Results:

- use of sunscreen with minimum Sun Protection Factor (SPF) 15 (a campaign message) increased from 2003:11:2–5.

Background:

Sun exposure increases risk of skin cancer, especially melanoma, incidence of which continues to rise. Reported skin cancer knowledge and trends in sun care behaviours are documented in a UK region where there has been 20 years of sun-related health promotion campaigns. Methods: In 2000, 2004 and 2008, a ‘care in the sun’ module was included in the Northern Ireland (NI) Omnibus survey. Randomly selected subjects were asked to complete a sun-related questionnaire and proportions of respondents analysed by demographic and socio-economic factors, with differences tested using chi-squared tests and the chi-squared test. Results: Around 3623 persons responded. Skin cancer knowledge was high (97%). Sun avoidance decreased with time and was lowest among younger age groups and males. Sunscreen use was high (70%), unchanged over 8 years, and more likely among younger age groups, females, those in paid employment, and those with tertiary level education. Use of sunscreen with minimum Sun Protection Factor (SPF) 15 (a campaign message) increased from 45% to 70% (P<0.01). Skin self-examination was infrequent (8%), less common among those aged ≥65 years, males and those with only primary or secondary level education. Conclusions: Messages on sunscreen use have penetrated the population well, but lower use among the unemployed suggests cost as an issue. Lack of sun avoidance in young people, especially men, poses a risk for further skin cancer.

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Introduction

Skin cancer is the most commonly diagnosed cancer in the UK with malignant melanoma responsible for the majority of skin cancer-related deaths and more likely than other skin cancers to affect younger age groups.\(^1,3\)

The global incidence and mortality of malignant melanoma has been steadily increasing for the past 50 years.\(^4\) Recent estimates calculate the number of global new cases annually at almost 160 000 with the number of melanoma-related deaths at over 40 000 per year.\(^2\) Within the UK incidence has increased more than 3-fold since the 1970s,\(^3\) and is predicted to continue to rise for at least another 20 years.\(^1,3\) In Northern Ireland (NI), the number of cases has risen from an average of 48 per year in the mid-1970s to 259 in the year 2006.\(^2\) There has been an almost parallel rise in melanoma-related deaths with 49 people dying from malignant melanoma in NI in 2006.\(^6\)

Ultraviolet (UV) radiation has been classified by the International Agency for Research on Cancer (IARC) as a Group 1 carcinogen to humans.\(^7,8\) In particular, a history of intermittent sun exposure and/or sunburn, has been shown to increase risk of malignant melanoma, especially if exposure occurs early in life.\(^1,9\) Sun protection and avoidance of sunburn are therefore important public health messages for melanoma prevention.\(^1\)

Host factors that confer an increased risk include skin type (Fitzpatrick skin types I and II at particular increased risk), number of melanocytic naevi, presence of dysplastic naevi, and melanoma in a first-degree relative.\(^4\) The majority of the indigenous population of NI have Fitzpatrick skin types I or II, conferring an increased risk of both sunburn and skin cancer.\(^10,11\)

Sun protection campaigns have been ongoing in NI since 1990 with messages on sun avoidance (particularly of the mid-day sun), use of shade, covering up in the sun and effective use of a high-factor sunscreen [minimum Sun Protection Factor (SPF) 15].\(^12,13\) Over recent years, the programme has targeted all age groups but especially children and their parents in settings such as play schools. This survey documents skin cancer knowledge and trends in reported sun avoidance and sun protection behaviours within a UK region where there has been an active health promotion campaign for 20 years and where melanoma rates continue to rise.

Methods

In 2000, 2004 and 2008, ‘care in the sun’ modules were included in the Omnibus survey of the lifestyle and views of the NI population performed by the NI Central Survey Unit. Each year, 2200 subjects aged \(\geq\) 16 years were selected for inclusion from a random sample of addresses drawn from the Land and Property Service Agency listing of private households. Interviewers randomly selected one eligible adult from each address for completion of a questionnaire on sun care behaviour, knowledge and attitudes. This questionnaire was based on the Health Education Monitoring Survey, a validated survey carried out by the Office of National Statistics in 1995 and 1996.\(^14,15\) Proportions of respondents to each question were recorded and analysed by demographic and socio-economic factors.

To ensure representativeness respondents’ characteristics were compared with that of both the NI population from the 2001 Population Census and the achieved sample of the Continuous Household Survey (C1HS). Statistical decisions with regard to differences in the proportions of respondents giving a particular answer to a question were conducted using \(z\)-tests which assume that any differences are normally distributed around zero. When comparing the overall distribution of answers between cohorts, the chi-square non-parametric test was utilized. In both cases, \(P\)-values are provided, although a 95% confidence level (\(P = 0.05\)) was used as the cut off for statistical significance. Where appropriate odds ratios were calculated, adjusted for age and sex, using logistic regression in order to compare the behaviours of two cohorts with different age and sex distributions.

