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Strategies to Reduce Indoor Tanning:

Current Research Gaps and Future Opportunities for Prevention

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Abstract

Exposure to ultraviolet radiation from indoor tanning device use is associated with an increased risk of skin cancer, including risk of malignant melanoma, and is an urgent public health problem. By reducing indoor tanning, future cases of skin cancer could be prevented, along with the associated morbidity, mortality, and healthcare costs. On August 20, 2012, the CDC hosted a meeting to discuss the current body of evidence on strategies to reduce indoor tanning as well as research gaps. Using the Action Model to Achieve Healthy People 2020 Overarching Goals as a framework, the current paper provides highlights on the topics that were discussed, including (1) the state of the evidence on strategies to reduce indoor tanning; (2) the tools necessary to effectively assess, monitor, and evaluate the short- and long-term impact of interventions designed to reduce indoor tanning; and (3) strategies to align efforts at the national, state, and local levels through transdisciplinary collaboration and coordination across multiple sectors. Although many challenges and barriers exist, a coordinated, multilevel, transdisciplinary approach has the potential to reduce indoor tanning and prevent future cases of skin cancer.

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Introduction

Exposure to ultraviolet (UV) radiation from indoor tanning device use (referred to as “indoor tanning” throughout this paper) is associated with an increased risk of skin cancer, including risk of malignant melanoma, a potentially deadly form of skin cancer.^{1–3} More than 9000 people in the U.S. died from melanoma in 2009 alone.⁴ Indoor tanning is potentially more harmful than excessive sun exposure because of the greater intensity of the UV radiation emitted, the greater amount of exposed skin, and the intermittent UV exposure to portions of the body not generally exposed to solar UV.⁵

Despite the associated health risks, indoor tanning remains common, particularly among white adolescent and young adult women.^{6–8} For example, recent estimates indicate that approximately 32% of U.S. white women aged 18–21 years have indoor-tanned in the past 12 months, with an average of 27.6 sessions per year.⁶ Additionally, U.S. skin cancer rates continue to increase, leading to unnecessary morbidity, mortality, and health-care costs.^{9,10} However, many cases of skin cancer are preventable, and reducing indoor tanning is an important public health goal through which future skin cancer cases can be averted.

On August 20, 2012, the CDC hosted a meeting of nationally and internationally recognized experts attending the CDC National Cancer Conference to discuss the current body of evidence on strategies to reduce indoor tanning, as well as research gaps. (Meeting participants are listed in the acknowledgements.) Many of the participants have published extensively in the skin cancer prevention literature, and the group represented a variety of sectors and areas of expertise. This paper provides highlights from the discussions, with a focus on research gaps amenable to public health action.

Action Model to Achieve Healthy People 2020 Overarching Goals

A goal of the DHHS Healthy People 2020 is to reduce the number of new cancer cases, as well as the illness, disability, and death caused by cancer.¹¹ Within that goal, two objectives focus on reducing the proportion of adolescents in Grades 9–12, and adults aged 18 years who report using artificial sources of UV light for tanning.¹¹ The Action Model to Achieve Healthy People 2020 Overarching Goals (Figure 1) can be used as a framework to address indoor tanning as a public health problem. Factors that influence tanning behaviors exist at multiple levels, from individual-level influences to broad contextual factors.¹²

The model suggests that efforts to reduce indoor tanning may be most successful if they address determinants at multiple levels, an approach that requires transdisciplinary collaboration and coordination across many sectors at the national, state, and local levels. Strategies to reduce indoor tanning include individual-focused interventions, interventions that involve social and family networks, mass media campaigns, and systems and environmental changes. Ongoing assessment, monitoring, and evaluation are needed to track the implementation of strategies to reduce indoor tanning, measure the short- and long-term impact of these strategies, and determine which interventions are most effective, feasible, scalable, and sustainable. Through dissemination of evidence-based and best practices, these findings can inform future efforts to reduce indoor tanning.

The subsequent sections of this paper are organized within this framework, focusing on (1) strategies at multiple levels to reduce indoor tanning; (2) tools necessary to effectively assess, monitor, and evaluate the impact of intervention efforts; and (3) strategies to align efforts at the national, state, and local levels. Table 1 summarizes future research opportunities as they align with the Action Model to Achieve Healthy People 2020 Overarching Goals.

