TECHNICAL REPORT
RERF TR 5-88
業 績 報 告 書

LIFE SPAN STUDY REPORT 11
PART 2. CANCER MORTALITY IN THE YEARS 1950-85 BASED ON THE RECENTLY REVISED DOSES (DS86)

寿 命 調 査　第 11 報
第 2 部 新線量（DS86）における 1950-85 年の癌死亡率

YUKIKO SHIMIZU, D.M.Sc. 清水由紀子
HIROO KATO, M.D. 加藤寛夫
WILLIAM J. SCHULL, Ph.D.

放影研
RERF

RADIATION EFFECTS RESEARCH FOUNDATION
財団法人　放 射 線 影 響 研 究 所

A cooperative Japan - United States Research Organization
日 米 共 同 研 究 機 関

RERF TECHNICAL REPORT SERIES
放影研業績報告書集

The RERF Technical Reports provide the official bilingual statements required to meet the needs of Japanese and American staff members, consultants, and advisory groups. The Technical Report Series is not intended to supplant regular journal publication.

放影研業績報告書は，日米専門職員，顧問，諮問機関の要求に応えるための日英両語による公式報告記録である．業績報告書は通例の誌上発表論文に代わるものではない．

The Radiation Effects Research Foundation (formerly ABCC) was established in April 1975 as a private nonprofit Japanese Foundation, supported equally by the Government of Japan through the Ministry of Health and Welfare, and the Government of the United States through the National Academy of Sciences under contract with the Department of Energy.

放射線影響研究所（元ABCC）は，昭和50年4月1日に公益法人として発足したもので，その経費は日米両政府の平等分担により，日本は厚生省の補助金，米国はエネルギー省との契約に基づく米国学士院の補助金とをもって運営されている．

CONTENTS
目 次

LIST OF TABLES
表

LIST OF FIGURES
図

放影研 RERF RADIATION EFFECTS RESEARCH FOUNDATION
財団法人 放射線影響研究所

Research Project 研究課題 1-75

LIFE SPAN STUDY REPORT 11
PART 2. CANCER MORTALITY IN THE YEARS 1950-85 BASED ON THE RECENTLY REVISED DOSES (DS86)

寿命調査 第11報
第2部 新線量(DS86)における1950-85年の癌死亡率

YUKIKO SHIMIZU, D.M.Sc. (清水由紀子)[1]; HIROO KATO, M.D. (加藤寛夫)[1]; WILLIAM J. SCHULL, Ph.D.[2]

Department of Epidemiology[1] *and Permanent Director*[2]
疫学部[1] 及び常務理事[2]

SUMMARY

ABCC and its successor, RERF, have followed since 1959 and retrospectively to 1950 the mortality in a fixed cohort of survivors of the atomic bombings of Hiroshima and Nagasaki, the so-called Life Span Study sample. The present study, the 11th in a series that began in 1961, extends the surveillance period three more years and covers the period 1950-85. It is based on the recently revised dose system, called DS86, that has replaced previous estimates of individual exposures. The impact of the change from the old system of dosimetry, the T65DR, to the new on the dose-response relationships for cancer mortality was described in the first of this series of reports. Here, the focus is on cancer mortality among the 76,000 A-bomb survivors within the LSS sample for whom DS86 doses have been estimated, with the emphasis on biological issues associated with radiation carcinogenesis.

Briefly, the following was found: The excess in leukemia mortality has continued to decline with time, but remains slightly but significantly elevated in the most recent years of study, 1981-85 in Hiroshima. For cancers other than leukemia, excess deaths continue to increase with time in proportion to the natural cancer mortality for the attained age, and the relative risk (RR) seems unchanged over time for specific age-at-the-time-of-the-bombing (ATB) cohorts except for the youngest cohort, i.e., 0-9 years ATB. For the latter cohort, unlike the older cohorts, the time from exposure to

要 約

ABCC及び放影研では，寿命調査集団と呼ばれる広島・長崎の原爆被爆者固定集団の死亡率追跡調査を1950年にさかのぼって1959年以来行ってきた．本報告は，1961年に始まった寿命調査報告書シリーズの第11報で，追跡期間を前報より3年間延長し，調査期間は1950-85年である．本報告は，以前の個人の被曝線量推定値に代わって，DS86と呼ばれる最近改定された被曝線量に基づいている．旧線量(T65DR)から新線量への切り替えによる癌死亡率の線量反応関係についての変化は，第11報の第1部に詳述した．本報告では，寿命調査集団のうち，DS86線量が推定されている76,000人の被爆者を対象に，放射線発癌に関する生物学的問題点に焦点を当てて癌死亡率を解析した．

結果は下記のようである．白血病の過剰死亡は，年々減少し続けているが，一番最近の調査期間，1981-85年においても，広島ではわずかであるが依然として残っており，統計的に有意である．白血病以外の全部位の癌については，過剰死亡は年齢別の自然癌死亡率に比例して，年々増加し続けている．相対リスクは，被爆時年齢が0-9歳を除いて，各被爆時年齢別コホートにおいて経年的変化は認められない．0-9歳のコホートは，それ以上の年齢のコホートと異なり，

Approved 承認 11 April 1988

Printed 印刷 December 1988

death (a measure of the latent period) is shortened for all cancers combined except leukemia in the high (1 Gy and over) dose group and the RR decreases with time under 30 years of age and then levels off. The present analysis still supports, in the main, the RR model rather than the absolute risk (AR) model in estimating lifelong risk.

For the same attained age, both the RR and AR are higher for younger age-ATB cohorts than for older ones.

Since the cohort is aging, the trend in estimated risk with time for the entire cohort has been examined, either with an adjustment for age-ATB effects or within specific age-ATB cohorts. The excess RR does not vary statistically over time to a significant degree for all cancers except leukemia, nor for cancers of the stomach, lung, and breast. However, at face value, a slightly decreasing trend with time is seen for cancer of the lung, and a slightly increasing trend is noted for all cancers except leukemia, and for cancers of the stomach and breast. Further surveillance will be necessary to clarify the pattern of temporal change in radiation-induced cancer.

Some sex differences in estimated risk are observed. As in the most recent previous report (1950-82), there is no statistically significant difference in excess deaths between males and females except for leukemia, though the RR is higher for females than for males, significantly so for cancers of the esophagus and lung, reflecting the higher background cancer rate for males. An extensive lung cancer analysis, based on the cohort for the present analysis using both radiation and smoking information, revealed that the sex difference in excess RR observed without adjustment for smoking, is no longer significant after adjustment.

As previously observed, a statistically significant increase in the frequency of deaths with increasing dose is observed for leukemia, cancers of the esophagus, stomach, colon, lung, breast, ovary, urinary bladder, and multiple myeloma. No significant increase is demonstrable as yet for cancers of the rectum, gallbladder, pancreas, uterus, and prostate and malignant lymphoma. In the present report, the study of the frequency of deaths related to ionizing radiation has been extended to include cancers of the bone, pharynx, nose and larynx, and skin except melanoma, but none of these sites showed a significant increase with dose. Mortality tends to

被爆から死亡までの期間（潜伏期）は，高線量被曝群（1 Gy 以上）の白血病を除く全癌では短縮しており，相対リスクは30歳までは年々減少し，その後平坦になっている．このように，本解析の結果は，生涯リスクの推定において，絶対リスクモデルよりも相対リスクモデルを大体において支持している．

同じ死亡時年齢であれば，若年被爆者群のリスクが老年被爆者群よりも相対リスク及び絶対リスク共に高い．

コホートは，老年化しているので，全コホートについて被爆時年齢を訂正するか，又は，被爆時年齢別に，リスクの経年変化を調べた．過剰相対リスクは，白血病以外の全部位の癌，胃癌，肺癌，乳癌について統計的に有意には変化していない．しかし，肺癌は減少傾向，白血病以外の全部位の癌，胃癌，乳癌は上昇傾向を示した．放射線誘発癌の経年変化のパターンを明らかにするには，更に調査が必要であろう．

推定リスクにおける性差の観察を行った．前回の報告（1950-82）と同様，男の自然癌死亡率が女よりも高いことを反映して，白血病以外の癌で男よりも女に相対リスクは高く，肺癌，食道癌については統計的に有意である．しかし，過剰死亡数については白血病以外の癌では統計的に有意な性差はない．肺癌については，同じコホートについての放射線と喫煙情報を使用した解析で，過剰相対リスクの性差は，喫煙を訂正しない場合は観察されるが，喫煙を訂正するとその差は統計的に有意でなくなる．

放射線量の増加と共に死亡率が有意に高くなるのは，以前にも観察されているように，白血病，食道癌，胃癌，結腸癌，肺癌，乳癌，卵巣癌，膀胱癌，及び多発性骨髄腫である．有意の上昇がみられないのは，直腸癌，胆嚢癌，膵臓癌，子宮癌，前立腺癌及び悪性リンパ腫である．本報告では，更に骨癌，咽頭癌，鼻癌，喉頭癌及び黒色腫以外の皮膚癌と放射線との関係も調べたが，いずれも有意な上昇は認められなかった．脳腫瘍以外の中枢神経系の腫瘍について

increase with dose for tumors of the central nervous system other than the brain ($0.05 < p < 0.10$), but not to increase for brain tumors.

The dose-response curve for all cancers except leukemia, the linear (L) model shows a good fit, although other nonlinear models (except the quadratic one) fit, statistically, the data now available as well as the L model. For leukemia, the L model fits well over the entire dose range, however, when the high dose range is excluded, the linear quadratic (LQ) model fits better than the L model.

Examination of the dose-response relationship at low doses (under 0.50 Gy), using much finer dose categories than have been employed previously, failed to reveal significant differences in the regression coefficients between the low and higher dose ranges except for leukemia, where the estimated risk coefficient for survivors exposed to under 0.5 Gy is lower than that for those exposed to 0.5 Gy and over.

The lifetime risk was estimated employing a method similar to that used in the BEIR III report. The estimated value, based on a L model, for both leukemia and all cancers except leukemia, is about two times higher than that estimated in the BEIR III report. The ratio of the present estimates to the BEIR III estimates under LQ model is much larger than the ratio of the two estimates under L model.

INTRODUCTION

Since 1950, the ABCC and its successor RERF, have studied a fixed cohort of A-bomb survivors and suitable comparison subjects, the so-called Life Span Study (LSS) sample, to ascertain the effects of A-bomb radiation on mortality. Periodic analyses of the results of this surveillance continue; the most recent account (in 1987)[1] spanned the years 1950-82. However, all of the reports published in recent years were based on the T65 system of dosimetry, and beginning about 1978 serious questions were raised about the accuracy of this method of estimating individual doses. Accordingly, an extensive binational reassessment of the A-bomb dosimetry was initiated in 1981. These activities have culminated in a revised method for estimating individual doses, the so-called Dosimetry System 1986 (DS86), and new dose estimates were calculated for members of the LSS cohort in early 1987. Subsequently, a series of analyses was begun using the DS86 doses to assess radiation-dependent mortality for the period 1950-85, extending the surveillance by three

は上昇傾向（$0.05 < p < 0.10$）を示したが，脳腫瘍については，その傾向は観察されなかった．

白血病以外の癌死亡率の線量反応曲線は，線形モデルによく適合しているが，統計的には線形モデルと同様に非線形モデル（二次モデル以外）にも適合する．白血病では，全線量域では線形モデルの適合が良いが，高線量被爆者を除くと線形二次モデルが線形モデルよりもよい適合を示した．

今まで使用されてきたよりも細かな線量区分を使用して，低線量域（0.50 Gy 以下）の線量反応関係の検討をしたが，低線量域と高線量域での回帰係数には有意な差は白血病を除いて認められなかった．白血病では，0.5 Gy 未満での回帰係数は 0.5 Gy 以上でのそれよりも低かった．

BEIR Ⅲ 報告と同様の方法を用いて，生涯リスクを推定した．線形モデルでは，白血病，白血病以外の全部位の癌共に，BEIR Ⅲ 報告の推定値よりも約2倍高い．線形二次モデルでは BEIR Ⅲ の推定値に対する比は線形モデルの場合よりも大きい．

緒　言

1950年以来 ABCC とその後継者である放影研は，原爆放射線が死亡率に及ぼす影響を評価する目的で，原爆被爆者と適当な比較対象者から成る固定集団，いわゆる寿命調査集団の研究を行ってきた．本研究の結果は定期的に解析されており，最も最近の報告書（1987年）[1] は1950-82年に関するものである．しかし，最近まで発表された報告書はすべて T65 線量推定方式に基づいている．この方法による個人線量推定の正確性について1978年ごろから重大な問題点が指摘されるようになった．これに応じて，日米両国による大規模な原爆放射線量再評価が1981年に開始された．その結果，個人線量推定法は改定され，いわゆる，“線量推定方式1986（DS86）”が導入された．これを用いて，1987年初めに寿命調査対象者の新しい線量推定値が算出された．その後 DS86 線量を用いて一連の解析が開始され，前回の報告書[1] での調査期間を1983年から1985年までの3年間延長した1950-

years, 1983-85, over that described in the previous report.[1] An assessment of the impact of the change in dosimetry from the T65D to the DS86 system on site-specific estimates of radiation-related cancer mortality (including AR and RR coefficients, the shape of the dose-response curve, and the relative biological effectiveness, RBE, of neutrons) has been published as Part 1 in this series.[2]

The present report (Part 2) concentrates on several of the biological issues regarding radiation-induced cancer raised by previous analyses of the LSS sample. More specifically, it focuses on the appearance with time of radiation-induced cancer and the effects of such risk modifiers as age ATB, age at time of death (ATD), sex, city, carcinogens other than radiation (i.e., smoking), and so on.

A brief description will also be given of the dose-response relationships for specific sites based on DS86 doses, referring also to results given in Part 1 of this series. In this regard, a more extensive analysis of the dose-response relationship at low doses (under 0.50 Gy) is given, with finer groupings of dose than have generally been employed in previous reports.

Mortality from causes other than cancer will be described in a subsequent report (Part 3).

MATERIALS AND METHODS

Although the T65DR system of dosimetry[3] has been used to estimate individual doses at RERF-ABCC for an appreciable time, some uncertainty has long surrounded both the quantity and quality of the radiation released by these two nuclear weapons. The dose reassessment initiated in 1981 has recently culminated in a new dosimetry, DS86.[2,4] Doses have now been calculated for 16,207 among a total of 19,387 proximally exposed subjects in the LSS sample, those within 1,600 m in Hiroshima or 2,000 m in Nagasaki, mostly survivors within wooden Japanese houses or tenements. As in previous LSS reports, estimates of shielded kerma above 6 Gy have been truncated at 6 Gy.

To avoid ambiguity in the paragraphs to follow, we define here the three terms used to describe individual doses, namely, the free-in-air (FIA) kerma, kerma in house or shielded area (for convenience, designated as shielded kerma), and organ-absorbed dose. The first describes the kerma in tissue at a point 1 m in air over bare ground (i.e., not

85年について放射線量と死亡率の関係の評価が行われた．線量推定方式をT65DからDS86へと変更することによる放射線誘発の部位別癌死亡率（絶対リスク係数及び相対リスク係数，線量反応曲線の形状，中性子の生物学的効果比（RBE）を含む）に及ぼす影響の評価は，本シリーズの第1部[2]として発表した．

本報（第2部）では，寿命調査集団の以前の解析によって明瞭になった放射線誘発癌に関する生物学的問題のうちの幾つかに限定して解析を行った．具体的には，放射線誘発癌の経時的変化並びに被爆時年齢，死亡時年齢，性，都市，放射線以外の発癌物質（喫煙）などのリスク修正要因の影響に限定している．

本シリーズの第1部に示した結果も引用しながら，DS86に基づく特定部位の癌における線量反応関係についても簡単に述べる．この点に関しては，低線量群を以前の報告書で一般に用いられていたよりも細かく区分して，低線量（0.50 Gy未満）での線量反応関係についてより詳細な解析を行った．

癌以外の原因による死亡については報告書の続報（第3部）で述べる．

調査対象及び方法

T65DR線量推定方式[3]はかなり長い間個人線量推定のためABCC-放影研で使用されてきたが，二つの核兵器により放出された放射線の量及び質には長い間不確定要素が存在していた．1981年に開始された線量再評価の結果，最近新線量推定方式DS86が決定された．[2,4] 現在，寿命調査集団中の近距離被爆者合計19,387名のうち16,207名についてDS86線量計算が終了している．これらの被爆者は，広島では爆心地から1,600 m以内で，長崎では2,000 m以内で，主に日本式家屋又は長屋内で被爆している．以前の寿命調査報告書と同じく，6 Gy以上の遮蔽kerma推定値は6 Gyで打ち切った．

以下の記述でのあいまいさを避けるために，個人線量を説明するのに用いる三つの用語，すなわち，空中（FIA）kerma，家屋などの遮蔽があった場合のkerma（便宜上遮蔽kermaと呼ぶ），及び臓器吸収線量をここで定義する．最初の用語（空中kerma）は，非遮蔽地面の

in or near a building); the second, the kerma of the individual with allowance for environmental shielding; and the last, the radiation absorbed by the organ or tissue under consideration. Ideally, risk estimates should be based on organ-absorbed dose, whenever possible. However, to provide a basis for comparison with those studies where organ-absorbed doses are not available, we shall also give the risk estimates based on shielded kerma.

Among a total of 120,128 LSS sample subjects in the extended cohort (LSS-E85),[1] there are 91,228 survivors for whom a T65DR dose could be estimated; this excludes 26,517 individuals "Not-in-city (NIC)" and 2,383 A-bomb survivors for whom a dose (T65DR) could not be estimated. DS86 dose estimates are available for a total of 75,991 (83.3%) of these 91,228 exposed persons (Table 1). Hereafter, these 75,991 individuals, who constitute the basis for the present analysis and include 59,784 distally exposed individuals in addition to the previously mentioned 16,207 proximally exposed, will be referred to as the DS86 subcohort. Assignment of doses to those survivors for whom detailed information on shielding does not exist is described elsewhere.[4]

(すなわち，建築物の中又は付近ではない)地上1mの点における組織中のkermaを，第2の用語(遮蔽kerma)は，環境による遮蔽を考慮した個人kermaを，また，最後の用語(臓器吸収線量)は，当該臓器又は組織に吸収された放射線を意味する．理想的には，リスク推定値は可能であれば常に臓器吸収線量に基づくものであるべきである．しかし，臓器吸収線量が利用できない研究との比較を容易にするために，遮蔽kermaに基づくリスク推定値も使用する．

寿命調査拡大集団(LSS-E85)[1]の対象者合計120,128名のうち，T65DR線量が推定できたのは91,228名である．この中には"市内不在者(NIC)26,517名"並びに線量(T65DR)を推定できなかった2,383名の被爆者は含まれていない．これら91,228名の被爆者のうち，合計75,991名(83.3%)についてDS86線量推定値が得られている(表1)．本解析の対象であり，遠距離被爆者59,784名と前述の近距離被爆者16,207名から成るこれら75,991名をDS86サブコホートと呼ぶことにする．遮蔽に関する詳細な情報が得られない被爆者に対する線量の推定については別途に述べる．[4]

TABLE 1 NUMBER OF SUBJECTS IN THE LSS E85 AND THE DS86 SAMPLES
表1 寿命調査E85集団及びDS86集団における対象者数

City	Sample	Exposure status			
		Total	T65 dose known	T65 dose unknown	Not-in-city
Total	LSS E85	120128	91228	2383	26517
	DS86	75991	75991	-	-
	not DS86	44137	15237	2383	26517
Hiroshima	LSS E85	82062	60468	1426	20168
	DS86	51390	51390	-	-
	not DS86	30672	9078	1426	20168
Nagasaki	LSS E85	38066	30760	957	6349
	DS86	24601	24601	-	-
	not DS86	13465	6159	957	6349

Ascertainment of death

Deaths are routinely identified through the obligatory household registries (koseki) that exist in Japan, and ascertainment is essentially complete. Causes of death are obtained from the Vital Statistics Death Schedules which are based on the death certificates. The present analysis is based on a total of 5,936 (83.7%) cancer deaths occurring in the years 1950-85 in the DS86 subcohort (75,991 persons) among a total of 7,096 cancer deaths in the 91,228 exposed survivors for whom T65DR doses are available (excluding NIC and T65D dose unknown). The underlying cause of death has been classified according to the International Classification of Diseases. (Detailed code rubrics are shown in Appendix Table 1). Appendix Table 2-1 shows the number of subjects, person-years at risk, and mean total, gamma, and neutron doses by DS86 shielded kerma, and Appendix Tables 3-1 show those by organ-absorbed dose.

Statistical methods

A detailed account of the statistical methods we employ has been given elsewhere.[1] Briefly, they involve the use of a grouped survival analysis based on a RR model. Specifically, the model fitted can be described as follows: Let i be the stratum in the cross-classification of city, sex, age ATB, and follow-up interval, j be the exposure category, and Y_{ij}, PY_{ij}, M_{ij} be the numbers of deaths, person-years, and the mortality rate in stratum i and dose group j, respectively. Under these circumstances, mortality in the ij-th stratum can be defined as

$$M_{ij} = M_{i0}\, RR_{ij} \quad ,$$

where RR_{ij} is the risk in stratum i of exposure group j, relative to exposure group 0, after adjusting the background cancer mortality rate for city, sex, age ATB, and time since exposure. More specifically, the coefficients are calculated assuming a linear (in dose) RR function, i.e.,

$$RR_{ij} = 1 + bD_{ij}\exp^{\alpha X} \quad ,$$

where D_{ij} is the mean total dose (gamma rays and neutrons) in the ij-th category, and X is the effect of a radiation modifier, such as sex, city, age ATB, and time since exposure. The total dose D_{ij} is further divided into its $gamma_{ij}$ and $neutron_{ij}$ components.

Parameters are estimated by the method of maximum likelihood, assuming that the num-

死亡の確認

死亡は通常個人の戸籍を照合して確認されており，生死の確認はほぼ完全である．死因は，死亡診断書に基づく人口統計死亡票から得ている．本解析は，T65DR 線量が得られている被爆者91,228名(NIC及びT65D線量不明群を除く)中の合計7,096件の癌死亡のうち，DS86 サブコホート(75,991名)内で1950-85年に発生した癌死亡合計5,936件(83.7%)に基づくものである．原死因を国際疾病分類に従って記号化した．(解析に用いた詳細な死因分類は付表1に示した)．付表2-1には，対象者数，観察人年，平均総線量，平均ガンマ線量及び平均中性子線量をDS86遮蔽kerma別に示した．付表3-1には，臓器吸収線量別にこれらの値を示した．

統計学的方法

本報で用いた統計学的方法に関する詳細な説明については別途に報告した．[1] 簡単に述べれば，相対リスクモデルに基づく，区分けした生存データの解析を行った．特に，適合モデルは次のように説明できる．すなわち，iを，都市，性，被爆時年齢及び追跡期間の交差分類における層，jを被曝線量区分，Y_{ij}, PY_{ij}, M_{ij} をそれぞれ層i及び線量群jにおける死亡数，人年及び死亡率とする．このような条件下で，ij 番目の層における死亡率は次のように表される

ただし，RR_{ij} は，都市，性，被爆時年齢及び被爆後経過時間について，自然癌死亡率を訂正した被爆群0に対する被爆群jの層iにおけるリスクを示す．更に詳しく述べると，係数は次の線形(線量に関して)相対リスク関数を仮定して算出した．すなわち，

ただし，D_{ij} は，ij 番目の区分における平均総線量(ガンマ線及び中性子線の合計)であり，Xは，性，都市，被爆時年齢及び被爆後経過時間などの放射線影響の修飾要因を示す．総線量 D_{ij} は更にガンマ線ij と中性子線ij の2要素に分けた．

死亡数 Y_{ij} は独立な Poisson 確率変数で期待値が $E(Y_{ij}) = PY_{ij} \cdot M_{io} \cdot RR_{ij}$ (ここで，PY_{ij} は常数として

bers of deaths Y_{ij} are independent Poisson random variables with expected values $E(Y_{ij}) = PY_{ij} \cdot M_{i0} \cdot RR_{ij}$, where PY_{ij} is treated as constant.

The three risk coefficients used here as the primary descriptors of the data are based on fitting the above model with the $\exp^{aX}$ term omitted. They are:

1. Excess RR per 1 Gy or RR at 1 Gy

$$\hat{b} \cdot 1,\ 1 + \hat{b} \cdot 1$$

2. Excess deaths per 10^4 person-year-gray (PYGy)

$$\left[\sum_i \sum_{j=1} PY_{ij} \cdot \hat{M}_{i0} \cdot \hat{b} \cdot D_{ij} / \sum_i \sum_{j=1} PY_{ij} \cdot D_{ij}\right] \times 10^4$$

3. Attributable risk (%)

$$\left[\sum_i \sum_{j=1} PY_{ij} \cdot \hat{M}_{i0} \cdot \hat{b} \cdot D_{ij} / \sum_i \sum_{j=1} Y_{ij}\right] \times 100$$

In the statistical analysis the person-years and the number of deaths are aggregated and stratified by city, sex, age ATB, follow-up interval, and radiation dose. The specific elements in the stratification are set out below.

扱う）であると仮定して，パラメータを最大尤度法により推定した．

主なデータの詳述に用いた三つのリスク係数は，上述のモデルから $\exp^{aX}$ 項を除いたものを適合させて得た．そのリスク係数は以下のとおりである．

1．1 Gy 当たりの過剰相対リスク，又は 1 Gy における相対リスク

2．10^4 人年 Gy（PYGy）当たりの過剰死亡

3．寄与リスク（%）

統計学的解析においては，人年と死亡数を，都市，性，被爆時年齢，追跡期間及び放射線量別にまとめ，層化した．層化における要素は以下のとおりである．

Present analysis (LSS Report 11) 今回の解析（寿命調査第11報）	Previous analysis (LSS Report 10) 前回の解析（寿命調査第10報）
1) Follow-up period 追跡期間 5-year intervals (1950-85) 5年間隔（1950-85年） 1950-55, 1956-60, 1961-65, 1966-70, 1971-75, 1976-80, 1981-85	1) Follow-up period 追跡期間 4-year intervals (1950-82) 4年間隔（1950-82年） 1950-54, 1955-58, 1959-62, 1963-66, 1967-70, 1971-74, 1975-78, 1979-82
2) Age ATB 被爆時年齢 <10, 10-19, 20-29, 30-39, 40-49, 50+	2) Age ATB 被爆時年齢 <10, 10-19, 20-34, 35-49, 50+
3) Attained age 年齢（死亡時年齢） <20, 20-29, 30-39, 40-49, 50-59, 60-69, 70+	3) Attained age 年齢（死亡時年齢） <20, 20-29, 30-39, 40-49, 50-59, 60-69, 70+
4) Radiation dose (DS86, Gy) 放射線量（DS86, Gy） 0, .01-.05, .06-.09, .10-.19, .20-.49, .50-.99, 1.00-1.99, 2.00-2.99, 3.00-3.99, 4.00+	4) Radiation dose (T65D, Gy) 放射線量（T65D, Gy） 0, .01-.09, .10-.49, .50-.99, 1.00-1.99, 2.00-2.99, 3.00-3.99, 4.00+
5) City (Hiroshima, Nagasaki) 都市（広島，長崎）	5) City (Hiroshima, Nagasaki) 都市（広島，長崎）
6) Sex (Male, Female) 性（男性，女性）	6) Sex (Male, Female) 性（男性，女性）

RESULTS

Site-specific cancer mortality

A summary of the relationship between site-specific cancer mortality and shielded kerma is presented in Table 2A (see also Appendix Table 2). As may be seen there, cancer mortality increases with dose, whether measured in terms of RR at 1 Gy, excess risk per 10^4 PYGy, or attributable risk (%). The site-specific cancers that show a statistically significant increase with dose ($p < 0.05$) are leukemia, cancers of the esophagus, stomach, colon, lung, breast, ovary, urinary tract, and multiple myeloma, whereas cancers of the rectum, gallbladder, pancreas, uterus and prostate, and malignant lymphoma do not (Table 2A, Figure 1A). Note that ovarian cancer, which was suggestively related to exposure in the previous LSS report,[1] is now significantly so.

結　果

部位別癌死亡率

部位別癌死亡率と遮蔽線量との関係の要約を表2Aに示した(付表2も参照)．この表から分かるように，1 Gy での相対リスク，10^4 人年 Gy 当たりの過剰死亡数又は寄与リスク(%)のいずれからみても，癌死亡率は線量と共に増加している．線量に伴って統計学的に有意な増加($p<0.05$)を示す部位別癌は，白血病，食道癌，胃癌，結腸癌，肺癌，乳癌，卵巣癌，泌尿器癌及び多発性骨髄腫である．一方，直腸癌，胆嚢癌，膵臓癌，子宮癌及び前立腺癌並びに悪性リンパ腫はそのような増加を示さなかった(表2A，図1A)．前回の寿命調査報告書[1]で被曝との関連性が示唆された卵巣癌は，今回被曝と有意に関連するものと判断された．

Interpretation of the meaningfulness of an increase in liver cancer following exposure to ionizing radiation is complicated. Firstly, the confirmation rate of liver cancer diagnosis on death certificates is only about 60%,[5] and secondly, it is difficult to distinguish primary from metastatic cancer of the liver on the basis of death certificates alone. The last LSS report, covering the years 1950-82,[1] suggested that the occurrence of liver cancer was possibly related to dose. But, when the observations were extended to 1985 and confined to the DS86 subcohort, no statistically significant increase with dose is seen as shown in Table 2A, but the increase is significant when liver cancer not otherwise specified (NOS), i.e., not specified as primary, is included (Table 2B). This presumably reflects the inclusion of secondary liver cancers, since the liver is a common site of metastasis for many of the sites known to be associated with exposure to ionizing radiation.

電離放射線被曝による肝癌の増加のもつ意味の解釈は複雑である．第一に，死亡診断書による肝癌診断の確認率は約60%にすぎない．[5] 第二に，死亡診断書のみでは，肝臓の原発癌と転移癌を区別することは困難である．1950-82年を対象とした前回の寿命調査報告書[1]は，肝癌の発生は線量と関連すると示唆している．観察を1985年まで延長し，DS86 サブコホートに限定すると，表2Aに示すとおり線量に伴う統計学的に有意な増加は認められない．しかし，特に記述のない，すなわち，原発と明記されていない肝癌を含めると増加は有意になる(表2B)．このことは，恐らく続発性の肝癌が含まれていることを反映するのであろう．なぜなら，肝臓は，電離放射線被曝と関連することが知られている多くの癌の転移部位となることが多いからである．

In scrutinizing more closely the statistically significant increase in urinary tract cancer, we find that the increase in urinary bladder cancer is statistically significant but that the increase in kidney cancer is not. Some 70% of the cancers assigned to the broader urinary tract rubric are of bladder origin.

泌尿器癌の統計学的に有意な増加をより詳細に検討すると，膀胱癌の増加は統計学的に有意であるが，腎臓癌の増加は有意ではないことが分かる．"泌尿器"というより広い分類に入る癌の約70%は膀胱から原発している．

TABLE 2A SUMMARY MEASURES OF RADIATION DOSE RESPONSE FOR CANCER MORTALITY BY SITE; BOTH CITIES, BOTH SEXES, (UNLESS OTHERWISE STATED†), ALL AGES ATB, 1950-85 (SHIELDED KERMA)

表2A 部位別癌死亡率に対する放射線量反応の総括尺度；両市，両性（他に記述がない限り†），全被爆時年齢，1950-85年（遮蔽kerma）

Site of cancer	No. of deaths	Statistical test (P)††	Estimated RR at 1 Gy	Excess risk per 10^4 PYGy	Attributable risk (%)†††
All malignant neoplasms	5936	0.000	1.39 (1.32, 1.46)	10.0 (8.36, 11.8)	10.2 (8.50, 12.0)
Leukemia	202	0.000	4.92 (3.89, 6.40)	2.29 (1.89, 2.73)	55.4 (45.7, 66.3)
All except leukemia	5734	0.000	1.29 (1.23, 1.36)	7.41 (5.83, 9.08)	7.86 (6.19, 9.64)
Digestive organs and peritoneum	3129	0.000	1.24 (1.16, 1.33)	3.39 (2.27, 4.59)	6.58 (4.41, 8.91)
Esophagus	176	0.02	1.43 (1.09, 1.91)	0.34 (0.08, 0.67)	12.7 (2.92, 25.0)
Stomach	2007	0.000	1.23 (1.13, 1.34)	2.07 (1.19, 3.05)	6.26 (3.61, 9.23)
Colon	232	0.000	1.56 (1.25, 1.98)	0.56 (0.26, 0.91)	15.1 (6.96, 24.7)
Rectum	216	0.67	0.93 (, 1.27)	-0.07 (, 0.25)	-1.93 (, 7.12)
Liver, primary	77	0.57	1.12 (0.87, 1.70)	0.05 (-0.05, 0.25)	3.90 (-4.38, 20.5)
Gallbladder and bile ducts	149	0.13	1.37 (0.98, 1.96)	0.22 (-0.01, 0.53)	8.24 (-0.55, 19.5)
Pancreas	191	0.53	0.89 (, 1.23)	-0.10 (, 0.20)	-3.01 (, 6.21)
Other, unspecified	81	0.29	1.32 (0.87, 2.14)	0.11 (-0.05, 0.35)	7.73 (-3.29, 24.2)
Respiratory system	747	0.000	1.40 (1.21, 1.63)	1.29 (0.71, 1.96)	10.1 (5.50, 15.3)
Lung	638	0.000	1.46 (1.25, 1.72)	1.25 (0.70, 1.89)	11.4 (6.36, 17.1)
Female breast†	155	0.000	2.00 (1.48, 2.75)	1.02 (0.53, 1.60)	22.1 (11.4, 34.8)
Cervix uteri and uterus†	382	0.08	1.22 (1.01, 1.50)	0.60 (0.04, 1.29)	5.30 (0.34, 11.5)
Cervix uteri†	90	0.17	1.43 (0.93, 2.30)	0.26 (-0.04, 0.70)	10.0 (-1.68, 26.9)
Ovary†	82	0.03	1.81 (1.16, 2.89)	0.45 (0.10, 0.90)	18.7 (3.97, 37.7)
Prostate†	52	0.85	1.05 (, 1.73)	0.03 (, 0.40)	1.89 (, 24.8)
Urinary tract	133	0.000	2.02 (1.45, 2.87)	0.55 (0.26, 0.89)	22.7 (10.8, 37.1)
Malignant lymphoma	110	0.81	0.95 (, 1.40)	-0.02 (, 0.18)	-1.75 (, 13.6)
Multiple myeloma	36	0.002	2.86 (1.55, 5.41)	0.21 (0.07, 0.39)	32.5 (11.3, 59.5)
Other	907	0.03	1.20 (1.05, 1.38)	0.77 (0.19, 1.44)	5.65 (1.37, 10.5)

Numbers in parentheses indicate a 90% confidence interval. 括弧内の数値は90%信頼区間を示す.

† Risk estimation for these sites is based on either males or females only.
これらの部位のリスク推定は男性のみ又は女性のみのいずれかに基づく.

†† p-value based on the test for increasing trend in radiation dose 放射線量の増加傾向の検定に基づくp値

††† Based on 41,719 subjects exposed to 0.01+ Gy (average 0.295 Gy) 0.01 Gy 以上（平均0.295 Gy）に被曝した41,719人に基づく

The risk coefficients shown in this table differ slightly from those presented in Appendix Table 11 in LSS Report 11 Part 1 (RERF, TR 12-87) due to the difference in rounding procedure applied to individual dose estimates.
本表に示すリスク係数は個人線量の推定に用いた四捨五入の方法が異なるため，寿命調査第11報の第1部（RERF, TR 12-87）の付表11に示したものよりやや異なる.

TABLE 2B SUMMARY MEASURES OF RADIAITON DOSE RESPONSE FOR CANCER MORTALITY BY SITE, FOR CERTAIN SPECIFIC CANCERS; BOTH CITIES, BOTH SEXES, ALL AGES ATB, 1950-85 (SHIELDED KERMA)

表2B 特定の癌に関する，死因別死亡率に対する放射線量反応の総括尺度；両市，両性，全被爆時年齢，1950-85年（遮蔽kerma）

Site of cancer	No. of deaths	Statistical test (P)†	Estimated RR at 1 Gy	Excess risk per 10^4 PYGy	Attributable risk (%)††
Liver including not specified as primary	590	0.02	1.24 (1.06, 1.47)	0.63 (0.17, 1.18)	7.02 (1.87, 13.2)
Kidney	38	0.18	1.58 (0.91, 2.94)	0.09 (-0.02, 0.26)	15.7 (-2.77, 43.3)
Bladder	90	0.003	2.13 (1.40, 3.28)	0.41 (0.16, 0.70)	23.6 (9.31, 40.8)
Tongue	26	0.40	0.83 (, 1.49)	-0.02 (, 0.06)	-5.35 (, 14.1)
Pharynx	23	0.61	0.83 (, 2.04)	-0.02 (, 0.09)	-6.14 (, 31.6)
Nose	44	0.58	0.84 (, 1.67)	-0.03 (, 0.12)	-4.04 (, 14.5)
Larynx	46	0.16	1.51 (0.95, 2.68)	0.10 (-0.01, 0.29)	13.4 (-1.47, 37.1)
Skin cancer except melanoma	21	0.69	1.17 (, 2.47)	0.02 (, 0.12)	5.60 (, 38.7)
Bone	27	0.65	1.22 (, 2.79)	0.02 (, 0.16)	6.56 (, 42.9)
Brain tumors	47	0.97	1.03 (0.51, 2.09)	0.01 (-0.12, 0.20)	1.0 (-13.0, 22.5)
Tumors of central nervous system (CNS) except brain	14	0.08	3.09 (1.06, 9.74)	0.10 (0.00, 0.24)	35.9 (1.4, 82.2)

Numbers in parentheses indicate a 90% confidence interval. 括弧内の数値は90%信頼区間を示す．

† p-value based on the test for increasing trend in radiation dose 放射線量の増加傾向の検定に基づくp値

†† Based on 41,719 subjects exposed to 0.01+ Gy (average 0.295 Gy) 0.01Gy以上（平均0.295 Gy）に被曝した41,719人に基づく

FIGURE 1A RELATIVE RISK AT 1 Gy (SHIELDED KERMA) AND 90% CONFIDENCE INTERVAL, 1950-85

図1A 1 Gy（遮蔽kerma）における相対リスク及び90%信頼区間，1950-85年

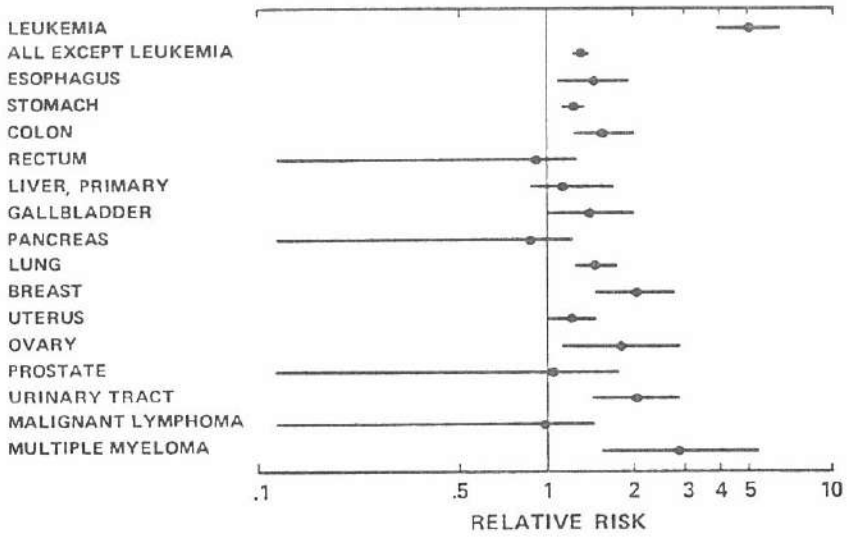
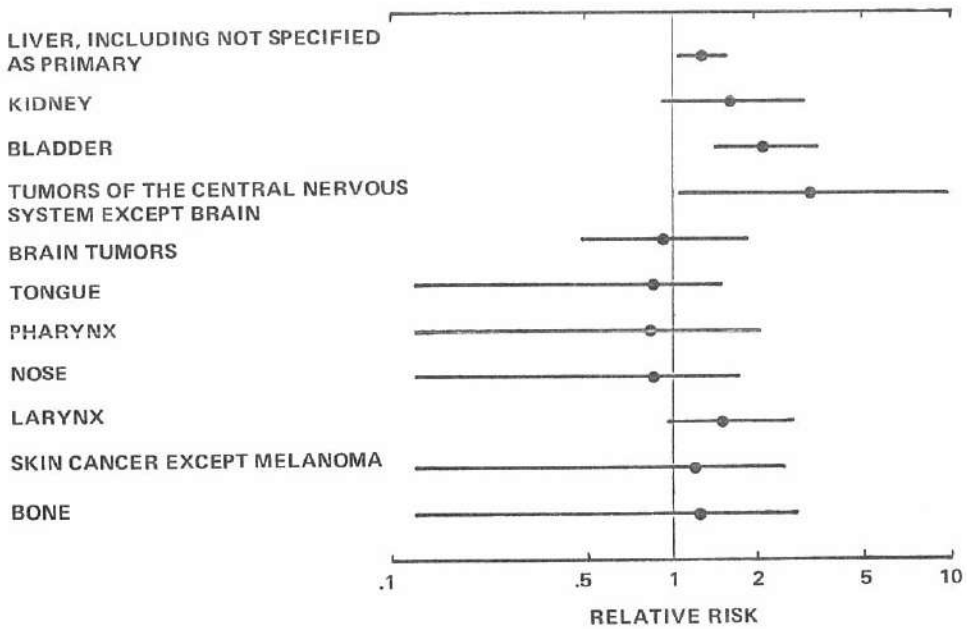


FIGURE 1B RELATIVE RISK AT 1 Gy (SHIELDED KERMA) AND 90% CONFIDENCE INTERVAL FOR CERTAIN SPECIAL CANCERS, 1950-85

図1B 特定の癌に対する，1 Gy（遮蔽kerma）における相対リスク及び90%信頼区間，1950-85年



In an earlier parallel analysis of the A-bomb survivors (1950-78) and ankylosing spondylitis patients,[6] it was noted that cancer of the central nervous system (CNS) except brain was significantly increased. However, the number of cancer deaths where a CNS tumor was stated to be the underlying cause of death is very small and, moreover, tumors of unspecified nature or even benign tumors at these sites could cause death. Since metastatic tumors involving the CNS are often mentioned in death certificates in Japan, all deaths from CNS tumors, including those of a benign or unspecified nature and those where the tumor was not stated to be the underlying cause of death, were reviewed by pathologists at RERF taking into account tumor registry data including autopsy or surgical information available at the Foundation.

以前行われた原爆被爆者(1950-78年)と強直性脊椎炎患者の比較解析[6]においては，脳を除く中枢神経系の癌が有意に増加していることが指摘された．しかし，中枢神経系腫瘍が原死因であるとされている癌死亡の件数は極めて少なく，更に，中枢神経系においては，詳細不明又は良性の腫瘍でも死をもたらし得る．日本の死亡診断書には，中枢神経系と関連する転移癌がしばしば記載されているので，放影研の病理学者が，当所で入手できる剖検資料又は外科資料を含む腫瘍登録データを考慮しながら，良性又は詳細不明を含む中枢神経系腫瘍によるすべての死亡について検討した．

Forty-seven (47) cases of brain tumor (16 malignant, 8 benign, and 23 of an unspecified nature) were ascertained by this procedure. Included in this number are three cases (two unspecified nature and one benign) where the tumor was not identified as the underlying cause of death. In addition, 14 cases of CNS tumors other than of the brain (5 benign, and 9 of an unspecified nature) were ascertained by the same procedure, including 1 case where the tumor was not specified as the underlying cause of death.

この方法により，47例の脳腫瘍(悪性16例，良性8例，詳細不明23例)が確認された．このうち3例(詳細不明2例，良性1例)においては，腫瘍が原死因であるとは特定されなかった．これに加えて，脳以外の中枢神経系腫瘍14例(良性5例，詳細不明9例)が同じ方法で確認されたが，このうち1例では腫瘍が原死因であるとは特定されなかった．

The relationship to dose of these 47 brain tumors and 14 CNS tumors other than brain tumors is shown in Table 3. Mortality tends to increase with dose insofar as CNS tumors other than brain tumors are concerned ($0.05 < p < 0.10$), but no increasing trend is observed for brain tumors alone ($p > 0.10$). This tendency is also obtained after excluding the three and one cases where the tumor was not specified as the underlying cause of death. The RR at 1 Gy, excess deaths per 10^4 PYGy, and attributable risk (%) for these two tumors are shown in Table 2B.

