

Annex 3 Disease worksheets

Section 1: Worksheet for: Cutaneous malignant melanoma (CMM)

Case definition and sequelae: (ICD-10) C43.

The disability weights used in this study are listed in Table A3.1.

Table A3.1 Disability weights (Dutch weights)

| Disease phase/treatment | Disability weight |
|--|-------------------|
| Primary treatment, no evidence dissemination | 0.190 |
| No evidence of dissemination after initial treatment | 0.190 |
| Primary treatment, lymph node but no distant dissemination | 0.430 |
| In remission | 0.190 |
| Disseminated melanoma | 0.810 |
| Terminal phase (Dutch weight for end-stage disease) | 0.930 |

Analysis of published case-control studies indicates a PAF for malignant melanoma of around 0.2, with non-significant variation by latitude ($p = 0.18$, see graph below). As noted in this document (Section 2.3) this is likely to underestimate the true PAF for two reasons:

- Measurement error in assessing UVR exposure
- The reference group is not a truly ‘non-exposed’ group. Rather it is a less exposed portion of a population being compared to a more exposed portion of the same population.

This estimate, based on case-control studies, however, refers to how much of the inter-individual variation in risk of CMM within a single population can be attributed to inter-individual variation in UVR exposure. This is a different parameter from that estimated by population-level (ecological) analyses, which estimates how much of the difference in incidence rates between populations is attributable to differences in population-specific average ambient levels of UVR exposure.

In an ecological analysis, Armstrong et al (1) estimated a PAF of 0.96 in males and 0.92 in females, based on comparison of white and black populations in the USA. The black population is the reference ‘unexposed’ population. Yet there may be constitutional differences between these two populations that contributes to the difference in incidence between the groups but is unrelated to UVR exposure. Armstrong also calculated a PAF based on a comparison of ethnically similar white populations in two different locations, NSW in Australia and the United Kingdom. The calculated PAF was 0.89 in males and 0.79 in females. The population living in the UK is the reference ‘unexposed’ population.

If one plots incidence rates derived from Jones et al (2) for the states of Australia, against the latitude of the capital city (to represent UVR exposure), a PAF can be calculated, using the low rate in Tasmania as the incidence rate in the ‘unexposed’. The calculated PAF is 0.70 in males and 0.66 for females. (Using the latitude of the middle of the state, the PAF is 0.62 for males and 0.59 for females).

Interestingly, a similar plot of age-standardized incidence rate for melanoma (from Globocan 2000 (3)) against latitude of the capital city for European countries reveals a reverse gradient, with a higher incidence of CMM at higher latitudes. This presumably reflects the complexity of the relationship between measures of UVR exposure and melanoma incidence. It may be that ecologic data from Australia provide the best ecologic estimate of PAF as the variation in melanoma incidence by latitude (as a proxy for UVR exposure) is less confounded by ethnic and behavioural differences, than estimates based on inter-country data.

Figure A3.1 represents the PAF derived from all relevant identified case-control studies that have used as the exposure measure, episodes of sunburn, or intermittent high intensity exposure. There were less data on other types of exposure, e.g. occupational exposure, and for melanoma it is likely that it is this intermittent pattern of UVR exposure that is most important. Studies used to derive the PAF are listed in Table A3.2. Note that some studies provided more than one data point, as different measures of exposure were included in the same study, e.g. different ages at which sunburn was experienced (childhood, adolescent or adult).

Figure A3.1 Latitudinal variation in PAF of sunburn or intermittent sun exposure for melanoma

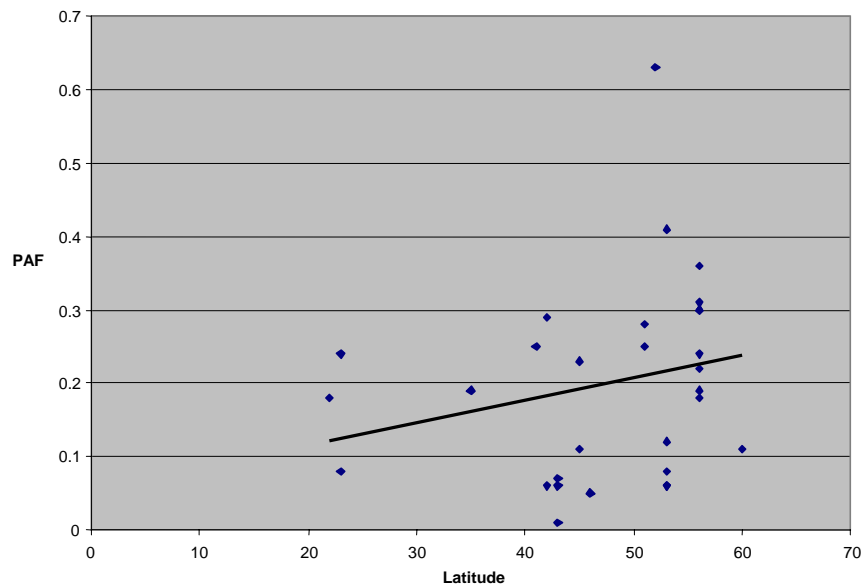


Table A3.2 Case control studies used to derive population attributable fractions of sunburn or intermittent UVR exposure, for CMM

| No | Reference | Odds ratio (95 % CI) | Exposure measure |
|----|--------------------|---|-------------------------------------|
| 4 | Bernengo, 1987 | 1.5 (0.7-3.5) | Severe blistering sunburn |
| 5 | Cristofolini, 1987 | 1.2 (0.7-2.1) ever | Severe sunburn |
| 6 | Dubin, 1990 | 1.61 (1.0-2.6) | Severe blistering sunburn |
| 7 | Elwood, 1984 | 1.3 (0.9-1.8) | Sunburn |
| 8 | Elwood, 1985 | 1.7 (1.1-2.7) | Hours recreational sun exposure |
| 9 | Green, 1985 | 2.4 (1.0-6.1) | Sunburn |
| 10 | Klepp, 1979 | 2.4 (1.0-5.8) | Southern Europe sunbathing holidays |
| 11 | Loria, 2001 | 2.4 (1.0-5.9) | Childhood sunburn |
| 12 | MacKie, 1982 | 2.8 (1.1-7.4) | Severe sunburn |
| 13 | MacKie, 1989 | 7.6 (1.8-32) male 2.3 (0.9-5.6) female | Severe sunburn |
| 14 | Naldi, 2000 | 1.1 (0.8-1.5) ever 1.6 (1.0-2.4) child | Severe sunburn |
| 15 | Osterlind, 1988 | 3.0 (1.5-5.9) adult 1.9 (1.2-3.1) adol. 2.7 (1.6-4.8) child | Sunburn |
| 16 | Pfahlberg, 2001 | 3.07 (1.73-5.59) adult 2.01 (1.18-3.49) | Blistering sunburn |
| 17 | Siskind, 2002 | 1.31 (1.08-1.58) | >6 sunburns |
| 18 | Sorahan, 1985 | 4.2 | Painful sunburns |
| 19 | Walter, 1999 | 1.28 (0.97-1.69) | Severe sunburn last 5 years |
| 20 | Weinstock, 1989 | 1.1 (0.6-2.3) ever 1.9 (1.1-3.4) adolescent | Blistering sunburn |
| 21 | Westerdahl, 1994 | 1.9 (1.2-3.1) adult 1.6 (1.0-2.5) adol. 1.6 (1.0-2.6) child | Severe sunburn |
| 22 | Whiteman, 1997 | 1.7 (0.5-5.9) | Blistering sunburn |
| 23 | Zanetti, 1992 | 1.5 (0.8-2.7) ever 1.2 (4.6-31) child | Severe sunburn |
| 24 | Zaridze, 1992 | 3.4 (0.6-17.4) | Sunbathing |

Although Figure A3.1 suggests an increase of PAF with latitude, this is non-significant. We chose to use a PAF of 0.5 (no latitudinal gradient) as a lower estimate (approximately midway between ecological and case-

controls studies) and 0.9 as an upper estimate, in line with ecological studies. A lower estimate of 0.2 as suggested by case-control studies was thought to be unrealistic due to measurement error in the assessment of UVR exposure.

References

1. **Armstrong, B.K. & Kricger, A.** How much melanoma is caused by sun exposure? *Melanoma Research*. 3 (6): 395-401 (1993).
2. **Jones, M.E. et al.** Interstate differences in incidence and mortality from melanoma. A re-examination of the latitudinal gradient. *Medical Journal of Australia*. 157 (6): 373-378 (1992).
3. **Ferlay, J. et al.** GLOBOCAN 2000: Cancer Incidence, Mortality and Prevalence Worldwide, Version 1.0 ed, IARC CancerBase No. 5. Lyon, IARC Press, 2001
4. **Bernengo, M.G. et al.** [Cutaneous melanoma at the Turin Melanoma Center. II. Risk of metastasis and free interval in relation to the clinical and histological prognostic factors in 502 patients in stage I (1975-1985)]. *G Ital Dermatol Venereol*. 122 (4): 143-153 (1987).
5. **Cristofolini, M. et al.** Risk factors for cutaneous malignant melanoma in a northern Italian population. *International Journal of Cancer*. 39 (2): 150-154 (1987).
6. **Dubin, N. et al.** Simultaneous assessment of risk factors for malignant melanoma and non-melanoma skin lesions, with emphasis on sun exposure and related variables. *International Journal of Epidemiology*. 19 (4): 811-819 (1990).
7. **Elwood, J.M. et al.** Pigmentation and skin reaction to sun as risk factors for cutaneous melanoma: Western Canada Melanoma Study. *British Medical Journal (Clinical Research Ed.)*. 288 (6411): 99-102 (1984).
8. **Elwood, J.M. et al.** Cutaneous melanoma in relation to intermittent and constant sun exposure--the Western Canada Melanoma Study. *International Journal of Cancer*. 35 (4): 427-433 (1985).
9. **Green, A. et al.** Sunburn and malignant melanoma. *British Journal of Cancer*. 51 (3): 393-397 (1985).
10. **Klepp, O. & Magnus, K.** Some environmental and bodily characteristics of melanoma patients. A case-control study. *International Journal of Cancer*. 23 (4): 482-486 (1979).
11. **Loria, D. & Matos, E.** Risk factors for cutaneous melanoma: a case-control study in Argentina. *International Journal of Dermatology*. 40 (2): 108-114 (2001).
12. **MacKie, R.M. & Aitchison, T.** Severe sunburn and subsequent risk of primary cutaneous malignant melanoma in Scotland. *British Journal of Cancer*. 46 (6): 955-960 (1982).
13. **MacKie, R.M. et al.** Personal risk-factor chart for cutaneous melanoma. *Lancet*. 2 (8661): 487-490 (1989).
14. **Naldi, L. et al.** Pigmentary traits, modalities of sun reaction, history of sunburns, and melanocytic nevi as risk factors for cutaneous malignant melanoma in the Italian population: results of a collaborative case-control study. *Cancer*. 88 (12): 2703-2710 (2000).
15. **Osterlind, A. et al.** The Danish case-control study of cutaneous malignant melanoma. II. Importance of UV-light exposure. *International Journal of Cancer*. 42 (3): 319-324 (1988).
16. **Pfahlberg, A. et al.** Timing of excessive ultraviolet radiation and melanoma: epidemiology does not support the existence of a critical period of high susceptibility to solar ultraviolet radiation-induced melanoma. *British Journal of Dermatology*. 144 (3): 471-475 (2001).
17. **Siskind, V. et al.** Sun exposure and interaction with family history in risk of melanoma, Queensland, Australia. *International Journal of Cancer*. 97 (1): 90-95 (2002).
18. **Sorahan, T. & Grimley, R.P.** The aetiological significance of sunlight and fluorescent lighting in malignant melanoma: a case-control study. *British Journal of Cancer*. 52 (5): 765-769 (1985).
19. **Walter, S.D. et al.** Association of cutaneous malignant melanoma with intermittent exposure to ultraviolet radiation: results of a case-control study in Ontario, Canada. *International Journal of Epidemiology*. 28 (3): 418-427 (1999).
20. **Weinstock, M.A. et al.** Nonfamilial cutaneous melanoma incidence in women associated with sun exposure before 20 years of age. *Pediatrics*. 84 (2): 199-204 (1989).
21. **Westerdahl, J. et al.** At what age do sunburn episodes play a crucial role for the development of malignant melanoma. *European Journal of Cancer*. 30A (11): 1647-1654 (1994).
22. **Whiteman, D.C. et al.** Risk factors for childhood melanoma in Queensland, Australia. *International Journal of Cancer*. 70 (1): 26-31 (1997).
23. **Zanetti, R. et al.** Cutaneous melanoma and sunburns in childhood in a southern European population. *European Journal of Cancer*. 28A (6-7): 1172-1176 (1992).
24. **Zaridze, D. et al.** Risk factors for skin melanoma in Moscow. *International Journal of Cancer*. 52 (1): 159-161 (1992).

