

# Ten-year changes in sun protection behaviors and beliefs of young adults in 13 European countries

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## Abstract

**Objective.** Sun protection behaviors are important to the prevention of skin cancers, but little is known about changes over time in attitudes and behavior.

**Methods.** Cross-sectional surveys were carried out among university students in thirteen European countries in 1990 ( $n=10,241$ ) and 2000 ( $n=10,161$ ). Sun protection behavior and beliefs about the importance of sunscreen use for health were measured.

**Results.** There was little change in the proportion of men and women who sunbathed, but use of sun protection increased over the 10-year interval from 52% to 63% in men and 80% to 87% in women. There was wide variation in sun protection use and strength of health beliefs between countries. The association between strength of beliefs and behavior was more marked in 2000 than 1990. Sun protection behavior was positively associated with the socioeconomic background of participants.

**Conclusion.** The use of sunscreen increased among educated young Europeans from several countries over the 1990s, but important sex differences remain. Awareness of the risk to health of unprotected sunbathing is high, but there is scope of strengthening attitudes to sunscreen use.

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## Introduction

There has been an increased incidence of both melanoma and non-melanomatous skin cancer in many countries over recent years. In Europe, melanoma is less prevalent than in the USA and Australia, but mortality and incidence rates vary widely between countries. For example, the age-standardized melanoma incidence rate per 100,000 in Greece in 2000 was 2.3 for men and 2.6 for women, compared with 11.9 for men and 15.4 for women in The Netherlands (Toms, 2004). The increase in melanoma mortality appears to have leveled off over recent years in Western Europe, but in Southern and Eastern Europe, it is still increasing (de Vries et al., 2003; Bosetti et al., 2004). Exposure to ultraviolet (UV) radiation is the main cause of melanoma and contributes to other skin cancers (Armstrong and Kricke, 1993), so sun protection represents a major public

health challenge (Eide and Wienstock, 2006). In some countries, public health campaigns have attempted to educate the population about the dangers of UV radiation exposure, for example, the 'SunSmart' campaign run by Cancer Research UK, and the Environmental Protection Agency's SunWise School Program in the USA. But several affluent countries do not appear to have large-scale national programs to promote sun safety (Severi et al., 2000).

Knowledge about sun protection behaviors such as sunscreen use is generally high in Western populations (Mackie, 2004) but is not consistently related to sunscreen use (Jerkegren et al., 1999; Guile and Nicholson, 2004). Social norms and attitudes are more important determinants of sunscreen use, with cosmetic motives such as desire for a tan competing with health-related beliefs about cancer prevention (Bränström et al., 2001; Kristjansson et al., 2004). Little is known about trends over recent years in sunscreen use and beliefs in the importance to health of sun protection. This study analyzed data on sun protection behavior and beliefs collected from university

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students from thirteen European countries in 1990 and 2000. Because sun exposure in early life may be a greater risk for the development of melanoma than equivalent exposure in later adult life (Autier and Dore, 1998), the sun protection practices of young adults are of considerable interest. This international dataset permits comparisons in trends between countries and allowed us to investigate the consistency of associations between health-related beliefs and behaviors. We also analyzed the relationship between sunscreen use and socioeconomic background, as defined by parental education and family wealth.

## Methods

### Study design and sample

The European Health Behavior Survey (EHBS) was carried out in 21 European countries between 1989 and 1991 (Step toe and Wardle, 1996). The International Health Behavior Survey (IHBS) used measures based on the EHBS and was carried out in 24 countries between 1999 and 2001 (Step toe et al., 2002a). The data presented here are from the 13 European countries included in both studies (Belgium, England, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, The Netherlands, Poland, Portugal and Spain) as described previously (Step toe et al., 2002b). Results from the EHBS are referred to as 1990 data, and results from the IHBS are referred to as 2000 data.

The questionnaire used for data collection was developed in English then translated into the language of each participating country. The development of questionnaire items and their reliability has been detailed in previous publications (Wardle and Step toe, 1991; Step toe et al., 1995). Data were

collected by collaborators working in universities across Europe from classes of students studying non-health-related courses. Students were told that the survey concerned activities related to health and that an international comparison was being carried out. The same universities took part in the two surveys. Although completing the questionnaire was voluntary, participation rates in most countries were over 90%. Sample sizes varied across countries depending on time constraints and the interests of collaborating groups, but altogether 10,352 participated in 1990 and 10,301 in 2000. Analyses were restricted to students aged between 17 and 30. The number of participants in each country is shown in Table 1.