これらの脳腫瘍47例及び脳腫瘍以外の中枢神経系腫瘍14例と線量との関係を表3に示した．脳腫瘍以外の中枢神経系腫瘍に関しては，死亡率は線量と共に増加する傾向を示すが($0.05 < p < 0.10$)，脳腫瘍のみの場合には増加傾向は認められない($p > 0.10$)．この傾向は，腫瘍が原死因と特定されなかった上述の3例と1例を除外した場合にも認められる．これら2種類の腫瘍における1 Gyでの相対リスク，10^4人年Gy当たりの過剰死亡及び寄与リスク(%)を表2Bに示した．

In the present analysis, the relationship to radiation of cancers of such sites as tongue, pharynx, nose, larynx, skin cancer except melanoma, and bone has also been examined, but none of these increases significantly with dose. (The RRs at 1 Gy for these sites are shown in Figure 1B and Table 2B.)

本解析では，舌癌，咽頭癌，鼻癌，喉頭癌，黒色腫以外の皮膚癌及び骨癌と放射線との関係も検討したが，いずれも線量と共に有意に増加していない．(これらの部位の1 Gyにおける相対リスクを図1B及び表2Bに示した)．

TABLE 3 MORTALITY FROM CNS TUMORS BY TYPE

表3 中枢神経系腫瘍の死亡率，病型別

	DS86 dose (shielded kerma, Gy)				Test†
	Total	0	0.01-0.09	0.10-0.49	0.50+	
			Brain tumors			
Observed	47	16	15	13	3	
Expected		21.42	13.96	7.49	4.13	
RR		1.00	1.44	2.32	0.97	P>0.10
			CNS tumors other than brain			
Observed	14	4	3	4	3	
Expected		6.12	4.27	2.32	1.29	
RR		1.00	1.08	2.63	3.56	0.05<p<0.10

† Test for increasing trend in radiation dose

放射線量の増加傾向に対する検定

TABLE 4 SUMMARY MEASURES OF RADIATION DOSE RESPONSE FOR MORTALITY OF STATISTICALLY SIGNIFICANT SITE; BOTH CITIES, BOTH SEXES, ALL AGES ATB, 1950-85 (ORGAN-ABSORBED DOSE)

表4 統計的に有意な部位の死亡率に対する放射線量反応の総括尺度；両市，両性，全被爆時年齢，1950－85年（臓器吸収線量）

Site of cancer	Relative Risk at 1 Gy	Excess deaths per 10^4 PYGy	Attributable risk (%)†
Leukemia	6.21 (4.83, 8.12)	2.94 (2.43, 3.49)	58.6 (48.4, 69.5)
All cancers except leukemia	1.41 (1.32, 1.51)	10.13 (7.96, 12.44)	8.1 (6.4, 10.0)
Esophagus	1.58 (1.13, 2.24)	0.45 (0.10, 0.88)	13.0 (3.0, 25.5)
Stomach	1.27 (1.14, 1.43)	2.42 (1.26, 3.72)	5.7 (3.0, 8.7)
Colon	1.85 (1.39, 2.45)	0.81 (0.40, 1.30)	16.3 (8.0, 26.2)
Lung	1.63 (1.35, 1.97)	1.68 (0.97, 2.49)	12.3 (7.2, 18.3)
Female breast	2.19 (1.56, 3.09)	1.20 (0.61, 1.91)	22.1 (11.3, 35.0)
Ovary	2.33 (1.37, 3.86)	0.71 (0.22, 1.32)	22.3 (6.9, 41.4)
Urinary tract	2.27 (1.53, 3.37)	0.68 (0.31, 1.12)	21.5 (9.8, 35.7)
Multiple myeloma	3.29 (1.67, 6.31)	0.26 (0.09, 0.47)	31.8 (11.0, 57.6)

Numbers in parentheses indicate a 90% confidence interval.

括弧内の数値は90%信頼区間を示す．

† Based on subjects exposed to 0.01+ Gy. Average doses for bone marrow, colon, stomach, lung, breast, ovary, urinary tract (bladder) are 0.242, 0.223, 0.228, 0.240, 0.240, 0.211, 0.231, respectively. For all cancers except leukemia, esophagus, and multiple myeloma, doses for colon, stomach, and bone marrow are used.

0.01Gy 以上に被曝した者に基づく．骨髄，大腸，胃，肺，乳房，卵巣，膀胱の平均線量は，それぞれ，0.242, 0.223, 0.228, 0.240, 0.240, 0.211, 0.231である．白血病以外の全部位の癌，食道癌及び多発性骨髄腫については，大腸，胃及び骨髄の線量を用いた．

TABLE 5A RELATIVE RISK AT 1 Sv BY AGE ATB AND SEX FOR CERTAIN SITE OF CANCER (ORGAN-ABSORBED DOSE)

表5A 各部位の癌における1 Svでの相対リスク，被爆時年齢及び性別（臓器吸収線量）

RBE	Site of cancer	Sex	Age ATB <10	10–19	20–29	30–39	40+
1	Leukemia	M	19.7	5.4	6.6	4.9	4.3
		F	20.5	5.6	6.8	5.1	4.4
	All except leukemia	M	2.06	1.65	1.57	1.24	1.18
		F	3.06	2.27	2.11	1.48	1.34
	Stomach	M	1.47	1.81	1.76	1.11	1.11
		F	1.92	2.59	2.50	1.22	1.21
	Female breast	F	2.90	3.34	2.21	2.26	1.11
	Lung	M	1.87		1.10	1.25	1.36
		F	4.25		1.36	1.92	2.34
	Colon	M	3.98		1.40	1.70	1.18
		F	8.42		2.00	2.74	1.44
10	Leukemia	M	17.9	4.8	5.9	4.5	3.9
		F	18.8	5.0	6.2	4.7	4.0
	All except leukemia	M	1.96	1.60	1.52	1.23	1.16
		F	2.92	2.20	2.04	1.45	1.32
	Stomach	M	1.40	1.71	1.65	1.09	1.09
		F	1.83	2.47	2.36	1.19	1.20
	Female breast	F	2.54	2.89	1.96	2.09	1.03
	Lung	M	1.78		1.08	1.22	1.32
		F	3.93		1.31	1.84	2.19
	Colon	M	3.82		1.39	1.67	1.17
		F	8.09		1.97	2.67	1.42

TABLE 5B EXCESS DEATHS (PER 10^4 Sv) BY AGE ATB AND SEX FOR CERTAIN SITE OF CANCER (ORGAN-ABSORBED DOSE)

表 5B 各部位の癌における過剰死亡（10^4 Sv 当たり），被爆時年齢及び性別（臓器吸収線量）

RBE	Site of cancer	Sex	Age ATB <10	10-19	20-29	30-39	40+
	Leukemia	M	3.84	2.03	4.34	6.31	4.72
		F	3.00	1.04	2.49	1.96	3.18
	All except leukemia	M	1.48	5.26	12.6	11.4	16.4
		F	4.07	7.07	13.7	13.7	18.6
1	Stomach	M	0.30	1.66	5.72	2.09	4.26
		F	0.72	1.94	5.36	1.74	3.93
	Female breast	F	0.32	2.23	1.21	1.54	0.18
	Lung	M	0.41		0.26	1.88	4.32
		F	0.59		0.46	2.52	5.54
	Colon	M	0.63		0.38	1.39	0.66
		F	0.44		0.55	1.62	0.99
	Leukemia	M	3.46	1.79	3.87	5.72	4.22
		F	2.71	0.92	2.24	1.79	2.88
	All except leukemia	M	1.35	4.87	11.5	10.6	15.1
		F	3.79	6.70	12.9	13.1	17.5
10	Stomach	M	0.26	1.47	4.93	1.75	3.72
		F	0.65	1.79	4.87	1.54	3.61
	Female breast	F	0.26	1.83	0.97	1.33	0.06
	Lung	M	0.37		0.22	1.69	3.79
		F	0.53		0.40	2.30	4.93
	Colon	M	0.60		0.36	1.32	0.63
		F	0.41		0.53	1.56	0.96

For sites demonstrating a significant increase in mortality with increasing dose (shielded kerma), described in Table 2, risk estimates have been computed for organ-absorbed doses and are shown in Table 4 (see also Appendix Table 3). The risk coefficients shown in Table 4 are derived from the overall sample for the study and, thus it should essentially be a weighted average of age ATB or sex-specific risk coefficients. Since the distribution of the study sample by age and sex should differ by different study populations of interest, the risk coefficients, i.e., RR at 1 Sv and excess death per 10^4 PYSv are shown by age ATB and sex in Tables 5A and 5B, respectively.

表2に示した線量(遮蔽kerma)と共に死亡率が有意に増加する部位については，臓器吸収線量に対するリスク推定値を算出し，表4に示した(付表3も参照)．表4のリスク係数は，全調査集団の値である．実際には被爆時年齢，性別リスク係数の加重平均になっている．性，年齢分布は調査集団によって異なるので，リスク係数，すなわち，1 Sv における相対リスク，10^4 人年 Sv 当たりの過剰死亡数を性，年齢別に表5A及び5Bに示した．

Age ATB and attained age (age at death)

In estimating the lifetime risk of radiation-induced cancers for all sites except leukemia, two risk projection models have been commonly used, namely, the RR model,[7] which assumes the risk to be a constant proportion of the background rate, and the AR model, which assumes the risk to be a constant independent of the natural rate. Previous LSS Report 9 (1950-78)[8] and Report 10 (1950-82)[1] have presented data based on age ATD-specific RRs or ARs by age ATB cohorts which support the RR model. Similar data are presented here, based on cancer deaths occurring from 1950-85. The RR at 1 Gy of all cancers except leukemia, as seen in Table 6, generally shows no difference by age ATD among different age-ATB cohorts (except for the age ATB<10 cohort). This result, which supports the RR model, is more strikingly seen when it is assumed that the minimum latent period for radiation-induced solid cancers is over 10 years and the values in parentheses in Table 6 are excluded. However, the tendency for the RR to be higher the younger the age ATD in the age ATB<10 cohort, first observed and described in the previous report,[1] is also statistically significant in the present analysis even though the DS86 subcohort represents only about 80% of the total LSS sample. The AR (excess deaths per 10^4 PYGy), shown in Table 7, rises with age in all age ATB cohorts except in the instance of leukemia. This does not support the notion of a constant AR throughout life, but is in conformity with the RR model.

被爆時年齢及び年齢(死亡時年齢)

白血病以外の全部位の放射線誘発癌の生涯リスクを推定する際には，リスクを対照群の自然癌死亡率に比例する定数と仮定する相対リスクモデル[7]と，リスクを自然癌死亡率と無関係に一定の率だけ上昇すると仮定する絶対リスクの二つのリスク推定モデルが通常使用されてきた．以前の寿命調査第9報(1950-78年)[8]及び第10報(1950-82年)[1]では，死亡時年齢別の相対リスク又は絶対リスクに基づくデータが被爆時年齢コホート別に示されており，相対リスクモデルが支持されている．本報でも，1950-85年に発生した癌死亡に基づく同様のデータを示した．表6に示したように，特定の被爆時年齢コホート(被爆時年齢10歳未満のコホートを除く)では，白血病以外の全癌の1 Gyでの相対リスクは死亡時年齢間で差異を示さない．相対リスクモデルを支持するこの結果は，放射線誘発充実性癌の最小潜伏期間を10年と仮定し，表6の括弧内の数値を除いた場合には更に明確なものとなる．しかし，前報[1]で初めて観察され，記述された，被爆時年齢10歳未満のコホートで死亡時年齢が低いほど相対リスクが高くなるという傾向は，DS86サブコホートが全寿命調査集団の約80%に当たるにすぎないにもかかわらず，本解析でも統計学的に有意である．表7に示すとおり，絶対リスク(10^4 人年 Gy 当たりの過剰死亡)は，白血病以外ではすべての被爆時年齢コホートにおいて死亡時年齢と共に増加する．これは生涯を通じて絶対リスクが一定であるという考えを支持するものではなく，相対リスクモデルに一致する．

TABLE 6 RELATIVE RISK AT 1 Gy BY AGE ATB AND AGE AT DEATH FOR VARIOUS SITES OF CANCER (SHIELDED KERMA)

表6 各部位の癌における1 Gyでの相対リスク，被爆時年齢及び死亡時年齢別（遮蔽kerma）

Age ATB	Age ATD								% change of excess RR after 1960 †
	Total	<20	20-29	30-39	40-49	50-59	60-69	70+	
Leukemia									
<10	17.05	44.16	3.41	8.64	0.95				-10.6*
10-19	4.76	54.74	-	2.45	1.02	0.82			-
20-29	5.06		5.33	3.54	43.09	1.02	0.82		-5.5
30-39	3.99			0	24.05	10.58	1.47	3.89	-12.7*
40-49	2.55				0.83	3.82	0.82	3.10	0.6
50+	6.50					15.63	5.18	6.90	0.3
Total	4.92	46.47	9.81	4.75	5.68	3.98	1.70	4.40	-4.4***, -8.1***
All cancers except leukemia									
<10	2.32	(70.07)	5.89	1.96	1.86				-10.4*
10-19	1.65	(40.90)	(0.82)	1.66	1.59	1.68			0.8
20-29	1.65			(1.38)	2.09	1.74	1.37		-0.2
30-39	1.26			(0.84)	(1.12)	1.11	1.23	1.48	8.1Sug
40-49	1.24				(1.25)	(1.12)	1.13	1.33	1.7
50+	1.11					(2.58)	(0.95)	1.15	1.8
Total	1.29	75.32	2.22	1.60	1.58	1.39	1.13	1.29	0.3, 1.0
Stomach cancer									
<10	1.58	(0)	7.22	1.30	1.54				-16.6
10-19	1.74	(0)	(0.82)	1.26	1.21	2.88			-
20-29	1.97			(0.82)	2.66	1.93	1.77		1.5
30-39	1.17			(76.88)	(1.00)	0.97	1.18	1.48	3.4
40-49	1.17				(1.60)	(1.17)	1.05	1.24	-0.0
50+	1.06					(3.30)	(0.92)	1.12	2.9
Total	1.23	0	1.30	1.26	1.70	1.40	1.06	1.22	0.6, 5.4Sug
Lung cancer									
<10	0.82	(0)	0.84	0.82	0.83				-
10-19	2.61	(0)	(0)	0.81	5.56	1.50			-3.0
20-29	1.35			(0)	0.83	1.75	1.03		-0.3
30-39	1.37			(0)	(0.81)	1.49	1.50	1.26	1.7
40-49	1.39				(0)	(1.58)	1.34	1.40	-0.5
50+	1.51					(0.85)	(2.29)	1.44	-1.0
Total	1.46	0	0.84	0.82	2.32	1.57	1.44	1.39	-0.6, -0.5
Breast cancer									
<10	2.07	(0)	0	0.92	3.04				-
10-19	3.13	(0)	(0)	10.48	2.16	4.21			-1.4
20-29	1.85			(2.10)	0.81	2.05	5.78		0.4
30-39	2.02			(0.83)	(0.80)	2.86	2.28	1.03	3.4
40-49	0.85				(0)	(0.82)	1.13	0.82	-0.6
50+	1.46					(8.16)	(0.82)	1.37	-0.5
Total	2.00	0	0	3.72	1.63	2.57	1.61	1.01	1.1, 3.0

† For leukemia the average annual % change of excess RR after 1950
白血病の場合は，1950年以降の過剰相対リスクの年平均変化率（%）

Numbers in parentheses are the RRs before the assumed minimum latent period of 10 years
括弧内の数値は，推定最小潜伏期間を10年とした場合のそれ以前の相対リスク

Underlines indicate age ATB adjusted 下線は被爆時年齢訂正 Sug p<0.10, * p<0.05, *** p<0.001
- No convergence 収束しない

TABLE 7 EXCESS DEATHS (PER 10^4 PYGy) BY AGE ATB AND AGE AT DEATH (ATD) FOR VARIOUS SITES OF CANCER (SHIELDED KERMA)

表7 各部位の癌における過剰死亡（10^4 人年 Gy 当たり），被爆時年齢及び死亡時年齢別（遮蔽kerma）

Age ATB	Age ATD							
	Total	<20	20-29	30-39	40-49	50-59	60-69	70+
Leukemia								
<10	2.93	6.71	0.93	1.27	-0.01			
10-19	1.19	3.95	-	0.56	0.02	-0.06		
20-29	2.13		3.93	1.52	4.84	0.01	-0.28	
30-39	2.54			0	3.18	2.26	1.09	3.89
40-49	2.11				-0.35	3.07	-0.24	3.50
50+	4.56					4.31	3.84	5.12
Total	2.29	6.48	2.17	1.16	1.88	1.54	1.09	4.24
All cancers except leukemia								
<10	2.29	(0.43)	1.32	2.85	5.16			
10-19	4.66	(3.96)	(-0.12)	2.00	5.84	13.91		
20-29	9.38			(1.39)	9.40	15.71	14.33	
30-39	9.31			(-1.32)	(1.33)	3.16	11.00	41.01
40-49	14.52				(2.48)	(3.37)	7.31	37.30
50+	7.89					(35.29)	(-2.88)	17.21
Total	7.41	0.79	0.54	1.98	5.35	9.62	6.85	30.53
Stomach cancer								
<10	0.42	(0)	0.43	0.43	1.24			
10-19	1.29	(0)	(-0.06)	0.23	0.58	6.61		
20-29	4.20			(-0.29)	5.40	5.46	8.21	
30-39	2.00			(4.77)	(0.01)	-0.35	2.82	11.93
40-49	3.95				(2.62)	(2.24)	1.15	8.52
50+	1.80					(15.79)	(-2.34)	5.56
Total	2.09	0	0.06	0.31	2.10	3.41	1.19	8.20
Lung cancer								
<10	-0.02	(0)	-0.01	-0.02	-0.10			
10-19	0.80	(0)	(0)	-0.03	1.75	1.15		
20-29	0.54			(0)	-0.06	1.71	0.19	
30-39	1.67			(0)	(-0.10)	1.10	3.82	3.11
40-49	3.10				(0)	(0.68)	2.19	7.26
50+	3.22					(-0.15)	(3.11)	4.74
Total	1.25	0	-0.00	-0.02	0.56	1.11	2.62	5.50
Breast cancer								
<10	0.18	(0)	0	-0.03	1.18			
10-19	1.98	(0)	(0)	2.99	2.39	4.55		
20-29	0.85			(0.37)	-0.16	1.90	4.14	
30-39	1.27			(-0.16)	(-0.18)	3.83	0.66	0.05
40-49	-0.26				(0)	(-0.41)	0.20	-0.23
50+	0.70					(11.27)	(-0.12)	0.87
Total	1.02	0	0	1.09	0.76	2.88	0.61	0.02

Numbers in parentheses are excess deaths before the assumed minimum latent period of 10 year

括弧内の数値は，推定最小潜伏期を10年とした場合のそれ以前の過剰死亡

To determine whether an RR model fits the data better than an AR model for all cancer except leukemia, the goodness of fit of these models (using the deviance) was computed and is shown separately for the RR and the AR models in Table 8. To estimate the background rates, two methods have been used. Firstly, these rates within the individual city, sex, age ATB, and attained age strata were estimated. We have termed this the nonparametric estimation of the rates. Secondly, the rates have been estimated through fitting a regression model, which includes terms for the effects of city, sex, age ATB, and attained age. We have called this the parametric approach. Since by definition the effect of attained age is constant in terms of relative risk for the RR model or absolute risk (excess deaths) for the AR model, there is no a priori reason to expect an effect of attained age under either model. However, when the effects of attained age exposure are examined, after adjusting for effects of age ATB and sex, no significant effect is found under the RR model (the difference in the deviance associated with fitting A, S, and E from fitting only A and S is near zero), but a significant effect is seen under the AR model (where the same comparison results in a difference in deviance of about 43 for one degree of freedom). We conclude from this that AR is changing with attained age, and this further supports the RR model.

白血病以外の全部位の癌について，絶対リスクモデルよりも相対リスクモデルの方がデータに良く適合するかどうかを調べる目的で，これらのモデルの適合度を(devianceを用いて)算出し，相対リスクモデルと絶対リスクモデルについてそれぞれ別々に表8に示した．自然癌死亡率を推定するために二つの方法を用いた．まず，各都市，性，被爆時年齢及び死亡時年齢の層における自然癌死亡率を推定した．我々はこの方法を自然癌死亡率のノンパラメトリック推定と呼んだ．第2に都市，性，被爆時年齢及び死亡時年齢の影響を考慮した回帰モデルを当てはめて自然癌死亡率を推定した．これをパラメトリック法と呼んだ．定義上は，相対リスクモデルでの相対リスク，又は絶対リスクモデルでの絶対リスク(過剰死亡)のいずれについても死亡時年齢に関して一定なので，いずれのモデルにおいても修飾要因として死亡時年齢の影響があると仮定する理由はない．しかし，被爆時年齢及び性の影響を補正して死亡時年齢の被爆に対する影響を調べると，相対リスクモデルでは有意な影響は認められないが(A，S及びEを適合させた場合のdevianceとA及びSのみを適合させた場合のdevianceの差はほとんどない)，絶対リスクモデルでは有意な影響が認められる(同様の比較で，自由度1のdevianceの差が約43)．このことから，絶対リスクは死亡時年齢と共に変化しており，相対リスクモデルの方が優れていると結論付けられる．

With respect to specific sites of cancer, i.e., stomach, colon, lung, and breast, although the variation is greater than that seen for all cancers except leukemia, because of the small numbers of cases, the tendency is similar. In the age ATB<10 cohort, the risk of stomach cancer appears to be greater the younger the age ATD, as observed for all solid cancers, but this tendency is not statistically significant. No definite trends are observed for breast, lung, and colon cancers, due, among other reasons, to the fact that the respective ages of full expression have not been reached as yet by the age ATB<10 cohort. For leukemia, the pattern of temporal change in risk coefficients (Tables 6 and 7) is different from that for solid tumors. In every age-ATB cohort, the RR of leukemia, which peaked 6-8 years after the bombing, tends to decrease with years after exposure.

胃，結腸，肺，乳房などの各部位の癌については，症例数が少ないために白血病以外の全部位の癌の場合よりも変動は大きいが，同様な傾向が認められる．被爆時年齢10歳未満のコホートにおいては，胃癌でのリスクはすべての充実性癌の場合と同様死亡時年齢が低いほど高いようであるが，この傾向は統計学的に有意ではない．乳癌，肺癌及び結腸癌については，特に被爆時年齢10歳未満のコホートがこれらの癌の好発年齢に到達していないためもあって，明瞭な傾向は認められない．白血病の場合，リスク係数の経時的変化のパターン(表6及び7)は充実性腫瘍のパターンとは異なる．いずれの被爆時年齢コホートにおいても，被爆後6～8年で最高になった白血病の相対リスクは，以後時間の経過に伴って減少する傾向を示している．

TABLE 8 GOODNESS OF FIT OF THE RELATIVE AND ABSOLUTE RISK MODELS, FOR ALL CANCERS EXCEPT LEUKEMIA AS MEASURED BY THE DEVIANCE (SHIELDED KERMA)

表8 白血病を除く全部位の癌のdevianceによる，相対リスクモデル及び絶対リスクモデルの適合度

Variable	Relative risk model		Absolute risk model
	Nonparametric for background rate	Parametric for background rate	Parametric for background rate
Background	871.1 (1512)	1041.5 (1671)	1041.5 (1671)
Radiation dose	796.1 (1511)	963.6 (1670)	998.3 (1670)
Radiation effect modifier			
Age ATB (A)	774.5 (1510)	944.1 (1669)	982.1 (1669)
Sex (S)	785.6 (1510)	954.2 (1669)	989.7 (1669)
Attained age (E)	786.3 (1510)	954.8 (1669)	945.2 (1669)
City (C)	796.1 (1510)	963.6 (1669)	997.6 (1669)
A + S	767.7 (1509)	936.8 (1668)	975.8 (1668)
A + E	774.0 (1509)	943.8 (1668)	934.6 (1668)
S + E	778.5 (1509)	946.8 (1668)	942.1 (1668)
A + S + E	766.9 (1508)	936.7 (1667)	932.8 (1667)

Numbers in parentheses are degrees of freedom 括弧内の数値は自由度

In comparing the difference in deviance resulting from the inclusion of an extra variable in the model, a reduction in deviance of 3.84 is significant at the 5% level.

モデルに1変数を追加することにより生じるdevianceの差異において，3.84のdevianceの減少は5％水準で有意である．

Both the RR and AR are higher the younger the age ATB in every age-ATD group for all sites of cancer except leukemia (Tables 6 and 7). It is particularly noteworthy that the highest RR value occurs in those survivors exposed at younger ages (especially if under 10 ATB) on whom accurate estimates of risk have not been possible earlier since these survivors had not yet attained the cancer predilection ages. A similar tendency is observed for cancer of the stomach and breast. For lung cancer, the increase in risk for younger age ATB is not shown, partly because, they have not reached yet the cancer predilection ages for this cancer site.

白血病以外の全部位の癌の相対リスク及び絶対リスクはいずれの死亡時年齢群においても被爆時年齢が若いほど高い（表6及び7）．以前は癌好発年齢に達していなかったので正確なリスク推定ができなかった若年被爆者（特に被爆時10歳未満）に相対リスクの最高値が認められることは特に注目に値する．胃癌及び乳癌についても同様の傾向が認められる．肺癌については，若年被爆者におけるリスクの増加は認められないが，これは部分的には，若年被爆者が肺癌の好発年齢に達していないためと考えられる．

Cancer risk estimation for age ATB<10

In the previous section, it has been noted that the RR of all cancers except leukemia in the age ATB<10 cohort is higher the younger the attained age (age ATD), and differs in this regard from the RR in the other age-ATB groups. This could imply that the latent period of radiation-induced cancers is shorter in the high-dose group (i.e., the attained age of radiation-induced cancer is earlier) than in the controls. To demonstrate this, cumulative mortality rates were calculated using life table methods for the 1.00+ Gy group, the 0.50-0.99 Gy group, and the 0-0.09 Gy group (as a comparison) and contrasted (Figure 2). In the 1.00+ Gy dose group, the cumulative cancer death rate over the entire study period is 25.9×10^{-3}, four times the rate, 6.5×10^{-3}, in the 0-0.09 Gy group. Moreover, cancers develop earlier than in the 0-0.09 Gy group, with the first death from stomach cancer, a boy of age 9 ATB, occurring 13 years after exposure. The 0.50-0.99 Gy group exhibits an intermediate pattern, a higher cumulative cancer death rate (16.2×10^{-3}) than that seen in the 0-0.09 Gy group. Cancer deaths (12 cases, excluding leukemia) in the 1.00+ Gy high-dose group include deaths from pelvic tumor, ovarian cancer, pancreatic cancer (2), reticulum cell sarcoma, liver cancer, thyroid cancer, stomach cancer (3), uterine cancer, and unspecified cancer. Though the number is small, the distribution by site is not conspicuously different from that in the general population.

The cumulative distributions of cases for all cancers except leukemia by time since exposure until death are shown by age ATB for both the high-dose (1.00+ Gy) group and the control (0-0.09 Gy) group in Figure 3. As indicated, the latent period (time since exposure until death) is shorter for the high-dose group than that for the control group in the age ATB < 10 group, whereas no such shortening is observed in the age ATB $\geq$ 10 group. These findings are again confirmed by a comparison of the average length of time since exposure until death (Table 9).

The 0-9 age-ATB group was divided further into two groups, ages 0-4 and 5-9 ATB (data are not shown). A meaningful analysis of the 0-4 age-ATB group was not possible, however, for most of these individuals have not yet reached the cancer predilection ages and the number of cancer deaths over 0.50 Gy is small (5 cases).

被爆時年齢10歳未満群の癌リスク推定

前節では，被爆時年齢10歳未満のコホートにおける白血病以外の全部位の癌は年齢（死亡時年齢）が若いほど高くなり，この点で他の被爆時年齢群の相対リスクの経時的変化とは異なることを指摘した．これは，放射線誘発癌の潜伏期間は高線量群の方が対照群よりも短い（すなわち，放射線誘発癌症例の死亡時年齢は若い）ことを意味していると考えられる．これを証明するために，1 Gy 以上群，0.50-0.99Gy 群及び 0-0.09Gy 群（対照群）の累積癌死亡率を生命表を用いて算出し，比較した（図２）．1 Gy 以上群では，調査期間全体を通じての累積癌死亡率は 25.9×10^{-3} であり，0-0.09 Gy 群の 6.5×10^{-3} の４倍である．更にこの線量群の発癌時期は 0-0.09 Gy 群よりも早く，最初の死亡例は胃癌による被爆時年齢９歳の男性であり，被爆後13年目に死亡している．0.50-0.99 Gy 群は中間的なパターンを示し，累積癌死亡率（16.2×10^{-3}）は 0-0.09 Gy 群よりも高い．1.00 Gy 以上の高線量群における癌による死亡（12例，白血病を除く）は，骨盤腫瘍，卵巣癌，膵臓癌(2)，細網肉腫，肝癌，甲状腺癌，胃癌(3)，子宮癌及び部位不明の癌によるものである．症例数は少ないが，部位別分布は一般集団のものと著しく異なってはいない．

被爆から死亡までの期間の白血病以外の全部位の癌症例の累積分布を高線量（1 Gy 以上）群と対照（0-0.09 Gy）群の両方について被爆時年齢別に図３に示した．本図が示すように，潜伏期間（被爆から死亡までの期間）は被爆時10歳未満群では高線量群の方が対照群よりも短いが，被爆時10歳以上群ではこのような短縮は認められない．これらの所見は，被爆から死亡までの期間の平均を比較することによっても確認できる（表９）．

被爆時０-９歳群を更に０-４歳群と５-９歳群の二つに分けた（データは示していない）．しかし，被爆時０-４歳群の対象者の多くは癌好発年齢にまだ達しておらず，0.50 Gy 以上での癌死亡数は少ない（５例）ので，同群について意義のある解析を行うことはできなかった．

FIGURE 2 CUMULATIVE MORTALITY RATE FROM ALL CANCERS EXCEPT LEUKEMIA AND 90% CONFIDENCE INTERVAL BY TIME SINCE EXPOSURE AND RADIATION DOSE (SHIELDED KERMA) FOR THOSE EXPOSED UNDER AGE 10

図2 被爆時年齢10歳未満の被爆者における，白血病以外の全部位の癌の累積死亡率及び90%信頼区間，被爆後経過時間及び放射線量別（遮蔽kerma）

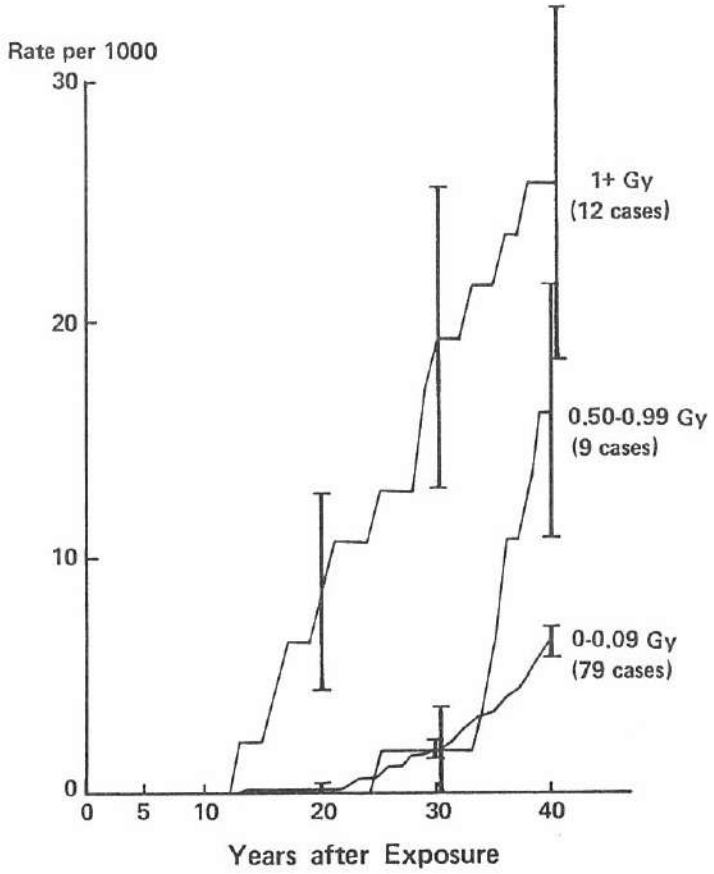


FIGURE 3 CUMULATIVE DISTRIBUTION OF DEATH FROM ALL CANCERS EXCEPT LEUKEMIA BY TIME SINCE EXPOSURE, AGE ATB, AND RADIATION DOSE (SHIELDED KERMA)

図3 白血病以外の全部位の癌による死亡の累積分布，被爆後経過時間，被爆時年齢及び放射線量別（遮蔽kerma）

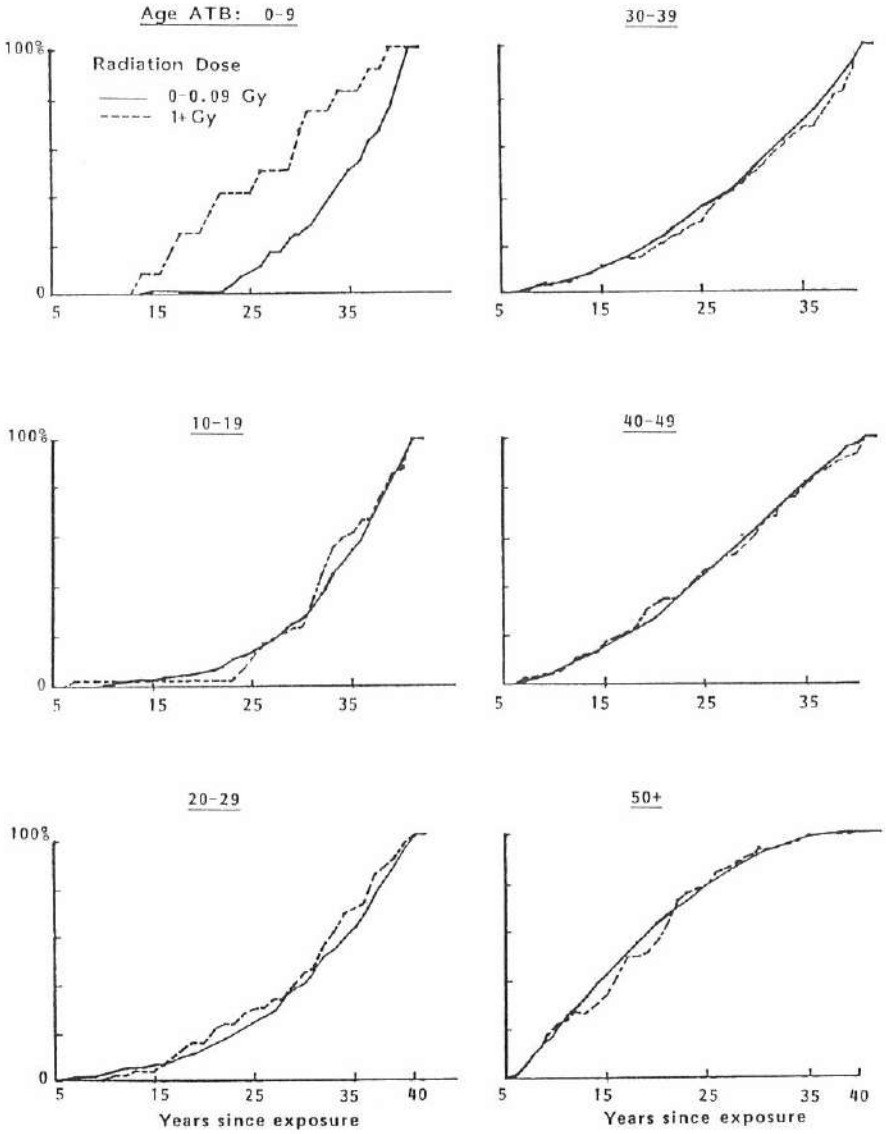


TABLE 9 MEAN YEARS (ITS STANDARD ERROR) SINCE EXPOSURE TO DEATH BY RADIATION DOSE AND AGE ATB (SHIELDED KERMA)

表9 被爆から死亡までの平均年数（その標準誤差），放射線量及び被爆時年齢別（遮蔽kerma）

Age ATB	Radiation dose (Gy) 0-0.09	0.10-0.49	0.50-0.99	1.00	TEST †
Total	24.8 (0.2)	25.4 (0.3)	25.2 (0.6)	25.8 (0.5)	
<10	33.2 (0.6)	33.7 (1.1)	35.0 (1.5)	25.5 (2.4)	p<0.001
10-19	32.0 (0.4)	32.3 (1.0)	32.7 (1.2)	31.9 (1.0)	
20-29	29.9 (0.4)	30.2 (0.8)	28.9 (1.6)	28.9 (1.1)	
30-39	27.9 (0.3)	29.2 (0.6)	28.8 (1.1)	28.6 (1.1)	
40-49	25.3 (0.2)	25.5 (0.5)	25.6 (0.9)	25.3 (0.9)	
50+	18.2 (0.2)	18.6 (0.5)	17.7 (0.9)	17.8 (1.0)	

† Equality of mean years among radiation dose groups were tested by age ATB.

放射線量群間での平均年数の均一性を被爆時年齢別に検定した．

TABLE 10 RISK COEFFICIENTS FOR AGE ATB UNDER 10

表10 被爆時年齢10歳未満のリスク係数

Disease	No. of cases	Relative risk at 1 Gy	Excess deaths per 10^4 PYGy
		Shielded kerma	
Leukemia	31	17.1 (9.17, 38.4)	2.93 (2.23, 3.59)
All cancers except leukemia	111	2.35 (1.61, 3.44)	2.29 (1.13, 3.68)
		Organ-absorbed dose	
Leukemia	31	19.8 (10.6, 45.3)	3.39 (2.59, 4.17)
All cancers except leukemia	111	2.66 (1.74, 4.00)	2.82 (1.37, 4.56)

For both shielded kerma and organ-absorbed dose, the RR at 1 Gy and the excess deaths per 10^4 PYGy for leukemia and all cancers except leukemia for the age ATB<10 cohort, postulating a linear dose response, are shown in Table 10. With organ-absorbed dose, in the years 1950-85, the annual excess deaths per 10^4 PYGy for all cancers except leukemia is 2.82. Considered in terms of age ATD, the risk is the highest in comparison with other age-ATB cohorts as previously seen (Tables 6 and 7).

遮蔽kermaと臓器吸収線量の両方について，被爆時10歳未満群における白血病及び白血病以外の全部位の癌の線形線量反応を仮定した場合の1 Gyでの相対リスク及び10^4人年Gy当たりの過剰死亡を，表10に示した．臓器吸収線量については，1950-85年における白血病以外の全部位の癌の10^4人年Gy当たりの年間過剰死亡数は2.82である．死亡時年齢から見ると，既に述べたように，10歳未満群のリスクは他の被爆時年齢群と比べると最も高い（表6及び7）．

Temporal change of site-specific cancer risk

The changes in RR at 1 Gy from 1950-85 are shown in Table 11 and Figure 4 for successive 5-year periods of surveillance. The RR for the three years (1983-85) of the last five years (1981-85), excluding the years 1981-82 included in the previous Report 10, is also given. The average annual changes in excess RR for leukemia after 1950 and for cancers other than leukemia after 1960 are shown in percentages, taking into account the minimum latent period for carcinogenesis.

部位別癌リスクの経時的変化

1950-85年を連続した5年間に区分し，この期間における1 Gyでの相対リスクの変化を表11及び図4に示した．最後の5年間（1981-85年）のうち，前回の第10報に含めた1981-82年を除く3年間（1983-85年）の相対リスクも同時に示した．発癌の最小潜伏期間を考慮に入れて，1950年以後の白血病及び1960年以後の白血病以外の全部位の癌の過剰相対リスクの年平均変化率を百分率で示した．

It is commonly known that the risk of leukemia has decreased with time, peaking 6-8 years after exposure to the bomb, and this temporal pattern differs somewhat by age ATB particularly for acute leukemia.[9] The younger age-ATB group reached the peak earlier and decreased more quickly thereafter as compared with the older age-ATB groups.[9] As seen in Table 11, the RR of leukemia has decreased with time after 1950. However, the RR is still significantly high for the years 1981-85, but when examined by age ATB, an excess in this period is observed only for the age 30-49 ATB group. For the age ATB < 30 group, no excess deaths have been observed after 1970. (No excess was observed for the age ATB 50+ group in the period 1981-85, probably because of the small number of subjects who were still alive in 1980; age 85 and over.) When examined by cities, significance in excess deaths for the period 1981-85 is obtained only in Hiroshima. (Number of leukemia deaths among survivors exposed to 1.00+ Gy: four in Hiroshima and one in Nagasaki.) No significant increase in risk is observed after 1971 in Nagasaki, reflecting the small sample number, especially the number exposed to high doses within the DS86 sample.

