Temporal Trends in Primary and Secondary Skin Cancer Prevention in the U.S.

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BACKGROUND

- Skin cancer incidence is rising in the United States despite public health efforts encouraging skin cancer prevention[1]
- Additional public health interventions are needed to combat rising rates of skin cancer and inadequate sun protective behaviors

OBJECTIVES

- Analysis of temporal trends of skin-cancer related preventive behaviors to examine for potential areas for improvement
- Primary (concerned with disease prevention) and secondary (concerned with early disease detection) preventive behaviors were examined

METHODS

- The National Health Information Survey (NHIS) was examined over a ten-year period from 2005 to 2015[2]
- NHIS conducts representative population-based annual interviewing of the adult US population
- Response rates ranged from 70.1% to 80.7% during the examined period[2]
- Our outcomes of interest were:
  1. Use of sun protective measures (including sun avoidance, protective clothing, and sunscreen use)
  2. Lifetime history of full body skin examination (FBSE) by a physician
  3. History in the past year of indoor tanning
  4. History in the past year of two or more sunburns
- Use of sun protective measures were defined as use always or most of the time when outside for more than one hour on a warm sunny day
- Protective clothing included at least one of the following: long pants, hat, or long-sleeved shirt
- Individuals that were excluded from analysis included:
  - Individuals who answered the sun protection questions by stating they "don't go out in the sun"[2]
  - Individuals with unknown or missing responses
- Multivariable logistic regression analyses were used with adjustment for sex, region, health insurance, alcohol use, smoking status, education, personal and family histories of skin cancer, income, race, and skin reaction to the sun.
- NHIS imputed data was used due to substantial missing data for income[2]
- P-values were adjusted for multiple comparisons

TABLE 1: Unadjusted and Adjusted Prevalences of Sun Protective Behaviors by Survey Year

	Year, Unadjusted Prevalence, % (95% CI)					Year, Adjusted Prevalence, % (95% CI)				
	2005	2010	2015	P_{trend} value*	Adjusted $P_{2015vs.2005}$ value†	2005	2010	2015	P_{trend} value*‡	Adjusted $P_{2015vs.2005}$ value†
Sun Avoidance	31.1 (30.2-32)	35.4 (34.5-36.3)	37.5 (36.5-38.4)	<0.001	<0.001	31.7 (30.9-32.6)	35.5 (34.7-36.4)	36.8 (35.9-37.6)	<0.001	**<0.001**
Protective Clothing	35.5 (34.7-36.3)	38.5 (37.5-39.4)	37.5 (36.6-38.4)	<0.001	0.006	35.9 (35.1-36.7)	38.4 (37.5-39.2)	37.2 (36.3-38.1)	<0.001	0.098
Sunscreen Use	30.6 (29.8-31.3)	32.7 (31.7-33.6)	35.5 (34.7-36.4)	<0.001	<0.001	31.5 (30.7-32.2)	33.1 (32.2-34)	34.3 (33.5-35.1)	<0.001	**<0.001**
Full Body Skin Exam	18.1 (17.4-18.7)	22 (21.2-22.8)	23.6 (22.9-24.4)	<0.001	<0.001	19 (18.4-19.6)	22.4 (21.7-23.1)	22.4 (21.7-23)	<0.001	**<0.001**
Indoor Tanning	14.8 (14.1-15.5)	6.2 (5.7-6.7)	3.9 (3.5-4.3)	<0.001	<0.001	14.1 (13.5-14.8)	6.2 (5.7-6.7)	4.1 (3.8-4.5)	<0.001	**<0.001**
Sunburn	18.7 (18.1-19.3)	21.0 (20.2-21.7)	19.6 (18.8-20.4)	<0.001	0.198	18.2 (17.7-18.8)	21.1 (20.4-21.8)	19.9 (19.2-20.7)	<0.001	0.001

Table 1: Unadjusted and adjusted prevalence of sun protective behaviors by survey year. Adjusting covariates include sex, census region, health insurance coverage, alcohol use, smoking status, education level, personal history of skin cancer, family history of skin cancer, income, race, and skin reaction to the sun. Bolded adjusted p values represent significant changes in behaviors.

FIGURE 1: Unadjusted and Adjusted Prevalences of Sun Protective Behaviors Over Time

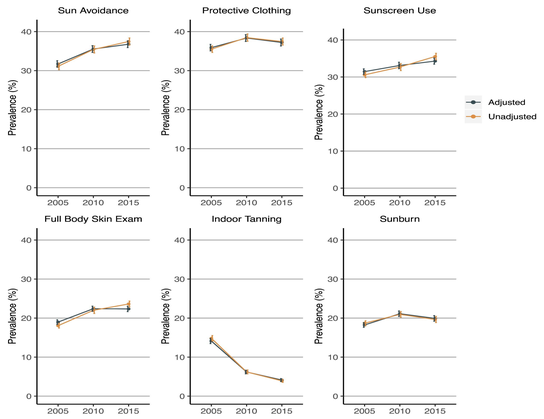

Figure 1:Unadjusted and adjusted prevalences of sun protective behaviors over time. The prevalences are the predictive marginal means. Adjusting covariates include sex, census region, health insurance coverage, alcohol use, smoking status, education level, personal history of skin cancer, family history of skin cancer, income, race, and skin reaction to the sun.

RESULTS

- Study included a total of 67,471 individuals
- Unadjusted and adjusted prevalence of most skin cancer preventive behaviors rose, including:
  - Sun avoidance
  - Sunscreen use
  - FBSE
- Unadjusted and adjusted prevalence of protective clothing did not rise
- Adjusted prevalence of indoor tanning decreased
- Adjusted prevalence of sunburn increased

CONCLUSIONS

- Indoor tanning is substantially decreasing, implying the success of targeted legislative and public health efforts[3]
- Rates of primary and secondary skin preventive behaviors remain suboptimal
- The prevalence of multiple sunburns is rising
- Rise in sunburns could be due to heightened sun awareness causing increased reporting or inadequate use of sun protection

LIMITATIONS

- NHIS survey reflects the United States population making our conclusions less generalizable to individuals in other countries
- Temporal trends were only analyzed over a 10 year period
- The influence of climate change was not considered in our analysis

FUTURE DIRECTIONS

- Further research needs include:
  - Why the prevalence of multiple sunburns is rising
  - How the impact of increased adoption of sun protective behaviors affects skin cancer incidence
- Previous success of public health efforts against indoor tanning may provide guidance for future public health efforts aimed at skin cancer prevention

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