### Measures

Sun protection use was established with the question ‘When you sunbathe, do you use sun protection, sunscreen cream or lotion’. Answers were ‘Yes’, ‘No’ or ‘I never sunbathe’. Health beliefs were assessed by asking respondents how important they felt it was for health to use sunscreen when sunbathing. Respondents rated their beliefs on a 10-point scale, where 1 = ‘of very low importance’ and 10 = ‘of very great importance’.

Questions concerning socioeconomic background were asked in the 2000 IHBS survey only. Information about the educational attainment of both parents was collected, and the sample was subsequently divided into lower parental education (neither parent went to college or university) and higher parental education (one or both parents went to college or university). Family wealth was assessed by asking respondents to categorize their family background as wealthy (within the highest 25% in your country in terms of wealth), quite well-off (within the 50–75% range for your country), not very well-off (within the 25–50% range for your country) or quite poor (within the lowest 25% in your country in terms of wealth). The population was subsequently divided into less wealthy (not very well off and quite poor) and more wealthy (wealthy, quite well off) categories.

Table 1  
Sunbathing, use of sun protection and strength of health beliefs in each country in 1990 and 2000

Country	Year	Mean age	n	Proportion who sunbathe (%)		Proportion using sun protection when sunbathing (%)		Strength of health beliefs (1–10)	
				Men	Women	Men	Women	Men	Women
Belgium	1990	19.0	1193	69	89	57	82	5.0	6.4
	2000	19.2	527	68	94	65	82	5.6	7.0
England	1990	20.1	704	73	79	70	88	5.9	7.3
	2000	19.8	786	68	79	76	91	6.6	7.9
France	1990	21.4	650	89	93	52	78	5.3	6.7
	2000	19.8	763	88	90	53	81	6.0	7.3
Germany	1990	23.6	779	92	94	80	90	6.3	7.6
	2000	22.5	727	88	95	74	90	6.9	8.3
Greece	1990	20.7	651	82	91	37	84	6.4	7.8
	2000	21.2	793	82	92	61	91	7.0	8.4
Hungary	1990	20.8	748	91	98	51	72	5.6	6.9
	2000	21.8	588	79	95	54	81	6.2	7.6
Iceland	1990	21.2	789	76	91	41	68	5.5	6.8
	2000	21.1	676	78	95	54	76	6.1	7.5
Ireland	1990	19.0	760	74	88	71	85	6.6	7.9
	2000	18.8	436	77	94	86	96	7.2	8.6
Italy	1990	19.6	810	95	98	48	78	5.8	7.2
	2000	20.2	2018	90	97	55	84	6.5	7.8
Netherlands	1990	19.6	744	91	73	48	78	5.1	6.5
	2000	21.1	682	81	94	73	92	5.8	7.2
Poland	1990	21.8	787	88	96	51	88	5.7	7.1
	2000	20.9	740	89	94	63	89	6.3	7.7
Portugal	1990	22.1	838	93	97	49	82	6.6	8.0
	2000	21.1	942	90	99	69	91	7.2	8.6
Spain	1990	20.7	791	89	97	28	69	6.0	7.3
	2000	20.9	483	81	96	60	88	6.6	8.0
Total	1990	20.6	10,241	84	92	53	80	6.0	7.0
	2000	20.6	10,161	83	94	63	87	6.3	7.9

### Statistical analysis

We computed the proportion of men and women who sunbathed and the proportion of sunbathers who used sunscreen in 1990 and 2000. These data were analyzed using SPSS version 10.1 to obtain means by country and STATA version 8.2 to obtain means and 95% confidence intervals (C.I.) for the whole sample taking account of the clustered nature of the data. Mean strength of beliefs in the importance of sun protection in each country in 1990 and 2000 was calculated. The relationship between beliefs and behavior was assessed by computing the proportion of individuals and 95% C.I. who used sun protection at each point on the 10-point belief scale. Additionally, logistic regression was used to assess associations between sun protection and beliefs in sunscreen use in 1990 and 2000, controlling for age and sex. Adjusted odds ratios, 95% CI for odds ratios and *p* values were obtained from logistic regressions conducted using STATA *svylogit*. Country was entered as the primary sampling unit for survey analysis in STATA in order to achieve accurate confidence intervals given the clustered nature of the data.