Section 2: Worksheet for: Cutaneous Squamous cell carcinoma (SCC)

Case definition and sequelae: (ICD-10) C44

The disability weights for cutaneous squamous cell carcinoma are based on a combination of disability weights from the Dutch study and the Australian Burden of Disease study, and are listed in Table A3.3.

Table A3.3 Disability weights for disease stages/treatment for SCC

| Disease phase/treatment | Disability weights |
|---|--|
| Squamous cell carcinoma, primary treatment. No lymph node involvement | 0.070 (Dutch weight) |
| Squamous cell carcinoma, primary treatment, lymph node involvement | 0.300 (imputed by comparison with similar weight for melanoma) |
| Squamous cell carcinoma – local recurrence | 0.070 (as for primary treatment, no LN involvement) |
| Disseminated disease | 0.400 (from Australian BoD study) |
| Terminal phase | 0.930 (Dutch weight for end-stage disease) |

The attributable risks for lightly pigmented populations were calculated from case-control studies, as outlined in section 2.3. While attributable risks were calculated for each type of exposure, in view of the current theories of the type of exposure that is important in the development of SCC, those relating to occupational and cumulative exposure were graphed by latitude (see Figure A3.2). There was a non-significant latitudinal gradient in the PAF ($p = 0.55$) with a mean of 0.35 and an intercept at PAF = 0.50. There are few data points on which to base the trendline, and substantial variation in estimates of population attributable fraction for latitude, reflecting the difficulties in obtaining accurate sun exposure data when conducting epidemiological studies.

There are few data available to allow calculation of the population attributable fraction in populations with medium pigmentation. The incidence in white populations is four to ten times higher than Hispanics in the southern USA, (1) and is lower in Japanese in Japan than Japanese in Hawaii, (2) but the rate in Japanese in Hawaii is less than that of whites in Hawaii (23/100,000 compared to 118/100,000) (2,3). There is a latitudinal gradient in skin cancer incidence in Japan, suggesting risk attributable to UVR (4). It is unclear whether SCC in populations of medium pigmentation behaves more like SCC in lightly pigmented populations or deeply pigmented populations. It may be that the PAF should be the same as for lightly pigmented populations, or be between the PAF for lightly pigmented and deeply pigmented populations. Further research is clearly needed to answer this question but for the purposes of this assessment we have assigned an attributable fraction that is one fifth the attributable fraction for lightly pigmented populations based on patterns of incidence in different populations in the same location.

The PAF assigned to black populations is based on data that indicate that SCC is extremely rare in these populations (5) and largely occurs at sites of chronic inflammation, eg tropical ulcers. While it is plausible that some SCC may develop in non-pigmented scar tissue due to an effect of UVR exposure, it seems likely that most SCC in dark-skinned populations are not related to UVR exposure. The PAF above is set at one fifth of the rate for populations with medium pigmentation. This is somewhat arbitrary but reflects the evidence to date suggesting that SCC in deeply pigmented populations is generally unrelated to UVR exposure. There are, however, no studies that have specifically attempted to calculate the relative risk or the PAF for UVR exposure in deeply pigmented populations.

Figure A3.2 PAF for SCC for occupational and total, sun exposure

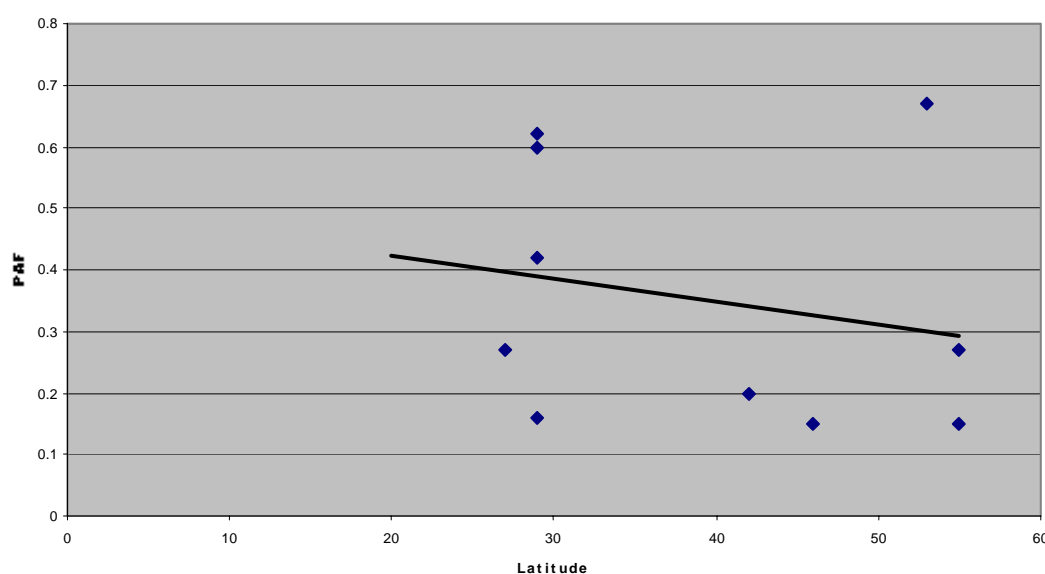


Figure A3.2 depicts the PAF for squamous cell carcinoma, based on occupational and total estimated exposure. Points on the graph are based on analyses in the studies listed in Table A3.4.

Table A3.4 Case control studies on occupational or total, sun exposure and SCC

| No. | Reference | Odds ratio (95% CI) | Exposure measure |
|-----|-----------------|---------------------|------------------------|
| 6 | Aubry, 1985 | 9.1 (0.99-84.47) | Occupational exposure |
| 7 | English, 1998 | 1.2 (0.58-2.8) | Occupational exposure |
| | | 3.5 (0.97-12) | Total exposure history |
| 8 | English, 1998 | 2.5 (0.88-6.9) | Total exposure history |
| 9 | Gallagher, 1995 | 1.4 (0.4-4.3) | Occupational exposure |
| | | 1.1 (0.6-2.1) | Total exposure history |
| 10 | Green, 1996 | 1.37 (0.80-2.34) | Occupational exposure |
| 11 | Kennedy, 2003 | 6.5 (1.7 – 25.6) | Occupational exposure |
| 12 | Rosso, 1996 | 1.6 (0.93-2.75) | Occupational exposure |

(Note that some studies generate more than one point by measuring more than one type of exposure, e.g. occupational and total exposure).

The mean PAF from these studies is 0.35, intercept (extrapolated) is 0.5 and there is no significant latitudinal gradient. Occupational or total sun exposure is probably the most important pattern of sun exposure for SCC occurrence. As case-control studies tend to give low PAF because of difficulties in measuring exposure and in defining a non-exposed population we assumed a lower estimate of PAF of 0.5 and an upper estimate of 0.7 in lightly pigmented groups, based on the extensive epidemiological experience of members of this working group. Table A3.5 summarizes the PAFs used in this assessment for groups with different skin pigmentation.

Table A3.5 Summary of the PAF for SCC for different pigment groups

| | Lightly pigmented | Medium pigmentation | Darkly pigmented |
|-------|-------------------|---------------------|------------------|
| Lower | 0.5 | 0.1 | 0.02 |
| Upper | 0.7 | 0.14 | 0.028 |

Note that the different PAF by pigment group means that the PAF cannot be simply applied to the total burden of disease estimates. Rather, for each region, the proportion of cases in each pigment group was calculated. These proportions were then applied to the regional disease estimates (in DALYs) and the PAF applied to each

pigment group estimate. The total DALYs for the region were then summed to give the total attributable burden of disease due to SCC for the region.

The mortality rate from SCC by age group and gender was estimated from incidence rates as presented in Table A3.6 derived from the Australian Burden of Disease Study (13).