白血病のリスクは被爆後6-8年目に最高となり，以後経年的に低下したことはよく知られているが，この経時的パターンは，特に急性白血病の場合，被爆時年齢によって若干異なる．[9] 若年被爆群のリスクは，高齢被爆群と比べて早い時期にピークに達し，その後より急速に低下した．[9] 表11から分かるように，白血病の相対リスクは1950年以降時間と共に低下してきたが，1981-85年の間の相対リスクは依然として有意に高い．しかし，被爆時年齢別に検討すると，この期間の過剰は被爆時年齢30-49歳群にのみ認められる．被爆時年齢30歳未満群においては，1970年以降に過剰死亡は認められない．（1981-85年に被爆時50歳以上群に過剰死亡は認められなかったが，これは恐らく，1980年に存命中の対象者は85歳以上であり，その数が少なかったためであろう）．都市別に検討すると，1981-85年の過剰死亡は広島でのみ有意である．（1 Gy以上に被曝した被爆者の白血病死亡数：広島4例，長崎1例．）長崎では，対象者数の少ないこと，特にDS86集団での高線量被爆者の数の少なさを反映して，1971年以降はリスクの有意な増加は認められない．

TABLE 11 RELATIVE RISK AT 1 Gy BY OBSERVATIONAL PERIOD FOR VARIOUS SITES OF CANACER (SHIELDED KERMA)

表11 各部位の癌における1 Gy での相対リスク，観察期間別（遮蔽kerma）

Site of cancer		Total 1950-85	1950-55	1956-60	1961-65	1966-70	1971-75	1976-80	1981-85	1983-85	% change of excess RR after 1960† (a)	(b)
Leukemia	No	202	35	39	26	18	28	31	25	12		
	RR	4.92	11.72	10.90	4.50	6.70	2.19	1.64	2.92	1.81		
		(3.89,6.40)	(6.70,23.79)	(6.12,23.43)	(2.18,10.03)	(3.14,15.64)	(1.13,4.42)	(0.96,3.03)	(1.47,6.33)	(0.93,4.49)	-9.0***	-9.0***
All cancers except leukemia	No	5734	532	637	773	843	925	987	1037	627		
	RR	1.29	1.24	1.12	1.23	1.26	1.29	1.40	1.43	1.47		
		(1.23,1.36)	(1.05,1.48)	(0.98,1.30)	(1.06,1.43)	(1.11,1.44)	(1.14,1.48)	(1.23,1.59)	(1.27,1.62)	(1.27,1.73)	3.5*	-0.9
Esophagus	No	176	20	18	29	38	25	26	20	13		
	RR	1.43	1.58	2.73	2.02	0.84	1.10	1.16	1.27	0.83		
		(1.09,1.91)	(,3.85)	(1.33,5.96)	(1.03,4.16)	(,1.37)	(,2.60)	(,3.13)	(0.86,2.73)	(,2.05)	-22.6Sug	-18.8
Stomach	No	2007	218	281	297	322	330	303	256	145		
	RR	1.23	1.22	1.01	1.28	1.17	1.11	1.45	1.45	1.63		
		(1.13,1.34)	(0.95,1.64)	(,1.29)	(1.04,1.61)	(0.98,1.43)	(0.92,1.38)	(1.15,1.87)	(1.14,1.86)	(1.20,2.26)	5.1	1.2
Colon	No	232	12	9	21	36	41	47	66	37		
	RR	1.56	0.82	0.82	1.62	1.82	1.30	1.93	1.61	1.99		
		(1.25,1.98)	(,1.93)	(,2.07)	(,4.14)	(0.98,3.54)	(,2.58)	(1.24,3.12)	(1.12,2.46)	(1.18,3.52)	4.5	-7.0
Lung	No	638	16	28	69	114	115	150	146	86		
	RR	1.46	0.82	1.94	1.58	1.52	1.72	1.56	1.10	1.07		
		(1.25,1.72)	(,1.72)	(0.91,4.24)	(0.97,2.64)	(1.03,2.30)	(1.23,2.48)	(1.13,2.18)	(0.84,1.56)	(,1.78)	-2.8	-4.7
Female breast	No	155	15	16	28	22	21	26	27	14		
	RR	2.00	0.84	1.01	1.23	5.03	0.84	2.96	2.55	2.59		
		(1.48,2.75)	(,2.86)	(,3.59)	(,2.82)	(2.38,12.06)	(,1.70)	(1.46,6.55)	(1.29,5.13)	(1.07,6.76)	5.4	1.1
Ovary	No	82	6	7	12	13	11	17	16	7		
	RR	1.81	1.97	0.82	0.82	2.71	3.68	2.33	0.82	0.81		
		(1.16,2.89)	(,9.51)	(,2.73)	(,3.50)	(0.93,8.30)	(1.22,11.55)	(1.05,5.52)	(,2.89)	(,2.70)	2.6	-3.9
Urinary tract	No	133	8	11	25	17	28	19	25	17		
	RR	2.02	0.82	0.82	0.97	5.72	0.83	3.85	3.67	3.15		
		(1.45,2.87)	(,4.13)	(,2.43)	(,2.50)	(2.66,14.19)	(,1.45)	(1.38,10.92)	(1.82,7.76)	(1.30,7.85)	9.6Sug	6.6
Multiple myeloma	No	36	1	2	2	2	6	7	16	9		
	RR	2.86	25.33	8.42	0.83	0.81	2.44	5.32	2.41	4.25		
		(1.55,5.41)	(,)	(1.26,)	(,14.25)	(,9.31)	(0.97,8.90)	(1.12,22.22)	(1.02,6.71)	(1.31,15.65)	-3.1	-5.7

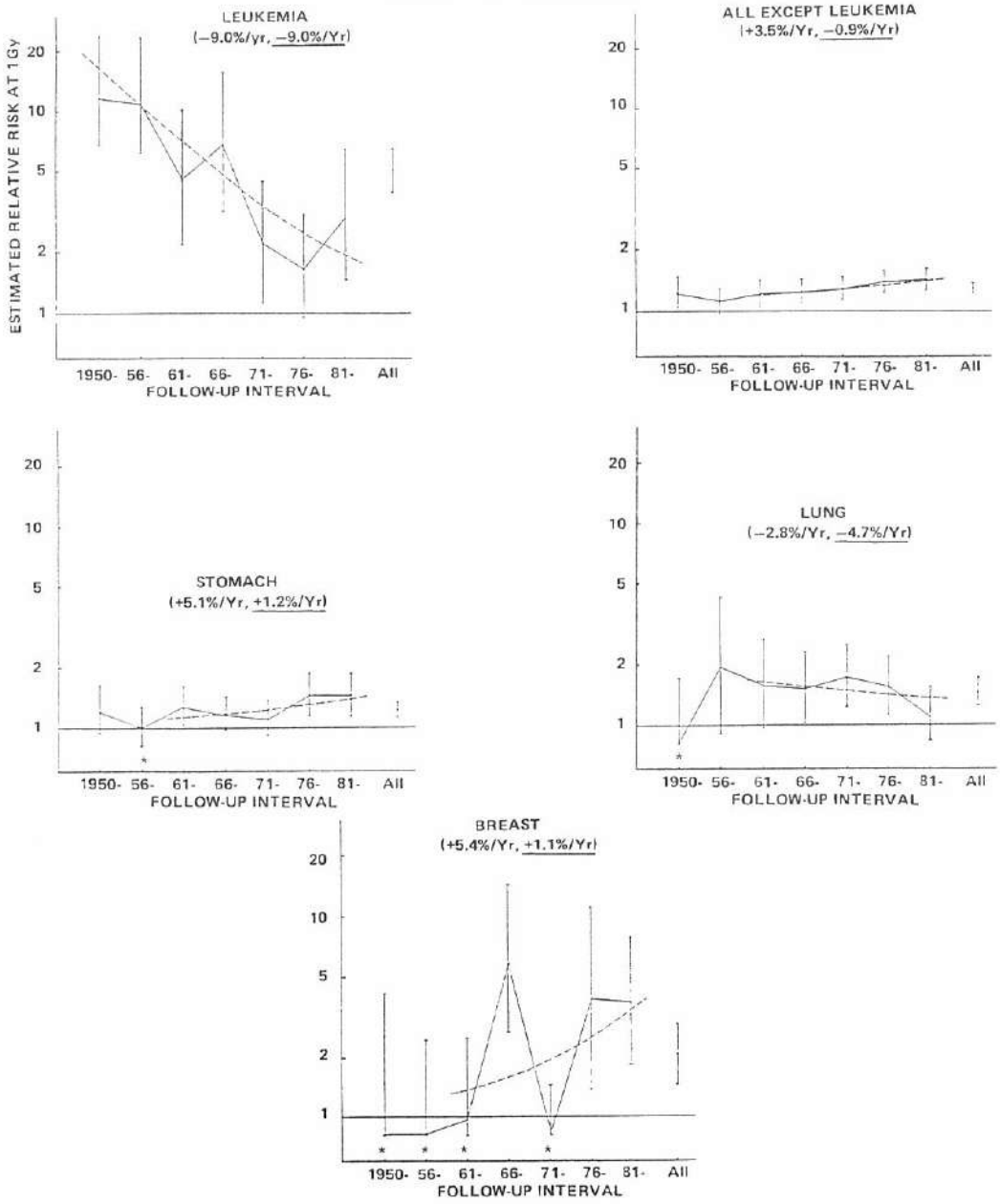
† For leukemia the average annual % change of excess RR after 1950 白血病の場合は，1950年以降の過剰相対リスクの年平均変化率（%）

Numbers in parentheses indicate a 90% confidence interval. 括弧内の数値は90%信頼区間を示す．

(a) Not adjusted for age ATB 被爆時年齢を訂正していない
(b) Adjusted for age ATB 被爆時年齢を訂正した
*** p<0.001, * p<0.05, Sug p<0.10

FIGURE 4A VARIATION IN RELATIVE RISK AT 1 Gy (SHIELDED KERMA) OF MORTALITY BY TIME INTERVAL AND SELECTED CANCERS; BOTH SEXES, ALL AGES ATB

図4A 特定の癌の1 Gy における相対リスクの観察期間別変化；男女合計，全被爆時年齢（遮蔽kerma）



Numbers in the parentheses are average annual percent change of excess relative risk without or with age ATB adjustment for radiation effect.

括弧内の数値は，放射線の影響について被爆時年齢を訂正しない場合と訂正した場合の過剰相対リスクの年平均変化率（%）．

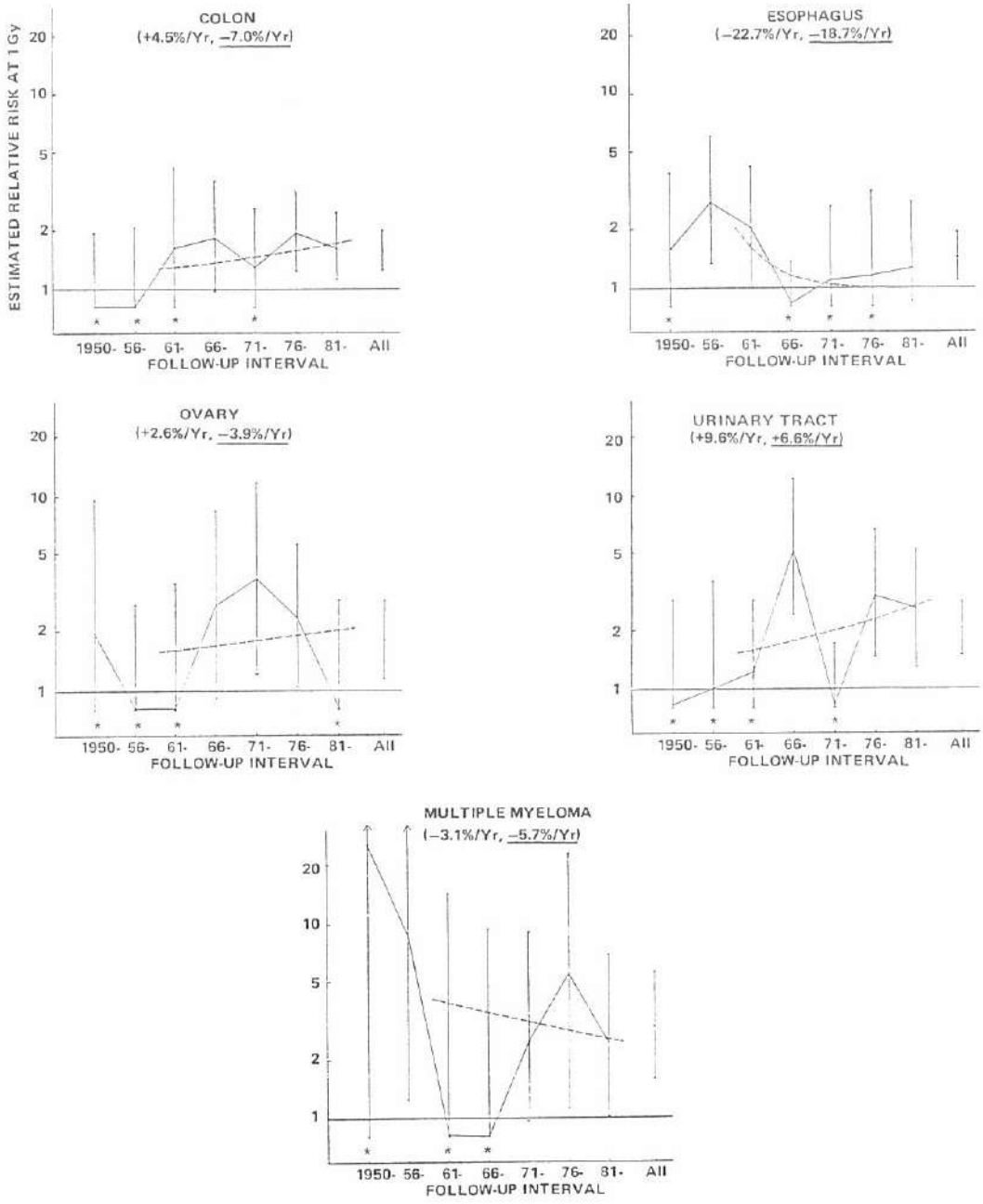
Bars indicate 90% confidence interval of relative risk at 1 Gy. Dashed lines show the fitted time trend during 1950-85 for leukemia. 1961-85 for other cancers.

縦棒は1 Gy における相対リスクの90%信頼区間を示す．破線は，白血病では1950－85年，その他の癌では1961－85年の推定された経時的傾向を示す．

*Minimum feasible value 最小の可能値

FIGURE 4B VARIATION IN RELATIVE RISK AT 1 Gy (SHIELDED KERMA) OF MORTALITY BY TIME INTERVAL AND SELECTED CANCERS; BOTH SEXES, ALL AGES ATB

図4B 特定の癌の1 Gyにおける相対リスクの観察期間別変化；男女合計，全被爆時年齢（遮蔽kerma）



Numbers in the parentheses are average annual percent change of excess relative risk without or with age ATB adjustment for radiation effect.
括弧内の数値は，放射線の影響について被爆時年齢を訂正しない場合と訂正した場合の過剰相対リスクの年平均変化率（%）．
Bars indicate 90% confidence interval of relative risk at 1 Gy. Dashed lines show the fitted time trend during 1961-85.
縦棒は1 Gyにおける相対リスクの90%信頼区間を示す．破線は1961-85年の推定された経時的傾向を示す．
*Minimum feasible value 最小の可能値

The RR for all cancers except leukemia increases significantly with time after 1960. The mean increase in excess RR per annum is 3.5%; this value becomes −0.9%, however, after adjusting for age ATB and is no longer significantly different from zero (Table 11). This is attributable to the fact that among those survivors of the same age ATD, the youngest age-ATB cohort with a high RR, having now attained the cancer predilection age, contributes importantly to the excess RR in the entire cohort.

白血病以外の全部位の癌の相対リスクは1960年以降時間と共に有意に増加している．1年当たりの過剰相対リスクの平均増加率は3.5%である．しかし，被爆時年齢を補正するとこの値は−0.9%になり，統計的にはもはや有意ではない(表11)．これは，死亡時年齢が同じ被爆者のうち，高い相対リスクを示す最若年被爆群が現在癌好発年齢に達しており，集団全体の過剰相対リスクに大きく寄与しているためである．

When individual sites are studied, none exhibits statistically significant annual changes after adjusting for age ATB, but at face value stomach, breast, and urinary tract cancers seem to show an increasing tendency, while cancers of the esophagus, colon, lung, ovaries, and multiple myeloma show a decreasing one.

各部位を個別に検討すると，被爆時年齢補正後に統計学的に有意な年次変化を示すものはないが，胃癌，乳癌，泌尿器癌が増加傾向を示し，食道癌，結腸癌，肺癌，卵巣癌及び多発性骨髄腫が低下傾向を示すようである．

Sex and other modifying factors

Sex. In Table 12, the RRs of cancer mortality at 1 Gy and excess deaths per 10^4 PYGy are presented by sex for the relevant organs. The RR does not differ for leukemia, but for cancers other than leukemia it is higher for females than for males, particularly for cancers of the esophagus and lung for which the difference in excess RR by sex is statistically significant ($p<0.05$). The higher RR among females for cancers other than leukemia presumably reflects the fact that the background mortality rate is higher for males than for females. For leukemia, however, though the background rate is also high for males, the RR is equal for males and females.

性及びその他の修飾要因

性． 部位別癌の1 Gyでの癌死亡相対リスク及び10^4人年Gy当たりの過剰死亡を男女別に表12に示した．白血病の相対リスクに性差はないが，白血病以外の癌の相対リスクは男性よりも女性の方が高い．この傾向は特に食道癌及び肺癌において顕著であり，過剰相対リスクの性差は統計学的に有意である($p<0.05$)．白血病以外の癌の相対リスクが女性の方に高いということは，男性の方が女性より自然癌死亡率が高いという事実を反映している．しかし，白血病の場合，男性の自然癌死亡率は高いが，相対リスクは男女間で等しい値を示している．

Excess deaths per 10^4 PYGy for each sex were calculated using an additive excess RR model[1] (i.e., the RR is expressed as a function of both radiation dose and sex), so that the estimates of the excess deaths would be essentially free from differences in background cancer mortality for the two sexes and organs (Table 12). Excess deaths per 10^4 PYGy do not differ significantly by sex, except for leukemia.

男女の10^4人年Gy当たりの過剰死亡を相加過剰相対リスクモデル[1]を用いて計算した(すなわち，相対リスクを放射線量と性の関数として表した)．これにより，過剰死亡推定値は，性別各臓器の自然癌死亡率の差を基本的に含まないものとなる(表12)．白血病を除いて，10^4人年Gy当たりの過剰死亡は男女で有意に異ならない．

TABLE 12 RISK COEFFICIENTS BY SEX (SHIELDED KERMA)
表12 リスク係数，性別（遮蔽kerma）

Site of cancer	Estimated RR at 1 Gy				Excess Deaths per 10^4 PYGy			
	Male	Female	M/F	Test	Male	Female	M/F	Test
Leukemia	4.96	4.92	1.00		3.14	1.80	1.74	*
All cancers except leukemia	1.17	1.44	0.81	**	5.76	8.78	0.66	
Esophagus	1.19	2.99	0.40	*	0.30	0.40	0.75	
Stomach	1.15	1.36	0.85		2.01	2.18	0.92	
Colon	1.45	1.67	0.87		0.60	0.51	1.18	
Lung	1.26	1.86	0.68	*	1.07	1.47	0.73	
Urinary tract	2.00	2.15	0.93		0.81	0.42	1.93	
Multiple myeloma	5.29	2.32	2.28		0.23	0.21	1.10	

* $p < 0.05$ ** $p < 0.01$

Other factor: Smoking. Since smoking is the most significant risk factor for the induction of lung cancer, the radiation-related risk coefficient for lung cancer was also estimated for all subjects of both sexes when smoking data are available (50% of the total cohort). Though, the detailed results will be described in a separate report,[10] the main findings are shown in Table 13. When the effects of smoking are ignored, the RR of lung cancer at 1 Gy is significantly higher for females than males, as seen in the total cohort. However, after adjustment for the effects of smoking, the difference in RR for males and females is no longer significant. It would thus appear that the effects of radiation may not differ by sex, though the RR may be higher for females, where the proportion of smokers is only 16%, than for males, where the proportion is nearly 84%.

Table 13 (see column 5) also provides a test of whether or not an interaction occurs between smoking and radiation in lung cancer induction. Note that no statistically significant interaction exists which implies that smoking and radiation act additively rather than multiplicatively in lung cancer induction.

To examine this issue further, a cumulative lung cancer mortality rate was calculated using life table methods on the cohort for whom smoking information is available to determine if a dose-dependent shortening of the latent period occurs when smoking is considered. Since the number of lung cancer deaths is small, the cohort was divided into only two radiation dose groups, namely, 0-0.09 Gy vs

その他の要因：喫煙. 喫煙は肺癌誘発の最も重要なリスク要因であるので，喫煙データが入手できる男女の全対象者（コホート全体の50%）について肺癌の放射線関連リスク係数も推定した．詳細な結果は別報[10]で述べるが，主要所見を表13に示した．喫煙の影響を無視すると，コホート全体と同様に，1 Gyでの肺癌の相対リスクは男性よりも女性の方が有意に高い．しかし，喫煙の影響を補正すると，男女間の相対リスクの差はもはや統計的には有意ではない．喫煙者の比率が16%にすぎない女性の方が，同比率がほぼ84%の男性よりも肺癌の相対リスクは高いが，放射線の影響は男女で異ならないと思われる．

表13（第5欄）では，肺癌の誘発において喫煙と放射線の相互作用が見られるか否かについても調べた．その結果，統計学的に有意な相互作用は存在せず，喫煙と放射線は肺癌誘発において相乗的というよりも相加的に作用することが示唆されている．

この問題を更に追求するために，喫煙情報が入手できるコホートについて生命表を用いて累積肺癌死亡率を算出し，喫煙を考慮した際には線量による潜伏期間の短縮が生じるかどうかを検討した．肺癌死亡数は少ないので，コホートを二つの放射線量群，すなわち，0-0.09 Gy群対0.5 Gy以上群と喫煙者対

0.50+ Gy, and smokers vs nonsmokers. The cumulative lung cancer mortality rates among the four exposure-smoking groups are shown in Figure 5 for the sexes separately.

For males, where the majority are smokers (84%), an excess in mortality among smokers in the "heavily" exposed group (0.50+ Gy) became apparent around 1965, but the background mortality rate (0 Gy) also increased at about this time. Thus, no dose-dependent shortening of the latent period is observed. For nonsmokers, no excess in mortality occurs in the heavily exposed group.

非喫煙者とに分類した．この四つの線量－喫煙群における累積肺癌死亡率を男女別に図5に示した．

大部分が喫煙者（84%）である男性においては，"高線量" 被曝群（0.5 Gy 以上）における喫煙者の過剰死亡率は1965年ごろから明瞭になってきたが，自然癌死亡率（0 Gy）もほぼこの時期に増加した．したがって，線量による潜伏期間の短縮は認められない．非喫煙者では，高線量被曝群に死亡率の過剰は見られない．

TABLE 13 RADIATION EFFECT BY SEX FOR LUNG CANCER (SHIELDED KERMA)
表13 肺癌に対する放射線の影響，性別（遮蔽kerma）

Variable	Model				
	1	2	3	4	5
Radiation dose (Gy)	4.010 (6.181)	5.899 (8.450)	5.788 (8.002)	6.809 (9.641)	7.607 (10.30)
Cumulative cigarette consumption (cigarettes/day x yr)			$.3428\times10^{-2}$ $(.7651\times10^{-3})$	$.3446\times10^{-2}$ $(.784\times10^{-3})$	$.3625\times10^{-2}$ $(.8654\times10^{-3})$
Radiation Effect modifier:					
Age ATB	-.079 (.054)	-.054 (.044)	-.067 (.046)	-.063 (.045)	-.066 (.043)
Sex		-2.324 (1.984)		-.658 (1.281)	-.362 (1.275)
Cigarette					-0.2951×10^{-3} $(.2190\times10^{-2})$
Deviance	443.941	440.625	366.783	366.436	366.430
df	3190	3189	3189	3188	3187
TEST for equality of radiation effect by sex		$\chi^2_{(1)}=3.316$ $p<.10$		$\chi^2_{(1)}=.347$ $p>.10$	
Relative risk at 1 Gy for Age ATB=30					
Male		1.11		1.53	
Female		2.17		2.03	

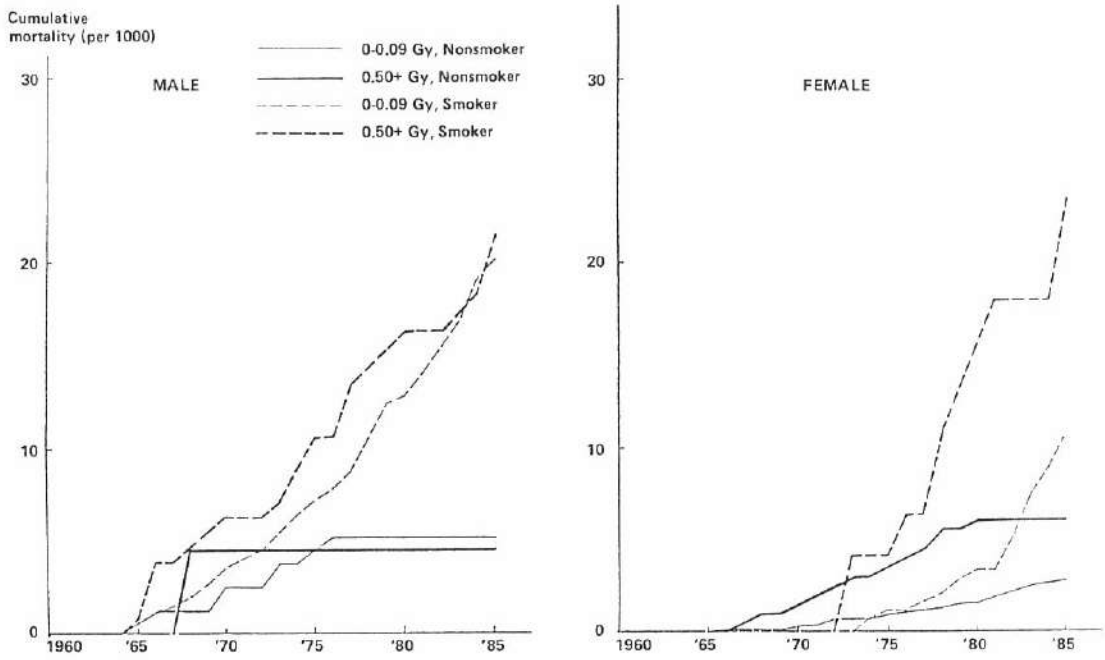
Numbers in parentheses indicate a standard error of the risk coefficients.
括弧内の数値はリスク係数の標準誤差を示す．

For females, where there are few smokers (16%), the excess mortality for the heavily exposed group began about 1966, but no shortening of the latent period is observed among nonsmokers. Among the smokers, though an excess mortality was apparent somewhat later, about 1973, no shortening of the latent period is observed. To recapitulate, there is no shortening of the latent period with exposure either among males or females when smoking is considered, and although an excess in mortality in the heavily exposed group appears to occur earlier among nonsmoking than smoking females, this tendency was not seen in males.

喫煙者の少ない（16%）女性においては，高線量被曝群の過剰死亡率は1966年ごろから見られ始めたが，非喫煙者に潜伏期間の短縮は認められない．喫煙者においては，過剰死亡率はやや遅く1973年ごろに現われたが，潜伏期間の短縮は認められない．要約すれば，喫煙を考慮した場合，男女いずれの場合も，線量に伴う潜伏期間の短縮は見られない．また，高線量被曝群における過剰死亡率は，女性では喫煙者よりも非喫煙者の方に早期に現われるようであるが，この傾向は男性には認められない．

FIGURE 5 CUMULATIVE MORTALITY RATE FROM LUNG CANCER BY RADIATION (SHIELDED KERMA), SMOKING, AND SEX

図5 喫煙及び性別肺癌の累積死亡率（遮蔽kerma）



Dose response

The dose-response curve for cancer mortality is expressed as the product of a term which generally increases with dose and a term which decreases with dose. As the second term takes into consideration a cell-killing effect at high doses, it can be ignored at the low-dose level.

線量反応

癌死亡率の線量反応曲線は，全般的に線量と共に増加する項と線量と共に減少する項の積として表される．第二の項が高線量での細胞致死の影響を考慮に入れるので，低線量レベルではこの影響を無視できる．

Since the doses received by the A-bomb survivors ranges from low to high, the dose-response curve will first be examined for the entire dose range. Briefly, three basic models were considered: linear (L), linear quadratic (LQ), and quadratic (Q). In addition, a cell-killing (K) term was added to each of these three basic models and they were designated as: L-K, LQ-K, and Q-K. Deviances were used to evaluate the goodness of fit of these models to the observed dose-response curve using organ-absorbed dose as well as shielded kerma. In Table 14A, the differences in deviance between the L and the non-L models with a linear term, i.e., LQ, L-K or LQ-K are shown. Among nonnested models, although the goodness of fit of any one can be ascertained, the difference in the fit of two different models cannot be compared in a straightforward manner. Since the L and Q models are not nested, a direct comparison of their fit is impossible statistically. As an alternate, we give a comparison of the Q and LQ models. The results with organ-absorbed dose clearly indicate that the LQ model fits significantly better than the Q model, except for cancer of the colon for which both fit equally well. Except in cases of leukemia and colon cancer, the three nonlinear models do not fit any better than the simple L model when organ-absorbed doses are used. For leukemia, the LQ model with a cell-killing term fits somewhat better than the L model (Figure 6). For colon cancer, the LQ or LQ-K model fits better than the L model. Further analyses, using shielded kerma, give very similar results to those just described for organ-absorbed doses; in general, nonlinear models do not fit appreciably better than the linear one except for leukemia and colon cancer. It should also be noted that even for all cancers except leukemia, where the LQ model affords a somewhat better (statistically suggestive) fit than the L model, the coefficient for the quadratic dose term is negative. This may reflect the fact that the dose-response curve bends down at high doses, though the L model with a cell-killing term does not fit any better than the L model.

Under the T65 dosimetry system, the dose-response curve differed between Hiroshima and Nagasaki, and the difference was large for leukemia. In Hiroshima, the curve was linear for the entire dose range, whereas in Nagasaki the curve was nonlinear in the low-dose range. Under the DS86 dosimetry system, though the dose-response curve seems to be linear as a result of the shifting of subjects with

原爆被爆者が受けた線量は低レベルから高レベルにまで及ぶので，全線量範囲の線量反応曲線をまず検討した．簡単に述べれば，線形（L），線形二次（LQ）及び二次（Q）の三つの基本モデルを考慮した．これに加えて，これら三つの基本モデルのそれぞれに細胞致死（K）項を加え，それぞれ，L-K，LQ-K及びQ-Kとした．臓器吸収線量及び遮蔽kermaを用いて観察された線量反応曲線に対するこれらのモデルの適合度を評価するためにdevianceを用いた．線形モデルと線形項を有する非線形モデル，すなわち，LQ，L-K又はLQ-Kにおけるdevianceの差を表14Aに示した．包含関係のないモデルでは，いずれの適合度も確認できるが，異なる二つのモデルの適合度の差を直接的な方法で比較することはできない．Lモデル及びQモデルは包含関係がないので，それらの適合度の直接的な比較は統計学的に不可能である．それに代わる方法として，QモデルとLQモデルの比較を行った．臓器吸収線量を用いた結果は，LQとQモデルが等しく適合する結腸癌を除いて，LQモデルの適合度がQモデルよりも有意に良いことを示唆している．白血病と結腸癌を除いて，臓器吸収線量を用いた場合三つの非線形モデルの適合度は単純なLモデルより良くはない．白血病では，細胞致死（K）項を有するLQモデルの適合度はLモデルよりも幾分良い（図6）．結腸癌では，LQ又はLQ-Kモデルの適合度はLモデルよりも良い．遮蔽kermaを用いて更に解析を行ったが，臓器吸収線量について前述したのと極めて近似した結果が得られた．すなわち全般的に，白血病及び結腸癌を除いて，非線形モデルの適合度が線形モデルより著しく良いということはない．また，LモデルよりLQモデルの方が若干良い適合度（統計学的に示唆的）を示す白血病以外の全部位の癌においても，二次線量項の係数は負であることに注意すべきである．これは高線量で線量反応曲線が下方に屈曲することを反映するものと思われるが，細胞致死（K）項を有するLモデルはLモデルより良い適合度を示さない．

T65線量推定方式では，線量反応曲線は広島と長崎とで異なっており，その差は白血病について大きかった．広島の線量反応曲線は全線量範囲を通じて線形であったが，長崎の同曲線は低線量範囲では非線形であった．T65DRで高線量群であった者がDS86では低線量群に移動された結果，DS86線量推定方式では

high T65DR doses to lower doses under the DS86, nonlinearity still remains in the low-dose range in Nagasaki (Figure 7). Accordingly, the goodness of fit of the dose response was determined for Hiroshima and Nagasaki separately under DS86 in comparison with that for T65D.

線量反応曲線は線形を示すように思われるが，長崎の低線量範囲における非線形性は依然として存在する（図7）．したがって，DS86での線量反応の適合度を，T65D の場合と対比させて，広島・長崎について別々に調べた．

TABLE 14A DIFFERENCE IN DEVIANCE BETWEEN THE LINEAR (L) MODEL AND OTHER NONLINEAR MODELS; LINEAR-QUADRATIC (LQ) MODEL, LINEAR WITH CELL-KILLING (L-K) MODEL, LINEAR-QUADRATIC WITH CELL KILLING (LQ-K) MODEL, AND BETWEEN (Q) AND (LQ) MODELS FOR SELECTED SITE OF CANCER

表14A 特定部位の癌に対する，線形（L）モデルと他の非線形モデル―線形二次（LQ）モデル，細胞致死項を有する線形（L-K）モデル，細胞致死項を有する線形二次（LQ-K）モデル― 並びに Qモデルと LQ モデルの間の deviance の差

Site of cancer	(L) − (LQ) df=1	(L) − (L-K) df=1	(L) − (LQ-K) df=2	(Q) − (LQ) df=1
		Shielded kerma		
Leukemia	0.6	0.5	6.4*	16.8***
All cancers except leukemia	2.8 Sug	2.8 Sug	2.8	38.4***
Stomach	0.8	1.3	1.5	10.8**
Colon	5.1*	1.6	7.9*	0.2
Lung	2.2	2.2	2.2	11.7***
Female breast	0.1	0.2	-	5.7*
		Organ-absorbed dose		
Leukemia	0.2	0.2	6.9*	21.4***
All cancers except leukemia	2.0	2.3	3.1	34.1***
Stomach	0.4	1.6	1.6	8.7**
Colon	6.5*	2.4	9.6**	0.5
Lung	2.3	2.3	2.2	12.7***
Female breast	0.3	0.5	-	6.9**

Sug $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

\- No convergence in LQ-K model
LQ-K モデルでは収束しない

TABLE 14B DIFFERENCE IN DEVIANCE BETWEEN THE LINEAR (L) MODEL AND LINEAR-QUADRATIC (LQ) MODEL, AND QUADRATIC (Q) AND LQ MODELS BY CITY FOR LEUKEMIA AND ALL CANCERS EXCEPT LEUKEMIA

表14B 白血病及び白血病以外の全部位の癌に対する，線形（L）モデルと線形二次（LQ）モデル並びに二次（Q）モデルとLQモデルの間のdevianceの差，都市別

		Leukemia		All cancers except leukemia	
	City	(L) - (LQ)	(Q) - (LQ)	(L) - (LQ)	(Q) - (LQ)
		Shielded kerma			
DS86 (<6Gy)	T	0.6	16.8***	2.8Sug	38.4***
	H	0.6	14.5***	0.5	23.3***
	N	0.0	3.1Sug.	4.0*	16.3***
DS86 (<4Gy)	T	6.7**	3.9*	0.0	15.9***
	H	4.6*	4.4*	0.2	10.2**
	N	2.6	0.1	1.1	7.4**
T65 (<6Gy)	T	1.5	10.7**	0.4	21.0***
	H	0.2	13.4***	0.1	16.8***
	N	3.1Sug	0.0	0.1	3.7Sug.
		Organ-abosrbed dose			
DS86 (<6Gy)	T	0.2	21.4***	2.0	34.1***
	H	0.1	18.8***	0.0	18.6***
	N	0.0	3.9*	3.7Sug	14.5***
DS86 (<4Gy)	T	2.4	9.3**	0.7	26.4***
	H	2.1	8.5**	0.0	15.9***
	N	0.4	1.4	2.4	12.2***
T65 (<6Gy)	T	0.7	14.3***	1.1	24.3***
	H	0.0	16.4***	0.1	16.1***
	N	2.2	0.1	0.5	5.4*

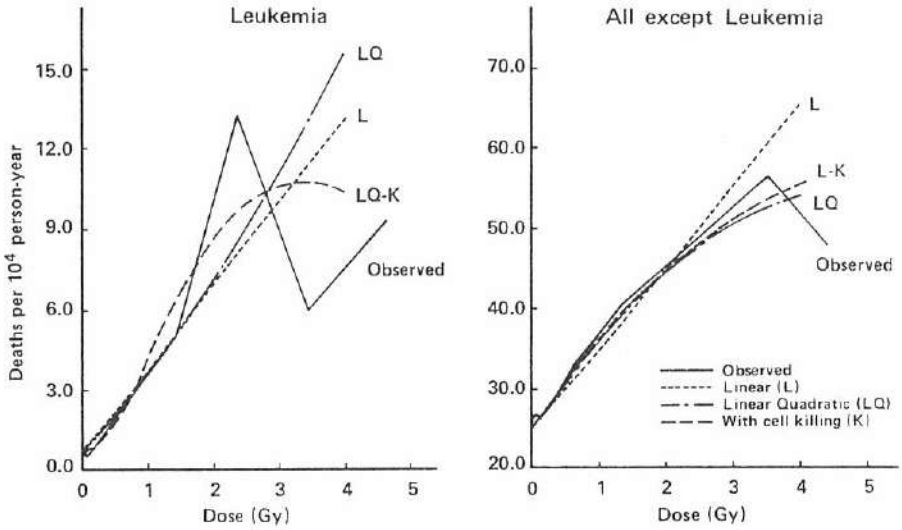
Sug p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Under the T65 dosimetry system, the leukemia data fit the L model in Hiroshima, but in Nagasaki the data show a better fit with the Q or LQ model. However, over the entire DS86 range, the L model shows a good fit for both Hiroshima and Nagasaki, but when restricted to <4 Gy, the LQ model presents a good fit for both Hiroshima and Nagasaki. This is in agreement with the good fit of the LQ-K model to the entire dose range for Hiroshima and Nagasaki combined, that is, a better fit of LQ model than L model in the low-dose range (Table 14B). For all cancers except leukemia, the L model shows a good fit in both Hiroshima and Nagasaki under both T65D and DS86. Moreover, even for the <4 Gy range, the L model gives a good fit (Table 14B).

T65線量推定方式では，広島の白血病データはLモデルに適合するが，長崎のデータはQ又はLQモデルに対してより良い適合度を示す．DS86では全線量範囲で，Lモデルが広島・長崎の両方に良く適合するが，4 Gy未満に限定すると，LQモデルが両市共に良く適合する．これは，広島と長崎を合わせた場合に，全線量範囲においてLQ-Kモデルが良く適合すること，すなわち，低線量範囲ではLモデルよりLQモデルの方が良い適合度を示すことと一致する（表14B）．白血病以外の全部位の癌では，T65DとDS86のいずれでも，両市共にLモデルが良く適合する．更に，4 Gy未満の範囲でも，Lモデルが良い適合度を示す（表14B）．

FIGURE 6 OBSERVED AND FITTED ORGAN-ABSORBED DOSE-RESPONSE CURVES FOR LEUKEMIA AND FOR ALL CANCERS EXCEPT LEUKEMIA

図6 白血病及び白血病以外の全部位の癌における臓器吸収線量反応曲線（観察値及び推定値）



Dose categories used in plots for observed dose-response curves are 0, 0.01-0.05, 0.06-0.09, 0.10-0.19, 0.20-0.49, 0.50-0.99, 1.0-1.9, 2.0-2.9, 3.0-3.39, 4.0+ Gy.

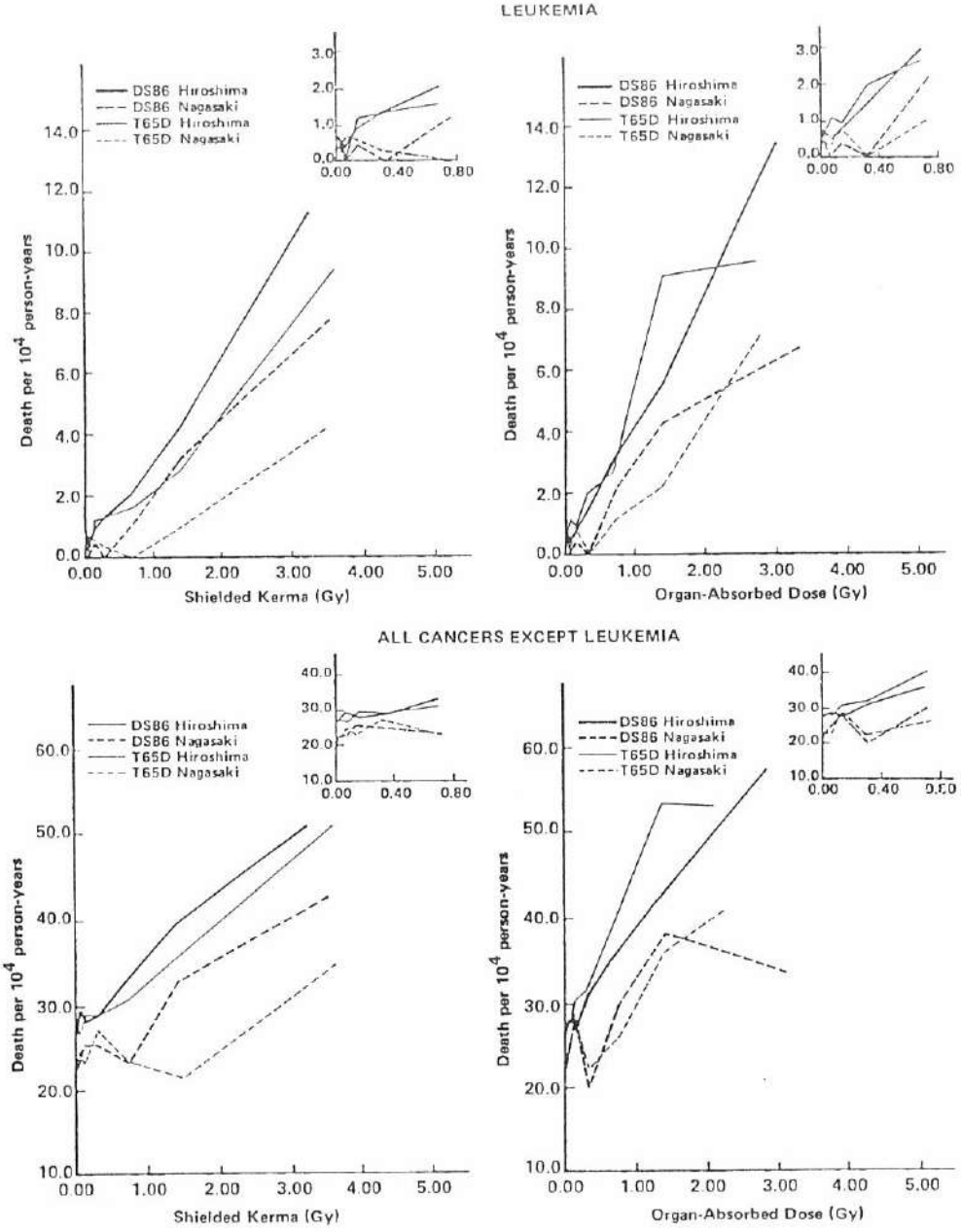
観察線量反応曲線のプロットに用いた線量区分は0，0.01－0.05，0.06－0.09，0.10－0.19，0.20－0.49，0.50－0.99，1.0－1.9，2.0－2.9，3.0－3.39，4.0＋ Gy.

Since the neutron dose is very small under the DS86 system, an analysis of the dose response using the gamma and neutron doses separately or to estimate the neutron RBE is difficult. However, the neutron RBE has been and continues to be of sufficient interest to warrant an effort. Accordingly, the following three models were fitted: linear for both gamma rays and neutrons (L-L); linear and quadratic for gamma rays and linear for neutrons (LQ-L); and quadratic for gamma rays and linear for neutrons (Q-L). Briefly, the LQ-L model fits better than the Q-L, whereas the L-L and LQ-L models fit equally well for the five selected sites and solid malignancies collectively. Even for leukemia, the LQ-L and L-L models fit equally well where a possible nonlinearity in the low-dose range was observed when total dose (gamma plus neutron) was used (data are not shown). Estimates of the RBE of neutrons (standard error) for leukemia and all cancers except leukemia are 52 (60) and 11 (39), respectively, based on the L-L model. (Incidentally, the RBE for leukemia based on the LQ-L model is 149 at 0.01 Gy, 60 at 0.1 Gy, and 27 at 1 Gy.) However, the uncertainties in these estimates are

DS86 方式では中性子線量が極めて低いので，ガンマ線量と中性子線量を用いて線量反応を別々に解析すること，すなわち，中性子の RBE を推定することは困難である．しかし，中性子の RBE はこれまで極めて重要な問題であったし，依然として重要であるので，RBE の推定は十分努力に値する．したがって，次の三つのモデルをデータに適合させた．すなわち，ガンマ線及び中性子に関して線形（L-L）；ガンマ線に線形二次，中性子に線形（LQ-L）；ガンマ線に二次，中性子に線形（Q-L）であるモデルを適合させた．簡単に述べると，五つの特定部位の癌と充実性悪性腫瘍全部位について，LQ-L モデルは Q-L モデルよりデータに良く適合するが，L-L モデル及び LQ-L モデルは等しく良く適合した．白血病については，総線量（ガンマ線＋中性子）を用いたときに低線量範囲で非線形性が認められたが LQ-L モデルと L-L モデルが同等に良く適合した（データは提示していない）．L-L モデルに基づく白血病及び白血病以外の全部位の癌に対する中性子の推定 RBE（標準誤差）は，それぞれ，52（60）及び11（39）である．（ついでながら，LQ-L モデルに基づく白血病の RBE は 0.01 Gy で149，0.1 Gy で60，1 Gy で27である）．

FIGURE 7 SHIELDED KERMA AND ORGAN-ABSORBED DOSE-RESPONSE CURVES FOR MORTALITY FROM LEUKEMIA AND ALL CANCERS EXCEPT LEUKEMIA BY CITY AND DOSIMETRY SYSTEM

図7 白血病及び白血病以外の全部位の癌死亡における線量反応曲線（遮蔽kerma及び臓器吸収線量）都市及び線量推定方式別



The insert in the upper right hand corner of each figure is an enlargement of the observed cancer rates at doses of less than 1.0 Gy.

各図の右上隅の挿入図は1.0 Gy未満での癌死亡率を拡大したものである。

Dose categories used in plots are 0, 0.01-0.05, 0.06-0.09, 0.10-0.19, 0.20-0.49, 0.50-0.99, 1.0-1.9, 2.0+ Gy.

プロットで用いた線量区分は0，0.01－0.05，0.06－0.09，0.10－0.19，0.20－0.49，0.50－0.99，1.0－1.9，2.0＋Gy.

too large to permit serious consideration of these RBEs.