Multivariable logistic regression was used to assess the associations between sun protection, sex, age, health beliefs and socioeconomic background (parental education and family wealth) in respondents who sunbathed in the 2000 survey. Checks were made for multicollinearity before entering variables into regressions. An additional logistic regression was carried out to determine factors associated with health beliefs, dividing belief ratings into stronger and weaker categories by division at the midpoint of the scale (5/6).

## Results

### Sun protection use

Table 1 shows the proportion of respondents who sunbathed and who used sun protection while sunbathing, for each country, at each time period. More women than men reported sunbathing, but the overall proportion did not change between 1990 and 2000. The proportion of sunbathers who used sunscreen varied widely between countries, but women were consistently more likely to use sun protection than men (odds ratio 3.82, C.I. 3.20 to 4.56, using data from both surveys). Sun protection use did not vary by age over this limited age range. The proportion of sunbathers who used sun protection rose from 53% to 63% in 2000 for men, a mean increase of 10% (C.I. 2.4 to 17.4), and from 80% to 87% for women (mean change 7%, C.I. 3.2 to 9.7). The largest increases were in Greek, Dutch and Spanish men. Use among women did not increase so much because baseline levels in 1990 were much higher. Changes in reported sunscreen use were larger than would be expected from regression to the mean (Barnett et al., 2005).

### Belief in the importance of sunscreen for health

Mean beliefs in the importance of sunscreen (among individuals who sunbathed) are summarized in Table 1. Women held stronger beliefs than men, and beliefs became stronger in 2000 compared with 1990. Belief ratings averaged 6.0 (C.I. 5.8 to 6.2) in men and 7.0 (C.I. 6.8 to 7.2) in women in 1990, rising to 6.3 (C.I. 6.1 to 6.5) and 7.9 (C.I. 7.8 to 8.1) in 2000. Students aged over 20 were more likely than younger students to hold strong beliefs that sunscreen use was important (odds ratio 1.34, C.I. 1.05 to 1.71, both survey periods, including sex in the model). Table 1 shows that

differences in beliefs in the importance of sunscreen varied widely, from an average belief score (out of 10) of 5.0 for Belgian men in 1990 to 8.6 for Irish and Portuguese women in 2000.

There were consistent associations between strength of beliefs and the likelihood of using sunscreen. The overall relationship is plotted in Fig. 1, with confidence intervals adjusted to take account of the clustered data. It can be seen that both in 1990 and 2000, individuals with stronger beliefs in the importance of using sunscreen were more likely to engage in sun protection. Interestingly, the curve was steeper in 2000 than 1990; fewer students with low belief ratings used sun protection in 2000 compared with 1990, while at the other end of the distribution, more students with strong beliefs used sun protection in 2000 than in 1990. The difference in regression effects was significant, with the odds ratio for sun protection adjusted for age and sex for every unit increase in belief rating being greater (1.78, C.I. 1.70 to 1.86,  $P < 0.001$ ) in 2000 than in 1990 (1.28, C.I. 1.20 to 1.35,  $P < 0.001$ ). This pattern was replicated in analyses of individual countries, where the odds of using sun protection were positively associated with belief ratings in all country samples ( $P < 0.001$ ).

### Socioeconomic factors, beliefs and sunscreen use

The multiple logistic regression on sunscreen use is summarized in Table 2. Students from wealthier backgrounds and those whose parents had more education were significantly more likely to use sunscreen. These associations with socioeconomic background were independent of age, sex and belief ratings.

### Factors associated with health beliefs

The proportion of respondents with health belief ratings above the midpoint of the scale was 66.3%. The logistic regression on belief ratings indicated that older respondents, women and those from wealthier backgrounds were likely to hold stronger beliefs in the importance to health of using sunscreen (Table 2). By contrast, parental education was

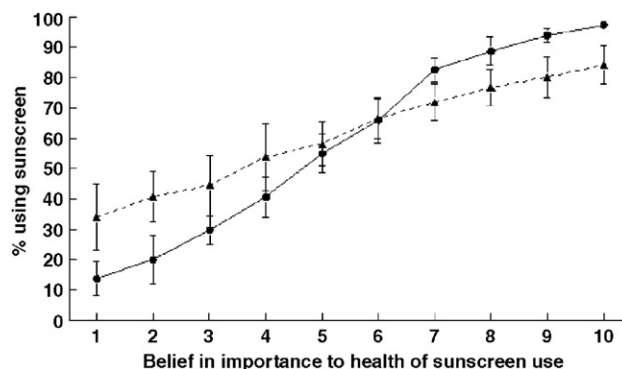


Fig. 1. Association between belief in importance of sunscreen for health and use of sun protection in 1990 (dashed line) and 2000 (solid line). Error bars are standard errors of the mean.

