Social Inequalities and Cancer
Kogevinas, M., Pearce, N., Susser, M. and Boffetta, P., eds
IARC Scientific Publications No. 138
International Agency for Research on Cancer, Lyon, 1997

Socioeconomic differences in cancer survival: a review of the evidence

M. Kogevinas and M. Porta

In the discussion of social inequalities in health there has been much debate on the role of medical care. Large differences in cancer incidence and mortality from cancer have been consistently observed. To understand the potential importance of socioeconomic differences in prompt detection and treatment of cancer it is essential to have data on cancer survival. These have been examined less extensively than differences in cancer incidence. We have reviewed 42 studies on social class differences in cancer survival. Twenty-three studies were conducted in North America, and 15 in western European countries. Twenty-three studies were carried out through population-based cancer registries and 17 through hospitals or hospital-based registries. Seven studies examined survival differences for multiple cancer sites. Social class differences in cancer survival appear remarkably general. Patients in low social classes had consistently poorer survival than those in high social classes. The magnitude of the differences for most cancer sites was fairly narrow, with most relative risks falling between 1 and 1.5. The widest differences were observed for cancers of good prognosis and specifically cancers of the female breast, corpus uteri, bladder and colon. The pattern of the social differences in survival did not vary consistently by sex, country, or source of the study population and did not depend on the socioeconomic indicator used.

In the discussion of social inequalities in health there has been much debate on the role of medical care. Large differences in cancer incidence and mortality from cancer have been consistently observed among a variety of social groups. To understand the potential importance of socioeconomic differences in prompt detection and treatment of cancer it is essential to have data on cancer survival. These have been examined less extensively than differences in cancer incidence. Studies conducted by Cohart in 1955 detected an association between socioeconomic status and cancer survival only for breast cancer (Cohart, 1955). About three decades later, interest in survival patterns was renewed when large differences among ethnic groups in the United States of America became evident (Young *et al.*, 1984). In this chapter the available evidence on the magnitude of socioeconomic differences in cancer survival is reviewed, and then issues of interpretation are briefly discussed. The factors determining the occurrence of social differences in survival are further discussed in the chapters in this book by Auvinen and Karjalainen and by Segnan.

The studies

Studies were identified through MEDLINE (Digital Library Systems, Inc.) and bibliographic references of published studies. Overall, 42 studies on cancer survival differences were reviewed. A few additional studies on less frequent cancers, such as soft-tissue sarcoma and multiple myeloma, have not been included (Savage *et al.*, 1984). For each investigation, a general description of the study (place, source of the study population, time period of enrolment and follow-up, vital status ascertainment, and number of subjects), the socioeconomic indicators used, and brief comments are given in Table 1. Twenty-three studies (55%) were conducted in North America, 15 (36%) studies in western European countries, two studies in Asia and one study in Australia; and one study covered four countries (Table 1). Twenty-five studies (60%) were carried out through population-based cancer reg-

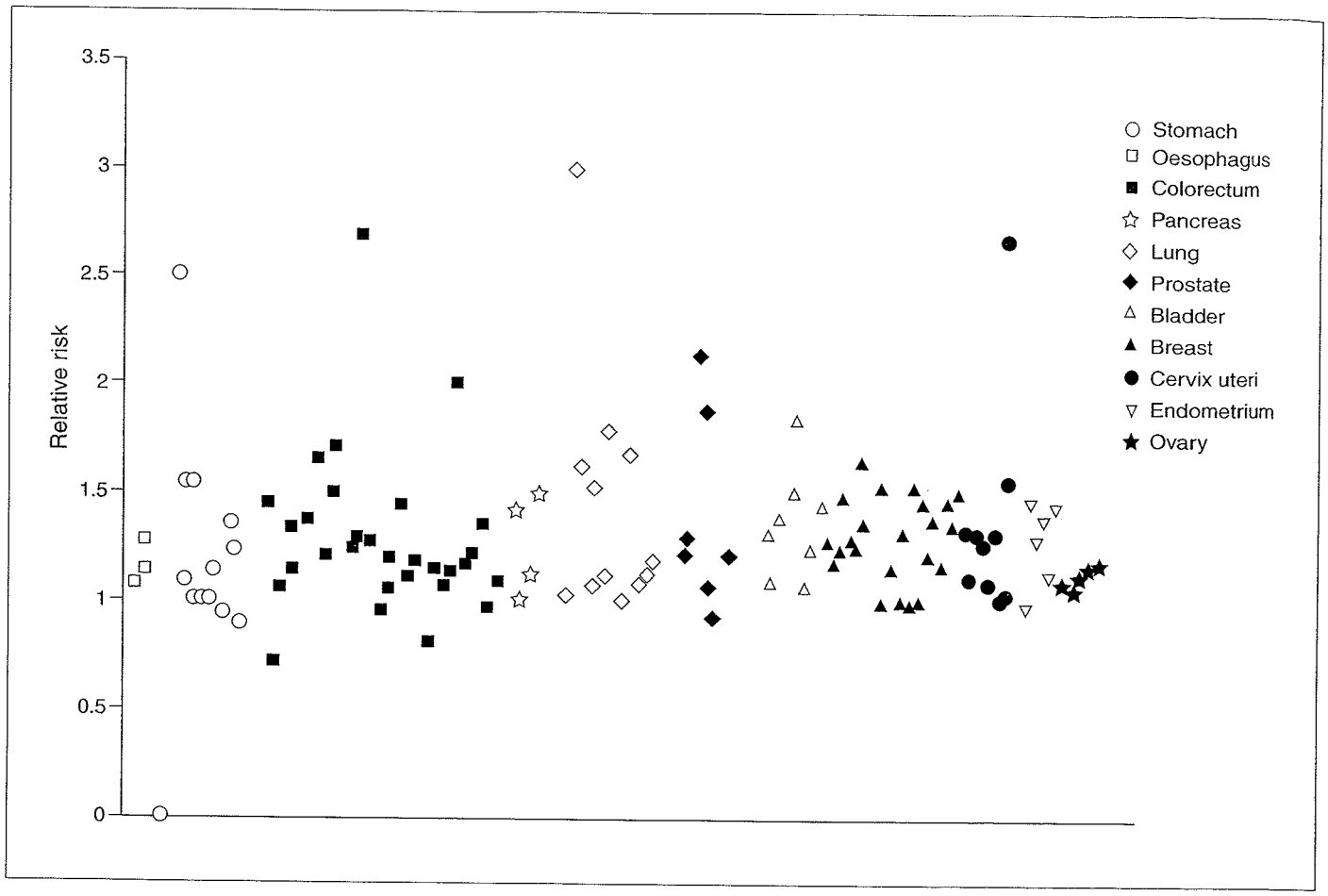

Figure 1. Socioeconomic differences in cancer survival. Relative risks for patients of low versus high socioeconomic status, as observed in 42 studies.

istries and 17 through hospitals or hospital-based registries. Seven studies examined survival differences in multiple (10 or more) cancer sites.

Studies on differences between ethnic groups were not systematically reviewed. In the United States, race is closely related to socioeconomic status; differences in cancer incidence and survival among races have been shown also to relate to socioeconomic factors (Devesa & Diamond, 1980).

Authors of the studies reviewed here used a variety of socioeconomic classifications. Residence was the most frequently used socioeconomic indicator (21 studies), mostly in studies conducted in North America. Census tracts (and less frequently, other units of residence such as census block and county) were ranked on the basis of information on sociodemographic characteristics of the population living in the tract, such as median family income, average education, percentage of working class men or composite indexes such as the Carstairs index. Occupation was used in seven studies either in the context of a social class scheme (in the United Kingdom and Finland) or for simply comparing large population categories such as blue- and white-collar workers. In four studies information was extracted from hospital records concerning type of insurance or type of hospital (for example, public versus private). Level of education was used in six studies, housing (ownership and amenities) in two studies, employment status in one study and Duncan's index of socioeconomic status in one study. In most studies results were reported for a single socioeconomic classification; occasionally, more than one classification was examined. The alternative classifications did not substantially modify the findings.

Results

A summary picture of the findings of all studies on socioeconomic differences in cancer survival is shown in Figure 1. The figure compares case fatality rates for patients of low socioeconomic status patients with those for patients of high socioeconomic status. In studies examining survival

in more than two groups, differences between the two extreme groups of the socioeconomic classification are plotted – for example, high versus low income and social class I versus social class V. Approximately 130 independent relative risks, derived from the 40 studies that were reviewed, are shown, ordered by cancer site. Whenever available, relative risks are plotted separately for each sex. Estimates of the relative risk were directly available in those studies using regression or similar techniques. In most studies, however, a classical life table analysis was applied and five-year crude or relative survival rates were provided. In those studies we calculated the social class ratio for the proportion of dead subjects at five years since diagnosis (one minus the five-year survival rate), therefore deriving estimates of the relative risk.

Social class differences in cancer survival after diagnosis appear remarkably consistent across different populations (Figure 1). Nearly all relative risk estimates were above unity, suggesting that those in low social classes have poorer survival than those in high social classes. Most relative risks were low, ranging between values of 1 and 1.5. The highest relative risks were observed for cancers of fairly good, or good, prognosis, such as breast, colorectal, bladder and uterine corpus. The pattern of survival differences did not vary consistently by sex, country, socioeconomic indicator, or source of the study population.

