and free of garbage was associated with increased colorectal screening, while those with low

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					stress from their neighbourhood had increased mammography adherence. Perceived community maintenance was not significant. Understanding perceptions of local environments may influence screening behaviour and inform a passive approach to addressing low adherence rates among disadvantaged populations in the United States. + perceived safety and cleanliness associated with higher colorectal screening rates + low perceived stress from neighbourhood associated with higher mammography screening rates Ø perceived community maintenance quality was not associated with either colorectal or mammography screening adherence
Bixby et al. 2015	Ecological cross-sectional n=11950 cases nested within 50 cities	Accessibility Greenspace	Air quality Surveillance	Lung cancer (mortality)	Relationship between greenspace and lung cancer mortality in the 50 largest cities (excluding London) of England. Poisson regression was used to determine variation in lung cancer mortality between cities given their amount of greenspace. After adjusting for age, deprivation, and pollution – no significant differences in lung cancer mortality were observed between cities given the amount of greenspace coverage. Ø greenspace coverage is not significantly associated with lung cancer mortality
Boice et al. 2003	Individual cross-sectional n=935 cases	Accessibility Land use	Surveillance	Overall cancer (incidence)	Examine cancer incidence rates in proximity to the decommissioned Apollo-Parks nuclear processing facilities in Pennsylvania. Standardized incidence ratios were calculated for cases diagnosed from 1993 to 1997. No significant elevations were detected from the expected rates in the area.
Boice et al. 2009	Ecological cross-sectional n=708 cases nested in 15 municipalities	Accessibility Land use	Surveillance	Brain, bone, kidney cancer, leukemia, and lung cancer (incidence)	Follow up from previous study, examining new cases in proximity to decommissioned Apollo-Parks nuclear facilities. There was a steady decrease in cancer incidence rates among the counties adjacent to the facilities, while an increase in rates among the distant counties from 1998 to 2002. These trends suggest no

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					relationship between proximity to the nuclear sites and an increased risk of cancer incidence. Ø proximity to decommissioned nuclear sites does not correlate with an increased risk of cancer
Borkhoff et al. 2013	Retrospective cohort study n=7652592 participants in 18400 census dissemination areas	Housing	Screening	Breast, cervical, and colorectal cancer screening (adherence)	Examination of differences in screening adherence for breast, cervical and colorectal cancer among at-risk Ontario, Canada populations given neighbourhood characteristics. Immigration status and neighbourhood SES was correlated with screening histories to elicit disparities in adherence. Those residing in low-SES, and high-immigrant areas had the lowest uptake for all three screening tests. Even in a universal healthcare system, disparities remain suggesting a need for targeted adherence in disadvantaged populations. - residence in a low-SES, and/or high-immigrant areas is correlated with lower breast, cervical and colorectal cancer screening adherence
Borugian et al. 2011	Individual cross-sectional n=229955 cases	Housing	Surveillance	Breast cancer (incidence)	Associations between neighbourhood SES and breast cancer incidence across Canada. A Poisson regression model was used to determine the variations in relative risk of breast cancer by primary residence area SES classification. Women in the lowest SES quintile had a 15% less chance of breast cancer diagnosis than those living in the highest quintile areas. This relationship could be related to screening behaviours among high and low-income populations. - lower SES area status is associated with a decreased risk of breast cancer incidence
Brown et al. 2016	Individual cross-sectional n=2330 thyroid, 2412 lung cases	Housing	Surveillance	Lung and thyroid cancer (incidence)	Relationship between residential location, and risk of lung or thyroid cancer incidence in Toronto. The analysis was moderated by SES, ethnicity and immigration status. Cases were disaggregated from postal code classifications to point locations using a Gaussian randomized spatial distribution technique. Distributions of lung and thyroid cases were inversely patterned, with higher thyroid incidence in the Northeast, and higher lung incidence in the Southeast. A higher proportion of

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					immigrants in the local area, particularly of Asian descent, was correlated with higher risk of thyroid cancer and lower risk of lung cancer. SES status and African ethnicity had no significant relationship with cancer incidence patterns. + higher proportion of immigrants and Asian ethnicity is correlated with an increased risk of thyroid cancer - higher proportion of immigrants and Asian ethnicity is correlated with a decreased risk of lung cancer Ø SES status and African ethnicity has no effect
Buller et al. 2017	Protocol for a clustered randomized trial n=145 parks	Greenspace Urban design	UV radiation	Skin cancer (methods)	Introduction of shade sails to public parks of Melbourne, Australia and Denver, Colorado. Plan to monitor behavioural effects from infrastructure, by observing time spent in shade and associated UV exposure. These values could then be used to estimate the number of skin cancer cases avoided by use of built shade. Baseline observations suggest in both countries midday UVR levels could result in sunburns for individuals with short exposure. The trial results are planned to provide evidence to planners, architects and landscapers the value of developing spaces with built or natural shade to reduce sun cancer risk.
Calo et al. 2015	Individual cross-sectional n=1720 subjects	Housing Public services Transportation	Screening	Colorectal cancer screening (adherence)	Examine association between census tract-level SES measures with colorectal cancer screening adherence in Houston, Texas. Two-level random intercept regression models were used to determine the strength of the associations. Increasing levels of an individual's surrounding neighbourhood poverty and housing foreclosures correlated with worse screening adherence. These results could be used to better target colorectal screening services that reduce cancer disparity. - census tract poverty correlates with lower colorectal cancer screening adherence at an individual level
Chakraborty et al. 2017	Individual cross-sectional n=568 respondents	Land use Transportation	Air quality	Cancer risk perception (behaviour)	Elicit individual level perceptions of cancer risk from air pollution in Houston, Texas. Generalized estimating equations used to analyze spatial distributions of individual risk perceptions. Blacks and Hispanics had

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					the highest rates of concern for air pollution from industrial sources, and from previous study results tend to be located in neighbourhoods with the highest exposure levels. Controlling for source distribution and demographic factors further emphasized the difference in perceptions between White and Black populations.
Chan et al. 2014	Retrospective cohort study n=188759 cases and 315529 controls	Housing	Diet Screening	Breast cancer screening (adherence)	Explore the association between low SES status, and mammography adherence among women with diabetes in Ontario, Canada. Likelihood of a mammogram was associated with SES factors and diabetes using conditional logistic regression. Women with diabetes, when controlling for SES, had a lower adherence rate than women without diabetes. Normally these differences would be explained by SES status, but in this case, diabetes remains an independent barrier to mammography use in Ontario. Ø SES status did not moderate the likelihood of mammography use among women with diabetes
Chang et al. 2010	Individual cross-sectional n=11209 cases	Housing	Surveillance	Liver cancer (incidence)	Examine association of neighbourhood ethnic composition and SES features – rental prices and home ownership rates – with liver cancer incidence in California. Incidence rate ratios (IRR) were calculated using SEER*Stat for each ethnic group and SES classification. Neighbourhood concentrations of solely Hispanics and solely Asians led to an elevated IRR. Lower-SES neighbourhoods regardless of ethnicity also had elevated IRRs. + neighbourhood ethnic concentration, and lower SES is associated with an elevated IRR for liver cancer.
Chang et al. 2012	Repeating individual cross-sectional n=5460 cases	Housing	Surveillance	Stomach cancer (incidence)	Comparison of changes to stomach cancer incidence rates among Hispanics in California from 1988 to 2004. SEER*Stat used to calculate estimated annual percent change (EAPC) of cancer incidence. Stomach cancers were more common among foreign-born Hispanics living in lower SES and higher ethnic concentrated areas. The EAPC of most stomach cancers has increased from

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					the first cross-section, to the last cross-section among Hispanics regardless of ethnic concentration or SES. + foreign-born Hispanics living in lower SES and more ethnically concentrated areas have higher stomach cancer incidence rates
Chen 2009	Ecological cross-sectional n=67 counties	Greenspace Transportation	Surveillance	Overall cancer (mortality)	Examine spatial patterns of cancer mortality in Alabama at the county level, and contrast with socioeconomic and environmental conditions. T-tests were used to compare incidence rates by county-level conditions. Cancer mortality was higher among populations in predominantly rural white counties, while being attenuated by wealth. Interestingly, higher rates of greenspace biodiversity was associated with lower mortality rates. This analysis could help identify underserved areas, and contributions of broad environmental factors to disparities in cancer mortality. + rural counties with large white populations, mediated by their wealth, tend to have higher cancer mortality - increased biodiversity in county greenspaces tend to have lower mortality rates
Cheng et al. 2009	Individual cross-sectional n=107481 cases	Housing	Surveillance	Prostate cancer (incidence and mortality)	Examine the influence of SES on prostate cancer incidence and mortality in California. SEER*Stat was used to calculate incidence and mortality rate ratios (RR) for each SES composite index quintile. The highest SES quintile had an elevated incidence RR compared to the lowest quintile. However, the relationship was reversed for the mortality RR. SES did not account for all the variation in RRs, with age and ethnicity further moderating the relationship. + higher SES is associated with an elevated incidence RR for prostate cancer + lower SES is associated with an elevated mortality RR for prostate cancer
Cho et al. 2011	Ecological cross-sectional	Housing Transportation	Screening Surveillance	Breast cancer (stage)	Explore association between immigrant spatial concentrations and stage at diagnosis for breast cancer cases in Cook County, Illinois. Multi-level logistic regression was used to determine the interaction effects

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	n=42714 cases in 1308 census tracts				of age and race on breast cancer stage coupled with neighbourhood changes in immigration concentration between 1990 and 2000. Controlling for individual factors, a one unit increase from 1990 to 2000 in the concentrated immigrant population was associated with a 4% increase in the likelihood of a distant metastasis diagnosis. Concentrated SES disadvantage was found to be independently associated with distant stage at diagnosis, with a 5% increase in likelihood when compared at the neighbourhood scale. + concentrated immigrant population composition, and concentrated SES disadvantage is associated with more severe stages of breast cancer at diagnosis
Conroy et al. 2017	Case-control n=2838 cases and 3117 controls	Accessibility Greenspace Housing Land use Transportation Urban design	Diet Surveillance	Breast cancer (incidence)	Identify the social and built environment characteristics that account for the associations between neighbourhood SES and breast cancer risk in San Francisco, California. Multilevel logistic regression models were used to estimate the odds ratio of breast cancer from nSES, while setting a random intercept at the block group level to account for spatial clustering of individuals. Women living in the highest nSES quintile had twice the OR of those in the lowest nSES quintile. Adjustment for urbanicity and land use diversity weakened the association of nSES with breast cancer, except for Whites. These results suggest a need to target breast cancer prevention strategies to land use homogenous and richer urban communities. + high nSES is associated with elevated ORs for breast cancer across all racial backgrounds - greater land use diversity and higher densities reduce the association between nSES and breast cancer
Conroy et al. 2017	Prospective cohort n=48247 participants in 7947 block groups	Accessibility Greenspace Housing Land use Transportation Urban design	Diet Obesity Physical activity	Breast cancer (incidence)	Investigate the contributions of obesogenic built environments to breast cancer risk in California from 1990 to 2008. Regression analysis using Cox proportional hazards, associated a composite index of neighbourhood SES – population density, modal share, land use composition, number of recreational areas, retail food environment index score, traffic density, and

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					street connectivity – with postmenopausal breast cancer incidence. A lower nSES score was associated with lower breast cancer risk, however a less diverse land use composition was associated with higher risk for Latinos. These results suggest obesogenic environmental factors are independently associated with breast cancer risk. - lower nSES score is associated with lower breast cancer risk at the neighbourhood level + less diversity in land use at the block group level is associated with increased breast cancer risk for Latinos
Corbin et al. 2011	Case-control n=457 cases and 792 controls	Land use Transportation	Air quality	Lung cancer (incidence)	Inspect the occupational factors associated with lung cancer in New Zealand. Unconditional regression used to estimate the odds ratio (OR) of lung cancer, after controlling for smoking, from working in a particular industry. Those in driving-related occupation had a significantly increased OR, with the largest disparities occurring among heavy truck and freight operators. New Zealand's transportation and suburbanized landscape may create excess risk, as the country is dependent on automotive-based travel and shipping modes. + working in a driving related occupation is associated with an elevated risk of lung cancer
Danysh et al. 2016	Case-control n=436 matched case-controls	Housing Transportation	Air quality	Brain cancer (incidence)	Evaluate the contribution of major roadway proximity to childhood central nervous system (CNS) tumor cases in Texas. Multivariable logistic regression was used to determine the frequency distribution of cases to controls given a continuous variable representation of roadway proximity, while controlling for demographic features, poverty, and urban status. Maternal residential proximity (<500m) to a major roadway was positively associated with an elevated frequency of early childhood CNS tumor cases. High road density also associated with an elevated frequency of cases. + close proximity to a major roadway, and a high road density is associated with an elevated frequency of childhood CNS tumor cases.

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Dean et al. 2014	Ecological cross-sectional n=2586 individuals in 381 census tracts	Social capital	Screening	Breast cancer screening (adherence)	Assess the role of perceived neighbourhood social capital in mammography adherence among Black women in Philadelphia. Multilevel analysis of Pearson's correlations between social capital indicators and screening adherence, while accounting for census tract and individual-level covariates. A perception of higher neighbourhood social capital was associated with increased screening adherence. Leveraging these perceptions to diffuse mammography information could improve adherence in minority areas. + higher perceived neighbourhood social capital is associated with increased screening adherence
DeGuzman et al. 2017	Individual cross-sectional n=6225 cases	Housing	Obesity Screening Surveillance	Breast cancer (stage)	Explore the role of concentrated disadvantage, coupled with obesity, in affecting the odds of a late stage breast cancer diagnosis in Arlington, Alexandria, Norfolk, Richmond, and Virginia Beach in Virginia. Spatial relationships between CD and late stage diagnosis were assessed with the bivariate local indicators of spatial association method, coupled with a logistic regression and mediation analysis to assess the influence of obesity. Higher CD at the area-level was associated with greater odds of a late stage diagnosis. Obesity is significantly correlated with neighbourhood poverty, but there is no significant mediating affect on the relationship with CD and diagnosis stage. + area-level CD is associated with elevated odds of late stage diagnosis for breast cancer Ø area-level obesity rates have no mediating effect on the association between CD and stage at diagnosis
Doubeni et al. 2012	Retrospective cohort n=100566 subjects	Housing	Screening	Colorectal cancer screening (adherence)	Examine effects of neighbourhood SES on colorectal cancer screening adherence in the insured health systems of Massachusetts, Georgia and New Mexico. Chi-square tests used to compare differences in screening use by nSES quartile, with multivariate spatial models developed to control for covariates and spatial clustering of subjects. Those living in the lowest quartile were less likely to undergo a colorectal screening procedure than those in the highest quartile. However,

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					the analysis did not control for ethnicity. These results suggests screening adherence differs based on nSES even among insured populations, suggesting underlying barriers that targeted screening may not resolve for disadvantaged areas. + nSES affects colorectal cancer screening, with the lowest quintiles having significantly lower adherence
Doubeni et al. 2012	Prospective cohort n=506488 participants	Transportation	Tobacco use Diet Obesity Physical activity	Colorectal cancer (incidence)	Assess the role of diet, tobacco use, physical activity and obesity in SES disparities of colorectal cancer risk among participants of the NIH AARP Diet and Health study from California, Florida, Lousiana, New Jersey, North Carolina, Pennsylvannia; Atlanta, Georgia; and Detroit, Michigan. Poisson regression models were fitted to assess the interaction effects between behavioural risk factors, area-level SES composite index scores, and colorectal cancer incidence. BMI, physical activity, diet quality and smoking combined explained 36.2% of the association between nSES and the risk of all types of colorectal cancer. Therefore, adverse health behaviours in low-SES populations may be responsible for elevated incidence patterns of colorectal cancer. + obesity and other health behaviours explain a significant portion of colorectal cancer risk attributable to area-level SES.
Echeverria et al. 2009	Individual cross-sectional n=4589 cases	Housing	Screening Surveillance	Breast cancer (stage)	Test associations between measures of neighbourhood SES – poverty, median income, composite score – on breast cancer stage at diagnosis for Hudson and Essex counties in New Jersey. Generalized estimating equations, adjusting for age and ethnicity, were used to determine differences in the odds ratio (OR) for late stage diagnosis given the nSES indicator. Those living in areas with lowest overall nSES scores had a higher OR than those in the highest scored areas. All three measures were significant for White and Black women, but not Hispanics – only the composite score was significant for this group. The poverty-based indicator had a weaker gradient of differences in association for White women. Therefore, multidimensional composite

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					SES scores are more effective in detecting associations for breast cancer staging among diverse populations. + composite SES scores can detect associations between neighbourhood factors and breast cancer staging regardless of ethnicity
Ehrenstein et al. 2016	Case-control n=106 cases and 30569 controls	Land use Transportation	Air quality	Brain cancer (incidence)	Inspect the risks of brain tumors among children from prenatal and early age exposure to ambient air toxics in California. Pearson's correlations developed to assess covariate association between air toxics and elevated odds ratios of brain tumors, employing a varimax rotation factor analysis technique. Exposure to air pollutants during early life and maternal development is associated with increased brain tumor risk. These results suggest exposure to industrial and transportation related air toxics are responsible for some of the childhood neurological cancer burden. + exposure during developmental stages is associated with an increased risk of brain tumors among children
Elit et al. 2012	Retrospective cohort n=3713531 participants	Public services	Screening	Cervical cancer screening (adherence)	Explore the sociodemographic factors that influence cervical cancer screening behaviour in Ontario, Canada. Logistic regression models were developed to assess relationships between different factors and screening rates. Women living in the lowest SES quintile neighbourhood were half as likely to adhere to cervical cancer screening standards as those in the highest SES quintile. These results suggest even in a universal healthcare system, there are neighbourhood-level differences in screening behaviour. - lower SES status correlates with decreased odds of adhering to recommended cervical screening frequency
Eschbach et al. 2004	Prospective cohort n=2669 individuals	Public services Social capital	Surveillance	All cancer types (mortality)	Investigate Mexican-American neighbourhoods in Texas, New Mexico, Colorado, Arizona, and California for disparities in cancer mortality by ethnic concentration. Cox proportional hazard models were developed to assess the impact of Mexican-American neighbourhood concentration on individual mortality. An increase in the density of Mexican-Americans resulted in lower odds of

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					cancer mortality. This result may be a function of increased social capital, and availability of culturally-sensitive health resources in more ethnically concentrated communities. - increasing concentration of Mexican-Americans results in lower odds of cancer mortality
Eschbach et al. 2005	Ecological cross-sectional n=8291 cases in 5725 census tracts	Accessibility Housing	Surveillance	Breast, cervical, colorectal, lung and prostate cancer (incidence)	Assess the role of ethnic concentration in modifying the incidence ratio for various cancers among Hispanics in Connecticut, Iowa, New Mexico, Utah, Hawaii; Detroit, Michigan; Atlanta, Georgia; San Francisco-Oakland, California; and Seattle, Washington. Poisson regression was used to establish correlations between ethnic composition and risk ratios, while controlling for age, income, and housing characteristics. Decreases in Hispanic census tract density increased the incidence of breast, colorectal and lung cancer. There was no observed relationship for cervical and prostate cancer sites. As the Hispanic population becomes more assimilated in the United States, individuals may lose a valuable sociocultural source of cancer prevention. - increasing concentration of Hispanics results in lower odds of breast, colorectal and lung cancer Ø no observed association for Hispanic density and incidence of cervical and prostate cancer
Flores et al. 2013	Repeating individual cross-sectional n=7619 (1990) and 11967 (2000)	Social capital	Screening Surveillance	Breast cancer (stage)	Identify the individual and community-level determinants of breast cancer stage at diagnosis in California during 1990 and 2000. T- and chi-square tests were used to assess levels of significance between individual and community-level factors – social capital as measured by a poverty and education index. From the 1990 to 2000 cross-sections, there was a significant decrease in advanced stage diagnosis for Black, White, and Asian women living in the most impoverished areas. However, there has been no change for Hispanic women between cross-sections.