As it is often difficult to extrapolate the risk at low doses from the risk coefficients obtained in the high-dose range, the risk coefficients obtained at low doses were compared with those for the entire dose range (Table 15). Under 0.20 Gy, the increase in the risk coefficient is not statistically significant for any cancer site, but under 0.50 Gy, the risk coefficients for leukemia, all cancers except leukemia, stomach cancer, and lung cancer were statistically significant. The risk coefficient for breast cancer is significant at less than 1 Gy, but that for colon cancer is not significant even at this level of exposure. Next, the risk coefficients in the low-dose range (<0.50 Gy) were compared with those in the high-dose range (0.50+ Gy). As for leukemia, the risk coefficient in the <0.50 Gy range is smaller than that in the 0.50+ Gy range. This also suggests that the dose-response curve fits the LQ model. Other cancers except leukemia showed no difference in risk coefficients between the low-dose level and the high-dose level, suggesting that they fit the linear model. However, colon cancer showed no elevated risk at <0.50 Gy; an increase in risk was observed only in the high-dose range. The difference between the two dose ranges in this case is, therefore, significant.

To determine the lowest dose range where a statistically significantly higher cancer mortality occurs than that seen in the control (0 Gy) group, Table 16 was constructed. With shielded kerma, the lowest dose ranges are 0.20-0.49 Gy for all cancers except leukemia and lung cancer, 0.50-0.99 for leukemia and cancer of the breast, 1.0-1.9 Gy for cancer of the stomach, and 2.0+ Gy for colon cancer. With organ-absorbed dose, the corresponding ranges are 0.20-0.49 Gy for leukemia, all cancers except leukemia, and cancer of the lung, 0.50-0.99 Gy for cancers of the stomach, and 1.0-1.9 for colon cancer.

しかし，これらの推定値の不確定性は大きく，これらのRBEを正当に考慮することはできない．

高線量範囲で得られたリスク係数から低線量でのリスクを外挿することはしばしば困難であるので，低線量で得られたリスク係数を全線量範囲で得られた係数と比較した（表15）．0.2 Gy 未満では，リスク係数の増加はいずれの癌部位においても統計学的に有意ではないが，0.5 Gy 未満では，白血病，白血病以外の全部位の癌，胃癌及び肺癌のリスク係数は統計学的に有意であった．乳癌のリスク係数は1 Gy 未満では有意であるが，結腸癌のリスク係数はこの線量レベルでも有意ではない．次に，低線量範囲（0.5 Gy 未満）におけるリスク係数を高線量範囲（0.5 Gy 以上）におけるリスク係数と比較した．白血病の場合には，0.5 Gy 未満におけるリスク係数は0.5 Gy 以上における同係数よりも小さい．このことも，線量反応曲線がLQモデルに適合することを示唆している．白血病以外のその他の癌のリスク係数は低線量レベルと高線量レベルとの間で異ならず，線形モデルに適合することを示唆している．しかし，結腸癌のリスクは0.5 Gy 未満では増加せず，高線量範囲でのみリスクの増加が認められた．したがって，この場合の両線量範囲間の差は有意である．

対照（0 Gy）群よりも統計学的に有意に高い癌死亡率が認められる最低の線量範囲を決定する目的で表16を作成した．遮蔽kerma の場合，最低線量範囲は，白血病以外の全部位の癌及び肺癌で0.2-0.49 Gy，白血病及び乳癌で0.5-0.99 Gy，胃癌で1-1.9 Gy，結腸癌で2 Gy 以上である．臓器吸収線量の場合，上記に対応する線量範囲は，白血病，白血病以外の全部位の癌及び肺癌で0.2-0.49 Gy，胃癌では0.5-0.99 Gy，結腸癌で1-1.9 Gy である．

TABLE 15 EXCESS RELATIVE RISK PER GRAY IN LOW-DOSE RANGE

表15 低線量範囲における1 Gy 当たりの過剰相対リスク

Site of cancer	Dose range (Gy)				Equality of excess RR		
	0-6	<.20	<.50	<1.0	<.50	.50+	Test
			Shielded kerma				
Leukemia	3.92***	.37	1.80Sug	2.37***	1.94	4.02	
All cancers except leukemia	.29***	.64Sug	.34*	.30***	.32	.29	
Stomach	.23***	.24	.24	.21	.23	.23	
Lung	.46***	1.12	1.06*	.63*	1.04	.45	
Female breast	1.00***	-.54	.22	1.21	.17	1.03	
Colon	.56***	-3.04Sug	-.46	-.06	-.43	.59	
			Organ-absorbed dose				
Leukemia	5.21***	-.12	2.40*	3.96***	2.44	5.53	*
All cancers except leukemia	.41***	.54	.38*	.46***	.37	.42	
Stomach	.27***	.17	.45Sug	.41**	.45	.26	
Lung	.63***	.17	1.09*	.83**	1.06	.60	
Female breast	1.19***	.21	.88	1.78**	.82	1.21	
Colon	.85***	-2.95Sug	-.53	-.10	-.52	.98	Sug

Sug p<0.10, * p<0.05, ** p<0.01, *** p<0.001

TABLE 16 ESTIMATED RELATIVE RISK COMPARED TO THE 0 Gy GROUP

表16 0 Gy 群と比較した場合の推定相対リスク

A) Shielded kerma

Site of cancer	Shielded kerma (Gy)						
	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.9	2.0+
Leukemia	1.14 (.80,1.62)	**.25** (.06,.68)	1.27 (.74,2.08)	1.59 (1.03,2.42)	**2.79** (1.77,4.30)	**6.09** (4.02,9.16)	**16.84** (11.52,24.60)
All cancers except leukemia	1.03 (.97,1.09)	1.09 (.99,1.20)	1.07 (.98,1.17)	**1.10** (1.02,1.19)	**1.21** (1.09,1.33)	**1.50** (1.34,1.69)	**1.97** (1.69,2.28)
Stomach	1.05 (.95,1.15)	1.07 (.90,1.25)	1.01 (.86,1.17)	1.08 (.95,1.24)	1.14 (.96,1.34)	**1.47** (1.20,1.78)	**1.65** (1.24,2.14)
Lung	**1.23** (1.04,1.46)	**1.46** (1.10,1.92)	1.07 (.80,1.42)	**1.47** (1.16,1.84)	**1.47** (1.09,1.95)	**1.94** (1.38,2.66)	**2.56** (1.65,3.80)
Female breast	1.12 (.80,1.58)	.71 (.30,1.42)	1.06 (.57,1.82)	1.19 (.71,1.94)	**2.23** (1.35,3.57)	**2.82** (1.49,4.93)	**3.43** (1.56,6.61)
Colon	1.04 (.79,1.36)	.75 (.42,1.25)	.58 (.32,.97)	.92 (.60,1.36)	1.01 (.59,1.64)	1.24 (.64,2.18)	**4.01** (2.33,6.48)

B) Organ-absorbed dose

Site of cancer	Organ-absorbed dose (Gy)						
	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.9	2.0+
Leukemia	.99 (.68,1.40)	.61 (.25,1.22)	1.08 (.61,1.82)	**1.79** (1.18,2.68)	**4.15** (2.76,6.19)	**8.01** (5.34,11.94)	**18.57** (12.05,28.20)
All cancers except leukemia	1.06 (1.0,1.12)	1.08 (.98,1.19)	1.06 (.97,1.16)	**1.12** (1.03,1.21)	**1.36** (1.23,1.51)	**1.66** (1.45,1.90)	**2.05** (1.66,2.50)
Stomach	1.06 (.96,1.16)	.93 (.78,1.10)	1.05 (.90,1.22)	1.16 (1.02,1.32)	**1.28** (1.07,1.53)	1.29 (.99,1.64)	**1.73** (1.19,2.43)
Lung	**1.30** (1.11,1.54)	1.21 (.89,1.62)	1.02 (.75,1.36)	**1.54** (1.22,1.93)	**1.63** (1.19,2.19)	**2.45** (1.73,3.38)	**2.14** (1.16,3.59)
Female breast	1.12 (.80,1.59)	1.02 (.49,1.89)	1.10 (.60,1.89)	1.39 (.85,2.21)	**2.67** (1.62,4.27)	2.39 (1.09,4.59)	**4.22** (1.77,8.54)
Colon	1.04 (.80,1.37)	1.01 (.61,1.59)	**.53** (.29,.91)	.93 (.60,1.38)	1.04 (.56,1.78)	**2.23** (1.20,3.81)	**5.87** (3.02,10.31)

Numbers in parentheses indicate a 90% confidence interval. 括弧内の数値は90%信頼区間を示す.

Underlined boldface numbers are significant at the 5% level.

下線を引いた太字の数値は5%水準で有意である.

DISCUSSION

Site-specific cancer mortality

The present analysis, based on the accumulation of cancer deaths in three additional years, 1983-85, and the new individual dose estimates, confirms previous findings with respect to the sites of cancer that show significant excesses in risk with radiation. Statistically significant excess risks are observed for cancers of the esophagus, stomach, colon, lung, breast, ovary, urinary tract, and multiple myeloma, but none for cancers of the rectum, liver, gallbladder, pancreas, uterus, and prostate. When urinary tract cancers are divided into those of the urinary bladder and the kidney separately, a statistically significant excess with dose is seen for cancer of the urinary bladder, some 70% of all cancers of the urinary tract, but not for kidney cancer. A significant excess risk of urinary bladder cancer cases for the period 1961-79 is observed.[11]

In the present analysis the relationship to dose of cancers of the bone, pharynx, nose and larynx, and skin cancer except melanoma has also been examined, but none of these cancers shows a significant increase with dose. Darby et al,[6] in their parallel analysis of A-bomb survivors (1950-78) and ankylosing spondylitis patients, observed a significant association of mortality from CNS tumors other than of the brain with dose in both groups, but no association was seen for brain tumors in either group. Following a pathological review of all cases of CNS tumors among the LSS sample, including the benign and those of unspecified nature, the same conclusion emerges from the present analysis. In the follow-up study of children receiving scalp irradiation for treatment of tinea capitis in Israel,[12] the risk increased for incidence of brain tumors as well as other CNS tumors, though only the scalp was heavily exposed. A detailed study of the incidence of CNS tumors based on the tumor registries to determine malignancy, histologic type, and so on, is under planning.

Inferences about radiation-related cancers, based upon mortality surveillance alone, are obviously compromised to some degree by the inaccuracies of death certificates as sources of information on the causes of death, and the incompleteness with which cancer deaths are reported.[5] Thus, the magnitude of the estimated excess cancer deaths based on death certificates should be corrected, depending on the confirmation and detection rates for site-specific cancer. The BEIR III report[7] used the av-

考　察

部位別癌死亡率

前回の報告の観察期間に1983-85年の3年間を追加した期間に発生した癌死亡並びに新しい個人線量推定値に基づく本解析では，放射線量に伴い有意な過剰リスクを示す癌部位については以前の所見と一致している．食道癌，胃癌，結腸癌，肺癌，乳癌，卵巣癌，泌尿器癌及び多発性骨髄腫については統計学的に有意な過剰リスクが認められるが，直腸癌，肝癌，胆嚢癌，膵臓癌，子宮癌及び前立腺癌については認められない．泌尿器癌を膀胱癌と腎臓癌とに分けると，泌尿器癌の約70％を占める膀胱癌に線量に伴う統計学的に有意な過剰が見られるが，腎臓癌には見られない．1961-79年の期間に，膀胱癌発生率の有意な過剰リスクが認められている．[11]

本解析では，骨癌，咽頭癌，鼻癌及び喉頭癌並びに黒色腫以外の皮膚癌と線量との関係も調べたが，いずれの癌も線量に伴う有意な増加を示さない．Darbyら[6]は，原爆被爆者（1950-78年）と強直性脊椎炎患者の比較解析を行い，両群において脳以外の中枢神経系の腫瘍の死亡率と線量との間に有意な関連性を認めたが，両群共に脳腫瘍と線量との関連性は認められなかった．寿命調査集団における良性及び良性悪性の別不明を含むすべての中枢神経系腫瘍について病理学的検討を行った結果，本解析でも同様の結論に達した．頭部白癬の治療のために頭皮に放射線を照射された子供に関するIsrael での追跡調査[12]によれば，頭皮のみに高線量が照射されたにもかかわらず，脳腫瘍及びその他の中枢神経系腫瘍の発生リスクが増加した．悪性度，組織型等を決定するため腫瘍登録に基づく中枢神経系腫瘍の発生率に関する詳細な研究を計画中である．

死亡調査のみに基づく放射線関連癌に関する推論は，死因の情報源としての死亡診断書の不正確さ並びに癌死亡報告の不完全さによってある程度不正確なものとならざるを得ない．[5] したがって，死亡診断書に基づく推定過剰癌死亡数は部位別癌の確認率及び探知率に従って補正しなければならない．BEIR III

erage correction factor of 1.23 for incompleteness. This is particularly important when analyzing rare cancers and cancer sites, where metastatic tumors are frequent, such as in the liver, lung, and brain. Our study suffers from these same shortcomings, underscoring the urgent need for parallel analysis of incidence data confined to histologically confirmed cases based on the tumor and tissue registries in Hiroshima and Nagasaki.[13] Although registry data too have their limitations, and migration from the geographic areas covered by the registries is a particularly vexing issue, the registries can further document the incompleteness and probable accuracy of death certificate statements, and provide better insight into the probable dose-response relationships for those malignancies that are not invariably fatal, e.g., thyroid and skin.

It was pointed out in a previous report[13] based on the tumor registry in Nagasaki (1959-78) that the RR associated with incident cases does not differ significantly from that based on mortality, but the excess risk per 10^4 PYGy is much higher, in general, for incident cases identified through the tumor registry than for mortality. This has important implications for the projection of risk, and needs confirmation or refutation at the earliest opportunity as the ratio changes over time. The BEIR III report used the ratio of lifetime excess risk estimates based on incident cases to that from mortality, and used 1.54 and 2.00, on average, as the values for males and females, respectively.[7]

Temporal patterns and the latent period of radiation-induced cancer

In man, cancers do not begin to appear immediately after exposure to ionizing radiation, but only after some minimum latent period (here defined as time from exposure until death). Since the A-bomb survivors were exposed to relatively large amounts of radiation almost instantly, they provide an exceptional cohort in which to investigate the temporal patterns of radiation-induced cancer, in contrast to occupational groups (exposed to radiation continuously but usually to rather small doses) or patients (exposed to diagnostic or therapeutic, often fractionated, radiation).

The temporal pattern does differ between leukemia and other solid tumors. Radiation-induced leukemia occurred 2-3 years after exposure, reached its peak within 6-8 years and has decreased with time

報告[7]では不完全性に対する平均補正率1.23が用いられた．まれな癌並びに肝臓，肺及び脳などのように転移腫瘍がしばしば発生する癌部位を解析する際には，この不完全性の問題は特に重要である．我々の研究においても同様の欠点が見られ，広島・長崎の腫瘍組織登録に基づいて，組織学的に確認された症例に限定した発生率データとの比較解析を早急に行う必要があることが強調されている．[13]腫瘍登録データにも限界はあり，登録対象地域からの転出は特に厄介な問題であるが，このデータを用いることにより，死亡診断書情報の不完全性及び正確性の詳細な記述が可能となり，また，甲状腺癌や皮膚癌のように常に致死的とは限らない悪性腫瘍の線量反応関係についてより深い観察ができるであろう．

長崎の腫瘍登録（1959-78年）に基づく以前の報告書[13]において，発生症例に基づく相対リスクは死亡率に基づく同リスクと有意に異ならないが，10^4 人年Gy当たりの過剰リスクは全体的に腫瘍登録で確認された発生症例の方が死亡率の場合よりもかなり高いことが指摘された．これはリスク予測に大きな意味をもつ問題なので，この比は時間と共に変化することから早い機会に検討を行う必要がある．BEIR第Ⅲ報では，癌発生症例に基づく推定生涯過剰リスクと死亡率に基づく同リスクの比率が用いられ，平均して男性には1.54，女性には2.00が用いられた．[7]

放射線誘発癌の経時的パターン及び潜伏期間

ヒトにおいては，癌は電離放射線被曝直後に発生するのではなく，最短の潜伏期間（ここでは被曝から死亡までの期間と定義する）を経た後にのみ発生する．原爆被爆者は，比較的大量の放射線にほとんど瞬間的に被曝したので，職業集団（放射線に継続して被曝しているが，被曝線量は通常かなり低い）又は患者（診断又は治療の目的で，しばしば放射線の分割照射を受ける）と対比すれば明らかなように放射線誘発癌の経時的パターンを調べる上で貴重な調査集団である．

経時的パターンは白血病とその他の充実性腫瘍とで異なっている．前述したように，放射線誘発白血病は被爆後2-3年目に発生し，6-8年以内にピークに

as described before.[9] The present report reveals, however, that a small statistically significant excess in leukemia mortality still exists even in the latest observational period, i.e., 1981-85, where four and one leukemia deaths were observed in Hiroshima and Nagasaki, respectively, among survivors exposed to 1.00 Gy or more. Thus, the period of occurrence of radiation-induced leukemia must be regarded as at least 35-40 years, and not the 25 years presently used by the International Commission on Radiation Protection.[14] For cancers other than leukemia, radiation-induced solid tumors, such as those of the stomach, lung, and breast, have a minimum latent period of 15 years or longer and increase proportionally to the increase in natural cancer mortality.[1,8]

Further observations on the effects of age ATB confirm earlier suggestive evidence that radiation-induced cancers increase significantly only when the survivors reach those ages at which cancers normally develop and, thus, the minimum latent period is longer for the younger age-ATB groups. More importantly, perhaps, there is still no evidence of a radiation dose-dependent shortening of the latent period except among those survivors exposed in the first 10 years of life.

It has been argued that these findings support the two-step mutational theory or the theory that two factors, an initiator and a promotor(s), are generally necessary in the occurrence of cancer. In the case of solid tumors, the first, presumably a mutational step (possibly the activation of an oncogene), is caused by radiation, and the second (and possibly other steps) occurs only when some other factor(s) acts as a promotor. Cell transformation and proliferation then occur and the cancer develops. If this is true, the time when the promotor acts to initiate the second step may be unrelated to the radiation dose, the initiator of the process, and therefore the latent period would be unrelated to dose. Cancer would develop only when the age at which it is normally prone to occur is attained.[8,15]

At least one animal experiment[16,17] has been designed to test this thesis directly. Briefly, the results of this experiment were as follows: Adult rats were irradiated with small amounts of x-ray radiation, but no cancer was induced. However, breast cancer occurred when prolactin was administered one year

達し，以後時間と共に減少した.[9] しかし，本報では，最近の観察期間である1981-85年においても白血病死亡率に若干の統計学的に有意な過剰が認められることが確認されている．すなわち，この期間中に，1 Gy 以上に被曝した被爆者に，広島，長崎でそれぞれ4件と1件の白血病による死亡が発生した．したがって，放射線誘発白血病の発生期間は少なくとも35-40年とみなすべきであり，現在国際放射線防護委員会[14]で用いられている25年ではないと思われる．白血病以外の癌の場合，胃癌，肺癌，乳癌等の放射線誘発の充実性腫瘍は15年以上の最小潜伏期間を有し，自然癌死亡率の増加と比例して増加する.[1,8]

被爆時年齢の影響を更に観察することにより，放射線誘発癌は被爆者が通常の発癌年齢に達したときに初めて有意に増加すること，また，したがって，最小潜伏期間は若年被爆群ほど長いことを示唆する以前の所見が確認された．恐らく更に重要なことは，10歳までに被爆した者以外には放射線量に依存した潜伏期間の短縮は依然として認められないということである．

これらの所見は，発癌に関する二段階突然変異説，すなわち，初発要因と促進要因という二つの要因が一般的に癌の発生に必要であるという理論を支持するものであると論じられてきた．充実性腫瘍の場合，最初の，恐らくは突然変異の段階（発癌遺伝子の活性化と思われる）が放射線によって生じ，第二の段階（そして恐らくその他の段階）は何らかの他の要因が促進要因として働いたときにのみ生じる．次に細胞の悪性転換と増殖が起こり，癌が発生する．この仮説が正しいとすれば，促進要因が働いて第二段階が開始する時期は癌化過程の初発要因である放射線量とは無関係であり，したがって，潜伏期間は線量とは無関係であり，放射線誘発癌は，その部位の癌が通常発生しやすい年齢（癌年齢）に達して初めて発生すると思われる.[8,15]

この仮説を直接に検証する目的で，少なくとも一つの動物実験[16,17]が行われた．簡単に述べると，この実験の結果は次のとおりである：成熟ラットに低線量のX線を照射したが，癌は誘発されなかった．しかし，このX線照射の1年後にプロラクチンを投与する

after irradiation, though no cancer was induced with that level of prolactin alone. These results indicate that x rays act as the initiator and prolactin as the promotor in the induction of breast cancer in the rat. Similar results were also obtained for rats irradiated by neutrons. These experimental findings are generally supported by the present analysis.

RR by attained age (age ATD) for specific age-ATB cohorts does not change with attained age, in general, whereas the AR increases. Thus, the present analysis still favors the RR model over the AR model.

Muirhead and Darby[18] have recently suggested a method to distinguish RR and AR models for radiation-induced cancer. They applied their method to mortality for all cancers except leukemia using the data of the LSS for the years 1950-78, and have shown that, with consideration of age ATB, sex, and time since exposure, the RR model fits the data significantly better than the AR model after adjusting for age ATB and sex. Though we did not apply the specific model that they used, we have examined the effects of age ATB, sex, and attained age (instead of time since exposure) on the fit of the RR and AR models separately using the deviance as a measure (Table 8). We reach the same conclusions as Muirhead and Darby, namely, the RR model fits significantly better than the AR model after adjusting for age ATB and sex.

If age ATB is fixed, an analysis of the temporal change in risk coefficients based on age ATD and one based on time (year) since exposure should yield similar results. However, it should be noted that, since age ATB is classified in 10-year intervals, whereas time since exposure is given in 5-year periods, the age ATD distribution overlaps two successive time-since-exposure periods. Thus, observations based on time since exposure are not identical to those on age ATD, when age ATB is fixed. The results of an analysis similar to Table 8, using time since exposure (instead of attained age), yielded similar results, as expected (data are not shown).

Muirhead and Darby also indicated that, when time since exposure is included among the adjusted variables (i.e., in addition to age ATB and sex), the RR and AR models fit the data equally well, and, as Table 8 shows, the same was obtained in

と乳癌が発生した．ただし，同レベルのプロラクチンの投与のみでは癌は誘発されなかった．これらの結果は，ラットにおける乳癌の誘発において，X線は初発要因として，また，プロラクチンは促進要因として働くことを示唆している．中性子を照射したラットについても同様の結果が得られた．全体的にみて，これらの実験的所見は本解析でも支持されている．

特定の被爆時年齢別コホートにおける年齢（死亡時年齢）別の相対リスクは全般的に死亡時年齢に伴って変化することはないが，絶対リスクは死亡時年齢に伴い増加する．したがって，本解析の結果は，依然として，絶対リスクモデルより相対リスクモデルを支持する．

Muirhead 及び Darby[18] は，放射線誘発癌に対する相対リスクモデルと絶対リスクモデルとを区別する方法を最近提案した．彼らは1950-78年の寿命調査データを用いて白血病以外の全部位の癌の死亡率にこの方法を適用した．その結果，被爆時年齢，性及び被爆後経過年数を考慮すると，被爆時年齢及び性を補正した場合，相対リスクモデルは絶対リスクモデルよりも極めて良くデータに適合することが分かった．我々は彼らが用いたモデルを使用しなかったが，被爆時年齢，性及び死亡時年齢（被爆後経過年数ではない）が相対リスクモデルと絶対リスクモデルの適合度に及ぼす影響を，それぞれ別々に，deviance を尺度として用いて調べた（表８）．我々は Muirhead 及び Darby と同じ結論に達した．すなわち，被爆時年齢及び性を補正すると，相対リスクモデルの適合度は絶対リスクモデルよりも極めて良くなる．

被爆時年齢を固定すると，死亡時年齢に基づくリスク係数の経時的変化と被爆後経過時間（年）に基づくリスク係数の経時的変化の解析は同様の結果を示すはずである．しかし，被爆後経過時間は５年間隔に分けられているのに対して，被爆時年齢は10年間隔に分けられているので，死亡時年齢分布は二つの連続した被爆後経過時間区分と重なることに注意すべきである．したがって，被爆時年齢を固定すると，被爆後経過時間に関する所見は，死亡時年齢に関する所見と同一とはならない．被爆後経過時間（死亡時年齢ではない）を用いた表８と同様の解析も，予想通り類似した結果を示した（データは示していない）．

Muirhead 及び Darby はまた，被爆後経過時間を補正変数に含めると（すなわち，被爆時年齢と性に加えると），相対リスクモデルと絶対リスクモデルは等しく良くデータに適合することを示唆した．表８から分かるように，我々の解析でも同じ結果が得られた

our analysis (see row labeled A + S + E). Since by definition the effect of time since exposure (or attained age) is constant in terms of RR for the RR model or AR (excess deaths) for the AR model, there is no a priori reason to expect an effect of time since exposure (or attained age) under either model.

As a result of the accumulation of further cancer deaths among survivors who were young ATB, particularly under 10 years of age, it is now possible to examine the effect of age ATB on the latent period more thoroughly. Analysis of these deaths reveals the latent period for all cancers except leukemia to be dose-dependent; it is shorter among the young who were exposed to higher doses. The RR at 1 Gy is smaller with time (at the attained age from under 20 to 39) and levels off at the attained age 40-49 (Table 6). The very high RR in the early period (which results from shortening of the latent period) for the age 0-9 ATB survivors may reflect a higher sensitivity to radiation among the younger group ATB or the existence of persons who are highly sensitive to radiation in the population.[8,19]

Although it cannot be predicted with certainty at the present time, it is conceivable that after an attained age of 50, the RR will continue to be the same as that now seen for age 40-49, as the RR model suggests.

The current analysis of cancer incidence among prenatally exposed survivors also shows a dose-dependent shortening of the latent period, as well as a significant increase in cancer risk.[20] These findings are consistent with the results obtained for the survivors of age 0-9 years ATB, and thus, the two independent observations, although both are based on small numbers of cancer cases, strengthen one another. The estimated risk coefficients among the in utero exposed survivors based on cancer incidence in the period 1950-84 are the same or slightly higher than the risks among survivors exposed under 10 years of age ATB.[20] In view of this, once sufficient deaths have occurred, it will be very interesting to reexamine the risks within the age 0-4 ATB and age 5-9 ATB groups, since the risk in the former can be anticipated to be higher than that in the latter.

The frequency of death from radiation-induced solid cancers did not reach a level of statistical signif-

（A＋S＋Eの列を参照）．定義上，被爆後経過時間（又は死亡時年齢）の影響は，相対リスクモデルでの相対リスク又は絶対リスクモデルでの絶対リスク（過剰死亡）に対して一定であるので，いずれのモデルにおいても被爆後経過時間（又は死亡時年齢）の影響があると予想すべき理由はない．

若年被爆者，特に被爆時10歳未満であった被爆者に癌死亡が多く見られるようになったことから，現在，潜伏期間に対する被爆時年齢の影響をより詳細に調べることが可能である．これらの死亡例を解析すると，白血病以外の全部位の癌の潜伏期間は線量に依存していることがわかる．潜伏期間は若年で高線量に被曝した者においては短い．1 Gy における相対リスクは時間と共に減少し（死亡時年齢が20歳未満から39歳まで），死亡時年齢40－49歳で横ばいになる（表6）．被爆時年齢0－9歳の被爆者において初期に極めて高い相対リスクが認められたこと（潜伏期間の短縮に起因する）は，若年被爆者の放射線感受性が高かったこと，又は，この集団に放射線感受性の高い者が含まれていたことを反映すると考えられる．[8,19]

現時点で正確に予測することはできないが，死亡時年齢が50歳以上になると，相対リスクモデルが示唆するように，相対リスクは40－49歳に見られるものと同じレベルを維持すると予想される．

胎内被爆者の癌死亡率に関して最近行われた解析も，潜伏期間の線量依存性の短縮並びに癌リスクの有意な増加を示している．[20] これらの所見は被爆時0－9歳の被爆者について得られたものと一致している．したがって，これら二つの別個の観察結果は，いずれも少数の癌症例に基づくものであるが，互いに補強し合っている．1950－84年の期間における癌死亡率に基づく胎内被爆者の推定リスク係数は被爆時年齢10歳未満の被爆者のリスクと同じかそれより若干高い．[20] このような傾向を考えると，死亡例が十分蓄積された段階で被爆時年齢0－4歳群と5－9歳群におけるリスクを再検討することは極めて興味深いことである．なぜなら，0－4歳群のリスクは5－9歳群のリスクより高くなると予想されるからである．

放射線誘発性充実性癌による死亡の頻度は1960年

TABLE 17 FIRST APPEARANCE OF A SIGNIFICANT INCREASE IN MORTALITY ATTRIBUTABLE TO SPECIFIC CANCERS

表17 特定の癌による死亡率の有意な増加が最初に現われる時期

		1950-55	1956-60	1961-65	1966-70	1971-75	1976-80	1981-85	Total
All cancers except leukemia	Risk coefficient	a +	+	a +	a +	a +	a +	a +	a +
	No. of deaths	532	637	773	843	925	987	1037	5734
Stomach	"	+	+	a +	+	+	a +	a +	a +
	"	218	281	297	322	330	303	256	2007
Colon	"	-	-	+	+	+	a +	a +	a +
	"	12	9	21	36	41	47	66	232
Lung	"	-	+	+	b +	a +	a +	+	a +
	"	16	28	69	114	115	150	146	638
Female breast	"	-	+	+	a +	-	a +	a +	a +
	"	15	16	28	22	21	26	27	155
Ovary	"	+	-	-	+	b +	b +	-	a +
	"	6	7	12	13	11	17	16	82
Urinary tract	"	-	-	-	a +	-	a +	a +	a +
	"	8	11	25	17	28	19	25	133
Multiple myeloma	"	+	b +	-	-	+	b +	b +	a +
	"	1	2	2	2	6	7	16	36

\+ Regression coefficient is positive. 回帰係数は正
\- Regression coefficient is negative. 回帰係数は負

a Significant at the 5% level 5%水準で有意 ..... $p<.05$
b Suggestive 示唆的 ..... $.05<p<.10$

icance until after 1960; thus, the minimum latent period appears to be 15 years or longer and may vary by site of cancer. It is difficult, however, to precisely determine the time when radiation-induced cancer becomes significant, and thus the minimum latent period. To investigate further the relationship of the minimum latent period by site of cancer, the sign (plus or minus) and the statistical significance of the regression coefficient with dose have been tabulated for seven successive 5-year periods of observation (Table 17).

These data suggest that the minimum latent period is 15-19 years (1961-65) for stomach cancer, 20-24 years (1966-70) for cancer of the lung and breast, 25-29 years (1971-75) for cancer of the ovary, and 30-34 years (1976-80) for cancers of the colon and urinary tract and multiple myeloma. The cancer age (the age at which a significant increase in natural cancer mortality occurs) is around the fifth decade for cancer of the stomach, breast, and ovary and is earlier than that for other sites of cancer, such as the lung, colon, urinary tract, and multiple myeloma which is around the sixth or seventh decade in Japan. Thus, the length of the minimum latent period for each cancer site appears to reflect the beginning of the cancer susceptible age for the individual sites of cancer.

Modifying factors

Previous studies have indicated that the frequency of occurrence of radiation-induced cancer is modified by age at exposure, attained age,[1,8] and sex.[1] The present report confirms that both the RR and AR are higher for younger age-ATB groups, when the attained age is fixed or when the age-ATB groups are adjusted for attained age. For survivors exposed in childhood (0-9 ATB), the latent period for solid tumors is shortened. Other studies also indicate that the risk is higher for individuals exposed at younger ages, though there is no indication of a shortening of the latent period for solid cancers for those individuals exposed in childhood.[12]

As has been reported earlier,[1] and is confirmed by the present study, the RR of lung cancer is higher for females than for males. Since the ARs do not differ between the sexes, the lower RR for males is probably a reflection of their higher background lung cancer mortality rate.

The present analysis discloses the difference in RR of lung cancer by sex to be smaller and no

以降までは統計学的有意性に達しなかった．したがって，最小潜伏期間は15年以上であり，癌部位によって異なると思われる．しかし，放射線誘発癌が顕著になる時期，つまり，最小潜伏期間を決定することは困難である．癌部位別の最短潜伏期間の関係を更に調べるために，線量に伴う回帰係数の符号（正又は負）及び統計学的有意性を七つの連続した5年間隔の観察期間について集計した（表17）．

これらのデータによれば，最小潜伏期間は，胃癌で15-19年（1961-65年），肺癌及び乳癌で20-24年（1966-70年），卵巣癌で25-29年（1971-75年），結腸癌，泌尿器癌及び多発性骨髄腫で30-34年（1976-80年）である．日本人の胃癌，乳癌及び卵巣癌の癌年齢（自然癌死亡率が有意に増加する年齢）は40歳代であり，肺癌，結腸癌，泌尿器癌及び多発性骨髄腫などその他の部位の癌の50歳代又は60歳代より早い．この様に，各部位の癌の最小潜伏期間の長さは各部位の癌の罹患年齢の開始時期を反映していると考えられる．

修飾要因

以前行われた研究は，放射線誘発癌の発生頻度が被爆時年齢，死亡時年齢[1,8]及び性[1]によって修正されることを示唆している．今回の研究成績では，死亡時年齢を固定するか被爆時年齢群を死亡時年齢について補正した場合，若年被爆群の相対リスク及び絶対リスクが高年齢被爆群のそれよりも高くなることが確認された．小児期（0-9歳）に被爆した者においては，充実性腫瘍の潜伏期間は短くなる．他の研究でも若年で被曝した者のリスクは高いことが示唆されているが，小児期に被曝した者における充実性腫瘍の潜伏期間の短縮は認められていない．[12]

以前に報告し，[1] 今回の研究で確認されたように，肺癌の相対リスクは男性よりも女性の方が高い．絶対リスクに男女差はないので，男性において相対リスクが低いのは，恐らく，自然肺癌死亡率が高いことを反映するものであろう．

今回の解析では，喫煙習慣の差を考慮すると肺癌の

longer statistically significant when differences in smoking habits are considered.[10] Similar results were obtained in a study of lung cancer incidence in the years 1950-81 on the same cohort.[21] The slightly higher, though not statistically significant, RR for females seen after adjusting for smoking, may be attributable to their lower serum vitamin levels,[22] and greater occupational exposures to carcinogens other than smoking, e.g., asbestos or chemicals. If these other exposures could be adequately measured, the slight difference observed in radiation-related RR between males and females might well disappear.

No evidence of an interaction between radiation and smoking in the induction of lung cancer emerges from the present study. Similar results have been previously obtained in cohort[21,23] and case-control[24] studies based on the same A-bomb survivors. Other studies, notably those on uranium and hard rock miners, however, vary; some indicate a possible interaction[25] and some suggest none.[26]

Dose response

From the standpoint of radiation protection, dose-response curves for low-LET radiation in the low-dose range are particularly important. Under the T65 dose system, more attention has been paid to dose-response curves in Nagasaki than in Hiroshima, which had a larger neutron component, in the study of low-LET radiation effects. The dose-response curve for leukemia in Nagasaki, though the number of cases was smaller, was nonlinear at less than 1 Gy. Rossi et al stated that the response curve of radiation-induced cancer should be nonlinear (quadratic) in the case of low-LET radiation at the low-dose level, based upon the dose response of chromosomal aberrations, whereas Radford supported the L model on the basis of the actual data.[7] In the final BEIR III report, the LQ model was used as the basic model for the calculation of risk coefficients, though results based on L and Q models were also indicated.

Under the DS86 dose system, the neutron component is substantially reduced, and the major component of the total dose is accounted for by gamma rays even in Hiroshima. This made it convenient to study the effect of low-LET radiation in both Hiroshima and Nagasaki. In Nagasaki since the gamma component is also reduced, though the dose-response curve for leukemia is closer to

相対リスクの性差は小さくなり，もはや統計学的に有意ではなくなることが示された.[10] 同じ調査集団について1950-81年の肺癌発生率の研究においても同様の結果が得られている.[21] 喫煙について補正を行った後でも女性の相対リスクが統計学的に有意ではないにしても若干高いのは，男性の血清ビタミン値が低いこと,[22] また，アスベスト又は化学薬品等喫煙以外の発癌物質への職業被曝の頻度が高いこと等によるものと考えられる．これらのその他の被曝について適切な補正が行われれば，放射線についての相対リスクの男女間に見られる若干の差異は消失するであろう．

肺癌誘発における放射線と喫煙との間に相互作用がある証拠は今回の研究からは得られなかった．同じ被爆者に基づいて以前に行われたコホート研究[21,23] 及び症例対照研究[24] においても同様の結果が得られている．その他の研究，特にウラン鉱夫及び硬岩鉱夫に関する研究の結果は多様であり，相互作用を示唆するもの[25] も，示唆しないもの[26] もある．

線量反応

放射線防護の立場から見ると，低線量範囲における低 LET 放射線の線量反応曲線は特に重要である．T65 線量方式に基づく低 LET 放射線の影響に関する研究では，中性子線量の大きい広島よりも長崎の線量反応曲線により大きな注意が払われてきた．症例数は少ないが，長崎における白血病の線量反応曲線は 1 Gy 未満では非線形であった．Rossi らは，染色体異常の線量反応に基づいて，放射線誘発癌の反応曲線は低線量の低 LET 放射線の場合には非線形（二次）であると述べたが，Radford は実際のデータに基づいてLモデルを支持した.[7] 最終的な BEIR 第Ⅲ報においては，リスク係数算出用の基本モデルとしてLQモデルが使用されたが，Lモデル及びQモデルに基づく推定値も併記されている．

DS86 線量推定方式では，中性子線量は大幅に減少し，広島においてもガンマ線が総線量の主要成分となっている．これにより，広島・長崎両市の低 LET 放射線の影響に関する研究が容易になった．長崎ではガンマ線量も減少しているので，白血病の線量反応曲線は線形に近くなるが，低線量では若干の非線形性は残存している．広島と長崎を

linear, though some nonlinearity still remains in the low-dose range. In view of the finding that the dose-response curve for leukemia for Hiroshima and Nagasaki combined fits the LQ-K model better than the L model and the risk coefficients at less than 0.50 Gy are smaller than those at 0.50 Gy or more, the LQ model in the low-dose range cannot be excluded. Although we still cannot distinguish categorically between curves for most sites of cancer mortality, it appears that the L model is an acceptable basis for estimating the risk of cancer mortality following exposure to low-LET, high-dose-rate radiation except leukemia.

The difference between the cities in radiation-related cancer mortality is less and statistically not significant when the DS86 doses are compared with the T65DR doses. At the same dose level, T65DR estimates indicated that the cancer mortality is higher for Hiroshima than for Nagasaki.

In the present analysis, we have indicated the lowest dose range at which statistically significantly excess cancer mortality can be seen (as contrasted with the 0-Gy group). Needless to say, since the statistical significance of a difference between two comparison groups depends on their sample sizes and the frequency of cancer mortality, the dose ranges indicated should change with the accumulation of further data and may differ from that derived from other exposure groups.

Lifetime risks

Although we have thus emphasized RRs and annual ARs of cancer mortality based on the new dosimetry, great interest also centers on the lifetime risk of mortality from radiogenic cancer. Our purposes in the paragraphs to follow are merely to provide some approximate notion of the implications of the changes in surveillance time, risk coefficients, and the like, and not to undertake a critical analysis of projection methods themselves or to advocate a particular approach. Accordingly, largely because the method is well described, we have followed the one employed in BEIR III, introducing the risk coefficients obtained in the present report, and confining our estimates to the lifetime risk of leukemia and cancers other than leukemia in the stationary population represented in the 16th Japanese Life Table (1985), and assuming an exposure to a single dose of 0.1 Sv of low-LET radiation. The parameters and sources of information used to

合わせた場合の白血病の線量反応曲線がLモデルよりもLQ-Kモデルの方に良く適合すること，並びに，0.5 Gy 未満でのリスク係数は 0.5 Gy 以上でのリスクより小さいことを考慮すれば，低線量範囲でのLQモデルも除外できない．ほとんどの部位の癌死亡率曲線を明確に鑑別することは依然としてできないが，低LETで高線量率の放射線に被曝した場合の白血病以外の癌死亡リスクを推定する際にはLモデルが適当であると思われる．

DS86 線量においては，T65DR 線量と比較すると，放射線関連癌死亡率の都市間の差は少なくなっており，統計学的に有意ではない．T65DR による癌死亡率は同じ線量レベルにおいては，長崎よりも広島の方が高い．

本解析において（0 Gy 群と対比させて）統計学的に有意な過剰癌死亡率を認め得る最低の線量範囲を示した．言うまでもなく，二つの比較群の差の統計学的有意性は集団の大きさ及び癌死亡頻度に依存するので，示唆した線量範囲はデータの蓄積と共に変化し，また，他の被曝集団に由来するデータとは異なるものと考えられる．

生涯リスク

ここまでは新線量推定方式に基づく癌死亡の相対リスク及び年間絶対リスクの推定に主眼をおいて述べてきたが，放射線誘発癌死亡の生涯リスクについても高い関心がある．以下に，観察期間，リスク係数などの変化の生涯リスクの推定に及ぼす影響を大まかに述べるにとどめ，予測方法についての批評的解析を試みたり，特定の方法を提案したりすることはしない．すなわち，既に明瞭に説明されているBEIR Ⅲ で用いられた方法に従って，本解析で得られたリスク係数を用い，日本人の生命表第16版（1985年）に示されている定常人口における白血病及び白血病以外の癌の生涯リスクに限って推定を行った．この際，0.1 Sv の低LET放射線に1回被曝したものと仮定した．推定値を得るために用いたパラメータ

obtain the estimates are as follows (for comparison, the corresponding parameters used in BEIR III are also shown):

と情報源は次のとおりである（比較のためBEIR Ⅲで用いられた値も同時に示した）.

PARAMETERS AND SOURCES OF INFORMATION TO ESTIMATE THE LIFETIME RISK
生涯リスク推定のためのパラメーター及び情報源

		Projection Model	Population	Cancer Death Rate	Radiation Dose	Minimum Latent Period/yr	Duration of Effect	Magnitude of Effect (excess death)
Leukemia	Present	Absolute risk model	1985 Japan life table	1985 Japan cancer death rate	DS86 bone marrow dose	2	3-41	Based on 1950-85 LSS data (RBE=10)
	BEIR III	Absolute risk model	1969-71 US life table	1969-71 US cancer death rate	T65D bone marrow dose	2	3-27	Based on 1950-71 LSS data (RBE=11.3 for L model)
All cancers except leukemia	Present	Relative risk model	1985 Japan life table	1985 Japan cancer death rate	DS86 colon dose	10	11-end of life	Based on 1956-85 LSS data (RBE=10)
	BEIR III	Relative risk model	1969-71 US life table	1969-71 US cancer death rate	T65D Lung dose	10	11-end of life	Based on 1955-74 LSS data (RBE=11.3 for L model)

The age- and sex-specific risk coefficients we use are, of course, based on death certificates, and to adjust for incompleteness of the diagnosis on death certificates the values were multiplied by 1.23 as was done in the BEIR III report.[7] We have employed the AR projection model for leukemia and the RR model for all cancers except leukemia.

我々が用いる年齢別及び男女別リスク係数は当然死亡診断書に基づくものであるので，同診断書の診断の不完全性を補正するために，BEIR 第Ⅲ報[7]と同様にリスク係数に1.23を乗じた．白血病については絶対リスクモデルを白血病以外の全部位の癌については相対リスクモデルを用いた．

As stated in the earlier section on the shape of the dose-response curve, insofar as leukemia is concerned the LQ model fits better than the L model if individuals in the high-dose range are excluded (i.e., when the analysis is confined to survivors receiving bone marrow doses of less than 2-3 Gy); however the L and LQ models fit the data from the entire dose range equally well. For all cancers except leukemia, although the L model fits well for both the total dose range and the dose range excluding the high doses, the LQ model cannot be shown to be inappropriate statistically. It should be noticed that Q term in the LQ model is negative when the entire dose range is used, reflecting the level off of the dose-response curve at the higher dose range. In order to obtain useful risk estimates in the low-dose range with the LQ model, we have estiamted the risk limiting doses to under 2 Gy, so

線量反応曲線の型の項で既に述べたように，白血病では高線量域で被爆した人々を除外した場合（つまり2-3 Gy未満の骨髄線量を受けた被爆者に限定して解析した場合）はLQモデルがLモデルよりも良く適合しているが，全線量域ではLモデルとLQモデルは共に良く適合している．白血病以外の全癌ではLモデルは全線量域及び高線量域を除いた場合のいずれにも良く適合しているが，統計的にLQモデルが適応しないとすることはできない．この際全線量域では高線量域での線量反応曲線が水平に近くなることを反映して，LQモデルのQ項の符号が負になることに注意しなければならない．我々は低線量域で，LQモデルによる意義のあるリスク推定を行うためにQ項の符号が正になるように2 Gy以下に限定して行った．以上に

as to obtain a positive Q term. Considering the argument described above, we have calcualted the lifetime risk estiamtes using both the L and the LQ model (the Q model was excluded for the LQ model fits better in every instance). This has been done using all doses, and only those doses under 2 Gy. Though the risk coefficients so far used in this report are all based on the RR model, the risk coefficient based on the AR model is used here to be consistent with the method used in BEIR III report.[7] The risk coefficients are shown in Table 18.