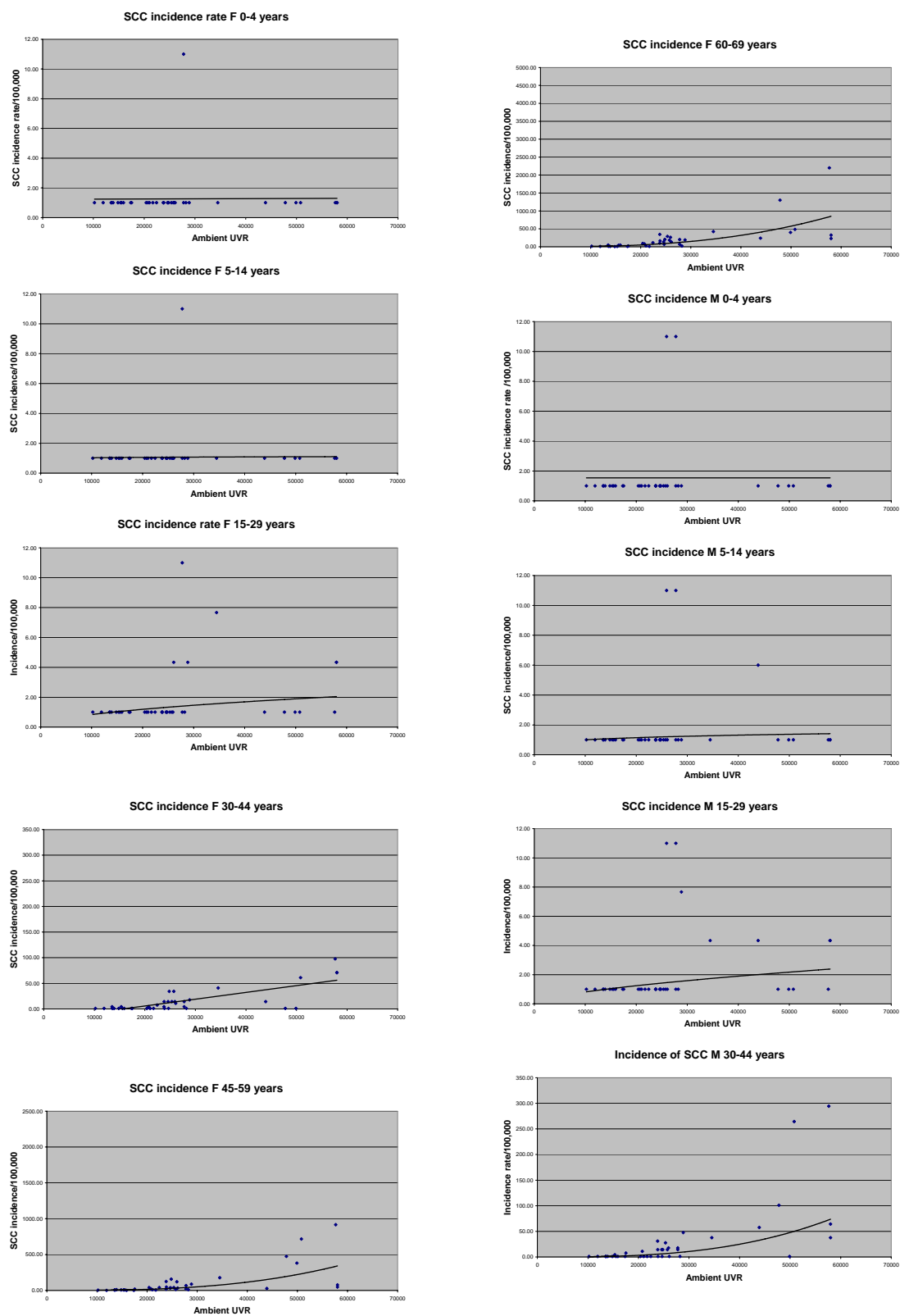
Table A3.6 Incidence to mortality ratios, by age group

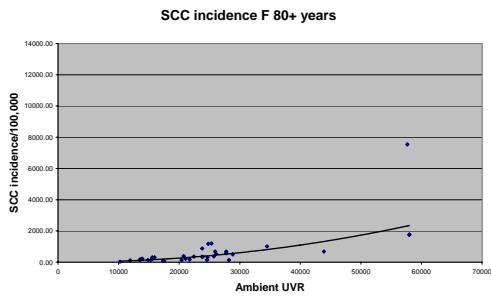
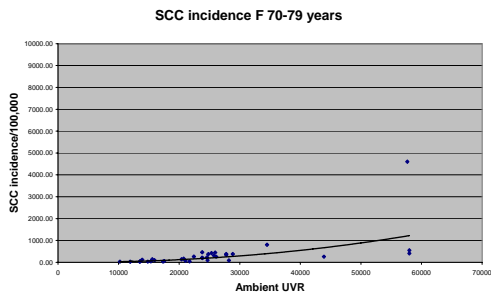
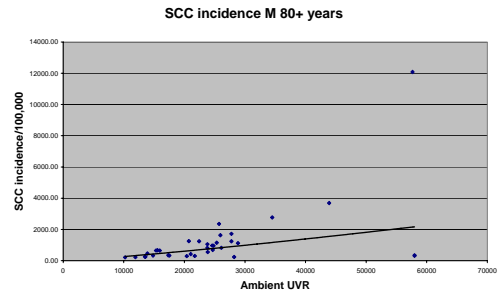
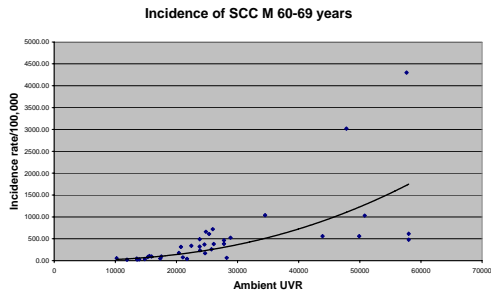
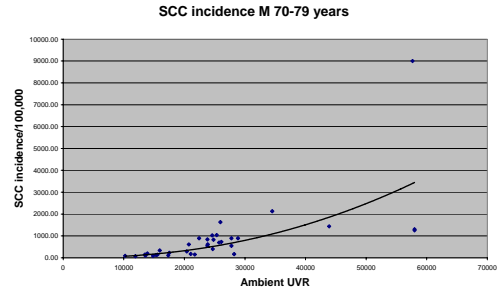
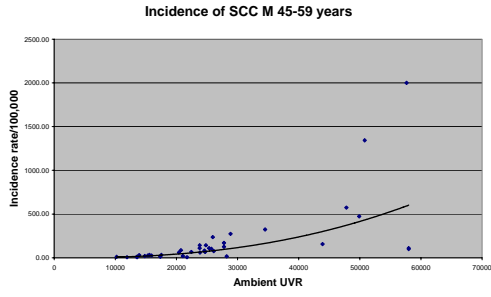
| Ratio of incidence to mortality rates for SCC | 0-4 | 5-14 | 15-24 | 25-34 | 35-44 | 45-54 | 55-64 | 65-74 | 75+ |
|---|-----|------|-------|-------|-------|--------|-------|-------|-------|
| Males | 0 | 0 | 0 | 0 | 635.2 | 863.5 | 541.0 | 291.3 | 85.2 |
| Females | 0 | 0 | 0 | 0 | 0 | 1149.4 | 653.5 | 516.1 | 120.4 |

Note: The mortality rate was derived by dividing the incidence rate by this incidence to mortality ratio except in those cells with a zero, where the mortality rate was taken as zero.

Incidence data from published epidemiological literature were used to develop dose-response curves which are presented in Figure A3.3.

Figure A3.3 Variation in incidence of SCC with annual ambient UVR





References

1. **Hoy WE.** Nonmelanoma skin carcinoma in Albuquerque, New Mexico: experience of a major health care provider. *Cancer* 1996;**77**(12):2489-95.
2. **Chuang TY, et al.** Nonmelanoma skin cancer in Japanese ethnic Hawaiians in Kauai, Hawaii: an incidence report. *J Am Acad Dermatol* 1995;**33**(3):422-6.
3. **Chuang TY, et al.** Squamous cell carcinoma in Kauai, Hawaii. *Int J Dermatol* 1995;**34**(6):393-7.
4. **Nagano T, et al.** Skin cancer screening in Okinawa, Japan. *J Dermatol Sci* 1999;**19**(3):161-5.
5. **Mora RG, & Perniciaro C.** Cancer of the skin in blacks. I. A review of 163 black patients with cutaneous squamous cell carcinoma. *J Am Acad Dermatol* 1981;**5**(5):535-43.
6. **Aubry, F. & MacGibbon, B.** Risk factors of squamous cell carcinoma of the skin. A case-control study in the Montreal region. *Cancer.* 55 (4): 907-911. (1985).
7. **English, D.R. et al.** Case-control study of sun exposure and squamous cell carcinoma of the skin. *International Journal of Cancer.* 77 (3): 347-353 (1998).
8. **English, D.R. et al.** Demographic characteristics, pigmentary and cutaneous risk factors for squamous cell carcinoma of the skin: a case-control study. *International Journal of Cancer.* 76 (5): 628-634. (1998).
9. **Gallagher, R.P. et al.** Sunlight exposure, pigmentation factors, and risk of nonmelanocytic skin cancer. II. Squamous cell carcinoma. *Archives of Dermatology.* 131 (2): 164-169. (1995).
10. **Green, A. et al.** Skin cancer in a subtropical Australian population: incidence and lack of association with occupation. The Nambour Study Group. *American Journal of Epidemiology.* 144 (11): 1034-1040 (1996).
11. **Kennedy, C. et al.** The influence of painful sunburns and lifetime sun exposure on the risk of actinic keratoses, seborrheic warts, melanocytic nevi, atypical nevi, and skin cancer. *Journal of Investigative Dermatology.* 120 (6): 1087-1093 (2003).
12. **Rosso, S. et al.** The multicentre south European study 'Helios'. II: Different sun exposure patterns in the aetiology of basal cell and squamous cell carcinomas of the skin. *British Journal of Cancer.* 73 (11): 1447-1454. (1996).
13. **Mathers C, et al.** The burden of disease and injury in Australia. Canberra: Australian Institute of Health and Welfare, 1999: 245

Section 3: Worksheet for: Basal cell carcinoma

Case definition and sequelae: (ICD-10) C44

The disability weights for basal cell carcinoma (BCC) of the skin are based on a combination of weights from the Dutch study and the Australian Burden of Disease Study and are listed in Table A3.8.

Table A3.8 Disability weights for stages of disease in BCC

| Disease phase/treatment | Disability weight |
|-------------------------|------------------------------------|
| Localised disease | 0.050 (Australian BoD study) |
| Lymph node involvement | 0.3 (same as SCC) |
| Disseminated disease | 0.4 (as for SCC) |
| Terminal disease | 0.930 (Dutch for terminal illness) |

Population attributable fractions were calculated from case-control studies and plotted against latitude of the study. While the trendline suggests decreasing PAF with increasing latitude (see Figure A3.4), this trend is not significant ($p = 0.32$, intercept = 0.33, mean = 0.25). Since it may be that the pattern and timing of exposure to UVR is important in the etiology of BCC, case-control studies may fail to capture the true risk related to UVR. Measures of sun exposure are coarse and rely on memory of distant events – most BCC arise in the elderly, while it may be sun exposure in youth that is important. As for melanoma, the population attributable fraction derived from case control studies is likely to underestimate the true population attributable fraction.