Strategies to Reduce Indoor Tanning

Individual-Level Strategies

Individual-level determinants provide key points of intervention to address tanning behavior.¹³ For example, indoor tanning is strongly associated with a preference for tanned skin and engaging in other appearance-focused behaviors.^{13–16} These attitudes and behaviors likely are driven, in part, by social norms that place a high value on physical appearance, particularly for women. Some studies indicate messages focused on the appearance-related effects of indoor tanning (i.e., premature skin aging) may be most salient to indoor tanners and may even facilitate long-term behavior change.^{17–20}

Targeted strategies that tailor prevention messages to specific types of tanners are likely to enhance the effectiveness of interventions.²¹ For example, patterns of indoor tanning vary, with some people tanning only before special events (e.g., a high school prom); some tanning sporadically; and others tanning regularly year-round. Targeted strategies are needed to help tanners quit or reduce their level of indoor tanning. Different strategies also may be needed to prevent the initiation of indoor tanning. When used in the context of a comprehensive approach, strategies that are targeted and well tailored may be effective for reaching specific sub-populations.²²

Some have promoted the use of sunless tanning products as a way to get a tanned appearance without UV exposure. One concern about this method of tanning is that dihydroxyacetone (DHA), a commonly used ingredient in sunless tanning products, is approved for use by the U.S. Food and Drug Administration (FDA) only for external application (21 CFR 70).^{23,24} When sunless tanning products are in lotion or cream form, consumers easily can avoid inhaling them or applying them to the eye area or mucous membranes, but adequate protection is less feasible when using spray-on tanning booths.²⁴ Further, evidence shows that DHA causes DNA damage in cultured keratinocytes.²⁵ Evidence is lacking regarding whether DHA would have the same effect on human skin.

Another concern is that promoting sunless tanning products does not address the underlying social factors that drive tanning behaviors. Sunless tanning products are often used in conjunction with, rather than in place of, UV tanning.^{26–30} Further, use of sunless tanning products does not appear to lead to safer outdoor sun exposure and potentially could increase the likelihood of sunburn.^{27,31,32}

Some research indicates that indoor tanning may have reinforcing properties akin to those ascribed to addictive substances, such as the release of endorphins when the skin is exposed to UV radiation.^{33,34} Endorphins are a type of natural opioid involved in the brain's reward

pathway. Their production during indoor tanning could create a future incentive to tan.³³ By adapting questionnaires used for substance-related addiction disorders, researchers have identified study participants who report regular, more frequent indoor tanning and tend to report more “opiate-like reactions to tanning” (i.e., relaxation, pain relief, stress relief, and a sense of well-being or euphoria).³⁵ Understanding the motivations of indoor tanners could inform future intervention efforts.

Roles of Parents, Peers, Clinicians, and Schools

As with other risky behaviors, indoor tanning often begins during the adolescent years.³⁶ The literature indicates that parental modeling of and permissive attitudes toward indoor tanning are among the strongest predictors of adolescent indoor tanning.^{14,15,36} Further, research indicates that girls who initiate indoor tanning with their mothers tend to begin tanning at an earlier age and are more likely to become regular, habitual tanners than girls who initially tanned alone or with a friend.³⁷

Few studies have assessed parents’ perceptions of the risks associated with indoor tanning or whether parents are indoor tanning with their children or are aware of their children’s indoor tanning behaviors. The literature suggests low parental knowledge and awareness of the risks associated with indoor tanning and points to a need for parental education.³⁸ Intervention research has not yet provided clear guidance on how to most effectively leverage the influential role of parents. Findings from one study of a parent–teen intervention suggest that coaching parents to discuss indoor tanning with their children and emphasizing the importance of parental monitoring of teen indoor tanning is a promising approach.³⁹

Perceived social norms regarding indoor tanning within one’s own peer group also are correlated with indoor tanning.^{14–16,36} Social norms encouraging indoor tanning likely stem, in part, from the belief that tanned skin is more attractive than untanned skin. Additionally, individuals erroneously may believe that indoor tanning is safe because the devices used for tanning are regulated by the FDA and are often advertised as being safe or healthy to use. Additional research to understand beliefs about indoor tanning, particularly among those most likely to tan, is needed.

Clinicians also can play a role in reducing indoor tanning.^{19,40} The U.S. Preventive Services Task Force (USPSTF) currently recommends behavioral counseling in clinical settings for children, adolescents, and young adults aged 10–24 years who have fair skin about minimizing their UV exposure to reduce the risk for skin cancer.^{19,41} Only three of the studies identified by the USPSTF review included indoor tanning as an outcome, and all three were conducted among female undergraduate indoor tanners.^{17,42,43}

Results from these three studies indicated that behavioral interventions, particularly appearance-focused interventions, reduced indoor tanning among this sub-population. Evidence on the efficacy of behavioral counseling for other age groups and men/boys is limited. Efforts are needed to identify ways to disseminate this type of information to clinicians and provide them with effective, user-friendly tools to use with their patients. Prior research indicates that clinicians’ attitudes and beliefs about the safety of indoor

tanning vary depending on demographic characteristics and specialty, so monitoring clinician attitudes, beliefs, and practices (i.e., patient counseling) is also important.⁴⁴

Schools traditionally play an important role in public health efforts targeting youth. A recent update to the Community Preventive Services Task Force (Task Force) review of primary and middle school interventions to prevent skin cancer found strong evidence of their effectiveness in increasing sun-protective behaviors and decreasing UV exposure, sunburn incidence, and formation of new moles.⁴⁵ Although none of the interventions specifically focused on indoor tanning, these findings suggest that elementary and middle school settings may provide opportunities to introduce children to the importance of protecting skin from UV radiation. A similar review is underway to assess the effectiveness of interventions in secondary schools and colleges.⁴⁶

Schools, colleges, and universities also may be venues where the promotion of indoor tanning could be limited. For example, schools and school-based organizations could pledge to decline advertising or sponsorship from tanning salons⁴⁷ or the presence of tanning devices on school property. A formal evaluation of these strategies has not been published.