Though, the detailed results will be described in a separate report,[27] the estimated lifetime risks by sex are shown in Table 19. For comparison, the corresponding values in the BEIR III report[7] are also given. The lifetime risk of leukemia or of all cancers except leukemia, based on a linear dose-response model and using the total dose range, is close to the value obtained when the doses are restricted to under 2 Gy, and around two times higher than the BEIR III value. Under the LQ model, when the doses are restricted to less than 2 Gy, the estimated lifetime risk for leukemia is only 70% of the value obtained using the L model (831/1193, 609/865 for male and female, respectively). For all cancers except leukemia, the LQ estimates are slightly smaller, but almost equal to the estimates based on the L model. Whereas, in BEIR III, the LQ estimates are as much as 50% smaller than the L estimates for both leukemia and all cancers except leukemia. This greater difference between the estimates in BEIR III, which were based on the T65 dosimetry, as compared with the present ones, is undoubtedly ascribable to the lesser degree of nonlinearity in the dose-response curve in the low-dose range when the DS86 doses are used. As a further reflection of this, the ratio of the present estimates to those of BEIR III under the LQ model is much larger (i.e., 3 times higher for leukemia and 5-6 times higher for all cancers except leukemia under 2 Gy) than the ratio of the two sets of estimates under the L model. For all cancers except leukemia, the ratio of the estimated value under the LQ model between the present study and BEIR III shows a particularly large value under 2 Gy. This may be ascribed to the fact that in BEIR III, the curvature in dose response for leukemia was used for all cancers except leukemia instead of the actual curvature which probably is much closer to linearity, and this may cause much smaller estimates to be produced than if the actual dose-response curve were to be applied.

記述した議論を考慮して，我々は生涯リスクの推定を，Lモデル及びLQモデルを用いて行い（Qモデルはいずれの場合にもLQモデルよりも適合が悪いので除外した），いずれのモデルの場合も，全線量域と2Gy以下の線量域に限定した場合の2通りについて行った．本報告でのリスク係数はすべて相対リスクモデルに基づいて行われているが，ここではBEIR Ⅲ報告[7]と同様に絶対リスクモデルに基づいてリスク係数を算出した．表18にそのリスク係数を示す．

詳細は別報[27]に記載されるが，性別の生涯リスクの推定値を表19に示した．また比較のためBEIR Ⅲ報告書[7]の対応する値も示した．線形線量反応モデルを使用した場合，白血病も白血病を除く全部位の癌も全線量域を用いた生涯リスク推定値は2Gy以下の線量域を用いた場合と近似した値を示しており，共にBEIR Ⅲの値の約2倍である．2Gy以下の線量域にLQモデルを使用した場合，白血病の生涯リスク推定値はLモデルを使用した場合の70%に減少している（男性831/1193，女性609/865）．白血病を除く全部位の癌ではLQの推定値はLモデルを用いた場合よりもやや小さいが，ほとんど近似した値を示している．一方，BEIR Ⅲでは，白血病，白血病以外の全部位の癌ともに，LQモデルの推定値はLモデルでの値の50%に減少している．T65線量に基づいているBEIR ⅢのLQとLの推定値の差が本報告に比べて著しいのは，DS86線量では低線量域での線量反応曲線の非線形性がより小さい事実に由来している．この差違を反映して，LQモデルを使用した場合，Lモデルの場合と比較して本報の推定値とBEIR Ⅲの推定値の比は非常に大きく（たとえば，2Gy以下の線量域では白血病で3倍，白血病を除く全部位の癌で5-6倍）なっている．2Gy以下の線量域では，白血病以外の全部位の癌でBEIR Ⅲの値との比が特に大きい値を示している．これは，BEIR Ⅲでは，白血病以外の全部位の癌のLQモデルに基づく推定値は，白血病の線量反応曲線から推定されているためである．実際の線量反応曲線は，白血病よりも直線に近いと思われる．したがって，白血病以外の全部位の癌のLQモデルに基づく推定値は，実際にLQモデルを適合させて求めた場合の値よりも小さくなっているためと考えられる．

Under 2 Gy for leukemia, the ratio of the L term in the LQ model (which can be regarded as a measure of the risk at low doses) to the linear coefficient under the L model is 1/1.99; whereas the ratio is 1/2.26 in BEIR III (from Table V-8). The corresponding ratios for all cancers except leukemia are 1/1.15 and 1/2.48 for the present estimates and BEIR III (Table V-11), respectively.

白血病の場合2 Gy以下の線量域ではLQモデルのL項（低線量域でのリスクを表わす指標とみなし得る）とLモデルの線形係数の比は1/1.99であるが，BEIR Ⅲ（表V-8）では1/2.26である．白血病を除く全部位の癌では，対応する値は，本報の推定で1/1.15，BEIR Ⅲ（表V-11）で1/2.48である．

TABLE 18 ESTIMATED AGE- AND SEX-SPECIFIC REGRESSION COEFFICIENT
RBE=10, DOSE RANGE 0-6 Gy

表18 回帰係数推定値，年齢及び性別，RBE＝10，線量域0-6 Gy

Model[c]	Coefficient for D, D^2	Sex	Age at exposure 0-9	10-19	20-29	30-39	40-49	50+
			Leukemia[a]					
L	D	M	4.81	2.06	4.54	4.90	4.10	8.25
		F	2.94	1.26	2.78	3.00	2.51	5.05
LQ	D	M	4.69	1.99	4.41	4.77	4.00	8.04
		F	2.88	1.22	2.70	2.93	2.45	4.94
	D^2	M	0.000687	0.000292	0.000646	0.000699	0.000585	0.00118
		F	0.000422	0.000179	0.000396	0.000429	0.000359	0.000723
			All cancers except leukemia[b]					
L	D	M	3.68	6.96	13.1	13.6	18.1	9.49
		F	5.08	9.59	18.0	18.7	25.0	13.1
LQ	D	M	4.75	9.48	18.8	17.9	25.3	13.5
		F	5.75	11.5	22.7	21.7	30.7	16.4
	D^2	M	-0.00478	0.00954	-0.0189	-0.0181	-0.0255	-0.0136
		F	-0.00579	-0.0116	-0.0229	-0.0219	-0.0309	-0.0165

a Based on Hiroshima and Nagasaki LSS data, 1950-85
1950-85年の広島・長崎寿命調査データに基づく

b Based on Hiroshima and Nagasaki LSS data, 1956-85
1956-85年の広島・長崎寿命調査データに基づく

c L: Excess risk $= \alpha_1 D$
LQ: Excess risk $= \alpha_1 D + \alpha_2 D^2$
D is in gray. Dは Gy による
Coefficients for D and D^2 are per 10^4 person per year
D及び D^2 の係数は10^4人年当たり

The lifetime risk for exposures in the low-dose range, estimated by multiplying these ratios and the lifetime risk based on the L model, for males (females), are 599 (435) and 11,187 (9,643) for leukemia and all cancers except leukemia, respectively. These value are a little smaller than those obtained with the LQ model in the present study.

これらの比をLモデルに基づく生涯リスク推定値に乗じて，低線量域での生涯リスク推定値を求めると白血病で男性（女性）で599（435），白血病を除く全部位の癌で11,187（9,643）となる．これらの推定値は本研究におけるLQモデルでの推定値よりも若干小さい．

TABLE 19 LIFETIME EXCESS DEATH FROM LEUKEMIA AND ALL CANCERS EXCEPT LEUKEMIA PER MILLION PERSONS FOLLOWING A SINGLE EXPOSURE TO 0.1 Sv

表19 0.1 Sv に1回被曝した場合の100万人当たりの，白血病及び白血病以外の全部位の癌による生涯過剰死亡

	Dose range (Gy)	L		LQ	
		M	F	M	F
Leukemia					
A: Present	0-6	1326	844	1293	825
Study	0-2	1193	865	831	609
B: BEIR III		566	384	274	186
A/B	0-6	2.3	2.2	4.7	4.4
	0-2	2.1	2.3	3.0	3.3
All cancers except leukemia					
A: Present	0-6	8782	10756	11924*	12881*
Study	0-2	12865	11090	11521	10096
B: BEIR III		4226	4852	1917	2133
A/B	0-6	2.1	2.2	6.2	6.0
	0-2	3.0	2.3	6.0	4.7

* Coefficient for quadratic term is negative.
二次項の係数は負

Preston and Pierce[4] have also estimated the lifetime risk using the same material with different assumptions and methods. It should be noted that Preston and Pierce give larger estiamte in their RERF Technical Report than in their paper published in the *Radiation Research*. They arrived at their number by simply multiplying the risk coefficient by 20%, which is the background lifetime risk for all cancers except leukemia in the LSS sample. The general population they used was assumed to have equal numbers in each of the six age and sex categories. Since this population includes a larger proportion of younger exposed persons, it should lead to a higher lifetime risk than the present analysis based on the stationary population used in the 1985 Japanese Life Table. Their revised ones are much closer to the present estimates.

Inferences drawn from a comparison of these values with others must be extremely guarded, for differences may not be attributable solely to the change

Preston と Pierce[4] は同じ資料は用いたが，異なった仮定，及び推定方法を用いて推定している．しかし彼らは放影研の業績報告書では Radiation Research に掲載された論文の推定値よりも大きな値を示している．彼らの数値は寿命調査集団における白血病を除く全部位の癌の自然生涯リスクすなわち2%にリスク係数を乗じて得たものである．彼らが用いた一般集団の年齢及び性の六つの区分はそれぞれ同数から成るものと仮定されている．この集団には若年被爆者らが多く含まれているので，1985年の日本人の生命表で用いられた定常人口に基づく本解析の推定値よりも高い生涯リスクが得られるはずである．彼らの改定された推定値は本解析での推定値により近い値となっている．

これらの推定値の比較から得られた推論の解釈には厳重な注意が必要である．推定値の差異がすべて線量の変更に由来するものではないからである．その差異は，推計に用いたモデルや，推計の対象人口の

in dosimetry. They reflect other differences as well, such as the projection model and population used, and the changes in risk coefficients with further surveillance. Our data, for example, include deaths to 1985, and some change in the risk coefficients is due to the extension of the follow-up period. The increasing trend in excess death in the 10-49 age ATB group is illustrative of this.

違いや，調査期間が更に長くなったことによるリスク係数の大きさの変更などにも同様に由来している．例えば，我々のデータは1985年までの死亡を含み，リスク係数の幾らかの変更は追跡期間の延長によるものである．後者の例として被爆時年齢10-49歳の被爆者に，過剰死亡数が時と共に増大する傾向が見られることがあげられる．

REFERENCES
参考文献

1. PRESTON DL, KATO H, KOPECKY KJ, FUJITA S: Studies of the mortality of A-bomb survivors. Report 8. Cancer mortality, 1950-82. Radiat Res 111:151-78, 1987 (RERF TR 1-86)

2. SHIMIZU Y, KATO H, SCHULL WJ, PRESTON DL, FUJITA S, PIERCE DA: Life Span Study Report 11. Part 1. Comparison of risk coefficients for site-specific cancer mortality based on the DS86 and T65DR shield kerma and organ dose. RERF TR 12-87

3. MILTON RC, SHOHOJI T: Tentative 1965 radiation dose estimation for atomic bomb survivors, Hiroshima and Nagasaki. ABCC TR 1-68

4. PRESTON DL, PIERCE DA: The effect of changes in dosimetry on cancer mortality risk estimates in the atomic bomb survivors. Radiat Res 114:437-66, 1988 (RERF TR 9-87)

5. YAMAMOTO T, MORIYAMA IM, ASANO M, GURALNICK L: RERF pathology studies. Report 4. Autopsy program and the Life Span Study, Hiroshima and Nagasaki, January 1961 - December 1975. RERF TR 18-78

6. DARBY SC, NAKASHIMA E, KATO H: A parallel analysis of cancer mortality among atomic bomb survivors and patients with ankylosing spondylitis given X-ray therapy. JNCI 75:1-21, 1985 (RERF TR 4-84)

7. NATIONAL ACADEMY OF SCIENCES - NATIONAL RESEARCH COUNCIL: The effects on populations of exposure to low levels of ionizing radiation. Report of the Advisory Committee on the Biological Effects of Ionizing Radiations (BEIR-III). Washington, DC, NAS-NRC, 1980

8. KATO H, SCHULL WJ: Studies of the mortality of A-bomb survivors. 7. Mortality, 1950-78: Part 1. Cancer mortality. Radiat Res 90:395-432, 1982 (RERF TR 12-80)

9. ICHIMARU M, ISHIMARU T, BELSKY JL: Incidence of leukemia in atomic bomb survivors belonging to a fixed cohort in Hiroshima and Nagasaki, 1950-71: Radiation dose, years after exposure, age at exposure, and type of leukemia. J Radiat Res 19:262-82, 1978 (RERF TR 10-76)

10. SHIMIZU Y: Relationship between radiation and smoking on radiation induced lung cancer deaths among the Life Span Study cohort, 1950-85. In preparation

11. SANEFUJI H, ISHIMARU T: Urinary bladder tumors among atomic bomb survivors, Hiroshima and Nagasaki, 1961-72. RERF TR 18-79

12. RON E, MODAN B: Thyroid and other neoplasms following scalp irradiation. In *Radiation Carcinogenesis: Epidemiology and Biological Significance.* Ed by Boice JD Jr and Fraumeni JF Jr. New York, Raven Press, 1984. pp 139-51

13. WAKABAYASHI T, KATO H, IKEDA T, SCHULL WJ: Studies of the mortality of A-bomb survivors, Report 7. Part III. Incidence of cancer in 1950-78, based on the Tumor Registry, Nagasaki. Radiat Res 93:112-46, 1983 (RERF TR 6-81)

14. INTERNATIONAL COMMISSION ON RADIATION PROTECTION: Recommendations of the International Commission on Radiation Protection (adopted January 17, 1977), ICRP Publication 26. Oxford, Pergamon Press, 1977

15. LAND CE, NORMAN JE: Latent periods of radiogenic cancers occurring among Japanese A-bomb survivors. In *Late Biological Effects of Ionizing Radiation. Vol. 1.* Vienna, International Atomic Energy Agency, 1978 [ST1/PUB/489]. pp 29-47

16. YOKORO K, NAKANO M, ITO A, NAGANO K, KODAMA Y, HAMADA K: Role of prolactin in rat mammary carcinogenesis: Detection of carcinogenicity of low-dose carcinogens and persisting dormant cancer cells. JNCI 58:1777-83, 1977

17. KAMIYA K, INOH A, FUJII Y, KANDA K, KOBAYASHI T, YOKORO Y: High mammary carcinogenicity of neutron irradiation in rats and its promotion by prolactin. Gann 65:449-56, 1985

18. MUIRHEAD CR, DARBY SC: Modelling the relative and absolute risks of radiation-induced cancers. J R Statistics Soc A 150(2):83-118, 1987

19. UNITED NATIONS: Report of United Nations Scientific Committee on the Effects of Atomic Radiation to the General Assembly, 1986 Report. Annex A: Genetic Effects of Radiation. III. Genes, Chromosomes and Cancer. pp 54-62, and Annex B: Dose-response relationships for radiation-induced cancer, F. Population heterogeneity and susceptibility to cancer induction. pp 182-3, New York, United Nations, 1986

20. YOSHIMOTO Y, KATO H, SCHULL WJ: Risk of cancer among children exposed in utero to A-bomb radiation, 1950-84. Lancet II:665-69, 1988 (RERF TR 4-88)

21. KOPECKY KJ, NAKASHIMA E, YAMAMOTO T, KATO H: Lung cancer, radiation, and smoking among A-bomb survivors. RERF TR 13-86

22. HIRAYAMA T: Diet and cancer. Nutr Cancer 1:67-81, 1979

23. PRENTICE RL, YOSHIMOTO Y, MASON MW: Relationship of cigarette smoking and radiation exposure to cancer mortality in Hiroshima and Nagasaki. JNCI 70:611-22, 1983 (RERF TR 1-82)

24. BLOT WJ, AKIBA S, KATO H: Ionizing radiation and lung cancer: A review including preliminary results from a case-control study among A-bomb survivors. In *Atomic Bomb Survivor Data: Utilization and Analysis.* Ed by Prentice RL, Thompson DJ. Philadelphia, SIAM, 1984. pp 235-48

25. WHITTEMORE AS, McMILLAN A: Lung cancer mortality among US uranium miners: A reappraisal. JNCI 71:489-99, 1983

26. RADFORD EP: Radiogenic cancer in underground miners. In *Radiation Carcinogenesis: Epidemiology and Biological Significance.* Ed by Boice J D Jr and Fraumeni J F Jr. New York, Raven Press, 1984. pp 225-30

27. SHIMIZU Y, KATO H, FUJITA S, SCHULL WJ: Estimation of lifetime risk in radiation exposure. In preparation

APPENDIX TABLES
付　表

Appendix Table 1　Definitions of categories of cause of death in terms of ICD rubrics
付表1　国際分類（ICD）に基づく死因分類の定義

Appendix Table 2　Based on shielded kerma
付表2　遮蔽線量に基づく

2-1	Mean shielded kerma dose and number of subjects, person-years at risk by dose categories	平均遮蔽線量，対象者数及び人年，遮蔽線量群別
2-2	All malignant neoplasm	全部位の癌
2-3	Leukemia	白血病
2-4	All cancers except leukemia	白血病以外の全部位の癌
2-5	Cancers of the digestive organs and peritoneum	消化器及び腹膜の癌
2-6	Cancer of the esophagus	食道癌
2-7	Cancer of the stomach	胃癌
2-8	Cancer of the colon	結腸癌
2-9	Cancer of the rectum	直腸癌
2-10	Cancer of the liver (primary)	肝臓癌（原発）
2-11	Cancers of the gall-bladder and bile ducts	胆嚢癌
2-12	Cancer of the pancreas	膵臓癌
2-13	Cancers of the digestive organs other than AT2-6 through AT2-12	付表2-6から2-12に含まれていない消化器癌
2-14	Cancers of the respiratory system	呼吸器癌
2-15	Cancer of the lung	肺癌
2-16	Cancer of the female breast	女性乳癌
2-17	Cancers of the cervix uteri and uterus	子宮頸部及び子宮体癌
2-18	Cancer of the cervix uteri	子宮頸癌
2-19	Cancer of the ovary	卵巣癌
2-20	Cancer of the prostate	前立腺癌
2-21	Cancer of the urinary tract	泌尿器癌
2-22	Malignant lymphoma	悪性リンパ腫
2-23	Multiple myeloma	多発性骨髄腫
2-24	Cancers other than those of AT2-5 through AT2-23	付表2-3から2-22に含まれないその他の癌
2-25	Cancer of the liver including not specified as primary	原発と記載のないものを含む肝癌
2-26	Cancer of the kidney	腎臓癌
2-27	Cancer of the bladder	膀胱癌

2-28	Cancer of the tongue	舌癌
2-29	Cancer of the pharynx	咽頭癌
2-30	Cancer of the nose	鼻癌
2-31	Cancer of the larynx	喉頭癌
2-32	Cancer of the skin except melanoma	黒色腫以外の皮膚癌
2-33	Cancer of the bone	骨癌

Appendix Table 3 Based on organ-absorbed dose

付表3 臓器吸収線量に基づく

3-1-1	Mean bone-marrow dose, number of subjects, and person-years at risk by dose categories	平均骨髄線量，対象者数，人年，骨髄線量群別
3-1-2	Mean colon dose, number of subjects, and person-years at risk by dose categories	平均結腸線量，対象者数，人年，結腸線量群別
3-1-3	Mean stomach dose, number of subjects, and person-years at risk by dose categories	平均胃線量，対象者数，人年，胃線量群別
3-1-4	Mean lung dose, number of subjects, and person-years at risk by dose categories	平均肺線量，対象者数，人年，肺線量群別
3-1-5	Mean breast dose, number of subjects, and person-years at risk by dose categories - female	平均乳房線量，対象者数，人年，乳房線量群別 - 女性
3-3	Leukemia	白血病
3-4	All cancers except leukemia	白血病以外の全部位の癌
3-7	Cancer of the stomach	胃癌
3-8	Cancer of the colon	結腸癌
3-15	Cancer of the lung	肺癌
3-16	Cancer of the female breast	女性乳癌

For each tables by cause of death (Appendix Tables 2-2 through 2-33 and 3-3 through 3-16), the following statistics by dose categories and follow-up periods are shown: number of observed death (OBS.) and expected death (EXP.) based on observed person-years, observed relative risk (OBS. REL. RISK), the estimated excess relative risk (EXCESS REL. RISK) per gray together with its standard error and p-value of the results of maximum likelihood ratio test for it. Fitted relative risks are also calculated using estimated excess relative risk and mean dose for each dose categories.

死因別の表（付表2-2から2-33及び付表3-3から3-16）には，各線量群，観察期間別の観察死亡数（OBS.），期待死亡数（EXP.），観察相対リスク（OBS. REL. RISK）及び過剰相対リスク（EXCESS REL. RISK）の最尤推定値とその標準誤差及びその尤度比検定の結果を示している．また，過剰相対リスクの推定値と各線量群の平均値を使用して計算したFITTED REL. RISKが示してある．

Results of dose-response modification score tests for several modifiers are also shown. Statistical tests for the modifiers are based on the following models.

また，線量反応の修飾要因のスコア検定（DOSE RESPONSE MODIFICATION SCORE TESTS）の結果も示した．各修飾要因の検定は，下記のモデルによった．

For sex, age ATB, city, loglinear in time since 1960 and loglinear in time since 1970, test of $H_0:\beta_2=0$ is done in the model

Sex, age ATB, city, loglinear in time since 1960, loglinear in time since 1970は，下記のモデルで $H_0:\beta_2=0$ の検定を行った．

$$RR_{ij} = 1 + \beta_1 D_{ij} \exp(\beta_2 X)$$

where X is one of the radiation effect modifiers mentioned above.

ただし，Xは下記の変数のいずれかである．

Sex	M:1	F:1
Age ATB	<20:1	20+:0
City	H:1	N:0

Loglinear in time since 1960	T≥1960:T-1960	T<1960:0
Loglinear in time since 1970	T≥1970:T-1970	T<1970:0

For sex (absolute), test of $H_0:\beta_3=0$ is done in the model

Sex (absolute) は下記のモデルで $H_0:\beta_3=0$ の検定を行った．

$$RR_{ij} = 1 + \beta_1 sex + \beta_2 D_{ij} \exp(\beta_3\ sex)$$

For nonlineality in dose response, test of $H_0:\beta_2=0$ is done in the model

Nonlineality in dose response は下記のモデルで $H_0:\beta_2=0$ の検定を行った．

$$RR_{ij} = 1 + \beta_1 D_{ij} + \beta_2 D_{ij}^2$$

APPENDIX TABLE 1 DEFINITIONS OF CATEGORIES OF CAUSE OF DEATH IN TERMS OF ICD RUBRICS

付表1 国際分類(ICD)に基づく死因分類の定義

Appendix table	Cause of death	ICD group		
		7th (1955)	8th (1965)	9th (1975)
2-2	All malignant neoplasms	140-205	140-163 170-174 180-209	140-208
2-3 (3-3)	Leukemia	204	204-207	204-208
2-4 (3-4)	All cancers except leukemia	140-203 205	140-203 208,209	140-203
2-5	Cancers of the digestive organs and peritoneum	150-155 157-159	150-159	150-155(0,1) 156-159
2-6	Cancer of the esophagus	150	150	150
2-7 (3-7)	Cancer of the stomach	151	151	151
2-8 (3-8)	Cancer of the colon	153	153	153
2-9	Cancer of the rectum	154	154	154
2-10	Cancer of the liver (primary)	155(0,8)	155	155(0,1)
2-11	Cancers of the gall-bladder and bile ducts	155.1	156	156
2-12	Cancer of the pancreas	157	157	157
2-13	Cancers of the digestive organs other than AT2-6 through AT2-12	152,158,159	152,158,159	152,158,159
2-14	Cancers of the respiratory system	160-165	160-163	160-165
2-15 (3-15)	Cancer of the lung	162,163	162	162
2-16 (3-16)	Cancer of the breast	170	174	174,175
2-17	Cancers of the cervix uteri and uterus	171-174	180-182	179-182

Appendix table	Cause of death	ICD group		
		7th (1955)	8th (1965)	9th (1975)
2-18	Cancer of the cervix uteri	171	180	180
2-19	Cancer of the ovary	175	183	183
2-20	Cancer of the prostate	177	185	185
2-21	Cancer of the urinary tract	180,181	188,189	188,189
2-22	Malignant lymphoma	200-202	200-202	200-202
2-23	Multiple myeloma	203	203	203
2-24	Cancers other than those of AT2-5 through AT2-23	140-148 156,176 178-179 190-199 205	140-149 170-173 184 186-187 190-199 208,209	140-149 155.2 170-173 184 186-187 190-199
2-25	Cancer of the liver including not specified as primary	155(0,8) 156	155,197.8	155(0,1,2)
2-26	Cancer of the kidney	180	189(0,1)	189(0,1)
2-27	Cancer of the bladder	181	188	188
2-28	Cancer of the tongue	141	141	141
2-29	Cancer of the pharynx	145-148	146-149	146-149
2-30	Cancer of the nose	160	160	160
2-31	Cancer of the larynx	161	161	161
2-32	Cancer of the skin except melanoma	191	173	173
2-33	Cancer of the bone	196	170	170
-	Brain tumors	193(1-9)	191	191
-	Tumors of central nervous system (CNS) except brain	193.0	192	192

APPENDIX TABLE 2 BASED ON SHIELDED KERMA
付表2 遮蔽線量に基づく

2-1 MEAN SHIELDED KERMA DOSE AND NUMBER OF SUBJECTS, PERSON-YEARS AT RISK BY DOSE CATEGORIES
平均遮蔽線量，対象者数及び人年，遮蔽線量群別

		SHIELDED KERMA DOSE IN GRAY										
		TOTAL	0	0.01-0.05	0.06-0.09	0.10-0.19	0.20-0.49	0.50-0.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+
MEAN DOSE (MGRAY)	TOTAL	162	0	19	72	139	318	693	1384	2423	3380	5298
	GAMMA	158	0	19	72	137	314	679	1344	2332	3233	5047
	NEUTRON	4	0	0	0	1	5	15	39	91	147	251
NO OF SUBJECT		75991	34272	19192	4129	5172	6558	3616	1946	687	211	258
		(45557)	(19766)	(12116)	(2449)	(3220)	(4038)	(2250)	(1095)	(382)	(115)	(126)
NUMBER OF PERSON YEARS AT RISK												
1950-85		2185335	984271	553960	119991	149669	188322	102709	55200	18311	5923	6919
		(1350441)	(586890)	(357989)	(73022)	(95686)	(119643)	(66180)	(32677)	(11295)	(3463)	(3596)
1950-55		388982	175299	98148	21183	26618	33632	18496	9977	3272	1056	1302
		(234182)	(101606)	(62151)	(12599)	(16630)	(20813)	(11545)	(5650)	(1959)	(588)	(642)
1956-60		350755	157785	88486	19247	24093	30355	16719	9028	2959	936	1146
		(213309)	(92479)	(56515)	(11534)	(15164)	(19015)	(10533)	(5181)	(1786)	(531)	(572)
1961-65		330790	148816	83501	18175	22744	28598	15730	8487	2791	877	1070
		(203154)	(88113)	(53742)	(10982)	(14465)	(18112)	(9997)	(4965)	(1727)	(510)	(542)
1966-70		310411	139893	78383	17100	21361	26894	14659	7869	2619	843	988
		(192616)	(83744)	(50891)	(10431)	(13682)	(17072)	(9454)	(4689)	(1641)	(500)	(511)
1971-75		289580	130438	73458	16011	19907	24829	13551	7271	2431	793	901
		(181325)	(78865)	(47996)	(9873)	(12880)	(15969)	(8874)	(4399)	(1520)	(466)	(483)
1976-80		268137	120730	68599	14766	18279	23046	12338	6621	2219	738	800
		(169208)	(73672)	(44990)	(9139)	(11909)	(14918)	(8231)	(4061)	(1393)	(445)	(451)
1981-85		246681	111310	63985	13508	16668	21175	11216	6007	2021	680	712
		(156647)	(68412)	(41702)	(8485)	(10955)	(13745)	(7546)	(3733)	(1268)	(424)	(396)
1981-83		145529	65707	37409	7964	9840	12473	6598	3535	1189	399	414
		(92517)	(40433)	(24628)	(5003)	(6480)	(8094)	(4447)	(2209)	(743)	(249)	(231)

( ):NUMBER FOR FEMALE

NUMBER OF PERSON YEARS AT RISK SHOWN IN THIS TABLE DIFFER SLIGHTLY FROM THOSE PRESENTED IN TABLE 2 IN LSS REPORT 11 PART 1 (RERF,TR 12-87) DUE TO THE DIFFERENCE IN ROUNDING PROCEDURE APPLIED TO INDIVIDUAL DOSE ESTIMATES.

本表に示す観察人年は，個人線量の推定に用いた四捨五入の方法が異なるため，寿命調査第11報の第1部〔RERF業績報告書 TR 12-87〕の表2に示したものよりやや異なる。

2-2 ALL MALIGNANT NEOPLASM
全部位の癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL		TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 TOTAL	OBS.	5936	2501	1358	335	429	558	349	244	93	32	37	0.3895
	EXP.		2680.68	1414.57	335.03	429.44	538.88	300.81	161.37	44.10	13.34	17.69	0.0428
	OBS. REL. RISK		1.00	1.03	1.07	1.07	1.11	1.24	1.62	2.26	2.57	2.24	(0.0000)
	FITTED REL. RISK		1.00	1.01	1.03	1.05	1.12	1.26	1.52	1.93	2.26	2.97	
1950-55	OBS.	567	221	153	25	34	46	43	24	8	7	6	0.6244
	EXP.		254.16	138.26	31.57	40.58	51.22	28.88	15.23	4.02	1.28	1.81	0.1627
	OBS. REL. RISK		1.00	1.27	0.91	0.96	1.03	1.71	1.81	2.29	6.28	3.81	(0.0000)
1956-60	OBS.	676	298	154	38	49	53	38	24	13	7	2	0.3318
	EXP.		301.17	162.47	38.27	49.66	62.38	35.15	18.51	4.92	1.38	2.09	0.1219
	OBS. REL. RISK		1.00	0.96	1.00	1.00	0.86	1.09	1.31	2.67	5.13	0.97	(0.0006)
1961-65	OBS.	799	314	202	43	57	87	43	37	13	1	2	0.2947
	EXP.		354.99	189.72	46.00	59.31	74.41	42.42	22.35	5.81	1.56	2.42	0.1083
	OBS. REL. RISK		1.00	1.20	1.06	1.09	1.32	1.15	1.87	2.53	0.72	0.94	(0.0023)
1966-70	OBS.	861	367	197	54	55	92	39	33	14	3	7	0.3340
	EXP.		391.73	201.95	48.76	62.72	77.17	44.67	23.28	6.32	1.82	2.57	0.1080
	OBS. REL. RISK		1.00	1.04	1.18	0.94	1.27	0.93	1.51	2.37	1.76	2.91	(0.0001)
1971-75	OBS.	953	408	206	58	80	83	58	39	11	4	6	0.3177
	EXP.		433.04	225.15	53.91	69.68	84.83	48.38	25.70	7.23	2.19	2.88	0.1004
	OBS. REL. RISK		1.00	0.97	1.14	1.22	1.04	1.27	1.61	1.62	1.94	2.21	(0.0002)
1976-80	OBS.	1018	435	222	61	76	87	69	40	19	3	6	0.4065
	EXP.		459.12	243.81	57.76	73.71	92.65	50.22	27.80	7.65	2.44	2.84	0.1050
	OBS. REL. RISK		1.00	0.98	1.11	1.09	0.99	1.45	1.52	2.62	1.30	2.23	(0.0000)
1981-85	OBS.	1062	458	224	56	78	110	59	47	15	7	8	0.4636
	EXP.		486.48	253.21	58.77	73.79	96.22	51.10	28.50	8.16	2.67	3.09	0.1062
	OBS. REL. RISK		1.00	0.94	1.01	1.12	1.21	1.23	1.75	1.95	2.79	2.75	(0.0000)
1983-85	OBS.	639	290	127	32	48	59	35	26	11	5	6	0.4831
	EXP.		292.72	151.95	35.44	44.63	58.29	30.64	17.01	4.89	1.58	1.86	0.1391
	OBS. REL. RISK		1.00	0.84	0.91	1.09	1.02	1.15	1.54	2.27	3.20	3.25	(0.0000)

FITTED RELATIVE RISK AT 1 GRAY : 1.3895 ± 0.0428 (P-VALUE: 0.0000)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.0051	(-)	M < F
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.8182	(-)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.0000	(+)	ATB <20 > ATB20+
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.6808	(+)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.9202	(+)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.5817	(+)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.1260	(-)	N.S

2-3 LEUKEMIA
白血病

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL	TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 OBS.	202	58	36	2	13	21	19	23	15	9	6	3.921
TOTAL EXP.		87.53	49.05	12.19	15.16	19.20	10.34	5.67	1.67	0.56	0.63	0.7764
OBS. REL. RISK		1.00	1.11	0.25	1.29	1.65	2.77	6.12	13.53	24.40	14.31	(0.0000)
FITTED REL. RISK		1.00	1.08	1.27	1.55	2.22	3.67	6.25	10.33	13.67	20.80	
1950-55 OBS.	35	9	1	0	3	1	4	7	1	5	4	10.72
EXP.		15.14	8.76	2.12	2.56	3.20	1.74	0.95	0.30	0.10	0.13	4.972
OBS. REL. RISK		1.00	0.19	0.00	1.97	0.53	3.86	12.33	5.52	84.34	53.78	(0.0000)
1956-60 OBS.	39	6	5	0	3	5	7	7	3	3	0	9.901
EXP.		16.91	9.33	2.34	2.98	3.69	2.04	1.12	0.35	0.11	0.14	4.341
OBS. REL. RISK		1.00	1.51	0.00	2.86	3.82	9.86	17.69	24.24	74.03	0.00	(0.0000)
1961-65 OBS.	26	5	7	1	1	5	2	2	3	0	0	3.501
EXP.		11.61	6.41	1.49	1.88	2.31	1.28	0.66	0.21	0.06	0.09	1.974
OBS. REL. RISK		1.00	2.53	1.55	1.23	5.04	3.62	7.02	33.53	0.00	0.00	(0.0005)
1966-70 OBS.	18	6	3	0	0	1	2	2	3	0	1	5.702
EXP.		8.40	4.53	0.93	1.20	1.49	0.80	0.43	0.14	0.04	0.05	3.616
OBS. REL. RISK		1.00	0.93	0.00	0.00	0.94	3.49	6.55	30.82	0.00	29.67	(0.0000)
1971-75 OBS.	28	10	7	0	2	3	2	2	2	0	0	1.187
EXP.		12.31	6.45	1.75	2.07	2.68	1.47	0.83	0.24	0.10	0.10	0.9182
OBS. REL. RISK		1.00	1.34	0.00	1.19	1.38	1.67	2.98	10.11	0.00	0.00	(0.0497)
1976-80 OBS.	31	15	7	1	1	2	2	0	2	1	0	0.6372
EXP.		12.84	7.43	1.96	2.53	3.20	1.68	0.96	0.24	0.08	0.07	0.6973
OBS. REL. RISK		1.00	0.81	0.44	0.34	0.54	1.02	0.00	7.18	10.68	0.00	(0.1319)
1981-85 OBS.	25	7	6	0	3	4	0	3	1	0	1	1.816
EXP.		10.32	6.13	1.59	1.96	2.64	1.31	0.73	0.19	0.06	0.06	1.325
OBS. REL. RISK		1.00	1.44	0.00	2.26	2.23	0.00	6.10	7.62	0.00	22.89	(0.0067)
1983-85 OBS.	12	6	3	0	1	0	0	1	0	0	1	0.8069
EXP.		5.24	2.89	0.72	0.83	1.17	0.61	0.36	0.10	0.04	0.04	1.184
OBS. REL. RISK		1.00	0.91	0.00	1.05	0.00	0.00	2.43	0.00	0.00	23.49	(0.1682)

FITTED RELATIVE RISK AT 1 GRAY : 4.9212 ± 0.7764 (P-VALUE: 0.0000)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.8634	(+)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.0068	(+)	M > F
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.0038	(+)	ATB <20 > ATB20+
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.9743	(+)	N.S
LOGLINEAR IN TIME SINCE 1960	≧1960:T-1960 T<1960:0	0.0000	(-)	1960+ < -1960
LOGLINEAR IN TIME SINCE 1970	≧1970:T-1970 T<1970:0	0.0001	(-)	1970+ < -1970
NON LINEALITY IN DOSE RESPONSE	D**2	0.3424	(+)	N.S

2-4 ALL CANCERS EXCEPT LEUKEMIA
白血病以外の全部位の癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL		TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85	OBS.	5734	2443	1322	333	416	537	330	221	78	23	31	0.2939
TOTAL	EXP.		2593.15	1365.52	322.84	414.28	519.68	290.48	155.70	42.43	12.79	17.06	0.0404
	OBS. REL. RISK		1.00	1.03	1.09	1.07	1.10	1.21	1.51	1.95	1.91	1.93	(0.0000)
	FITTED REL. RISK		1.00	1.01	1.02	1.04	1.09	1.20	1.39	1.70	1.95	2.48	
1950-55	OBS.	532	212	152	25	31	45	39	17	7	2	2	0.2372
	EXP.		239.02	129.50	29.45	38.02	48.01	27.14	14.28	3.72	1.18	1.68	0.1268
	OBS. REL. RISK		1.00	1.32	0.96	0.92	1.06	1.62	1.34	2.12	1.91	1.34	(0.0333)
1956-60	OBS.	637	292	149	38	46	48	31	17	10	4	2	0.1230
	EXP.		284.26	153.13	35.93	46.70	58.69	33.11	17.39	4.57	1.27	1.95	0.1032
	OBS. REL. RISK		1.00	0.95	1.03	0.96	0.80	0.91	0.95	2.13	3.08	1.00	(0.1648)
1961-65	OBS.	773	309	195	42	56	82	41	35	10	1	2	0.2284
	EXP.		343.38	183.31	44.51	57.43	72.10	41.14	21.69	5.60	1.50	2.33	0.1037
	OBS. REL. RISK		1.00	1.18	1.05	1.08	1.26	1.11	1.79	1.98	0.74	0.95	(0.0178)
1966-70	OBS.	843	361	194	54	55	91	37	31	11	3	6	0.2576
	EXP.		383.33	197.42	47.83	61.53	75.69	43.87	22.85	6.18	1.78	2.52	0.1022
	OBS. REL. RISK		1.00	1.04	1.20	0.95	1.28	0.90	1.44	1.89	1.79	2.52	(0.0020)
1971-75	OBS.	925	398	199	58	78	80	56	37	9	4	6	0.2900
	EXP.		420.73	218.70	52.17	67.60	82.16	46.91	24.88	6.98	2.09	2.78	0.0998
	OBS. REL. RISK		1.00	0.96	1.18	1.22	1.03	1.26	1.57	1.36	2.02	2.28	(0.0005)
1976-80	OBS.	987	420	215	60	75	85	67	40	17	2	6	0.3958
	EXP.		446.28	236.39	55.80	71.17	89.45	48.54	26.83	7.41	2.36	2.76	0.1058
	OBS. REL. RISK		1.00	0.97	1.14	1.12	1.01	1.47	1.58	2.44	0.90	2.31	(0.0000)
1981-85	OBS.	1037	451	218	56	75	106	59	44	14	7	7	0.4301
	EXP.		476.16	247.08	57.18	71.84	93.58	49.79	27.78	7.97	2.60	3.02	0.1050
	OBS. REL. RISK		1.00	0.93	1.03	1.10	1.20	1.25	1.67	1.86	2.84	2.44	(0.0000)
1983-85	OBS.	627	284	124	32	47	59	35	25	11	5	5	0.4717
	EXP.		287.47	149.07	34.72	43.79	57.12	30.03	16.65	4.79	1.54	1.82	0.1395
	OBS. REL. RISK		1.00	0.84	0.93	1.09	1.05	1.18	1.52	2.32	3.28	2.77	(0.0000)

FITTED RELATIVE RISK AT 1 GRAY : 1.2939 ± 0.0404 (P-VALUE: 0.0000)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.0019	(-)	M < F
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.2741	(-)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.0002	(+)	ATB <20 > ATB20+
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.8661	(+)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.0333	(+)	1960+ > -1960
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.0439	(+)	1970+ > -1970
NON LINEALITY IN DOSE RESPONSE	D**2	0.0903	(-)	N.S

2-5 CANCERS OF THE DIGESTIVE ORGANS AND PERITONEUM
消化器及び腹膜の癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL		TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 TOTAL	OBS.	3129	1331	733	185	231	289	174	121	36	9	20	0.2413
	EXP.		1407.73	738.68	179.26	229.08	287.30	160.76	86.59	23.08	7.08	9.41	0.0520
	OBS. REL. RISK		1.00	1.05	1.09	1.07	1.06	1.14	1.48	1.65	1.34	2.25	(0.0000)
	FITTED REL. RISK		1.00	1.00	1.02	1.03	1.07	1.16	1.32	1.57	1.78	2.22	
1950-55	OBS.	293	121	81	12	13	26	24	12	3	0	1	0.1953
	EXP.		131.93	69.77	16.52	21.05	26.58	15.14	8.26	2.08	0.70	0.99	0.1606
	OBS. REL. RISK		1.00	1.27	0.79	0.67	1.07	1.73	1.58	1.58	0.00	1.10	(0.1976)
1956-60	OBS.	366	155	95	22	29	30	18	11	5	2	1	0.0747
	EXP.		160.57	86.33	21.52	27.87	34.98	19.81	10.34	2.68	0.76	1.14	0.1264
	OBS. REL. RISK		1.00	1.14	1.06	1.08	0.89	0.84	1.10	1.94	2.73	0.91	(0.5120)
1961-65	OBS.	451	192	104	25	33	47	21	20	6	1	2	0.2196
	EXP.		200.11	105.83	26.27	33.73	42.25	24.33	12.94	3.27	0.88	1.39	0.1339
	OBS. REL. RISK		1.00	1.02	0.99	1.02	1.16	0.90	1.61	1.91	1.18	1.50	(0.0588)
1966-70	OBS.	483	210	124	31	27	44	19	17	5	2	4	0.1708
	EXP.		218.37	112.22	27.79	35.94	43.80	25.53	13.26	3.52	1.02	1.45	0.1239
	OBS. REL. RISK		1.00	1.15	1.16	0.78	1.04	0.77	1.33	1.48	2.03	2.88	(0.0822)
1971-75	OBS.	504	217	110	31	44	51	24	20	4	1	2	0.1336
	EXP.		228.40	118.82	28.78	37.00	45.14	25.70	13.76	3.74	1.15	1.52	0.1157
	OBS. REL. RISK		1.00	0.97	1.13	1.25	1.19	0.98	1.53	1.13	0.91	1.39	(0.2191)
1976-80	OBS.	509	211	110	31	47	42	39	17	8	0	4	0.3732
	EXP.		229.86	121.64	28.92	36.91	46.39	25.02	13.88	3.77	1.21	1.41	0.1451
	OBS. REL. RISK		1.00	0.99	1.17	1.39	0.99	1.70	1.33	2.31	0.00	3.10	(0.0019)
1981-85	OBS.	523	225	109	33	38	49	31	24	5	3	6	0.4637
	EXP.		238.50	124.09	29.46	36.59	48.09	25.22	14.16	4.01	1.35	1.53	0.1510
	OBS. REL. RISK		1.00	0.93	1.19	1.10	1.08	1.30	1.80	1.32	2.36	4.16	(0.0001)
1983-85	OBS.	309	143	51	16	24	32	21	11	4	3	4	0.5816
	EXP.		139.55	73.74	17.59	22.05	28.91	14.93	8.23	2.35	0.77	0.89	0.2136
	OBS. REL. RISK		1.00	0.67	0.89	1.06	1.08	1.37	1.31	1.66	3.82	4.37	(0.0002)

