Gezondheidsraad
Health Council of the Netherlands

To the Minister of Housing, Spatial Planning
and the Environment (VROM)

Subject : Advisory letter *UV radiation and sunbeds*
Our reference : U 5556/EvR/iv/062-G21 Publication nr. 2009/11E
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Dear Minister,

On 29 July 2009, various media reported that the International Agency for Research on Cancer (IARC) had classified the use of tanning devices (sunbeds) that emit ultraviolet (UV) radiation as 'carcinogenic to humans'.[1] Since 1992 the classification for 'the use of sunlamps and sunbeds' and for UV radiation was 'probably carcinogenic to humans', whereas solar radiation was classified as 'carcinogenic to humans'.[2]

The Health Council of the Netherlands published advisory reports on UV radiation in 1986 and 1994, the first of which also contained recommendations for responsible use of tanning devices.[3,4] In the light of these earlier advisory reports, the Health Council would like to address your ministry's request for further details on the background and significance of the revised IARC classification and of the scientific knowledge available on the effects of UV radiation.

This advisory letter has been drawn up by the Standing Committee on Radiation and Health; details of the standing committee's composition are provided in annex A.

It should be noted first that practically the entire population is unavoidably exposed to UV radiation from the sun. Only people who are practically always indoors and people whose entire body is almost completely covered by clothing are subject to minimum exposure. People also intentionally expose themselves to UV radiation when sunbathing and when using sunbeds. Medical exposure to sources of artificial UV radiation is not dealt with in this advisory letter.

Previous Health Council advisory reports

In the advisory report of 1986 the Health Council concluded that exposing the skin to UV radiation had both positive and negative effects on health.[4] The production of vitamin D is a positive effect, whereas negative effects include the formation of erythema (sunburn) when a certain threshold dose is exceeded; acceleration of the skin's aging process; certain effects on the immune system; and increased risk of skin carcinomas. A relationship to increased risk of melanomas was also

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suspected but, owing to a lack of quantitative data, the Committee that drafted the report did not consider the formation of melanomas in the exposure limits it proposed. The advisory report of 1994 confirms these conclusions and indicates that more information is available on factors that possibly play a role in the relationship between exposure to UV radiation and the formation of melanomas.[3]

Both advisory reports stated that exposing the eye to UV radiation exceeding a threshold dose results in inflammation of the cornea and conjunctiva (snow-blindness or welders' eyes). Exposure to UV radiation also increases the likelihood of cataracts.

The Health Council's advisory report of 1986 proposed that the annual radiation dose from the use of tanning devices should not exceed 20 kJ/m^2 (= 200 SED[1]); this dose is equivalent to 28 hours exposure to UV index 8, which is a measure of the maximum achievable dose of UV radiation from sunlight in the Netherlands.[6,7] At the time, this annual dose amounted to approximately half of the difference in radiation dose between the exposure levels of indoor and outdoor workers in the Netherlands. The risk of skin carcinomas for indoor workers would therefore remain much lower than that for outdoor workers, who are generally not interested in additional tanning.[8] Besides limiting annual exposure, it was also deemed important to limit individual exposure to avoid sunburn, as sunburn can increase the risk of melanomas in particular. The advisory report also provides recommendations for the intensity and frequency of consecutive exposures and the requirements which tanning devices should meet.

[1] The SED (Standard Erythema Dose), 100 J/m^2, is approximately half of the UV dose that causes reddening of white skin that has not been exposed to UV radiation for a considerable period of time. This is currently the internationally accepted measure for the erythema-effective dose.[5] The Health Council's various advisory reports used various definitions. For example, the Minimum Erythema Dose (MED) was used in the 1986 report and was defined as 'the radiation dose that produces erythema in a white person's lightly pigmented skin that has not recently been exposed to UV radiation.' The report recommended that a value of 200 J/m^2 should be adopted for this. Because the individual minimum erythema dose depends on many factors, the Health Council's advisory 1994 report recommended using the 'Standard Minimum Erythema Dose' (sMED) as the unit for the erythema-effective dose. It was stated that sMED exposure within a period of 8 hours generally resulted in noticeable reddening of the skin of white-skinned subjects who had not been exposed to UV radiation for a considerable period of time. It was recommended that a value of 250 J/m^2 should be adopted for this.