Where consistency of questions allowed the results of the 2008 survey have been compared with those from the previous surveys, and differences tested using the chi-squared test, to illustrate 8-year trends within the NI population.

Results

Demographics

A total of 3623 persons responded over the 8-year period. Response rates varied from 50% in 2000 to 59% in 2004 (55% in 2008). There was an approximate 1.2:1 female to male ratio and slight over-representation of older age groups relative to the NI population, with 52% of respondents in the 2008 survey aged \(\geq\) 45 years, compared with 45% in the mid-year population estimate.\(^16\)

Skin cancer knowledge

A total of 97% of respondents in 2008 reported having heard of skin cancer. This declined with age, 7% of those aged \(\geq\) 65 years reporting never having heard of it compared with 1% of those aged 16–24 years (\(P = 0.008\)). Females were less likely than males to report never having heard of skin cancer (2% vs. 5%, \(P = 0.004\)), as were those who had reached either secondary (1% vs. 8% primary, \(P < 0.001\)) or tertiary (1% vs. 8% primary, \(P < 0.001\)) level education with the differences between secondary and primary (OR 0.11, \(P < 0.001\)), and secondary and tertiary (OR 0.10, \(P < 0.001\)), level education remaining significant after adjustment for age and sex. See table 1.

The most commonly reported source of sun care information was television (79%) followed by magazines (49%), newspapers (49%), health professionals (35%) and family and friends (31%). There was a general trend for female respondents to report more exposure to skin cancer information than their male counterparts, particularly via television (\(P = 0.010\)), magazines (\(P < 0.001\)), healthcare professionals (\(P = 0.003\)), posters/leaflets (\(P < 0.001\)), pharmacies (\(P < 0.001\)) and the workplace (\(P < 0.001\)). Television, newspapers and the Internet were the most common sources of information for men. See table 1.

Sun protection practices

Use of sun avoidance as a method of sun protection within the NI population was proportional to age. In 2008, 16% of respondents aged \(\geq\) 65 years compared with only 2% of those aged 16–24 years reported never going out in the sun (\(P < 0.001\)), while 27% of those aged \(\geq\) 45 years reported avoidance of the mid-day sun compared with only 13% of those aged 16–24 years (\(P = 0.002\)). Younger respondents (aged 16–24 years) were in general less likely than those aged \(\geq\) 25 years to report never going out in the sun (\(P = 0.015\)), avoidance of the mid-day sun (\(P = 0.004\)), staying in the shade (\(P < 0.001\)) or wearing a hat (\(P < 0.001\)). See table 2.

Sun avoidance was also a more popular method of sun protection for female respondents than for males. In 2008, 11% compared with 6% of males reported never going out in the sun (\(P = 0.002\)), 30% compared with 19% reported avoidance of the mid-day sun (\(P < 0.001\)) and 29% compared with 18% reported staying in the shade (\(P < 0.001\)). Males, however, were just as likely to report use of clothing to cover up in the sun (23% of both groups), and more likely than females to report wearing a hat (37% vs. 28%, \(P = 0.001\)). See table 2.

Between 2000 and 2008 there was a general decline in the proportion of respondents using sun avoidance as a method of sun protection with fewer respondents reporting never going out in the sun (8% vs. 10%,
Sex (OR 1.57, P < 0.01) and staying in the shade (24% vs. 31%, P < 0.01). See table 3.

Overall reported use of sunscreen in 2008 was high at 70%. This was unchanged over the 8-year period. See table 3. Rates of reported use peaked when sunbathing abroad (74%) but were lower, both when sunbathing (45%) and during other outdoor activities (45%), at home. See table 2. Between 2000 and 2008 there was a significant decline in the proportion of respondents (both male and female) reporting use of sunscreen when sunbathing in NI, from 63% to 45% (P < 0.01).

Reported sunscreen use in 2008 was greatest in the younger age groups (aged 16–45 years), both when sunbathing at home (P = 0.003) and abroad (P < 0.001). Conversely older age groups (aged ≥45 years) were more likely to use sunscreen at home when not actively sunbathing, i.e. during other outdoor activities. As with sun avoidance use of sunscreen was a more popular reported method of sun protection for females than for males (76% vs. 63%, P < 0.001), particularly when sunbathing at home (51% vs. 37%, P < 0.001). There was no significant gender difference when sunbathing abroad or during other outdoor activities at home. See table 2.