The major findings of the studies are summarized in Tables 2–13. Each of these tables is organized in two sections: one section lists studies in which the parameter modelled was survival (in which case a high value signifies an advantage), and the other lists studies in which the parameter modelled was mortality (in which case a high value indicates a disadvantage).

Four studies examined socioeconomic differences in survival for all neoplasms (Table 2). In all studies, survival was poorest in the low socioeconomic groups.

Socioeconomic differences in survival of patients with oesophageal cancer have been examined in two studies (Table 3). In both studies survival was poorest in the low socioeconomic groups.

Socioeconomic differences in survival of patients with stomach cancer have been examined in eight studies (Table 4). In three studies survival was poorest in the low socioeconomic groups. The reverse pattern was seen in one study, while no consistent pattern was observed in four studies.

Socioeconomic differences in survival of patients with colorectal cancer have been examined in 15 studies (Table 5). Out of the 11 studies examining colon cancer, survival was poorest in the low socioeconomic groups in eight studies. In four of those studies differences were statistically significant or were wider than 10% at five years after diagnosis (one study reported survival at 10 months after diagnosis). No appreciable differences were seen in three studies. Out of the eight studies examining rectal cancer, seven found that survival was poorest in the low socioeconomic group. In three of those studies differences were statistically significant or were wider than 10% at five years after diagnosis (one study reported survival at 10 months after diagnosis). Four studies reported survival jointly for colorectal cancer. In three of those studies survival was poorest in the low socioeconomic group. In two of those studies differences were statistically significant or were wider than 10% at five years after diagnosis.

Socioeconomic differences in survival of patients with pancreatic cancer have been examined in three studies (Table 6). In two studies survival was poorest in the low socioeconomic groups, while no appreciable difference was seen in the third study.

Socioeconomic differences in survival of patients with lung cancer have been examined in 10 studies (Table 7). In eight studies survival was poorest in the low socioeconomic groups. In two of those studies differences were statistically significant or were wider than 10% at five years after diagnosis. No appreciable difference was seen in one study, and risk estimates were not presented in another study.

Socioeconomic differences in survival of patients with prostate cancer have been examined in seven studies (Table 8). In six studies, survival was poorest in the low socioeconomic groups. In three of those studies differences were wider than 10% at five years after diagnosis (one study reported survival at 10 months after diagnosis). The reverse pattern was seen in one study.

Socioeconomic differences in survival of patients with bladder cancer have been examined in five studies (Table 9). In all studies survival was poorest in the low socioeconomic groups. In four of those studies differences were statistically significant or were wider than 10% at five years after diagnosis (one study reported survival at 10 months after diagnosis).

Socioeconomic differences in survival of breast cancer patients have been examined in 24 studies (Table 10). In 19 studies survival was poorest in the low socioeconomic groups. In addition, in a multicentric study the same pattern was seen for three out of four countries. In 13 of those studies differences were statistically significant or were wider than 10% at five years after diagnosis (one study reported survival at 10 months after diagnosis). Three studies showed no association between socioeconomic status and survival and in one study survival was poorest in the high socioeconomic group.

Socioeconomic differences in survival of patients with cervical cancer have been examined in 10 studies (Table 11). In eight studies survival was poorest in the low socioeconomic groups; in five of those studies differences were statistically significant or were wider than 10% at five years after diagnosis (one study reported survival at 10 months after diagnosis). Two studies showed no association between socioeconomic status and survival.

Socioeconomic differences in survival of patients with cancer of the corpus uteri have been examined in six studies (Table 12). In five studies survival was poorest in the low socioeconomic groups; in three of those studies differences were statistically significant or were wider than 10% at five years after diagnosis (one study reported survival at 10 months after diagnosis). The reverse pattern was seen in one study.

Socioeconomic differences in survival of patients with ovarian cancer have been examined in five studies (Table 13). In four studies survival was poorest in the low socioeconomic groups, although differences were narrow. The reverse pattern was seen in one study.

Issues of interpretation

Socioeconomic differences in cancer survival, if not artifactual, may be related to differences in timing of diagnosis, in treatments applied, in the biological characteristics of the neoplasm or in host factors (Vågerö & Persson, 1987). These and other issues are discussed in depth in the chapters by Auvinen and Karjalainen and by Segnan in this volume. Here we briefly address only some factors capable of biasing comparisons among social groups: clinical lead-time bias, variations in staging practices, length bias, and the accuracy of measurements of the cause of death and of social class.

Diagnostic patterns have been shown to affect comparisons of incidence and case fatality rates. The validity of long-term comparisons of survival has also been questioned (Enstrom & Austin, 1977). A problem common to all survival studies is that case fatality rates have been shown to be less valid than incidence or mortality rates. Furthermore, the survival in high socioeconomic groups could appear to be better not because prompt diagnosis altered the natural course of the disease but simply because of lead-time bias – that is, because the diagnosis took place earlier in the natural history of the disease in one group than in the comparison group. Lead-time bias came to be understood and is often considered primarily within the context of screening programmes, when asymptomatic disease is targeted in a well-defined group of persons invited to be screened. However, only a fraction of the 'population of cancers' can be detected by screening programmes; the vast majority of cancers are diagnosed when persons with symptoms seek medical attention and, hence, the survival of most patients can be computed only from clinical diagnosis of symptomatic disease. Measuring survival from the time of onset of symptoms might be thought to overcome some of the disadvantages of measuring it from time of diagnosis, by discounting the effect of diagnostic delays due to socioeconomic barriers to medical diagnosis. However, such a possibility is not without problems of its own – mainly because the perception, assessment, recall and reporting of symptoms differ substantially among social groups. Thus, again, the 'time zero' from which survival is computed may not be similar for the different groups. Therefore, clinical lead-time bias occurs when a decrease in the time of symptomatic disease (or in the duration of symptoms, or in the interval from symptom onset to treatment onset) appears spuriously associated with longer survival (Porta *et al.*, 1991; Maguire *et al.*, 1994).

Is there evidence suggesting that the point in the natural history of the cancer at which diagnosis takes place is uniform or has a similar distribution across social groups? Such information as is available on stage at presentation indicates that high socioeconomic groups are frequently diagnosed earlier. Therefore, clinical (symptomatic) lead-time could be one of the factors contributing to cancer survival differences. Unfortunately, little attention has been paid to quantitative estimation of the

magnitude of clinical lead-time, and of the ensuing differences in survival, among different socioeconomic groups. Studies on 'diagnostic delay' could be reoriented to bridge this gap (Maguire *et al.*, 1994).

Analysing differences in survival across socioeconomic groups within strata of the stage of the cancer at diagnosis is one option that might also overcome some of the problems mentioned above. However, this would require that the staging effort was similar in the different social groups. Without similar staging practices, we would face a problem similar to that caused by differing access among groups to screening and diagnosis: if lower social groups had their cancers less accurately staged than higher groups (for example, tumours differentially deemed to be less disseminated in the lower than in the higher classes), stratifying or otherwise adjusting by stage would not be sufficient to produce a valid estimate of differences in survival within each stage stratum. Certainly, the intensity of the staging effort in different socioeconomic groups is difficult to ascertain, since it depends on several factors that are related to each other and to sociocultural factors: the timing in the natural course of the cancer at which patients can and choose to seek medical attention, the quality of care in every given health care setting (which may depend on workload, technology, referral options and so on), and how much value the patient, the family and the health professionals place on an accurate diagnosis and staging of the cancer (Mechanic, 1972; Eisenberg, 1980; Twaddle, 1981; Feinstein *et al.*, 1985; Funch, 1988; Gifford, 1986; Greenberg *et al.*, 1991; Franks & Clancy, 1993). In this context, it is worth remembering that information on stage in cancer registries may be of questionable quality. In a study in the United States, stage was wrongly coded in 20% of the cases. The major misclassifications occurred between regional and distant stages of disease; the percentage of patients presenting with local disease was fairly accurate (Feigl *et al.*, 1982).

Data are also very scant on differences among social groups in the distribution of histological subtypes and of markers of tumour aggressiveness (Hulka *et al.*, 1984). Yet, host–tumour interactions may differ in society, and some clinical and biological factors (such as nutritional and immunological status) may be important mediating variables of their effect upon survival. Given that the rate of tumour growth is related both to survival and to the likelihood of early clinical detection (slower-growing tumours being more amenable to the latter), the possibility of length bias should be kept in mind, too (Porta *et al.*, 1991). It would also be meaningful to assess to what extent the causes of each type of cancer influence its prognosis, since many exposures (for example, occupational and nutritional ones) are unevenly distributed in society.

In the studies reviewed here the proportion of patients lost to follow-up did not generally differ between socioeconomic groups. Yet, diagnosis and certification of the actual cause of death may be another source of error. If valid diagnoses are less common in the disadvantaged social groups, then the case fatality rates for specific cancer could be artificially low. In addition, low social classes may be affected more by 'competing risks', since all-cause mortality is higher in low compared with high social classes. In general, this would leave fewer low socioeconomic status survivors to die of cancer. These problems were addressed in a number of studies examining survival patterns for different sets of case fatality rates, which were calculated for mortality from all causes, all cancers or only the cancer at diagnosis. Statistical models that take into account mortality from competing causes were also used. These analyses suggest that competing risks may not seriously affect the overall patterns of social differences in cancer survival.