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Freedman et al. 2011	Individual cross-sectional n=15374 participants	Accessibility Housing Land use Urban design	Air quality	All cancer types (incidence)	Explore associations between neighbourhood features – SES, ethnic composition, crime, segregation, residential stability, connectivity, air pollution, and density – and cancer incidence across the United States. Used 2-level random intercept logistic models to assess the intraclass variability in cancer outcomes attributable to each neighbourhood indicator. Living in a more segregated and higher crime area was associated with greater incidence of cancer among men and women. These results suggest neighbourhood social factors play a significant role in cancer risk. + residence in a more segregated and higher crime area is associated with increased risk of cancer incidence
Fryzek et al. 2001	Ecological cross-sectional n=107227 cases across 5 counties	Accessibility Land use	Air quality	Lung cancer and all other cancer types (mortality)	Assess the cancer impacts of chromium emissions from the PG&E plant in Hinkley, California. Age-adjusted mortality rates for lung cancer and all other types of cancer were calculated for each of the surrounding counties (n=3) and control counties (n=2) outside of the Hinkley airshed. Comparison of the rate ratios found no statistically significant differences in cancer mortality between the exposure and control counties. However, the presence of a funding relationship between the authors and PG&E severely limits the veracity of these findings.
Gany et al. 2013	Ecological cross-sectional n=321 stores	Accessibility Land use	Tobacco use	Cancer risk (incidence)	Probe associations between smokeless tobacco availability and school proximity in New York City, to identify potential cancer risk disparities. Store shelf inventory results were contrasted with the location of public schools, while identifying variations in surrounding cultural composition. Smokeless products tended to be sold in more ethnically diverse neighbourhoods, with the product format often aligning with the dominant cultural background of the surrounding community. Therefore, smoke-free school policies could be ineffective in reducing tobacco use among youth in ethnic minority neighbourhoods, leading to higher incidence rates among these populations.
Garshick et al.	Retrospective cohort	Transportation	Air quality	Lung cancer (mortality)	Scrutinize the associations between vehicle exhaust and lung cancer mortality in a group of United States long-

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
2008	n=31135 cases	Urban design			haul trucking workers. Proportional hazard regression was used to assess differences between length of employment, job type, and mortality risk. Results indicated regardless of job type, length of employment positively associated with mortality risk, even after controlling for smoking behaviour. The largest sources of risk include operating a diesel truck, working in a core-area urban environment, and being involved in loading dock operations. + employment in a trucking-related occupation is associated with higher risk of lung cancer mortality
Gensburg et al. 2009	Retrospective cohort n=3081 participants	Accessibility Housing Land use Public services	Air quality Hazards	Breast, bladder, cervical, colorectal, kidney, lung, ovary, prostate, stomach cancers, and leukemia (incidence)	Inventory cancer incidence patterns among residents of the former Love Canal brownfield site in Buffalo, New York from 1979 to 1996. Univariate analyses were performed to compare standardized incidence ratios (SIRs) for Love Canal residents compared to the rest of the state. Elevated SIRs were found for bladder and kidney cancers among former residents, with no elevated SIRs for other cancers. These results correlate with other studies that have found similar incidence patterns among those exposed to contaminated air, soil and water in the Love Canal area during childhood. + residence in the Love Canal area is associated with an increased risk of bladder and kidney cancer Ø no elevated risks were found for leukemia or breast, cervical, colorectal, lung, ovary, prostate and stomach cancers
Glanz et al. 2000	Clustered randomized trial n=756 participants across 14 sites	Greenspace	UV radiation	Skin cancer (incidence)	Test the effectiveness of a skin cancer prevention program affecting childhood sun protective behaviours at outdoor recreation sites in Oahu, Hawaii. Univariate analyses were performed to assess differences between the educational and education/environmental interventions. The education/environment arm was not superior to the education arm. Sun protection policies were implemented in sites exposed to both intervention arms, and there was an improvement in children's use of shade in the treatment arms of the study. Interventions had been partly maintained at the 3-month follow-up.

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					- educational programming that targets shade use can reduce skin cancer risk among children
Glanz et al. 2001	Clustered randomized trial n=176 participants	Greenspace	UV radiation	Skin cancer (incidence)	Test the effectiveness of the above-mentioned interventions on the staff associated with the outdoor recreation childhood programming in Oahu, Hawaii. Multivariate models were used to assess the effects of the programming on staff behaviour at baseline, post-intervention, and follow-up. Similar results were found for staff members, with no superiority found for the education/environment treatment in improving shade use compared to the education treatment. - educational programming that targets shade use can reduce skin cancer risk among outdoor staff
Glanz et al. 2015	Clustered randomized trial n=435 pools	Greenspace Urban design	UV radiation	Skin cancer (incidence)	Assess the effectiveness of a skin cancer prevention program at outdoor pools in the United States. Program consisted of a basic educational program, or an enhanced educational program that provided environmental shade interventions. Level of intervention maintenance at baseline, post-test, and follow-up were compared between the two treatment groups. Enhanced condition pools had greater maintenance at three-year follow-up and had implemented more sun protective policies, and in some cases had added additional environmental supports to reduce skin cancer risk. - environmental interventions at outdoor pools are more effective in promoting shade use
Goldberg et al. 1999	Individual cross-sectional n=3730 participants	Accessibility Land use Public services	Air quality Hazards	Bladder, colorectal, esophagus, kidney, liver, lung, pancreas prostate, skin and stomach cancer	Determine if men living close to the Miron Quarry landfill in Montreal, Canada had higher risk of various cancers than men in more remote locations. Odds ratios from incidence data were calculated from a linear or categorical exposure-distance metric. Elevated risks for pancreas, liver, and prostate cancer were found in the immediate surrounding area of the site, and a further cluster of pancreatic cancer was found downwind from the site. The authors note these elevated risks are not persuasive from a statistical analysis perspective, and do not align with previous findings of studies in the area.

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
Gomez et al. 2015	Individual cross-sectional n=7958 cases	Housing	Screening Surveillance	Cervical cancer (stage)	Explore the impact of neighbourhood SES on stage at diagnosis for cervical cancer among Hispanics in California. Logistic regression analysis was deployed to assess the effect of nSES characteristics on stage at diagnosis. Those living in low-SES areas had an elevated chance of a late-stage diagnosis compared to those in high-SES areas. However, those living in areas with a high density of Hispanics were found to have lower risks than those living in more diverse neighbourhoods. + living in a low-SES area is correlated with a greater chance of a late-stage diagnosis - living in a high density Hispanic area is associated with less risk of a late-stage diagnosis, regardless of nSES
Hao et al. 2009	Individual cross-sectional n=743238 cases	Accessibility Public services	Surveillance	Colorectal cancer screening (incidence and adherence)	Probe the factors associated with the decline of colorectal cancer incidence in California from 1998 to 2004. Jointpoint regression was used to examine incidence trends given county-level features, and screening availability. Rates significantly decreased for Whites with the exception of those living in non-metropolitan areas and with poor screening facility access. African American and Hispanic populations saw no decrease generally. Screening rates have increased significantly among the White population regardless of county conditions, while African Americans and Hispanics in non-metro counties with low screening access and high poverty have unchanged adherence rates.
Hart et al. 2016	Individual cross-sectional n=115921 cases	Accessibility Transportation	Air quality	Breast cancer (incidence)	Parse the relationship of particulate matter emissions and distance to roadway with breast cancer incidence among the Nurses' Health Study II cohort in the United States. Time-varying Cox proportional hazards were developed for each roadway distance classification and for each 10mg/m^3 increase in PM density. Multivariate models found little evidence of an association between increased risk of breast cancer and PM exposure. However, those living within 50m of the three largest road types had elevated risks compared to those the farthest away (>200m) by distance to residence. These

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					associations were not statistically significant given the small exposed sample size. Ø no elevated breast cancer incidence from exposure to particulate matter or proximity to roadways
Hashim et al 2016	Ecological cross-sectional n=3 neighbourhoods	Accessibility Housing Public services Transportation	Alcohol use Tobacco use Diet Obesity Physical activity Surveillance Sexual activity	All cancer types (incidence)	Examine the effects of ethnic composition and neighbourhood SES classification on cancer incidence in New York City. Stepwise logistic regression techniques were used to correlate Community Health Survey measures with neighbourhood features and age-standardized incidence rates. Neighbourhood of primary residence was a significant determinant of cancer risk. The prevalence of diabetes and substance use in Harlem and Upper East Side neighbourhoods contributed the largest portion of cancer risk. Prevention measures should focus on culturally-aware techniques that target the unique context of each community.
Henry et al 2014	Individual cross-sectional n=278097 cases	Housing Public services Transportation	Surveillance	Colorectal cancer (incidence and stage)	Associate census-tract level poverty with incidence rates and stage at diagnosis for colorectal cancer cases in Arizona, Colorado, Connecticut, Florida, Georgia, Hawaii, Idaho, Iowa, Louisiana, Minnesota, New York, New Jersey, Texas, Utah, West Virginia, and Los Angeles County, California. Two-tailed Tiwari tests were used in SEER*Stat to compute incidence rate ratios (IRR) and difference in early to late stage diagnosis rates by poverty classification. Colorectal cancer IRRs were elevated in the most impoverished areas for Whites, Blacks and Asians. However, there was an inverse association for Hispanics, with high poverty leading to a low IRR. Stage at diagnosis was linearly correlated with increasing poverty, with the most impoverished areas having the greatest number of late stage diagnoses. + high poverty results in an elevated rate of colorectal cancer among Whites, Blacks and Asians - high poverty has an inverse association with colorectal cancer incidence among Hispanics + stage at diagnosis is positively associated with poverty; high poverty areas have later stages at diagnosis

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
Holowaty et al 2010	Ecological cross-sectional n=238326 individuals across 27049 census tracts	Accessibility	Surveillance	Lung and prostate cancer (incidence)	Investigate the geographic variation of lung and prostate cancer incidence across dissemination areas of the Wellington-Dufferin-Guelph public health unit in Ontario, Canada. Elliptical analysis was used to compared predicted incidence ratios to actual distributions, while controlling for spatial effects using Bayesian techniques. Use of the Moran's I statistic identified spatial clusters of lung cancer in the urban core of Guelph, and clusters of prostate cancer in the Orangeville area. Mediation analysis found household income attenuated the lung cancer patterns but had no effect on prostate cancer clusters. This analysis demonstrates the feasibility of small scale spatial analysis of cancer incidence patterns.
Hurley et al 2014	Ecological cross-sectional n=106731 cases across 423970 exposure zones	Urban design	Circadian rhythm	Breast cancer (incidence)	Evaluate the impact of artificial light sources on breast cancer risk, using information from the California Teachers Study. Cox proportional hazard models were developed to estimate the hazard ratio from each indicator of light at night. Increased risk was found among women living in areas with the highest levels of ambient outdoor light at night. These results may contribute to the hypothesis that light at night disrupts circadian rhythm and melatonin production, increasing breast cancer risk. + ambient outdoor light at night is associated with increased breast cancer risk
Hystad et al 2012	Methods extension of a case-control study n=8353 individuals	Accessibility Land use Transportation	Air quality	Lung cancer (methods)	Explore the role of residential mobility in shaping the results of a lung cancer exposure assessment in Canada. Spatial surface models were developed to estimate exposure from industrial and transportation sources, and compared with traditional linear regression models. PM2.5 exposure were best predicted by the spatial surface models. NO2 and O3 exposure was best predicted by linear regression. Applying the models to study participants, over half of cases were classified into different exposure levels given the type of model. The results demonstrate the importance of using of a time-based linear regression model to account for variations in exposure given residential history.

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
Hystad et al 2013a	Cohort analytic n=2390 cases and 3507 controls	Accessibility Land use Transportation	Air quality	Lung cancer (incidence)	Probe the influence of ambient air pollution and proximity to traffic-based emission sources on lung cancer incidence in Alberta, British Columbia, Manitoba, Newfoundland, Nova Scotia, Ontario, PEI, and Saskatchewan, Canada. Two-level random intercept regression models, accounting for longest-term residence, were employed to determine associations between each pollutant and odds of lung cancer. PM2.5 had the most significant impact on elevating lung cancer incidence ratios, followed by NO2 and then O3. Those living within 100m of a highway were found to have potentially higher risks, but not significant. No relationship was observed for proximity to major roadways and lung cancer risk. + PM2.5, NO2, and O3 have a significant association with elevated lung cancer incidence ratios Ø road proximity measures had no significant association with lung cancer incidence
Hystad et al 2013b	Cohort analytic n=1224 cases and 1802 controls	Housing Transportation	Air quality Alcohol use Tobacco use Diet Physical activity Surveillance	Lung cancer (incidence)	Determine the influence of long-term neighbourhood SES on lung cancer incidence in Alberta, British Columbia, Manitoba, Newfoundland, Nova Scotia, Ontario, PEI, and Saskatchewan, Canada. Two-level random intercept logistic regression models were developed to assess associations, while controlling for residential location using a random intercept term. Significantly higher odds of lung cancer were found in the most deprived areas. Subsequent mediation analyses found adjustment for known risk factors still revealed a significant relationship, with smoking behaviour as the strongest predictor of incidence. However, an even stronger predictor was study entry SES-level, mediating over half of the influence of long-term SES. + high deprivation is associated with increased lung cancer incidence, even after controlling for known risk factors
Islami et al 2013	Individual cross-sectional n=34981 cases	Accessibility	Surveillance	Breast, colorectal, lung, prostate	Probe the relationships of neighbourhood of residence and ethnicity with stage at diagnosis for cancer cases in New York City. Multi-nominal logistic regression models

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
				and all other types of cancer (stage)	were used to compare stage at diagnosis odds ratios with neighbourhood features. Ethnicity and neighbourhood of primary residence had significant and independent effects on stage at diagnosis. Ethnicity had a larger impact than neighbourhood on cancer stage. Overall, advanced stage diagnoses are declining, particularly among colorectal sites – indicating early successes with targeted screening programs in New York City. + ethnicity and neighbourhood of residence are significant predictors of late stage cancer diagnosis
James et al 2012b	Ecological cross-sectional n=not reported	Accessibility Land use	Air quality	Cumulative cancer risk (incidence)	Examine ethnic and income disparities in cancer risk from air toxics in Cancer Alley, Louisiana. OLS linear regression was employed to determine associations of each predictor independently and jointly. Individuals in low-income census tracts experienced higher cumulative risk, while Black areas saw elevated risk compared to White areas. Further spatial analysis found exceptionally magnified impacts for poor communities with significant concentrations of Black people. These disparities could be the result of poor land use control in predominantly Black communities, allowing the location of emissions-intensive industrial land uses in close proximity. + ethnicity and income are associated with an elevated cumulative risk of cancer from air toxics
James et al 2016	Prospective cohort n=108630 participants	Greenspace Urban design	Air quality Physical activity Surveillance	Cancer risk (mortality)	Assess the influence of greenness on cancer mortality in the United States Nurses' Health Study cohort. Cubic regression splines were used to assess linear relationships, while likelihood ratio tests were employed in non-linear scenarios. Analyses were stratified by age, smoking status and individual-level SES. Elevated mortality rates were found for individuals with the least "greenness" surrounding their primary residence. Mediation analysis found the relationship flowed through physical activity rates, PM2.5 exposure, social engagement, and self-reported mental health. - increased "greenness" is associated with reduced cancer mortality, mainly from increased physical activity, lower

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					PM2.5 exposure, improved social engagement, and positive mental health
Janitz et al 2016	Case-control n=307 cases and 1013 controls	Accessibility Land use Transportation	Air quality	Leukemia (incidence)	Investigate childhood traffic-related air pollution exposure and incidence of acute leukemia in Oklahoma. Conditional logistic regression was used to evaluate the association between NO2 emissions, road density and childhood incidence, accounting for week of birth. There were similar distributions of exposure between cases and controls, however elevated incidence rates were found for children residing at birth in urban areas. No significant associations were observed for road density or road proximity measures. + urban residence is weakly associated with increased incidence of acute leukemia Ø road proximity and density measures have no observed association with acute leukemia incidence
Jarret et al 2012	Simulation model n=not reported	Transportation	Physical activity	Breast and colorectal cancer (incidence)	Estimate the effects of walking and cycling on costs to the England and Wales health systems from breast and colorectal cancer incidence. Monte Carlo simulations were developed to calculate the estimated number of cases avoided from increased utilitarian physical activity. Approximately UK£ 17 billion in healthcare and tertiary response costs would be saved after 20 years of moderately increasing walking and cycling for transport. These effects could have a time lag due to disease processes, with some savings not realized until 30 to 50 years after the sustained increase.
Jemal et al 2005	Ecological cross-sectional n=30 cancer registries	Accessibility Public services	Surveillance	Prostate cancer (mortality)	Associate geographic patterns of prostate cancer mortality with access to medical care in the United States. Assessed differences between Whites and Blacks using Pearson correlation analysis. Results suggest geographic variation in mortality rates may be partially influenced by access to medical care. Whites tend to have lower mortality rates than Blacks when holding access to care constant, however non-metro areas have significantly elevated mortality rates, even with lower incidence rates, compared to metro areas.

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					+ lower access to care partially explains the geographic variation in prostate cancer mortality
Jia et al 2008	Ecological cross-sectional n=159 sampling locations	Accessibility Housing	Air quality	Lifetime excess cancer risk (incidence)	Inspect the variations in volatile organic compounds from air emissions – shaping cancer risk – in Ann Arbor, Ypsilanti, and Dearborn, Michigan. Wilcoxon signed rank tests were used to compare variations in risk exposure. Over a quarter of sampled residential locations had benzene, naphthalene, chloroform, and carbon tetrachloride emissions that exceeded EPA standards for lifetime excess cancer risks. The highest concentrations were observed in urban and industrial areas.
Keller & Howe 1993	Individual cross-sectional n=421 cases	Accessibility Transportation	Air quality Surveillance	Colorectal and lung cancer (incidence)	Probe non-tobacco related risk factors of lung cancer incidence, compared to colorectal trends, in Cook County, Illinois. A mean expected value was calculated and then compared to the actual incidence rate, controlling for tobacco use. Cases among White and non-White females were elevated, while cases among males were significantly lower than expected. The elevated patterns had no detectable spatial clusters and were consistent with population distributions. Urban residence and air pollution does not appear to be an independent risk factor of lung cancer. Ø lung cancer is not independently determined by urban residence and air pollution exposure
Kheirbek et al 2012	Ecological cross-sectional n=70 monitoring stations	Accessibility Land use Transportation	Air quality	Cancer risk (methods)	Scrutinize the spatial variations in cancer risk from benzene, BTEX and formaldehyde emissions in New York City. A step-wise model building technique was used to arrive at a spatial regression model that fit estimated pollutant concentrations to monitoring data. BTEX emissions exhibited the largest spatial variability, corresponding with density of traffic signals and solvent-use industries. Variation in benzene exposure were influenced by total roadway length and traffic signal density. Formaldehyde emissions were predicted by traffic signal density, road length, and interior building area. These modelling techniques appear to accurately simulate cancer risks from land use and transportation emissions in an urban area.

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
Kim et al 2010	Prospective cohort n=111129 cases	Housing	Tobacco use Diet Obesity Physical activity Surveillance	Colorectal cancer (incidence)	Explore the relationships between neighbourhood SES and risk of colorectal cancer for women in the United States. Cox proportional hazards were developed to assess the influence of neighbourhood SES on incidence ratios. Colon cancer sites were not associated with nSES, except among college educated women with higher nSES. Also, higher nSES was inversely correlated with rectal cancer sites. Mediation analysis found these correlations were explained by red meat intake, multivitamin use, and body mass index. - higher SES results in lower colorectal cancer risk among women, particularly those college-educated
Kim et al 2013	Prospective cohort n=134569 cases	Transportation	Physical activity	Cancer risk (mortality)	Associate physical activity levels with cancer mortality in California. Cox proportional hazards were developed, adjusting for age, sex and tobacco use, from five physical activity indicators. These ratios were then subjected to a global Wald test to assess the independent and joint influence of each indicator. Prolonged voluntary sitting (watching TV) or sitting while driving or taking transit was not associated with increased cancer mortality risk. Ø cancer mortality risk is not associated with physical inactivity through voluntary sitting or transportation
Kloog et al 2010	Ecological cross-sectional n=164 countries	Urban design	Circadian rhythm	Breast, colorectal, larynx, liver, and lung cancer (incidence)	Investigate contributions of exposure to light at night with breast, colorectal, larynx, liver, and lung cancer incidence in 164 countries. OLS regression models were used to analyse correlations, with a spatial dependency term added to control for autocorrelation. Breast cancer had a significant positive association with light at night exposure. There was no significant relationship for all other cancer types. + breast cancer is associated with light exposure at night Ø colorectal, larynx, liver, and lung cancer are not associated with light exposure at night
Knox 2005	Retrospective cohort n=12018 cases	Accessibility Housing Land use	Air quality	Leukemia and all other cancer types (mortality)	Identify air toxics emitted from industrial sources in the United Kingdom, and associate with childhood cancer mortality. Relative risk ratios for mortality were created from comparing number of short range to hazard-births

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
		Transportation			to deaths. Excess RRs were found within 1.0 km of bus stations, hospitals, heavy transportation facilities, railways, and oil refineries. High concentrations of cancer at birth were found within 0.3 km of bus stations, hospitals and heavy transportation facilities. Little to no risk were found for proximity to railways and incinerators. These excess rates are likely the result of exposure to particulates from combustion processes. + proximity to bus stations, hospitals, heavy transportation facilities, railways and oil refineries is associated with increased childhood cancer mortality Ø proximity to railways and incinerators is not associated with excess childhood cancer risk
Knox 2006	Retrospective cohort n=12017 cases	Accessibility Housing Transportation	Air quality	Leukemia and all other cancer types (mortality)	Evaluate the role of transportation emissions in childhood cancer mortality across the United Kingdom. Relative risk ratios for mortality were created by estimating the nearest hazard to a case, and then comparing nearby births and deaths. Elevated RRs were found for children living within 0.5 km of bus or rail infrastructure. The suspected carcinogen in these cases is 1,3-butadiene exposure from diesel engines. + proximity to bus or rail infrastructure is associated with excess childhood cancer mortality risk
Knox 2008	Ecological cross-sectional n=352 local authorities	Accessibility Housing Public services Transportation	Air quality Alcohol use Tobacco use	Brain, breast, colorectal, esophagus, lung, ovary, pancreas, prostate, stomach, skin, and uterine cancer (mortality)	Analyze the geographic relationships between emissions and cancer mortality rates in English cities. Comparisons at the city level were completed with linear regression equations that compared the standardized mortality ratios to emission levels, controlling for substance use. Lung and stomach cancers were associated with substance use controls, and emissions. Bladder, colorectal, esophagus, and pancreatic cancers were associated with only substance use controls. All other cancers had no significant associations with either variables. These results may be representative of other factors, and combustion may not be the independent driver of mortality at the city level. Additional factors could include housing security, transportation patterns, proximity of sensitive to noxious land uses.