FITTED RELATIVE RISK AT 1 GRAY : 1.2413 ± 0.0520 (P-VALUE: 0.0000)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.0157	(-)	M < F
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.6435	(-)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.0038	(+)	ATB <20 > ATB20+
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.9490	(+)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.0589	(+)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.0374	(+)	1970+ > -1970
NON LINEALITY IN DOSE RESPONSE	D**2	0.6875	(-)	N.S

2-6 CANCER OF THE ESOPHAGUS
食道癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL		TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 TOTAL	OBS.	176	83	27	11	18	13	10	8	4	0	2	0.4297
	EXP.		81.08	39.12	10.28	12.95	15.89	9.15	5.29	1.25	0.44	0.58	0.2500
	OBS. REL. RISK		1.00	0.67	1.05	1.36	0.80	1.07	1.48	3.13	0.00	3.40	(0.0238)
	FITTED REL. RISK		1.00	1.01	1.03	1.06	1.13	1.29	1.58	2.02	2.39	3.17	
1950-55	OBS.	20	9	3	1	3	1	1	1	1	0	0	0.5819
	EXP.		9.18	4.64	1.12	1.41	1.78	1.02	0.59	0.14	0.05	0.07	0.8249
	OBS. REL. RISK		1.00	0.66	0.91	2.17	0.57	1.00	1.72	7.54	0.00	0.00	(0.3568)
1956-60	OBS.	18	9	2	1	0	1	1	2	1	0	1	1.732
	EXP.		7.95	4.02	1.08	1.40	1.73	1.00	0.57	0.14	0.05	0.06	1.438
	OBS. REL. RISK		1.00	0.44	0.82	0.00	0.51	0.88	3.13	6.37	0.00	13.81	(0.0139)
1961-65	OBS.	29	13	3	2	3	2	3	1	2	0	0	1.021
	EXP.		13.26	6.48	1.70	2.09	2.59	1.59	0.92	0.20	0.07	0.10	0.8589
	OBS. REL. RISK		1.00	0.47	1.20	1.47	0.79	1.93	1.11	10.05	0.00	0.00	(0.0869)
1966-70	OBS.	38	20	7	3	2	5	0	1	0	0	0	-0.1643
	EXP.		18.45	8.26	2.10	2.60	3.12	1.92	1.09	0.25	0.07	0.13	0.1359
	OBS. REL. RISK		1.00	0.78	1.32	0.71	1.48	0.00	0.85	0.00	0.00	0.00	(0.3865)
1971-75	OBS.	25	13	2	1	5	0	2	2	0	0	0	0.1012
	EXP.		10.76	5.55	1.58	2.14	2.43	1.43	0.74	0.22	0.07	0.08	0.4757
	OBS. REL. RISK		1.00	0.30	0.53	1.93	0.00	1.16	2.25	0.00	0.00	0.00	(0.8231)
1976-80	OBS.	26	8	6	2	4	2	3	1	0	0	0	0.1616
	EXP.		11.59	5.86	1.59	1.95	2.52	1.29	0.88	0.19	0.08	0.06	0.5274
	OBS. REL. RISK		1.00	1.48	1.83	2.97	1.15	3.38	1.65	0.00	0.00	0.00	(0.7642)
1981-85	OBS.	20	11	4	1	1	2	0	0	0	0	1	0.2660
	EXP.		9.88	4.31	1.10	1.36	1.70	0.91	0.51	0.12	0.04	0.07	0.6549
	OBS. REL. RISK		1.00	0.83	0.82	0.66	1.05	0.00	0.00	0.00	0.00	12.27	(0.4348)
1983-85	OBS.	13	7	3	0	1	2	0	0	0	0	0	-0.1665
	EXP.		6.27	2.81	0.72	0.94	1.18	0.60	0.34	0.08	0.03	0.04	0.0826
	OBS. REL. RISK		1.00	0.96	0.00	0.95	1.52	0.00	0.00	0.00	0.00	0.00	(0.5323)

FITTED RELATIVE RISK AT 1 GRAY : 1.4297 ± 0.2500 (P-VALUE: 0.0238)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.0177	(-)	M < F
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.8423	(-)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.6052	(-)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.0834	(+)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.1572	(-)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.5829	(-)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.9405	(+)	N.S

2-7 CANCER OF THE STOMACH
胃癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL	TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 OBS.	2007	854	469	119	143	191	114	78	21	5	13	0.2281
TOTAL EXP.		901.47	471.94	115.44	147.84	185.15	104.00	55.80	14.76	4.49	6.10	0.0640
OBS. REL. RISK		1.00	1.05	1.09	1.02	1.09	1.16	1.48	1.50	1.18	2.25	(0.0000)
FITTED REL. RISK		1.00	1.00	1.02	1.03	1.07	1.16	1.31	1.54	1.74	2.15	
1950-55 OBS.	218	91	82	8	8	18	19	9	2	0	1	0.2226
EXP.		98.71	51.89	12.20	15.51	19.60	11.20	6.11	1.53	0.51	0.74	0.1917
OBS. REL. RISK		1.00	1.30	0.71	0.56	1.00	1.84	1.60	1.41	0.00	1.47	(0.2045)
1956-60 OBS.	281	116	71	17	25	25	14	8	4	1	0	0.0062
EXP.		123.04	66.04	16.59	21.52	27.01	15.31	7.96	2.07	0.58	0.89	0.1292
OBS. REL. RISK		1.00	1.14	1.09	1.23	0.98	0.97	1.07	2.05	1.81	0.00	(1.0000)
1961-65 OBS.	297	125	74	11	20	32	14	15	3	1	2	0.2819
EXP.		131.00	69.68	17.40	22.48	28.08	16.13	8.55	2.19	0.58	0.92	0.1741
OBS. REL. RISK		1.00	1.11	0.66	0.93	1.19	0.91	1.84	1.43	1.80	2.27	(0.0489)
1966-70 OBS.	322	145	81	18	21	26	12	10	5	1	3	0.1681
EXP.		145.75	74.23	18.67	23.98	29.28	17.14	8.87	2.37	0.69	1.01	0.1499
OBS. REL. RISK		1.00	1.10	0.97	0.88	0.89	0.70	1.13	2.12	1.46	3.00	(0.1463)
1971-75 OBS.	330	151	67	20	23	39	13	13	1	1	2	0.1078
EXP.		149.56	77.63	18.89	24.23	29.58	16.82	9.10	2.44	0.75	1.00	0.1385
OBS. REL. RISK		1.00	0.85	1.05	0.94	1.31	0.77	1.41	0.41	1.33	1.98	(0.3833)
1976-80 OBS.	303	121	62	21	28	28	26	11	4	0	2	0.4546
EXP.		137.81	72.10	17.00	21.82	27.50	14.84	8.17	2.20	0.72	0.84	0.1997
OBS. REL. RISK		1.00	0.98	1.41	1.46	1.16	2.00	1.53	2.07	0.00	2.70	(0.0073)
1981-85 OBS.	256	105	52	24	18	23	16	12	2	1	3	0.4452
EXP.		115.62	60.38	14.70	18.30	24.10	12.56	7.03	1.94	0.66	0.70	0.2141
OBS. REL. RISK		1.00	0.95	1.80	1.08	1.05	1.40	1.88	1.13	1.68	4.71	(0.0069)
1983-85 OBS.	145	63	24	11	11	14	13	4	1	1	3	0.6251
EXP.		65.02	34.19	8.32	10.59	13.86	7.17	4.00	1.11	0.35	0.40	0.3198
OBS. REL. RISK		1.00	0.72	1.37	1.07	1.04	1.87	1.03	0.93	2.94	7.76	(0.0054)

FITTED RELATIVE RISK AT 1 GRAY : 1.2281 ± 0.0640 (P-VALUE: 0.0000)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.1231	(-)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.6504	(-)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.0476	(+)	ATB <20 > ATB20+
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.2022	(-)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.1615	(+)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.1232	(+)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.8557	(-)	N.S

2-8 CANCER OF THE COLON
結腸癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL	TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 OBS.	232	103	57	10	10	20	12	8	6	2	4	0.5627
TOTAL EXP.		103.44	55.15	13.30	17.18	21.67	11.88	6.44	1.73	0.53	0.66	0.2442
OBS. REL. RISK		1.00	1.04	0.75	0.58	0.93	1.01	1.25	3.49	3.76	6.07	(0.0004)
FITTED REL. RISK		1.00	1.01	1.04	1.08	1.17	1.38	1.75	2.34	2.82	3.84	
1950-55 OBS.	12	4	5	0	1	2	0	0	0	0	0	-0.1848
EXP.		4.95	2.90	0.78	0.96	1.20	0.70	0.35	0.10	0.03	0.04	0.1180
OBS. REL. RISK		1.00	2.13	0.00	1.29	2.06	0.00	0.00	0.00	0.00	0.00	(0.4884)
1956-60 OBS.	9	5	3	0	0	1	0	0	0	0	0	-0.1845
EXP.		3.77	2.13	0.54	0.75	0.94	0.51	0.25	0.07	0.02	0.03	0.0524
OBS. REL. RISK		1.00	1.06	0.00	0.00	0.80	0.00	0.00	0.00	0.00	0.00	(0.5120)
1961-65 OBS.	21	7	4	2	2	2	3	0	1	0	0	0.6215
EXP.		8.65	4.92	1.36	1.75	2.20	1.24	0.62	0.16	0.05	0.06	0.8271
OBS. REL. RISK		1.00	1.01	1.82	1.41	1.12	2.99	0.00	7.58	0.00	0.00	(0.3401)
1966-70 OBS.	36	17	5	4	0	5	1	3	0	1	0	0.8181
EXP.		16.06	8.81	1.98	2.66	3.27	1.85	0.95	0.26	0.07	0.08	0.7459
OBS. REL. RISK		1.00	0.54	1.91	0.00	1.44	0.51	2.98	0.00	13.09	0.00	(0.1168)
1971-75 OBS.	41	13	13	3	4	2	4	1	1	0	0	0.2950
EXP.		18.65	9.62	2.41	3.00	3.67	2.08	1.10	0.28	0.08	0.14	0.4787
OBS. REL. RISK		1.00	1.94	1.79	1.91	0.78	2.76	1.31	5.19	0.00	0.00	(0.5023)
1976-80 OBS.	47	25	9	1	2	1	2	3	2	0	2	0.9280
EXP.		20.78	11.09	2.76	3.83	4.46	2.41	1.29	0.37	0.12	0.12	0.6631
OBS. REL. RISK		1.00	0.67	0.30	0.46	0.19	0.69	1.94	4.52	0.00	13.65	(0.0084)
1981-85 OBS.	66	32	18	0	1	7	2	1	2	1	2	0.6118
EXP.		30.61	15.69	3.49	4.43	5.93	3.10	1.89	0.50	0.17	0.20	0.4642
OBS. REL. RISK		1.00	1.10	0.00	0.22	1.13	0.62	0.51	3.81	5.53	9.70	(0.0238)
1983-85 OBS.	37	18	8	0	0	6	1	0	2	1	1	0.9863
EXP.		16.77	8.89	2.07	2.56	3.44	1.77	1.02	0.27	0.09	0.11	0.7614
OBS. REL. RISK		1.00	0.84	0.00	0.00	1.62	0.53	0.00	6.83	10.41	8.30	(0.0199)

FITTED RELATIVE RISK AT 1 GRAY : 1.5627 ± 0.2442 (P-VALUE: 0.0004)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.5849	(-)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.8399	(+)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.0052	(+)	ATB <20 > ATB20+
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.0549	(+)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.2617	(+)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.5133	(+)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.0450	(+)	QUADRATIC TERM IS SIGNIFICANT

2-9 CANCER OF THE RECTUM
直腸癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL	TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 OBS.	216	93	53	11	16	25	10	6	2	0	0	-0.0687
TOTAL EXP.		98.66	51.59	12.14	15.33	19.28	10.66	5.69	1.54	0.46	0.65	0.1268
OBS. REL. RISK		1.00	1.09	0.96	1.11	1.38	1.00	1.12	1.38	0.00	0.00	(0.6802)
FITTED REL. RISK		1.00	1.00	1.00	0.99	0.98	0.95	0.91	0.84	0.78	0.65	
1950-55 OBS.	21	10	5	0	0	1	3	2	0	0	0	0.5889
EXP.		9.04	4.96	1.26	1.63	2.05	1.19	0.61	0.16	0.06	0.07	0.7979
OBS. REL. RISK		1.00	0.91	0.00	0.00	0.44	2.35	2.95	0.00	0.00	0.00	(0.3897)
1956-60 OBS.	21	10	5	1	4	1	0	0	0	0	0	-0.1846
EXP.		9.59	5.09	1.17	1.49	1.88	1.06	0.57	0.14	0.04	0.06	0.0307
OBS. REL. RISK		1.00	0.93	0.81	2.54	0.50	0.00	0.00	0.00	0.00	0.00	(0.3594)
1961-65 OBS.	34	17	8	1	2	6	0	0	0	0	0	-0.1664
EXP.		16.30	8.09	1.74	2.18	2.78	1.60	0.93	0.21	0.07	0.10	0.0934
OBS. REL. RISK		1.00	0.95	0.55	0.88	2.07	0.00	0.00	0.00	0.00	0.00	(0.3401)
1966-70 OBS.	26	8	8	3	3	2	2	0	0	0	0	-0.1645
EXP.		11.79	6.19	1.50	1.89	2.34	1.32	0.69	0.17	0.05	0.07	0.1488
OBS. REL. RISK		1.00	1.90	2.95	2.33	1.20	2.23	0.00	0.00	0.00	0.00	(0.5376)
1971-75 OBS.	31	14	9	2	3	2	1	0	0	0	0	-0.1660
EXP.		14.77	7.10	1.64	2.14	2.64	1.53	0.80	0.23	0.07	0.09	0.1101
OBS. REL. RISK		1.00	1.34	1.29	1.48	0.80	0.69	0.00	0.00	0.00	0.00	(0.3375)
1976-80 OBS.	41	17	9	0	2	8	2	1	2	0	0	0.7634
EXP.		18.03	10.01	2.47	3.12	3.87	1.98	1.01	0.30	0.08	0.12	0.6662
OBS. REL. RISK		1.00	0.95	0.00	0.68	2.19	1.07	1.05	7.07	0.00	0.00	(0.1380)
1981-85 OBS.	42	17	9	4	2	5	2	3	0	0	0	0.2093
EXP.		19.23	10.14	2.36	2.87	3.72	2.02	1.08	0.33	0.10	0.14	0.4292
OBS. REL. RISK		1.00	1.00	1.91	0.79	1.52	1.12	3.14	0.00	0.00	0.00	(0.6242)
1983-85 OBS.	27	12	3	3	1	4	1	3	0	0	0	0.7404
EXP.		12.09	6.58	1.53	1.95	2.50	1.30	0.69	0.21	0.07	0.09	0.7916
OBS. REL. RISK		1.00	0.46	1.98	0.52	1.61	0.78	4.38	0.00	0.00	0.00	(0.2674)

FITTED RELATIVE RISK AT 1 GRAY : 0.9313 ± 0.1268 (P-VALUE: 0.6802)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.1913	(+)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.1998	(+)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.5338	(-)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.9851	(-)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.2843	(-)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.2025	(-)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.2310	(-)	N.S

2-10 CANCER OF THE LIVER (PRIMARY)
肝臓癌（原発）

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL	TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 OBS.	77	35	15	4	7	7	6	2	0	0	1	0.1216
TOTAL EXP.		33.93	17.73	4.78	5.70	7.39	4.00	2.21	0.73	0.25	0.27	0.2714
OBS. REL. RISK		1.00	0.82	0.81	1.19	0.92	1.46	0.88	0.00	0.00	3.54	(0.5716)
FITTED REL. RISK		1.00	1.00	1.01	1.02	1.04	1.08	1.16	1.29	1.39	1.61	
1950-55 OBS.	0	0	0	0	0	0	0	0	0	0	0	XXX
EXP.		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	XXX
OBS. REL. RISK		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
1956-60 OBS.	1	1	0	0	0	0	0	0	0	0	0	-0.1856
EXP.		0.41	0.22	0.07	0.08	0.10	0.06	0.04	0.01	0.00	0.00	0.3624
OBS. REL. RISK		1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.7773)
1961-65 OBS.	4	1	1	1	0	0	0	1	0	0	0	2.249
EXP.		2.00	0.95	0.20	0.23	0.30	0.18	0.09	0.02	0.00	0.01	3.772
OBS. REL. RISK		1.00	2.10	9.96	0.00	0.00	0.00	21.10	0.00	0.00	0.00	(0.2774)
1966-70 OBS.	7	3	2	0	0	1	0	0	0	0	1	1.276
EXP.		3.07	1.57	0.42	0.58	0.70	0.39	0.19	0.05	0.01	0.02	2.017
OBS. REL. RISK		1.00	1.30	0.00	0.00	1.47	0.00	0.00	0.00	0.00	50.52	(0.1213)
1971-75 OBS.	8	5	1	0	0	2	0	0	0	0	0	-0.1715
EXP.		3.85	1.81	0.43	0.60	0.77	0.41	0.22	0.07	0.03	0.02	0.2411
OBS. REL. RISK		1.00	0.40	0.00	0.00	1.90	0.00	0.00	0.00	0.00	0.00	(0.6242)
1976-80 OBS.	11	4	2	2	2	0	1	0	0	0	0	-0.1666
EXP.		4.85	2.41	0.73	0.82	1.06	0.58	0.34	0.12	0.04	0.05	0.2121
OBS. REL. RISK		1.00	1.01	3.32	2.96	0.00	2.08	0.00	0.00	0.00	0.00	(0.5657)
1981-85 OBS.	46	21	9	1	5	4	5	1	0	0	0	-0.1659
EXP.		19.95	10.77	2.93	3.39	4.47	2.37	1.34	0.46	0.16	0.18	0.1043
OBS. REL. RISK		1.00	0.79	0.32	1.40	0.85	2.00	0.71	0.00	0.00	0.00	(0.5967)
1983-85 OBS.	29	18	5	0	2	1	2	1	0	0	0	-0.1662
EXP.		12.51	6.74	1.91	2.14	2.86	1.50	0.85	0.29	0.11	0.10	0.1140
OBS. REL. RISK		1.00	0.52	0.00	0.65	0.24	0.93	0.82	0.00	0.00	0.00	(0.4839)

FITTED RELATIVE RISK AT 1 GRAY : 1.1216 ± 0.2714 (P-VALUE: 0.5716)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.2542	(-)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.5284	(-)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.1225	(-)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.9726	(+)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.0699	(-)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.0626	(-)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.3585	(+)	N.S

2-11 CANCERS OF THE GALL-BLADDER AND BILE DUCTS
胆嚢癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL	TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 OBS.	149	54	43	8	17	10	5	10	1	1	0	0.3730
TOTAL EXP.		69.28	37.12	7.70	9.84	12.55	7.02	3.74	1.05	0.31	0.38	0.2771
OBS. REL. RISK		1.00	1.49	1.33	2.22	1.02	0.91	3.43	1.22	4.12	0.00	(0.1269)
FITTED REL. RISK		1.00	1.01	1.03	1.05	1.12	1.25	1.50	1.89	2.20	2.88	
1950-55 OBS.	0	0	0	0	0	0	0	0	0	0	0	XXX
EXP.		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	XXX
OBS. REL. RISK		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
1956-60 OBS.	7	2	4	0	0	0	0	1	0	0	0	0.3243
EXP.		3.12	1.75	0.41	0.48	0.62	0.35	0.18	0.05	0.01	0.02	1.231
OBS. REL. RISK		1.00	3.57	0.00	0.00	0.00	0.00	8.53	0.00	0.00	0.00	(0.7401)
1961-65 OBS.	16	2	3	4	2	3	0	2	0	0	0	1.462
EXP.		7.16	3.80	0.91	1.17	1.50	0.85	0.43	0.11	0.02	0.05	1.431
OBS. REL. RISK		1.00	2.82	15.66	6.12	7.16	0.00	16.71	0.00	0.00	0.00	(0.1923)
1966-70 OBS.	21	4	12	1	1	1	1	1	0	0	0	-0.1585
EXP.		8.76	5.17	1.24	1.74	2.13	1.18	0.55	0.16	0.05	0.05	0.2568
OBS. REL. RISK		1.00	5.08	1.77	1.26	1.03	1.89	4.00	0.00	0.00	0.00	(0.6892)
1971-75 OBS.	22	6	3	2	4	3	1	2	1	0	0	2.097
EXP.		10.09	5.53	1.14	1.46	1.85	1.07	0.59	0.16	0.06	0.05	1.514
OBS. REL. RISK		1.00	0.91	2.95	4.60	2.73	1.58	5.73	10.27	0.00	0.00	(0.0345)
1976-80 OBS.	36	19	12	0	4	1	0	0	0	0	0	-0.1687
EXP.		17.44	9.27	1.69	2.10	2.62	1.58	0.90	0.26	0.07	0.08	0.0816
OBS. REL. RISK		1.00	1.19	0.00	1.75	0.35	0.00	0.00	0.00	0.00	0.00	(0.2453)
1981-85 OBS.	47	21	9	1	6	2	3	4	0	1	0	0.9576
EXP.		22.71	11.60	2.30	2.80	3.83	2.02	1.09	0.32	0.10	0.13	0.6914
OBS. REL. RISK		1.00	0.84	0.47	2.24	0.56	1.61	3.96	0.00	10.82	0.00	(0.0554)
1983-85 OBS.	29	14	2	1	6	1	2	2	0	1	0	1.272
EXP.		13.86	7.41	1.41	1.74	2.38	1.22	0.64	0.19	0.06	0.08	1.019
OBS. REL. RISK		1.00	0.27	0.70	3.42	0.42	1.62	3.08	0.00	17.52	0.00	(0.0652)

FITTED RELATIVE RISK AT 1 GRAY : 1.3730 ± 0.2771 (P-VALUE: 0.1269)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.8220	(-)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.8346	(-)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.1758	(+)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.7674	(-)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.9700	(-)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.9315	(+)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.2943	(-)	N.S

2-12 CANCER OF THE PANCREAS
膵臓癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL	TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 OBS.	191	79	48	17	13	15	11	7	1	0	0	-0.1058
TOTAL EXP.		83.92	46.29	11.04	14.35	17.82	9.92	5.24	1.44	0.44	0.54	0.1192
OBS. REL. RISK		1.00	1.10	1.64	0.96	0.89	1.18	1.42	0.74	0.00	0.00	(0.5270)
FITTED REL. RISK		1.00	1.00	0.99	0.99	0.97	0.93	0.86	0.75	0.66	0.47	
1950-55 OBS.	3	0	1	1	0	1	0	0	0	0	0	-0.1855
EXP.		1.22	0.69	0.20	0.26	0.32	0.18	0.09	0.02	0.01	0.01	0.1200
OBS. REL. RISK		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	(0.8065)
1956-60 OBS.	18	9	6	2	0	1	0	0	0	0	0	-0.1835
EXP.		8.46	4.39	0.93	1.19	1.48	0.88	0.48	0.12	0.04	0.05	0.1137
OBS. REL. RISK		1.00	1.29	2.02	0.00	0.64	0.00	0.00	0.00	0.00	0.00	(0.3681)
1961-65 OBS.	33	18	7	3	2	1	1	1	0	0	0	-0.1778
EXP.		14.15	7.64	2.01	2.65	3.23	1.91	0.98	0.26	0.07	0.10	0.0826
OBS. REL. RISK		1.00	0.72	1.17	0.59	0.24	0.41	0.81	0.00	0.00	0.00	(0.3428)
1966-70 OBS.	21	10	6	1	0	2	0	2	0	0	0	0.0146
EXP.		9.27	5.08	1.21	1.55	1.91	1.10	0.59	0.16	0.05	0.06	0.4842
OBS. REL. RISK		1.00	1.09	0.77	0.00	0.97	0.00	3.12	0.00	0.00	0.00	(1.0000)
1971-75 OBS.	39	13	13	3	2	3	3	1	1	0	0	0.2408
EXP.		17.57	9.64	2.17	2.79	3.42	1.93	1.01	0.29	0.09	0.10	0.4775
OBS. REL. RISK		1.00	1.82	1.87	0.97	1.19	2.10	1.34	4.73	0.00	0.00	(0.5839)
1976-80 OBS.	38	14	8	5	5	2	4	0	0	0	0	-0.1657
EXP.		16.43	9.18	2.25	2.94	3.66	1.97	1.08	0.28	0.09	0.11	0.0879
OBS. REL. RISK		1.00	1.02	2.61	1.99	0.64	2.38	0.00	0.00	0.00	0.00	(0.4543)
1981-85 OBS.	39	15	7	2	4	5	3	3	0	0	0	0.6054
EXP.		16.82	9.67	2.27	2.97	3.80	1.96	1.01	0.30	0.10	0.10	0.6186
OBS. REL. RISK		1.00	0.81	0.99	1.51	1.48	1.72	3.33	0.00	0.00	0.00	(0.2836)
1983-85 OBS.	24	10	5	1	2	3	2	1	0	0	0	0.1774
EXP.		10.30	6.04	1.41	1.86	2.35	1.18	0.58	0.17	0.06	0.05	0.5936
OBS. REL. RISK		1.00	0.85	0.73	1.11	1.32	1.75	1.77	0.00	0.00	0.00	(0.7773)

FITTED RELATIVE RISK AT 1 GRAY : 0.8942 ± 0.1192 (P-VALUE: 0.5270)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.4806	(-)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.5130	(-)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.0694	(-)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.8430	(+)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.2953	(-)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.3926	(-)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.2901	(-)	N.S

2-13 CANCERS OF THE DIGESTIVE ORGANS OTHER THAN AT2-6 THROUGH AT2-12
付表2-6から2-12に含まれていない消化器癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL	TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 OBS.	81	30	21	5	7	8	6	2	1	1	0	0.3226
TOTAL EXP.		35.94	19.75	4.60	5.91	7.56	4.13	2.16	0.57	0.16	0.23	0.3551
OBS. REL. RISK		1.00	1.27	1.30	1.42	1.27	1.74	1.11	2.08	7.61	0.00	(0.2899)
FITTED REL. RISK		1.00	1.01	1.02	1.05	1.10	1.22	1.43	1.77	2.04	2.63	
1950-55 OBS.	19	7	5	2	1	3	1	0	0	0	0	-0.1839
EXP.		8.83	4.70	0.96	1.29	1.62	0.88	0.50	0.13	0.04	0.06	0.1109
OBS. REL. RISK		1.00	1.34	2.62	0.98	2.34	1.43	0.00	0.00	0.00	0.00	(0.5777)
1956-60 OBS.	11	3	4	1	0	1	1	0	0	1	0	0.9597
EXP.		4.32	2.69	0.73	0.96	1.23	0.66	0.29	0.08	0.02	0.03	1.421
OBS. REL. RISK		1.00	2.14	1.96	0.00	1.17	2.19	0.00	0.00	83.51	0.00	(0.2367)
1961-65 OBS.	17	9	4	1	2	1	0	0	0	0	0	-0.1777
EXP.		7.59	4.27	0.95	1.18	1.56	0.85	0.43	0.11	0.02	0.04	0.1051
OBS. REL. RISK		1.00	0.79	0.89	1.43	0.54	0.00	0.00	0.00	0.00	0.00	(0.4201)
1966-70 OBS.	12	3	3	1	0	2	3	0	0	0	0	1.102
EXP.		5.23	2.90	0.68	0.92	1.12	0.65	0.33	0.10	0.03	0.03	1.404
OBS. REL. RISK		1.00	1.80	2.55	0.00	3.10	8.00	0.00	0.00	0.00	0.00	(0.3929)
1971-75 OBS.	8	2	2	0	3	0	0	1	0	0	0	0.5051
EXP.		3.36	1.93	0.53	0.65	0.79	0.44	0.21	0.06	0.02	0.02	1.272
OBS. REL. RISK		1.00	1.74	0.00	7.76	0.00	0.00	7.91	0.00	0.00	0.00	(0.6315)
1976-80 OBS.	7	3	2	0	0	0	1	1	0	0	0	0.9979
EXP.		2.95	1.73	0.43	0.52	0.70	0.36	0.20	0.06	0.02	0.02	1.726
OBS. REL. RISK		1.00	1.14	0.00	0.00	0.00	2.73	4.82	0.00	0.00	0.00	(0.3994)
1981-85 OBS.	7	3	1	0	1	1	0	0	1	0	0	1.688
EXP.		3.67	1.53	0.31	0.39	0.54	0.28	0.21	0.04	0.01	0.02	2.314
OBS. REL. RISK		1.00	0.80	0.00	3.17	2.27	0.00	0.00	30.30	0.00	0.00	(0.2073)
1983-85 OBS.	5	1	1	0	1	1	0	0	1	0	0	4.567
EXP.		2.73	1.07	0.22	0.27	0.34	0.19	0.11	0.03	0.01	0.02	5.384
OBS. REL. RISK		1.00	2.54	0.00	10.13	8.04	0.00	0.00	87.95	0.00	0.00	(0.0793)

FITTED RELATIVE RISK AT 1 GRAY : 1.3226 ± 0.3551 (P-VALUE: 0.2899)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.1615	(-)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.1930	(-)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.9031	(-)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.6546	(+)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.2077	(+)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.1685	(+)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.6085	(-)	N.S

2-14 CANCERS OF THE RESPIRATORY SYSTEM
呼吸器癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL		TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85	OBS.	747	298	175	50	52	77	45	31	12	3	4	0.4004
TOTAL	EXP.		346.60	172.05	41.51	53.05	66.24	37.20	20.98	5.35	1.66	2.35	0.1206
	OBS. REL. RISK		1.00	1.18	1.40	1.14	1.35	1.41	1.72	2.61	2.10	1.98	(0.0001)
	FITTED REL. RISK		1.00	1.01	1.03	1.08	1.12	1.27	1.54	1.95	2.29	3.02	
1950-55	OBS.	29	11	9	3	2	4	0	0	0	0	0	-0.1844
	EXP.		13.06	6.91	1.64	2.10	2.67	1.49	0.78	0.19	0.06	0.10	0.0741
	OBS. REL. RISK		1.00	1.55	2.17	1.13	1.78	0.00	0.00	0.00	0.00	0.00	(0.3149)
1956-60	OBS.	42	16	8	2	3	4	5	2	1	0	1	1.359
	EXP.		20.30	9.66	2.12	2.77	3.46	1.94	1.22	0.28	0.09	0.15	0.8336
	OBS. REL. RISK		1.00	1.05	1.20	1.37	1.47	3.27	2.09	4.49	0.00	8.25	(0.0122)
1961-65	OBS.	87	24	27	7	7	11	4	6	1	0	0	0.3740
	EXP.		39.22	19.68	5.08	6.47	8.13	4.73	2.59	0.62	0.20	0.28	0.3420
	OBS. REL. RISK		1.00	2.24	2.25	1.77	2.21	1.38	3.79	2.63	0.00	0.00	(0.2488)
1966-70	OBS.	133	55	25	8	13	16	8	5	3	0	0	0.3852
	EXP.		61.84	30.69	7.50	9.38	11.56	6.76	3.86	0.92	0.26	0.42	0.2850
	OBS. REL. RISK		1.00	0.92	1.20	1.56	1.56	1.33	1.54	3.67	0.00	0.00	(0.1389)
1971-75	OBS.	139	54	30	8	14	11	12	4	2	1	3	0.7079
	EXP.		64.26	31.79	7.76	10.23	12.24	7.07	3.86	1.04	0.31	0.44	0.3391
	OBS. REL. RISK		1.00	1.12	1.23	1.63	1.07	2.02	1.23	2.29	3.87	8.08	(0.0022)
1976-80	OBS.	160	69	37	12	6	13	9	10	4	0	0	0.4392
	EXP.		73.46	37.26	9.00	11.50	14.41	7.85	4.57	1.13	0.37	0.45	0.2709
	OBS. REL. RISK		1.00	1.06	1.42	0.56	0.96	1.22	2.33	3.76	0.00	0.00	(0.0557)
1981-85	OBS.	157	69	39	10	7	18	7	4	1	2	0	0.0743
	EXP.		74.47	38.07	8.41	10.59	13.75	7.37	4.31	1.17	0.36	0.51	0.1895
	OBS. REL. RISK		1.00	1.17	1.28	0.71	1.41	1.03	1.00	0.93	5.92	0.00	(0.6801)
1983-85	OBS.	93	39	24	6	5	10	4	4	1	0	0	0.0108
	EXP.		43.77	21.25	5.01	6.39	8.29	4.45	2.62	0.71	0.21	0.29	0.2233
	OBS. REL. RISK		1.00	1.27	1.34	0.88	1.35	1.01	1.71	1.59	0.00	0.00	(1.0000)

FITTED RELATIVE RISK AT 1 GRAY : 1.4004 ± 0.1206 (P-VALUE: 0.0001)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.0504	(-)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.8195	(-)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.2196	(+)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.7436	(-)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.4438	(-)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.3489	(-)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.1531	(-)	N.S

2-15 CANCER OF THE LUNG
肺癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL	TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 OBS.	638	253	151	42	40	68	38	28	11	3	3	0.4605
TOTAL EXP.		296.94	146.64	35.37	45.21	56.45	31.61	17.79	4.57	1.42	2.01	0.1364
OBS. REL. RISK		1.00	1.21	1.33	1.04	1.41	1.41	1.91	2.83	2.48	1.76	(0.0000)
FITTED REL. RISK		1.00	1.01	1.03	1.06	1.14	1.31	1.62	2.10	2.49	3.33	
1950-55 OBS.	16	5	6	2	2	1	0	0	0	0	0	-0.1838
EXP.		7.45	3.81	0.84	1.12	1.43	0.77	0.40	0.10	0.03	0.05	0.1153
OBS. REL. RISK		1.00	2.34	3.54	2.66	1.04	0.00	0.00	0.00	0.00	0.00	(0.4463)
1956-60 OBS.	28	14	3	1	1	3	4	1	1	0	0	0.9441
EXP.		13.50	6.37	1.44	1.86	2.31	1.31	0.84	0.20	0.07	0.11	0.8420
OBS. REL. RISK		1.00	0.45	0.67	0.52	1.25	2.95	1.14	4.91	0.00	0.00	(0.1492)
1961-65 OBS.	69	19	22	4	6	8	3	6	1	0	0	0.5774
EXP.		30.88	15.60	4.06	5.23	6.53	3.78	2.05	0.49	0.15	0.23	0.4431
OBS. REL. RISK		1.00	2.29	1.60	1.86	1.99	1.29	4.75	3.32	0.00	0.00	(0.1261)
1966-70 OBS.	114	47	21	7	10	15	6	5	3	0	0	0.5235
EXP.		53.56	26.28	6.32	7.90	9.76	5.72	3.10	0.78	0.22	0.36	0.3107
OBS. REL. RISK		1.00	0.91	1.26	1.44	1.75	1.20	1.84	4.39	0.00	0.00	(0.0736)
1971-75 OBS.	115	43	26	8	10	10	10	3	1	1	3	0.7203
EXP.		53.21	26.28	6.42	8.47	10.10	5.83	3.20	0.86	0.26	0.36	0.3755
OBS. REL. RISK		1.00	1.22	1.54	1.46	1.23	2.12	1.16	1.44	4.79	10.19	(0.0039)
1976-80 OBS.	150	61	35	12	6	13	9	10	4	0	0	0.5626
EXP.		68.95	34.90	8.45	10.76	13.53	7.35	4.20	1.07	0.35	0.43	0.3026
OBS. REL. RISK		1.00	1.13	1.61	0.63	1.09	1.38	2.69	4.21	0.00	0.00	(0.0232)
1981-85 OBS.	146	64	38	8	5	18	6	4	1	2	0	0.1048
EXP.		69.39	33.40	7.84	9.86	12.79	6.85	3.99	1.07	0.34	0.47	0.2051
OBS. REL. RISK		1.00	1.23	1.11	0.55	1.53	0.95	1.09	1.01	6.37	0.00	(0.5777)
1983-85 OBS.	86	36	23	4	4	10	4	4	1	0	0	0.0742
EXP.		40.46	19.54	4.67	5.98	7.69	4.13	2.42	0.65	0.20	0.27	0.2564
OBS. REL. RISK		1.00	1.32	0.96	0.75	1.46	1.09	1.85	1.73	0.00	0.00	(0.7518)

FITTED RELATIVE RISK AT 1 GRAY : 1.4605 ± 0.1364 (P-VALUE: 0.0000)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.0576	(-)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.8494	(-)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.1186	(+)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.9207	(-)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.4717	(-)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.3464	(-)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.1115	(-)	N.S

2-16 CANCER OF THE FEMALE BREAST
女性乳癌

HIROSHIMA + NAGASAKI, FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL	TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 OBS.	155	57	39	5	10	14	15	9	2	2	2	1.004
TOTAL EXP.		66.73	39.88	8.49	11.40	14.34	8.13	3.86	1.33	0.43	0.40	0.3769
OBS. REL. RISK		1.00	1.14	0.69	1.03	1.14	2.16	2.73	1.76	5.41	5.81	(0.0001)
FITTED REL. RISK		1.00	1.02	1.07	1.14	1.31	1.68	2.35	3.39	4.24	6.07	
1950-55 OBS.	15	4	6	1	2	0	2	0	0	0	0	-0.1640
EXP.		6.53	3.96	0.77	1.09	1.34	0.75	0.36	0.12	0.03	0.04	0.3232
OBS. REL. RISK		1.00	2.48	2.11	2.99	0.00	4.34	0.00	0.00	0.00	0.00	(0.7290)
1956-60 OBS.	16	9	2	0	1	1	3	0	0	0	0	0.0128
EXP.		6.78	4.14	0.87	1.25	1.55	0.85	0.39	0.12	0.03	0.04	0.5925
OBS. REL. RISK		1.00	0.36	0.00	0.60	0.49	2.66	0.00	0.00	0.00	0.00	(1.0000)
1961-65 OBS.	28	12	9	0	1	2	2	2	0	0	0	0.2323
EXP.		11.99	7.35	1.53	2.07	2.66	1.40	0.66	0.22	0.05	0.07	0.5784
OBS. REL. RISK		1.00	1.22	0.00	0.48	0.75	1.43	3.01	0.00	0.00	0.00	(0.6714)
1966-70 OBS.	22	5	4	1	1	5	1	2	1	1	1	4.029
EXP.		9.52	5.58	1.20	1.60	2.03	1.17	0.58	0.19	0.06	0.06	2.392
OBS. REL. RISK		1.00	1.37	1.59	1.19	4.69	1.62	6.61	9.81	29.62	34.12	(0.0002)
1971-75 OBS.	21	9	7	2	0	1	2	0	0	0	0	-0.1622
EXP.		9.07	5.30	1.18	1.55	1.91	1.14	0.54	0.19	0.07	0.06	0.2186
OBS. REL. RISK		1.00	1.33	1.70	0.00	0.53	1.76	0.00	0.00	0.00	0.00	(0.4930)
1976-80 OBS.	26	8	4	1	3	5	1	2	1	0	1	1.964
EXP.		11.01	6.68	1.48	1.95	2.43	1.40	0.65	0.25	0.10	0.08	1.291
OBS. REL. RISK		1.00	0.82	0.94	2.12	2.84	0.98	4.21	5.61	0.00	18.06	(0.0077)
1981-85 OBS.	27	10	7	0	2	0	4	3	0	1	0	1.552
EXP.		11.84	6.87	1.47	1.90	2.43	1.41	0.68	0.24	0.09	0.07	1.110
OBS. REL. RISK		1.00	1.21	0.00	1.25	0.00	3.36	5.25	0.00	13.03	0.00	(0.0218)
1983-85 OBS.	14	5	4	0	1	0	2	1	0	1	0	1.592
EXP.		6.10	3.84	0.77	0.99	1.25	0.70	0.33	0.12	0.05	0.04	1.573
OBS. REL. RISK		1.00	1.34	0.00	1.23	0.00	3.47	3.66	0.00	24.68	0.00	(0.0719)

FITTED RELATIVE RISK AT 1 GRAY : 2.0038 ± 0.3769 (P-VALUE: 0.0001)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	XXX N (X) NOT APPLICABLE			
SEX(MALE VS. FEMALE) ABSOLUTE	XXX N (X) NOT APPLICABLE			
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.1014	(+)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.5054	(-)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.1898	(+)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.4270	(+)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.7872	(-)	N.S

2-17 CANCERS OF THE CERVIX UTERI AND UTERUS
子宮頸部及び子宮体癌

HIROSHIMA + NAGASAKI, FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL		TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85	OBS.	382	142	106	32	32	32	18	10	6	2	2	0.2206
TOTAL	EXP.		161.87	99.08	21.46	29.32	36.48	20.02	9.14	2.99	0.75	0.87	0.1544
	OBS. REL. RISK		1.00	1.22	1.70	1.24	1.00	1.02	1.25	2.29	3.04	2.61	(0.0755)
	FITTED REL. RISK		1.00	1.00	1.02	1.03	1.07	1.15	1.30	1.53	1.71	2.11	
1950-55	OBS.	69	14	26	4	8	6	6	2	2	0	1	1.024
	EXP.		28.80	18.20	3.75	5.15	6.42	3.54	1.57	0.49	0.12	0.16	0.6043
	OBS. REL. RISK		1.00	3.02	2.26	3.29	1.97	3.58	2.70	8.65	0.00	13.04	(0.0140)
1956-60	OBS.	55	28	12	5	1	5	1	2	1	0	0	-0.0148
	EXP.		23.53	14.46	3.01	4.13	5.16	2.82	1.26	0.40	0.10	0.13	0.3122
	OBS. REL. RISK		1.00	0.70	1.40	0.20	0.81	0.30	1.33	2.08	0.00	0.00	(1.0000)
1961-65	OBS.	39	10	14	1	6	3	5	0	0	0	0	-0.1172
	EXP.		16.23	10.18	2.24	3.08	3.90	2.04	0.91	0.29	0.05	0.09	0.2840
	OBS. REL. RISK		1.00	2.23	0.72	3.18	1.25	3.99	0.00	0.00	0.00	0.00	(0.7773)
1966-70	OBS.	54	20	14	8	4	6	2	0	0	0	0	-0.1665
	EXP.		22.35	13.80	3.14	4.34	5.41	2.93	1.34	0.45	0.11	0.12	0.0443
	OBS. REL. RISK		1.00	1.13	2.85	1.03	1.24	0.76	0.00	0.00	0.00	0.00	(0.2435)
1971-75	OBS.	64	25	16	7	6	4	2	3	0	1	0	0.1483
	EXP.		27.68	16.63	3.54	4.73	5.77	3.29	1.57	0.54	0.12	0.16	0.3442
	OBS. REL. RISK		1.00	1.06	2.19	1.40	0.77	0.67	2.12	0.00	9.26	0.00	(0.6171)
1976-80	OBS.	52	25	10	6	3	4	1	1	1	0	1	0.2101
	EXP.		21.75	13.26	2.99	4.14	5.13	2.81	1.26	0.41	0.12	0.12	0.4065
	OBS. REL. RISK		1.00	0.66	1.75	0.63	0.68	0.31	0.69	2.11	0.00	7.13	(0.4463)
1981-85	OBS.	49	20	14	1	4	4	1	2	2	1	0	0.5685
	EXP.		20.75	12.55	2.79	3.76	4.69	2.60	1.23	0.41	0.13	0.10	0.5474
	OBS. REL. RISK		1.00	1.16	0.37	1.10	0.88	0.40	1.69	5.12	7.96	0.00	(0.1213)
1983-85	OBS.	37	14	13	1	4	0	1	1	2	1	0	0.5259
	EXP.		15.43	9.48	2.16	2.92	3.63	1.97	0.94	0.30	0.10	0.07	0.6146
	OBS. REL. RISK		1.00	1.51	0.51	1.51	0.00	0.56	1.17	7.37	10.83	0.00	(0.1658)

FITTED RELATIVE RISK AT 1 GRAY : 1.2206 ± 0.1544 (P-VALUE: 0.0755)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE		P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	XXX N (X)	NOT APPLICABLE			
SEX(MALE VS. FEMALE) ABSOLUTE	XXX N (X)	NOT APPLICABLE			
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0		0.2637	(-)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0		0.9405	(-)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960	T<1960:0	0.9651	(+)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970	T<1970:0	0.3688	(+)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2		0.3867	(+)	N.S