Finally, it should be borne in mind that changes in socioeconomic status over the lifespan are seldom part of the analyses in this area. Social class and many other socioeconomic indicators are often measured inaccurately; hence, differences in cancer survival among the social groups involved may be concealed.

Concluding remarks

- A clear pattern was observed in social class differences in cancer survival. Patients in low social classes had consistently poorer survival than those in high social classes.
- The magnitude of the differences for most cancer sites is moderate, with most relative risks falling between 1 and 1.5.
- The widest differences tended to occur in cancers of good prognosis and specifically cancers of the female breast, corpus uteri, bladder and colon.

- Even if in some settings socioeconomic status per se is not considered to be a strong and independent predictor of cancer survival, it is important to analyse how biological and clinical predictors of survival correlate with socioeconomic variables.
- Further efforts should also be devoted to assessing quantitatively the magnitude of clinical lead-time, variations in diagnostic and staging practices, and length bias, and their possible influence on observed differences in survival among different socioeconomic groups.

Acknowledgements

This work was partly funded by a grant from the Ministry of Education and Science, Spain (DGICT SAB95-0189), by Fondo de Investigación Sanitaria, Spain (grant 92/0311) and by CIRIT, Spain (GRQ93-9304).

References

Auvinen, A. (1992) Social class and colon cancer survival in Finland. *Cancer*, 70, 402–409

Auvinen, A., Karjalainen, S. & Pukkala, E. (1995) Social class and cancer patient survival in Finland. *Am. J. Epidemiol.*, 142, 1089–1102

Bain, R.B., Greenberg, R.S. & Whitaker, J.P. (1986) Racial differences in survival of women with breast cancer. *J. Chronic Dis.*, 39, 631–642

Bako, G., Ferenczi, L., Hanson, J., Hill, G.H. & Dewar, R. (1985) Factors influencing the survival of patients with cancer of the stomach. *Clin. Invest. Med.*, 8, 22–28

Bassett, M.T. & Krieger, N. (1986) Social class and black-white differences in breast cancer survival. *Am. J. Public Health*, 76, 1400–1403

Berg, J.W., Ross, R. & Latourette, H.B. (1977) Economic status and survival of cancer patients. *Cancer*, 39, 467–477

Boffetta, P., Merletti, F., Winkelmann, R., Magnani, C., Cappa, A.P. & Terracini, B. (1993) Survival of breast cancer patients from Piedmont, Italy. *Cancer Causes Control*, 4, 209–215

Bonett, A., Roder, D. & Esterman, A. (1984) Determinants of case survival for cancers of the lung, colon, breast and cervix in South Australia. *Med. J. Aust.*, 141, 705–709

Brenner, H., Mielck, A., Klein, R. & Ziegler, H. (1991) The role of socioeconomic factors in the survival of patients with colorectal cancer in Saarland/Germany. *J. Clin. Epidemiol.*, 44, 807–815

Cohart, E.M. (1955) Socioeconomic distribution of cancer of the female sex organs in New Haven. *Cancer*, 8, 34–41

Chirikos, T.N. & Horner, R.D. (1985) Economic status and survivorship in digestive system cancers. *Cancer*, 56, 210–217

Chirikos, T.N., Reiches, N.A. & Moeschberger, M.L. (1984) Economic differentials in cancer survival: a multivariate analysis. *J. Chronic Dis.*, 37, 183–193

Dayal, H.H., Power, R.N. & Chiu, C. (1982) Race and socioeconomic status in survival from breast cancer. *J. Chronic Dis.*, 35, 675–683

Dayal, H.H., Polissar, L. & Dahlberg, S. (1985) Race, socioeconomic status, and other prognostic factors for survival from prostate cancer. *J. Natl. Cancer Inst.*, 74, 1001–1006

Dayal, H., Polissar, L., Yang, C.Y. & Dahlberg, S. (1987) Race, socioeconomic status, and other prognostic factors for survival from colorectal cancer. *J. Chronic Dis.*, 40, 857–864

Devesa, S.S. & Diamond, E.L. (1980) Association of breast cancer and cervical cancer incidences with income and education among whites and blacks. *J. Natl. Cancer Inst.*, 65, 515–528

Eisenberg, L. (1980) What makes persons "patients" and patients "well"? *Am. J. Med.*, 69, 277–286

Ell, K., Nishimoto, R., Mediansky, L., Mantell, J. & Hamovitch, M. (1992) Social relations, social support and survival among patients with cancer. *J. Psychosom. Res.*, 36, 531–541

Enstrom, J.E. & Austin, D.F. (1977) Interpreting cancer survival rates. *Science*, 195, 847–851

Feigl, P., Polissar, L., Lane, W.W. & Guinee, V. (1982) Reliability of basic cancer patient data. *Stat. Med.*, 1, 191–204

Feinstein, A.R., Sosin, D.M. & Wells, C.K. (1985) The Will Rogers phenomenon: stage migration and new diagnostic techniques as a source of misleading statistics for survival in cancer. *New Engl. J. Med.*, 312, 1604–1608

Franks, P. & Clancy, C.M. (1993) Physician gender bias in clinical decisionmaking: screening for cancer in primary care. *Med. Care*, 31, 213–218

Funch, D.P. (1988) Predictors and consequences of symptom reporting behaviors in colorectal cancer patients. *Med. Care*, 26, 1000–1008

Gifford, S.M. (1986) The meaning of lumps: a case study of the ambiguities of risk. In: Janes, C.R., Stall, R. & Gifford, S.M., eds, *Anthropology and epidemiology. Interdisciplinary approaches to the study of health and disease*. Dordrecht, Reidel. pp. 213–246

Gordon, N.H., Crowe, J.P., Brumberg, D.J. & Berger, N.A. (1992) Socioeconomic factors and race in breast cancer recurrence and survival. *Am. J. Epidemiol.*, 135, 609–618

Greenberg, E.R., Baron, J.A., Dain, B.J., Freeman, D.H., Jr, Yates, J.W. & Korson, R. (1991) Cancer staging may have different meanings in academic and community hospitals. *J. Clin. Epidemiol.*, 44, 505–512

Hulka, B.S., Chambless, L.E., Wilkinson, W.E., Deubner, D.C. & McCarty, K.S., Jr (1984) Hormonal and personal effects on estrogen receptors in breast cancer. *Am. J. Epidemiol.*, 119, 692–704

Karjalainen, S. & Pukkala, E. (1990) Social class as a prognostic factor in breast cancer survival. *Cancer*, 66, 819–826

Kato, I., Tominaga, S. & Ikari, A. (1992) The role of socioeconomic factors in the survival of patients with gastrointestinal cancers. *Jpn. J. Clin. Oncol.*, 22, 270–277

Keirn, W. & Metter, G. (1985) Survival of cancer patients by economic status in a free care setting. *Cancer*, 55, 1552–1555

Kogevinas, M. (1990) *OPCS Longitudinal study. Socio-demographic differences in cancer survival* (Series LS No. 5). London, Her Majesty's Stationery Office. pp. 1971–1983

Kogevinas, M., Marmot, M.G., Fox, J. & Goldblatt, P.O. (1991) Socioeconomic differences in cancer survival. *J. Epidemiol. Community Health*, 45, 216–219

Lamont, D.W., Symonds, R.P., Brodie, M.M., Nwabineli, N.J. & Gillis, C.R. (1993) Age, socio-economic status and survival from cancer of cervix in the West of Scotland 1980–87. *Br. J. Cancer*, 67, 351–357

LeMarchand, L., Kolonel, L.N. & Nomura, A.M.Y. (1984) Relationship of ethnicity and other prognostic factors to breast cancer survival patterns in Hawaii. *J. Natl. Cancer Inst.*, 73, 1259–1265

Linden, G. (1969) The influence of social class in the survival of cancer patients. *Am. J. Public Health*, 59, 267–274

Lipworth, L., Abelin, T. & Connelly, R.R. (1970) Socioeconomic-factors in the prognosis of cancer patients. *J. Chronic Dis.*, 23, 105–116

Lipworth, L., Bennett, B. & Parker, P. (1972) Prognosis of nonprivate cancer patients. *J. Natl. Cancer Inst.*, 48, 11–16

Maguire, A., Porta, M., Malats, N., Gallén, M., Piñol, J.L. & Fernandez, E. for the ISDS II Project Investigators (1994) Cancer survival and the duration of symptoms. An analysis of possible forms of the risk function. *Eur. J. Cancer*, 30A, 785–792

Mechanic, D. (1972) Social psychologic factors affecting the presentation of bodily complaints. *New Engl. J. Med.*, 286, 1132–1139

Milner, P.C. & Watts, M. (1987) Effect of socioeconomic status on survival from cervical cancer in Sheffield. *J. Epidemiol. Community Health*, 41, 200–203