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Given that exposure to UV radiation from sunlight is almost unavoidable and certainly cannot be regulated, the Health Council's opinion was and continues to be that sunbathing should be done sensibly and in moderation, and this advice also applies to the use of tanning devices. The information issued by Dutch Cancer Society (KWF Kankerbestrijding) is in line with this advice.[9]

Recent scientific developments

Science has progressed since the Health Council's last publication on UV radiation in 1994. More information is now available about the negative effects and particularly the relationship to the formation of melanomas.[10] There is still considerable uncertainty about the degree to which UV radiation and especially sunbeds may be the cause of melanomas.[11-13] Various epidemiological studies have found a link between the occurrence of melanomas and the use of tanning devices, especially after their use by young people below the age of approximately 35.[10] This finding was one of the main reasons for the IARC's reclassification of the use of sunbeds.[1]

On the other hand, more information is also available on possible positive effects. Vitamin D production in the skin during exposure to UV radiation is an established fact. In 2008 the Health Council produced an advisory report on vitamin D in which it concluded that limited exposure to UV radiation from sunlight is an important source of vitamin D, in addition to that obtained from dietary intake, whether or not fortified with vitamin supplements.[14] The required duration and degree of exposure in the Netherlands to ensure an adequate vitamin D supply depends on the intensity of the UV radiation; the area of skin exposed; the type of skin; and the extent to which the skin is accustomed to exposure to UV radiation. The vitamin D report states that daily exposure of the head and hands to the midday sun for around 15 minutes in the period from April to October results in sufficient vitamin D production for people with white skin that is unaccustomed to exposure. In practice this situation can only occur on a cloudless day in April or May. In all other cases people must be exposed for a longer period or must expose a larger area of skin.

There are also increasing indications that exposure to UV radiation may help counteract some forms of cancer other than skin cancer, possibly as a result of vitamin D production.[15-18] However, the details on this are not sufficient to enable an estimate of the required degree of exposure to UV radiation from the sun or from artificial sources.

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The IARC classification

IARC has divided a large number of chemical substances, complex mixtures, workplace exposures, physical and biological agents and lifestyle factors into particular classes on the basis of scientific evidence on whether or not they are carcinogenic to humans.[2] Five groups are recognised:

- Group 1: carcinogenic to humans
- Group 2A: probably carcinogenic to humans
- Group 2B: possibly carcinogenic to humans
- Group 3: not classifiable as to its carcinogenicity to humans
- Group 4: probably not carcinogenic to humans

IARC evaluates whether a given agent (such as UV radiation) or process (such as the use of sunbeds) is capable of causing cancer under certain conditions. An agent or process that can do so constitutes a hazard, but no statement is made about the extent of the hazard. IARC does not determine the risk in terms of the risk of cancer.

The designation of an agent or process as carcinogenic to humans means that it may cause cancer in certain, but not necessarily in all circumstances. The risk of cancer depends on the nature of the agent or process and the exposure circumstances, while the types of cancers and their mortality rate will differ. It would therefore be incorrect to simply compare the risks of agents and processes that have been placed in the same group. The risk asbestos poses to public health is completely different from the risk associated with the use of sunbeds: although both asbestos and the use of sunbeds now have been placed in IARC group 1, the nature of the exposure is different; the size of the risk is different (a relative risk of less than 2 for UV radiation, as against a relative risk of approximately 10 for asbestos and mesothelioma and approximately 2 for asbestos and lung cancer); the distribution of exposure among the population differs and the nature of the severity of the related forms of cancer is different.

Epidemiological data

IARC's decision to classify the use of sunbeds as 'carcinogenic to humans' is based on an analysis of scientific literature by a working group IARC set up for that purpose.[10] The analysis was

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published as a review and was mainly based on data from (a few) epidemiological studies of the incidence of melanomas among sunbed users.

However, the Health Council takes the view that it is not possible to state with certainty that the use of sunbeds is responsible for an increased incidence of melanomas and, if it is, under which circumstances this applies with regard to, for example, the frequency of use, the age and skin type of users, and the types of sunbed lamps. However, it has become apparent that there is a higher incidence of melanomas among people in higher social classes,[19] possibly because people in those classes can more readily afford to take holidays in sunny climates and to use sunbeds. Nevertheless, it is also conceivable that other characteristics may explain the increased incidence of melanomas among sunbed users. Available data confirm the suspicion that people who use sunbeds also display behaviour in the sun that is associated with an increased risk of melanomas.[20] This may therefore make it more difficult to distinguish between these risk factors. Contrary to IARC's classification, the Health Council therefore has reservations about the scientific evidence that the use of sunbeds significantly contributes to the incidence of melanomas, regardless of the type of equipment and how it is used.