Use of a SPF of 15 or over was reported by 70% of respondents who reported using sunscreen in 2008, with most frequent use reported by the 25–44 year age group (72%). This was a significant increase from 45% in 2000 (P < 0.01), a difference seen throughout all age groups and sexes. See table 4. Male respondents were more likely than females to report using a SPF of at least 15 (73% vs. 68%), although this did not reach statistical significance.

Married respondents in 2008 were more likely to report avoidance of the mid-day sun (P < 0.001), staying in the shade (P = 0.013), wearing a hat (P < 0.001) and use of sunscreen (P = 0.008) than single respondents. See table 2. The latter two remain significant when adjusted for age and sex (OR 1.57, P = 0.017 and OR 2.25, P < 0.001, respectively). Respondents in paid employment were more likely to report using sunscreen that those who were unemployed (79% vs. 58%, P < 0.001). See table 2. This remains significant when the results are adjusted for age and sex (OR 0.45, P < 0.001). Those who have reached higher levels of education (tertiary level) were more likely than other educational groups to report going out in the sun (P = 0.032). They were however more likely to report avoidance of the mid-day sun (P < 0.001) and use of sunscreen (P < 0.001), again with these results remaining statistically significant when adjusted for age and sex (OR 2.18, P < 0.001 and OR 4.47, P < 0.001, respectively). See table 2.

Regular skin self-examination was reported by only 8% of the population, although this was an improvement from 5% in 2000 (P = 0.02). See table 3. Lowest reported levels were seen among those aged ≥65 years but this did not reach statistical significance. Those most likely to report carrying out regular skin self-examination included females (9% vs. 6% males, P = 0.05), and those who had reached tertiary level education (13% vs. 6%, P < 0.001). There was no significant difference according to marital or employment status for this variable. See table 2.

Ten per cent of respondents reported taking no sun protection measures, a significant increase from 8% in 2000 (P < 0.01), and with highest rates among those aged 16–24 years (12%). Male respondents were twice as likely as females to report going out in the sun without any protection (14% vs. 7%, P < 0.001), with a similar result seen among single respondents (13% vs. 8% married, P = 0.012). See table 2.

**Discussion**

This population-based survey documents skin cancer knowledge and trends in sun avoidance and sun protection behaviours in a UK population where melanoma rates are rising rapidly, particularly among males. A high level of reliability of results was achieved by using a questionnaire based on a validated survey. The 50–59% response rate obtained was representative of gender, but slightly weighted towards older age groups, as would be expected with a survey which depends on home visits.

Skin cancer knowledge was high among the surveyed population but lower among older age groups, males and those who had reached primary level education only. Television and the printed media were the most common sources of information, more so than health professionals. The internet is also highlighted as a source of information for men.

Sun avoidance, seeking shade and use of physical barriers such as clothing are recommended as the first line of defence against skin damage, with sunscreen, minimum SPF 15, offering additional protection. These were key messages of previous sun care campaigns in NI. In this survey, the reported implementation of sun avoidance behaviours was low, particularly among males and those aged 16–24 years, and had fallen significantly over the 8-year period surveyed. This, combined with the higher levels of sun exposure at home and abroad reported by younger age groups, represents a behavioural risk factor for future skin cancer development. Previous studies carried out within Europe and the USA have shown a similar trend with younger age groups most likely to report skin cancer risk behaviours.

The reported use of sunscreen as a method of sun protection was high in this population but similar to that reported in the Heath Education Monitoring Survey in 1996 (68%) and lower than that reported from a volunteer on-line survey conducted by Cancer Research UK in 2007 (82%). Regarding the latter this could possibly be explained by the biases likely of a volunteer online survey.

The reported use of sunscreen as the most common method of sun protection is in keeping with previous studies and, combined with the low levels of other methods of sun protection and sun avoidance within the NI population, suggests a heavy reliance on sunscreen to protect the skin. Despite this sunscreen is not being used as often as recommended, particularly when people are exposed to the sun at home in NI where,
worryingly, there has been a decline in the reported use of sunscreen when sunbathing over the 8-year period. Reassuringly, there has been an increase in the proportion of the population using sunscreen with an SPF of at least 15, the minimum level recommended by most dermatologists and the regional health promotion programme in NI. However, there remain groups of the population, particularly females, who are still failing to do this.

The high use of sunscreen in married respondents, not a factor of age, may be the result of the recent targeting of sun care campaigns towards the parents of young children, suggesting that at least some of the health promotion messages over recent years have successfully penetrated the NI population.