Table 2  
Multiple logistic regression on sun protection use and beliefs in the importance of sunscreen for health (2000 survey)

		Sun protection use		Belief in importance of sunscreen	
		Odds ratio (95% C.I.)	<i>p</i>	Odds ratio (95% C.I.)	<i>p</i>
Age		0.98 (0.91 to 1.05)	0.55	1.09 (1.03 to 1.15)	0.008
Sex	Men	1		1	
	Women	2.14 (1.73 to 2.66)	0.001	3.59 (3.12 to 4.12)	0.001
Family background	Less wealthy	1		1	
	More wealthy	1.22 (1.03 to 1.44)	0.023	1.22 (1.01 to 1.48)	0.044
Parent education	Lower education	1		1	
	Higher education	1.27 (1.06 to 1.53)	0.013	0.87 (0.73 to 1.04)	0.12
Health belief		1.78 (1.60 to 1.87)	0.001		

unrelated to health beliefs after taking family wealth into account.

## Discussion

The results of this study showed an increase in the proportion of European students using sun protection in 2000 compared with a decade earlier. This was true in nearly all of the 13 countries evaluated. Men showed a larger increase than women, but they also started at a much lower level in 1990. There were no marked changes in the proportion who sunbathed, so the increased use of sun protection was not accompanied by a reduction in the number of young men and women sunbathing. In both 1990 and 2000, women remained more likely than men to use sun protection, as would be expected from reports of gender differences in sun protection from several parts of the world (Santmyre et al., 2001; Schofield et al., 2001; Abroms et al., 2003; Purdue et al., 2001; Bränström et al., 2004; Ling et al., 2003).

The link between belief in the importance of sunscreen for health and the use of sun protection was highly consistent both within and across countries. Strong relationships between beliefs and behavior are found for many health-related actions (Weinstein and Rothman, 2005) and have been observed in analyses of other behaviors in the EHBS and IHBS (Stephens and Wardle, 1996; Wardle et al., 2004). Mean belief ratings increased by an average of 5% in men and 13% in women and were small but positive in all countries for both men and women. It is unlikely that increased belief in the importance of sunscreen is due to a greater awareness of the causes of skin cancer because awareness levels are typically high in educated sectors of the population (Jerkegren et al., 1999; Guile and Nicholson, 2004; Halpern and Kopp, 2005). It may be in part a response to promotion of the efficacy of sun protection by

commercial and health organizations. There may also have been an increase in the number of young people who believe that they are personally at risk of developing skin cancer, but we did not investigate perceptions of susceptibility to skin cancer in this survey.

A particularly interesting finding was that the association between health beliefs and behavior became steeper in 2000 compared with 10 years earlier (Fig. 1). Beliefs in the importance of sun protection for health are balanced against positive social attitudes to tanned skin. The latter can be extremely influential, as demonstrated by alarming findings that people who have previously had melanoma may be just as likely to seek a tan as people who have never had melanoma (Jackson et al., 2000). Our findings suggest that, for individuals with strong beliefs that sunscreen is important for health, the health benefits of sun protection may have carried more weight in sun protection decisions in 2000 than a decade earlier. For these people, health-related motivation to protect against UV radiation has become more likely to override the desire to tan and other factors encouraging exposure. The reverse pattern was observed at the lower end of the belief distribution, in that respondents in 2000 with weak beliefs were actually less likely than those in 1990 to use sun protection. Given that between 1990 and 2000 there was a large increase in the variety of sun protection products available, increased marketing of these products, and in some countries, sustained public health campaigns emphasizing the health benefits of sun protection, we can speculate that the group of low-belief respondents in 2000 are likely to be a ‘hard core’ of people who resist or reject health messages.

Students from wealthier and more educated backgrounds were more likely to use sun protection, and those from wealthier backgrounds also held stronger belief in the importance of sunscreen use (Table 2) as has been shown in an older UK sample (Miles et al., 2005). Sunscreen use has previously been associated with greater education and income in the USA (Santmyre et al., 2001). Although previous work has not found cost to be a significant barrier to the use of sunscreen (Boggild and From, 2003; Autier et al., 2001; Marlenga, 1995), it may be a factor for young adults from less affluent backgrounds. The difference in behavior could also be associated with socioeconomic differences in other relevant beliefs, including perceptions of personal susceptibility to melanoma, perceptions of the severity and curability of melanoma and concern over other types of UV radiation-related skin damage, which were not measured in this study.