There are no published calculations of attributable fraction for UVR causing BCC, based on ecologic studies, such as Armstrong has undertaken for CMM (1). However, using a similar methodology where

$$\text{PAF} = (I_p - I_u) / I_p$$

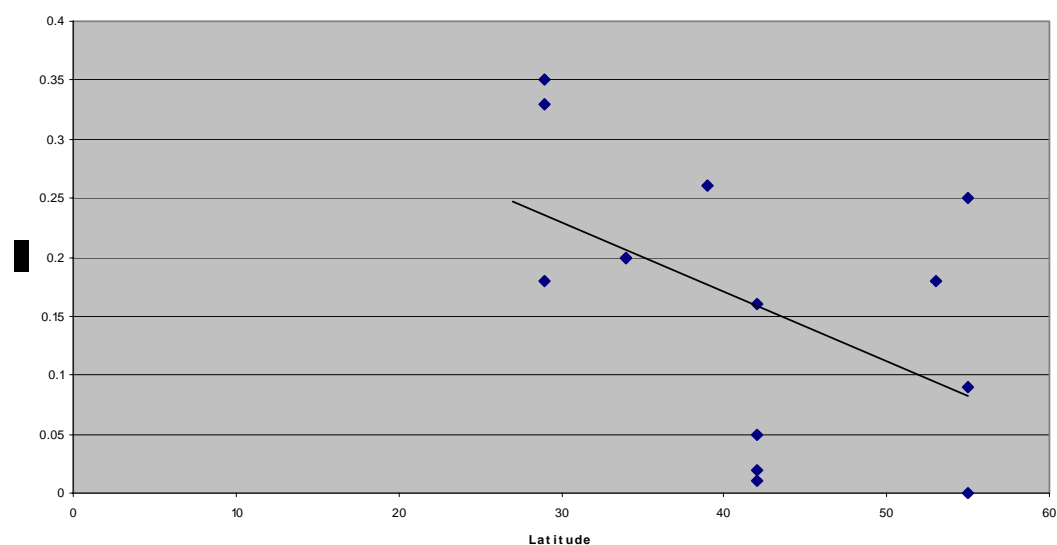
where I_p is the incidence of BCC in the whole population, and I_u its incidence in people who have not been exposed to the sun, existing data can be used to calculate PAF. Armstrong used the incidence of disease (in that case, melanoma) in people with black skin as an estimate of I_u in white people in the same population. We have already noted the paucity of population data on the incidence of BCC due to destructive treatment modes and lack of a disease register. However, Munyao's thirty year retrospective study of all BCC's reported to the Kenya Cancer Registry, gives a mean annual incidence rate in white populations of 58.5 per million, compared to 0.065 per million in black populations (2). This would give an attributable fraction (using the above formula) of 0.999. Also, using data comparing incidence rates for BCC in Hispanic compared to Anglo populations (3) (using the incidence rate for BCC in the Hispanic group as I_u), the estimated PAF would be 0.87.

A lower estimate of PAF of 0.50 was used in this assessment, based on case-control studies but recognizing the difficulty of obtaining accurate UVR exposure measurement in such studies. An upper estimate of 0.9 was used based on the above calculation.

Basal cell carcinoma is rare in African Americans and it appears that most of those who do develop BCC are of lighter skin colour (4). Basal cell carcinoma was absent in a skin survey in the North Solomon's - an area that has some of the most deeply pigmented people in the world (5). However, unlike SCC, BCC in deeply pigmented persons usually occurs on sun-exposed areas, primarily the head and neck regions and appears to be mainly related to UVR exposure (6,7).

There are no available data to calculate population attributable fraction in those of medium and dark pigmentation, but the disease is considered to have the same causal relationship with UVR exposure and thus the same PAF for all pigment groups.

Figure A3.4 PAF for BCC and history of sunburn or intermittent sun exposure



Points on the plot are drawn from calculations based on the studies listed in Table A3.9.

Table A3.9 Case control studies of BCC and UVR exposure measured as sunburn or intermittent sun exposure

| No. | Reference | Odds ratio (95% CI) | Exposure measure |
|-----|-----------------|---------------------|-----------------------|
| 8 | Foote, 2001 | 1.26 (0.9-1.77) | Sunburn |
| 9 | Gallagher, 1995 | 2.6 (1.1-6.5) | Intermittent exposure |
| | | 4.5 (1.7-12.3) | Sunburn – child |
| 10 | Hunter, 1990 | 1.9 (1.5-2.4) | Sunburn |
| 11 | Kennedy, 2003 | 1.6 (1.1-2.2) | Sunburn - child |
| 12 | Kricker, 1995 | 1.74 (1.03-2.95) | Intermittent exposure |
| 13 | Kricker, 1995 | 1.85 (1.09-3.13) | Intermittent exposure |
| | | 1.24 (0.69-2.24) | Sunburn |
| 14 | Rosso, 1996 | 1.47 (1.18-1.83) | Intermittent exposure |
| | | 1.45 (1-2.12) | Sunburn – child |
| | | 1.05 (0.86-1.42) | Sunburn – adult/ever |
| 15 | Zanetti, 1996 | 1.68 (1.17-2.39) | Sunburn – child |
| | | 1.3 (0.95-1.78) | Sunburn – adult/ever |

Additional other studies were examined but either presented insufficient information to calculate the PAF, or used different exposure measurements, e.g occupational exposure, fair skin. Graphs were drawn of PAF and latitude using each different method of exposure measurement – the one presented here shows the most commonly measured type of exposure. The mortality rate was calculated from the incidence rate using the ratios presented in Table A3.10 (derived from data in the Australian Burden of Disease Study) (16).

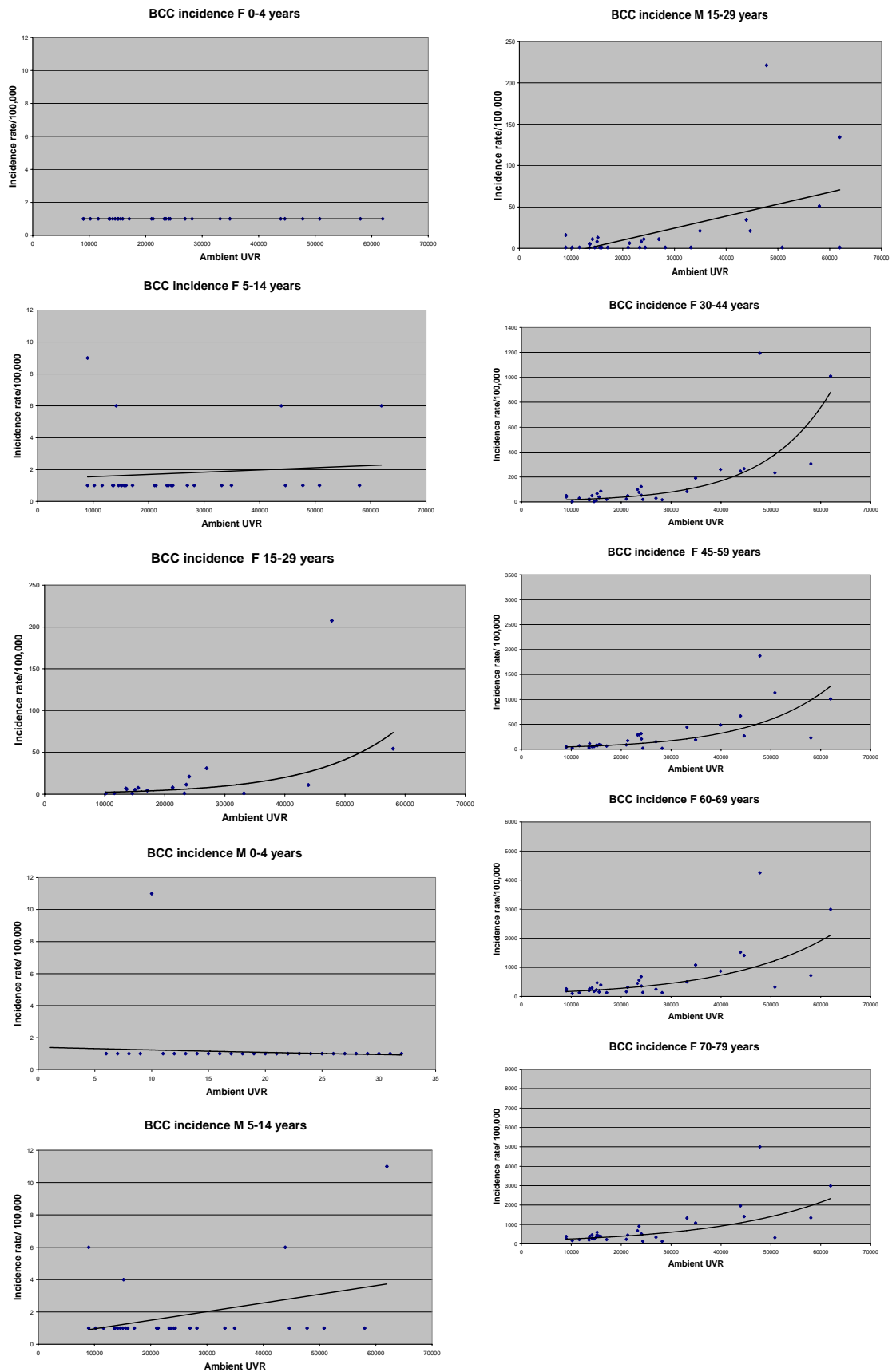
Table A3.10 Incidence to mortality ratios for BCC

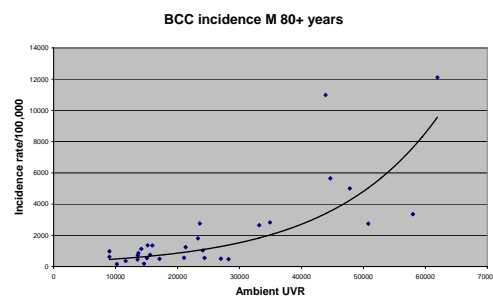
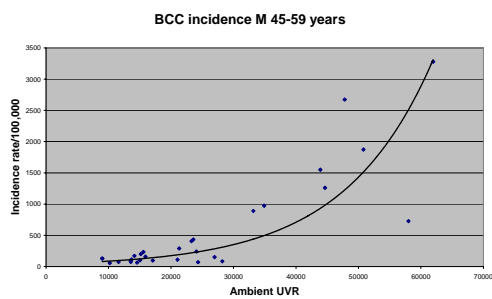
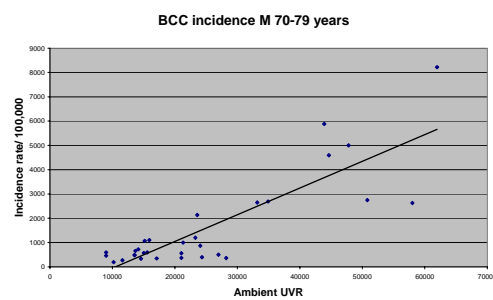
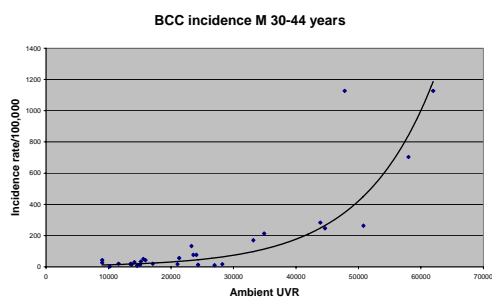
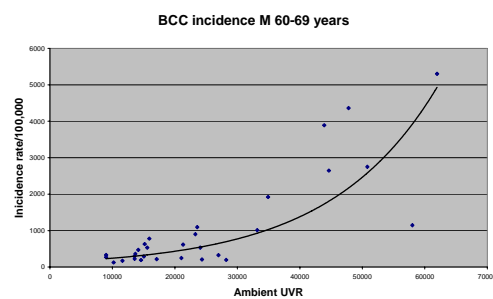
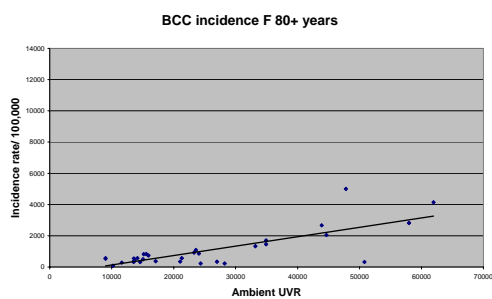
| Ratio of incidence to mortality | AGE | | | | | | | | |
|---------------------------------|-----|------|-------|-------|--------|---------|----------|--------|--------|
| | 0-4 | 5-14 | 15-24 | 25-34 | 35-44 | 45-54 | 55-64 | 65-74 | 75+ |
| Males | 0 | 0 | 0 | 0 | 5716.7 | 7771.1 | 4868.616 | 2621.6 | 766.9 |
| Females | 0 | 0 | 0 | 0 | 0 | 10344.2 | 5881.3 | 4645.0 | 1083.4 |

Note: The mortality rate was derived by dividing the incidence rate by this incidence to mortality ratio except those cells with a zero, where the mortality rate was taken as zero.