Mass Media Campaigns

Mass media campaigns are strongly recommended (in conjunction with other interventions) by the Task Force as a strategy for reducing tobacco use among adolescents.⁴⁸ Similarly, mass media may increase awareness of the harmful effects of indoor tanning, change social norms over time, and possibly prime people for other intervention efforts. However, a recently updated literature review by the Task Force found insufficient evidence to determine the effectiveness of mass media interventions alone to reduce individuals' exposure to UV radiation.⁴⁹

Mass media campaigns in other countries have seen varied success and rarely have been evaluated formally. A particularly successful overall sun-safety campaign in Denmark included an initiative targeting indoor tanners aged 12–25 years and encouraged them to “turn off the sunbed.” Provocative campaign videos have “gone viral,” and surveillance efforts indicate a decrease in the presence of indoor tanning devices in public buildings and a decrease in use since the campaign started.⁵⁰ This success is attributed to a comprehensive social marketing approach and the extensive effort put into social media and youth-oriented communication.⁵¹

Popular media can influence social norms, either by promoting tanning and a tanned appearance or by denormalizing indoor tanning and encouraging people to embrace their untanned skin. Having a tan first became fashionable in the U.S. in the late 1920s.⁵² Magazine articles and advertisements promoting tanning as a way to enhance one's appearance became increasingly common.

Similar promotion of tanning still occurs today. For example, the reality TV show *Jersey Shore* is credited with making the phrase “GTL™” or “gym, tan, laundry™” popular.⁵³ Alternatively, recent news coverage of a New Jersey mother who was accused of allowing her daughter, aged 5 years, to indoor tan portrayed the behavior in a negative light.^{54,55} In

addition, *Cosmopolitan* magazine has covered the dangers of indoor tanning as part of an ongoing “Practice Safe Sun” campaign,⁵⁶ and a number of celebrities have spoken out about the dangers of indoor tanning.^{57,58} The impact of this media activity has not been evaluated.

Storytelling is another strategy that can make evidence-based health messages more meaningful and salient to the target audience. One example is the story of Clare Oliver, an Australian who was diagnosed with melanoma and died at age 26 years.⁵⁹ She believed her melanoma partially was caused by indoor tanning and publicly shared her story in an effort to raise awareness about the dangers of indoor tanning. Clare’s story gained media attention and likely increased awareness of the link between indoor tanning and skin cancer risk and the potential deadliness of melanoma.^{60–62} The media attention “encouraged public outrage” at the cause of Claire Oliver’s death and became a catalyst for new legislation and a decrease in the number of tanning salons in Australia’s provincial cities.^{60–62}

The Role of Legislation

In Australia, evidence suggests that new legislation implemented in tandem with public education campaigns during 2006–2009 played an important role in decreasing the number of tanning salons.⁶¹ In the U.S., most related research has focused on levels of compliance and enforcement and has not provided clear evidence as to which legislative and regulatory strategies are most effective.¹³ Further, U.S. studies have indicated that compliance and enforcement are low.¹³ Future legislative decisions must take these challenges into consideration and identify strategies to facilitate compliance and enforcement. Studies examining public support for and the effects of legislation and regulatory strategies could help to inform such decisions. Complete, accurate, and unbiased informational resources about indoor tanning and the effectiveness of legislation and regulatory strategies are needed to inform decision makers.

Unsupervised indoor tanning devices present a challenge to enforcement of interventions, especially laws that prohibit tanning for minors. Future strategies need to consider the implications that unsupervised use could have on the effectiveness of efforts to regulate indoor tanning. Data on the prevalence and use of unsupervised indoor tanning devices are lacking. Two projects are being conducted through federally funded Prevention Research Centers (www.cdc.gov/prc/) to examine indoor tanning among young adults, including the presence and use of unsupervised tanning devices.

The Role of the Industry

Currently, little information is published about the indoor tanning industry. A study conducted in 2006 found an average of 42 indoor tanning salons in major U.S. cities, exceeding the number of Starbucks® and McDonald’s® in those same cities.⁶³ The study also found that cities with higher percentages of whites had significantly higher facility densities than those with lower percentages of whites⁶⁴ and that living within 2 miles of an indoor tanning facility is a significant predictor of indoor tanning among adolescents.⁶⁵ More information on the industry, including its size, revenue, ownership, distribution of products, and marketing and pricing strategies, as well as the percentage of the market that is

represented by minors' tanning device use could inform future systems and environmental change decisions.