## Limitations

We have no information on sunbathing frequency, or the type and frequency of sun protection use, and therefore the results should be interpreted with some caution. Respondents were asked about their use of sun protection, and this could include sun protection methods other than high-factor sunscreen. It has also been argued that ‘compensation’ effects may operate and that, since the UVB wavelengths primarily blocked by sunscreen are not the same as the UVA wavelengths responsible



for melanoma, use of sunscreen might lead to lengthier exposure to potentially carcinogenic radiation (Autier et al., 1999). The compensation debate is outside the remit of this analysis, but many of present day sunscreens are protective across a broad spectrum of UV radiation, and evidence that sunscreen use promotes increased exposure is equivocal (Eide and Weinstock, 2006).

The rationale for choosing to study students has been described elsewhere (Steptoe and Wardle, 1996). Students are an easily identifiable, socially homogenous and relatively healthy sector of young people, and in making international comparisons, it is important to compare like with like. However, the sun protection attitudes and behaviors described here are not necessarily representative of the general population. The EHBS and IHBS were both concerned with a range of health behaviors and attitudes, so the questions about sun protection were short and subtle variations in sun-related behaviors could not be detected. Skin type affects risk of malignancy and varies between northern and southern European countries, but we did not assess skin color in this study.

## Conclusion

The findings of these two surveys indicate that use of sun protection has increased over recent years in young European adults. However, even in this highly educated population, there was still a sizeable minority of respondents in 2000 who sunbathed without sun protection. Sun protection was particularly low among individuals who did not believe that sunscreen use was important for health. Attempts to increase public awareness of the link between skin cancer and sun exposure may have limited effects on sun protection behavior because most people are already aware of the connection. Our results suggest that health beliefs are very important and may be susceptible to change. Well-designed interventions focusing on attitudes may persuade those who still sunbathe without protection to improve their behavior in the sun.