Incidence data from published epidemiological literature were used to develop dose-response curves which are presented in Figure A3.5.

Figure A3.5 Variation in BCC incidence by annual ambient UVR





References

1. **Armstrong, B.K. & Kricker, A.** How much melanoma is caused by sun exposure? *Melanoma Research*. 3 (6): 395-401 (1993).
2. **Munyao, T.M. & Othieno-Abinya, N.A.** Cutaneous basal cell carcinoma in Kenya. *East African Medical Journal*. 76 (2): 97-100 (1999).
3. **Armstrong, B.K. & Kricker, A.** The epidemiology of UV induced skin cancer. *Journal of Photochemistry and Photobiology. B, Biology*. 63 (1-3): 8-18 (2001).
4. **Halder, R.M. & Bridgeman-Shah, S.** Skin cancer in African Americans. *Cancer*. 75 (2 Suppl): 667-673 (1995).
5. **Foster, H.M. & Webb, S.J.** Skin cancer in the North Solomons. *Australian and New Zealand Journal of Surgery*. 58 (5): 397-401 (1988).
6. **Altman, A. et al.** Basal cell epithelioma in black patients. *Journal of the American Academy of Dermatology*. 17 (5 Pt 1): 741-745 (1987).
7. **Fleming, I.D. et al.** Skin cancer in black patients. *Cancer*. 35 (3): 600-605 (1975).
8. **Foote, J.A. et al.** Predictors for cutaneous basal- and squamous-cell carcinoma among actinically damaged adults. *International Journal of Cancer*. 95 (1): 7-11 (2001).
9. **Gallagher, R.P. et al.** Sunlight exposure, pigmentary factors, and risk of nonmelanocytic skin cancer. I. Basal cell carcinoma. *Archives of Dermatology*. 131 (2): 157-163 (1995).
10. **Hunter, D.J. et al.** Risk factors for basal cell carcinoma in a prospective cohort of women. *Annals of Epidemiology*. 1 (1): 13-23 (1990).
11. **Kennedy, C. et al.** The influence of painful sunburns and lifetime sun exposure on the risk of actinic keratoses, seborrheic warts, melanocytic nevi, atypical nevi, and skin cancer. *Journal of Investigative Dermatology*. 120 (6): 1087-1093 (2003).
12. **Kricker, A. et al.** A dose-response curve for sun exposure and basal cell carcinoma. *International Journal of Cancer*. 60 (4): 482-488 (1995).
13. **Kricker, A. et al.** Does intermittent sun exposure cause basal cell carcinoma? a case-control study in Western Australia. *International Journal of Cancer*. 60 (4): 489-494 (1995).
14. **Rosso, S. et al.** The multicentre south European study 'Helios'. II: Different sun exposure patterns in the aetiology of basal cell and squamous cell carcinomas of the skin. *British Journal of Cancer*. 73 (11): 1447-1454. (1996).
15. **Zanetti, R. et al.** The multicentre south European study 'Helios'. I: Skin characteristics and sunburns in basal cell and squamous cell carcinomas of the skin. *British Journal of Cancer*. 73 (11): 1440-1446. (1996).
16. **Mathers, C. et al.** The burden of disease and injury in Australia. Canberra, Australian Institute of Health and Welfare, 1999, pp. 245.

Section 4: Worksheet for: Photoageing/solar keratoses

Case definition and sequelae: Includes actinic keratosis (solar keratosis), wrinkling, actinic lentiginos, progression to squamous cell carcinoma

The disability weights for those aspects of photoageing that attract a disability are listed in Table A3.12. No studies list a disability weight for removal of a solar keratosis, so that this was inferred by comparison with the disability weight for localized BCC (0.05 from the Dutch study and the Australian Burden of Disease Study) and that for dental caries (0.01 in the Global Burden of Disease Study).

Table A3.12 Disability weights for aspects of photoageing

| Disease phase/treatment | Disability weight |
|-----------------------------|------------------------------|
| Progression to SCC, removal | 0.070 (Australian BoD study) |
| Removal of solar keratosis | 0.02 (inferred, see text) |

There are no ecologic and few case-control studies on the contribution sun exposure makes to “photoageing”. However, it is clear that wrinkles are a product of both normal ageing and photoageing. Griffiths estimates that 85% of wrinkling is due to the effects of sun-exposure (1). Photoageing also includes actinic lentiginos and solar keratoses. In terms of the global burden of disease, we are only interested in solar keratoses –despite their lack of an inherent disability there is a premalignant potential, which causes them to be removed and a possibility of malignant transformation. Frost et al (2) examined the prevalence of solar keratoses in relation to a number of different measures of past UVR exposure – sunburns <20 years, sunburns >20years, occupational exposure, lifetime exposure and recreational exposure. The calculated PAFs using these different measures of exposure range from – 0.35 for recreational exposure, to 0.57 for sunburn occurring below the age of 20 years.

Photoageing is by definition due to UVR exposure. Solar keratoses are recognizably distinct from other keratoses, eg arsenical keratosis and are a feature of severe sun damage. In view of this, we have used a PAF of 1.0 in this analysis, ie burden of disease due to photoageing is fully attributed to UVR exposure. Table A3.13 shows the estimated prevalence per cent of solar keratoses in lightly pigmented population, by latitudinal band.

Table A3.13 Prevalence per cent of solar keratoses in lightly pigmented populations, by latitude

| Latitude (degrees) | Male | | | | | | | | | Female | | | | | | | |
|-----------------------|-------------|------|-------|-------|-------|-------|-------|-----|--|-------------|------|-------|-------|-------|-------|-------|------|
| | Age (years) | | | | | | | | | Age (years) | | | | | | | |
| | 0-4 | 5-14 | 15-29 | 30-44 | 45-59 | 60-69 | 70-79 | 80+ | | 0-4 | 5-14 | 15-29 | 30-44 | 45-59 | 60-69 | 70-79 | 80+ |
| 0-10 | 0 | 0 | 1 | 5 | 24 | 33 | 40 | 36 | | 0 | 0 | 0 | 2.5 | 12 | 16.5 | 20 | 18 |
| 10-20 | 0 | 0 | 0 | 4.4 | 21 | 30 | 37 | 35 | | 0 | 0 | 0 | 2.2 | 10.5 | 15 | 18.5 | 17 |
| 20-30 | 0 | 0 | 0 | 4 | 18.9 | 23 | 31 | 27 | | 0 | 0 | 0 | 2 | 9.5 | 11.5 | 15.5 | 13.5 |
| 30-40 | 0 | 0 | 0 | 3.8 | 15.4 | 18 | 27 | 24 | | 0 | 0 | 0 | 1.9 | 8 | 9 | 13.5 | 12 |
| 40-50 | 0 | 0 | 0 | 3.2 | 10 | 12 | 17 | 15 | | 0 | 0 | 0 | 1.6 | 5 | 6 | 8.6 | 7.5 |
| 50-60 | 0 | 0 | 0 | 0.8 | 2.5 | 5 | 8 | 5 | | 0 | 0 | 0 | 0.4 | 1.3 | 2.5 | 4 | 2.5 |
| 60-70 | 0 | 0 | 0 | 0.3 | 0.8 | 1.5 | 3.5 | 2.5 | | 0 | 0 | 0 | 0.15 | 0.4 | 0.75 | 1.75 | 1.25 |

References

1. **Griffiths, C.E.** Dowling Oration delivered at the Royal College of Physicians, London, Friday 5 June 1998. Retinoids: renaissance and reformation. *Clinical and Experimental Dermatology*. 24 (4): 329-335 (1999).
2. **Frost, C.A. et al.** The prevalence and determinants of solar keratoses at a subtropical latitude (Queensland, Australia). *British Journal of Dermatology*. 139 (6): 1033-1039 (1998).

Worksheet for: Sunburn

There are no disability weights already calculated for sunburn. Table A3.14 lists disability weights for sunburn that have been inferred by comparison to other minor disabilities in either the Dutch study or the Global Burden of Disease Study.

Table A3.14 Disability weights for sunburn

| Disease state | Disability weight |
|--------------------|---|
| Painful sunburn | 0.01 (similar acute tonsillitis, Dutch study) |
| Blistering sunburn | 0.158 (<20% burn, short term, GBD) |

All sunburn is considered to be attributable to excess UVR exposure, i.e. PAF = 1.0. Tables A3.15 – A3.17 show the estimated incidence rate (%) of sunburn by latitudinal band.

Table A3.15 Incidence rate (%) of sunburn by latitude for lightly pigmented populations (Male = Female)

| Latitude (degrees) | Age (years) | | | | | | | |
|--------------------|-------------|------|-------|-------|-------|-------|-------|-----|
| | 0-4 | 5-14 | 15-29 | 30-44 | 45-59 | 60-69 | 70-79 | 80+ |
| 0-10 | 25.0 | 67.5 | 63.3 | 46.7 | 38.3 | 10.0 | 5.0 | 0.0 |
| 10-20 | 25.0 | 65.0 | 63.3 | 46.7 | 38.3 | 10.0 | 5.0 | 0.0 |
| 20-30 | 20.0 | 62.5 | 63.3 | 46.7 | 38.3 | 10.0 | 5.0 | 0.0 |
| 30-40 | 20.0 | 57.5 | 63.3 | 46.7 | 38.3 | 10.0 | 5.0 | 0.0 |
| 40-50 | 15.0 | 51.0 | 60.0 | 46.7 | 38.3 | 10.0 | 5.0 | 0.0 |
| 50-60 | 10.0 | 45.0 | 57.0 | 42.0 | 36.0 | 10.0 | 5.0 | 0.0 |
| 60-70 | 5.0 | 25.0 | 36.3 | 31.7 | 26.0 | 10.0 | 5.0 | 0.0 |

Table A3.16 Incidence rate (%) of sunburn by latitude for populations of medium pigmentation

| Latitude (degrees) | Age (years) | | | | | | | |
|--------------------|-------------|------|-------|-------|-------|-------|-------|-----|
| | 0-4 | 5-14 | 15-29 | 30-44 | 45-59 | 60-69 | 70-79 | 80+ |
| 0-10 | 12.5 | 32.5 | 31.7 | 23.3 | 19.2 | 5.0 | 2.5 | 0.0 |
| 10-20 | 12.5 | 32.5 | 31.7 | 23.3 | 19.2 | 5.0 | 2.5 | 0.0 |
| 20-30 | 10.0 | 31.3 | 31.7 | 23.3 | 19.2 | 5.0 | 2.5 | 0.0 |
| 30-40 | 10.0 | 28.8 | 31.7 | 23.3 | 19.2 | 5.0 | 2.5 | 0.0 |
| 40-50 | 7.5 | 25.5 | 30.0 | 23.3 | 19.2 | 5.0 | 2.5 | 0.0 |
| 50-60 | 5.0 | 22.5 | 28.5 | 21.0 | 18.0 | 5.0 | 2.5 | 0.0 |
| 60-70 | 2.5 | 12.5 | 18.2 | 15.8 | 13.0 | 5.0 | 2.5 | 0.0 |