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					+ lung and stomach cancer mortality is associated with substance use and emissions at the city level + bladder, colorectal, esophagus, and pancreatic cancer mortality is associated with substance use at the city level Ø brain, breast, ovary, prostate, skin, and uterine cancer mortality is not associated with substance use or emissions at the city level
Ladabaum et al 2013	Individual cross-sectional n=16159 subjects and 153804 controls	Housing Social capital	Surveillance	Colorectal cancer (incidence)	Inspect California Cancer Registry colorectal cancer cases to elicit associations of neighbourhood factors with incidence patterns. Variations in colorectal cancer by neighbourhood SES and ethnic concentrations were compared using incidence rate ratios. Ethnic concentration was inversely associated with incidence among Asians, while nSES was inversely associated with incidence among Whites. Colorectal cancer appears to vary greatly among Asian subpopulations, with neighbourhood factors significantly influencing patterns of incidence. + lower nSES is associated with an increased risk of colorectal cancer among Whites + lower ethnic concentration of Asians is associated with increased risk of colorectal cancer
Leader & Michael 2013	Individual cross-sectional n=2668 participants	Urban design Social capital	Screening	Breast, cervical, and colorectal cancer screening (adherence)	Probe the role of social capital and adherence to screening recommendations for breast, cervical, and colorectal cancer in the Philadelphia metro area. Bivariate analyses were used to establish differences, while logistic regression models associated screening rates with social capital features. Higher social capital was a significantly positive feature of breast and colorectal cancer screening, but not cervical cancer. Social capital may be influenced by the built environment through the design of spaces that either provide for or detract from opportunities for interaction. + social capital increases the chance of adhering to breast or colorectal cancer screening recommendations Ø social capital has no effect on cervical cancer screening

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
Lee et al 2017	Individual cross-sectional n=549547 cases	Accessibility	Obesity Surveillance	All cancer types (incidence)	Identify geographic distributions of childhood cancers in New York City. Once correlation coefficients were calculated for each cancer type, a Bernoulli spatial scan statistic was used to detect clusters. Moderate correlations at the neighbourhood level were observed for obesity and childhood cancer incidence. This method of emergency department-based surveillance could be useful in identifying environmental risks of cancer.
Lian et al 2012	Simulation model n=4205 cases	Accessibility Housing Public services Transportation	Screening Surveillance	Breast cancer diagnosis stage (methods)	Test nine GIS-based measures of accessibility to mammography facilities – shortest travel time, average of five shortest travel times, service density, unweighted service catchment area, continuous weighted area, 3-timezone-quick weighted area, 3-timezone-slow weighted area, 6-timezone-quick weighted area, and 6-timezone-slow weighted area. Each measure was associated with odds of late-stage cancer diagnosis in St. Louis, Missouri. The analysis consisted of first calculating Spearman rank correlation coefficients for simple effects modelling, then Kappa coefficients to test agreement between each measure. Global and local Moran's I tests were used to assess spatial autocorrelation effects of each measure. Predictive validity of each measure was assessed using a generalized linear mixed logistic regression model that associates each measure with neighbourhood-level risk of a late-stage diagnosis. The travel time measures showed the lowest correlations, and no agreement. Only the 6-timezone-weighted service catchment area metrics were associated with increased odds of a late-stage diagnosis when controlling for sociodemographic neighbourhood features. This method appears to be the most valuable for use in geospatial analysis of epidemiological trends for breast cancer.
Lin & Wimberly 2017	Ecological cross-sectional n=11296 cases in 229 census tracts	Accessibility Housing Public services Transportation	Screening Surveillance	Breast and colorectal cancer (stage)	Inspect geographic variations in late stage breast and colorectal cancer diagnosis given neighbourhood factors – urban/rural residence, SES, and spatial access – in South Dakota. Chi-square tests were first used to assess associations between factors, then a two-level logistic regression model was developed to detect joint effects of

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					selected factors. Residence in isolated rural areas was significantly associated with late-stage colorectal cancer risk, however it became insignificant after adjusting for area-level SES. Thus, SES is an independent determinant of colorectal stage at diagnosis. There was no association observed for breast cancer staging across all of the neighbourhood factors. + area-level SES is associated with increased risk of late stage colorectal cancer diagnosis Ø colorectal cancer staging is not influenced by urban/rural residence or spatial accessibility Ø breast cancer staging is not influenced by urban/rural residence, SES, or spatial accessibility
Lofters et al 2011	Individual cross-sectional n=455864 subjects	Housing Land use Public services Transportation	Screening	Cervical cancer screening (adherence)	Explore the predictors of cervical cancer screening adherence among immigrant women in Ontario. To provide more accurate estimates of risk, multivariate Poisson regression models were used to estimate each predictor's influence on likelihood of screening. Country of origin had no influence on screening adherence. However, residence in a low-income area significantly decreased the likelihood of a screening exam. - low-income residence is associated with lower cervical cancer screening adherence Ø ethnicity has no influence on cervical cancer screening adherence
Lynch et al 2017	Ecological cross-sectional n=77086 participants across 3037 census tracts	Housing Transportation	Screening Surveillance	Prostate cancer (stage)	Evaluate neighbourhood factors of prostate cancer aggressiveness in Pennsylvania. A Neighborhood-Wide Association Study technique was employed to create a Bayesian hierarchical logistic regression model to determine the influence of factors. This method is based on Genome-Wide Association Study techniques. From the analysis, prostate cancer aggressiveness appears to be mainly predicted by poverty, White only residence, household poverty, living alone, renting a home built before 1939, population density, household income, immigration, and commuting to work by public transit.

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					Therefore, the housing and transportation environment can affect stage at diagnosis for prostate cancer.
Ma et al 2017	Ecological cross-sectional n=4 monitoring sites	Land use Transportation Urban design	Air quality	Lifetime cancer risk (incidence)	Analyze the cancer risk from polycylic aromatic hydrocarbons (PAHs) in Gold Coast, Australia road dust, using transportation and land use factors. Statistical modelling techniques were used to develop a set of factors that influence PAH concentration based on air sampling data. Fine road dust appears to have a cancer risk, while those bound to coarser materials do not pose significant risk. These particulates are emitted from land use and transportation sources, and tend to become trapped in “urban canyon” areas of high-density environments.
MacKinnon et al 2007	Ecological cross-sectional n=18683 cases in 9112 block groups	Housing	Screening Surveillance	Breast cancer (stage)	Assess the connection between SES and late stage breast cancer diagnosis in Florida. A spatial scan statistic was used to identify block groups with elevated late stage diagnosis and then determine the degree of influence by block-level SES quintiles. Census tracts with severe or near poverty levels were more likely to have a late-stage diagnosis than richer neighborhoods. Tracts with low mammography use also had significantly elevated late-stage breast cancer incidence than other tracts. + high poverty and/or low mammography use is associated with an increased chance of late stage breast cancer incidence
Mahalingaiah et al 2014	Prospective cohort n=85251 participants	Accessibility Housing Land use Transportation	Air quality Tobacco use Diet Physical activity	Uterine cancer (incidence)	Correlate road and particulate matter (PM) exposures to uterine cancer risk in California. Cox proportional hazards models were developed to assess the relationship between the road and PM factors with cancer risk. Living close to a major road, and exposure to PM10 was not associated with an increased risk of uterine cancer. However, exposure to PM2.5 significantly elevated the risk of uterine cancer incidence over 2-year, 4-year, and cumulative periods. + exposure to PM2.5 is associated with uterine cancer

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
Major et al 2010	Individual cross-sectional n=409775 cases	Accessibility Housing Land use	Alcohol use Tobacco use Diet Obesity Physical activity Surveillance	All cancer types (mortality)	Examine the relationship between neighbourhood SES and cancer mortality in California. Multivariable Cox regression models were developed to associate nSES and other factors with the mortality hazard ratios. Those in most deprived areas had an elevated risk of cancer mortality, even after controlling for other well-known risk factors. SES deprivation has an independent relationship with cancer mortality. + deprived areas have elevated risks of cancer mortality
Major et al 2014	Individual cross-sectional n=494988 participants	Housing Transportation	Alcohol use Diet Physical activity Surveillance	Liver cancer (mortality)	Investigate the effects of neighbourhood level factors – SES, alcohol outlet density, individual behaviours – on liver cancer mortality among AARP study members living in California, Florida, Lousiana, New Jersey, North Carolina, Pennsylvania; Atlanta, Georgia; and Detroit, Michigan. Multilevel Cox proportional hazards were created, with a random effect term to estimate geographic variations, and controlling for individual-level factors. Liver cancer mortality was influenced by socioeconomic deprivation, with alcohol outlet density, physical activity, and diet explaining a significant portion of the variation. Targeting prevention efforts, coupled with environmental interventions, could reduce mortality in deprived areas. + deprived areas tend to have higher rates of liver cancer mortality
Markwick et al 2014	Individual cross-sectional n=34168 participants	Accessibility Housing Public services	Alcohol use Tobacco use Diet Surveillance	Cancer risk (incidence)	Identify determinants of cancer risk among Aboriginals in Victoria, Australia. Developed prevalence ratios (PR) for Aboriginals and non-Aboriginals using generalized linear modelling with a log function and assumed binomial distribution, controlling for age and sex. Aboriginals had an elevated cancer PR, with increased psychosocial stress, lower SES, higher substance use, and poor diets compared to non-Aboriginal people.
Mazumdar et al 2016	Ecological cross-sectional	Accessibility Land use Public services Transportation	Air quality Alcohol use Physical activity	Breast, cervical, colorectal, and	Scrutinize the effects of neighbourhood design and walkability on hospital admissions due to breast, cervical, colorectal and lung cancer incidence in the Australian Capital Territory. Monte Carlo regression was used to investigate relationships identified through a

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
	n=39581 patients nested by census tract	Urban design		lung cancer (incidence)	spatial scan statistic, with a negative binomial model applied to confirm associations. There was an increased risk of cancer hospitalization when living in less walkable areas or living in an outlying suburb. However, there is low statistical power to the study, and wide confidence ratios when assessing cancers independently. + overall risk of hospitalization from cancer increases when living in outlying suburban areas, or less walkable communities Ø breast, cervical, colorectal, and lung cancer is not independently associated with neighbourhood factors
McNamara et al 2017	Individual cross-sectional n=24768 cases	Housing Urban design Safety	Obesity Surveillance	All cancer types (incidence)	Probe the extent of housing and neighbourhood conditions contributing to cancer incidence in the United Kingdom and Ireland. Age-adjusted risk ratios were calculated to build regression models, controlling for various factors to assess independent and joint effects. Adjusting for housing and neighbourhood factors, reduces the SES differences in cancer incidence. Poor neighbourhood quality appears to have a larger effect than poor housing quality. Therefore, these factors likely mediate the relationship between SES and cancer incidence at the neighbourhood level. + poor housing and neighbourhood quality is associated with higher cancer incidence
Meshefedjian et al 2016	Individual cross-sectional n=10726 participants	Accessibility Housing Public services	Tobacco use Diet Screening Surveillance	Breast, cervical, and colorectal cancer screening (adherence)	Inspect the influence of deprivation, access to care, and lifestyle factors on screening behaviour in Montreal, Canada. The Rao-Scott X2 test was used to analyze bivariate associations, followed by developing a multivariable logistic regression model. Use of screening services increased as material deprivation declined, access to health services improved, tobacco use was reduced, and diet quality improved. Prevention policies should target screening outreach to deprived and isolated communities to improve adherence. + reducing material deprivation, increasing access to service, and altering lifestyles results in higher breast, cervical, and colorectal cancer screening adherence

MEDICAL SCIENCES					
Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
Mezei et al 2006	Individual cross-sectional n=14601 cases	Housing	Surveillance	Brain cancer, leukemia, and all other types (incidence)	Correlate neighbourhood SES with childhood cancer incidence in Canada. Poisson regression analysis was used to associate age-standardized incidence ratios with neighbourhood SES quintiles. The pattern of childhood cancer incidence across quintiles suggests no statistically significant relationship in a universal health care setting. Ø nSES is not associated with childhood cancer incidence in Canada
Millon-Underwood & Kelber 2015	Individual cross-sectional n=5648 participants	Accessibility Housing Public services	Screening	Breast cancer screening (adherence)	Probe the characteristics that influence breast cancer screening behaviour among women in Milwaukee, Wisconsin. Multivariate logistic regression models were used to assess influence of each factor independently. Women who reside outside the inner city and have local access to mammography clinics tend to have higher screening adherence. + residence outside of the inner city and having local access to a clinics is associated with improved screening adherence
Mobley et al 2017	Individual cross-sectional n=1000000 cases	Accessibility Housing Land use Public services	Screening Surveillance	Breast cancer (stage)	Determine the effects of residential isolation on late stage breast cancer diagnosis in the United States. Two models – one place-centred, and one person-centred – were constructed using the Generalized Linear Latent and Mixed Model procedure. Asians living in an isolated (ethnically concentrated) community tend to have lower risk of a late-stage diagnosis. Whites living in an isolated area tend to have higher risk of a late-stage diagnosis. + late stage breast cancer diagnosis risk is increased among Whites living in isolated communities - late stage breast cancer diagnosis risk is decreased among Asians living in isolated communities
Molina et al 2017	Individual cross-sectional n=536 participants	Social capital	Screening	Breast cancer screening (adherence)	Parse out the neighbourhood level barriers to mammography among Latinas in Western Washington State. Ran three sets of the multinomial regression model to assess influence of neighbourhood characteristics. Women living in the highest concentrated neighbourhoods tended to identify economic-based barriers to screening. Policies that

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					target eliminating economic barriers in highly segregated Hispanic communities could increase screening rates.
Morello-Frosch & Jesdale 2005	Ecological cross-sectional n=45710 census tracts across 309 metro areas	Accessibility Land use Transportation	Air quality	Cancer risk (incidence)	Link racial residential segregation with disparities in cancer risk from ambient air toxics across the United States. A Poisson linear regression model was deployed to compare the population cancer risk index with residential segregation quintiles. Segregated tracts had elevated levels of ambient air toxics. After controlling for SES, increasing segregation correlated with increasing cancer risk, with the largest disparities among Hispanics. These effects of segregation on cancer risk are likely the result of historical inequities in local infrastructure and zoning decisions that target marginalized communities. + residential ethic-based segregation correlates with elevated cancer risk from air toxics
Ng et al 2004	Interrupted time series n=not reported	Public services	Surveillance	Cervical cancer (mortality)	Review cervical cancer mortality trends by neighbourhood SES in Canada from 1971 to 1996. Poisson distributions of the annual age standardized mortality ratio were used to assess trends, and variances by nSES quintile. Over the study period, cervical cancer mortality rates have significantly declined in urban areas. The implementation of targeted screening programs at the local level is likely responsible as more severe cases have been avoided through early detection.
Osiecki et al 2013	Ecological cross-sectional n=70 census tracts	Accessibility Housing Social capital	Surveillance	Cancer risk (incidence)	Identify the spatial distributions of environmental cancer risk given sociodemographic conditions in Chicago, Illinois. Bivariate models were used to assess correlations between factors, spatially weighting using a queen matrix rook. Spatial autocorrelation was tested for using the Global Moran's I method. Predominantly poor and Black census tracts had elevated non-point cancer risks, and increased incidence rates. Further local autocorrelation tests are required to confirm spatial relationships of environmental cancer risk.
Palmer et al 2012	Prospective cohort	Housing	Alcohol use Tobacco use	Breast cancer (incidence)	Assess the link between individual and neighbourhood-level SES with breast cancer incidence among African-American women in California, District of Columbia

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
	n=54896 participants		Physical activity Screening Surveillance		Georgia, Illinois, Indiana, Louisiana, Massachusetts, Maryland, New Jersey, New York, and South Carolina. Incidence rate ratios were compared with SES exposures using generalized estimating equations. Negative SES factors – income, housing value, rental income, education, occupation, and family structure – correlated with increased breast cancer incidence at the individual and neighbourhood levels. + lower SES is correlated with elevated breast cancer incidence at the individual and neighbourhood level
Pan et al 2005	Case-control n=2908 matched cases and controls	Accessibility Land use	Air quality Surveillance Hazards	Lung cancer (incidence)	Scrutinize the effect of naturally occurring asbestos on lung cancer incidence in California. Multivariate logistic regression models were developed to assess the association between proximity and incidence. Proximity to asbestos deposits was calculated with a Wilcoxon rank-sum test. Increasing proximity to naturally occurring sources of asbestos by 10 km intervals increased the odds of lung cancer incidence. + proximity to naturally occurring asbestos is associated with lung cancer incidence
Papathomas et al 2011	Individual cross-sectional n=271 cases and 2977 controls	Accessibility Land use Transportation Urban design	Air quality Physical activity	Lung cancer (incidence)	Probe gene-environment interactions in shaping lung cancer among non-smokers in the United Kingdom. Profile regression analysis was used to identify subpopulation clusters, revealing covariate relationships. The use of gene profile regression strengthened the results of previous studies, suggesting even more significant links among non-smokers between lung cancer and PM10 air pollution.
Parikh & Wei 2016	Ecological cross-sectional n=2 areas	Land use Transportation	Air quality	Breast cancer (incidence)	Compare breast cancer incidence patterns between metro Atlanta and rural Georgia given polycyclic aromatic hydrocarbon (PAH) and PM2.5 emissions. ANOVA regression analysis was used to determine significance of emission density for incidence. The Atlanta metro area had a significantly elevated annual incidence rate compared to rural Georgia from 1992 to 2011. Emissions of PAHs and PM2.5 were significantly associated with these elevated incidence rates. Thus, air

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					pollution in urban areas could be associated with increased breast cancer risk. + PAH and PM2.5 emissions in an urban setting are associated with elevated risks of breast cancer incidence
Parise & Caggiano 2016	Individual cross-sectional n=163569 cases	Accessibility Housing Land use Transportation	Surveillance	Breast cancer (mortality)	Examine disparities in breast cancer mortality by ethnicity, SES, and urbanization in California. Cox proportion hazards were used to assess risk of mortality by ethnicity, SES and urbanization measures. Log-rank tests were used to determine survival ratios. Contingency tables were used to assess regional variations in mortality. Blacks and American Indians had elevated mortality across the majority of regional areas. Asians and Hispanics had decreased mortality rates. These variations seem to be caused by SES factors in most areas, and urbanization in the Los Angeles region.
Patel et al 2017	Repeating individual cross-sectional n=231205 cases	Housing	Surveillance	Lung cancer (incidence)	Explore correlative trends between neighbourhood SES and lung cancer incidence in California during 1988-1992, 1998-2002, and 2008-2012. Two-sided tests were used to determine significant relationships from the incidence rate ratios calculated using SEER*Stat. Across all three cross-sections, those living in the lowest nSES areas had the highest lung cancer incidence rates, regardless of sex or ethnicity. + lower nSES is associated with higher lung cancer incidence at the neighbourhood level.
Peterson et al 2014	Individual cross-sectional n=581 cases	Housing	Screening Surveillance	Ovary cancer (stage)	Determine the influence of neighbourhood SES on ovarian cancer stage at diagnosis in Chicago, Illinois. Logistic regression models, stratified by age and race, were used to assess influence. Bootstrapped samples corrected for potential bias. Greater neighbourhood disadvantage was associated with more severe tumors at diagnosis for ovarian cancer. + greater neighbourhood disadvantage results in higher odds of a late stage ovarian cancer diagnosis

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
Press et al 2016	Ecological cross-sectional n=5 counties	Accessibility Land use	Air quality Hazards	Kidney and liver cancer (incidence)	Examine clusters of kidney and liver cancer incidence in Mountain View, California from 1988 to 2011, comparing clusters around a Superfund site with four control counties. Observed and expected numbers of cases, stratified by age, sex and race, were compared at the county level. Two-sided tests at the 99% level were used to assess significance of the clusters. No statistically significant clusters were observed across the observation period. Proximity to the Superfund site appeared to not influence clusters of kidney and liver cancer cases.
Pruitt et al 2014a	Secondary analysis of a randomized control trial n=5628 cases	Accessibility	Screening	Colorectal cancer screening (adherence)	Assess the influence of spatial proximity to health services on colorectal cancer screening adherence in Fort Worth, Texas. Global Moran's I tests were used to determine spatial relationships with a lag time adjustment, followed up with a sequential additive covariate model to test neighbourhood-level effects. It appears social networks of screening patients contribute to higher overall screening adherence at the community level. Future studies should assess the influence of these networks on screening behaviour.
Pruitt et al 2014b	Secondary analysis of a randomized control trial n=3195 cases	Accessibility Public services	Screening	Colorectal cancer screening (methods)	Evaluate the performance of cross-classified models compared to hierarchical models in describing variability in colorectal cancer screening use by social factors in Forth Worth, Texas. Deviance information criterion was used to assess the performance of the Bayesian hierarchical 2-level random effects logistic regression model compared to the Bayesian cross-classified random effects logistic model. The cross-classified model was superior or equivalent in fit to the hierarchical model. However, both models exhibited similar unexplained variances when accounting for covariate measures.
Puett et al 2014	Individual cross-sectional n=121700 individuals	Accessibility Transportation	Air quality	Lung cancer (incidence)	Link long-term residential exposure to ambient particulate matter and distance to roadway with lung cancer incidence in the United States. Time-varying Cox proportional hazards were developed to assess influence of distance quartiles on incidence. Living within 50 m of an A1 road (compared to >200 m) resulted in higher lung cancer risk, particularly among non-smokers.