2-18 CANCER OF THE CERVIX UTERI
子宮頸癌

HIROSHIMA + NAGASAKI, FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL		TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85	OBS.	90	35	18	10	6	10	6	3	1	1	0	0.4262
TOTAL	EXP.		39.82	23.66	4.71	6.22	7.79	4.48	2.19	0.73	0.19	0.22	0.3681
	OBS. REL. RISK		1.00	0.87	2.42	1.10	1.46	1.53	1.56	1.56	5.90	0.00	(0.1726)
	FITTED REL. RISK		1.00	1.01	1.03	1.06	1.13	1.29	1.57	2.01	2.38	3.15	
1950-55	OBS.	11	1	4	0	3	1	2	0	0	0	0	1.015
	EXP.		4.59	2.85	0.63	0.88	1.10	0.59	0.24	0.07	0.02	0.03	1.533
	OBS. REL. RISK		1.00	6.45	0.00	15.89	4.17	15.46	0.00	0.00	0.00	0.00	(0.4930)
1956-60	OBS.	10	5	2	1	0	0	1	1	0	0	0	0.7283
	EXP.		4.66	2.75	0.48	0.59	0.74	0.44	0.22	0.08	0.02	0.02	1.354
	OBS. REL. RISK		1.00	0.68	1.94	0.00	0.00	2.13	4.23	0.00	0.00	0.00	(0.4884)
1961-65	OBS.	10	5	2	0	1	1	1	0	0	0	0	-0.0372
	EXP.		4.83	2.76	0.44	0.55	0.72	0.40	0.21	0.06	0.01	0.02	0.7600
	OBS. REL. RISK		1.00	0.70	0.00	1.77	1.34	2.39	0.00	0.00	0.00	0.00	(1.0000)
1966-70	OBS.	15	4	5	4	1	1	0	0	0	0	0	-0.1648
	EXP.		6.51	3.88	0.80	1.09	1.36	0.78	0.38	0.13	0.03	0.03	0.2583
	OBS. REL. RISK		1.00	2.10	8.14	1.49	1.20	0.00	0.00	0.00	0.00	0.00	(0.4751)
1971-75	OBS.	15	6	3	1	0	3	1	1	0	0	0	0.6735
	EXP.		6.84	4.01	0.75	0.95	1.16	0.72	0.38	0.13	0.03	0.04	1.038
	OBS. REL. RISK		1.00	0.85	1.51	0.00	2.96	1.58	3.02	0.00	0.00	0.00	(0.4795)
1976-80	OBS.	15	6	1	4	0	3	0	1	0	0	0	0.0525
	EXP.		6.62	3.89	0.78	1.05	1.32	0.75	0.38	0.13	0.04	0.04	0.5928
	OBS. REL. RISK		1.00	0.28	5.85	0.00	2.51	0.00	2.90	0.00	0.00	0.00	(0.8876)
1981-85	OBS.	14	8	1	0	1	1	1	0	1	1	0	1.266
	EXP.		5.77	3.53	0.83	1.12	1.39	0.79	0.37	0.13	0.05	0.03	1.384
	OBS. REL. RISK		1.00	0.20	0.00	0.65	0.52	0.92	0.00	5.61	15.38	0.00	(0.0864)
1983-85	OBS.	12	7	1	0	1	0	1	0	1	1	0	1.385
	EXP.		5.01	3.02	0.70	0.94	1.18	0.66	0.32	0.10	0.04	0.03	1.578
	OBS. REL. RISK		1.00	0.24	0.00	0.76	0.00	1.08	0.00	6.84	17.69	0.00	(0.0769)

FITTED RELATIVE RISK AT 1 GRAY : 1.4262 ± 0.3681 (P-VALUE: 0.1726)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE		P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	XXX N	(X) NOT APPLICABLE			
SEX(MALE VS. FEMALE) ABSOLUTE	XXX N	(X) NOT APPLICABLE			
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0		0.2592	(-)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0		0.3431	(-)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960	T<1960:0	0.5127	(+)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970	T<1970:0	0.2489	(+)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2		0.4230	(-)	N.S

2-19 CANCER OF THE OVARY
卵巣癌

HIROSHIMA + NAGASAKI, FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL	TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 OBS.	82	31	18	1	8	11	6	5	1	1	0	0.8098
TOTAL EXP.		34.32	21.18	4.63	6.42	7.95	4.38	2.03	0.69	0.22	0.19	0.4781
OBS. REL. RISK		1.00	0.94	0.24	1.38	1.53	1.52	2.72	1.60	5.03	0.00	(0.0286)
FITTED REL. RISK		1.00	1.02	1.06	1.11	1.25	1.55	2.09	2.93	3.62	5.09	
1950-55 OBS.	6	3	1	0	1	0	0	1	0	0	0	0.9683
EXP.		2.65	1.63	0.32	0.41	0.52	0.28	0.13	0.04	0.01	0.01	2.053
OBS. REL. RISK		1.00	0.54	0.00	2.16	0.00	0.00	6.75	0.00	0.00	0.00	(0.4839)
1956-60 OBS.	7	4	2	0	1	0	0	0	0	0	0	-0.1777
EXP.		3.04	1.86	0.38	0.51	0.66	0.35	0.15	0.04	0.01	0.01	0.3538
OBS. REL. RISK		1.00	0.82	0.00	1.50	0.00	0.00	0.00	0.00	0.00	0.00	(0.5902)
1961-65 OBS.	12	3	5	0	0	3	1	0	0	0	0	-0.1796
EXP.		5.04	3.03	0.64	0.96	1.15	0.66	0.33	0.12	0.03	0.03	0.2511
OBS. REL. RISK		1.00	2.77	0.00	0.00	4.36	2.56	0.00	0.00	0.00	0.00	(0.7518)
1966-70 OBS.	13	5	2	0	1	2	2	0	1	0	0	1.712
EXP.		5.30	3.37	0.77	1.07	1.31	0.70	0.32	0.11	0.03	0.03	1.771
OBS. REL. RISK		1.00	0.63	0.00	0.99	1.62	3.03	0.00	9.61	0.00	0.00	(0.1285)
1971-75 OBS.	11	5	0	0	1	1	2	2	0	0	0	2.681
EXP.		4.45	2.78	0.66	0.91	1.10	0.63	0.29	0.11	0.04	0.03	2.461
OBS. REL. RISK		1.00	0.00	0.00	0.98	0.81	2.84	6.12	0.00	0.00	0.00	(0.0547)
1976-80 OBS.	17	5	6	0	2	0	1	2	0	1	0	1.326
EXP.		7.01	4.46	0.97	1.33	1.69	0.90	0.42	0.14	0.04	0.05	1.312
OBS. REL. RISK		1.00	1.88	0.00	2.11	0.00	1.56	6.68	0.00	31.69	0.00	(0.0773)
1981-85 OBS.	16	6	2	1	2	5	0	0	0	0	0	-0.1807
EXP.		6.84	4.02	0.89	1.24	1.52	0.86	0.39	0.14	0.06	0.03	0.2364
OBS. REL. RISK		1.00	0.57	1.27	1.84	3.75	0.00	0.00	0.00	0.00	0.00	(0.6468)
1983-85 OBS.	7	4	1	1	0	1	0	0	0	0	0	-0.1871
EXP.		2.98	1.73	0.40	0.54	0.68	0.39	0.18	0.06	0.03	0.02	0.2485
OBS. REL. RISK		1.00	0.43	1.88	0.00	1.10	0.00	0.00	0.00	0.00	0.00	(0.5839)

FITTED RELATIVE RISK AT 1 GRAY : 1.8098 ± 0.4781 (P-VALUE: 0.0286)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	XXX N (X) NOT APPLICABLE			
SEX(MALE VS. FEMALE) ABSOLUTE	XXX N (X) NOT APPLICABLE			
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.4089	(+)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.0687	(+)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.5914	(+)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.9625	(-)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.2900	(-)	N.S

2-20 CANCER OF THE PROSTATE
前立腺癌

HIROSHIMA + NAGASAKI, MALES, ALL AGES ATB

FOLLOWUP INTERVAL	TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 OBS.	52	30	8	3	5	1	2	2	0	1	0	0.0497
TOTAL EXP.		25.37	10.98	2.90	3.63	4.35	2.51	1.64	0.33	0.11	0.18	0.3128
OBS. REL. RISK		1.00	0.62	0.88	1.16	0.19	0.67	1.03	0.00	7.91	0.00	(0.8625)
FITTED REL. RISK		1.00	1.00	1.00	1.01	1.02	1.03	1.07	1.12	1.16	1.25	
1950-55 OBS.	2	0	1	1	0	0	0	0	0	0	0	-0.1871
EXP.		0.83	0.45	0.14	0.16	0.20	0.12	0.07	0.02	0.01	0.01	0.1481
OBS. REL. RISK		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	(0.7401)
1956-60 OBS.	2	1	1	0	0	0	0	0	0	0	0	-0.1864
EXP.		1.06	0.41	0.10	0.11	0.15	0.09	0.06	0.01	0.00	0.01	0.0575
OBS. REL. RISK		1.00	2.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.7401)
1961-65 OBS.	7	5	1	0	0	0	0	1	0	0	0	0.2140
EXP.		3.52	1.49	0.36	0.44	0.55	0.34	0.22	0.04	0.02	0.03	1.028
OBS. REL. RISK		1.00	0.47	0.00	0.00	0.00	0.00	3.22	0.00	0.00	0.00	(0.8065)
1966-70 OBS.	4	4	0	0	0	0	0	0	0	0	0	-0.1796
EXP.		1.86	0.89	0.24	0.29	0.34	0.21	0.13	0.03	0.01	0.01	0.2412
OBS. REL. RISK		1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.6242)
1971-75 OBS.	10	4	2	1	3	0	0	0	0	0	0	-0.1747
EXP.		4.83	2.10	0.57	0.71	0.82	0.51	0.32	0.07	0.02	0.04	0.1219
OBS. REL. RISK		1.00	1.15	2.11	5.09	0.00	0.00	0.00	0.00	0.00	0.00	(0.5220)
1976-80 OBS.	11	6	1	0	0	1	2	0	0	1	0	2.001
EXP.		5.65	2.28	0.57	0.74	0.85	0.47	0.36	0.06	0.02	0.03	2.097
OBS. REL. RISK		1.00	0.41	0.00	0.00	1.11	4.00	0.00	0.00	55.37	0.00	(0.0741)
1981-85 OBS.	16	10	2	1	2	0	0	1	0	0	0	-0.1597
EXP.		7.62	3.34	0.93	1.19	1.45	0.78	0.49	0.10	0.03	0.06	0.1846
OBS. REL. RISK		1.00	0.46	0.82	1.28	0.00	0.00	1.55	0.00	0.00	0.00	(0.6101)
1983-85 OBS.	13	7	2	1	2	0	0	1	0	0	0	-0.1560
EXP.		6.13	2.71	0.74	1.00	1.22	0.64	0.40	0.09	0.02	0.05	0.2368
OBS. REL. RISK		1.00	0.65	1.19	1.75	0.00	0.00	2.21	0.00	0.00	0.00	(0.7401)

FITTED RELATIVE RISK AT 1 GRAY : 1.0497 ± 0.3128 (P-VALUE: 0.8625)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	XXX N (X) NOT APPLICABLE			
SEX(MALE VS. FEMALE) ABSOLUTE	XXX N (X) NOT APPLICABLE			
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.6966	(-)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.6077	(+)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.5858	(+)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.6039	(+)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.7032	(+)	N.S

2-21 CANCER OF THE URINARY TRACT
泌尿器癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL	TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 OBS.	133	49	30	6	8	14	13	8	4	0	1	1.019
TOTAL EXP.		58.99	31.26	7.88	10.01	12.49	6.97	3.70	1.00	0.30	0.40	0.4086
OBS. REL. RISK		1.00	1.16	0.92	0.96	1.35	2.24	2.60	4.84	0.00	2.98	(0.0004)
FITTED REL. RISK		1.00	1.02	1.07	1.14	1.32	1.69	2.37	3.42	4.29	6.14	
1950-55 OBS.	8	2	3	0	1	1	1	0	0	0	0	-0.1846
EXP.		3.27	1.83	0.54	0.66	0.85	0.48	0.25	0.06	0.02	0.03	0.1104
OBS. REL. RISK		1.00	2.68	0.00	2.46	1.93	3.37	0.00	0.00	0.00	0.00	(0.7518)
1956-60 OBS.	11	5	4	0	1	0	0	1	0	0	0	-0.1779
EXP.		4.49	2.44	0.77	0.92	1.14	0.69	0.37	0.10	0.03	0.04	0.2021
OBS. REL. RISK		1.00	1.47	0.00	0.97	0.00	0.00	2.42	0.00	0.00	0.00	(0.7184)
1961-65 OBS.	25	7	8	4	2	1	2	1	0	0	0	-0.0302
EXP.		10.86	6.07	1.45	1.93	2.43	1.34	0.63	0.18	0.04	0.07	0.4282
OBS. REL. RISK		1.00	2.05	4.27	1.61	0.64	2.31	2.45	0.00	0.00	0.00	(0.9204)
1966-70 OBS.	17	6	1	0	1	1	2	4	1	0	1	4.724
EXP.		7.48	3.66	1.08	1.37	1.62	1.02	0.51	0.14	0.06	0.06	3.127
OBS. REL. RISK		1.00	0.34	0.00	0.91	0.77	2.44	9.81	8.60	0.00	20.45	(0.0001)
1971-75 OBS.	28	15	6	1	2	3	1	0	0	0	0	-0.1666
EXP.		12.77	6.77	1.57	1.99	2.48	1.37	0.71	0.19	0.06	0.08	0.0342
OBS. REL. RISK		1.00	0.78	0.54	0.85	1.03	0.62	0.00	0.00	0.00	0.00	(0.3929)
1976-80 OBS.	19	4	4	1	0	5	4	1	0	0	0	2.850
EXP.		8.15	4.48	1.21	1.53	1.86	0.99	0.54	0.15	0.05	0.05	1.994
OBS. REL. RISK		1.00	1.82	1.69	0.00	5.49	8.27	3.77	0.00	0.00	0.00	(0.0383)
1981-85 OBS.	25	10	4	0	1	3	3	1	3	0	0	2.670
EXP.		11.96	6.02	1.26	1.59	2.11	1.07	0.69	0.18	0.05	0.07	1.648
OBS. REL. RISK		1.00	0.79	0.00	0.75	1.70	3.35	1.74	20.49	0.00	0.00	(0.0020)
1983-85 OBS.	17	7	3	0	1	2	2	0	2	0	0	2.145
EXP.		8.25	4.09	0.87	1.02	1.42	0.70	0.46	0.11	0.02	0.05	1.743
OBS. REL. RISK		1.00	0.87	0.00	1.15	1.66	3.38	0.00	20.70	0.00	0.00	(0.0291)

FITTED RELATIVE RISK AT 1 GRAY : 2.0187 ± 0.4086 (P-VALUE: 0.0004)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.9171	(-)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.2896	(+)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.2068	(+)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.4748	(-)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.0456	(+)	1960+ > -1960
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.1232	(+)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.2929	(-)	N.S

2-22 MALIGNANT LYMPHOMA
悪性リンパ腫

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL	TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 OBS.	110	63	16	6	7	10	3	3	2	0	0	-0.0476
TOTAL EXP.		53.22	26.09	5.57	6.89	8.71	5.09	2.96	0.85	0.24	0.38	0.1806
OBS. REL. RISK		1.00	0.52	0.91	0.86	0.97	0.50	0.86	1.99	0.00	0.00	(0.8065)
FITTED REL. RISK		1.00	1.00	1.00	0.99	0.99	0.97	0.94	0.89	0.85	0.76	
1950-59 OBS.	8	5	1	0	0	1	0	0	1	0	0	0.5619
EXP.		3.65	1.81	0.45	0.57	0.72	0.43	0.24	0.07	0.03	0.04	1.186
OBS. REL. RISK		1.00	0.40	0.00	0.00	1.02	0.00	0.00	10.50	0.00	0.00	(0.4624)
1956-60 OBS.	8	4	2	0	2	0	0	0	0	0	0	-0.1824
EXP.		4.02	2.06	0.35	0.43	0.57	0.33	0.18	0.05	0.00	0.02	0.1611
OBS. REL. RISK		1.00	0.98	0.00	4.70	0.00	0.00	0.00	0.00	0.00	0.00	(0.8101)
1961-65 OBS.	10	5	3	0	0	0	0	1	1	0	0	1.032
EXP.		4.85	2.45	0.50	0.59	0.76	0.44	0.27	0.08	0.02	0.04	1.456
OBS. REL. RISK		1.00	1.19	0.00	0.00	0.00	0.00	3.58	12.48	0.00	0.00	(0.2176)
1966-70 OBS.	23	13	3	1	1	3	1	1	0	0	0	-0.0087
EXP.		11.51	5.51	1.11	1.32	1.71	1.00	0.58	0.15	0.04	0.08	0.4510
OBS. REL. RISK		1.00	0.48	0.80	0.67	1.56	0.88	1.53	0.00	0.00	0.00	(1.0000)
1971-75 OBS.	19	9	2	3	2	1	2	0	0	0	0	-0.1645
EXP.		8.62	4.38	1.10	1.45	1.69	0.98	0.51	0.15	0.04	0.06	0.1854
OBS. REL. RISK		1.00	0.44	2.61	1.32	0.57	1.93	0.00	0.00	0.00	0.00	(0.6033)
1976-80 OBS.	22	14	3	1	1	3	0	0	0	0	0	-0.1660
EXP.		10.81	5.05	1.15	1.35	1.69	1.01	0.60	0.20	0.06	0.08	0.1241
OBS. REL. RISK		1.00	0.46	0.67	0.57	1.37	0.00	0.00	0.00	0.00	0.00	(0.3771)
1981-85 OBS.	20	13	2	1	1	2	0	1	0	0	0	-0.1666
EXP.		9.75	4.83	0.91	1.19	1.58	0.89	0.58	0.16	0.06	0.06	0.0557
OBS. REL. RISK		1.00	0.31	0.82	0.63	0.95	0.00	1.29	0.00	0.00	0.00	(0.6242)
1983-85 OBS.	12	6	1	1	1	2	0	1	0	0	0	0.1286
EXP.		5.63	2.77	0.59	0.84	1.09	0.58	0.32	0.10	0.04	0.03	0.7284
OBS. REL. RISK		1.00	0.34	1.58	1.12	1.73	0.00	2.89	0.00	0.00	0.00	(0.8415)

FITTED RELATIVE RISK AT 1 GRAY : 0.9524 ± 0.1808 (P-VALUE: 0.8065)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.6710	(-)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.7045	(-)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.2043	(-)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.2824	(-)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.1555	(+)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.2071	(+)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.6172	(-)	N.S

2-23 MULTIPLE MYELOMA
多発性骨髄腫

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL	TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 OBS.	36	13	9	1	0	7	2	1	0	1	2	1.861
TOTAL EXP.		17.34	8.73	1.76	2.31	2.97	1.63	0.86	0.24	0.06	0.09	1.116
OBS. REL. RISK		1.00	1.38	0.76	0.00	3.15	1.64	1.55	0.00	22.00	28.64	(0.0019)
FITTED REL. RISK		1.00	1.04	1.13	1.26	1.58	2.27	3.49	5.43	7.01	10.40	
1950-55 OBS.	1	0	0	0	0	1	0	0	0	0	0	24.33
EXP.		0.37	0.27	0.07	0.09	0.11	0.06	0.03	0.01	0.00	0.00	86.47
OBS. REL. RISK		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	(0.3149)
1956-60 OBS.	2	0	1	0	0	0	0	0	0	1	0	7.424
EXP.		0.89	0.56	0.10	0.13	0.16	0.08	0.05	0.02	0.00	0.01	13.63
OBS. REL. RISK		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	(0.0513)
1961-65 OBS.	2	0	2	0	0	0	0	0	0	0	0	-0.1737
EXP.		0.96	0.55	0.10	0.11	0.16	0.08	0.04	0.01	0.00	0.00	0.6382
OBS. REL. RISK		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	(0.7913)
1966-70 OBS.	2	0	1	1	0	0	0	0	0	0	0	-0.1866
EXP.		0.80	0.44	0.13	0.19	0.22	0.13	0.07	0.02	0.01	0.01	0.3074
OBS. REL. RISK		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	(0.7401)
1971-75 OBS.	6	3	2	0	0	0	0	0	0	0	1	1.442
EXP.		2.86	1.46	0.30	0.37	0.48	0.26	0.12	0.03	0.00	0.02	2.443
OBS. REL. RISK		1.00	1.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	56.76	(0.1198)
1976-80 OBS.	7	3	1	0	0	1	1	1	0	0	0	4.318
EXP.		4.05	1.62	0.25	0.27	0.37	0.22	0.17	0.03	0.00	0.02	4.496
OBS. REL. RISK		1.00	0.83	0.00	0.00	3.64	6.00	7.94	0.00	0.00	0.00	(0.0807)
1981-85 OBS.	16	7	2	0	0	5	1	0	0	0	1	1.409
EXP.		7.32	3.83	0.83	1.15	1.47	0.79	0.40	0.12	0.04	0.04	1.389
OBS. REL. RISK		1.00	0.55	0.00	0.00	3.57	1.32	0.00	0.00	0.00	24.25	(0.0880)
1983-85 OBS.	9	4	0	0	0	3	1	0	0	0	1	3.249
EXP.		4.08	2.05	0.50	0.69	0.87	0.47	0.23	0.06	0.02	0.03	3.170
OBS. REL. RISK		1.00	0.00	0.00	0.00	3.50	2.16	0.00	0.00	0.00	38.29	(0.0312)

FITTED RELATIVE RISK AT 1 GRAY : 2.8610 ± 1.1158 (P-VALUE: 0.0019)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.3179	(+)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.8181	(+)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.6097	(-)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.6807	(+)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.6640	(-)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.8591	(-)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.2503	(+)	N.S

2-24 CANCERS OTHER THAN THOSE OF AT2-5 THROUGH AT2-23
付表2-3から2-22に含まれないその他の癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL		TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 TOTAL	OBS.	907	429	188	44	83	81	52	31	15	4	0	0.1970
	EXP.		420.58	217.40	49.33	82.07	78.74	43.72	23.89	6.58	1.93	2.76	0.0335
	OBS. REL. RISK		1.00	0.85	0.87	0.99	1.01	1.17	1.27	2.23	2.03	0.00	(0.0264)
	FITTED REL. RISK		1.00	1.00	1.01	1.03	1.06	1.13	1.26	1.47	1.64	1.99	
1950-55	OBS.	101	52	24	4	4	6	6	2	1	2	0	0.1904
	EXP.		47.14	24.67	5.27	6.74	8.60	4.83	2.59	0.64	0.20	0.31	0.2850
	OBS. REL. RISK		1.00	0.88	0.69	0.54	0.63	1.13	0.70	1.42	8.98	0.00	(0.4028)
1956-60	OBS.	128	70	22	9	8	8	6	1	3	1	0	0.0503
	EXP.		59.59	31.21	6.71	8.58	10.87	6.15	3.39	0.87	0.23	0.40	0.2117
	OBS. REL. RISK		1.00	0.60	1.14	0.79	0.63	0.83	0.25	2.94	3.64	0.00	(0.7913)
1961-65	OBS.	112	51	22	5	7	15	6	4	2	0	0	0.1973
	EXP.		50.59	26.68	6.33	8.07	10.12	5.78	3.09	0.78	0.21	0.34	0.2666
	OBS. REL. RISK		1.00	0.82	0.78	0.86	1.47	1.03	1.28	2.53	0.00	0.00	(0.4424)
1966-70	OBS.	92	43	20	4	7	14	2	2	0	0	0	-0.1666
	EXP.		44.29	21.28	4.88	6.02	7.60	4.41	2.41	0.64	0.19	0.30	0.0208
	OBS. REL. RISK		1.00	0.97	0.84	1.20	1.90	0.47	0.85	0.00	0.00	0.00	(0.2835)
1971-75	OBS.	123	57	24	5	6	8	11	8	3	1	0	0.7886
	EXP.		57.71	28.68	6.69	8.65	10.53	5.84	3.21	0.93	0.27	0.38	0.3798
	OBS. REL. RISK		1.00	0.85	0.76	0.70	0.77	1.87	2.52	3.28	3.71	0.00	(0.0056)
1976-80	OBS.	164	75	39	8	13	11	9	6	3	0	0	0.0700
	EXP.		74.53	39.65	9.30	11.46	14.64	7.87	4.39	1.28	0.38	0.49	0.1872
	OBS. REL. RISK		1.00	0.98	0.86	1.13	0.75	1.14	1.36	2.34	0.00	0.00	(0.6985)
1981-85	OBS.	187	81	37	9	18	19	12	8	3	0	0	0.3050
	EXP.		86.71	45.23	10.16	12.54	16.38	8.73	4.81	1.44	0.44	0.55	0.2285
	OBS. REL. RISK		1.00	0.88	0.95	1.54	1.24	1.47	1.78	2.22	0.00	0.00	(0.1681)
1983-85	OBS.	116	55	25	6	9	9	4	6	2	0	0	0.1728
	EXP.		55.56	27.60	6.09	7.35	9.77	5.18	2.93	0.89	0.27	0.35	0.2532
	OBS. REL. RISK		1.00	0.91	1.00	1.24	0.93	0.78	2.07	2.27	0.00	0.00	(0.4839)

FITTED RELATIVE RISK AT 1 GRAY : 1.1970 ± 0.0935 (P-VALUE: 0.0264)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.4794	(-)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.6587	(+)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.3229	(+)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.8803	(+)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.4786	(+)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.5191	(+)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.0335	(-)	QUADRATIC TERM IS SIGNIFICANT

2-25 CANCER OF THE LIVER INCLUDING NOT SPECIFIED AS PRIMARY

原発と記載のないものを含む肝癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL		TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 TOTAL	OBS.	590	278	122	30	38	51	34	21	12	2	1	0.2410
	EXP.		274.91	138.52	32.43	40.32	51.51	28.46	16.06	4.46	1.39	1.91	0.1183
	OBS. REL. RISK		1.00	0.87	0.91	0.96	0.98	1.18	1.29	2.65	1.42	0.52	(0.0210)
	FITTED REL. RISK		1.00	1.00	1.02	1.03	1.07	1.16	1.32	1.57	1.78	2.22	
1950-55	OBS.	66	36	17	3	2	2	2	2	1	1	0	0.0999
	EXP.		31.92	15.78	3.28	4.18	5.33	3.00	1.75	0.41	0.14	0.21	0.3141
	OBS. REL. RISK		1.00	0.96	0.81	0.42	0.33	0.59	1.01	2.15	6.56	0.00	(0.6801)
1956-60	OBS.	74	39	15	6	2	4	5	0	3	0	0	0.1054
	EXP.		34.50	17.85	3.89	5.01	6.29	3.59	1.99	0.51	0.13	0.25	0.2952
	OBS. REL. RISK		1.00	0.74	1.36	0.35	0.56	1.23	0.00	5.15	0.00	0.00	(0.6892)
1961-65	OBS.	60	28	15	4	3	4	5	1	0	0	0	-0.1762
	EXP.		27.88	14.24	3.28	4.10	5.19	2.98	1.63	0.40	0.11	0.19	0.0766
	OBS. REL. RISK		1.00	1.05	1.20	0.73	0.77	1.67	0.61	0.00	0.00	0.00	(0.4130)
1966-70	OBS.	54	26	10	3	2	9	1	2	0	0	1	0.2757
	EXP.		26.32	12.10	2.83	3.55	4.44	2.60	1.47	0.39	0.12	0.19	0.3994
	OBS. REL. RISK		1.00	0.84	1.07	0.57	2.05	0.39	1.38	0.00	0.00	5.40	(0.3482)
1971-75	OBS.	75	36	15	2	3	6	5	5	2	1	0	0.7366
	EXP.		35.70	16.94	4.04	5.25	6.44	3.61	2.00	0.58	0.18	0.26	0.4637
	OBS. REL. RISK		1.00	0.88	0.49	0.57	0.92	1.37	2.48	3.42	5.57	0.00	(0.0303)
1976-80	OBS.	108	41	22	7	13	9	5	6	3	0	0	0.4495
	EXP.		47.50	25.28	6.16	7.67	9.76	5.23	2.94	0.87	0.28	0.31	0.3297
	OBS. REL. RISK		1.00	1.01	1.32	1.96	1.07	1.11	2.36	3.98	0.00	0.00	(0.1146)
1981-85	OBS.	155	72	28	5	14	17	11	5	3	0	0	0.1906
	EXP.		71.10	36.33	8.95	10.57	14.07	7.44	4.29	1.31	0.43	0.51	0.2146
	OBS. REL. RISK		1.00	0.76	0.55	1.31	1.19	1.46	1.15	2.26	0.00	0.00	(0.3865)
1983-85	OBS.	97	51	20	3	4	8	5	4	2	0	0	0.0969
	EXP.		46.05	22.24	5.51	6.24	8.47	4.45	2.64	0.80	0.27	0.33	0.2425
	OBS. REL. RISK		1.00	0.81	0.49	0.58	0.85	1.01	1.37	2.25	0.00	0.00	(0.6629)

FITTED RELATIVE RISK AT 1 GRAY : 1.2410 ± 0.1183 (P-VALUE: 0.0210)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.5847	(+)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.6036	(-)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.7770	(-)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.6904	(-)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.3800	(+)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.5905	(+)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.2247	(-)	N.S

2-26 CANCER OF THE KIDNEY
腎臓癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL		TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85	OBS.	38	17	7	2	4	3	1	2	2	0	0	0.5829
TOTAL	EXP.		17.15	8.80	2.19	2.86	3.56	1.93	1.01	0.30	0.08	0.12	0.6040
	OBS. REL. RISK		1.00	0.80	0.92	1.41	0.85	0.52	2.00	6.79	0.00	0.00	(0.1846)
	FITTED REL. RISK		1.00	1.01	1.04	1.08	1.18	1.40	1.78	2.39	2.88	3.94	
1950-55	OBS.	2	0	1	0	1	0	0	0	0	0	0	-0.1740
	EXP.		0.80	0.46	0.13	0.18	0.22	0.12	0.06	0.02	0.00	0.01	0.5477
	OBS. REL. RISK		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	(0.7913)
1956-60	OBS.	1	1	0	0	0	0	0	0	0	0	0	-0.1853
	EXP.		0.39	0.25	0.07	0.09	0.12	0.06	0.02	0.00	0.00	0.00	0.1577
	OBS. REL. RISK		1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	XXX	0.00	(0.8231)
1961-65	OBS.	9	3	2	1	1	1	0	1	0	0	0	0.3506
	EXP.		3.79	2.13	0.55	0.75	0.92	0.50	0.24	0.07	0.01	0.03	1.066
	OBS. REL. RISK		1.00	1.18	2.29	1.89	1.37	0.00	5.25	0.00	0.00	0.00	(0.7083)
1966-70	OBS.	4	2	0	0	0	0	0	1	1	0	0	3.513
	EXP.		1.70	0.85	0.27	0.33	0.39	0.25	0.13	0.04	0.02	0.02	4.879
	OBS. REL. RISK		1.00	0.00	0.00	0.00	0.00	0.00	6.57	19.19	0.00	0.00	(0.0525)
1971-75	OBS.	9	5	2	0	1	1	0	0	0	0	0	-0.1759
	EXP.		3.82	2.08	0.55	0.77	0.91	0.51	0.25	0.08	0.02	0.02	0.1134
	OBS. REL. RISK		1.00	0.74	0.00	0.99	0.84	0.00	0.00	0.00	0.00	0.00	(0.5376)
1976-80	OBS.	3	1	1	1	0	0	0	0	0	0	0	-0.1522
	EXP.		1.50	0.63	0.18	0.21	0.25	0.13	0.08	0.02	0.01	0.01	0.5410
	OBS. REL. RISK		1.00	2.39	8.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.7401)
1981-85	OBS.	10	5	1	0	1	1	1	0	1	0	0	1.734
	EXP.		5.15	2.41	0.43	0.54	0.75	0.37	0.23	0.07	0.02	0.03	1.988
	OBS. REL. RISK		1.00	0.43	0.00	1.90	1.38	2.80	0.00	15.12	0.00	0.00	(0.1426)
1983-85	OBS.	7	2	1	0	1	1	1	0	1	0	0	4.985
	EXP.		3.58	1.72	0.32	0.37	0.53	0.25	0.15	0.04	0.01	0.02	5.032
	OBS. REL. RISK		1.00	1.04	0.00	4.78	3.37	7.11	0.00	40.65	0.00	0.00	(0.0351)

FITTED RELATIVE RISK AT 1 GRAY : 1.5829 ± 0.6040 (P-VALUE: 0.1846)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.3889	(-)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.6212	(-)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.0029	(+)	ATB <20 > ATB20+
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.7281	(-)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.5810	(+)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.7558	(+)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.8773	(-)	N.S

2-27 CANCER OF THE BLADDER
膀胱癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL		TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 TOTAL	OBS.	90	30	23	4	4	9	12	6	1	0	1	1.134
	EXP.		39.57	21.16	5.43	6.83	8.48	4.82	2.56	0.66	0.21	0.27	0.5240
	OBS. REL. RISK		1.00	1.43	0.97	0.77	1.40	3.28	3.09	1.99	0.00	4.92	(0.0027)
	FITTED REL. RISK		1.00	1.02	1.08	1.16	1.35	1.77	2.52	3.70	4.66	6.73	
1950-55	OBS.	5	1	2	0	0	1	1	0	0	0	0	0.0678
	EXP.		2.05	1.14	0.34	0.41	0.53	0.30	0.16	0.04	0.01	0.02	0.9955
	OBS. REL. RISK		1.00	3.60	0.00	0.00	3.91	6.85	0.00	0.00	0.00	0.00	(0.9203)
1956-60	OBS.	10	4	4	0	1	0	0	1	0	0	0	-0.1460
	EXP.		4.10	2.19	0.70	0.84	1.02	0.64	0.35	0.09	0.03	0.04	0.3698
	OBS. REL. RISK		1.00	1.87	0.00	1.22	0.00	0.00	2.91	0.00	0.00	0.00	(0.7913)
1961-65	OBS.	16	4	6	3	1	0	2	0	0	0	0	-0.1784
	EXP.		7.08	3.93	0.90	1.18	1.51	0.84	0.39	0.10	0.02	0.04	0.0236
	OBS. REL. RISK		1.00	2.70	5.88	1.50	0.00	4.21	0.00	0.00	0.00	0.00	(0.6628)
1966-70	OBS.	13	4	1	0	1	1	2	3	0	0	1	5.174
	EXP.		5.78	2.81	0.81	1.05	1.22	0.77	0.38	0.10	0.04	0.04	3.898
	OBS. REL. RISK		1.00	0.51	0.00	1.38	1.18	3.74	11.44	0.00	0.00	33.61	(0.0008)
1971-75	OBS.	18	9	4	1	1	2	1	0	0	0	0	-0.1623
	EXP.		8.43	4.41	0.99	1.18	1.52	0.84	0.43	0.11	0.03	0.05	0.1953
	OBS. REL. RISK		1.00	0.85	0.95	0.79	1.23	1.11	0.00	0.00	0.00	0.00	(0.5777)
1976-80	OBS.	15	3	3	0	0	4	4	1	0	0	0	3.906
	EXP.		6.13	3.55	1.00	1.28	1.55	0.83	0.44	0.12	0.04	0.04	2.885
	OBS. REL. RISK		1.00	1.72	0.00	0.00	5.27	9.80	4.59	0.00	0.00	0.00	(0.0204)
1981-85	OBS.	13	5	3	0	0	1	2	1	1	0	0	2.183
	EXP.		6.01	3.13	0.89	0.89	1.13	0.60	0.39	0.09	0.02	0.04	1.994
	OBS. REL. RISK		1.00	1.15	0.00	0.00	1.06	4.02	3.05	12.72	0.00	0.00	(0.0516)
1983-85	OBS.	9	5	2	0	0	1	1	0	0	0	0	-0.1665
	EXP.		4.24	2.14	0.48	0.59	0.77	0.40	0.27	0.06	0.01	0.03	0.2212
	OBS. REL. RISK		1.00	0.79	0.00	0.00	1.08	2.15	0.00	0.00	0.00	0.00	(0.7642)

FITTED RELATIVE RISK AT 1 GRAY : 2.1343 ± 0.5240 (P-VALUE: 0.0027)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.7691	(+)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.1593	(+)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.7099	(-)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.3582	(-)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.1308	(+)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.2976	(+)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.2523	(-)	N.S

2-28 CANCER OF THE TONGUE
舌癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL		TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85	OBS.	26	12	4	1	4	5	0	0	0	0	0	-0.1662
TOTAL	EXP.		11.51	6.09	1.47	2.01	2.43	1.39	0.73	0.21	0.08	0.07	0.1102
	OBS. REL. RISK		1.00	0.63	0.65	1.91	1.97	0.00	0.00	0.00	0.00	0.00	(0.4028)
	FITTED REL. RISK		1.00	1.00	0.99	0.98	0.95	0.89	0.78	0.60	0.46	0.16	
1950-55	OBS.	1	0	1	0	0	0	0	0	0	0	0	-0.1926
	EXP.		0.38	0.24	0.06	0.10	0.11	0.06	0.03	0.01	0.00	0.00	0.3295
	OBS. REL. RISK		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	(0.7913)
1956-60	OBS.	8	4	0	1	1	2	0	0	0	0	0	-0.1823
	EXP.		3.72	1.95	0.41	0.55	0.69	0.37	0.22	0.06	0.02	0.03	0.2291
	OBS. REL. RISK		1.00	0.00	2.29	1.70	2.68	0.00	0.00	0.00	0.00	0.00	(0.6985)
1961-65	OBS.	5	2	1	0	1	1	0	0	0	0	0	-0.1834
	EXP.		1.98	1.14	0.33	0.45	0.54	0.33	0.16	0.05	0.02	0.01	0.1520
	OBS. REL. RISK		1.00	0.87	0.00	2.22	1.85	0.00	0.00	0.00	0.00	0.00	(0.6714)
1966-70	OBS.	3	2	0	0	0	1	0	0	0	0	0	-0.1553
	EXP.		1.18	0.74	0.19	0.27	0.33	0.18	0.07	0.03	0.01	0.01	0.6672
	OBS. REL. RISK		1.00	0.00	0.00	0.00	1.77	0.00	0.00	0.00	0.00	0.00	(0.8065)
1971-75	OBS.	3	2	0	0	1	0	0	0	0	0	0	-0.1631
	EXP.		1.43	0.62	0.15	0.23	0.26	0.16	0.10	0.03	0.01	0.01	0.4245
	OBS. REL. RISK		1.00	0.00	0.00	3.08	0.00	0.00	0.00	0.00	0.00	0.00	(0.7184)
1976-80	OBS.	3	1	0	0	1	1	0	0	0	0	0	-0.0406
	EXP.		1.45	0.65	0.17	0.22	0.25	0.15	0.08	0.02	0.01	0.01	1.053
	OBS. REL. RISK		1.00	0.00	0.00	6.66	5.93	0.00	0.00	0.00	0.00	0.00	(1.0000)
1981-85	OBS.	3	1	2	0	0	0	0	0	0	0	0	-0.1882
	EXP.		1.36	0.76	0.16	0.20	0.25	0.15	0.07	0.02	0.01	0.01	0.1827
	OBS. REL. RISK		1.00	3.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.6801)
1983-85	OBS.	1	1	0	0	0	0	0	0	0	0	0	-0.1889
	EXP.		0.43	0.23	0.06	0.08	0.10	0.06	0.03	0.01	0.01	0.00	0.6657
	OBS. REL. RISK		1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.7913)

FITTED RELATIVE RISK AT 1 GRAY : 0.8338 ± 0.1102 (P-VALUE: 0.4028)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.8212	(+)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.7188	(+)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.8257	(+)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.7219	(+)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.7084	(+)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.8174	(+)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.5137	(-)	N.S

2-29 CANCER OF THE PHARYNX
咽頭癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL		TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 TOTAL	OBS.	23	13	4	1	1	1	3	0	0	0	0	-0.1678
	EXP.		11.53	5.21	1.18	1.34	1.77	1.04	0.64	0.16	0.04	0.09	0.1440
	OBS. REL. RISK		1.00	0.68	0.75	0.66	0.50	2.56	0.00	0.00	0.00	0.00	(0.6033)
	FITTED REL. RISK		1.00	1.00	0.99	0.98	0.95	0.89	0.78	0.60	0.46	0.15	
1950-55	OBS.	1	0	1	0	0	0	0	0	0	0	0	-0.1461
	EXP.		0.57	0.29	0.03	0.03	0.04	0.02	0.02	0.00	0.00	0.00	2.021
	OBS. REL. RISK		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	(0.9203)
1956-60	OBS.	2	2	0	0	0	0	0	0	0	0	0	-0.1854
	EXP.		0.81	0.47	0.14	0.17	0.22	0.12	0.06	0.01	0.00	0.01	0.0925
	OBS. REL. RISK		1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.7184)
1961-65	OBS.	4	2	1	0	0	1	0	0	0	0	0	-0.1787
	EXP.		1.90	0.80	0.23	0.29	0.35	0.23	0.13	0.03	0.01	0.02	0.1843
	OBS. REL. RISK		1.00	1.19	0.00	0.00	2.68	0.00	0.00	0.00	0.00	0.00	(0.6985)
1966-70	OBS.	4	3	1	0	0	0	0	0	0	0	0	-0.1764
	EXP.		2.36	0.79	0.15	0.19	0.24	0.14	0.09	0.02	0.00	0.02	0.3052
	OBS. REL. RISK		1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.6801)
1971-75	OBS.	2	1	0	0	0	0	1	0	0	0	0	4.265
	EXP.		1.05	0.45	0.10	0.09	0.15	0.07	0.07	0.01	0.00	0.00	8.543
	OBS. REL. RISK		1.00	0.00	0.00	0.00	0.00	14.26	0.00	0.00	0.00	0.00	(0.3349)
1976-80	OBS.	6	3	0	1	0	0	2	0	0	0	0	0.7714
	EXP.		2.63	1.45	0.39	0.41	0.53	0.31	0.19	0.05	0.02	0.02	1.594
	OBS. REL. RISK		1.00	0.00	2.23	0.00	0.00	5.68	0.00	0.00	0.00	0.00	(0.5902)
1981-85	OBS.	4	2	1	0	1	0	0	0	0	0	0	-0.1776
	EXP.		2.21	0.95	0.16	0.16	0.24	0.13	0.09	0.03	0.01	0.02	0.1242
	OBS. REL. RISK		1.00	1.16	0.00	6.93	0.00	0.00	0.00	0.00	0.00	0.00	(0.6885)
1983-85	OBS.	4	2	1	0	1	0	0	0	0	0	0	-0.1782
	EXP.		2.21	0.95	0.16	0.16	0.24	0.13	0.09	0.03	0.01	0.02	0.0898
	OBS. REL. RISK		1.00	1.16	0.00	6.92	0.00	0.00	0.00	0.00	0.00	0.00	(0.7083)

FITTED RELATIVE RISK AT 1 GRAY : 0.8322 ± 0.1440 (P-VALUE: 0.6033)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.5353	(+)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.8016	(-)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.8431	(-)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.6717	(+)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.9975	(-)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.9887	(-)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.5586	(-)	N.S