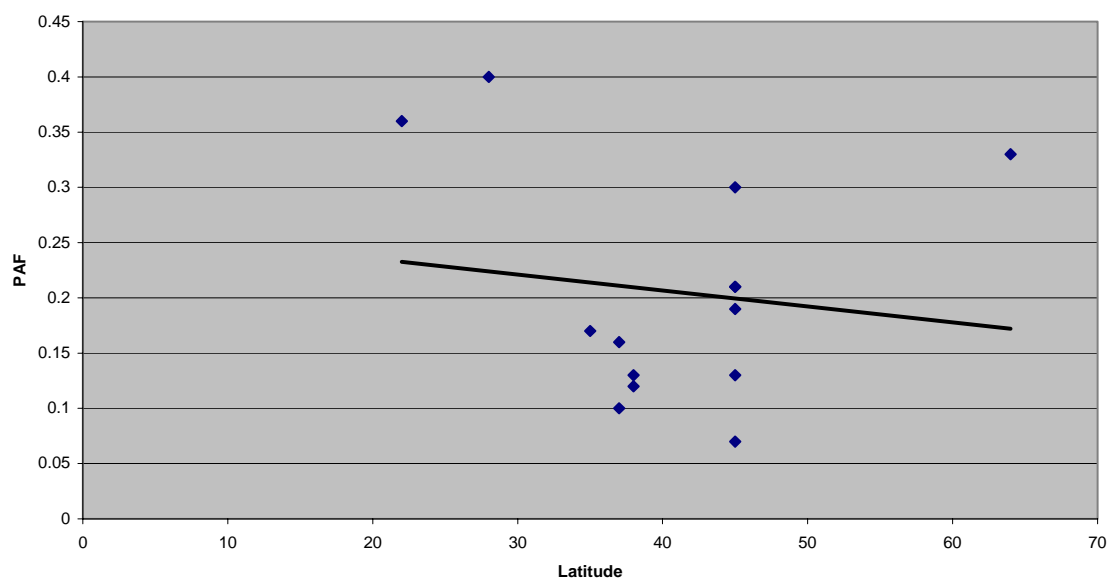
Table A3.17 Incidence rate (%) of sunburn by latitude for deeply pigmented populations

| Latitude (degrees) | Age (years) | | | | | | | |
|--------------------|-------------|------|-------|-------|-------|-------|-------|-----|
| | 0-4 | 5-14 | 15-29 | 30-44 | 45-59 | 60-69 | 70-79 | 80+ |
| 0-10 | 2.5 | 6.8 | 6.3 | 4.7 | 3.8 | 1.0 | 0.5 | 0.0 |
| 10-20 | 2.5 | 6.5 | 6.3 | 4.7 | 3.8 | 1.0 | 0.5 | 0.0 |
| 20-30 | 2.0 | 6.3 | 6.3 | 4.7 | 3.8 | 1.0 | 0.5 | 0.0 |
| 30-40 | 2.0 | 5.8 | 6.3 | 4.7 | 3.8 | 1.0 | 0.5 | 0.0 |
| 40-50 | 1.5 | 5.1 | 6.0 | 4.7 | 3.8 | 1.0 | 0.5 | 0.0 |
| 50-60 | 1.0 | 4.5 | 5.7 | 4.2 | 3.6 | 1.0 | 0.5 | 0.0 |
| 60-70 | 0.5 | 2.5 | 3.6 | 3.2 | 2.6 | 1.0 | 0.5 | 0.0 |

Section 5: Worksheet for Cortical Cataract

Population attributable fractions derived from the epidemiological literature were graphed against the latitude of the study location (Figure A3.6). There was a non-significant latitudinal gradient ($p = 0.62$) with a mean of 0.19 and an intercept of 0.26. A PAF of 0.20 was applied to the estimates of burden of disease due to cortical cataract. While the inaccuracy of sun exposure measurement in studies of skin cancer led us to use a higher PAF than the mean PAF derived from case-control studies for the skin disorders associated with UVR exposure, more detailed exposure measurements have been used in many of the cataract studies, so that the PAF used is closer to the mean of data presented in Figure A3.6.

Figure A3.6 Cortical cataract and UVR exposure by latitude



The studies from which Figure A3.6 were derived are listed in Table A3.18.

Table A3.18 Case control and cohort studies on the association between cortical cataract and UVR exposure

| No. | Reference | Odds ratio (95% CI) | Exposure measure |
|-----|--------------------|--|--------------------------------|
| 1 | AREDS, 2001 | 1.33 (0.98-1.82) | Cumulative ocular exposure |
| 2 | Collman, 1988 | 1.53 (0.21-7.19) | Average sun exposure |
| 3 | Cruickshanks, 1992 | F 0.94 (0.70-1.26) M 1.36 (1.02-1.79) | Average annual exposure |
| 4 | Delcourt, 2000 | 2.48 (1.24-4.99) | Cumulative hours of sunshine |
| 5 | Graziosi, 1996 | 1.73 (1.03-2.93) | Sunlight index |
| 6 | Kato, 2001 | 2.91 (1.13-9.62) | Time spent outdoors, diff ages |
| 7 | McCarty, 1999 | 1.44 (1.21-1.73) | Cumulative ocular exposure |
| 8 | McCarty, 2000 | PAF = 0.10 (0.085-0.12) | |
| 9 | Mohan, 1989 | 0.78 (0.68-0.90) | Amount of cloud cover |
| 10 | Rosmini, 1994 | 2.26 (1.14-4.46) | Sunlight index |
| 11 | West, 1998 | 1.57 (1.04-2.38) | Cumulative ocular exposure |
| 12 | Wong, 1993 | 2.1 (0.6-7.9) | Sunlight index |

References

1. **AREDS.** Risk factors associated with age-related nuclear and cortical cataract : a case-control study in the Age-Related Eye Disease Study, AREDS Report No. 5. *Ophthalmology.* 108 (8): 1400-1408. (2001).
2. **Collman, G.W. et al.** Sunlight and other risk factors for cataracts: an epidemiologic study. *American Journal of Public Health.* 78 (11): 1459-1462. (1988).
3. **Cruickshanks, K.J. et al.** Ultraviolet light exposure and lens opacities: the Beaver Dam Eye Study. *American Journal of Public Health.* 82 (12): 1658-1662 (1992).
4. **Delcourt, C. et al.** Light exposure and the risk of cortical, nuclear, and posterior subcapsular cataracts: the Pathologies Oculaires Liees a l'Age (POLA) study. *Archives of Ophthalmology.* 118 (3): 385-392 (2000).
5. **Graziosi, P. et al.** Location and severity of cortical opacities in different regions of the lens in age-related cataract. *Investigative Ophthalmology and Visual Science.* 37 (8): 1698-1703. (1996).
6. **Katoh, N. et al.** Cortical lens opacification in Iceland. Risk factor analysis -- Reykjavik Eye Study. *Acta Ophthalmologica Scandinavica.* 79 (2): 154-159. (2001).
7. **McCarty, C.A. et al.** The epidemiology of cataract in Australia. *American Journal of Ophthalmology.* 128 (4): 446-465 (1999).
8. **McCarty, C.A. et al.** Attributable risk estimates for cataract to prioritize medical and public health action. *Investigative Ophthalmology and Visual Science.* 41 (12): 3720-3725 (2000).
9. **Mohan, M. et al.** India-US case-control study of age-related cataracts. India-US Case-Control Study Group. *Archives of Ophthalmology.* 107 (5): 670-676. (1989).
10. **Rosmini, F. et al.** A dose-response effect between a sunlight index and age-related cataracts. Italian-American Cataract Study Group. *Annals of Epidemiology.* 4 (4): 266-270. (1994).
11. **West, S.K. et al.** Sunlight exposure and risk of lens opacities in a population-based study: the Salisbury Eye Evaluation project. *JAMA.* 280 (8): 714-718 (1998).
12. **Wong, L. et al.** Sunlight exposure, antioxidant status, and cataract in Hong Kong fishermen. *Journal of Epidemiology and Community Health.* 47 (1): 46-49 (1993).

Section 6: Worksheet for Pterygium

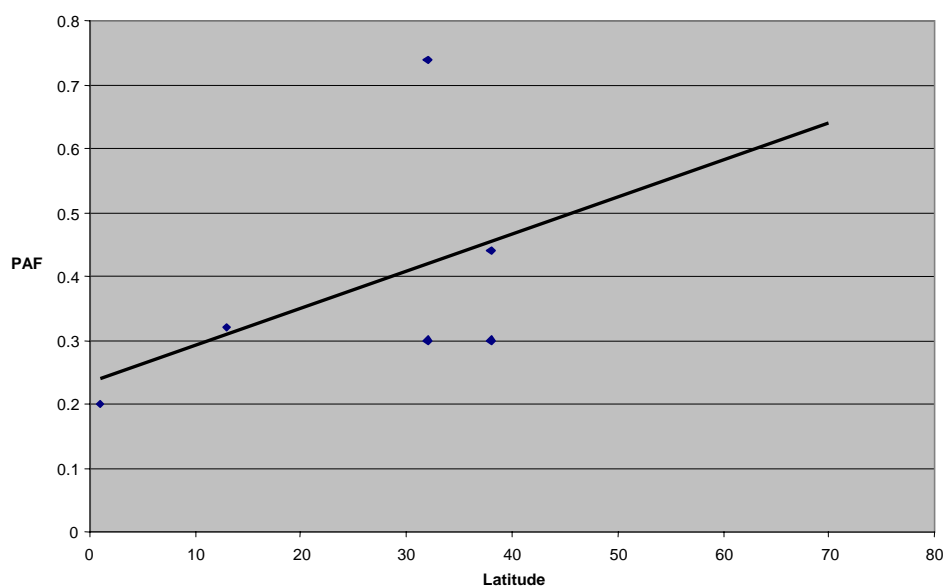
Case definition and sequelae: H11.0 (excludes pseudopterygium)

Disability weight: There are no disability weights already calculated for pterygium. After discussion with clinical experts, we assigned a disability weight of 0.081 (similar weight to dental caries, Global Burden of Disease, 1990 (1))

Figure A3.7 presents the PAF calculated from case-control studies, and related to latitude ($p = 0.35$, intercept = 0.23).

The positive gradient of this line is somewhat counter-intuitive. It is largely influenced by a hospital-based (rather than population-based) case-control study in Singapore (2) from which we have estimated a PAF of 0.2 based on an odds ratio of 1.31 (95% CI 1.09 to 1.57) for sunlight exposure ten years ago – a measure subject to considerable recall inaccuracy. It could reasonably be omitted from this graph, which is otherwise based on population-based case-control studies. If this were omitted, there would be little latitudinal variation in the PAFs ($p = 0.79$) with a mean of 0.42 and an intercept of 0.33. The other outlying figure is from Threlfall et al (3), from which a PAF of 0.74 was calculated from an odds ratio of 6.77 (95% CI 2.60-19.68) using daily ocular radiation dose as the measure of UVR exposure. Most other studies use an averaged annular ocular dose as the measure of UVR exposure.