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					+ proximity to major roads is associated with lung cancer incidence
Raaschou-Neilsen et al 2013	Meta-analysis of prospective cohort studies n=36832 total participants	Accessibility Land use Transportation	Air quality	Lung cancer (incidence)	Probe the relationship between lung cancer incidence and long-term exposure to air pollution in London, United Kingdom. Cox proportional hazard regression models were fitted for each cohort, and then a random-effects model was used to pool the results. Increases in PM10 and PM2.5 concentrations resulted in elevated risks. An increase of 4000 vehicle-km per day on roads within 100 m of residence is associated with incidence. However, no associated was detected for nitrogen oxide concentrations and traffic density on the nearest street. + increases in PM10 and PM2.5 concentration, and increases in vehicle-km per day on roads within 100m is associated with higher lung cancer incidence Ø traffic level on nearest road and NO concentration is not associated with lung cancer incidence
Raaschou-Neilsen et al 2017	Prospective cohort n=35886 participants	Accessibility Land use Transportation	Air quality	Kidney cancer (incidence)	Relate kidney cancer incidence with long-term exposure to air pollution in London, United Kingdom. Cox proportional hazards were developed for each cohort, applying age as the time scale for the analysis. Non-statistically significant associations were found for PM2.5 concentration, NO concentration, and traffic density on nearest street for kidney cancer incidence. Ø pollutant concentration and traffic density on nearest street is not associated with kidney cancer incidence
Reyes-Ortiz et al 2008	Individual cross-sectional n=20818 participants	Housing	Surveillance	Breast, cervical, and colorectal cancer (stage)	Investigate the influence of ethnic concentration on stage at diagnosis among Hispanics in Alaska, Connecticut, Hawaii, rural Georgia, Iowa, New Mexico, Utah, and the cities of Atlanta, Georgia; Detroit, Michigan; San Francisco-Oakland, California; San Jose-Monterey, Los Angeles; and Seattle-Puget Sound, Washington. Analysis consisted of a multivariable ANOVA model, using an m2 test for associations, and an F test for significance. Hispanics living in areas with more concentrated ethnic populations were more likely to be diagnosed with late stage breast, cervical or colorectal cancer. This increased

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					risk of late stage diagnosis offsets the benefit of a lower incidence rate found in other concentration studies. + higher Hispanic concentration at the tract level is associated with late-stage breast, cervical and colorectal cancer diagnosis
Reynolds et al 2001	Case-control n=92 cases with 368 matched controls	Accessibility Transportation	Air quality	Leukemia (incidence)	Probe the role of traffic density and SES in early childhood leukemia incidence in San Diego, California. Odds ratios were calculated for each traffic density measure, using logistic regression to associate terms with a control for ethnicity and income. Neither metrics significantly correlated with childhood leukemia incidence, with only a potential difference in odds ratio between the highest and lowest SES levels. Ø traffic density and SES have no association with childhood leukemia incidence
Reynolds et al 2002	Ecological cross-sectional n=7143 cases	Accessibility Transportation	Air quality	Brain cancer, leukemia, and all other types (incidence)	Explore the influence of spatial traffic measures on childhood cancer incidence patterns in California. Poisson regression was used to determine spatial effects, with a cubic spline function applied to the exposure quartile measure. Vehicle and road density did not significantly correlate with any childhood cancers. Ø vehicle and road density have no association with childhood cancer incidence
Reynolds et al 2004	Case-control n=4639 cases with 8730 matched controls	Accessibility Transportation	Air quality	Brain cancer, leukemia, and all other types (incidence)	Examine traffic measures in California, and subsequent role in shaping childhood cancer incidence patterns. Conditional logistic regression was used to calculate odds ratios and associate them with traffic density quartiles. Traffic density did not significantly vary the distributions of childhood cancer incidence. Ø traffic density is not associated with childhood cancer incidence
Reynolds et al 2005	Ecological cross-sectional n=176302 cases	Accessibility Land use	Air quality Hazards	Breast cancer (incidence)	Scrutinize the effects of agricultural pesticide use on spatial variations in breast cancer incidence for California. Rate ratios were computed using Poisson regression models under the GENMOD procedure, adjusting for age, race and degree of urbanization. There

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					was no observed variance in breast cancer incidence for areas with high and/or low pesticide applications. Ø pesticide application is not associated with breast cancer incidence
Richardson et al 2010	Ecological cross-sectional n=2603 cases across 1009 census tracts	Accessibility Greenspace	Air quality	Lung cancer (mortality)	Analyze the socioeconomic gradient in greenspace exposure to elicit associations with lung cancer mortality in New Zealand. Negative binomial regression models were used to develop incidence rate ratios, controlling for age, sex, SES, tobacco use, PM10 emissions, and population density. Greenspace varied by SES, with deprived neighbourhoods having less area. When compared with lung cancer mortality rates, there was no significant relationship detected across all tracts. Ø greenspace area is not associated with lung cancer mortality at the tract level
Roberts & Chen 2006	Simulation model n=1 incinerator	Accessibility Land use Public services	Air quality	Cancer risk (incidence)	Assess the cancer risk from an incinerator in Wales, United Kingdom. A prospective health risk assessment approach was used to estimate cancer risk, based on the US EPA Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. The probability of new cancers from the 25-year operation of the facility is 1.8%, translating to potentially one additional cancer.
Rundle et al 2013	Case-control n=574 case-control matched pairs	Housing	Surveillance	Prostate cancer (stage)	Examine SES variations in stage at diagnosis for prostate cancer in Detroit, Michigan. A neighbourhood socioeconomic status index was developed, and then associated with prostate cancer aggressiveness using a generalized estimating equation, assuming a Poisson distribution. Higher nSES classification was associated with increased odds of an aggressive prostate cancer diagnosis, only partially moderated by screening frequency. Stronger mediating factors may be access to healthcare resources, transportation, and occupation. + higher area SES is associated with increased odds of an aggressive prostate cancer diagnosis
Singh & Jemal 2017	Repeating individual cross-sectional	Housing	Surveillance	Breast, cervical,	Investigate disparities in cancer mortality and incidence by SES and ethnicity from 1950 to 2014 in the United

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
	n=not reported			colorectal, esophagus, liver, lung, prostate, stomach, and all other types of cancer (incidence and mortality)	States. Weighted least squares regression models were fitted to age-adjusted mortality rates annually at the county level. Log-linear models were used to estimate annual rates of changes. Across the study period, individuals in more deprived areas have experienced higher rates of incidence. The largest excess risks occur for cervical, colorectal, liver, lung, and stomach sites. Further, between 1979 and 2011, widening income and education gaps have accelerated the growth of mortality in predominantly Black deprived areas. Social policies that affect housing and community stability could be a primary determinant of the broad variance in risks.
Sposto et al 2016	Individual cross-sectional n=12098 individuals	Housing Land use Transportation	Surveillance	Breast cancer (mortality)	Examine variations in breast cancer mortality by ethnicity in California. A Cox multiple regression model was used, deploying two-sided tests for significance. African-Americans have significantly elevated breast cancer mortality odds compared to White and Hispanic populations. Assessment of stage at diagnosis, nSES, and smoking revealed significant prediction of mortality. + African-Americans have elevated rates of cancer mortality from neighbourhood-level factors
Stark 2000	Protocol for an individual cross-sectional study n=197 participants	Accessibility Housing Land use	Air quality Hazards	All cancer types (incidence)	Protocol for the assessment of cancer incidence among former residents of Love Canal in Buffalo, New York during 1940 to 1978. Only descriptive statistics are presented as the small sample size limits the potential for any significant exploratory analysis. The planned results of this study are to determine the second-generation cancer effects of exposure to the pollutants at the Love Canal brownfield site.
Steenland et al 1998	Case-control n=994 cases and 1085 controls	Transportation	Air quality	Lung cancer (incidence)	Relate lung cancer incidence to air pollutant exposure among truck workers in the United States. Logistic regression was deployed, adjusting for age, ethnicity, smoking, diet, and asbestos exposure. Increasing cumulative exposure correlated with increased odds of lung cancer after controlling for major lifestyle factors. The primary determinant of this relationships is exposure to elemental carbon.

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					+ working in the trucking industry is associated with lung cancer incidence
Stewart et al 2012	Interrupted time series n=19 cases	Accessibility Urban design	Hazards	Cancer risk (incidence and mortality)	Probe the potential cancer risks from a telecommunications tower installed in Sandwell, England. Standardized incidence and mortality ratios were developed for four time periods: 1993 to 1995, 1999 to 2001, 2001 to 2003, and 2002 to 2004. These ratios were compared with rates of the surrounding West Midlands area to determine if there was clustering occurring around the tower. There were no significant elevated cancer rates observed in the ward around the tower across all time periods. The authors cannot conclude proximity to the tower is associated with cancer incidence given the statistical power limitations. Ø proximity to a telecommunications tower is not associated with increased cancer risk
Studnicki et al 2006	Ecological cross-sectional n=330 observations across 66 counties	Public services	Surveillance	Cancer risk (mortality)	Determine the effects of special healthcare taxing districts on cancer mortality risk in Florida. ANOVA was used to assess the influence of county-level characteristics on the outcomes. Linear mixed-effects regression was used to determine the significance for age-standardized mortality ratios. Implementation of a local healthcare tax was associated with lower age-adjusted cancer mortality. The study of taxation may be an interesting contribution to cancer prevention and control research and policy. - local healthcare taxation is associated with lower cancer mortality at the county level
Suhayda et al 1997	Protocol and evaluation of an individual cross-sectional study n=390 individuals	Accessibility Public services	Screening	Breast, cervical, colorectal, prostate, skin, and all other types of cancer screening (adherence)	Analyze the effects of a mobile cancer screening program in Pittsburgh, Pennsylvania. Basic descriptive statistics are presented for the intervention. Of 390 patients screened, 57 breast, 3 cervical, 7 colorectal, 21 prostate, and 53 skin cancer cases were diagnosed. In addition, of 390 screened, 40 returned for their follow up exam, and 11 met their third adherence target. Mobile clinics set up in public or community clinic spaces could be a better

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					approach to reaching vulnerable and disadvantaged communities in urban settings.
Sutradhar et al 2017	Individual cross-sectional n=2537960 subjects	Accessibility Public services	Screening	Breast cancer screening (adherence)	Examine the socioeconomic factors associated with breast cancer screening adherence in Ontario, Canada – a universal healthcare setting. To account for time and spatial patterns, a non-homogenous multistate Markov model was used to determine breast cancer screening adherence variation. The chance of adherence was significantly higher for those that live in wealthier areas, have better access to consistent primary care provider, and hold higher education. + neighbourhood SES and access to care are significant predictors of mammography adherence in a universal healthcare setting
Thomas Ray et al 2016	Retrospective cohort n=28408 individuals	Accessibility	Surveillance UV radiation	Skin cancer (incidence)	Identify spatial clusters of basal cell carcinoma in northern California. Clusters were identified with a Poisson spatial scan statistic. Median income within identified clusters was higher than areas with no detectable clusters. Identifying skin cancer cases through spatial techniques could be useful in targeting educational campaigns to vulnerable populations.
Torabi et al 2014	Repeating individual cross-sectional n=7249 cases	Accessibility Urban design	Surveillance	Colorectal cancer (mortality)	Explore geographic factors that influence the variation of colorectal cancer mortality in Manitoba, Canada – a universal healthcare setting. A spatial Poisson mixed model was used to estimate the influence of each geographic factor on individual mortality outcomes. Urban areas located in the southern portion of the city have elevated mortality rates compared to suburban areas. In addition, between the 1977 and 2009 cohorts, SES has become a predominant predictor of mortality with lower SES areas having the largest proportion of colorectal cancer mortality. + area-level SES is associated with increased colorectal cancer mortality
Tousey et al 1999	Case-control	Housing Transportation	Air quality Tobacco use	Lung cancer (incidence)	Investigate the determinants of elevated lung cancer incidence among Whites in Jacksonville, Florida. Odds ratios were developed using a stratified logistic

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
	n=507 cases and 1007 controls		Diet Obesity Surveillance		regression analysis, controlling for individual factors. Smoking was a significant determinant of risk among Whites, along with increased dietary fat intake. Residential patterns, air quality from mobile sources, and occupation had little effect on risk. + diet is a predictor of lung cancer risk in Whites Ø residential location, air quality, and occupation has a marginal effect on lung cancer risk
Tsui et al 2013	Ecological cross-sectional n=2502 census tracts	Accessibility Land use Public services	Screening Vaccines	Cervical cancer risk (incidence)	Correlate access to safety-net clinics with cervical cancer risk from HPV infections in Los Angeles, California. Multivariate ordinary least squares regression was used to associate distance to clinic with cervical cancer risk at the neighbourhood-level. Clinics were more likely to be located in high-risk urban areas, however in suburban locations there is poor accessibility. Even though low-vaccinated areas are well-served, there is significant disparities in uptake warranting action that improves knowledge of screening and HPV prevention.
Urayama et al 2009	Individual cross-sectional n=380 cases	Accessibility Housing	Surveillance	Leukemia (methods)	Inspect residential mobility patterns among childhood leukemia cases in California. The Pearson x2 test was used to compare differences between children that had moved, to those who lived in the same residence. Controls for urban/rural status and SES were applied to each residential record of a case. Greater residential mobility was associated with older age at diagnosis, and lower nSES. Of practical implications, the bulk of severe cases tended to be diagnosed among more mobile children, rendering current fixed residential address-based studies as ineffective in capturing true risk exposures. Future studies should account for maternal and early life residential locations to capture a history of exposure-based leukemia risks.
Vahabi et al 2015	Ecological cross-sectional n=1407060 individuals in 15 census metros	Housing	Screening	Breast cancer screening (adherence)	Determine predictors of mammography screening among immigrants in Ontario, Canada. Poisson regression analysis was performed to account for clustering effects of individuals. Screening rates among immigrants tended to be lower when living in a low-income area, not having a culturally appropriate

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					provider, and not being enrolled in primary care. Policy should focus on improving access to care, and addressing transportation barriers to reaching culturally sensitive services in a universal healthcare setting.
Vieira et al 2005	Retrospective cohort n=4385 participants	Accessibility Housing	Surveillance	Breast, colorectal, and lung cancer	Associate residence location with breast, colorectal and lung cancer incidence in Cape Cod, Massachusetts. Generalized additive models were used to create local disease odds, with pointwise permutation tests to detect increases or decreases in risk. Increasing time latency in the models from 0 to 15 to 20 years increased the significance of observed clusters. No clusters of concern were found for lung cancer, but three breast cancer clusters occurred in areas with known groundwater pollution. Further study should assess the causality of these exposures in those areas.
Wardle et al 2003	Ecological cross-sectional n=4320 students in 36 schools	Housing Transportation Urban design	Tobacco use Diet Obesity Physical activity	Cancer risk (incidence)	Analyze the effects of SES, tobacco use, diet, BMI, and physical activity on long-term risk of cancer for adolescents in London, United Kingdom. Polynomial constructs were used to assess univariate relationships between risk factors and cancer outcomes. Children in low income areas were more likely to smoke, eat a high fat diet, be overweight, and have low physical activity. Trends persisted after controlling for gender and ethnicity. These early behaviours may be increasing risk of cancer in later life.
Warner & Gomez 2010	Ecological cross-sectional n=124009 cases in 1092 census tracts	Housing	Screening Surveillance	Breast and all types of cancer (mortality and stage)	Scrutinize mortality rates for breast and all types of cancer given residential ethnic segregation in California. Cox proportional regression models were developed to assess the influence of segregation, age, year of diagnosis, marital status, and neighbourhood SES. Living in a concentrated Black neighbourhood was associated with lower mortality for women, however they were more likely to be diagnosed with a late stage cancer. Adjusting for neighbourhood SES partially diminished the significance of this relationship. + living in an ethnically concentrated area is associated with elevated risk of a late stage diagnosis

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					- living in an ethnically concentrated area is associated with lower risk of cancer mortality
Watanabe-Galloway et al 2011	Cohort analytic n=130148 participants	Accessibility Public services	Alcohol use Tobacco use Obesity Screening Surveillance	All cancer types screening (adherence)	Review behavioural trends in cancer screening use from 1997 to 2006 in North Dakota. Age-adjusted Wald chi-square tests were used to test for differences and significance. Over the study period, there has been no improvement in reducing cancer risk behaviour. In addition, binge drinking, tobacco use, and obesity are still significantly elevated among indigenous populations compared to Whites. Future policy needs to focus on building healthy community infrastructure in North Dakota Plains population areas to reduce cancer risk.
Wheatley & Sadhra 2010	Ecological cross-sectional n=1 sampling location	Land use Transportation	Air quality	Lifetime cancer risk (incidence)	Assess the cancer effects of polycyclic aromatic hydrocarbon (PAH) emissions from transport and waste management sources in the United Kingdom. Lifetime risk was estimated using an exposure unit concentration model of heavy metal, PAH, benzene, and 1,3-butadiene emissions. Emissions from transportation of clinic waste were very similar to stack emissions from incineration. The lack of incineration options increase the risk of transportation methods substantially as clinic waste must be shipped long distances to be handled in an appropriately designed landfill setting.
Wilde et al 2013	Individual cross-sectional n=62 individuals	Housing Public services Urban design	Screening UV radiation	Skin cancer screening (adherence)	Describe the results of a skin cancer screening intervention among the homeless population in Salt Lake City, Utah. The authors present descriptive statistics of the program's effectiveness in diagnosing skin cancer. Of the 62 individuals screened, 15 were diagnosed with skin cancer. Only about 10% of the screened group had adequate sun protection behaviour, significantly increasing the risk of skin cancer from UV exposure among the homeless population. Shade was the primary sun protective method homeless individuals identified to reduce their UV exposure.
Williams et al 2015	Ecological cross-sectional	Accessibility Public services	Screening Surveillance	Breast cancer (stage)	Examine the impact of spatial access to healthcare services on late stage breast cancer diagnosis in Missouri. Spatial network analysis was used to asses the

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
	n=28356 cases in 115 counties	Transportation			variation in facility access, and the impact on diagnosis. Controlling for ethnicity and area SES, women living in areas with lower access were more likely to have a late stage diagnosis. These results should guide the distribution of clinic screening resources, to ensure adequate spatial coverage of the population. + low proximity to a screening facility is associated with increased risk of a late stage breast cancer diagnosis.
Wilson et al 2015	Ecological cross-sectional n=867 census tracts	Housing	Air quality	Cancer risk (incidence)	Evaluate cancer disparities in South Carolina given sociodemographic factors. Multiple linear regression models were used to assess the influence of each factor. Risk from on-road sources was significantly elevated compared to other sources. These risks were correlated with ethnicity and home ownership. A higher percentage of non-white populations and lower home ownership rate was associated with living in a higher risk area. + ethnicity and home ownership is a predictor of living in a high cancer risk area
Woltman & Newbold 2007	Individual cross-sectional n=8327 participants	Accessibility Housing Public services	Screening Surveillance	Cervical cancer screening (adherence)	Identify individual and neighbourhood-level characteristics that explain the difference in pap testing adherence in Montreal, Toronto, and Vancouver, Canada. Multilevel logistic regression models were developed to assess significance at the neighbourhood-level of each factor. Neighbourhood-level ethnic concentration across all three metros appeared to predict screening behaviour, with the relationship persisting after controlling for culture of origin. Policies to improve screening should focus on neighbourhood-level community strategies that target vulnerable new Canadian communities.
Wong et al 1992	Ecological cross-sectional n=2451 cases across 4 counties	Accessibility Land use	Air quality	Skin cancer (incidence)	Investigate skin cancer incidence clusters among four counties in Montana. Chi-square tests used to determine significance at incidence rate per 100000 people. Residents in counties with exposure to a nearby smelting operation did not have elevated skin cancer incidence compared to control counties. However, this study was

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					funded by the Anaconda Mining Company potentially biasing the results of the reported findings.
Wong et al 2013	Individual cross-sectional n=74179 cases	Housing	Surveillance	Lung cancer (incidence)	Analyze lung cancer incidence among Hispanics in California given area-level SES. Age-standardized incidence ratios were calculated using SEER*Stat, using weighted linear regression to test significance with nSES. Higher nSES was associated with increased lung cancer incidence among women but not men. However, this result could be moderated by acculturation, with higher SES areas tending to have lower concentrations of Hispanics thus lessening the effects of social capital. + higher nSES residence is associated with increased lung cancer incidence among Hispanic women
Wu et al 2012	Individual cross-sectional n=234 individuals	Accessibility Land use Transportation	Air quality	Cancer risk (incidence)	Probe ethnic disparities in cancer risk from ambient air pollution in Camden, New Jersey. Summary statistics were computed for each concentration level, and then associated with area-level ethnicity. Ambient concentrations appeared to come from local community sources, with benzene being the largest contributing factor to cancer risk. The target community with multiple point sources had elevated risks from land use related emissions compared to a similar urban reference community with no land use point source emissions.
Yu et al 2017	Individual cross-sectional n=30690 cases	Accessibility Greenspace Housing Land use Transportation	Physical activity	All cancer types (incidence)	Assess cancer treatment costs by neighbourhood walkability in Canberra, Australia. Linear regression was used to model the relationship between WalkScore and treatment costs, with an SES interaction term. A 20-unit increase in WalkScore was associated with a 12.1% reduction in cancer treatment costs and 12.5% reduction in admissions, with the association not varying by socioeconomic status. - neighbourhood walkability is associated with hospital cancer costs, regardless of neighbourhood SES
Zeigler-Johnson et al 2011	Individual cross-sectional n=21808 cases	Accessibility Housing Transportation	Screening Surveillance	Prostate cancer (stage)	Examine the influence of neighbourhood deprivation on stage at diagnosis for prostate cancer in Pennsylvania. Pearson chi-square test were used to determine significance, while a generalized estimating equation

MEDICAL SCIENCES					
Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					calculated the odds ratio of a late stage diagnosis. African Americans living in more deprived areas had elevated odds of a late stage prostate cancer diagnosis compared to Whites. This ethnic determinant continued to persist across all nSES quartiles, with predominantly African-American areas having elevated risks. + residence in an ethnically African-American concentrated area is associated with elevated odds of a late stage prostate cancer diagnosis
Zenk et al 2006	Ecological cross-sectional n=343 neighbourhoods	Accessibility Housing Public services Transportation	Screening	Breast cancer screening (adherence)	Determine the spatial availability of affordable mammography services in Chicago, Illinois contrasting with ethnicity and SES factors. OLS regression was used to determine the spatial effects of screening availability on adherence, controlling for spatial lag using Lagrange Multiplier tests. Access to a facility by auto and public transit tended to decline as neighbourhood deprivation increased, with African-American neighbourhoods having the largest disparities in access by all modes. Policy should focus on redistributing screening facilities and exploring mobile screening options to reach inaccessible areas of the city.