Marketing tactics being used by the indoor tanning industry are also of concern. A recent report released by the U.S. House of Representatives Committee on Energy and Commerce described false and misleading practices used to target particularly vulnerable potential customers.⁶⁶ Others have highlighted similarities between advertising strategies used by the tobacco and indoor tanning industries, including “mitigating health concerns, appealing to a sense of social acceptance, emphasizing the psychotropic effects, and targeting specific population segments.”⁶⁷

In 2010, the U.S. Federal Trade Commission approved a Final Settlement Order of a complaint against the Indoor Tanning Association, the primary trade organization for the tanning industry, requiring that the Association cease its practice of exaggerating benefits and denying the risks of indoor tanning.⁶⁸ Consumer fraud cases, based on deceptive claims and unfair sales practices, could be brought to bear against the industry. One such case was filed in 2010 by the Attorney General of Texas.⁶⁹

The industry often touts the health benefits of indoor tanning because exposure to UVB radiation from the sun or a tanning device can lead to vitamin D production within the body.⁷⁰ Vitamin D plays an important role in bone health, but research on other potential health benefits is inconclusive.^{71,72} Further, the amount of vitamin D produced during indoor tanning varies, depending on individual characteristics (e.g., skin type) and characteristics of the tanning device (e.g., the ratio of UVA to UVB radiation emitted).^{70,73} Adequate vitamin D can be obtained safely through food and dietary supplements without the risks associated with excessive UV exposure.^{70,71}

Lessons Learned from Tobacco

Applying “lessons learned” from the public health successes in addressing tobacco use may facilitate efforts to reduce indoor tanning. One lesson is the impact legislation can have on social norms.⁷⁴ Legislation may influence people’s beliefs about the health risks associated with the behavior. A second lesson is the influence of mass media campaigns and popular media on social norms, especially as part of a comprehensive approach that includes other intervention strategies.^{74,75} A third lesson is the role of understanding the industry, which may facilitate efforts to inform consumers of potential health risks associated with product use and help decision makers predict the effects of systems and environmental changes on the economy, the industry, and product users.^{75,76}

Differences between tobacco use and indoor tanning create some challenges to using the same approaches. For example, cigarette use often results in secondhand smoke exposure among nonsmokers, whereas indoor tanning exposes only the user to UV radiation. Also, studies have demonstrated that taxation is effective in reducing tobacco use.⁷⁷ However, although a 10% excise tax on indoor tanning services went into effect on July 1, 2010, based on provisions outlined in the federal Affordable Care Act,⁷⁸ early evidence suggests that the tax may have limited impact on indoor tanning behaviors.⁷⁹ This may be due to promotional pricing offered by tanning salons to promote frequent indoor tanning.⁸⁰ In addition, some

venues (e.g., fitness centers and apartment complexes) may include indoor tanning as one of multiple amenities in a larger package, which would not be subject to the tax.

Assessment, Monitoring, and Evaluation

Ongoing efforts are needed to track the development and implementation of and public support for new interventions. In addition, efforts are needed to evaluate the short- and long-term effects of new interventions and determine which strategies are most effective, feasible, scalable, and sustainable. Standardized tools and methods would facilitate consistently monitoring the development and implementation of new legislation and regulations at the local, state, and national level. Some tools for monitoring tanning behaviors at the national level are already in place (e.g., Youth Risk Behavior Survey⁸¹ and National Health Interview Survey⁸²). Additional surveillance efforts at the state and local levels could facilitate evaluation of new legislation and regulations as they go into effect.

Monitoring trends in the use of unsupervised tanning devices and intentional outdoor tanning is also important, as efforts to reduce indoor tanning could unintentionally lead to an increase in these behaviors. In addition to monitoring behaviors, monitoring beliefs and social norms about indoor tanning will inform message development. Surveys already in use such as the National Health Interview Survey,⁸² Health Information National Trends Survey,⁸³ and HealthStyles⁸⁴ could be used. DocStyles²³ and other existing surveys targeting clinicians could be used to monitor clinician counseling practices.

Economic analyses that could quantify the impact of efforts to reduce indoor tanning (e.g., the lost productivity attributable to indoor tanning and the impact of the 10% excise tax) also are needed. Researchers have used economic analyses to estimate the number of potential skin cancers prevented through indoor tanning regulations in Australia and the associated cost savings to the Australian government.⁸⁵ The American Academy of Dermatology has commissioned a U.S. study to estimate the healthcare costs faced by private health insurance companies attributable to indoor tanning. Researchers anticipate that a reduction in indoor tanning would result in cost savings to private insurance companies.