Figure A3.7 Pterygium and UVR exposure



On the basis of the above discussion, a PAF of 0.42 was used as a lower estimate of population attributable fraction and a PAF of 0.74 was used as an upper estimate. Studies from which these data are derived are listed in Table A3.19.

Tab1e A3.19 Studies on pterygium and UVR exposure

| No. | Reference | Odds ratio (95% CI) | Exposure measure |
|-----|-----------------|---------------------|-------------------------------|
| 4 | Luthra, 2001 | 1.87 (1.52-2.29) | Outdoor job location |
| 5 | McCarty, 2000 | 1.63 (1.18-2.25) | Mean annual ocular UVB |
| 2 | Saw, 2000 | 1.31 (1.09-1.57) | Sunlight exposure |
| 6 | Taylor, 1989 | 3.06 (1.77-5.31) | Mean annual ocular UVB |
| 3 | Threlfall, 1999 | 6.77 (2.6-19.68) | Average daily ocular dose |
| | | 2.31 (1.28-4.25) | Av. Daily global solar energy |
| | | 2.63 (1.49-4.71) | Daily hours sunshine |

Table A3.20 shows the estimated prevalence (%) of pterygium by latitudinal band.

Table A3.20 Prevalence (%) of pterygium by latitude

| Latitude (degrees) | Male | | | | | | | | Female | | | | | | | |
|-----------------------|------------|------|-------|-------|-------|-------|-------|-----|--------|------|-------|-------|-------|-------|-------|------|
| | Age(years) | | | | | | | | | | | | | | | |
| | 0-4 | 5-14 | 15-29 | 30-44 | 45-59 | 60-69 | 70-79 | 80+ | 0-4 | 5-14 | 15-29 | 30-44 | 45-59 | 60-69 | 70-79 | 80+ |
| 0-10 | 0 | 0 | 1 | 5 | 24 | 33 | 40 | 36 | 0 | 0 | 0 | 2.5 | 12 | 16.5 | 20 | 18 |
| 10-20 | 0 | 0 | 0 | 4.4 | 21 | 30 | 37 | 35 | 0 | 0 | 0 | 2.2 | 10.5 | 15 | 18.5 | 17 |
| 20-30 | 0 | 0 | 0 | 4 | 18.9 | 23 | 31 | 27 | 0 | 0 | 0 | 2 | 9.5 | 11.5 | 15.5 | 13.5 |
| 30-40 | 0 | 0 | 0 | 3.8 | 15.4 | 18 | 27 | 24 | 0 | 0 | 0 | 1.9 | 8 | 9 | 13.5 | 12 |
| 40-50 | 0 | 0 | 0 | 3.2 | 10 | 12 | 17 | 15 | 0 | 0 | 0 | 1.6 | 5 | 6 | 8.6 | 7.5 |
| 50-60 | 0 | 0 | 0 | 0.8 | 2.5 | 5 | 8 | 5 | 0 | 0 | 0 | 0.4 | 1.3 | 2.5 | 4 | 2.5 |
| 60-70 | 0 | 0 | 0 | 0.3 | 0.8 | 1.5 | 3.5 | 2.5 | 0 | 0 | 0 | 0.15 | 0.4 | 0.75 | 1.75 | 1.25 |

References

1. **Murray, C. & Lopez, A.** The Global Burden of Disease: A comprehensive assessment of mortality and disability from diseases, injuries, and risk factors in 1990 and projected to 2020. *Global Burden of Disease and Injury Series*, Harvard School of Public Health. Harvard University Press, 1996.
2. **Saw, S.M. et al.** Risk factors for the development of pterygium in Singapore: a hospital-based case-control study. *Acta Ophthalmologica Scandinavica*. 78 (2): 216-220 (2000).
3. **Threlfall, T.J. & English, D.R.** Sun exposure and pterygium of the eye: a dose-response curve. *American Journal of Ophthalmology*. 128 (3): 280-287 (1999).
4. **Luthra, R. et al.** Frequency and risk factors for pterygium in the Barbados Eye Study. *Archives of Ophthalmology*. 119 (12): 1827-1832. (2001).
5. **McCarty, C.A. et al.** Epidemiology of pterygium in Victoria, Australia. *British Journal of Ophthalmology*. 84 (3): 289-292 (2000).
6. **Taylor, H.R. et al.** Corneal changes associated with chronic UV irradiation. *Archives of Ophthalmology*. 107 (10): 1481-1484 (1989).

Section 7: Worksheet for Carcinoma of the conjunctiva and carcinoma of the cornea

ICD 10 classification: C 69.0, C69.1

There are no calculated disability weights for the various phases and treatments of carcinoma of the cornea and conjunctiva. The disability weights presented below were inferred by comparison with disability weights for similar disorders, in consultation with clinical experts. The disability weights are listed in Table A3.21.

Table A3.21 Disability weights for the disease phases and treatments of carcinoma of the cornea and conjunctiva

| Disease phases/treatments | Disability weights |
|---|--|
| Primary treatment – local resection | 0.190 (same as melanoma, primary resection) |
| Primary treatment – extensive resection | 0.298 (injury to the eyes, long term, Australian BOD study) |
| Advanced disease – enucleation | 0.430 (same as melanoma, extensive resection) |
| Enucleation (long term) | 0.2 (more than an amputated arm, but less than an amputated foot, GBD) |

While cancers of the cornea and conjunctiva are squamous cell carcinomas, one might expect the disability weight to be higher in a disorder involving a critical, sensitive and cosmetically obvious organ, such as an eye, compared to skin involvement. The above weights were imputed based on discussion with clinicians (personal communication, Prof L Hirst).

Sun found links between SCCC and UVB exposure of a similar magnitude to SCC of the eyelid (1). The PAF calculated from the single relevant study by Lee et al (using as a UV exposure measure cumulative exposure at $\leq 30^\circ$ for ≥ 50 years), gave a PAF of 0.62, based on an odds ratio of 3.9 (1.0-14.8) (2). After discussion within this working group it was decided to use the same PAF as for SCC. Notably, there has been a huge increase in the incidence of SCCC with HIV in Africa – PAF for HIV has been estimated at 0.66 (3).

Tables A3.22 – A3.24 shows the estimated incidence rate of SCCC per million population, by latitudinal band and categories of skin pigmentation.

Table A3.22 Incidence rate of SCCC per million – lightly pigmented populations

| Latitude (degrees) | Male | | | | | | | | Female | | | | | | | |
|-----------------------|------------|------|-------|-------|-------|-------|-------|------|--------|------|-------|-------|-------|-------|-------|------|
| | Age(years) | | | | | | | | | | | | | | | |
| | 0-4 | 5-14 | 15-29 | 30-44 | 45-59 | 60-69 | 70-79 | 80+ | 0-4 | 5-14 | 15-29 | 30-44 | 45-59 | 60-69 | 70-79 | 80+ |
| 0-10 | 0.0 | 0.7 | 1.9 | 5.5 | 12.0 | 15.0 | 17.0 | 19.0 | 0.0 | 0.2 | 1.5 | 4.5 | 8.0 | 11.0 | 13.0 | 15.0 |
| 10-20 | 0.0 | 0.2 | 0.8 | 3.5 | 8.2 | 10.2 | 13.8 | 15.5 | 0.0 | 0.1 | 0.7 | 3.3 | 8.0 | 10.0 | 13.0 | 15.0 |
| 20-30 | 0.0 | 0.0 | 0.4 | 1.8 | 5.3 | 7.5 | 11.3 | 13.0 | 0.0 | 0.0 | 0.4 | 1.5 | 4.0 | 5.5 | 6.5 | 7.5 |
| 30-40 | 0.0 | 0.0 | 0.3 | 1.2 | 4.0 | 5.5 | 7.0 | 8.0 | 0.0 | 0.0 | 0.2 | 0.9 | 3.0 | 5.0 | 6.5 | 7.0 |
| 40-50 | 0.0 | 0.0 | 0.1 | 0.5 | 1.2 | 2.5 | 3.0 | 5.0 | 0.0 | 0.0 | 0.1 | 0.3 | 0.8 | 2.0 | 2.5 | 4.0 |
| 50-60 | 0.0 | 0.0 | 0.0 | 0.2 | 0.5 | 1.0 | 1.5 | 2.5 | 0.0 | 0.0 | 0.0 | 0.2 | 0.4 | 0.9 | 1.3 | 2.3 |
| 60-70 | 0.0 | 0.0 | 0.0 | 0.1 | 0.3 | 0.7 | 1.2 | 2.2 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.6 | 1.2 | 1.9 |

Table A3.23 Incidence rate of SCCC per million –populations of medium pigmentation

| Latitude (degrees) | Male | | | | | | | | Female | | | | | | | |
|-----------------------|------------|------|-------|-------|-------|-------|-------|------|--------|------|-------|-------|-------|-------|-------|------|
| | Age(years) | | | | | | | | | | | | | | | |
| | 0-4 | 5-14 | 15-29 | 30-44 | 45-59 | 60-69 | 70-79 | 80+ | 0-4 | 5-14 | 15-29 | 30-44 | 45-59 | 60-69 | 70-79 | 80+ |
| 0-10 | 0.0 | 0.1 | 0.7 | 3.3 | 8.0 | 10.0 | 13.0 | 15.0 | 0.0 | 0.1 | 0.6 | 3.2 | 7.0 | 9.0 | 12.0 | 14.0 |
| 10-20 | 0.0 | 0.1 | 0.6 | 2.5 | 6.3 | 8.5 | 9.5 | 11.5 | 0.0 | 0.1 | 0.5 | 1.2 | 4.0 | 5.5 | 6.5 | 7.0 |
| 20-30 | 0.0 | 0.0 | 0.5 | 2.2 | 5.5 | 7.5 | 8.0 | 10.0 | 0.0 | 0.0 | 0.2 | 1.0 | 3.8 | 5.2 | 6.2 | 6.8 |
| 30-40 | 0.0 | 0.0 | 0.2 | 0.8 | 3.0 | 4.8 | 6.2 | 6.8 | 0.0 | 0.0 | 0.1 | 0.6 | 2.8 | 4.6 | 6.0 | 6.5 |
| 40-50 | 0.0 | 0.0 | 0.1 | 0.2 | 0.6 | 1.3 | 2.0 | 3.2 | 0.0 | 0.0 | 0.1 | 0.2 | 0.5 | 1.2 | 1.8 | 2.8 |
| 50-60 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.6 | 1.2 | 1.9 | 0.0 | 0.0 | 0.0 | 0.1 | 0.3 | 0.5 | 0.6 | 0.8 |
| 60-70 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.4 | 0.5 | 0.9 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.4 | 0.5 | 0.9 |