Monnet, E., Boutron, M.C., Faivre, J. & Milan, C. (1993) Influence of socioeconomic status on prognosis of colorectal cancer. A population-based study in Cote D'Or, France. *Cancer*, 72, 1165–1170

Morrison, A.S., Lowe, C.R., MacMahon, B., Ravnihar, B. & Yuasa, S. (1977) Incidence risk factors and survival in breast cancer: report on five years of follow-up observation. *Eur. J. Cancer*, 13, 209–214

Murphy, M., Goldblatt, P., Thornton-Jones, H. & Silcocks, P. (1990) Survival among women with cancer of the uterine cervix: influence of marital status and social class. *J. Epidemiol. Community Health*, 44, 293–296

Nandakumar, A., Anantha, N., Venugopal, T.C., Sankaranarayanan, R., Thimmasetty, K. & Dhar, M. (1995) Survival in breast cancer: a population based study in Bangalore, India. *Int. J. Cancer*, 60, 593–596

Nomura, A., Kolonel, L., Rellahan, W., Lee, J. & Wegner, E. (1981) Racial survival patterns for lung cancer in Hawaii. *Cancer*, 48, 1265–1271

Porta, M., Gallén, M., Malats, N. & Planas, J. (1991) Influence of "diagnostic delay" upon cancer survival: an analysis of five tumour sites. *J. Epidemiol. Community Health*, 45, 225–230

Savage, D., Lindenbaum, J., Van Ryzin, J., Struening, E. & Garrett, T.J. (1984) Race, poverty, and survival in multiple myeloma. *Cancer*, 54, 3085–3094

Schrijvers, C.T., Mackenbach, J.P., Lutz, J.M., Quinn, M.J. & Coleman, M.P. (1995a) Deprivation and survival from breast cancer. *Br. J. Cancer*, 72, 738–743

Schrijvers, C.T., Coebergh, J.W., van der Heijden, L.H. & Mackenbach, J.P. (1995b) Socioeconomic variation in cancer survival in the southeastern Netherlands, 1980–1989. *Cancer*, 75, 2946–2953

Stavraky, K.M., Kincade, J.E., Stewart, M.A. & Donner, A.P. (1987) The effect of socioeconomic factors on the early prognosis of cancer. *J. Chronic Dis.*, 40, 237–244

Stavraky, K.M., Donner, A.P., Kincade, J.E. & Stewart, M.A. (1988) The effect of psychosocial factors on lung cancer mortality at one year. *J. Clin. Epidemiol.*, 41, 75–82

Steinhorn, S.C., Myers, M.H., Hankey, B.F. & Pelham, V.F. (1986) Factors associated with survival differences between black women and white women with cancer of the uterine corpus. *Am. J. Epidemiol.*, 124, 85–93

Twaddle, A.C. (1981) Sickness and the sickness career: some implications. In: Eisenberg, L. & Kleinman, A., eds, *The relevance of social science for medicine.* Dordrecht, Reidel. pp. 111–133

Vågerö, D. & Persson, G. (1987) Cancer survival and social class in Sweden. *J. Epidemiol. Community Health*, 41, 204–209

Waxler-Morrison, N., Hislop, T.G., Mears, B. & Kan, L. (1991) Effects of social relationships on survival for women with breast cancer: a prospective study. *Soc. Sci. Med.*, 33, 177–183

Wegner, E.L., Kolonel, L.N., Nomura, A.M. & Lee, J. (1982) Racial and socioeconomic status differences in survival of colorectal cancer patients in Hawaii. *Cancer*, 49, 2208–2216

Young, J.L., Jr, Gloeckler-Ries, L. & Pollack, E.S. (1984) Cancer patient survival among ethnic groups in the United States. *J. Natl. Cancer Inst.*, 73, 341–352

Corresponding author:

M. Kogevinas

Institut Municipal d'Investigació Mèdica, Universitat Autònoma de Barcelona, Carrer del Doctor Aiguader 80, E-08003 Barcelona, Spain

Table 1. Socioeconomic differences in cancer survival: description of the studies

Reference; country	Study design	Social indicator	Comments
Auvinen, 1992; Finland	Registry-based (nationwide); enrolment 1979–1982; follow-up 1987; vital status ascertainment 100%; 1951 women and 1196 men with colon cancer	Social class on the basis of own occupation in 1970 census and, for housewives, of husband's occupation: social class I, professional and administrative; class II, lower administrative and self-employed; class III, skilled workers; class IV, unskilled workers; farmers	Population overlapping with Auvinen *et al.*, 1995
Auvinen *et al.*, 1995; Finland	Registry-based, record-linkage study (1970 census, Finnish Cancer Registry); enrolment 1971–1985; follow-up 1990; vital status ascertainment about 100%; 106 661 subjects aged 25–64 at census; 12 cancer sites	Social class on the basis of own occupation in 1970 census and, for housewives, of husband's occupation: social class I, professional and administrative; class II, lower administrative and self-employed; class III, skilled workers; class IV, unskilled workers	
Bain *et al.*, 1986; USA	Registry-based (Atlanta); enrolment and follow-up 1978–1982; 2858 women with breast cancer	County of residence, in two : groups Fulton county (low status) versus all other counties (high)	Definition and validity of social scale is not well specified
Bako *et al.*, 1985; Canada	Hospital-registry-based (Edmonton); enrolment and follow-up 1969–1973; 332 males and 135 females with stomach cancer	Last occupation: agriculture; blue-collar; white-collar; not in labour force	
Bassett & Krieger, 1986; USA	Registry-based (West Washington Cancer Surveillance System); enrolment and follow-up 1973–1983; vital status ascertainment 97.8% Whites and 96% Blacks; 1506 women with breast cancer	Residence, in two groups on the basis of 1980 census block group characteristics including percentage working class (wage earners in specific occupational categories). Comparisons between blocks with <35% or >35% working class	
Berg *et al.*, 1977; USA	Hospital-based (Tumour Registry of the University of Iowa Hospitals); enrolment 1940–1969; follow-up 1974; vital status ascertainment above 98%; 1621 subjects; 39 cancer types	Economic status, in three categories: private patients (high status); clinic pay patients (mid-to-high status); indigent patients (low status)	
Boffetta *et al.*, 1993; Italy	Pathology department records and hospital registers (Piedmont region); enrolment 1979–1981; follow-up 1987; vital status 95%; 5265 women with breast cancer	Education: less than seven years; seven years or more	

Table 1. (Contd) Socioeconomic differences in cancer survival: description of the studies

Reference; country	Study design	Social indicator	Comments
Bonett *et al.*, 1984; Australia	Registry-based, South Australia; enrolment 1977–1983; vital status around 90%; subjects born in Australia or Europe; four cancer sites (2676 women with breast cancer, 2227 subjects with colon cancer, 2934 subjects with lung cancer and 420 women with cervical cancer)	Residence, in two groups on the basis of median male income of postcode at 1981 census	
Brenner *et al.*, 1991; Germany	Registry-based (Saarland, Germany); enrolment 1974–1983; 2627 colorectal cancer patients aged 45–74	Residence, in three groups on the basis of number of blue-collar workers and persons with less than nine years of schooling in the community	
Chiricos *et al.*, 1984; USA	Hospital-based (Ohio State University Hospital); enrolment and follow-up 1977–1981; 1180 White men	Occupation, classified as blue-collar/white-collar, and economic status (mean dollar income), estimated on the basis of information from 1970 census in three groups (>US$ 13 000; US$ 6000–13 000; <US$ 6000)	
Chirikos & Horner, 1985; USA	Hospital-registry-based (Ohio State University); enrolment and follow-up 1977–1981; 84 men with colorectal cancer	Expected income derived from occupation (on the basis of information at the 1970 census), in three groups (>US$ 13 000; US$ 6000–12 999; US$ <5999)	
Dayal *et al.*, 1982; USA	Hospital-based (Medical College of Virginia); enrolment and follow-up 1968–1972; vital status ascertainment 94%; 323 women with breast cancer	Residence, in three groups on the basis of six 1970 census tract characteristics including education and income	
Dayal *et al.*, 1985; USA	Hospital-based (11 centres); enrolment 1977–1981; follow-up 1984; 2513 Caucasian and Black subjects with prostate cancer	Residence (zip) codes: quartiles on the basis of educational level (percentage of high-school graduates)	
Dayal *et al.*, 1987; USA	Hospital-based (11 centres); enrolment 1977–1982; follow-up 1981; 3617 colon and 1528 rectal cancer patients	Residence (zip) codes: tertiles on the basis of percentage of high-school graduates	
Ell *et al.*, 1992; USA	Hospital-based (Univ. S. California Comprehensive Cancer Center); three cancer sites; enrolment and follow-up dates not available; 166 women with breast cancer	Duncan's socioeconomic index, based on income, education and occupational status	

Table 1. (Contd) Socioeconomic differences in cancer survival: description of the studies