Monitoring the incidence of skin cancers and ocular melanoma continues to be important. The CDC National Program of Cancer Registries (NPCR: www.cdc.gov/cancer/npcr/) and the National Cancer Institute Surveillance, Epidemiology, and End Results program (SEER: seer.cancer.gov/) collect nationwide data on melanoma. Through a collaborative effort with the North American Association of Central Cancer Registries, state central cancer registries (CCR), Integrating the Healthcare Enterprise, and other organizations, the CDC developed the Implementation Guide for Healthcare Provider Reporting to the CCR to facilitate the implementation of standardized data transmissions from a healthcare provider's electronic health records (EHR) to the central cancer registry.²³

Modeling studies also can be used to estimate the percentage of melanoma cases attributable to indoor tanning¹ and the potential increases in skin cancer rates if indoor tanning use continues at the current levels. NPCR and SEER do not collect data on common nonmelanoma skin cancers (NMSC), such as basal and squamous cell carcinomas,^{4,86} but EHRs are one potential tool for gathering such data. Previously, healthcare claims data and

the National Ambulatory Medical Care Service database have been combined to estimate the number of new NMSC diagnoses and affected individuals in the U.S. population.⁸⁷

Aligning Efforts at the National, State, and Local Levels

In recent years, public health researchers^{88–90} have called for transdisciplinary, multilevel efforts to address determinants of health from the molecular level to the societal level. The literature from a variety of fields suggests that multilevel, ecologic interventions are useful in addressing health-related behaviors.^{91,92} Similar approaches are needed to reduce indoor tanning. A practical challenge to this approach is trying to align efforts across the national, state, and local levels and across multiple disciplines and sectors to maximize synergy and the return on public health investments.

Some efforts to coordinate skin cancer prevention efforts are already in place. For example, the National Council on Skin Cancer Prevention (NCSCP) is a non-profit organization with the mission of serving as a “united voice to reduce skin cancer incidence, morbidity, and mortality through awareness, prevention, early detection, research, and advocacy” (www.skincancerprevention.org/). The NCSCP has played a unique role in connecting more than 45 organizations, agencies, and associations and facilitating information- and resource-sharing. Many of the meeting participants are members of the NCSCP in various capacities and regularly attend the organization’s meetings.

Convening interested parties to share best practices and lessons learned on issues may be useful in maximizing the impact of ongoing efforts. Such meetings could be conducted via webinars to increase frequency while minimizing costs and would provide partners the opportunity to provide updates on relevant activities within their respective organizations. The meetings also would facilitate collaboration around research proposals and priorities, faster dissemination of research findings, and a more coordinated approach.

This approach will require partnership with many stakeholders, both traditional and less traditional (e.g., youth organizations, parent–teacher associations, schools, colleges, universities, student organizations, comprehensive cancer control programs, other public health organizations and programs, clinicians, pharmaceutical companies, health insurance companies, employers, professional groups, celebrities, and popular magazines). Many of these groups have well-established networks across the U.S. that could provide strategic channels for communication and public health action. State and local health departments may find it helpful to engage some of these potential partners as they consider new opportunities to address indoor tanning in their communities. The public health sector has the unique role and ability to convene diverse groups around health issues such as indoor tanning.

Conclusion

Future cases of skin cancer could be prevented by reducing indoor tanning device use. This paper highlights the need for a comprehensive, multilevel approach. Given how widespread indoor tanning is within the U.S., targeted and tailored interventions likely will be most effective if done within the context of comprehensive skin cancer prevention efforts that

promote sun protection and sunburn avoidance when outdoors, in addition to addressing contextual factors that promote tanning.⁹³ Intervention efforts should address determinants of tanning behavior at all levels of influence from individual characteristics, to the roles of parents, clinicians, and schools, to contextual factors, including systems and environmental changes, the media, social norms, and the indoor tanning industry.

Addressing these many factors will require transdisciplinary collaboration and coordination across multiple levels. Key partners will need to work with each other and with new, less-traditional partners to align efforts to reduce indoor tanning at the national, state, and local levels. Such an approach has the potential to shift social norms and prevent future cases of skin cancer.

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References

1. Boniol M, Autier P, Boyle P, Gandini S. Cutaneous melanoma attributable to sunbed use: systematic review and meta-analysis. *BMJ*. 2012; 345:e4757. [PubMed: 22833605]
2. International Agency for Research on Cancer Working Group on Artificial Ultraviolet Light (UV) and Skin Cancer. . The association of use of sunbeds with cutaneous malignant melanoma and other skin cancers: a systematic review. *Int J Cancer*. 2007; 120(5):1116–22. [PubMed: 17131335]
3. Lazovich D, Vogel RI, Berwick M, Weinstock MA, Anderson KE, Warshaw EM. Indoor tanning and risk of melanoma: a case-control study in a highly exposed population. *Cancer Epidemiol Biomarkers Prev*. 2010; 19(6):1557–68. [PubMed: 20507845]
4. CDC. National Program of Cancer Registries (NPCR). 2013. www.cdc.gov/cancer/npcr/
5. Miller SA, Hamilton SL, Wester UG, Cyr WH. An analysis of UVA emissions from sunlamps and the potential importance for melanoma. *Photochem Photobiol*. 1998; 68(1):63–70. [PubMed: 9679452]
6. CDC. Use of indoor tanning devices by adults—U.S 2010. *MMWR Morb Mortal Wkly Rep*. 2012; 61(18):323–6. [PubMed: 22572978]
7. Eaton DK, Kann L, Kinchen S, et al. Youth risk behavior surveillance—U.S 2011. *MMWR Surveill Summ*. 2012; 61(4):1–162. [PubMed: 22673000]
8. Albert MR, Ostheimer KG. The evolution of current medical and popular attitudes toward ultraviolet light exposure: part 3. *J Am Acad Dermatol*. 2003; 49(6):1096–106. [PubMed: 14639391]
9. Jemal A, Saraiya M, Patel P, et al. Recent trends in cutaneous melanoma incidence and death rates in the U.S. 1992–2006. *J Am Acad Dermatol*. 2011; 65(5S1):S17–25. e1–3. [PubMed: 22018063]