NATURAL SCIENCES					
Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
Anenberg et al. 2011	Simulation model n=8 regional areas	Accessibility Land use Transportation Urban design	Air quality	Avoided premature lung cancer cases (mortality)	Simulation of the relationship between particulate matter emissions and number of premature lung cancer cases. Reducing global human-made emissions by 50% could avoid ~157000 premature deaths from lung cancer. Reductions in particulate emissions from the residential, industrial and transportation sectors by 47%, 35%, and 15% respectively would contribute to achieving an overall 50% global reduction.

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
Arrieta et al. 2003	Ecological cross-sectional n=3 sampling sites	Accessibility Land use Transportation	Air quality	Estimated cancer cases (incidence)	Estimates of cancer incidence from air pollution (PM_{10}) in the Paso del Norte region. Samples were collected from 3 point-source locations then used to generate an estimate of the number of overall cancer cases caused by pollution in the regional area. Approximately 5-12 cases per 100000 people are estimated to be caused by PM_{10} emissions from transportation sources.
Cook et al. 2004	Retrospective cohort n=not reported	Transportation	Air quality	Estimated lifetime cancer risk (methods)	Explore the contributions of ambient benzene exposure to estimated lifetime cancer risk in the United States from 1995 to 1997, calculated using a time-weighted or average exposure approach. The time-weighted approach results in a more reliable estimate of risk, when compared to individual-level monitoring results, compared to the average constant exposure model.
Diaz-Robles et al. 2013	Simulation model n=not reported	Transportation	Air quality	Cumulative cancer risk (incidence)	Simulation of changes in cumulative cancer risk for Nashville, Tennessee as the result of planned reductions in air pollution from transportation sources. Modelling of the effects of the reductions was conducted using CMAQ to assess emission reductions in each 36x36 km grid cell of the Central Eastern US airshed region, with downtown Nashville as the central cell. Results found diesel particulate matter, benzene and 1,3-butadiene accounted for the majority of culumative cancer risk, with 32.8% (diesel) and 19.4% (others) reductions achieved by 2020 due to better regulation of trucking in the Nashville metropolitan area.
Grant et al. 2007	Simulation model n=47 monitoring sites	Land use	Air quality	Cancer risk (incidence)	Review the potential impacts of 1,3-butadiene (BD) and chloroprene emissions on cancer risk in Texas. Cancer incidence data from 1993 to 2002 was analyzed for correlative patterns with known static emission sources. Samples were collected from monitoring stations around these sites and then used to develop a model estimating the impacts of daily emissions from these activities. No clusters were detected within the study area; however, the sample size limits the statistical power of the study.
Hussain et al 1998	Simulation model n=not reported	Greenspace Public services	Hazards	Skin cancer (incidence)	Assess the role of water and soil-bound polycyclic aromatic hydrocarbons (PAHs) in skin cancer risk for

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					Ontario, Canada waterways. Dermal exposure risks from PAHs were estimated using toxic equivalency factors. Generally, there were no excess risks of significance from soil and water exposure in Ontario's beaches and waterways. Washing within 24 hours of exposure removes virtually all particulates from the skin. Ø no excess skin cancer risks from exposure to PAHs in suspended soil and/or water
James et al 2012	Interrupted time series n=3 monitoring sites	Transportation Urban design	Air quality Hazards	Cancer risk (incidence)	Analyze the effects of soil-based exposure to metals and polycyclic aromatic hydrocarbons (PAHs) on cancer risk in Iqualit, Nunavut, Canada. T-tests used to determine significance of excess cancers per 100000 people, and Anderson-Darling tests for normality. Paving of roads in Iqualit was associated with a significantly decreased risk of cancer from inhalation of soil particles. However, paved roads did not reduce PM2.5 exposure levels, only PM10 and total suspended particle exposure rates. - paving roads reduces excess cancer risk from inhalation of soil particles
Jia et al 2014	Ecological cross-sectional n=650000 residents in 212 census tracts	Accessibility Housing Land use Transportation	Air quality	Cumulative cancer risk (incidence)	Relate air toxics exposure to ethnic disparities in cancer risk for Memphis, Tennessee. Excess cancer risk was estimated from a linear no-threshold toxic exposure model. Spatial autocorrelations were evaluated with the Moran's I test. At the county level, there is an estimated cumulative cancer risk of 55 cases per million people. African-American counties have higher risks than White counties. The largest relative disparities are caused by point source emissions (38%), transportation emissions (23%), and population density (13%). These disparities are likely the result of Memphis' industrial land use patterns and segregation of communities into undesirable areas.
Kam et al 2013	Simulation model n=5 travel zones	Transportation	Air quality	Lung cancer (incidence)	Assess PM2.5 emissions in different Los Angeles, California transportation environments – light rail, subway, freeway, trucking highway, avenue – leading to an estimate of lung cancer risk. Each commute mode environment was sampled using mobile techniques, with lung cancer risk factors derived from these samples

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					using a toxic exposure model. The freeway environment had elevated lung cancer risks of 3.8 times the light rail environment, and 4.5 times the subway environment. However, the subway environ had significantly elevated metal concentrations, suggesting the light rail travel mode to potentially have preventative effects. - light rail transit is associated with lower lung cancer risk compared to other motorized travel modes
Kapadia et al 2016	Simulation model n=5 areas	Transportation	Air quality	Lung cancer (mortality)	Evaluate the premature lung cancer mortality from global aviation-based emissions. The relationship between aviation travel and lung cancer mortality was modelled using a concentration response function for PM2.5 emissions. Global aviation activity is estimated to cause an additional 3600 annual premature mortalities from lung cancer. Switching to ultra low sulfur fuel could reduce the annual premature mortality rate to 2980.
Kavouras et al 2015	Ecological cross-sectional n=8 monitoring stations	Land use Transportation	Air quality	All cancer types (mortality)	Estimate variations in cancer mortality rates from altering the land use patterns of Albuquerque, New Mexico. Least-squares multivariate linear regression was used to assess the influence on cancer mortality of alterations to PM2.5 emissions from land use changes. The annualized cumulative cancer risks from air toxics in the area are less than one-in-a-million, suggesting no adverse effects from current land use patterns.
Kelsall & Wakefield 2002	Simulation model n=568 cases across 39 electoral wards	Accessibility Housing Transportation	Surveillance	Colorectal cancer (incidence)	Analyze the geographic variations in relative risk for colorectal cancer in Birmingham, United Kingdom. Distribution of relative risks are modelled with a Gaussian random field model, with an assumed smooth underlying risk surface. There is little spatial variation in colorectal cancer incidence for Birmingham. There is no evidence of a relationship between Carstairs SES index and incidence patterns. Ø the Carstairs SES index is not associated with colorectal cancer incidence
Linder et al 2008	Ecological cross-sectional	Accessibility Housing	Air quality	Cancer risk (incidence)	Probe spatial distributions of air pollution related cancer risks in Houston, Texas. Statistical significance of high incident risk census tracts was subject to a Pearson's 2

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
	n=not reported	Land use			test, followed by log transformations to control for skew. Cancer risk increases with increases to the proportion of Hispanic residents in a census tract, with variations in SES deprivation. The highest risk areas are along the shipping channel. + concentrations of Hispanics are associated with increased cancer risk at the census tract level
Logue et al 2009	Ecological cross-sectional n=3 monitoring sites	Land use	Air quality	Cancer risk (incidence)	Determine methods to quantify cancer risk from air toxics in Pittsburgh, Pennsylvania. A spatial-temporal model was developed from air samples taken in the region, and then used to calculate cancer risk. Emissions from industrial sources make up the majority of cancer risk, largely centred around the downtown area. Dry cleaning air toxin emissions also significantly contribute to local-level cancer risk.
Pearson et al 2000	Individual cross-sectional n=579 individuals	Accessibility Transportation	Air quality	Leukemia and all other types (incidence)	Associate proximity to high traffic streets with childhood leukemia and cancer incidence in Denver, Colorado. Stratified analysis was performed to elicit the effects of the traffic density metrics on the odds ratios. Children living within 750 feet of a high traffic street (>20000 vehicles per day) had elevated odds of leukemia and other cancers. Distance-weighted traffic density may be associated with childhood cancer incidence. + living in proximity to a highly-trafficked street is associated with increased odds of childhood cancer
Polidori et al 2008	Ecological cross-sectional n=3 trucks at 1 sample site	Accessibility Transportation	Air quality	Lung cancer risk (incidence)	Inspect the concentrations of particulate matter in Long Beach, California to elicit estimates of lifetime lung cancer risk. Vehicles were subjected to highway and urban environment test cycles, with results used to estimate lifetime lung cancer risk. Given the modelling results, lung cancer risk is highest during rush hour traffic, and lowest during the early afternoon. Commuters travelling on the I-110 and I-710 are at elevated risk. In addition, individuals living around the Long Beach-Wilmington area face elevated risks from chronic exposure to transportation emissions.

NATURAL SCIENCES					
Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
Presley et al 2010	Ecological cross-sectional n=21 schools	Greenspace Public services Urban design	Air quality Hazards	Cancer risk (incidence)	Scrutinize schoolyard exposures to air and soil contaminants in New Orleans following Hurricanes Katrina and Rita. T-tests were performed to compare pollutant concentrations in pre and post-hurricane samples. The hurricanes appear to have elevated the risk of cancer from exposure to heavy metals, with increased concentrations of lead and thallium found in schoolyard samples. School renovation activities need to account for the surrounding property and may involve significant soil reclamation efforts to reduce cancer risk.
Shekarrizfard et al 2015	Ecological cross-sectional n=2514 individuals in 133 sampling sites	Land use Transportation	Air quality	Breast and prostate cancer (incidence)	Review the distribution of breast and prostate cancer risks from two transportation emission models in Montreal, Canada. Odds ratios were estimated using an unconditional logistic regression model. There was little difference (5-8%) between the land use and transportation-based models, with agreement significantly influenced by road length. The cost of the land use model however renders the transportation model superior for use in routine modelling situations.
Zhang et al 2016	Simulation model n=not reported	Accessibility Land use Transportation	Air quality	Excess lifetime cancer risk (incidence)	Scrutinize the excess cancer risks from PAH concentrations in the United States. Emissions were modelled using a 36x36 km grid, deriving assumptions from the National Emission Inventory and North American Land Data Assimilation System. Emissions of outdoor naphthalene and PAHs was determined to be significant in causing an excess 10000 cancer cases. These pollutants are predominantly from oil and gas refineries, transportation, and residential heating. Power generation appears to be a minimal contributor, with transportation and supportive land uses the most impactful area for regulation.

SOCIAL SCIENCES					
Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
Alford-Teaster et al. 2016	Retrospective cohort n=646533 individuals	Accessibility Public services Transportation	Screening	Mammography (methods)	Investigation of travel time as a valid metric of geographic access to screening facilities. Residential addresses of participants in a large breast cancer cohort study were geocoded to determine the travel time to the closest screening facilities compared with the travel time to their actual screening facility. Those living in more ethnically diverse urban areas and live farther from their workplace are less likely to use the physically closest facility. The results suggests those in geographically saturated screening facility environments may be less likely to use their closest facility.
Berrigan et al. 2014	Ecological cross-sectional n=935 counties	Accessibility Housing Land use Transportation	Obesity	Obesity-related cancer (mortality)	Understand the relationships between urban sprawl and overall cancer mortality from obesity-related causes in the United States. Spatial autocorrelation models were developed to determine the influence of sprawl, demographic covariates, interactions, urbanicity, county-level autocorrelation on obesity-related cancer mortality. Obesity-related cancer mortality is higher in less sprawling areas, with variations depending on the supra-regional area of county location. A more nuanced analysis incorporating SES factors would be required to elicit the reasons for the association contrary to the hypothesis of poor health in sprawling areas. - sprawl has a negative association with obesity-related cancer mortality, varying based on regional area
Buller et al. 2016	Clustered randomized trial n=4347 participants across 37 resorts	Greenspace Urban design	UV radiation	Skin cancer (methods)	The GO Sun Smart intervention delivers educational messaging and environmental modifications to vacation resort environments to reduce harmful UV exposure. The trial consisted of observing resort clients pre and post-intervention on a randomized basis. Baseline results found 40% of vacationers used shade as a skin cancer risk reduction technique, but overall vacationers were at high risk of UV exposure and subsequent elevated chances of skin cancer.
Chakraborty 2009	Ecological cross-sectional n=747 census tracts	Accessibility Housing Land use	Air quality	Estimated lifetime cancer risk (incidence)	Estimate of the spatial distribution of lifetime cancer risk from air pollution in Tampa, Florida. National air toxics data was used to generate inhalation estimates from industrial and transportation sources, thus equating to a

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
		Transportation			quantifiable lifetime risk of cancer. Spatial distributions suggest census tracts with higher population density, lower rates of home and vehicle ownership, and higher Black or Hispanic homogeneity face the highest risk. Interestingly, households with no vehicle have the most disproportionate risks compared to other census tracts. + lower rates of home and vehicle ownership are associated with higher cancer risks from air pollution at the census tract level
Chakraborty et al. 2014	Ecological cross-sectional n=1066 census tracts	Accessibility Housing Land use Transportation	Air quality	Estimated cancer risk (incidence)	Examine the spatial distribution of cancer risk from industrial and transportation sourced air pollution in Houston, Texas. Use of a spatial regression model to determine the risk associations with social factors at the census tract level. Areas with a higher rate of Hispanics, lower rate of homeowners, and higher income inequality are at significantly elevated risk from chronic and acute hazardous air pollutant exposure. Areas with higher rates of Blacks have elevated risks of chronic exposure but not acute level exposure suggesting disparities in placement of industrial pollutant sources. These populations tend to locate in higher risk areas for economic reasons, yet pollutant sources often existed prior to residential land use establishment suggesting a lack of planning controls on proximity to hazards. + Higher rates of Hispanics and Blacks, lower rates of homeownership, and higher income inequality is associated with increased cancer risk from chronic air pollution at the census tract level
Collins et al. 2015	Ecological cross-sectional n=595 households in 120 census tracts	Accessibility Housing Land use Transportation	Air quality	Lifetime excess cancer risk (incidence)	Probe whether correlations at the census tract level translate to associations at the household level for lifetime excess cancer risk disparities from air pollution in Houston, Texas. Analysis performed with generalized estimating equation to assess influence of ethnicity, renter occupancy rates, health perceptions, and residential location on cancer risk. Desire to live close to public transit among Black and Hispanic populations is associated with higher cancer risk, with further effects from homeownership and ethnic concentration. Desire to live close to work, and low knowledge of exposure was

SOCIAL SCIENCES					
Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					not associated with elevated risks. The desire to avoid discrimination may lead to concentration of these populations, further entrenching historical disparities in exposure to air pollution. + Black and Hispanic populations living close to public transit face elevated cancer risks from air pollution Ø proximity to work, and knowledge about exposures had no association with cancer risks from air pollution
Collins et al. 2015	Ecological cross-sectional n=610 households	Accessibility Housing Land Use Transportation	Air quality	Estimated lifetime cancer risk (incidence)	Estimation of the lifetime cancer risk from inhalation of hazardous air pollutants in Miami, Florida. Census tract-level SES, ethnic composition, and local land uses were identified as mediating factors that affect the distribution of risk from air pollution. + lower neighbourhood SES, higher renter occupancy status, closer proximity to place of employment, and use of bus-based transit associated with higher lifetime cancer risk among disadvantaged minority populations - presence of parks, public services, transit, and other amenities associated with a lower lifetime cancer risk
Escobedo et al. 2017	Individual cross-sectional n=10068 cases	Accessibility Public services Transportation	UV radiation Surveillance	Skin cancer (stage)	Examine the influence of patient characteristics and access to care for risk of advanced melanoma in Los Angeles, California. Unconditional logistic regression was used to associate patient and environmental factors with stage at diagnosis for melanoma. High density of clinics was associated with lower risk of an advanced tumor at diagnosis. Living farther from a clinic was associated with increased risk of an advanced case, but that association became null after controlling for demographics, health insurance type, SES indicators, and clinic density. - high density of clinics resulted in a lower risk of an advanced stage tumor at diagnosis Ø being located farther by travel time distance to a clinic had no effect on stage at diagnosis, after controlling for patient and environmental factors

SOCIAL SCIENCES					
Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
Figueroa & Breen 1995	Individual cross-sectional n=not reported	Housing Public services	Screening Surveillance	Breast and cervical cancer (stage)	Analyze the associations of three SES measures – poverty, concentrated disadvantage, healthcare service availability – with differences in stage at diagnosis for breast and cervical cancer cases in Atlanta, Georgia; Detroit, Michigan; and San Francisco, California. Logistic regression was employed for each cancer site and test the association with each SES measure. The concentrated disadvantage variable predicted an increased probability of late stage diagnosis for breast and cervical cancer cases. Subsequent moderation analyses found this variable was more effective than others in predicting late-stage diagnosis. + residence in a disadvantaged neighbourhood is correlated with an increased chance of late-stage diagnosis for breast and cervical cancer Ø poverty and healthcare service availability were ineffective measures to assess late stage diagnosis probability at the neighbourhood level
Graham et al. 2015	Ecological cross-sectional n=6 cities	Accessibility Transportation	Screening	Breast cancer screening (adherence)	Scrutinize the public transportation travel time barriers to mammography facility access for residents of Boston, Philadelphia, San Antonio, San Diego, Denver and Seattle metro areas. Population-weighted median travel times to the nearest screening facility were calculated for each metropolitan area. This travel time was compared with the census-tract rate of carless households, creating a metric of transit-marginalized tracts where travel times exceeded 30 minutes for these households. In these cities, 98% of women had access to a mammography clinic within 30 minutes by transit or anytime by car. Shifting the geographic distribution of screening facilities and providing mobile services could be eliminate remaining disparities.
Grineski et al. 2013	Ecological cross-sectional n=878 census tracts	Accessibility Land use Transportation	Air quality	Cancer risk (incidence)	Analyze the correlations between neighbourhood-level sociodemographic factors and cancer risk from air toxics in Miami, Florida. Bivariate correlations between variables were examined with two separate regression models. Areas with lower incomes, and higher concentrations of Hispanics experienced greater risk of cancer from air pollution. These disparities are likely the

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					result of freeway construction in the city, often targeted at minority neighbourhoods, which has enabled rapid suburbanization of the region and exportation of transportation pollution on poor and racialized neighbourhoods of the core area. + low SES and Hispanic concentration correlates with increased cancer risk from air pollution
Grineski et al. 2016	Ecological cross-sectional n=602 participants in 519 census tracts	Housing Land use	Air quality Hazards Surveillance	Cancer risk (incidence)	Assess the influence of environmental hazards – flood zone, proximity to chemical industries, air pollution – on disparities in cancer risk for Miami, Florida. Generalized estimating equations were developed to model relationships between hazards, neighbourhood features, and cancer risk. OLS regression was applied to test for multicollinearity in the models. Generally, Blacks and Hispanic census tracts faced greater environmental hazards that could correlate with an increased risk of cancer, with the relationship being further influenced by SES. Thus, lower SES areas experience even higher rates of cancer risk, than higher SES areas while holding environmental risks constant. + Black and Hispanic communities face disproportionate cancer risks from environmental hazards, often further compounded by SES factors
Guajardo & Oyana 2009	Ecological cross-sectional n=7782 cases in 22 neighbourhoods	Accessibility Land use Transportation	Air quality	Breast and lung cancer (incidence)	Investigate geographic patterns of breast and lung cancer incidence in the Tittabawassee and Saginaw River areas of Michigan. Odds ratios were developed for the association between cancer cases and environmental pollution. Four spatial techniques were used to test for collinearity, including the Local Moran's Test, Turnbull's method, Bithell's linear risk score, and the Lawson and Waller score. Those in close proximity to the river had a higher rate of breast cancer, while an increase in lung cancer incidence was noted for neighbourhoods in close proximity to known emission sources from industrial uses and transportation corridors. Environmental contamination in the area around the rivers should be better regulated to reduce cancer incidence.