Reference; country	Study design	Social indicator	Comments
Gordon *et al.*, 1992; USA	Hospital-based (Ohio); 1392 women with breast cancer diagnosed between 1974–1985; follow-up 1990; loss to follow-up 2.9%	Residence, using 1980 census tract indices including education, income, and percentage below poverty line	
Karjalainen & Pukkala, 1990; Finland	Registry-based, record-linkage study (Finish Cancer Registry, 1970 population census); enrolment 1971–1980; follow-up 1982; vital status ascertainment, complete; 10 181 women aged 25–-69 with breast cancer	Social class on the basis of own occupation in 1970 census and, for housewives, of husband's occupation: social class I, professional and administrative; class II, lower administrative and self-employed; class III, skilled workers; class IV, unskilled workers	Population overlapping with Auvinen *et al.*, 1995
Kato *et al.*, 1992; Japan	Registry-based (Aichi Cancer Registry); enrolment and follow-up 1983–1988; two cancer sites (4485 subjects with stomach cancer and 2618 with colorectal cancer)	Occupation, in four groups. Men: professional; clerical; production; service. Women: professional–clerical; production; service; housewife	
Keirn & Metter, 1985; USA	Hospital-based (City of Hope Medical Center, CA); enrolment 1976–1981; three cancer sites (430 subjects with breast cancer, 265 with colon cancer and 406 with lung cancer)	Economic status, in two groups: low status patients defined as those receiving indigent insurance; high status those with non-indigent insurance	
Kogevinas *et al.*, 1991; England and Wales	Registry-based, record-linkage study (1971 census, National Cancer Registration Scheme); enrolment 1971–1981; follow-up 1983; 6737 men and 6470 women; 18 cancer sites	Housing tenure, in two categories: owner occupiers (high status); council tenants (low status)	Results also available for Registrar General's social class (Kogevinas, 1990)
Lamont *et al.*, 1993; Scotland	Registry-based (West of Scotland); enrolment 1980–1987; 1588 women with invasive cervical cancer	Residence (postcode), using Carstairs–Morris index of deprivation (seven categories)	
LeMarchand *et al.*, 1984; USA	Registry-based (Hawaii Tumour Registry); enrolment 1960–1979; follow-up 1980; vital status ascertainment 93.2%; 2956 women with breast cancer	Residence, in three groups on the basis of 1960 and 1970 census tract characteristics (education and income)	
Linden, 1969; USA	Registry-based (California Tumour Registry); enrolment 1942–1962; follow-up 1966; 1662 White women aged 55–64 with localized breast cancer	Type of hospital: public/county (low status); private (high)	

Table 1. (Contd) Socioeconomic differences in cancer survival: description of the studies

Reference; country	Study design	Social indicator	Comments
Lipworth *et al.*, 1970; USA	Hospital-based (Boston non-private hospitals and clinics); enrolment and follow-up 1957–1963; 79 men and 21 women; 10 cancer sites	Residence, classified in two categories on the basis of median family income in 1960 census tracts: >US$ 5000; <US$ 5000	
Lipworth *et al.*, 1972; USA	Hospital-based (Boston hospitals participating in state cancer registry); enrolment and follow-up 1964–1966; 122 men and 42 women; 10 sites	Two patient groups: private patients (high status); non-private patients (low status)	
Milner & Watts, 1987; UK	Trent Cancer Registry; enrolment 1971–1984; follow-up 1986; 548 women with cervical cancer	Residence. Electoral wards ranked in five groups according to percentage of unskilled and semiskilled workers: 1 (high) to 5 (low)	
Monnet *et al.*, 1993; France	Registry-based (Côte d'Or); enrolment 1976–1980; follow-up 1987; vital status ascertainment 98%; 771 patients with colorectal cancer	Type of housing, as registered in 1970 census in three categories: comfortable; midcomfort; no comfort	
Morrison *et al.*, 1977; four countries	Hospital-based (Boston, MA, USA; Glamorgan, Wales; Slovenia, Yugoslavia; Tokyo, Japan); 3146 women with breast cancer; loss to follow-up less than 2%	Education, in four categories	
Murphy *et al.*, 1990; England and Wales	Registry-based (South Thames); enrolment and follow-up 1977–1981; 1728 women (879 with social class information) with cervical cancer	Social class on the basis of occupation: social class I and II (high); III, IV and V (low)	Not defined whether social class in women is based on own or husband's occupation
Nandakumar *et al.*, 1995; India	Registry-based (Bangalore); enrolment 1982–1989; follow-up 1993; 1514 women with breast cancer	Education, in two groups: illiterate; literate	
Nomura *et al.*, 1981; USA	Registry-based (Hawaii Tumour Registry); enrolment 1960–1974; follow-up 1976; vital status ascertainment 98.5%; 1900 subjects with lung cancer	Residence, in three groups on the basis of census tract information (average income and average education of persons living in the tract)	
Roberts *et al.*, 1990; Scotland	Registry-based (Edinburgh); enrolment 1979; follow-up 1986; 87 women with breast cancer	Residence (postcode sector), in two groups on the basis of census data (percentage of the population in social class IV and V)	

Table 1. (Contd) Socioeconomic differences in cancer survival: description of the studies

Reference; country	Study design	Social indicator	Comments
Rosso *et al.*, pers. commun.; Italy	Registry-based, record-linkage study (1981 census, Piedmont Cancer Registry); enrolment 1985-87; follow-up 1993; 11 053 subjects; 21 cancer sites	Education: primary or less; middle; high; university. Relative risk also provided for housing tenure (owner occupier; council tenant)	Results also available for housing tenure
Shelton *et al.*, 1992; USA	Registry-based (Connecticut Tumour Registry); enrolment 1984–1988; follow-up 1990; vital status ascertainment around 90%; 3711 women with *in situ* and invasive carcinoma of the cervix	Residence, in three groups on the basis of 1980 census tract information (percentage high-school education)	Results also available for other socioeconomic indicators (percentage living below poverty line, and median family income)
Schrijvers *et al.*, 1995a; England	Registry-based (South Thames Regional Health Authority); 29 676 women with breast cancer diagnosed between 1980 and 1989	Residence (enumeration districts): five groups using Carstairs index (overcrowding, male unemployment, low social class and car ownership)	
Schrijvers *et al.*, 1995b; The Netherlands	Eindhoven Cancer Registry; enrolment 1980–1989; follow-up 1991; loss to follow-up 1%; 15 016 subjects; five cancer sites	Residence (postcode): five groups on the basis of education of head of household	
Stavraky *et al.*, 1988; Canada	Hospital-based (two hospitals, Ontario); enrolment and follow-up 1980–1982; 25–70 years at diagnosis; 224 English-speaking subjects with lung cancer	Education, in three categories: high (≥12 grade); average (grades 8–11); low (<8 grade)	
Stavraky *et al.*, 1987; Canada	Hospital-based (two hospitals, Ontario); enrolment and follow-up 1980–1982; 25–70 years at diagnosis; 975 English-speaking subjects; all cancers combined	Education, in three categories: high (≥12 grade); average (grades 8–11); low (<8 grade)	Results also available for other socioeconomic indicators such as the seven-point Hollinshead scale of occupation
Steinhorn *et al.*, 1986; USA	Registry-based (San Francisco-Oakland, Detroit, Atlanta); enrolment 1973–1977; 5415 women with cancer of the corpus uteri	Residence, in two groups on the basis of 1970 census tract information on median family income and mean highest education	
Vågerö & Persson, 1987; Sweden	Registry-based, record-linkage study (1960 census, Swedish Cancer Registry); enrolment and follow-up 1961–1979; 5936 men and 39 012 women aged 20–64 at diagnosis, economically active in 1960; 13 cancer sites	Occupational status at 1960 census, in two categories: blue-collar; white-collar. (In men, also self-employed agricultural workers)	

Table 1. (Contd) Socioeconomic differences in cancer survival: description of the studies

Reference; country	Study design	Social indicator	Comments
Waxler-Morrison *et al.*, 1991; Canada	Hospital-based (AMEC, Vancouver); enrolment 1980–1981; follow-up 1985; 168 women with breast cancer	Employment status (employed; not employed) and education	
Wegner *et al.*, 1982; USA	Registry-based (Hawaii Tumour Registry); enrolment 1960–1974; follow-up 1981; vital status ascertainment >95%; 1446 subjects with colon cancer and 881 with rectal cancer	Residence, in three groups on the basis of census tract information (average years of education and average income of persons living in the tract)	

Table 2. Socioeconomic differences in cancer survival: all neoplasms

Reference; country	Social scale	Results	Comments
Study modelling survival			
Vågerö & Persson, 1987; Sweden	*Men*		Results provided in figures only: approximate five-year survival rates were 42% for male white-collar workers, 38% for male blue-collar workers, 64% for female white-collar workers, and 53% for female blue-collar workers
	Blue-collar	Better	
	White-collar	Worse	
	Self-employed		
	Women		
	Blue-collar	Better	
	White-collar	Worse	
Studies modelling mortality			
Chiricos *et al.*, 1984; USA	Blue-collar	1.0	Relative risk (CI not available). Cox regression: *P* values for socioeconomic status around 0.05. Relative risk not significant when adjusting for stage
	White-collar	0.80	
	>US$ 13 000	0.97	
	US$ 6000–13 000	1.0	
	<US$ 6000	1.24	
Stavraky *et al.*, 1987; Canada	*Men*		Relative risk (95% CI). Logistic regression, adjusting for age and other variables. Outcome: alive at one year without disease versus alive at one year with disease or dead. Non-employed men (RR = 1.5; 95% CI = 0.9–2.4) and women (RR = 1.4; 95% CI = 0.9–2.2) had worse survival than those employed. Similar results for other socioeconomic indicators such as the seven-point Hollinshead scale of occupation
	Low education	1.0	
	High education	0.9 (0.5–1.6)	
	Women		
	Low education	1.0	
	High education	0.8 (0.9–2.4)	
Kogevinas *et al.*, 1991; England and Wales	*Men*		Standardized case fatality ratio (standardized for age and period of follow-up). Crude five-year survival rates were 26% for male owner occupiers, 21% for male council tenants, 43% for female owner occupiers and 36% for female council tenants
	Owner occupier	0.92	
	Council tenant	1.10	
	Women		
	Owner occupier	0.94	
	Council tenant	1.05	

CI, confidence interval; RR, relative risk.