10. Guy GP, Ekwueme DU. Years of potential life lost and indirect costs of melanoma and non-melanoma skin cancer: a systematic review of the literature. *Pharmacoeconomics*. 2011; 29(10): 863–74. [PubMed: 21846158]
11. DHHS. Healthy People 2020. 2013. www.healthypeople.gov/2020/default.aspx
12. DHHS. The Secretary's Advisory Committee on National Health Promotion and Disease Prevention objectives for 2020: recommendations for the framework and format of Healthy People 2020. 2008. healthypeople.gov/2020/about/advisory/PhaseI.pdf
13. Watson M, Holman D, Guy G, Fox K, Seidenberg A, Lazovich D. Preventing skin cancer through reduction of indoor tanning: the current state of the evidence. *Am J Prev Med*. 2013; 44(6):682–9. [PubMed: 23683987]
14. Coups EJ, Phillips LA. A more systematic review of correlates of indoor tanning. *J Eur Acad Dermatol Venereol*. 2011; 25(5):610–6. author reply 617–8. [PubMed: 21349117]
15. Holman D, Watson M. Correlates of intentional tanning among adolescents in the U.S. : a systematic review of the literature. *J Adolesc Health*. 2013; 52(S5):S52–S59.10.1016/j.jadohealth.2012.09.021 [PubMed: 23601612]
16. Schneider S, Kramer H. Who uses sunbeds? A systematic literature review of risk groups in developed countries. *J Eur Acad Dermatol Venereol*. 2010; 24(6):639–48. [PubMed: 20015180]
17. Hillhouse J, Turrisi R, Stapleton J, Robinson J. A randomized controlled trial of an appearance-focused intervention to prevent skin cancer. *Cancer*. 2008; 113(11):3257–66. [PubMed: 18937268]
18. Hillhouse JJ, Turrisi R. Examination of the efficacy of an appearance-focused intervention to reduce UV exposure. *J Behav Med*. 2002; 25(4):395–409. [PubMed: 12136499]
19. Moyer VA. U S. Preventive Services Task Force. Behavioral counseling to prevent skin cancer: U.S. Preventive Services Task Force recommendation statement. *Ann Intern Med*. 2012; 157(1): 59–65. [PubMed: 22751761]
20. Mahler HI, Kulik JA, Gerrard M, Gibbons FX. Long-term effects of appearance-based interventions on sun protection behaviors. *Health Psychol*. 2007; 26(3):350–60. [PubMed: 17500622]
21. Hillhouse J, Turrisi R, Shields AL. Patterns of indoor tanning use: implications for clinical interventions. *Arch Dermatol*. 2007; 143(12):1530–5. [PubMed: 18087003]
22. Robinson JK, Baker MK, Hillhouse JJ. New approaches to melanoma prevention. *Dermatol Clin*. 2012; 30(3):405–12. [PubMed: 22800548]
23. U.S. Food and Drug Administration. Color additives. Code of Federal Regulations title. 2012; 21(70)
24. U.S. Food and Drug Administration. Sunless Tanners and Bronzers. Cosmetics. www.fda.gov/Cosmetics/ProductandIngredientSafety/ProductInformation/ucm134064.htm
25. Petersen AB, Wulf HC, Gniadecki R, Gajkowska B. Dihydroxyacetone, the active tanning ingredient in sunless tanning lotions, induces DNA damage, cell-cycle block and apoptosis in cultured HaCaT keratinocytes. *Mutat Res*. 2004; 560(2):173–86. [PubMed: 15157655]
26. Brooks K, Brooks D, Dajani Z, et al. Use of artificial tanning products among young adults. *J Am Acad Dermatol*. 2006; 54(6):1060–6. [PubMed: 16713463]
27. Cokkinides VE, Bandi P, Weinstock MA, Ward E. Use of sunless tanning products among U.S. adolescents aged 11 to 18 years. *Arch Dermatol*. 2010; 146(9):987–92. [PubMed: 20855697]
28. Mahoney A, Swetter SM, Biello KB, Resnick EA, Feuerstein I, Geller AC. Attitudes toward indoor tanning among users of sunless tanning products. *Arch Dermatol*. 2012; 148(1):124–6. [PubMed: 22250251]
29. Paul CL, Paras L, Harper A, Coppa K. Harm minimization in tan seekers: an exploration of tanning behaviour and the potential for substitutional use of sunless tanning products. *J Health Psychol*. 2011; 16(6):929–37. [PubMed: 21441364]
30. Stryker JE, Yaroch AL, Moser RP, Atienza A, Glanz K. Prevalence of sunless tanning product use and related behaviors among adults in the U.S. : results from a national survey. *J Am Acad Dermatol*. 2007; 56(3):387–90. [PubMed: 17097362]
31. Beckmann KR, Kirke BA, McCaul KA, Roder DM. Use of fake tanning lotions in the South Australian population. *Med J Aust*. 2001; 174(2):75–8. [PubMed: 11245507]