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					+ proximity to industry and transport corridors is associated with an increased risk of lung cancer + proximity to the river area is associated with an increased risk of breast cancer
Hernandez et al 2011	Interrupted time series n=6129 cases pre and 7470 cases post	Housing	Surveillance	Colorectal cancer (stage and mortality)	Scrutinize spatial patterns of colorectal cancer stage at diagnosis and mortality rates in Miami-Dade County pre- and post-implementation of the 1996 Welfare Reform Act (WRA). Negative binomial regression models were developed for pre- and post-panels, adjusting for spatial autocorrelation by applying an inverse distance spatial lag term. There were similar distributions of late stage diagnoses across both study periods. Blacks had the highest mortality rate pre-WRA, declining post-WRA. However, significant disparities in mortality remain between Black and White populations post-WRA.
Hystad et al 2015	Case-control n=2340 cases and 2531 controls	Accessibility Land use Transportation	Air quality Surveillance	Breast cancer (incidence)	Inspect the associations between breast cancer incidence and past exposure to traffic-related air pollution in Alberta, British Columbia, Manitoba, Newfoundland, Nova Scotia, Ontario, PEI, and Saskatchewan, Canada. Unconditional logistic regression, with a spatial random effects term, was used to estimate odds ratios for breast cancer from NO2 exposure over a 20 year residential history. Measures of NO2 exposure positively correlated with elevated premenopausal breast cancer incidence rates, being slightly reduced when restricting to individuals with routine mammography histories. No associations were found for road proximity measures. + NO2 exposure is associated with an elevated risk of breast cancer in premenopausal women Ø road proximity measures had no association with breast cancer incidence
McEntee & Ogneva-Himmelberger 2008	Ecological cross-sectional n=1361 census tracts	Accessibility Land use Transportation Urban design	Air quality	Lung cancer (incidence)	Assess lung cancer incidence from exposure to diesel particulates near major highway corridors in Massachusetts. Hot spots were identified using the Gi * statistic technique, with spatial autocorrelation analysis using the Moran's I statistic. Differences between groups were assessed with independent sample t-tests. Lung

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					cancer incidence was not statistically associated with being in proximity to a highway corridor. However, certain neighbourhoods had significantly elevated emissions leading to a need to intervene through land use and transportation modal policies to reduce overall emissions from highway travel. Ø proximity to a highway corridor is not associated with lung cancer incidence
Mitchell & Popham 2008	Ecological cross-sectional n=40813236 individuals across 32482 local areas	Accessibility Greenspace	Physical activity Surveillance	Lung cancer (mortality)	Explore the influence of exposure to greenspace on lung cancer mortality in England. Negative binomial regression adjusted models were developed, controlling for income deprivation. No significant relationships were found between income deprivation and exposure to greenspace. Therefore, greenspace exposure does not mediate the relationship between income and lung cancer mortality. Ø exposure to greenspace is not associated with lung cancer mortality through income deprivation
Morello-Frosch et al 2002	Ecological cross-sectional n=700000 participants in schools	Accessibility Housing Land use Public services	Air quality	Lifetime estimated cancer risk (incidence)	Examine the environmental inequities that lead to elevated cancer risks from air pollution among schoolchildren in the Los Angeles Unified School District, California. Estimates of cancer risk were derived from inhalation unit risk models, calculated at the census tract level. Black and Hispanic children tended to have the highest burden of estimated cancer risk. Given the rapid expansion of the LA school system, stricter controls are needed on placement of schools to avoid exposures to air toxics from highways and industry.
Moy et al 2008	Simulation model n=not reported	Accessibility Land use Public services	Air quality	Cancer risk (incidence)	Estimate the cancer risk impact from waste management-related emissions in Brooklyn, New York. Cancer risk values were derived from models of inhalation unit factors for different waste management techniques. All forms of waste management were found to be within acceptable limits for cancer risk, however, in this case, the waste from energy incinerator option poses the least overall risk, while a waste transfer station

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					(including export trucking impacts) would have substantially higher risks.
Nicholson et al 2017	Ecological cross-sectional n=478 counties	Greenspace Housing Land use Transportation	Physical activity	All cancer types (incidence)	Investigate associations between local zoning policies, physical activity and cancer incidence among a sample of United States counties. Single mediation regression models were developed to test the causal influence of each zoning factor, mediated through physical activity, to associate with cancer incidence. The Sobel test was used to determine the significance of the exposure's effects on the outcome through the mediating factor. Zoning policies that prioritized crosswalks, bike-pedestrian connectivity, and cycling/walking paths was associated with reduced cancer incidence. With the exception of crosswalks, these association were fully mediated by self-reported physical activity levels. Thus, zoning policies should focus on building activity-supportive environments to reduce overall cancer incidence rates. - prioritizing crosswalks and cycling/walking infrastructure is associated with lower cancer incidence
Pastor et al 2004	Ecological cross-sectional n=not reported	Accessibility Land use Public services	Air quality	Cancer risk (incidence)	Evaluate spatial variations of cancer risks associated with exposure to air toxics among children of color in the Los Angeles Unified School District, California. Logistic base regression was used to assess the impact of air pollution cancer risk on school performance. Moving from the lowest risk schools to highest risk schools, there is an estimated 10% performance gap, after controlling for teacher performance and ethnicity. These results suggest the need for stricter land use and environmental standards in the siting of school facilities in urban areas.
Pastor et al 2005	Ecological cross-sectional n=7049 census tracts	Accessibility Housing Land use Transportation	Air quality	Cancer risk (incidence)	Investigate environmental cancer inequality using air toxics data for California. Estimates of lifetime cancer risks were distributed based on mobile and stationary sources, and then assessed with a multivariate model, controlling for income, land use, and spatial correlative factors. Race is a significant predictor of cancer risk, with Hispanic and Asian concentrated areas having the highest overall pollution risks. Black populations are more evenly distributed in their cance risk by ethnic

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					concentration. Mediation analysis found home ownership accounts for 50% of the variance in effects, 20% for presence of manufacturing employment, and 40% for commercial, industrial, or transportation uses. + residence in a Hispanic or Asian concentrated area is associated with increased cancer risk
Ransom et al 2009	Pilot test of ecological cross-sectional n=40 census tracts	Accessibility Land use	Diet Physical activity	Cancer risk reduction (methods)	Assess the influence of street-level physical activity and dietary community resources on cancer prevention behaviour in Brooklyn, New York City, piloting a novel resource inventory technique. The Kruskal-Wallis test indicated the differences in availability by ethnic group, with resource accessibility calculated using median regression models. More supermarkets, greengrocers, and fast-food restaurants were available in Jamaican neighbourhoods, while more bodegas were available in African-American areas. There were no differences in availability of health food and commercial exercise venues among White, Jamaican, and African-American census tracts. This type of inventory technique could be useful in assessing food and activity environment contributions to cancer risk at the community level.
Raun et al 2013	Ecological cross-sectional n=5 recycling centres	Accessibility Housing Public services	Air quality	Cancer risk (incidence)	Analyze the cancer risk from airborne metal particulates in Houston, Texas. Sampled concentrations were compared with EPA models of cancer risk effects, deriving a residential exposure risk value. Emissions modelling suggests a potential carcinogenic risk among communities located downwind from metal recycling facilities that poorly control smoke and dust from their activities. Further study of cancer clusters is required to confirm this hypothesized impact from emissions.
Richardson & Mitchell 2010	Ecological cross-sectional n=6432 wards	Accessibility Greenspace Land use	Air quality Physical activity Surveillance	Lung cancer (mortality)	Investigate gender-based variances in lung cancer mortality from greenspace exposure in the United Kingdom. Negative binomial regression models were developed to associate the exposure with the outcome, controlling for gender. Males showed no association between greenspace exposure and lung cancer mortality. Females had an elevated mortality rate among wards with intermediate greenspace exposure, with a

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					significant interaction effect between exposure and gender along the median quartile. However, adjusting for smoking behaviour rendered this relationship non-significant across all wards. Ø greenspace exposure varies by gender, however there is no relationship with lung cancer mortality
Richardson et al 2012	Ecological cross-sectional n=49 cities	Greenspace	Surveillance	Lung cancer (mortality)	Inspect greenspace coverage and lung cancer mortality rates in 49 United States cities. The greenspace variable was split into categories, associated with mortality using a linear regression model. No association was detected between greenspace coverage and lung cancer mortality, with income, ethnicity, air pollution and automobile dependency rendering any relationship non-significant in the entire sample. Ø greenspace coverage is not associated with lung cancer mortality at the city level
Walker et al 2015	Ecological cross-sectional n=5473 cases by census block area	Accessibility Housing Land use Public services Transportation	Surveillance	Oral cancer (incidence)	Identify the geographic variation of oral cancer incidence in the Vancouver metro area. Pearson's chi-square test as used to test for the significance of associations in spatial terms. Cochrane-Armitage chi-square tests were used to assess neighbourhood-level variations of incidence. Suburban populations had elevated risks compared to urban populations. This variation may be the result of Asian populations migrating out of the core area, or due to behavioural differences in suburban populations. + suburban populations have an elevated risk of oral cancer incidence
Wang et al 2010	Ecological cross-sectional n=37913 cases in 1245 ZIP codes	Accessibility Housing Public services Transportation	Screening Surveillance	Breast, colorectal, lung, and prostate cancer (stage)	Explore risk factors of late-stage diagnoses for breast, colorectal, lung, and prostate cancers in Chicago, Illinois. Bayesian spatial Poisson regression was used to assess the spatial effects of the risk factors. Those living in disadvantaged areas had elevated rates of late stage diagnosis for breast and prostate cancer. There was no observed association for colorectal and lung cases. + late-stage diagnosis of breast and prostate cancer is associated with neighbourhood disadvantage

SOCIAL SCIENCES					
Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					Ø neighbourhood disadvantage does not influence late stage diagnosis of colorectal and lung cancer

TABLE 2. Data extracted from qualitative studies

MEDICAL SCIENCES					
Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
Andrasik et al. 2008	Face to face interviews n=35 individuals	Public services Transportation	Screening	Cervical cancer screening (adherence)	Identify barriers to cervical cancer screening among African-American women in Miami, Florida. Participants were recruited from community-based healthcare organizations – interviewed with an open-ended set of questions. The main barriers identified by participants was poor transit access, high cost of parking in clinic locations, and a psychological barrier to accessing care from poorer populations. + transportation access and screening adherence
Cruz et al. 2007	Focus groups n=39 individuals	Accessibility Land use Public services	Alcohol use Tobacco use Screening	Oral cancer screening (adherence)	Identify barriers to prevention of oral cancer among Hispanics in New York City. Outreach workers conducted focus groups with a large residential complex, and two community agencies. Attitudes towards oral cancer screening, and knowledge of prevention techniques was limited among both community members and healthcare workers. Focus groups also identified the use of self-treatment remedies sold from local retail outlets as a structural barrier to prevention. - cultural retail outlets and oral cancer awareness
English et al. 2008	Focus groups n=25 individuals	Public services Transportation	Screening	Mammography screening (adherence)	Identify barriers to mammography screening at the individual, community and environmental level in the Navajo Nation, New Mexico. Interviews conducted by local healthcare professionals with residents were analyzed for reasons of poor adherence to screening recommendations. The improvement of transportation access, or delivery of mobile screening through local community members could be a solution to increasing adherence in remote indigenous communities. + transportation access and screening adherence

Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
Goldman et al. 2008	Face to face interviews n=37 individuals	Accessibility Land use Transportation	Air quality Diet Physical activity	Cancer risk reduction behaviour (methods)	Identify cancer risk reduction behaviours among participants of the Healthy Directions study cohort in Boston. Research team conducted interviews with participants to elicit perceptions of cancer risk, and the subsequent adaptive behaviours. Results from the interviews found the participants viewed their physical activity levels as too low, and diet quality as poor when thinking about cancer. Further, many perceived environmental factors as elevating risk including air, water and soil pollution, proximity to nuclear and coal power plants, and living in crowded cities. Participants tended to communicate cancer risk in terms of leading a healthy lifestyle.
Kanarek & Bialek 2003	Content analysis n=3082 county governments	Public services	Surveillance	Colorectal and lung cancer prevention activities (policy)	Assessment of the readiness level of local governments in implementing Healthy People 2010 cancer prevention policies. Using a content analysis coding procedure, communities were determined to be static, progressing, exemplary, or maintaining their policy status in the implementation of cancer prevention policies. Smaller and more rural counties tended to have lower capacity to implement cancer prevention and control policy objectives, with over half showing no progress since the introduction of the Healthy People 2010 mandate.
Pruss-Ustun & Corvalan 2007	Content analysis with a Delphi survey instrument n=100 subject experts	Housing Land use Public services Transportation Urban design	Air quality UV radiation	Estimated overall cancer risk (incidence)	Experts were surveyed using a Delphi technique to approximate the contributions of environmental factors to overall cancer risk. The Delphi survey estimated 19% of total risk for cancer is from environmental conditions such as pollution, diet quality, and physical activity levels driven by land use, transportation, and urban design factors. Experts also estimated there are spinoff effects for equity and sustainability by focusing on policies that reduce risk from environmental factors.
Wagner et al. 2016	Face to face interviews n=20 individuals	Accessibility Public services Transportation	Screening	Mammography screening (adherence)	Identify barriers to mammography adherence among women living in rural Georgia. Participants were recruited from local community health agencies, and individually interviewed using open-ended questions. Responses indicated poor accessibility to clinic locations, and a lack of reliable transportation. Participants also

MEDICAL SCIENCES					
Authors	Design & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					perceived they would be at higher risk for breast cancer given their rural location. + transportation access and screening adherence - urbanicity and perceived breast cancer risk

TABLE 3. Data extracted from mixed method studies

MEDICAL SCIENCES					
Authors	Methods & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
Dobbinson et al. 2014	Focus groups with 8 of the intervention schools n=100 students across 8 schools Clustered randomized trial n=25 intervention schools, and 26 control schools	Greenspace Public services Urban design	UV radiation	Skin cancer risk reduction behaviour (methods)	This study determined the impacts of installing shade structures in Melbourne secondary school playgrounds on sun protection behaviours among students. Intervention schools received an enhanced set of structures with seating and tables, while control schools only received the shade sails. Intervention and control schools were randomly assigned to their treatment. Structures with tables and chairs tended to be used more than other types, and proximity to grass tended to reduce overall use. Warmer temperatures, regardless of UV radiation levels tended to promote higher shade use. Focus groups noted shade structures tended to develop a social hierarchy that controlled use by age and status, while tables were noted by students to make the shade structure more attractive. + enhanced shade structures tended to promote better sun protective behaviours - presence of grass negatively affected shade structure use by students
Dobbinson et al. 2017	Structured observations Quantitative protocol n=3 intervention, 3 control sites	Greenspace Urban design	UV radiation	Skin cancer risk reduction behaviour (methods)	This paper describes a mixed-methods study protocol that will track the effects of installing shade structures, and enhancing the physical conditions of 3 greenspaces in Brimbank, Australia. The methodology consists of structured observation supplemented with face to face interviews and focus groups that use a piloted survey instrument. Results from the survey, and certain

Authors	Methods & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					observations will be analyzed to elicit empirical relationships between structure placement and features with sun protective behaviours. The primary hypothesis is the installation of built shade will significantly increase shade use compared to the natural shade amenities found in control sites.
Gyawu et al. 2015	Structured observation of products and purchasing behaviour Ecological cross-sectional analysis of environment around outlets n=61 retail food outlets	Accessibility Land Use	Diet	Overall cancer rates (incidence and mortality)	This study evaluates the availability of healthy food in the Alabama Black Belt, as well as identifies through structured observation the effects of cancer risk reduction messaging. Presence of convenience stores and fast food locations were found to have an impact of cancer incidence and mortality rates at the county level. In addition, more affluent and whiter counties were found to have healthier food options available across all types of outlets. + Convenience stores and fast food outlets have a significant positive correlation with county-level cancer incidence and mortality rates Ø Supermarket access did not vary based on income or ethnic composition of county
Halbert et al. 2016	Face to face interviews Individual cross-sectional n=262 participants	Accessibility Land use Public services Transportation	Screening	Colorectal cancer screening (adherence)	Identify social determinants of colorectal cancer screening behaviour among African Americans in Philadelphia. Participants were recruited from public advertisements, responding to a telephone survey about their screening behaviours, and an individual face to face interview. Neighborhood satisfaction was used as a proxy measure for land use diversity, public service availability, and transportation quality. The likelihood of screening increased with neighborhood satisfaction. During interviews, participants noted visual presence of healthcare facilities in their community tended to promote better screening behaviour. + higher neighborhood satisfaction is associated with higher colorectal cancer screening rates
Hislop et al. 2003	Face to face interviews Individual cross-sectional n=769 participants	Accessibility Public services	Screening	Cervical cancer screening (adherence)	Identify determinants of cervical cancer screening behaviour among ethnic Chinese in Vancouver and Richmond, British Columbia. Participants were

Authors	Methods & Sample	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative)
					randomly sampled from five census tracts that had a high density of ethnic Chinese residents. Reported screening behaviours were compared with centrally collected pap testing rates. Pap testing rates differed significantly based on neighborhood location, with more urban areas having lower rates. Further investigation through interviews found language barriers across both suburban and urban locales, and a lack of access in urban locations to healthcare services as significant barriers to pap testing adherence. - higher rates of urbanicity led to lower pap testing rates
Rice et al. 2015	Content analysis Individual cross-sectional n=405 participants	Housing Land use	Air quality Alcohol use Diet Obesity Screening Hazards	Risk perception for breast, cervical, colorectal and prostate cancers (methods)	This study determined African American environmental risk perceptions for breast, cervical, colorectal and prostate cancer in Charleston, South Carolina. Participants were recruited through a convenience sample at community events in the regional area, with an initial interview followed up by a piloted survey instrument. Low cancer risk tended to correlate with lower alcohol consumption and higher diet ratings. Cancer worry was correlated with substance use, low diet rating and having a recent screening examination. Generally, participants were knowledgeable about the environmental determinants of these risk factors. + cancer worry is higher among those who had a recent screening examination - perceived cancer risk is lower among those with low alcohol use and higher quality diets

TABLE 4. Data extracted from reviews

MEDICAL SCIENCES					
Authors	Review Features	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative | Q: review question)
Apostolopoulos et al. 2012	Narrative How does the transport environment increase a trucker's risk of obesity and associated cancers? Searched PubMed and TRANSPORT up to 2009 n=120 studies	Transportation	Obesity Physical activity	Overall risk of cancer (incidence)	Review of the transportation environment's effects on the risk of developing cancer through obesity. Structured along a thematic narrative review, the work identifies links between the dependence on long-distance trucking-based freight movement in North America, and a high rate of obesity in the trucking and warehouse sectors. The review then draws on the well-understood relationship between obesity, inactivity, and certain cancers. More research is needed to establish the health savings of avoiding colorectal, kidney and other cancers from modifications to transportation infrastructure and behaviours that reduce the reliance on long-distance motor freight travel in the transportation system. Q: Majority of evidence in this review is of a cross-sectional nature. The higher quality evidence (case-control studies) tended to find a weakly significant relationship between obesity and overall cancer incidence risk. + Higher levels of obesity were associated with a higher overall lifetime risk of cancer incidence
Boffetta et al. 1997	Narrative What are the known cancer risk modifications by exposure to polycyclic aromatic hydrocarbons? n=201 studies	Accessibility Land use Transportation	Air quality	Odds ratio for bladder, kidney, larynx, and lung cancer (incidence)	Diesel exhaust could potentially influence the odds of bladder, kidney, larynx and lung cancer incidence. The evidence collated in this review did not consistently show an excess incidence ratio of cancer. However, all studies did show a consistent increase in the risk of developing one of these cancers. Exposure to polycyclic aromatic hydrocarbons in urban areas is assumed to be the primary driver of lung cancer. No associations were found for the incidence of other cancers. Q: The authors conclude that the evidence cannot with certainty determine diesel pollution – particularly PAHs – cause elevated risks of cancer, and any potential association is weak in its significance compared to other risk factors. + Exposure to PAHs is weakly associated with lung cancer incidence Ø Exposure to PAHs are not associated with bladder, kidney and larynx incidence
Boothe et al.	Systematic	Accessibility	Air quality	Leukemia (odds ratio)	Exposure to harmful air pollutants while in maternal development or around birth may be associated with expression

Authors	Review Features	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative | Q: review question)
2014	How does exposure to traffic affect childhood cancer? Searched Medline, EMBASE, PsycINFO, Cochrane, ERIC, Sociological Abstracts, Social Services Abstracts, Health and Safety Sciences Abstracts, CINAHL, EconLit, Web of Science, TRIS, Global Health, Science Direct, LILACS, Enviroline, Dissertation Abstracts, and Pollution Abstracts from 1980 to 2011 n=9 studies from 17500 results	Transportation			of leukemia during childhood. A review and meta-analysis of the evidence found traffic exposure in residential locations was positively associated with occurrence of childhood leukemia. There was little evidence of other childhood cancer effects. The results of this review could be used to inform urban planning by minimizing the development of high-intensity residential, schools, parks and community centres near high traffic corridors. However, there could be a trade-off with other cancer prevention goals of increasing physical activity. Q: The limited number of studies included in the analysis influences the power of the results, and therefore, limits the otherwise statistically significant findings of the review. + Exposure to higher rates of vehicular traffic in residential locations is positively associated with increased occurrence of childhood leukemia
Brender et al. 2011	Systematic How has environmental proximity analysis been used in the assessment of childhood cancers? Searched PubMed n=25 studies	Accessibility Land use Transportation	Air quality Diet Surveillance	Brain cancer, leukemia and all other cancers (occurrence)	Environmental proximity analysis involves assessing the spatial relationships between environmental determinants and health outcomes. In the context of childhood cancers, residential proximity metrics are the most used across analyses. These metrics found traffic-related pollution, and proximity to noxious land uses as the highest proportionate sources of risk for childhood brain cancer and leukemia occurrence. Further, residential proximity to large applications of pesticides is associated with occurrence of all other cancers combined during childhood. These findings should be considered in the siting of noxious land uses, and provide evidence for the prohibition of siting schools near highways and major commercial agriculture operations. Q: The methodological limitations of the review hinder the results presented, and the limited number of studies reduce the statistical power of the overall findings.