Table 3. Socioeconomic differences in survival from oesophageal cancer

Reference; country	Social scale	Results	Comments
Study modelling survival			
Berg *et al.*, 1977; USA	Private	41%	Crude survival rate at six months after diagnosis
	Clinic pay	45%	
	Indigent	38%	
Study modelling mortality			
Kogevinas *et al.*, 1991; England and Wales	*Men*		Standardized case fatality ratio (standardized for age and period of follow-up). Crude five-year survival rates were 5% for male owner occupiers, 3% for male council tenants, 11% for female owner occupiers and 2% for female council tenants
	Owner occupier	0.93	
	Council tenant	1.03	
	Women		
	Owner occupier	0.92	
	Council tenant	1.16	

Table 4. Socioeconomic differences in survival from stomach cancer

Reference; country	Social scale	Results	Comments
Studies modelling survival			
Berg *et al.*, 1977; USA	Private	40%	Crude survival rate at eight months after diagnosis
	Clinic pay	34%	
	Indigent	37%	
Lipworth *et al.*, 1970; USA	*Men*		Relative three-year survival rate
	>US$ 5000	27.6%	
	<US$ 5000	11%	
	Women		
	>US$ 5000	0%	
	<US$ 5000	41%	
Lipworth *et al.*, 1972; USA	*Men*		Crude survival rate at 10 months after diagnosis, adjusted for stage
	Private	39%	
	Non-private	25%	
	Women		
	Private	47%	
	Non-private	30%	
Kato *et al.*, 1992; Japan	*Men*		Five-year cumulative survival rate. Survival differences between occupations were also observed in a Cox regression analysis, adjusting for age, extent of disease, marital status and residence, but were not statistically significant. Relative risk for professional versus service workers was 0.83 (95% CI = 0.65–1.06) in men and 0.84 (95% CI = 0.68–1.03) in women
	Professional	59%	
	Clerical	51%	
	Production	44%	
	Service	42%	
	Women		
	Professional–clerical	47%	
	Production	40%	
	Service	42%	
	Housewives	37%	

Table 4. (Contd) Socioeconomic differences in survival from stomach cancer

Reference; country	Social scale	Results	Comments
Studies modelling survival			
Vågerö & Persson, 1987; Sweden	*Men* Blue-collar White-collar Self-employed	No appreciable difference	Relative five-year survival rate. Results provided in figures only for men
Studies modelling mortality			
Bako *et al.*, 1985; Canada	*Men* Agriculture Blue-collar White-collar Not in labour force *Women* Agriculture Blue-collar White-collar Not in labour force	 1.0 0.81 (0.57–1.15) 0.82 (0.37–1.83) 0.81 (0.60–1.09) 1.0 1.21 (0.59–2.45) 1.21 (0.67–2.18) 0.93 (0.45–1.92)	Relative risk (95% CI). Cox regression
Studies modelling mortality			
Kogevinas *et al.*, 1991; England and Wales	*Men* Owner occupier Council tenant *Women* Owner occupier Council tenant	 0.96 1.06 1.02 0.96	Standardized case fatality ratio (standardized for age and period of follow-up). Crude five-year survival rates were 5% for male owner occupiers, 3% for male council tenants, 6% for female owner occupiers and 8% for female council tenants
Schrijvers *et al.*, 1995b; The Netherlands	High Intermediate Low	1.0 0.92 (0.71–1.20) 0.89 (0.69–1.15)	Cox regression adjusted for age

CI, confidence interval.

Table 5. Socioeconomic differences in survival from colorectal cancer

Reference; country	Social scale	Results	Comments
Studies modelling survival			
Berg *et al.*, 1977; USA	*Colon*		Crude five-year survival rate
	Private	42%	
	Clinic pay	39%	
	Indigent	28%	
	Rectum		
	Private	41%	
	Clinic pay	33%	
	Indigent	24%	
Kato *et al.*, 1992; Japan	*Men*		Colorectal cancer. Five-year cumulative survival rate. Survival differences between occupations were also observed in a Cox regression analysis, adjusting for age, extent of disease, marital status and residence, but were not statistically significant. Relative risk for professional versus service workers was 0.83 (95% CI = 0.65–1.06) in men and 0.84 (CI = 0.68–1.03) in women
	Professional	62%	
	Clerical	57%	
	Production	58%	
	Service	53%	
	Women		
	Professional–clerical	72%	
	Production	64%	
	Service	57%	
	Housewives	51%	
Keirn & Metter, 1985; USA	*Local stage*		Colon cancer. Median survival (in months) for regional and remote stages, and 75th percentile survival (in months) for local stage
	Indigent	53	
	Non-indigent	50	
	Regional		
	Indigent	41	
	Non-indigent	47	
	Remote		
	Indigent	12	
	Non-indigent	10	
Lipworth *et al.*, 1970, USA	*Men, colon*		Relative three-year survival rate
	>US$ 5000	55%	
	<US$ 5000	38%	
	Women, colon		
	>US$ 5000	36%	
	<US$ 5000	51%	
	Men, rectum		
	>US$ 5000	26%	
	<US$ 5000	24%	
	Women, rectum		
	>US$ 5000	41%	
	<US$ 5000	31%	
Lipworth *et al.*, 1972; USA	*Men, colon*		Crude survival rate at 10 months after diagnosis, adjusted for stage
	Private	63%	
	Non-private	55%	
	Women, colon		
	Private	70%	
	Non-private	51%	

Table 5. (Contd) Socioeconomic differences in survival from colorectal cancer

Reference; country	Social scale	Results	Comments
Studies modelling survival			
	Men, rectum		
	Private	79%	
	Non-private	48%	
	Women, rectum		
	Private	71%	
	Non-private	59%	
Vågerö & Persson, 1987; Sweden	*Men, colon*		Results provided in figures only. Approximate five-year relative survival rates for colon cancer were 47% for male white-collar workers, 44% for male blue-collar workers and 37% for self-employed farmers. Approximate five-year relative survival rates for rectal cancer were 47% for male white-collar workers, 39% for male blue-collar workers and 32% for self-employed farmers
	White-collar	Best	
	Blue-collar	Medium	
	Self-employed	Worse	
	Women, colon		
	White-collar	Better	
	Blue-collar	Worse	
	Men, rectum		
	White-collar	Best	
	Blue-collar	Medium	
	Self-employed	Worse	
	Women, rectum		
	White-collar	Better	
	Blue-collar	Worse	
Studies modelling mortality			
Auvinen, 1992; Finland	I	0.88	Colon cancer. Relative risk. Life-table regression analysis corrected by cause of death and adjusting for age and sex. Five-year survival rates were 50% for social class I and 43% for class IV
	II	0.96	
	III	1.0	
	IV	1.01	
	Farmers	1.08	
	Unknown	1.12	
Bonett *et al.*, 1984; Australia	High	1.0	Colon cancer. Relative risk (95% CI). Cox regression analysis. Five-year survival rates were 37% for low status, 43% for medium status and 53% for high status
	Low	1.26 (1.04–1.52)	
Brenner *et al.*, 1991; Germany	*Colon*		Cox regression adjusted for urbanity, region, year of diagnosis, sex, age and stage
	High	1.00	
	Medium	1.04 (0.87–1.25)	
	Low	1.22 (1.01–1.47)	
	Rectum		
	High	1.00	
	Medium	1.05 (0.86–1.28)	
	Low	1.32 (1.09–1.60)	
Chirikos & Horner, 1985; USA	>US$ 13 000	0.29*	Colorectal cancer. Risk ratios from Cox regression adjusted for age, disease severity and treatment. Middle income is the reference group. *$P < 0.05$
	US$ 6000–12 999	1.0	
	<US$ 5999	0.78	