The less frequent use of sunscreens in the unemployed suggests that expense of such products may be barrier to usage, an area worthy of further study. Respondents with higher educational attainment were less likely to avoid the sun than other educational groups but also more likely to use sun protection including avoidance of the mid-day sun and sunscreen. They therefore appear to be more likely to go out in, but take care in, the sun.

Although there has been a rise in reported skin self-examination for cancer from 2004 the persistently low level is disappointing as this was a campaign message and has been shown to have an important role in secondary prevention of melanoma. Reported skin self-examination is particularly low among men and those with lower educational attainment. Furthermore, although skin cancer occurs in younger people, it is more common with increasing age where skin self-examination was reported at only 5%. Evidence from previous studies indicates that it is possible for individuals to be successfully taught to carry out reliable self skin examinations by public health campaigns. Efforts therefore need to be made to promote skin self-examination within the NI population, especially among older age groups and those who sunbathe a lot. Among older people there is a role for carers in this respect as recommended by The All Party Parliamentary Group on Skin (APPGS) in 2008.

The results of this survey demonstrate that health promotion messages on the use of sunscreen, and on the use of an adequate SPF of sunscreen, have gained credibility in the NI population, although lower use among the unemployed suggests cost may be an issue. Messages on other methods of sun protection have unfortunately been less successful. This is in keeping with previous European studies which have shown that,

<table>
<thead>
<tr>
<th>Method of sun protection</th>
<th>2000 (%)</th>
<th>2004 (%)</th>
<th>2008 (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never go out in the sun</td>
<td>10</td>
<td>7</td>
<td>8</td>
<td>0.02</td>
</tr>
<tr>
<td>Avoid the mid-day sun</td>
<td>33</td>
<td>25</td>
<td>24</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Stay in the shade</td>
<td>31</td>
<td>25</td>
<td>24</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Sunscreen</td>
<td>67</td>
<td>69</td>
<td>70</td>
<td>0.10</td>
</tr>
<tr>
<td>Sunscreen SPF 15+ (of all sunscreen users)</td>
<td>45</td>
<td>53</td>
<td>70</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Regular skin checks</td>
<td>5</td>
<td>3</td>
<td>8</td>
<td>0.02</td>
</tr>
<tr>
<td>No sun protection measures</td>
<td>8</td>
<td>13</td>
<td>10</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

P-values shown if significant (<0.05)
although knowledge about sun protection behaviours is generally high in European populations, it is not consistently associated with implementation of those behaviours. Experience from countries such as Australia demonstrates that it is possible to improve the sun protection behaviours and attitudes of a population with public health campaigns. This survey has identified target groups within this population for specific care in the sun messages. The first is sun avoidance among the young, a message which should be targeted at those who do not achieve tertiary level education, and therefore needs to be introduced to children and young adults while they are still at primary or secondary school. Options for targeting primary school children include campaigns aimed at their parents emphasizing the long-term health risks associated with sunburn in childhood. For secondary school children campaigns should be directed towards the child and tailored for their age group, e.g. use of colourful posters in schools and youth clubs, use of local radio and use of magazines to target teenage girls.

The second specific sun care message identified by this survey is the promotion of sunscreen use in men. Use of television and the printed media, particularly newspapers, are likely to be key in targeting the male population but future campaigns should also consider how best to use alternative approaches such as healthcare professionals, the workplace and in particular the internet. Cost of sunscreen should be considered as a possible deterrent to use, particularly among the unemployed. It is worth noting that in this respect the APPGS has recommended zero VAT on sunscreens.

For women campaigns should promote use of an adequate SPF of sunscreen. Underlying female attitudes to sun care should also be addressed by campaigns involving the use of appearance appeals, both emphasizing the harm to physical appearance with sun exposure and increasing the perceived attractiveness of pale untanned skin. Industries such as the cosmetic, beauty and travel industries should all be involved if such campaigns are to be successful.

Finally public health campaigns should also target the elderly population and in particular raise their awareness of the importance of regular skin check. Again television and the printed media are likely to be the key but other options include the use of opportunite health promotion, either verbally or via the use of posters, when elderly patients attend GP surgeries and pharmacies.

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Conflicts of interest: None declared.

Key points
- Sun exposure increases risk of skin cancer, the incidence of which continues to rise.
- This validated survey demonstrates the positive effect of 20 years of sun protection campaigns in an area of the UK with high rates of melanoma.
- It identifies target groups for specific care in the sun messages in the future, such as sun avoidance among the young, the use of sunscreen in men, use of an adequate SPF of sunscreen in women, and the importance of regular skin checks especially in the elderly where skin cancer is more common.
- The Internet may prove a useful tool for delivery of health messages targeting men.

References