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## References

- Abroms, L., Jorgensen, C.M., Southwell, B.G., Geller, A.C., Emmons, K.M., 2003. Gender differences in young adults' beliefs about sunscreen use. *Health Educ. Behav.* 30, 29–43.
- Armstrong, B.K., Krickler, A., 1993. How much melanoma is caused by sun exposure? *Melanoma Res.* 3, 395–401.
- Autier, P., Dore, J.F., 1998. Influence of sun exposures during childhood and during adulthood on melanoma risk. *Int. J. Cancer* 77, 533–537.
- Autier, P., Dore, J.F., Negrier, S., et al., 1999. Sunscreen use and duration of sun exposure: a double-blind, randomized trial. *J. Natl. Cancer Inst.* 91, 1304–1309.
- Autier, P., Boniol, M., Severi, G., Dore, J.F., 2001. Quantity of sunscreen used by European students. *Brit. J. Dermatol.* 144, 288–291.
- Barnett, A.G., van der Pols, J.C., Dobson, A.J., 2005. Regression to the mean: what it is and how to deal with it. *Int. J. Epidemiol.* 34, 215–220.
- Boggild, A.K., From, L., 2003. Barriers to sun safety in a Canadian outpatient population. *J. Cutan. Med. Surg.* 7, 292–299.
- Bosetti, C., La Vecchia, C., Naldi, L., Lucchini, F., Negri, E., Levi, F., 2004. Mortality from cutaneous malignant melanoma in Europe. Has the epidemic levelled off? *Melanoma Res.* 14, 301–309.
- Bränström, R., Brandberg, Y., Holm, L., Sjöberg, L., Ullen, H., 2001. Beliefs, knowledge and attitudes as predictors of sunbathing habits and use of sun protection among Swedish adolescents. *Eur. J. Cancer Prev.* 10, 337–345.
- Bränström, R., Ullén, H., Brandberg, Y., 2004. Attitudes, subjective norms and perception of behavioural control as predictors of sun-related behaviour in Swedish adults. *Prev. Med.* 39, 992–999.
- de Vries, E., Bray, F.I., Coebergh, J.W.W., Parkin, D.M., 2003. Changing epidemiology of malignant cutaneous melanoma in Europe 1953–1997: rising trends in incidence and mortality but recent stabilizations in western Europe and decreases in Scandinavia. *Int. J. Cancer* 107, 119–126.
- Eide, M.J., Wienstock, M.A., 2006. Public health challenges in sun protection. *Dermatol. Clin.* 24, 119–124.
- Guile, K., Nicholson, S., 2004. Does knowledge influence melanoma-prone behavior? Awareness, exposure, and sun protection among five social groups. *Oncol. Nurs. Forum* 31, 641–646.
- Halpern, A.C., Kopp, L.J., 2005. Awareness, knowledge and attitudes to non-melanoma skin cancer and actinic keratosis among the general public. *Int. J. Dermatol.* 44, 107–111.
- Jackson, A., Wilkinson, C., Hood, K., Pill, R., 2000. Does experience predict knowledge and behavior with respect to cutaneous melanoma, moles, and sun exposure? Possible outcome measures. *Behav. Med.* 26, 74–79.
- Jerkegren, E., Sandrieser, L., Brandberg, Y., Rosdahl, I., 1999. Sun related behaviour and melanoma awareness among Swedish university students. *Eur. J. Cancer Prev.* 8, 27–34.
- Kristjansson, S., Ullen, H., Helgason, A.R., 2004. The importance of assessing the readiness to change sun-protection behaviours: a population-based study. *Eur. J. Cancer* 40, 2773–2780.
- Ling, T.C., Faulkner, C., Rhodes, L.E., 2003. A questionnaire survey of attitudes to use of sunscreens in northwest England. *Photodermatol. Photoimmunol.* 19, 98–101.
- Mackie, R.M., 2004. Awareness, knowledge and attitudes to basal cell carcinoma and actinic keratoses among the general public within Europe. *J. Eur. Acad. Dermatol.* 18, 552–555.
- Marlenga, B., 1995. The health beliefs and skin cancer prevention practices of Wisconsin dairy farmers. *Oncol. Nurs. Forum* 22, 681–686.
- Miles, A., Waller, J., Hiom, S., Swanston, D., 2005. SunSmart? Skin cancer knowledge and preventive behaviour in a British population representative sample. *Health Educ. Res.* 20, 579–585.
- Purdue, M.P., Marrett, L.D., Peters, L., Rivers, J.K., 2001. Predictors of sunburn among Canadian adults. *Prev. Med.* 33, 305–312.
- Santmyre, B.R., Feldman, S.R., Fleischer, A.B., 2001. Lifestyle high-risk behaviors and demographics may predict the level of participation in sun-protection behaviors and skin cancer primary prevention in the United

- States: results of the 1998 National Health Interview Survey. *Cancer* 92, 1315–1324.
- Schofield, P.E., Freeman, J.L., Dixon, H.G., Borland, R., Hill, D.J., 2001. Trends in sun protection behaviour among Australian young adults. *Aust. N. Z. J. Publ. Heal.* 25, 62–65.
- Severi, G., Giles, G.G., Robertson, C., Boyle, P., Autier, P., 2000. Mortality from cutaneous melanoma: evidence for contrasting trends between populations. *Br. J. Cancer* 82, 1887–1891.
- Step toe, A., Wardle, J., 1996. The European health and behaviour survey: the development of an international study in health psychology. *Psychol. Health* 11, 49–73.
- Step toe, A., Sanderman, R., Wardle, J., 1995. Stability and changes in health behaviors in young adults over a one-year period. *Psychol. Health* 10, 155–169.
- Step toe, A., Wardle, J., Cui, W., et al., 2002a. An international comparison of tobacco smoking, beliefs and risk awareness in university students from 23 countries. *Addiction* 97, 1561–1571.
- Step toe, A., Wardle, J., Cui, W., et al., 2002b. Trends in smoking, diet, physical exercise, and attitudes toward health in European university students from 13 countries, 1990–2000. *Prev. Med.* 35, 97–104.
- Toms, J.R. (Ed.), 2004. *CancerStats Monograph 2004*. Cancer Research UK, London.
- Wardle, J., Step toe, A., 1991. The European health and behavior survey—Rationale, methods and initial results from the United Kingdom. *Soc. Sci. Med.* 33, 925–936.
- Wardle, J., Haase, A.M., Step toe, A., Nillapun, M., Jonwutiwes, K., Bellisle, F., 2004. Gender differences in food choice: the contribution of health beliefs and dieting. *Ann. Behav. Med.* 27, 107–116.
- Weinstein, N.D., Rothman, A.J., 2005. Commentary: revitalizing research on health behavior theories. *Health Educ. Res.* 20, 294–297.