Table 5. (Contd) Socioeconomic differences in survival from colorectal cancer

Reference; country	Social scale	Results	Comments
Studies modelling mortality			
Dayal *et al.*, 1987; USA	*Colon*		Cox regression, adjusting for age, sex and race
	High	1.00	
	Medium	0.90	
	Low	0.97	
	Rectum		
	High	1.00	
	Medium	1.02	
	Low	1.09	
Kogevinas *et al.*, 1991; England and Wales	*Men, colon*		Standardized case fatality ratio (standardized for age and period of follow-up). Crude five-year survival rates for colon cancer were 25% for male owner occupiers, 13% for male council tenants, 26% for female owner occupiers and 25% for female council tenants. Crude five-year survival rates for rectal cancer were 27% for male owner occupiers, 20% for male council tenants, 24% for female owner occupiers and 33% for female council tenants
	Owner occupier	0.89	
	Council tenant	1.28	
	Women, colon		
	Owner occupier	0.92	
	Council tenant	1.02	
	Men, rectum		
	Owner occupier	0.92	
	Council tenant	1.09	
	Women, rectum		
	Owner occupier	1.04	
	Council tenant	0.85	
Monnet *et al.*, 1993; France	Comfortable	1.0	Colorectal cancer. Cox regression, adjusting for all prognostic variables. Five-year relative survival rates were 39% for comfortable housing, 22% for midcomfort and 12% for no comfort
	Mid-comfort	1.49 (1.20–1.72)	
	No comfort	2.01 (1.29–3.18)	
Schrijvers *et al.*, 1995b; The Netherlands	High	1.0	Colorectal. Cox regression adjusted for age and period of follow-up
	2	1.00 (0.79–1.28)	
	3	1.06 (0.87–1.30)	
	4	1.15 (0.95–1.40)	
	Low	1.17 (0.97–1.41)	
Wegner *et al.*, 1982; USA	*Colon*		
	High	0.82 (0.66–1.02)	Relative risk (95% CI). Cox regression. Risk ratios adjusted for age, sex, race and stage
	Middle	0.96 (0.80–1.17)	
	Low	1.0	
	Rectum		
	High	0.79 (0.60–1.05)	
	Middle	0.79 (0.61–1.03)	
	Low	1.0	

CI, confidence interval.

Table 6. Socioeconomic differences in survival from cancer of the pancreas

Reference; country	Social scale	Results	Comments
Studies modelling survival			
Berg *et al.*, 1977; USA	Private Clinic pay Indigent	48% 37% 34%	Crude survival rate at four months after diagnosis
Vågero & Persson, 1987; Sweden	Blue-collar White-collar Self-employed	No appreciable differences	Results provided in figures only; approximate five-year survival rates around 5%
Study modelling mortality			
Kogevinas *et al.*, 1991; England and Wales	*Men* Owner occupier Council tenant *Women* Owner occupier Council tenant	 0.96 1.07 0.96 1.45	Standardized case fatality ratio (standardized for age and period of follow-up). Crude one-year survival rates were 9% for male owner occupiers and male council tenants, 11% for female owner occupiers and 5% for female council tenants

Table 7. Socioeconomic differences in survival from lung cancer

Reference; country	Social scale	Results	Comments
Studies modelling survival			
Berg *et al.*, 1977; USA	Private Clinic pay Indigent	40% 34% 26%	Crude survival rate at nine months after diagnosis
Keirn & Metter, 1985; USA	*Local stage* Indigent Non-indigent *Regional* Indigent Non-indigent *Remote* Indigent Non-indigent	 15 27 15 19 7 7	Median survival (in months) for regional and remote stages, and 75th percentile survival for local stage
Lipworth *et al.*, 1970 USA	*Men* >US$ 5000 <US$ 5000 *Women* >US$ 5000 <US$ 5000	 10% 9.6% 15% 5%	Relative three-year survival rate
Lipworth *et al.*, 1972 USA	*Men* Private Non-private *Women* Private Non-private	 38% 23% 35% 32%	Crude survival rate at 10 months after diagnosis, adjusted for stage
Vågerö & Persson, 1987; Sweden	*Men* Blue-collar White-collar Self-employed *Women* Blue-collar White-collar	No appreciable differences	Results provided in figures only; approximate five-year survival rates in males were 10–15%
Studies modelling mortality			
Bonett *et al.*, 1984; Australia	High Low	NA	Cox regression analysis; results not presented; differences not statistically significant
Kogevinas *et al.*, 1991; England and Wales	*Men* Owner occupier Council tenant *Women* Owner occupier Council tenant	 0.96 1.04 0.94 1.06	Standardized case fatality ratio (standardized for age and period of follow-up). Crude five-year survival rates (not age-adjusted) were 6% for male owner occupiers, 5% for male council tenants, 8% for female owner occupiers and 3% for female council tenants
Nomura *et al.*, 1981 USA	High Medium Low	1.0 1.17 (1.0–1.4) 1.14 (0.97–1.3)	Relative risk (95% CI). Cox regression, adjusting for age, sex, race and stage

Table 7. Socioeconomic differences in survival from lung cancer

Reference; country	Social scale	Results	Comments
Studies modelling mortality			
Schrijvers *et al.*, 1995b; The Netherlands	High	1.0	Cox regression, adjusting for age and period of follow-up
	2	0.97 (0.80–1.18)	
	3	1.05 (0.90–1.24)	
	4	1.14 (0.98–1.33)	
	Low	1.18 (1.02–1.36)	
Stavraky *et al.*, 1988; Canada	Low	1.0	Relative risk (95% CI). Logistic regression, adjusting for age, sex and various psychosocial factors. Increased risk in subjects with reserved personality, extremely sober or enthusiastic personality, and persons in high need for one aspect of social support
	Average	1.2 (0.4–3.4)	
	High	0.6 (0.2–1.9)	

CI, confidence interval; NA, not available.

Table 8. Socioeconomic differences in survival from cancer of the prostate

Reference; country	Social scale	Results	Comments
Studies modelling survival			
Berg *et al.*, 1977; USA	Private Clinic pay Indigent	44% 29% 20%	Crude five-year survival rate. 'Adjusted' five-year survival rates (only cancer deaths) were 60% for private patients, 49% for clinic pay and 43% for indigent
Lipworth *et al.*, 1970; USA	>US$ 5000 <US$ 5000	62% 52%	Relative three-year survival rate
Lipworth *et al.*, 1972; USA	Private Non-private	89% 71%	Crude survival rate at 10 months after diagnosis, adjusted for stage
Vågerö & Persson, 1987; Sweden	Blue-collar White-collar Self-employed	Slightly better Worse Worse	Relative five-year survival rate. Results provided in figures only; approximate survival rates were 53% for white-collar workers and 50% for blue-collar and self-employed workers
Studies modelling mortality			
Dayal *et al.*, 1985; USA	Highest Mid-high Mid-low Lowest	1.0 1.50 1.49 1.86	Cox regression; relative risk adjusted for age and sex; no significant differences by treatment modality; differences observed within each stage of the disease
Kogevinas *et al.*, 1991; England and Wales	Owner occupier Council tenant	1.03 0.94	Standardized case fatality ratio (standardized for age and period of follow-up). Crude five-year survival rates (not age-adjusted) were 21% for owner occupiers and 25% for council tenants
Schrijvers *et al.*, 1995b; The Netherlands	High Intermediate Low	1.0 1.05 (0.77–1.43) 1.20 (0.95–1.59)	Cox regression adjusted for age

Table 9. Socioeconomic differences in survival from bladder cancer

Reference; country	Social scale	Results	Comments
Studies modelling survival			
Berg *et al.*, 1977; USA	Private	42%	Crude five-year survival rate. 'Adjusted' five-year survival rates (only cancer deaths) were 58% for private patients, 53% for clinic pay and 43% for indigent
	Clinic pay	35%	
	Indigent	23%	
Lipworth *et al.*, 1970; USA	*Men*		Relative three-year survival rate
	>US$ 5000	70%	
	<US$ 5000	54%	
	Women		
	>US$ 5000	55%	
	<US$ 5000	51%	
Lipworth *et al.*, 1972; USA	*Men*		Crude survival rate at 10 months after diagnosis, adjusted for stage
	Private	87%	
	Non-private	63%	
	Women		
	Private	84%	
	Non-private	55%	
Vågerö & Persson, 1987; Sweden	*Men*		Results provided in figures only; approximate five-year survival rates were 73% for male white-collar workers, 70% for self-employed and 68% for male blue-collar workers
	Blue-collar	Worse	
	White-collar	Better	
	Self-employed	Medium	
	Women		
	Blue-collar	Worse	
	White-collar	Better	
Study modelling mortality			
Kogevinas *et al.*, 1991; England and Wales	*Men*		Standardized case fatality ratio (standardized for age and period of follow-up). Crude five-year survival rates were 43% for male owner occupiers, 38% for male council tenants, 49% for female owner occupiers and 33% for female council tenants
	Owner occupier	0.91	
	Council tenant	1.11	
	Women		
	Owner occupier	0.83	
	Council tenant	1.17	