Authors	Review Features	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative | Q: review question)
					+ Higher proximity to noxious land uses and highly-trafficked transportation corridors leads to an increased occurrence of childhood brain cancer, leukemia, and all other types of cancer
Gomez et al. 2015	Systematic What are the cancer outcomes from exposures to the social and/or built environment? Searched PubMed up to 2014 n=34 studies from 1265 results	Accessibility Housing Land use Public services Transportation	Air quality Alcohol use Diet Obesity Physical activity Screening Surveillance	Overall cancer risk (incidence)	This review explores how the built and social environment may influence cancer risk, incidence, screening and outcomes. Most of the evidence found statistically significant associations between a built/social environment factor and cancer. However, the variation in associations can be predominantly attributed to sociodemographic factors such as ethnicity, acculturation, and SES. Geographic localization tends to greatly shape patterns of biologic and environmental risk. Further, there is an interaction effect between geographic location and sociodemographic variables as certain concentrations of ethnic enclaves lead to better cancer protective behaviours compared to more scattered populations. The findings of this review demonstrate the importance of neighborhoods as a spatial analytic unit to assess the effects of built and social environment factors on cancer etiology and control. Q: This review, while limited in its search strategy, is an example of the study we base our scoping review from in its analytic strategy. + Social and built environment features, moderated by sociodemographic factors, are associated with overall cancer risk at the neighborhood level
Halpin et al. 2010	Narrative How do global trends in chronic disease align with the strategies of the New Public Health concept? n=117 studies	Land use Transportation Urban design	Tobacco use Diet Obesity Physical activity Screening Surveillance	Overall cancer (prevalence)	This review assesses the general direction of the evidence linking environmental factors and the overall prevalence of cancer. Structured along the concept of New Public Health – an iteration of the multilevel prevention model – the author concludes the most effective ways to approach cancer risk is through: 1) a health in all policies approach; 2) use of community-based interventions delivered with local actors at the societal level; 3) regulation of second hand smoke and access to tobacco; 4) regulating the location of fast food outlets through zoning; 5) improved urban design to promote physical activity; and 6) targeting health resources to prevention rather than response. Q: The theoretical framing of the review provides a methodological strength, however there is a lack of

Authors	Review Features	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative | Q: review question)
					reproducibility and no quality assessment of individual studies limiting the veracity of the findings.
Hamra et al. 2015	Systematic What is the relationship between nitrogen oxide exposures and lung cancer? Searched PubMed from 1990 to 2014 n=20 studies from 179 results	Accessibility Transportation	Air quality	Lung cancer (incidence)	Nitrogen oxides are primarily emitted from transportation and industrial sources. This review and meta-analysis found a 10 microgram per cubic metre increase of NO2 correlated with a 4 percent increase in lung cancer incidence. Measures of traffic volume and distance to roadways tended towards modest increases in the risk of lung cancer incidence. The International Agency for Research on Cancer's classification of outdoor air pollution as a Group 1 carcinogen appears to be supported by the conclusions of this analysis. Q: Geographic location could be a significant cofounder of the magnitude of relative risk of lung cancer. Further, the authors recognize that the average exposure lag of 20 years combined with no formal quality assessment as part of the analysis limits the power of the statistical results. + Nitrogen oxide pollution is correlated with risk of lung cancer
Hiatt et al. 2009	Narrative What exposures to environmental factors increase breast cancer risk? Research produced by the Breast Cancer and Environment Research Centers n=165 studies	Accessibility Land use Transportation	Air quality Alcohol use Diet Obesity	Breast cancer (incidence)	Environmental factors in the pubertal stages of life could be a primary determinant of breast cancer in later life. Through exposures to outdoor air pollution, binge drinking, poor diets and high chances of obesity – the built environment may influence exposure to known lifestyle risk factors. Chemicals found in the built environment may also elevate the risk of breast cancer incidence in later life. Early results of the research coalition suggest breast cancer etiology may be influenced by early life factors rather than later life exposures. Q: The studies collated as part of this review are limited to one coalition of research centres, potentially biasing the findings.
Krieger 2005	Narrative What critical issues around social determinants of health are relevant to understanding cancer disparity? n=75 studies	Housing Public services Transportation	Air quality Surveillance	Overall cancer risk (methods)	Social determinants tend to be influenced by built environment factors, as well as determining exposure to those factors through geographic selection. There are competing definitions of social determinants of health, focusing on either being equitable or equal in distribution of risk. Further, from a cancer perspective, much of the research focuses on environmental justice in the social determinants of cancer risk, rather than a pure public health approach. Both qualitative and quantitative research needs to integrate a strong theoretical framework to

Authors	Review Features	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative | Q: review question)
					elicit the social factors that influence cancer risk. The review provides a breadth of future directions for cancer prevention research. Q: The narrative and theoretical aspects of this review limit the applicability of its findings; however it does provide strong recommendations for future research.
Landrine et al. 2017	Systematic How does racial housing segregation contribute to cancer incidence, mortality, risk, screening or stage at diagnosis? Searched from PubMed up to 2016 n=17 studies from 668 results	Accessibility Housing Public services Transportation	Surveillance	Breast, prostate, colorectal, lung and overall cancer risk (incidence)	Housing segregation based on ethnicity could create disparities in cancer incidence, mortality and severity. Most studies captured in the review found strong associations between housing segregation and disparities in breast cancer incidence, mortality and severity. Other studies focused on colorectal, lung, prostate, and overall cancer outcomes. The most common metrics used in analyses were the isolation and dissimilarity indexes. Segregation effects were typically found within an intrastate setting, while interstate analyses tended to find less correlative effects on cancer disparity. However, many of the studies did not assess potential mediators or moderators – SES, acculturation, care availability – that could influence segregation in the analysis. Q: The authors noted multiple flaws in the reviewed studies including frequent use of invalid segregation measures; lack of diversity in types of cancer assessed; and not testing for the mediating factors of segregation effects on cancer disparity. + Racial-based housing segregation tends to correlate with increased cancer disparities.
Le & Zidek 2010	Narrative What is the state of the evidence on the link between air pollution and cancer? n=127 studies	Land use Transportation	Air quality	Lung cancer (methods)	Air pollution could be a risk factor for lung cancer, and potentially other cancers. Results surveyed suggest an association between air quality and lung cancer, while evidence for other cancers is inconclusive. However, lag time between diagnosis and exposure, and poor knowledge of confounding mediators of the associations limits the significance of the association. From an analytic perspective, the use of fixed-site sampling rather than spatially variable exposure metrics severely limits the detection of differences in activity patterns that could inform cancer prevention and control efforts. Overall, the authors recommend a null relationship between air pollution and lung cancer.

Authors	Review Features	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative | Q: review question)
					Q: The methodological flaws of the review constrain the reliability of the findings; however, the authors do adopt a more conservative approach by recommending a null finding for the association between lung cancer and air pollution. Ø air pollution has a null association with lung cancer and all other cancers
Manju et al. 2009	Systematic What is the quality of the evidence linking bladder cancer risk and transportation occupations? Searched MEDLINE from 1977 to 2008 n=30 studies	Transportation	Air quality Physical activity	Bladder cancer (incidence)	Transportation-based occupations such as driving, logistics, and construction could be associated with bladder cancer risk. The review collated case-control studies focused on truck drivers, bus drivers, and railroad workers. Stratification of the reported pooled risks by study publication year found a significant relationship for truck drivers (1.18) and bus drivers (1.23) and incidence of bladder cancer, while no significant relationship was found for railroad workers. The authors hypothesize that long-term exposure to polycyclic aromatic hydrocarbons could be responsible for an increased rate of bladder cancer incidence. Further, proacted periods of inactivity could also be a mediating pathway for bladder cancer risk among driving-based occupations. Q: The study design adopts a systematic review methodology, yet due to heterogeneity in research designs only pooled risk analyses could be performed on the captured studies. Poor reporting of case-control samples also limits the power of the statistical findings. + those in truck and bus related occupations had a higher risk of bladder cancer incidence Ø those in railroad related occupations had no increased risk of bladder cancer incidence
Morello-Frosch et al. 2002	Narrative What are the environmental inequities in cancer risk for Southern California? n=3 studies	Accessibility Housing Land use Public services Transportation	Air quality	Overall cancer risk (incidence)	Environmental inequities in Southern California tend to be the result of disproportionate exposure to air pollution, poor housing choice and transportation access, and low quality public services. For minority populations, this creates disparities in the overall risk of cancer. These populations tend to be ethnically concentrated and have lower socioeconomic status than the general population. The siting of public facilities and housing away from noxious land uses and major transportation corridors would lower overall risk. Smaller

Authors	Review Features	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative | Q: review question)
					factories pose a unique regulatory challenge, as they are often unregistered in local hazard databases. Q: The geographic restriction to Southern California limits the transferability of the findings and policy recommendations to other settings.
Solomon & Balmes 2003	Narrative What are the health effects of diesel exhaust? n=68 studies	Transportation	Air quality	Lung cancer (incidence)	Diesel exhaust could be a potential determinant of lung cancer, as well as other forms of cancer. Multiple cohort studies have found associations between diesel exhaust and lung cancer incidence among transportation related occupations. Regulatory changes have reduced on-road sources of diesel emissions; however, risk remains among those chronic exposures in trucking and bus related settings. Q: The methodological limitations of the review could influence the power of the reported associations. + Diesel exhaust exposure is linked with increased lung cancer incidence among trucking and bus related occupations
Stevens 2001	Narrative How does circadian disruption contribute to the long-term risk of breast cancer? n=87 studies	Urban design	Alcohol use Circadian rhythm	Breast cancer (incidence)	Experimental studies have found decreased melatonin production among those working in nighttime occupations. Decreased melatonin production has been linked to breast cancer incidence and severity. The alteration of built environments to limit nighttime artificial light exposure, coupled with improved circadian rhythms among those working in nighttime settings could reduce breast cancer risk. Q: Methodological limitations of the review limit the applicability of the findings. Further, given the limited experimental evidence, the associations reported in this review are considerably weaker than other breast cancer risk factors.
Stevens & Rea 2006	Narrative How does circadian disruption modify the risk of developing breast cancer? n=71 studies	Land use Public services Transportation Urban design	Circadian rhythm	Breast cancer (incidence)	Artificial lighting in the built environment could be related to circadian disruption. This disruption results in lower melatonin production, which is a known biologic risk factor of breast cancer. The largest barrier to addressing artificial lighting is the dominance of engineering standards in setting visual performance requirements rather than reducing the negative effects on human biologic processes. A focus on reducing circadian disruption could be a promising area of research for breast cancer risk reduction.

MEDICAL SCIENCES					
Authors	Review Features	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative | Q: review question)
					Q: Methodological limitations of the review limit the applicability of the findings. Further, given the limited exploration of experimental evidence available, the reported associations could be biased towards a positive relationship.

NATURAL SCIENCES					
Authors	Review Features	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative | Q: review question)
Stober et al. 1998	Narrative What is the association between diesel exhaust exposure and lung cancer among truck drivers? n=11 studies	Accessibility Land use Transportation	Air quality	Lung cancer (incidence)	Diesel exhaust exposure could be associated with lung cancer incidence among truck drivers. Chronic exposure to polycyclic aromatic hydrocarbons was found to be associated with elevated lung cancer incidence in some studies, yet half of the studies did not adequately control for smoking habits or report confidence intervals. Overall, the evidence suggests no relationship between diesel exhaust exposure and lung cancer incidence. Q: The methodological limitation of the search strategy could be biasing the results towards the null; however, the authors completed a rigorous analysis of each study's designs. Ø truck drivers exposed to diesel exhaust showed no elevated rates of lung cancer incidence

SOCIAL SCIENCES					
Authors	Review Features	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative | Q: review question)
Aneja et al. 2011	Narrative What are the applications of GIS technology to oncology research? n=20 studies	Accessibility	Surveillance	Overall cancer risk (methods)	Geographic information systems (GIS) have been used in cancer research to: 1) create heat maps of mortality; 2) show distributions of screening and care services to identify geographic disparities; and 3) determine associations between socio-demographic variables and cancer outcomes. The implementation of GIS in cancer control practice is limited by knowledge about spatial analysis techniques in medicine and public health, and resourcing issues caused by data availability and interoperability. GIS techniques, while currently limited in

Authors	Review Features	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative | Q: review question)
					their use, could be an important tool in cancer prevention and control policy efforts. Q: The evidence collated as part of this review merely applied GIS in associative cross-sectional analyses. Furthermore, many studies failed to apply spatial autocorrelation techniques to validate results thus limiting the quality of evidence.
Bailey & Solomon 2004	Narrative What are the cancer risk effects of pollution from sea-based shipping ports in the United States? n=220 studies	Accessibility Land use Transportation	Air quality	Lung cancer risk (incidence)	Seaports are the site of intensive transportation emissions, potentially having an impact to lung cancer risk. The review captured multiple studies that found an elevated risk of lung cancer incidence from long-term exposure to diesel exhaust. A handful of these studies were also conducted near shipping port locations. Overall, the authors recommend residential areas be located far away from industrial and commercial shipping activities, while also considering the transportation (ie. truck and rail) effects of moving goods to and from port locations. Q: Given the methodological limitations of this review, and potential funding bias from the Sierra Club, the results of this review are considered marginally weaker than similar studies. + closer proximity to shipping port locations leads to higher risk of lung cancer incidence
Maantay 2002	Scoping How have spatial variables been mapped and measured in analyses of cancer risk in the Bronx? Research from the author's knowledge of research in the Bronx from 1993 to 1999 n=13 studies	Accessibility	Air quality Surveillance	Overall cancer risk (methods)	Environmental equity analysis aims to assess disparities in cancer risk from environmental determinants. The authors reviewed the state of equity-based analytic techniques in assessing the environmental determinants of cancer. The current methodological paradigm is limited by: a lack of comprehensive datasets about hazards; inadequate exposure metrics; poor methodologies for assessing spatial relationships between exposures, confounders, and outcomes; and insufficient population-level health information. Findings from these types of studies could be improved through increased methodological rigour in exposure assessment; deploying GIS technology to understand spatial relationships; and incorporating local-level planning and zoning policy contexts to provide more specific recommendations. Q: The selection of only studies conducted in the Bronx area of New York limit the transferability of the findings and recommendations to other research settings.

SOCIAL SCIENCES					
Authors	Review Features	Env. Factor	Risk Factor	Cancer	Findings (+ positive | Ø mixed | - negative | Q: review question)
Maxwell et al. 2010	Scoping How is remotely sensed geographic information used in cancer research? Searched PubMed, Scopus, Science Direct and 7 other databases n=5 studies from 650 results	Accessibility Land use Transportation	Air quality	Overall cancer risk (methods)	Remotely sensed geographic information systems can be used to understand spatial relationships in complex systems. Aerial photographs, LandSat satellite imagery, and remotely sensed land cover data was collected for use in studies assessing exposure to pesticides for bladder, breast, non-Hodgkin's lymphoma, and overall cancer risk. Satellite imagery is widely available around the globe at fine grain resolutions. Therefore, it could be an important resource for spatial-based exposure assessments of overall cancer risk. The largest challenge is converting raw spatial data into meaningful exposure metrics, potentially requiring new methodologies for spatial-based analyses of pesticides, air pollution, land use and other hazards. Q: The low number of results suggests potential methodological flaws in the scoping data assessment process. Most air quality studies in our review used a form of remotely sensed data – in particular, land use regression modelling.