32. Girgis A, Tzelepis F, Paul CL, Walsh RA, McElduff P, McKenzie J. Australians' use of fake tanning lotions: another piece of the puzzle. *Aust N Z J Public Health*. 2003; 27(5):529–32. [PubMed: 14651400]
33. Shah, A.; Smith, S.; Heckman, C. Tanning dependence: is tanning an addiction?. In: Heckman, CJ.; Manne, SL., editors. *Shedding light on indoor tanning*. London: Springer; 2012. p. 107-20.
34. Juzeniene A, Moan J. Beneficial effects of UV radiation other than via vitamin D production. *Dermatoendocrinol*. 2012; 4(2):109–17. [PubMed: 22928066]
35. Hillhouse JJ, Baker MK, Turrisi R, et al. Evaluating a measure of tanning abuse and dependence. *Arch Dermatol*. 2012; 148(7):815–9. [PubMed: 22801615]
36. Coups, EJ.; Phillips, LA. Prevalence and correlates of indoor tanning. In: Heckman, CJ.; Manne, SL., editors. *Shedding light on indoor tanning*. London: Springer; 2012. p. 33-68.
37. Baker MK, Hillhouse JJ, Liu X. The effect of initial indoor tanning with mother on current tanning patterns. *Arch Dermatol*. 2010; 146(12):1427–8. [PubMed: 21173329]
38. Magee KH, Poorsattar S, Seidel KD, Hornung RL. Tanning device usage: what are parents thinking? *Pediatr Dermatol*. 2007; 24(3):216–21. [PubMed: 17542867]
39. Lazovich D, Choi K, Rolnick C, Jackson J, Forster JL, Southwell B. An intervention to decrease adolescent indoor tanning: a multi-method pilot study. *J Adolesc Health*. 2013; 52(S5):S76–S82. [PubMed: 23601614]
40. Balk SJ. Council on Environmental H, Section on D. Ultraviolet radiation: a hazard to children and adolescents. *Pediatrics*. 2011; 127(3):e791–e817. [PubMed: 21357345]
41. Lin JS, Eder M, Weinmann S. Behavioral counseling to prevent skin cancer: a systematic review for the U.S. Preventive Services Task Force. *Ann Intern Med*. 2011; 154(3):190–201. [PubMed: 21282699]
42. Stapleton J, Turrisi R, Hillhouse J, Robinson JK, Abar B. A comparison of the efficacy of an appearance-focused skin cancer intervention within indoor tanner subgroups identified by latent profile analysis. *J Behav Med*. 2010; 33(3):181–90. [PubMed: 20058183]
43. Turrisi R, Mastroleo NR, Stapleton J, Mallett K. A comparison of 2 brief intervention approaches to reduce indoor tanning behavior in young women who indoor tan very frequently. *Arch Dermatol*. 2008; 144(11):1521–4. [PubMed: 19015434]
44. Johnson KR, Heilig LF, Hester EJ, Francis SO, Deakynne SJ, Dellavalle RP. Indoor tanning attitudes and practices of U.S. dermatologists compared with other medical specialists. *Arch Dermatol*. 2006; 142(4):465–70. [PubMed: 16618866]
45. Community Preventive Services Task Force. Preventing skin cancer: primary and middle school interventions. the guide to community preventive services: the community guide: what works to promote health. 2012. www.thecommunityguide.org/cancer/skin/education-policy/primaryandmiddleschools.html
46. Community Preventive Services Task Force. Preventing skin cancer: education and policy approaches in secondary schools and colleges. The Guide to Community Preventive Services: The Community Guide: what works to promote health. 2012. www.thecommunityguide.org/cancer/skin/education-policy/secondarieschools.html
47. Freeman S, Francis S, Lundahl K, Bowland T, Dellavalle RP. UV tanning advertisements in high school newspapers. *Arch Dermatol*. 2006; 142(4):460–2. [PubMed: 16618865]
48. Task Force on Community Preventive Services. Recommendations regarding interventions to reduce tobacco use and exposure to environmental tobacco smoke. *Am J Prev Med*. 2001; 20(2S): 10–5.
49. Community Preventive Services Task Force. Preventing skin cancer: mass media. 2012. www.thecommunityguide.org/cancer/skin/community-wide/massmedia.html
50. Danish Cancer Society and TrygFonden. Sunbed habits of children and young people in Denmark 2010. 2011. www.cancer.dk/NR/rdonlyres/069F9868-5721-4B9A-8016-D470A7AD4B0C/0/Sunhabitsofchildrenand-youngpeople2010.pdf
51. Sinclair, CA. Lessons learnt in sunbed advocacy and education: an international perspective. CDC Skin Cancer Informal Expert Meeting; Washington DC. 2012;