The UV spectrum of sunbeds and solar radiation

UV radiation from the sun or sunbeds may affect health positively as well as negatively. The nature and intensity of UV radiation determine whether an effect occurs; these variables differ considerably in time and place. In the case of the sun, the time of day (sun's height), time of year and atmospheric conditions such as cloud cover are important. For sunbeds the type of lamp and possibly the housing are important.

The UV spectrum is divided into three wavelength ranges: UV-A (315-400 nm[2]), UV-B (280-315 nm) and UV-C (100-280 nm).[21] On the longwave side the UV range is delimited by violet-blue light (wavelengths exceeding 400 nm) and on the shortwave side it is delimited by the range of X-ray and gamma radiation (wavelengths of less than 10 nm).

Radiation from the sun reaching the earth's surface does not contain UV-C: this radiation is filtered out by the ozone in the stratosphere. UV-C is also filtered out of the radiation emitted by sunbed lamps and the same generally applies to a large percentage of the UV-B radiation.

[2] A nanometre (nm) is one thousand-millionth (10^{-9}) of a metre.

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Radiation in the UV-B band has the largest impact with regard to biological effects such as sunburn, the occurrence of skin carcinomas, tanning and vitamin D production. On the other hand, the amount of UV-A radiation energy emitted by the sun and sunbeds is much higher than the amount of UV-B radiation energy emitted.

Protection of the skin against UV radiation is primarily achieved by skin thickening; this makes it less easy for UV radiation to reach the sensitive cells in the lower layers of skin. Skin thickening mainly arises through exposure to UV-B and hardly at all through exposure to UV-A. Tanning also provides some degree of protection through screening and the absorption of UV radiation by the pigment, and especially through the capture of reactive substances (radicals) generated by UV. Rapid tanning is caused by photochemical conversion of pigments under the influence of UV-A. This type of tan disappears quickly and provides no protection against later exposure to UV radiation. Slow tanning is caused by an increase in the production of pigment, especially under the influence of UV-B. This type of tanning provides some protection against UV radiation (but less protection than skin thickening in white skinned people) and it only disappears over several months.

The solar spectrum falling on the earth's surface when the sun is high comprises approximately 95% UV-A and 5% UV-B. The traditional sun lamp radiated UV-B percentages in the tens and higher. With the emergence of sunbeds in the 1980s the tendency was towards purer UV-A sources: tanning without burning. However, this type of tanning provided no protection against UV radiation during sunbathing. In recent years lamps have therefore started to be used in sunbeds that emit a limited amount (around 1%) of UV-B radiation and solarium operators point out the similarity to solar radiation.[22]

Conclusions

A reasonable reduction of the risk can be achieved by using sunbeds in accordance with the guidelines that the Health Council set out in 1986, and which were also accepted by the sector at the time.[23] Given the practical considerations, the Health Council's opinion was and continues to be: sunbathe sensibly and in moderation. As yet, there is no justification for making a distinction between sunbathing and the use of sunbeds.

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Various organisations, including the Dutch Cancer Society, which work together in the Sensible Sunbathing Platform[3], have drawn up Ten Golden Rules for sunbathing sensibly.[24] The rules are fairly similar to the Health Council's previous guidelines, all be it that it is not true to say that exposure to UV radiation when sunbathing in the more southerly climes of the northern hemisphere is similar to that from using sunbeds. The two can differ markedly in practice.

Excessive exposure of children and young people to UV radiation that results in sunburn should be avoided. Throughout their entire lifetime people who begin sunbathing at a young age or make frequent use of a sunbed face a greater risk than those who start at a later age.

Vitamin D production in the skin can easily be kept at the required level in the Netherlands from April to October by exposing the head and hands to the midday sun, during a lunchtime walk for example. Production is quickest for people with white skin that is unaccustomed to exposure; they only need 15 minutes exposure on a cloudless day. People with dark skin produce less vitamin D in the skin and therefore require a longer period of exposure; the same applies to people with white skin that is accustomed to sunlight. Certain types of sun lamps can also contribute to vitamin D production. However, the Health Council advises that these should only be used in consultation with a physician.