Table 10. Socioeconomic differences in survival from female breast cancer

Reference; country	Social scale	Results	Comments
Studies modelling survival			
Bain *et al.*, 1986; USA	High	78.6%	Three-year survival rate
	Low	82.1%	
Berg *et al.*, 1977; USA	Private	54%	Crude five-year survival rate
	Clinic pay	45%	
	Indigent	37%	
Dayal *et al.*, 1982; USA	High	50%	Approximate five-year survival rate
	Medium	42%	
	Low	39%	
Keirn & Metter, 1985; USA	*Local stage*		Median survival (in months) for remote stage, 75th percentile for regional stage and 80th percentile for local stage
	Non-indigent	53	
	Indigent	32	
	Regional		
	Non-indigent	43	
	Indigent	32	
	Remote		
	Non-indigent	19	
	Indigent	29	
Linden, 1969; USA	Private hospital	86%	Five-year relative survival rate
	Public hospital	68%	
Lipworth *et al.*, 1970; USA	>US$ 5000	71%	Relative three-year survival rate
	<US$ 5000	62%	
Lipworth *et al.*, 1972; USA	Private	89%	Crude survival rate at 10 months after diagnosis, adjusted for stage
	Non-private	73%	
Morrison *et al.*, 1977; USA, Wales, Yugoslavia, Japan	*USA*		Five-year age-adjusted survival rate
	16+	69%	
	12–15	63%	
	8–11	53%	
	<8	52%	
	Wales		
	12–15	67%	
	8–11	52%	
	Yugoslavia		
	12–15	41%	
	8–11	60%	
	<8	39%	
	Japan		
	12–15	80%	
	8–11	75%	
	<8	72%	
Roberts *et al.*, 1990; Scotland	High	70%	Approximate five-year survival rate
	Low	70%	
Vågerö & Persson, 1987; Sweden	White-collar	72%	Approximate relative five-year survival rate
	Blue-collar	65%	

Table 10. (Contd) Socioeconomic differences in survival from female breast cancer

Reference; country	Social scale	Results	Comments
Studies modelling mortality			
Auvinen, 1995; Finland	I II III IV	0.75 (0.65–0.86) 0.85 (0.76–0.94) 0.93 (0.85–1.03) 1.0	Risk ratio adjusted for age and year of diagnosis. Five-year cumulative survival: class I, 77%; class II, 75%; class III, 73%; class IV, 72%
Bassett & Krieger, 1986; USA	High Low	1.0 1.52 (1.28–1.88)	Relative risk adjusted for race, age, stage and histology
Boffetta *et al.*, 1993; Italy	≥ 7 years < 7 years	0.7 (0.4–1.1) 1	Relative risk adjusted for age; analysis limited to subjects living in Torino
Bonett *et al.*, 1984; Australia	High Low	1.0 1.35 (1.0–1.7)	Cox regression analysis
Ell *et al.*, 1992; USA	Duncan's index	0.996	Relative risk
Gordon *et al.*, 1992; USA	High Low	1.0 1.49 (1.17–1.89)	Cox regression
Karjalainen & Pukkala, 1990; Finland	I II III IV	0.78 (0.68–0.90) 0.85 (0.77–0.93) 0.92 (0.88–0.97) 1.0	Risk ratio adjusted for age, follow-up, calendar period of diagnosis, stage and the interaction of stage and follow-up period. Overlapping with Auvinen *et al.*, 1995
Kogevinas *et al.*, 1991; England and Wales	Owner occupier Council tenant	0.99 0.97	Standardized case fatality ratio. Crude five-year survival rates: 50% for owner occupiers and 52% for council tenants
LeMarchand *et al.*, 1984; USA	High Medium Low	1.0 0.96 (0.77–1.2) 1.23 (0.97–1.57)	Relative risk (95% CI), adjusting for age, stage, race, histology and marital status
Nandakumar *et al.*, 1995; India	Illiterate Literate	1.0 0.7 (0.6–0.8)	Relative risk (95% CI), adjusting for religious group, marital status and clinical extent of the disease. Five-year survival rates were 35% (illiterate) and 46% (literate)
Rosso *et al.*, pers. commun.; Italy	University High Middle Low	0.89 (0.54–1.49) 0.94 (0.70–1.27) 1.01 (0.99–1.51) 1.0	Relative risk adjusted for age, place of birth and housing
Schrijvers *et al.*, 1995a; England	Affluent 2 3 4 Deprived	1.0 1.15 (1.05–1.27) 1.30 (1.18–1.44) 1.31 (1.18–1.46) 1.35 (1.16–1.579	Cox regression adjusted for follow-up period and period of diagnosis. Women aged 30–64
Schrijvers *et al.*, 1995b; The Netherlands	High 2 3 4 Low	1.0 1.06 (0.84–1.33) 1.04 (0.86–1.26) 1.15 (0.96–1.38) 1.18 (0.99–1.42)	Cox regression adjusted for age and period of follow-up
Waxler-Morrison *et al.*, 1991; Canada	Employed Not employed	1.0 1.52	Cox regression adjusting for nodal status, stage of disease, marital status and four other factors

CI, confidence interval.

Table 11. Socioeconomic differences in survival from cervical cancer

Reference; country	Social scale	Results	Comments
Studies modelling survival			
Berg *et al.*, 1977; USA	Private Clinic pay Indigent	73% 67% 57%	Crude five-year survival rate
Bonett *et al.*, 1984; Australia	High Low	73% 60%	Four-year survival rate; results not statistically significant in Cox regression analysis
Lipworth *et al.*, 1970; USA	>US$ 5000 <US$ 5000	71% 55%	Relative three-year survival rate
Lipworth *et al.*, 1972; USA	Private Non-private	84% 77%	Crude survival rate at 10 months after diagnosis, adjusted for stage
Murphy *et al.*, 1990; England and Wales	I and II III IV and V	No appreciable differences	Kaplan-Meier survival curves shown in figure
Vågerö & Persson, 1987; Sweden	White-collar Blue-collar	Better Worse	Approximate relative five-year survival rates were 70% for white-collar workers and 65% for blue-collar workers (results provided in figure)
Studies modelling mortality			
Kogevinas *et al.*, 1991; England and Wales	Owner occupier Council tenant	0.95 0.97	Standardized case fatality ratio. Crude five-year survival rates were 54% for owner occupiers and 53% for council tenants
Lamont *et al.*, 1993; Scotland	1 Most affluent 2 Affluent 3 Above average 4 Average 5 Below average 6 Deprived 7 Most deprived	0.56 (0.4–0.7) 0.62 (0.5–0.8) 0.86 (0.8–0.97) 1.06 (0.96–1.2) 1.02 (0.9–1.1) 1.16 (1.0–1.3) 1.52 (1.3–1.7)	Age-standardized cancer morbidity ratio
Milner & Watts, 1987 UK	1 (high) 2 3 4 5 (low)	0.96 0.88 0.98 0.80 1.21	Observed over expected deaths adjusted for age (ratios calculated by Kogevinas and Porta for this review)
Shelton *et al.*, 1992 USA	High Medium Low	0.64 (0.4–1.0) 0.96 (0.6–1.4) 1.0	Relative risk (95% CI). Logistic regression adjusting for age, race and stage of the disease

CI, confidence interval.

Table 12. Socioeconomic differences in survival from cancer of the corpus uteri

Reference; country	Social scale	Results	Comments
Studies modelling survival			
Berg *et al.*, 1977; USA	Private Clinic pay Indigent	70% 66% 57%	Crude five-year survival rate. Adjusting for stage of the disease narrowed survival differences
Lipworth *et al.*, 1970; USA	>US$ 5000 <US$ 5000	75% 78%	Relative three-year survival rate
Lipworth *et al.*, 1972; USA	Private Non-private	88% 61%	Crude survival rate at 10 months after diagnosis, adjusted for stage
Vågerö & Persson, 1987; Sweden	Blue-collar White-collar	Better Worse	Relative five-year survival rate. Results provided in figures only; approximate survival rates were 88% for white-collar workers and 82% for blue-collar workers
Studies modelling mortality			
Kogevinas *et al.*, 1991; England and Wales	Owner occupier Council tenant	0.85 1.20	Standardized case fatality ratio (standardized for age and period of follow-up). Crude five-year survival rates were 65% for owner occupiers and 54% for council tenants
Steinhorn *et al.*, 1986; USA	High income Low income	1.0 1.33	Relative risk (95% CI not available) for adenocarcinoma ($P < 0.01$); Cox regression adjusting for race, age, stage, study centre and education. Similar results for education (RR = 1.18; $P < 0.05$). Relative risk for sarcomas not significant for income (RR = 0.83) but significant for education (RR = 1.86; $P < 0.05$)

CI, confidence interval.

Table 13. Socioeconomic differences in survival from ovarian cancer

Reference; country	Social scale	Results	Comments
Study modelling survival			
Berg *et al.*, 1977; USA	Private Clinic pay Indigent	44% 43% 40%	Crude survival rate at 18 months after diagnosis
Lipworth *et al.*, 1970; USA	>US$ 5000 <US$ 5000	32% 30%	Relative three-year survival rate
Lipworth *et al.*, 1972; USA	Private Non-private	58% 55%	Crude survival rate at 10 months after diagnosis, adjusted for stage
Vågerö & Persson, 1987; Sweden	Blue-collar White-collar	Better Worse	Relative five-year survival rate. Results provided in figures only; approximate survival rates were 34% for white-collar workers and 30% for blue-collar workers
Study modelling mortality			
Kogevinas *et al.*, 1991; England and Wales	Owner occupier Council tenant	0.94 1.07	Standardized case fatality ratio (standardized for age and period of follow-up). Crude five-year survival rates were 26% for owner occupiers and 19% for council tenants