2-30 CANCER OF THE NOSE
鼻癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL		TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85	OBS.	44	15	13	3	6	3	3	1	0	0	0	-0.1628
TOTAL	EXP.		19.98	10.64	2.45	3.09	3.92	2.19	1.19	0.31	0.09	0.14	0.1406
	OBS. REL. RISK		1.00	1.63	1.63	2.58	1.02	1.83	1.12	0.00	0.00	0.00	(0.5777)
	FITTED REL. RISK		1.00	1.00	0.99	0.98	0.95	0.89	0.78	0.61	0.47	0.18	
1950-55	OBS.	6	4	2	0	0	0	0	0	0	0	0	-0.1859
	EXP.		2.76	1.48	0.33	0.40	0.50	0.29	0.17	0.04	0.02	0.02	0.1682
	OBS. REL. RISK		1.00	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.5541)
1956-60	OBS.	8	2	4	0	1	1	0	0	0	0	0	-0.1784
	EXP.		3.95	1.94	0.37	0.49	0.62	0.34	0.20	0.05	0.01	0.03	0.2412
	OBS. REL. RISK		1.00	4.07	0.00	4.07	3.18	0.00	0.00	0.00	0.00	0.00	(0.6390)
1961-65	OBS.	7	1	3	1	1	1	0	0	0	0	0	-0.1722
	EXP.		2.96	1.67	0.43	0.55	0.70	0.40	0.20	0.05	0.02	0.02	0.3296
	OBS. REL. RISK		1.00	5.31	6.90	5.35	4.25	0.00	0.00	0.00	0.00	0.00	(0.6468)
1966-70	OBS.	6	3	0	1	1	0	1	0	0	0	0	-0.0069
	EXP.		2.81	1.46	0.33	0.39	0.51	0.28	0.14	0.04	0.01	0.02	0.8592
	OBS. REL. RISK		1.00	0.00	2.81	2.38	0.00	3.41	0.00	0.00	0.00	0.00	(1.0000)
1971-75	OBS.	10	1	2	0	3	1	2	1	0	0	0	3.484
	EXP.		4.34	2.23	0.63	0.81	1.00	0.56	0.30	0.08	0.02	0.03	3.160
	OBS. REL. RISK		1.00	3.90	0.00	16.13	4.34	15.38	14.54	0.00	0.00	0.00	(0.0773)
1976-80	OBS.	4	2	2	0	0	0	0	0	0	0	0	-0.1820
	EXP.		1.68	1.04	0.23	0.31	0.37	0.21	0.11	0.03	0.01	0.01	0.2415
	OBS. REL. RISK		1.00	1.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.6468)
1981-85	OBS.	3	2	0	1	0	0	0	0	0	0	0	-0.1640
	EXP.		1.48	0.82	0.12	0.15	0.22	0.10	0.08	0.02	0.00	0.01	0.4679
	OBS. REL. RISK		1.00	0.00	5.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.7290)
1983-85	OBS.	2	1	0	1	0	0	0	0	0	0	0	-0.1565
	EXP.		0.95	0.52	0.10	0.11	0.17	0.08	0.05	0.01	0.00	0.01	0.7698
	OBS. REL. RISK		1.00	0.00	9.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.7913)

FITTED RELATIVE RISK AT 1 GRAY : 0.8372 ± 0.1406 (P-VALUE: 0.5777)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.9238	(-)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.8335	(-)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	1.0000	(+)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.5954	(+)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.8107	(-)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.9925	(+)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.5416	(-)	N.S

2-31 CANCER OF THE LARYNX
喉頭癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL	TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 OBS.	46	19	9	3	4	5	3	1	1	0	1	0.5114
TOTAL EXP.		21.21	10.26	2.63	3.34	4.14	2.39	1.44	0.32	0.11	0.15	0.5180
OBS. REL. RISK		1.00	0.98	1.27	1.34	1.35	1.40	0.77	3.52	0.00	7.48	(0.1604)
FITTED REL. RISK		1.00	1.01	1.04	1.07	1.16	1.35	1.69	2.22	2.65	3.58	
1950-55 OBS.	5	1	1	1	0	2	0	0	0	0	0	-0.1782
EXP.		2.07	1.11	0.34	0.41	0.51	0.31	0.18	0.04	0.02	0.02	0.2677
OBS. REL. RISK		1.00	1.87	6.03	0.00	8.12	0.00	0.00	0.00	0.00	0.00	(0.7518)
1956-60 OBS.	6	0	1	1	1	0	1	1	0	0	1	14.37
EXP.		2.85	1.35	0.31	0.42	0.53	0.29	0.17	0.04	0.01	0.02	16.32
OBS. REL. RISK		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	(0.0019)
1961-65 OBS.	8	3	1	1	0	2	1	0	0	0	0	0.0337
EXP.		3.91	1.74	0.44	0.51	0.65	0.40	0.26	0.05	0.02	0.03	0.7835
OBS. REL. RISK		1.00	0.75	2.98	0.00	4.03	3.23	0.00	0.00	0.00	0.00	(1.0000)
1966-70 OBS.	10	2	4	0	2	1	1	0	0	0	0	-0.1612
EXP.		4.10	2.24	0.67	0.86	1.05	0.60	0.33	0.08	0.03	0.03	0.3011
OBS. REL. RISK		1.00	3.67	0.00	4.76	1.95	3.41	0.00	0.00	0.00	0.00	(0.6985)
1971-75 OBS.	11	7	2	0	1	0	0	0	1	0	0	0.2521
EXP.		5.26	2.49	0.59	0.78	0.92	0.54	0.28	0.08	0.02	0.04	0.8894
OBS. REL. RISK		1.00	0.60	0.00	0.96	0.00	0.00	0.00	9.91	0.00	0.00	(0.6547)
1976-80 OBS.	4	4	0	0	0	0	0	0	0	0	0	-0.1823
EXP.		2.04	0.86	0.18	0.24	0.30	0.16	0.18	0.02	0.01	0.00	0.1456
OBS. REL. RISK		1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.6468)
1981-85 OBS.	2	2	0	0	0	0	0	0	0	0	0	-0.1757
EXP.		0.89	0.47	0.09	0.12	0.17	0.08	0.05	0.02	0.00	0.01	0.4024
OBS. REL. RISK		1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.7401)
1983-85 OBS.	2	2	0	0	0	0	0	0	0	0	0	-0.1769
EXP.		0.99	0.47	0.09	0.12	0.17	0.08	0.05	0.02	0.00	0.01	0.3791
OBS. REL. RISK		1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.7518)

FITTED RELATIVE RISK AT 1 GRAY : 1.5114 ± 0.5180 (P-VALUE: 0.1604)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.1184	(-)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.8536	(-)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.6708	(-)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.6789	(-)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.0418	(-)	1960+ < -1960
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.1533	(-)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.5691	(+)	N.S

2-32 CANCER OF THE SKIN EXCEPT MELANOMA
黒色腫以外の皮膚癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL	TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 OBS.	21	10	6	1	0	2	1	0	0	1	0	0.1743
TOTAL EXP.		8.31	5.02	1.40	1.87	2.32	1.25	0.58	0.16	0.04	0.05	0.6125
OBS. REL. RISK		1.00	0.99	0.59	0.00	0.72	0.66	0.00	0.00	19.82	0.00	(0.6801)
FITTED REL. RISK		1.00	1.00	1.01	1.02	1.05	1.12	1.23	1.41	1.56	1.88	
1950-55 OBS.	3	2	1	0	0	0	0	0	0	0	0	-0.1849
EXP.		1.20	0.74	0.20	0.25	0.33	0.18	0.07	0.02	0.00	0.01	0.2845
OBS. REL. RISK		1.00	0.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.6714)
1956-60 OBS.	3	2	0	0	0	0	0	0	0	1	0	2.396
EXP.		1.17	0.73	0.20	0.27	0.33	0.18	0.08	0.02	0.00	0.01	4.500
OBS. REL. RISK		1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	122.53	0.00	(0.1328)
1961-65 OBS.	6	3	1	0	0	2	0	0	0	0	0	-0.1778
EXP.		2.43	1.35	0.40	0.52	0.65	0.38	0.19	0.05	0.01	0.02	0.1488
OBS. REL. RISK		1.00	0.60	0.00	0.00	2.50	0.00	0.00	0.00	0.00	0.00	(0.6892)
1966-70 OBS.	1	1	0	0	0	0	0	0	0	0	0	-0.1884
EXP.		0.37	0.26	0.07	0.09	0.11	0.06	0.03	0.01	0.00	0.00	0.8768
OBS. REL. RISK		1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.7913)
1971-75 OBS.	4	2	1	0	0	0	1	0	0	0	0	0.0381
EXP.		1.55	0.98	0.26	0.37	0.45	0.24	0.10	0.03	0.01	0.01	1.240
OBS. REL. RISK		1.00	0.79	0.00	0.00	0.00	3.28	0.00	0.00	0.00	0.00	(1.0000)
1976-80 OBS.	3	0	2	1	0	0	0	0	0	0	0	-0.1649
EXP.		1.19	0.72	0.21	0.27	0.33	0.16	0.08	0.02	0.01	0.00	0.5034
OBS. REL. RISK		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	(0.7184)
1981-85 OBS.	1	0	1	0	0	0	0	0	0	0	0	-0.1889
EXP.		0.40	0.24	0.06	0.09	0.11	0.06	0.03	0.01	0.00	0.00	0.6081
OBS. REL. RISK		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	(0.8065)
1983-85 OBS.	1	0	1	0	0	0	0	0	0	0	0	-0.1888
EXP.		0.40	0.24	0.06	0.09	0.11	0.06	0.03	0.01	0.00	0.00	0.1617
OBS. REL. RISK		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	(0.8065)

FITTED RELATIVE RISK AT 1 GRAY : 1.1743 ± 0.6125 (P-VALUE: 0.6801)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.1819	(-)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.1949	(-)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	1.0000	(+)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	1.0000	(+)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.2446	(-)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.4029	(-)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.3507	(+)	N.S

2-33 CANCER OF THE BONE
骨癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL	TOTAL DEATHS	SHIELDED KERMA DOSE IN GRAY 0	.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	EXCESS R.R PER GRAY STD.ERROR (P-VALUE)
1950-85 OBS.	27	14	6	0	1	3	2	0	1	0	0	0.2212
TOTAL EXP.		12.85	6.61	1.39	1.78	2.18	1.19	0.68	0.18	0.06	0.08	0.5635
OBS. REL. RISK		1.00	0.83	0.00	0.52	1.27	1.54	0.00	5.02	0.00	0.00	(0.6468)
FITTED REL. RISK		1.00	1.00	1.02	1.03	1.07	1.15	1.30	1.53	1.71	2.12	
1950-55 OBS.	1	0	1	0	0	0	0	0	0	0	0	-0.1695
EXP.		0.41	0.22	0.07	0.08	0.10	0.06	0.03	0.01	0.00	0.00	0.8170
OBS. REL. RISK		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	(0.7913)
1956-60 OBS.	6	6	0	0	0	0	0	0	0	0	0	-0.1774
EXP.		3.12	1.53	0.23	0.31	0.40	0.21	0.14	0.03	0.01	0.02	0.3361
OBS. REL. RISK		1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.6171)
1961-65 OBS.	4	1	1	0	0	1	0	0	1	0	0	3.654
EXP.		1.79	0.95	0.22	0.32	0.35	0.19	0.12	0.03	0.01	0.01	5.220
OBS. REL. RISK		1.00	1.88	0.00	0.00	5.06	0.00	0.00	61.89	0.00	0.00	(0.1082)
1966-70 OBS.	4	1	2	0	1	0	0	0	0	0	0	-0.1834
EXP.		2.15	1.00	0.16	0.18	0.24	0.15	0.09	0.02	0.00	0.01	0.4122
OBS. REL. RISK		1.00	4.31	0.00	11.83	0.00	0.00	0.00	0.00	0.00	0.00	(0.7518)
1971-75 OBS.	5	3	0	0	0	2	0	0	0	0	0	-0.0538
EXP.		2.56	1.20	0.24	0.30	0.33	0.20	0.11	0.04	0.01	0.02	0.8207
OBS. REL. RISK		1.00	0.00	0.00	0.00	5.11	0.00	0.00	0.00	0.00	0.00	(0.9203)
1976-80 OBS.	5	3	2	0	0	0	0	0	0	0	0	-0.1692
EXP.		2.07	1.18	0.33	0.41	0.52	0.27	0.14	0.05	0.02	0.01	0.1046
OBS. REL. RISK		1.00	1.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.5839)
1981-85 OBS.	2	0	0	0	0	0	2	0	0	0	0	65.90
EXP.		0.75	0.52	0.13	0.18	0.24	0.11	0.05	0.01	0.00	0.00	243.7
OBS. REL. RISK		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	(0.0205)
1983-85 OBS.	0	0	0	0	0	0	0	0	0	0	0	XXX
EXP.		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	XXX
OBS. REL. RISK		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	

FITTED RELATIVE RISK AT 1 GRAY : 1.2212 ± 0.5635 (P-VALUE: 0.6488)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.9630	(-)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.8694	(+)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.2361	(+)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.4026	(+)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.6611	(+)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.6550	(+)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.7884	(-)	N.S

APPENDIX TABLE 3 BASED ON ORGAN-ABSORBED DOSE
付表3 臓器吸収線量に基づく

3-1-1 MEAN BONE-MARROW DOSE, NUMBER OF SUBJECTS, AND PEROSN-YEARS AT RISK BY DOSE CATEGORIES
平均骨髄線量，対象者数及び人年，骨髄線量群別

		BONE-MARROW DOSE IN GRAY										
		TOTAL	0	0.01-0.05	0.06-0.09	0.10-0.19	0.20-0.49	0.50-0.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+
MEAN DOSE (MGRAY)	TOTAL	130	0	19	73	139	316	692	1388	2382	3441	4606
	GAMMA	128	0	19	73	139	314	685	1369	2340	3380	4511
	NEUTRON	1	0	0	0	1	2	7	19	41	62	95
NO OF SUBJECT		75991	35290	19740	4059	5210	6375	3042	1578	412	130	155
NUMBER OF PERSON YEARS AT RISK												
1950-85		2185336	1013825	569955	116874	150579	182652	86582	45360	11856	3416	4226
1950-55		388982	180510	100960	20846	26769	32723	15532	8116	2101	643	782
1956-60		350755	162517	91052	18877	24206	29583	14013	7367	1882	570	688
1961-65		330790	153283	85911	17788	22873	27810	13194	6874	1776	535	645
1966-70		310411	144058	80726	16662	21419	25928	12336	6493	1692	490	608
1971-75		289580	134350	75637	15549	19959	24025	11475	5997	1584	438	565
1976-80		268137	124400	70554	14232	18456	22216	10480	5450	1460	389	500
1981-85		246681	114707	65115	12920	16897	20366	9562	4962	1362	350	438
1981-83		145529	67713	38429	7604	9975	11991	5633	2921	805	205	253

3-1-2 MEAN COLON DOSE, NUMBER OF SUBJECTS, AND PERSON-YEARS AT RISK BY DOSE CATEGORIES
平均結腸線量，対象者数，人年，結腸線量群別

		COLON DOSE IN GRAY										
		TOTAL	0	0.01-0.05	0.06-0.09	0.10-0.19	0.20-0.49	0.50-0.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+
MEAN DOSE (MGRAY)	TOTAL	117	0	19	72	139	313	688	1368	2347	3511	4413
	GAMMA	117	0	19	72	139	312	685	1358	2325	3478	4365
	NEUTRON	1	0	0	0	0	1	4	10	21	33	48
NO OF SUBJECT		75991	36132	19518	4113	5209	6218	2829	1380	361	147	84
NUMBER OF PERSON YEARS AT RISK												
1950-85		2185336	1037751	563825	118185	150022	178693	80297	40018	10185	4025	2334
1950-55		388982	184782	99870	21137	26736	31930	14442	7089	1828	751	418
1956-60		350755	166357	90113	19101	24151	28872	13043	6452	1624	672	370
1961-65		330790	156900	85047	17948	22791	27179	12281	6141	1518	636	349
1966-70		310411	147435	79911	16820	21294	25401	11440	5760	1434	585	333
1971-75		289580	137504	74843	15710	19809	23599	10600	5320	1359	522	314
1976-80		268137	127349	69724	14403	18369	21789	9660	4838	1260	462	283
1981-85		246681	117424	64316	13067	16873	19924	8832	4419	1162	397	268
1981-83		145529	69308	37957	7701	9957	11727	5209	2601	683	229	156

3-1-3 MEAN STOMACH DOSE, NUMBER OF SUBJECTS, AND PERSON-YEARS AT RISK BY DOSE CATEGORIES
平均胃線量，対象者数，人年，胃線量群別

		STOMACH DOSE IN GRAY										
		TOTAL	0	0.01-0.05	0.06-0.09	0.10-0.19	0.20-0.49	0.50-0.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+
MEAN DOSE (MGRAY)	TOTAL	120	0	19	72	139	314	692	1376	2372	3545	4460
	GAMMA	119	0	19	72	138	312	686	1361	2340	3492	4394
	NEUTRON	1	0	0	0	1	2	5	15	32	52	66
NO OF SUBJECT		75991	36030	19591	4025	5203	6260	2844	1413	388	127	110
NUMBER OF PERSON YEARS AT RISK												
1950-85		2185336	1034888	566254	115651	149879	179672	80303	40478	11184	3362	3055
1950-55		388982	184261	100242	20684	26730	32127	14517	7251	1970	642	557
1956-60		350755	165892	90462	18699	24142	29038	13124	6573	1789	558	498
1961-65		330790	156455	85400	17580	22774	27315	12393	6213	1689	522	470
1966-70		310411	147019	80250	16469	21282	25525	11556	5792	1599	469	449
1971-75		289580	137137	75170	15357	19842	23682	10682	5355	1509	427	409
1976-80		268137	127017	70073	14069	18319	21917	9739	4860	1397	388	356
1981-85		246681	117107	64656	12792	16790	20059	8892	4433	1281	355	316
1981-83		145529	69120	38160	7542	9905	11811	5239	2608	753	208	183

3-1-4 MEAN LUNG DOSE, NUMBER OF SUBJECTS, AND PERSON-YEARS AT RISK BY DOSE CATEGORIES
平均肺線量，対象者数，人年，肺線量群別

		LUNG IN DOSE GRAY										
		TOTAL	0	0.01-0.05	0.06-0.09	0.10-0.19	0.20-0.49	0.50-0.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+
MEAN DOSE (MGRAY)	TOTAL	128	0	19	72	139	314	688	1378	2379	3445	4585
	GAMMA	127	0	19	72	138	312	682	1362	2344	3392	4505
	NEUTRON	1	0	0	0	1	2	6	16	35	53	80
NO OF SUBJECT		75991	35609	19616	4005	5210	6303	3006	1537	432	113	160
NUMBER OF PERSON YEARS AT RISK												
1950-85		2185336	1022669	566655	115577	150396	180633	85488	44208	12403	2969	4356
1950-55		388982	182114	100358	20587	26758	32340	15347	7908	2197	566	808
1956-60		350755	163950	90531	18654	24180	29229	13838	7189	1978	491	715
1961-65		330790	154632	85425	17574	22830	27498	13022	6819	1860	456	674
1966-70		310411	145303	80273	16481	21362	25649	12190	6337	1768	420	628
1971-75		289580	135508	75201	15403	19907	23778	11318	5848	1659	375	582
1976-80		268137	125473	70127	14099	18458	21970	10333	5291	1534	342	508
1981-85		246681	115689	64740	12778	16901	20170	9421	4815	1407	319	441
1981-83		145529	68283	38217	7525	9971	11879	5550	2835	828	188	254

3-1-5 MEAN BREAST DOSE, NUMBER OF SUBJECTS, AND PERSON-YEARS AT RISK BY DOSE CATEGORIES

平均乳房線量，対象者数，人年，乳房線量群別－女性

		BREAST DOSE IN GRAY										
		TOTAL	0	0.01-0.05	0.06-0.09	0.10-0.19	0.20-0.49	0.50-0.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+
MEAN DOSE (MGRAY)	TOTAL	133	0	19	73	139	317	692	1398	2392	3400	4796
	GAMMA	131	0	19	73	138	314	681	1368	2327	3290	4635
	NEUTRON	2	0	0	0	1	4	11	31	65	110	161
NO OF SUBJECT		45557	20305	12377	2382	3214	3982	1963	894	275	74	91
NUMBER OF PERSON YEARS AT RISK												
1950-85		1350441	602930	365943	70687	95501	117327	58389	26658	8180	2168	2658
1950-55		234182	104369	63501	12280	16576	20497	10099	4614	1403	377	466
1956-60		213309	94990	57796	11197	15140	18665	9261	4220	1283	332	425
1961-65		203154	90511	54930	10666	14468	17736	8823	4049	1250	319	402
1966-70		192816	86012	52038	10110	13658	16709	8370	3842	1189	303	386
1971-75		181325	81018	49089	9550	12833	15654	7843	3588	1100	288	363
1976-80		169208	75716	45977	8808	11869	14631	7271	3303	1017	285	331
1981-85		156647	70314	42613	8076	10958	13435	6721	3042	939	263	286
1981-83		92517	41559	25172	4760	6479	7909	3970	1795	555	152	166

3-3 LEUKEMIA
白血病

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL		TOTAL DEATHS	BONE MARROW DOSE IN GRAY									EXCESS R.R. PER GRAY STD.ERROR (P-VALUE)
				.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	
1950-85	OBS.	202	61	33	5	11	23	24	24	15	2	4	5.206
TOTAL	EXP.		89.85	51.46	12.12	15.20	18.56	8.57	4.51	1.04	0.31	0.40	1.023
OBS. REL. RISK			1.00	0.94	0.61	1.07	1.83	4.13	7.85	21.29	9.52	14.89	(0.0000)
FITTED REL. RISK			1.00	1.10	1.36	1.73	2.67	4.59	8.24	13.39	18.91	25.00	
1950-55	OBS.	35	9	1	1	2	3	5	5	4	2	3	13.01
	EXP.		15.52	9.19	2.05	2.58	3.09	1.46	0.79	0.19	0.06	0.08	6.021
OBS. REL. RISK			1.00	0.19	0.84	1.34	1.68	5.91	10.93	35.68	55.06	66.61	(0.0000)
1956-60	OBS.	38	6	5	0	3	6	9	5	5	0	0	13.41
	EXP.		17.32	9.81	2.35	2.95	3.60	1.67	0.90	0.22	0.07	0.09	5.952
OBS. REL. RISK			1.00	1.47	0.00	2.93	4.81	15.52	15.95	68.91	0.00	0.00	(0.0000)
1961-65	OBS.	26	6	6	1	1	5	4	2	1	0	0	4.692
	EXP.		11.92	6.64	1.50	1.90	2.23	1.04	0.55	0.13	0.04	0.05	2.608
OBS. REL. RISK			1.00	1.79	1.32	1.05	4.46	7.65	7.28	15.69	0.00	0.00	(0.0006)
1966-70	OBS.	18	7	2	0	0	1	2	4	2	0	0	7.230
	EXP.		8.72	4.56	0.95	1.20	1.43	0.68	0.34	0.07	0.02	0.03	4.595
OBS. REL. RISK			1.00	0.55	0.00	0.00	0.87	3.64	14.65	33.32	0.00	0.00	(0.0000)
1971-75	OBS.	28	11	6	1	2	2	2	4	0	0	0	1.571
	EXP.		12.63	6.87	1.71	2.00	2.61	1.26	0.63	0.17	0.05	0.06	1.194
OBS. REL. RISK			1.00	1.00	0.67	1.15	0.88	1.82	7.24	0.00	0.00	0.00	(0.0455)
1976-80	OBS.	31	15	7	1	1	2	2	0	3	0	0	1.007
	EXP.		13.18	7.86	1.99	2.58	3.08	1.36	0.71	0.14	0.04	0.05	0.9659
OBS. REL. RISK			1.00	0.78	0.44	0.34	0.57	1.29	0.00	18.49	0.00	0.00	(0.0732)
1981-85	OBS.	25	7	6	1	2	4	0	4	0	0	1	2.888
	EXP.		10.56	6.52	1.58	1.99	2.51	1.09	0.58	0.11	0.02	0.05	1.881
OBS. REL. RISK			1.00	1.39	0.96	1.52	2.40	0.00	10.41	0.00	0.00	33.35	(0.0027)
1983-85	OBS.	12	6	3	0	1	0	0	1	0	0	1	1.184
	EXP.		5.37	3.07	0.68	0.83	1.12	0.53	0.29	0.06	0.02	0.02	1.609
OBS. REL. RISK			1.00	0.87	0.00	1.08	0.00	0.00	3.06	0.00	0.00	38.00	(0.1146)

FITTED RELATIVE RISK AT 1 GRAY : 6.2064 ± 1.0232 (P-VALUE: 0.0000)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.9740	(+)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.0082	(+)	M > F
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.0089	(+)	ATB <20 > ATB20+
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.8698	(+)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.0000	(-)	1960+ < -1960
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.0002	(-)	1970+ < -1970
NON LINEALITY IN DOSE RESPONSE	D**2	0.5183	(+)	N.S

3-4 ALL CANCERS EXCEPT LEUKEMIA
白血病以外の全部位の癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL		TOTAL DEATHS	COLON DOSE IN GRAY									EXCESS R.R. PER GRAY STD.ERROR (P-VALUE)
				.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	
1950-85	OBS.	5734	2562	1384	341	410	529	273	158	37	20	10	0.4126
TOTAL	EXP.		2725.93	1408.12	336.47	412.62	499.88	214.01	101.79	20.35	9.29	5.47	0.0575
	OBS. REL. RISK		1.00	1.05	1.08	1.06	1.13	1.36	1.85	1.93	2.29	1.94	(0.0000)
	FITTED REL. RISK		1.00	1.01	1.03	1.06	1.13	1.28	1.57	1.97	2.45	2.82	
1950-55	OBS.	532	224	154	26	32	54	27	10	3	0	2	0.2889
	EXP.		251.71	132.40	31.44	38.57	45.89	19.74	8.94	1.99	0.83	0.50	0.1758
	OBS. REL. RISK		1.00	1.31	0.93	0.93	1.32	1.54	1.28	1.70	0.00	4.49	(0.0603)
1956-60	OBS.	637	312	149	38	51	40	26	13	7	1	0	0.1214
	EXP.		298.36	157.30	38.18	47.44	56.08	23.93	10.97	2.16	1.05	0.54	0.1414
	OBS. REL. RISK		1.00	0.91	0.96	1.03	0.68	1.04	1.14	3.11	0.92	0.00	(0.3349)
1961-65	OBS.	773	323	203	49	67	67	36	22	4	2	0	0.2866
	EXP.		361.43	189.36	46.62	58.33	69.29	29.33	14.11	2.55	1.35	0.63	0.1452
	OBS. REL. RISK		1.00	1.20	1.18	1.29	1.08	1.37	1.75	1.75	1.85	0.00	(0.0295)
1966-70	OBS.	843	379	207	50	56	86	32	23	4	3	3	0.3650
	EXP.		402.53	204.48	49.85	60.53	73.93	31.33	15.36	2.78	1.48	0.75	0.1460
	OBS. REL. RISK		1.00	1.08	1.07	0.98	1.24	1.08	1.59	1.53	2.16	4.27	(0.0022)
1971-75	OBS.	925	415	216	52	76	83	47	26	4	4	2	0.4421
	EXP.		442.12	225.75	55.13	64.93	80.12	34.80	16.30	3.41	1.52	0.91	0.1449
	OBS. REL. RISK		1.00	1.02	1.00	1.25	1.10	1.44	1.70	1.25	2.81	2.34	(0.0003)
1976-80	OBS.	987	443	234	59	81	92	52	34	6	5	1	0.5871
	EXP.		468.99	243.91	57.79	70.38	85.61	36.99	17.26	3.57	1.56	0.94	0.1522
	OBS. REL. RISK		1.00	1.02	1.08	0.92	1.14	1.49	2.09	1.78	3.40	1.12	(0.0000)
1981-85	OBS.	1037	466	231	67	67	107	53	30	9	5	2	0.6138
	EXP.		499.81	254.94	57.47	72.47	88.97	37.89	18.85	3.88	1.51	1.21	0.1490
	OBS. REL. RISK		1.00	0.97	1.25	0.99	1.29	1.50	1.71	2.49	3.55	1.78	(0.0000)
1983-85	OBS.	627	292	129	43	42	57	30	22	7	3	2	0.7017
	EXP.		301.61	153.90	35.06	44.26	54.07	22.80	11.33	2.33	0.88	0.76	0.2005
	OBS. REL. RISK		1.00	0.87	1.27	0.98	1.09	1.36	2.00	3.11	3.51	2.73	(0.0000)

FITTED RELATIVE RISK AT 1 GRAY : 1.4126 ± 0.0575 (P-VALUE: 0.0000)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.0029	(-)	M < F
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.3124	(-)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.0003	(+)	ATB <20 > ATB20+
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.6830	(+)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.0127	(+)	1960+ > -1960
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.0318	(+)	1970+ > -1970
NON LINEALITY IN DOSE RESPONSE	D**2	0.2147	(-)	N.S

3-7 CANCER OF THE STOMACH
胃 癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL		TOTAL DEATHS	STOMACH DOSE IN GRAY									EXCESS R.R. PER GRAY STD.ERROR (P-VALUE)
				.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	
1950-85 TOTAL	OBS.	2007	897	494	106	149	199	85	45	10	5	7	0.2713
	EXP.		943.47	490.33	118.38	147.56	179.16	77.70	36.83	8.12	2.54	2.89	0.0857
	OBS. REL. RISK		1.00	1.06	0.94	1.06	1.17	1.29	1.28	1.30	2.07	2.55	(0.0002)
	FITTED REL. RISK		1.00	1.01	1.02	1.04	1.08	1.19	1.37	1.84	1.96	2.21	
1950-55	OBS.	218	86	61	7	11	25	12	5	0	0	1	0.2053
	EXP.		103.41	53.33	12.76	15.54	19.04	8.48	3.88	0.91	0.32	0.31	0.2449
	OBS. REL. RISK		1.00	1.23	0.59	0.76	1.41	1.52	1.39	0.00	0.00	3.45	(0.3711)
1956-80	OBS.	281	120	72	16	29	19	11	6	2	0	0	-0.0474
	EXP.		128.81	68.78	17.39	21.68	26.08	11.21	5.18	1.09	0.38	0.39	0.1643
	OBS. REL. RISK		1.00	1.07	0.94	1.37	0.74	1.00	1.18	1.88	0.00	0.00	(0.7913)
1961-65	OBS.	297	130	76	11	29	27	13	7	2	1	1	0.2759
	EXP.		137.24	72.51	17.94	22.74	27.14	11.86	5.67	1.07	0.41	0.42	0.2230
	OBS. REL. RISK		1.00	1.11	0.65	1.35	1.05	1.16	1.30	1.97	2.56	2.53	(0.1345)
1966-70	OBS.	322	151	86	15	19	28	11	8	1	2	1	0.1888
	EXP.		152.27	77.47	19.15	23.67	28.83	12.42	6.04	1.23	0.40	0.50	0.1970
	OBS. REL. RISK		1.00	1.12	0.79	0.81	0.98	0.89	1.33	0.82	5.09	2.02	(0.2921)
1971-75	OBS.	330	155	76	15	22	38	15	5	2	1	1	0.2318
	EXP.		156.62	80.51	19.37	23.81	28.70	12.71	6.02	1.37	0.38	0.49	0.2051
	OBS. REL. RISK		1.00	0.95	0.78	0.93	1.34	1.19	0.84	1.48	2.60	2.04	(0.1871)
1976-80	OBS.	303	130	67	20	19	37	18	9	2	0	1	0.6639
	EXP.		144.34	74.58	17.23	21.75	26.43	11.33	5.30	1.28	0.34	0.43	0.2801
	OBS. REL. RISK		1.00	1.00	1.29	0.97	1.55	1.76	1.89	1.73	0.00	2.60	(0.0051)
1981-85	OBS.	256	109	56	22	20	25	15	5	1	1	2	0.5092
	EXP.		120.79	63.14	14.54	18.37	22.84	9.69	4.73	1.16	0.30	0.35	0.2787
	OBS. REL. RISK		1.00	0.98	1.68	1.21	1.21	1.72	1.17	0.98	3.66	6.31	(0.0208)
1983-85	OBS.	145	65	23	12	15	16	7	3	1	1	2	0.8172
	EXP.		67.88	35.74	8.39	10.68	13.14	5.47	2.69	0.64	0.17	0.20	0.4317
	OBS. REL. RISK		1.00	0.67	1.49	1.47	1.27	1.34	1.16	1.64	6.23	10.24	(0.0067)

FITTED RELATIVE RISK AT 1 GRAY : 1.2713 ± 0.0857 (P-VALUE: 0.0002)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.1261	(-)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.8362	(-)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.0307	(+)	ATB <20 > ATB20+
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.1419	(-)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.0890	(+)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.0932	(+)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.8523	(-)	N.S

3-8 CANCER OF THE COLON
結腸癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL		TOTAL DEATHS	COLON DOSE IN GRAY									EXCESS R.R. PER GRAY STD.ERROR (P-VALUE)
				.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	
1950-85 TOTAL	OBS.	232	106	58	14	9	19	9	9	4	2	2	0.8454
	EXP.		108.67	57.18	13.90	17.15	20.73	8.88	4.10	0.81	0.37	0.22	0.3549
	OBS. REL. RISK		1.00	1.04	1.03	0.54	0.94	1.04	2.25	5.08	5.57	9.32	(0.0002)
	FITTED REL. RISK		1.00	1.02	1.06	1.12	1.26	1.58	2.16	2.99	3.97	4.73	
1950-55	OBS.	12	4	5	1	1	1	0	0	0	0	0	-0.2209
	EXP.		5.19	3.06	0.82	0.98	1.16	0.48	0.23	0.05	0.02	0.01	0.3328
	OBS. REL. RISK		1.00	2.12	1.59	1.32	1.12	0.00	0.00	0.00	0.00	0.00	(0.5323)
1956-60	OBS.	9	5	3	0	0	1	0	0	0	0	0	-0.2246
	EXP.		3.95	2.24	0.60	0.77	0.88	0.35	0.15	0.03	0.02	0.01	0.4290
	OBS. REL. RISK		1.00	1.06	0.00	0.00	0.90	0.00	0.00	0.00	0.00	0.00	(0.5777)
1961-65	OBS.	21	7	4	3	2	1	3	0	1	0	0	1.503
	EXP.		9.06	5.24	1.43	1.78	2.11	0.85	0.41	0.07	0.04	0.02	1.484
	OBS. REL. RISK		1.00	0.99	2.71	1.45	0.61	4.58	0.00	17.43	0.00	0.00	(0.1253)
1966-70	OBS.	36	17	6	3	2	3	3	1	1	0	0	1.233
	EXP.		16.96	9.01	2.09	2.66	3.12	1.37	0.61	0.10	0.05	0.02	1.091
	OBS. REL. RISK		1.00	0.66	1.43	0.75	0.96	2.18	1.63	9.58	0.00	0.00	(0.0966)
1971-75	OBS.	41	14	14	5	1	4	1	2	0	0	0	0.2808
	EXP.		19.57	9.99	2.52	2.91	3.55	1.51	0.69	0.13	0.08	0.04	0.6163
	OBS. REL. RISK		1.00	1.96	2.77	0.48	1.58	0.93	4.03	0.00	0.00	0.00	(0.6547)
1976-80	OBS.	47	28	9	1	2	2	1	3	1	1	1	1.252
	EXP.		21.77	11.54	2.96	3.53	4.27	1.83	0.81	0.17	0.07	0.04	0.9236
	OBS. REL. RISK		1.00	0.65	0.28	0.47	0.39	0.46	3.09	4.82	11.39	23.81	(0.0082)
1981-85	OBS.	66	33	17	1	1	7	1	3	1	1	1	0.9497
	EXP.		32.16	18.08	3.49	4.50	5.65	2.48	1.20	0.25	0.10	0.09	0.6797
	OBS. REL. RISK		1.00	1.03	0.28	0.22	1.21	0.39	2.44	3.98	10.21	11.33	(0.0169)
1983-85	OBS.	37	18	7	0	1	5	1	2	1	0	1	1.542
	EXP.		17.82	9.19	2.06	2.56	3.28	1.39	0.66	0.13	0.05	0.05	1.128
	OBS. REL. RISK		1.00	0.71	0.00	0.36	1.41	0.67	2.82	6.95	0.00	19.28	(0.0146)

FITTED RELATIVE RISK AT 1 GRAY : 1.8454 ± 0.3549 (P-VALUE: 0.0002)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.4286	(-)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.7602	(+)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.0101	(+)	ATB <20 > ATB20+
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.0296	(+)	H > N
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.4196	(+)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.7308	(+)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.0158	(+)	QUADRATIC TERM IS SIGNIFICANT

3-15 CANCER OF THE LUNG
肺 癌

HIROSHIMA + NAGASAKI, MALES + FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL	TOTAL DEATHS		LUNG DOSE IN GRAY									EXCESS R.R. PER GRAY STD.ERROR (P-VALUE)
			.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	
1950-85	OBS. 638	282	164	36	37	69	34	27	5	1	3	0.6276
TOTAL	EXP.	307.56	151.04	36.08	44.79	54.80	25.32	13.43	2.89	0.75	1.33	0.1787
	OBS. REL. RISK	1.00	1.27	1.17	0.87	1.48	1.58	2.36	2.03	1.56	2.65	(0.0000)
	FITTED REL. RISK	1.00	1.01	1.04	1.09	1.19	1.43	1.87	2.49	3.17	3.88	
1950-55	OBS. 16	6	5	2	2	1	0	0	0	0	0	-0.2042
	EXP.	7.73	3.88	0.86	1.17	1.36	0.59	0.29	0.06	0.02	0.03	0.2679
	OBS. REL. RISK	1.00	1.66	3.00	2.21	0.95	0.00	0.00	0.00	0.00	0.00	(0.5120)
1956-60	OBS. 28	14	3	1	2	3	4	0	1	0	0	1.341
	EXP.	14.04	6.43	1.50	1.87	2.23	1.03	0.69	0.13	0.05	0.06	1.135
	OBS. REL. RISK	1.00	0.47	0.67	1.07	1.35	3.88	0.00	7.44	0.00	0.00	(0.1117)
1961-65	OBS. 69	21	21	6	4	8	3	6	0	0	0	0.9096
	EXP.	31.95	16.22	4.20	5.24	6.39	2.87	1.59	0.30	0.09	0.15	0.6158
	OBS. REL. RISK	1.00	1.97	2.18	1.16	1.90	1.59	5.74	0.00	0.00	0.00	(0.0668)
1966-70	OBS. 114	48	24	8	7	16	5	5	1	0	0	0.6407
	EXP.	55.52	27.03	6.43	7.71	9.62	4.45	2.40	0.46	0.15	0.23	0.4302
	OBS. REL. RISK	1.00	1.03	1.44	1.05	1.92	1.30	2.41	2.50	0.00	0.00	(0.0931)
1971-75	OBS. 115	46	27	7	9	11	9	2	1	0	3	0.9382
	EXP.	55.08	27.10	6.74	8.17	9.89	4.66	2.45	0.53	0.14	0.24	0.4851
	OBS. REL. RISK	1.00	1.19	1.24	1.32	1.33	2.31	0.98	2.26	0.00	14.97	(0.0037)
1976-80	OBS. 150	63	38	9	5	14	9	10	1	0	0	0.7756
	EXP.	71.34	36.08	8.60	10.74	12.97	6.08	3.03	0.72	0.14	0.31	0.3986
	OBS. REL. RISK	1.00	1.22	1.19	0.53	1.22	1.68	3.74	1.58	0.00	0.00	(0.0146)
1981-85	OBS. 146	64	45	3	8	16	4	4	1	1	0	0.1662
	EXP.	71.80	34.29	7.76	9.89	12.34	5.64	3.02	0.68	0.16	0.32	0.2717
	OBS. REL. RISK	1.00	1.47	0.43	0.91	1.46	0.80	1.49	1.65	7.01	0.00	(0.4884)
1983-85	OBS. 86	36	27	2	5	9	3	4	0	0	0	0.0805
	EXP.	41.89	20.13	4.68	5.94	7.42	3.44	1.81	0.42	0.09	0.18	0.3240
	OBS. REL. RISK	1.00	1.56	0.50	0.98	1.41	1.01	2.58	0.00	0.00	0.00	(0.7913)

FITTED RELATIVE RISK AT 1 GRAY : 1.6276 ± 0.1787 (P-VALUE: 0.0000)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE	P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	M:1 F:0	0.0948	(-)	N.S
SEX(MALE VS. FEMALE) ABSOLUTE	M:1 F:0	0.3205	(+)	N.S
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0	0.2668	(+)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0	0.9549	(+)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960 T<1960:0	0.3532	(-)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970 T<1970:0	0.2574	(-)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2	0.1490	(-)	N.S

3-16 CANCER OF THE FEMALE BREAST
女性乳癌

HIROSHIMA + NAGASAKI, FEMALES, ALL AGES ATB

FOLLOWUP INTERVAL		TOTAL DEATHS	BREAST DOSE IN GRAY									EXCESS R.R. PER GRAY STD.ERROR (P-VALUE)
				.01-.05	.06-.09	.10-.19	.20-.49	.50-.99	1.0-1.99	2.0-2.99	3.0-3.99	4.0+	
1950-85 TOTAL	OBS.	155	57	39	7	10	16	15	6	3	0	2	1.192
	EXP.		68.58	40.88	8.42	11.28	14.16	7.06	3.12	0.94	0.26	0.30	0.4475
	OBS. REL. RISK		1.00	1.15	1.00	1.07	1.36	2.56	2.31	3.83	0.00	8.06	(0.0001)
	FITTED REL. RISK		1.00	1.02	1.08	1.17	1.37	1.82	2.67	3.85	5.05	6.53	
1950-55	OBS.	15	4	6	2	1	0	2	0	0	0	0	-0.0642
	EXP.		6.71	4.02	0.79	1.09	1.32	0.65	0.29	0.08	0.02	0.03	0.6241
	OBS. REL. RISK		1.00	2.51	4.27	1.54	0.00	5.19	0.00	0.00	0.00	0.00	(0.8875)
1956-60	OBS.	16	9	2	0	1	2	2	0	0	0	0	0.0357
	EXP.		6.93	4.25	0.89	1.26	1.51	0.71	0.32	0.08	0.02	0.03	0.7172
	OBS. REL. RISK		1.00	0.36	0.00	0.61	1.02	2.16	0.00	0.00	0.00	0.00	(0.9203)
1961-65	OBS.	28	12	9	0	1	2	2	2	0	0	0	0.5720
	EXP.		12.31	7.52	1.54	2.11	2.57	1.18	0.55	0.13	0.04	0.05	0.8291
	OBS. REL. RISK		1.00	1.23	0.00	0.49	0.80	1.73	3.72	0.00	0.00	0.00	(0.3961)
1966-70	OBS.	22	5	4	2	1	5	0	3	1	0	1	4.601
	EXP.		9.78	5.72	1.20	1.59	2.00	1.04	0.46	0.14	0.04	0.04	2.757
	OBS. REL. RISK		1.00	1.37	3.27	1.23	4.88	0.00	12.87	13.87	0.00	47.10	(0.0003)
1971-75	OBS.	21	9	7	2	0	2	1	0	0	0	0	-0.1919
	EXP.		9.32	5.45	1.19	1.48	1.92	1.00	0.42	0.14	0.04	0.04	0.1820
	OBS. REL. RISK		1.00	1.33	1.74	0.00	1.08	1.03	0.00	0.00	0.00	0.00	(0.4795)
1976-80	OBS.	26	8	4	1	4	4	2	1	1	0	1	2.468
	EXP.		11.34	6.87	1.42	1.88	2.42	1.24	0.53	0.19	0.05	0.06	1.585
	OBS. REL. RISK		1.00	0.82	1.00	3.01	2.34	2.29	2.69	7.41	0.00	23.71	(0.0054)
1981-85	OBS.	27	10	7	0	2	1	6	0	1	0	0	1.517
	EXP.		12.18	7.05	1.40	1.87	2.41	1.24	0.55	0.18	0.05	0.06	1.185
	OBS. REL. RISK		1.00	1.21	0.00	1.30	0.51	5.88	0.00	5.69	0.00	0.00	(0.0668)
1983-85	OBS.	14	5	4	0	1	0	3	0	1	0	0	1.798
	EXP.		6.27	3.75	0.73	0.98	1.23	0.62	0.28	0.09	0.03	0.03	1.812
	OBS. REL. RISK		1.00	1.34	0.00	1.28	0.00	6.07	0.00	13.33	0.00	0.00	(0.0985)

FITTED RELATIVE RISK AT 1 GRAY : 2.1917 ± 0.4475 (P-VALUE: 0.0001)

DOSE RESPONSE MODIFICATION SCORE TESTS

DOSE RESPONSE MODIFIER	VARIABLE		P-VALUE	SIGN OF SCORE	DISCRIPTION OF RADIATION EFFECT
SEX(MALE VS. FEMALE)	XXX N	(X) NOT APPLICABLE			
SEX(MALE VS. FEMALE) ABSOLUTE	XXX N	(X) NOT APPLICABLE			
AGE ATB (UNDER 20 VS. 20+)	<20:1 20+:0		0.1731	(+)	N.S
CITY (HIROSHIMA VS. NAGASAKI)	H:1 N:0		0.7124	(-)	N.S
LOGLINEAR IN TIME SINCE 1960	T≧1960:T-1960	T<1960:0	0.3002	(+)	N.S
LOGLINEAR IN TIME SINCE 1970	T≧1970:T-1970	T<1970:0	0.5980	(+)	N.S
NON LINEALITY IN DOSE RESPONSE	D**2		0.6806	(-)	N.S