Yours sincerely,

(signed)
Professor M. de Visser
Vice President

[3] The Sensible Sunbathing Platform incorporates: ANBOS (General Dutch Sector Organisation for Beauty Care), Huidfonds (Skin Funds), KWF Kankerbestrijding (Dutch Cancer Society), NCV (Dutch Cosmetics Association), NVDV (Dutch Association of Dermatology and Venereology), NVH (Dutch Association of Skin Therapists) and SVZ (Association for Sensible Sunbathing).

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Annex **A**

Composition of the Standing Committee

The Standing Committee on Radiation and Health that drafted this advisory letter was made up of the following persons:

- Professor M. de Visser, *President*
  Vice President of the Health Council of the Netherlands, The Hague
  Professor of neuromuscular diseases, University of Amsterdam
- Professor D. van Norren, *Vice President*
  Professor of ocular physics, University of Utrecht
- Dr. L.M. van Aernsbergen, *observer*
  Physicist, Ministry of Housing, Spatial Planning and the Environment, The Hague
- Dr. H.F. Boersma
  Physicist, University of Groningen
- Dr. J. Geleijns
  Physicist, Leiden University Medical Centre
- Dr. F.R. de Gruijl
  Biophysicist, Leiden University Medical Centre
- Professor T.H.J.J. van der Hagen
  Professor of reactor physics, Delft University of Technology
- Professor M.G.M. Hunink
  Professor of medical epidemiology and biostatistics, Erasmus Medical Centre Rotterdam

- Dr. A. Keverling Buisman, *adviser*
  Physicist, Schoorl
- Professor A.J. van der Kogel
  Professor of radiobiology, Radboud University Medical Centre Nijmegen
- Professor J.J.W. Lagendijk
  Professor of medical physics, University Medical Centre Utrecht
- Professor J.W. Leer
  Professor of radiotherapy, Radboud University Medical Centre Nijmegen
- L.W. Meinders, *observer*
  Dutch Health Care Inspectorate, Ministry of Health, Welfare and Sport, The Hague
- Professor L. Mullenders
  Professor of toxicogenetics, Leiden University Medical Centre
- Professor W.F. Passchier
  Emeritus Professor of risk analysis, University of Maastricht
- Professor T.J.F. Savelkoul
  Professor of medical toxicology and radiation protection, Leiden University Medical Centre
- A.M.T.I. Vermeulen, *observer*
  Ministry of Social Affairs and Employment, The Hague
- Professor L. Verschaeve
  Professor of toxicology, University of Antwerp, Belgium
- Professor A. Vander Vorst
  Emeritus Professor of electrical engineering, Louvain la Neuve, Belgium
- Professor A.A. van Zeeland
  Professor of molecular radiation dosimetry and radiation mutagenesis, University of Leiden
- Dr. E. van Rongen, *scientific secretary*
  Radiobiologist, Health Council of the Netherlands, The Hague

This advisory report was prepared by Professor W.F. Passchier, Dr. F.R. de Gruijl and Dr. E. van Rongen. It was then submitted to the entire standing committee. Comments were also requested from Dr. E. de Vries, epidemiologist at the Erasmus Medical Centre Rotterdam.

The Health Council and interests

Members of Health Council Committees – which also include the members of the Advisory Council on Health Research (RGO) since 1 February 2008 – are

appointed in a personal capacity because of their special expertise in the matters to be addressed. Nonetheless, it is precisely because of this expertise that they may also have interests. This in itself does not necessarily present an obstacle for membership of a Health Council Committee. Transparency regarding possible conflicts of interest is nonetheless important, both for the President and members of a Committee and for the President of the Health Council. On being invited to join a Committee, members are asked to submit a form detailing the functions they hold and any other material and immaterial interests which could be relevant for the Committee's work. It is the responsibility of the President of the Health Council to assess whether the interests indicated constitute grounds for non-appointment. An advisorship will then sometimes make it possible to exploit the expertise of the specialist involved. During the establishment meeting the declarations issued are discussed, so that all members of the Committee are aware of each other's possible interests.