Table A3.24 Incidence rate of SCCC per million –deeply pigmented populations

| Latitude (degrees) | Male | | | | | | | | Female | | | | | | | |
|-----------------------|------------|------|-------|-------|-------|-------|-------|------|--------|------|-------|-------|-------|-------|-------|-----|
| | Age(years) | | | | | | | | | | | | | | | |
| | 0-4 | 5-14 | 15-29 | 30-44 | 45-59 | 60-69 | 70-79 | 80+ | 0-4 | 5-14 | 15-29 | 30-44 | 45-59 | 60-69 | 70-79 | 80+ |
| 0-10 | 0.0 | 0.1 | 0.3 | 3.2 | 6.5 | 8.0 | 9.8 | 14.0 | 0.0 | 0.1 | 0.3 | 1.4 | 4.3 | 5.5 | 6.7 | 8.2 |
| 10-20 | 0.0 | 0.0 | 0.2 | 1.2 | 4.2 | 6.8 | 8.2 | 11.0 | 0.0 | 0.0 | 0.2 | 0.9 | 3.6 | 4.2 | 5.5 | 6.8 |
| 20-30 | 0.0 | 0.0 | 0.1 | 0.6 | 2.5 | 4.1 | 5.1 | 6.5 | 0.0 | 0.0 | 0.1 | 0.5 | 1.6 | 2.6 | 3.8 | 5.0 |
| 30-40 | 0.0 | 0.0 | 0.1 | 0.4 | 0.8 | 2.3 | 3.5 | 4.3 | 0.0 | 0.0 | 0.1 | 0.3 | 0.6 | 1.3 | 2.6 | 3.9 |
| 40-50 | 0.0 | 0.0 | 0.0 | 0.1 | 0.3 | 0.7 | 1.5 | 1.9 | 0.0 | 0.0 | 0.1 | 0.1 | 0.3 | 0.6 | 0.8 | 1.2 |
| 50-60 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.4 | 0.7 | 0.9 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.7 |
| 60-70 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.3 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.3 | 0.4 |

References

1. **Sun, E.C. et al.** Epidemiology of squamous cell conjunctival cancer. *Cancer Epidemiology, Biomarkers and Prevention*. 6 (2): 73-77 (1997).
2. **Lee, G.A. et al.** Risk factors in the development of ocular surface epithelial dysplasia. *Ophthalmology*. 101 (2): 360-364 (1994).
3. **Waddell, K.M. et al.** Carcinoma of the conjunctiva and HIV infection in Uganda and Malawi. *British Journal of Ophthalmology*. 80 (6): 503-508 (1996).

Section 8: Worksheet for Reactivation of herpes labialis

ICD-10 classification: B00.1

Disability weight: 0.005 (less than acute nasopharyngitis 0.014 (Australian BOD study), more than 0)

Young et al (1) examined the association of UVR exposure with recurrent herpes labialis in a population of blood donors in Southern Wisconsin, USA. 'Cases' gave a history of having had more than one cold sore and had a herpes virus antibody titre ≥ 8 . The control group reported that they had never had a cold sore. Cases reported more UVR exposure assessed by estimated time outdoors during childhood and as an adult, occupational exposure, history of severe sunburns and use of a sunlamp. Depending on the measure of UVR exposure the calculated PAF was 0.15 (dark tan during childhood), 0.14 (dark tan as an adult), and 0.25 (outdoor job during childhood). Young et al (2) listed the lower lip as the most frequent site of development of observed lesions (58.9%) consistent with a causative role of UVR exposure. Of new lesions developing during the observation period (season of observation not defined) 20% were identified as being due to sun exposure.

We know that self-reported sun exposure in the past is difficult to quantify accurately. In addition, in studying recurrent lesions of herpes simplex cases are asked to recall details of the number of cold sores they have had and to make a judgment about whether UVR exposure was the causative factor, or involved in the causation.

What is clear is that UVR exposure has a causative role in the reactivation of herpes labialis. We have used the calculated PAF of 0.25 as a lower estimate, based on the literature presented (the highest PAF presented, but in case-control studies which are likely to underestimate the association due to inaccuracy in the exposure measure) and an upper estimate of 0.50 to provide an adjustment for the inaccuracy inherent in exposure measures which are a proxy for actual UVR exposure.

Tables A3.25-27 present the estimates of prevalence of persons with recurrent herpes labialis by different pigmentation groups and by latitudinal band.

Table A3.25 Prevalence (%) of persons with recurrent herpes labialis, lightly pigmented populations (male = female)

| Latitude (degrees) | Male | | | | | | | | Female | | | | | | | |
|-----------------------|------------|------|-------|-------|-------|-------|-------|-----|--------|------|-------|-------|-------|-------|-------|-----|
| | Age(years) | | | | | | | | | | | | | | | |
| | 0-4 | 5-14 | 15-29 | 30-44 | 45-59 | 60-69 | 70-79 | 80+ | 0-4 | 5-14 | 15-29 | 30-44 | 45-59 | 60-69 | 70-79 | 80+ |
| 0-10 | 0 | 22 | 45 | 42 | 38 | 36 | 30 | 28 | 0 | 22 | 45 | 42 | 38 | 36 | 30 | 28 |
| 10-20 | 0 | 20 | 40 | 38 | 36 | 35 | 30 | 26 | 0 | 20 | 40 | 38 | 36 | 35 | 30 | 26 |
| 20-30 | 0 | 17 | 35 | 35 | 34 | 32 | 30 | 24 | 0 | 17 | 35 | 35 | 34 | 32 | 30 | 24 |
| 30-40 | 0 | 15 | 30 | 33 | 32 | 30 | 28 | 22 | 0 | 15 | 30 | 33 | 32 | 30 | 28 | 22 |
| 40-50 | 0 | 11 | 23 | 28 | 29 | 26 | 24 | 20 | 0 | 11 | 23 | 28 | 29 | 26 | 24 | 20 |
| 50-60 | 0 | 9 | 19 | 25 | 26 | 22 | 20 | 15 | 0 | 9 | 19 | 25 | 26 | 22 | 20 | 15 |
| 60-70 | 0 | 8 | 16 | 19.5 | 22 | 20 | 15 | 10 | 0 | 8 | 16 | 19.5 | 22 | 20 | 15 | 10 |

Table A3.26 Prevalence (%) of persons with recurrent herpes labialis, medium pigmented populations (male = female)

| Latitude (degrees) | Male | | | | | | | | Female | | | | | | | |
|-----------------------|------------|------|-------|-------|-------|-------|-------|------|--------|------|-------|-------|-------|-------|-------|------|
| | Age(years) | | | | | | | | | | | | | | | |
| | 0-4 | 5-14 | 15-29 | 30-44 | 45-59 | 60-69 | 70-79 | 80+ | 0-4 | 5-14 | 15-29 | 30-44 | 45-59 | 60-69 | 70-79 | 80+ |
| 0-10 | 0 | 8.8 | 18 | 16.8 | 15.2 | 14.4 | 12 | 11.2 | 0 | 8.8 | 18 | 16.8 | 15.2 | 14.4 | 12 | 11.2 |
| 10-20 | 0 | 8 | 16 | 15.2 | 14.4 | 14 | 12 | 10.4 | 0 | 8 | 16 | 15.2 | 14.4 | 14 | 12 | 10.4 |
| 20-30 | 0 | 6.8 | 14 | 14 | 13.6 | 12.8 | 12 | 9.6 | 0 | 6.8 | 14 | 14 | 13.6 | 12.8 | 12 | 9.6 |
| 30-40 | 0 | 6 | 12 | 13.2 | 12.8 | 12 | 11.2 | 8.8 | 0 | 6 | 12 | 13.2 | 12.8 | 12 | 11.2 | 8.8 |
| 40-50 | 0 | 4.4 | 9.2 | 11.2 | 11.6 | 10.4 | 9.6 | 8 | 0 | 4.4 | 9.2 | 11.2 | 11.6 | 10.4 | 9.6 | 8 |
| 50-60 | 0 | 3.6 | 7.6 | 10 | 10.4 | 8.8 | 8 | 6 | 0 | 3.6 | 7.6 | 10 | 10.4 | 8.8 | 8 | 6 |
| 60-70 | 0 | 3.2 | 6.4 | 7.8 | 8.8 | 8 | 6 | 4 | 0 | 3.2 | 6.4 | 7.8 | 8.8 | 8 | 6 | 4 |

Table A3.27 Prevalence (%) of persons with recurrent herpes labialis, deeply pigmented populations (male = female)

| Latitude (degrees) | Male | | | | | | | | Female | | | | | | | |
|-----------------------|------------|------|-------|-------|-------|-------|-------|-----|--------|------|-------|-------|-------|-------|-------|-----|
| | Age(years) | | | | | | | | | | | | | | | |
| | 0-4 | 5-14 | 15-29 | 30-44 | 45-59 | 60-69 | 70-79 | 80+ | 0-4 | 5-14 | 15-29 | 30-44 | 45-59 | 60-69 | 70-79 | 80+ |
| 0-10 | 0 | 22 | 45 | 42 | 38 | 36 | 30 | 28 | 0 | 22 | 45 | 42 | 38 | 36 | 30 | 28 |
| 10-20 | 0 | 20 | 40 | 38 | 36 | 35 | 30 | 26 | 0 | 20 | 40 | 38 | 36 | 35 | 30 | 26 |
| 20-30 | 0 | 17 | 35 | 35 | 34 | 32 | 30 | 24 | 0 | 17 | 35 | 35 | 34 | 32 | 30 | 24 |
| 30-40 | 0 | 15 | 30 | 33 | 32 | 30 | 28 | 22 | 0 | 15 | 30 | 33 | 32 | 30 | 28 | 22 |
| 40-50 | 0 | 11 | 23 | 28 | 29 | 26 | 24 | 20 | 0 | 11 | 23 | 28 | 29 | 26 | 24 | 20 |
| 50-60 | 0 | 9 | 19 | 25 | 26 | 22 | 20 | 15 | 0 | 9 | 19 | 25 | 26 | 22 | 20 | 15 |
| 60-70 | 0 | 8 | 16 | 19.5 | 22 | 20 | 15 | 10 | 0 | 8 | 16 | 19.5 | 22 | 20 | 15 | 10 |

References

1. **Young, T.B. et al.** Cross-sectional study of recurrent herpes labialis. Prevalence and risk factors. *American Journal of Epidemiology*. 127 (3): 612-625 (1988).
2. **Young, S.K. et al.** A clinical study for the control of facial mucocutaneous herpes virus infections. I. Characterization of natural history in a professional school population. *Oral Surgery, Oral Medicine, Oral Pathology*. 41 (4): 498-507 (1976).

Section 9: Worksheet for hypovitaminosis D, rickets, osteomalacia and osteoporosis

ICD 10 classification: E55, E 55.9 and M 83.9

No studies list disability weights for rickets, osteomalacia or specifically for the sequelae of osteoporosis. As noted in Table A3.17, we have inferred disability weights from other studies for similar conditions (see Table A3.24)

Table A3.24 Disability weights for disorders of vitamin D deficiency

| Disease phase | Disability weight |
|---|---|
| Hypovitaminosis D | 0.00 |
| Rickets (0-4 years) | 0.3 (between mild and moderate rheumatoid arthritis, Australian BoD study) |
| Rickets + sequelae (5-59) Osteomalacia | 0.2 (mild rheumatoid arthritis, Australian BoD study) |
| Osteoporosis sequelae | 0.1 (more than chronic back pain, less than Grade 2 osteoarthritis, Australian BoD study) |