TABLE 5. Data extracted from commentaries

MEDICAL SCIENCES					
Authors	Premise	Env. Factor	Risk Factor	Cancer	Findings
Asare et al. 2017	Comment on the social determinants of health as a theoretical framework to address cancer disparities and minority participation in cancer research. The United States has struggled to address socio-ecological factors of health, giving rise to a need for the environmental justice movement.	Accessibility Housing Land use Public services Transportation	Screening Surveillance	Cancer screening (adherence)	The social determinants of health theory is a useful construct to understand barriers to screening, disparities in cancer outcomes, and low participation by vulnerable populations in research. A lack of reliable transportation, poor access to screening facilities, and poor-quality living spaces can compromise screening adherence. These difficulties are further compounded by ethnic, income, gender identity, age and sexual orientation. The integration of the theory into cancer screening practice could improve screening adherence and increase participation in cancer research.
Ashe et al. 2011	Exploration of local government powers to shape behaviours through policy and legislation that would improve population health and in turn reduce cancer risk. Local governments often possess a “police” power to regulate in the public interest. However, local governments can be limited by their respective state legislatures, and often struggle with a reactive inertia to enact policy changes.	Accessibility Greenspace Housing Land use Public services Transportation Urban design	Air quality Tobacco use Diet Physical activity	Cancer risk (policy)	Local governments in the United States have a range of policy and legislative options available that could reduce the overall risk of cancer caused by behavioural or environmental factors. For example, implementation of mixed use development policies in planning documents could improve physical activity; safer street designs; rezoning to allow more grocery stores and farmers markets that could improve the food environment; creating “joint use” agreements to leverage community spaces for more local public service delivery; and minimum setbacks for noxious uses from residential and commercial areas, improving air quality.
Choi et al. 2005	Conversational piece about the future of chronic disease, and the views of public health professionals on improvements that need to be made to built environments and social structures to reduce overall cancer risk.	Land use Transportation	Alcohol use Tobacco use Diet Obesity Physical activity	Cancer risk (policy)	Built environments need to be structured to promote healthier lifestyles as the desirable and easy choice. By promoting better lifestyles, overall risk of cancer can be reduced in a proactive fashion. These interventions should include investments in walking and cycling infrastructure,

Authors	Premise	Env. Factor	Risk Factor	Cancer	Findings
					altering zoning codes to promote healthier food environments, and limiting access to harmful substances.
DeGuzman & Schminkey 2016	Discussion of an extension to the socio-ecological model of health by addressing the role of chronic toxic stress exposure from neighbourhood level factors in altering genetic expression of cancer risk. Formation of a toxic stress model that extends the Public Health Exposome theory with socio-ecological features.	Housing Public services Urban design	Tobacco use Diet Genomics	Cancer risk (theory)	Neighbourhood violence, noise and other stressors can affect a person's smoking and dietary habitats. Those with a chronic level exposure to environmentally-related stress tend to have higher rates of unhealthy behaviours, which in turn can lead to generational genetic alterations. Low-quality housing in denser settings, disinvestment in local area public services, and poor urban design that only prioritizes automotive travel tends to be associated with environmental stressors. Therefore, by targeting these environmental stressors, policy makers can reduce the risk of genetic and behavioural-based cancers.
Frieden et al. 2008	Review of environmental-based primary, secondary and tertiary level policy initiatives for cancer prevention in the United States. Private property rights and unwillingness from local governments to enact policy changes limits the implementation of these recommendations.	Accessibility Land use Transportation	Alcohol use Tobacco use Diet Screening	Cancer risk (policy)	Primary and secondary levels of prevention are recognized as the most cost-effective levels to implement environmental interventions that can reduce cancer risk. Primary interventions could include limiting outdoor advertising for alcohol and tobacco products, investments in the built environment to increase physical activity, and zoning policies to create healthier food environments, and setting minimum separation requirements for sensitive land uses from noxious or harmful industrial and commercial uses. Secondary interventions include increasing access to screening services through transportation programs and mobile screening strategies.
Gomez et al. 2011	Description of the California Neighborhoods Data System (CNDS) – a information	Housing Land use	Surveillance	All cancer types (incidence)	The CNDS tracks all registered cancer cases in California, with an individual-level geocoded location. These records can then

Authors	Premise	Env. Factor	Risk Factor	Cancer	Findings
	management system that gathers local-level area exposure measures on SES, density, residential segregation, ethnicity, distance to public services, walkability and connectivity for use in cancer prevention and surveillance.	Transportation Urban design			be compared with area-level social and environmental metrics that could be determinants of disparities in cancer incidence patterns. This data platform could be used in epidemiological research to design more relevant policy and deliver more targeted interventions.
Hanrahan et al. 2004	Overview of the Wisconsin Public Health Information Network (WI-PHIN) – an environmental childhood cancer surveillance information management platform. Collects individual-level case and environmental data that can be analyzed using in program statistical tools.	Accessibility Land use	Air quality Surveillance	All cancer types (incidence)	Childhood cancers are often the result of environmental exposures during maternal or early childhood development stages. The WI-PHIN aims to gather case-control information about all childhood cancers, and assess the exposure-response relationships with environmental and social factors. This includes collating environmental data at the local scale, and gathering residential histories and SES conditions for all cases.
Insall 2013	Review of active travel policies in the United Kingdom. For generations, transportation policy has been focused on private motorized travel rather than emphasizing active travel modes for both short and long-distance trips. Policy makers often struggle with implementing active travel policies as they often have a "windscreen" perspective of planning for car travel.	Transportation	Physical activity	Cancer risk (policy)	Public health's return to local government level policy and decision-making in the United Kingdom presents an opportunity to reshape transportation systems to suit active travel – walking and cycling. These modes can be further supported by low-emission public transit to meet long-distance needs. Investments in these modes would reap long-term rewards for cancer risk reduction efforts as carbon emissions are cut, and physical activity levels are increased from more active lifestyles and transportation patterns.
James et al. 2015	Description of a transdisciplinary training program developed to cross-train St. Louis School of Medicine postdoctoral fellows in environmental health. Focus on addressing cancer disparities	Urban design	Obesity Surveillance	Breast cancer (stage)	The training program saw the combination of postdoctoral fellows with a background in urban design, and another in public health form a study to examine the effects of environmental-induced BMI on breast cancer outcomes among African-Americans. Further, an interdisciplinary

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	through coordinated medical and public health practice.				journal club was formed to gather evidence on the intersections of urban design and cancer prevention.
Krieger 2017	Proposition that cancer prevention and control research should not seek ton identify risk factors of cancer types that would sum to 100% attribution of causation. This assertion is grounded in the socioecological theory of health effects.	Land use Public services Transportation	Air quality Alcohol use Tobacco use Diet Obesity Physical activity Screening Surveillance UV radiation	Cancer risk (theory)	Medical and science professions seem to be enamored with finding the absolute causations of individual health behaviours and genetic results. Rather, the public health professions seek to understand the contextual factors that shape the unique circumstances of each case. Adopting a primary and secondary approach that focuses on the eradication of inequities in cancer effects and outcomes, rather than the elimination of the disease through tertiary interventions.
Krukowski & West 2010	Overview of how the food environment can contribute to cancer prevention efforts in the United States. The alteration of individual behaviours is dependent on ensuring a supportive environment that provides access to healthy food and limits the availability of harmful sources.	Land use	Diet	Cancer risk (policy)	Research had found higher proportions of minority groups in the United States have lower incomes with worse access to healthy food outlets. These populations also tend to have higher cancer incidence and mortality rates, suggesting a link with dietary factors. Policies to reduce these disparities include increasing the availability of food in neighborhood grocery stores, and encouraging the location of healthy food outlets in disadvantaged neighbourhoods through zoning and performance regulations.
Litt et al. 2004	Summary of a meeting that focused on the methodological approaches by the Pew Environmental Health Commission to tracking environmental risks for cancer in the United States.	Accessibility Land use Public services Transportation	Air quality UV radiation	Cancer risk (methods)	A survey of practitioners, and review of presentations at the meeting suggest a need to emphasize the tracking of neurological and respiratory based cancers in the United States. These cancers tend to be associated with environmental factors, therefore tracking efforts should focus on gathering and linking incidence data with high-quality contextual environmental exposure data. The creation of a national

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					environmental health tracking network would provide the basis for effective cancer prevention research and policy that eliminates health disparities.
Naguib et al. 2017	Report on the development of an outreach colorectal screening initiative using a mobile unit in the United Kingdom. The program delivers a one-stop screening service within communities.	Accessibility Public services	Screening	Colorectal cancer screening (methods)	The colorectal cancer screening clinic would park in the local town centre or shopping area to provide drop in service. Of the 180 individuals that participated, there was 98% satisfaction with the service and many remarked they found the mobile unit more attractive than a hospital or clinic given ease of access and simplified screening experience. This approach could be used to increase screening access for vulnerable and remote populations.
Perera et al. 2002	Summary of evidence produced by the Columbia Center for Children's Environmental Health on the childhood cancer effects of urban air pollution. Children in South Bronx, New York City have an elevated rate of cancer, and have poor air quality from surrounding industrial and transportation uses.	Housing Transportation	Air quality Diet	Total lifetime cancer risk (incidence)	South Bronx was found to have disproportionately high rates of cancer among children from underserved minority populations. The exposures associated with these disparate outcomes are complex, and some pollutants may be interacting to create new risk profiles. The authors estimate that exposures before the age of 6 may account for half of the total lifetime cancer risk. Potential policy responses include reducing pesticide applications in urban environments on public and private greenspaces, as well as focusing on separating industrial and transportation from residential areas.
Perera 2008	Examines the role of fossil fuel dependency in childhood cancer risk across the United States. This dependency is based on the suburban land use-transportation cycle requiring automotive travel to accommodate the sprawled development patterns which in	Land use Transportation	Air quality	Cancer risk (policy)	Reports on transportation and industrial land use activities indicate investments made to address emissions and reduce dependency on fossil fuels would have minimal cost. These costs are compared with the expenses that may be incurred as future generations have higher rates of air pollution related cancers. Presently there

Authors	Premise	Env. Factor	Risk Factor	Cancer	Findings
	turn are primarily focused on serving car-based travel modes.				are also hundreds of childhood cancer cases that could be prevented through investments in low carbon mobility, industrial production, and energy generation.
Pickle et al. 2006	Summary of GIScience and cancer control meeting. Discussion topics focused on how to build consensus between professions on prioritizing policy and research initiatives, identify roadblocks to future progress, and recommendations for immediate action in the research community.	Accessibility	Surveillance	All types of cancer (methods)	The meeting identified geospatial techniques as a strong tool to improve cancer control research and practice. Participants identified the following needs: improve privacy regulations to allow use of individual-level geocoded data; develop tools and theories for spatial health data; create a one-stop data platform; develop strategies for managing uncertainty in analysis; and integrate community-based participatory research methods.
Roth et al. 2009	Report on the use of a mobile breast cancer screening unit in West Virginia. The program delivers mammography services to rural communities in the state.	Accessibility Public services	Screening	Breast cancer screening (methods)	The mobile mammography unit travels to rural areas of West Virginia to provide better access to screening services for disadvantaged populations. These areas tend to be poorer, have lower adherence rates, and low access to cancer screening facilities. Mobile screening services could be an important model to deliver preventative cancer services to remote and disadvantaged populations.
Sears et al. 2006	Examines Canada's regulation of chlorophenoxy herbicide 2,4-dichlorophenoxyacetic acid (2,4-D). This pesticide is used to kill weeds in grass, often in residential settings.	Greenspace Urban design	Hazards	Cancer risk (policy)	The 2,4-D herbicide is composed of dioxins that may cause cancer through bioaccumulation in the food supply, and physical contact with contaminated surfaces. Canadian regulations do not cover these forms of herbicide, however the *Spraytech v Hudson* decision asserted local government rights to regulate pollutants for the protection of health.
Stevens 2005	Proposal that circadian disruption from nighttime light could be a	Urban design	Circadian	Breast cancer risk (theory)	Artificial light exposure at night can disrupt circadian rhythms by altering

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	driver of increased breast cancer risk. As humans increasingly urbanize, there is an increase in exposure to light at night and disruption to circadian rhythms from irregular shift work.				melatonin production. Reduced melatonin levels have been associated with increased breast cancer risk. Preliminary studies have found an association between irregular shift workers (i.e. nurses) and breast cancer incidence. Therefore, circadian disruption from light exposure may affect breast cancer risk.
Stevens et al. 2007	Summary of proceedings at a circadian disruption and cancer workshop. The workshop sought to understand the extent to which changes in light may affect the risk of breast and prostate cancers. As industrialized populations work more irregular shifts and are exposed to higher levels of light at night, there may be an increased risk of brain and prostate cancer.	Urban design	Circadian	Breast and prostate cancer risk (theory)	Light may influence behavioural factors that could affect cancer etiology. These include disruption to circadian rhythms, decreased melatonin production, increased production of fatty acids, and altering diurnal processes. As societies industrialize with widespread outdoor light sources there are significant changes in their disease profiles, showing higher rates of breast and prostate cancer incidence. The long-term goal is to quantify the contribution of light exposure to increased breast and prostate cancer risk.
Stewart et al. 2016	Outline of opportunities for primary and secondary cancer prevention efforts. The authors emphasize the importance of including environmental and social factors in cancer research methods, and using precision medicine-based approaches.	Accessibility Housing Land use Transportation Urban design	Air quality Alcohol use Tobacco use Diet Physical activity Screening	Cancer risk (policy)	Trends in cancer incidence patterns suggest improved socioeconomic conditions leads to higher alcohol and tobacco use, dietary change towards high fat/sugar foods, and decreased physical activity. In addition, industrializing nations tend to have higher air pollution levels from poorly regulated industrial and transportation sectors. Cancer prevention policy needs to focus on regulation of tobacco products through land use restrictions, and reducing obesity through urban design, transportation, and mixed-use housing development approaches.
Thomas & Gostin 2013	Review of legal options to encourage cancer prevention and control policies. Governments at	Greenspace Housing	Air quality Diet	Cancer risk (policy)	Governments influence individual behaviours through regulatory decisions. Improved greenspaces, active travel

MEDICAL SCIENCES					
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	the national and subnational levels have significant power to alter human behaviour through environmental modification. Governments can intervene via monitoring cancer rates, mandatory health disclosures, regulating advertising, setting incentives, direct regulation, performance-based regulation, and optimizing the built environment.	Land use Transportation	Physical activity Screening		infrastructure and public spaces all can contribute to reducing cancer risk through increased physical activity. Relocation of screening services from centralized hospital locations to distributed clinic or mobile models can improve adherence. Better land use policies can improve air quality for residential areas, and improve the local food environment. Investments in public transit can lower overall emissions from transportation sources. Requiring health impact assessments of new developments can avoid the creation of future cancer risks.
Wingo et al. 2005	Proposal for a national cancer surveillance framework in the United States that emphasizes primary and secondary cancer prevention methods. The framework aims to integrate research and policy decisions across medicine and social science disciplines.	Accessibility Greenspace Land use Public services Transportation Urban design	Air quality Tobacco use Diet Obesity Physical activity Screening UV radiation	Cancer risk (policy)	The framework identifies a wide range of environmental and social policies that could reduce the overall risk of cancer in the United States. Policy initiatives include taxation of harmful products, regulation of polluters, physical activity programming, addressing urban sprawl, improving diet quality, and equitably distributing screening services. The framework is dependent on leveraging spatial analysis techniques to identify geographic disparities, and leverage the existing Census data management system to deliver more effective cancer prevention policies.

SOCIAL SCIENCES					
Authors	Premise	Env. Factor	Risk Factor	Cancer	Findings
Davoren & Antonopoulos 2012	Review of the potential legislative or judicial changes that could reduce cancer risk from high alcohol use and poor dietary quality. Australian communities	Accessibility Land use	Alcohol use Diet	Cancer risk (policy)	The author provides various legislative and judicial recommendations to reduce alcohol use and improve dietary intake, thus reducing the lifetime risk of developing cancer. Changes include

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	tend to struggle with these risk factors given their suburban community structure, and weak zoning regimes.				updating zoning codes to decrease prevalence of fast food, limiting density of alcohol outlets, and regulating outdoor advertising to limit the exposure of vulnerable populations to messaging associated with potentially harmful products.
Gostin 2004	Outline of public health aspects in United States law, and how government power can be used to reduce the risk of cancer. The local level must focus on environmental interventions as their ability to implement taxation and regulation is often limited to higher levels of government.	Housing Land use Transportation Urban design	Air quality Alcohol use Tobacco use Diet Obesity Physical activity Screening	Cancer risk (policy)	Law can be a benefit and hindrance to reduction of cancer risk in the United States. Superficially popular government policies such as highway investments, or deregulation of zoning restrictions can have unintended health consequences. The public health profession at the local level has a tradition of implementing environmental interventions that can reduce cancer risk. Previously, noxious land uses were separated from sensitive residential uses to limit exposure to harmful pollutants. A focus on building complete streets, and addressing SES through a design, housing and transportation approach would help address cancer risk. Also, laws need to address accessibility of harmful substances, as well as relax certain elements of the zoning code to permit healthier food environments.
Jacobs et al. 2007	Examination of policy challenges at the federal and local levels in the United States to address the adverse lung cancer effects of poor quality public housing. These units tend to have poor ventilation, use lead paints, and are located in proximity to noxious land uses.	Housing Urban design	Air quality	Lung cancer risk (policy)	The authors recommend the following policy options to address lung cancer disparities caused by substandard housing: improved and lower cost building hazard reduction techniques; improved understanding of interaction effects; control of confounding variables in residential settings; long-term assessment of policy effectiveness; improved delivery of comprehensive health interventions in housing; and ensuring scientific findings

Authors	Premise	Env. Factor	Risk Factor	Cancer	Findings
					are made accessible to policy-makers. The introduction of "polluter pays" and "shared commons" principles in public housing management could address the financial implications of these policy initiatives.
Maantay 2002	Examination of the environmental justice implications of municipal zoning in modifying cancer risk for New York City communities. The Not In My Backyard (NIMBY) attitude could be a primary driver of the disparities in distribution of risk across the city, as more entrenched and powerful areas export their pollution to less powerful areas of the city.	Accessibility Land use	Air quality	Cancer risk (policy)	Waste management appears to be the primary driver of air quality-based cancer risk in New York City. NIMBYism tends to force the location of these facilities to minority and poor neighbourhoods subjecting them to higher risk. Potential policy responses include the introduction of public service regulations that limit the exportation of waste from the local area, use of "Good Neighbor Agreeements" to encourage good operator behaviour, and community audits of industrial areas in proximity to residential areas. Amendments to zoning regulations are the largest avenue for change, yet will need to overcome the inertia of NIMBYism that affects municipal council decision-making.
MacEachren et al. 2008	Overview of the Pennsylvania Cancer Atlas program. The software aims to integrate cancer registry data, with social and environmental metrics in a spatial data manipulation and analysis platform for use by practitioners.	Accessibility	Surveillance	All cancer types (incidence)	The goals of the cancer atlas program are: to represent geographic distributions of cancer cases; provide avenues to examine spatial differences and similarities across subtypes, risks, and contextual factors; and provide an open source mapping solution to better inform cancer prevention policy and research.
Martin-Moreno et al. 2010	Review of Great Recession (2008-2015) effects on cancer prevention and control in the United Kingdom and Ireland. Suggestion of policy initiatives that could have been deployed during the crisis to maintain healthy lifestyles while still stimulating the economy.	Land use Public services Transportation	Air quality Alcohol use Tobacco use Diet Physical activity Screening	Cancer risk (policy)	Policy responses during recessions tend to slash preventative health and social measures, focusing instead on economic stimulation. These approaches tend to increase cancer risk. However, countries could focus on raising taxes on alcohol and tobacco to drive down use while raising revenue; relax zoning codes for mixed use

Authors	Premise	Env. Factor	Risk Factor	Cancer	Findings
			Surveillance		development to spur construction and create healthier communities; provide incentives for polluters to invest in green technologies; and initiate construction projects to build active travel and public transportation infrastructure that advances sustainability and cancer risk reduction from lower emissions and higher physical activity rates.
Rees & Silberman 2010	Overview of the Delaware Geography-Health Initiative curriculum. The curriculum aims to deliver geography education using health data at the high school advanced placement level. The primary focus is on cancer disparities in Delaware given environmental contextual factors.	Accessibility	Air quality	All types of cancer (methods)	The curriculum is composed of eight units that introduce students to the core concepts of health geography. The cancer unit examines the distributions of all types of cancer across Delaware, exploring spatial patterns of incidence and the effects of aggregation on spatial representations. This curriculum provides an excellent model for other interdisciplinary education in the healthy communities field.
Tyson et al. 1998	Summary of workshop presentations that focus on cancer prevention through environmental justice methods. These methods aim to reduce or eliminate cancer disparities between ethnic groups, and socioeconomic classes. Vulnerable populations tend to have the highest exposures, and worst outcomes from a lack of power to shape their communities.	Accessibility Housing Land use Public services Transportation	Air quality Surveillance	Cancer risk (policy)	Presentations all articulated elements of the environmental justice movement in the theoretical framing of their policy solutions. The placement of waste management facilities, transportation corridors and heavy industries tend to endanger the residential locations of the most vulnerable populations. The enforcement of existing protections to redistribute environmental risks across the entire population would reduce the elevated cancer risks among disadvantaged populations.
Walls et al. 2016	Review of hazardous building material contributions to cancer risk in New Zealand. These potentially harmful pollutants may be the source of some unqualified	Housing Land use Transportation Urban design	Air quality Hazards	Cancer risk (policy)	Building materials can be considered hazardous based on their internal properties, exposures during the manufacturing or installation process, or interactions with other environmental exposures. Gas based heating, sick building

Authors	Premise	Env. Factor	Risk Factor	Cancer	Findings
	cancers in the World Health Organization's 25 x 25 strategy.				syndrome, fibreglass, asbestos, formaldehyde, radon, heavy metals, chemicals, hormones, EDCs, and copper can contribute to increased cancer risks. The adoption of a precautionary approach to use of these materials, and any new materials, could avoid involuntary exposures in housing and transportation settings.
White et al. 2005	Summary of a transportation and health workshop. The workshop's objectives were to gather an interdisciplinary group of researchers, evaluate the evidence of an association between roadway proximity and cancer incidence, seek approaches to address these emissions, and consider integrated planning and design strategies that mitigate cancer risk.	Transportation	Air quality	Cancer risk (policy)	Transportation infrastructure has an inconsistent relationship with elevated cancer risk. While traffic density and proximity have been shown to predict elevated rates of early childhood cancer, other cancers remain weakly associated in their effect size. Further research is required that accounts for socioeconomic status, demographic factors, and the role of indoor/outdoor pollutant interactions. There is enough evidence to suggest that concerted action should be taken to reduce automotive dependency, and transition to a low carbon transportation system.
Wimbush et al. 2007	Overview of the Scotland Community Planning Partnerships that seek to address the social determinants of cancer disparity at the local government level. Since the reunification of public health and planning responsibility at the local level for Scotland, there is has been an effort to establish healthy community policy mechanisms.	Land use Public services	Alcohol use Tobacco use Diet Physical activity	Cancer risk (policy)	Community Planning Partnerships (CPPs) are statutory documents that coordinate the delivery of all public services, and guide local government decision making to produce health and social improvements. In the case of cancer prevention, CPPs have been used to reduce alcohol and tobacco consumption through outdoor advertising, bans on smoking in public areas, and local taxation. Further, the food environment has been altered through land use changes to permit more grocers and markets, while banning advertising of harmful foods in local schools.

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