52. Martin JM, Ghaferi JM, Cummins DL, et al. Changes in skin tanning attitudes. Fashion articles and advertisements in the early 20th century. *Am J Public Health*. 2009; 99(12):2140–6. [PubMed: 19846688]
53. Donnelly, M. Relive the birth of “GTL”. MTV Remote Control Blog. 2012. remotecontrol.mtv.com/2012/08/30/jersey-shore-first-gtl-video/
54. Siegal I, Battle P. New Jersey tanning mom denies charges of child endangerment. *US News*. 2012. Siegal, I.; Battle, P. New Jersey tanning mom denies charges of child endangerment. usnews.nbcnews.com/_news/2012/05/02/11500434-new-jersey-tanning-mom-denies-charges-of-child-endangerment?lite
55. Cooney, K. New Jersey mom arrested for taking 6-year-old to tanning booth. *Health*. 2012. newsfeed.time.com/2012/05/02/new-jersey-mom-arrested-for-taking-5-year-old-to-tanning-booth/
56. Colino, S. Scary truths tanning salons deny. *Cosmo’s Practice Safe Sun*. 2012. www.cosmopolitan.com/advice/health/indoor-tanning-dangers-1209
57. Berman, J. Victoria Beckham joins the “Protect The Skin You’re In” T-shirt campaign. NYU Langone Medical Center; 2008. communications.med.nyu.edu/media-relations/news/victoria-beckham-joins-protect-skin-youre-t-shirt-campaign
58. Good Morning America. Once-”Tanorexic” teen tries to save others. 2007. abcnews.go.com/GMA/OnCall/story?id=3144868&page=1
59. ABC News (Australian Broadcasting Corporation). Skin cancer—the dangers of a deadly tan (and solariums). ABC’s The 7:30 Report. 2007. www.youtube.com/watch?v=_KmHEJXZrQ
60. MacKenzie R, Imison M, Chapman S, Holding S. Mixed messages and a missed opportunity: Australian news media coverage of Clare Oliver’s campaign against solarium. *Med J Aust*. 2008; 189(7):371–4. [PubMed: 18837679]
61. Makin JK, Dobbins SJ. Changes in solarium numbers in Australia following negative media and legislation. *Aust N Z J Public Health*. 2009; 33(5):491–4. [PubMed: 19811490]
62. Sinclair CA, Makin JK. Sometimes it takes a loss of life to make a difference. *BMJ*. 2008; 336(7635):73. [PubMed: 18187723]
63. CITY100. Our findings. CITY100: Controlling Indoor Tanning in Youth. 2008. www.indoortanningreportcard.com/ourfindings.html
64. Hoerster KD, Garrow RL, Mayer JA, et al. Density of indoor tanning facilities in 116 large U.S. cities. *Am J Prev Med*. 2009; 36(3):243–6. [PubMed: 19215849]
65. Mayer JA, Woodruff SI, Slymen DJ, et al. Adolescents’ use of indoor tanning: a large-scale evaluation of psychosocial, environmental, and policy-level correlates. *Am J Public Health*. 2011; 101(5):930–8. [PubMed: 21421947]
66. U.S. House of Representatives Committee on Energy and Commerce—Minority Staff. False and misleading health information provided to teens by the indoor tanning industry. Investigative Report. 2012
67. Greenman J, Jones DA. Comparison of advertising strategies between the indoor tanning and tobacco industries. *J Am Acad Dermatol*. 2010; 62(4):685.e1–18. [PubMed: 20138395]
68. Federal Trade Commission. In the matter of Indoor Tanning Association, a corporation. 2010. FTC File No. 0823159 www.ftc.gov/os/caselist/0823159/index.shtm
69. State of Texas v. Curtis Ryan, Lynda Ryan, and Tony Ryan d/b/a Euro Tan. Travis City, TX: 2010. No. D-1-GV-10-000530 www.oag.state.tx.us/newspubs/releases/2010/040510eurotan_pop.pdf
70. Woo DK, Eide MJ. Tanning beds, skin cancer, and vitamin D: an examination of the scientific evidence and public health implications. *Dermatol Ther*. 2010; 23(1):61–71. [PubMed: 20136909]
71. IOM. Dietary reference intakes for calcium and vitamin D. Washington DC: National Academies Press; 2011.
72. WHO/International Agency for Research on Cancer. Vitamin D and cancer. Lyon, France: IARC; 2008.
73. Sayre RM, Dowdy JC, Shepherd JG. Variability of pre-vitamin D3 effectiveness of UV appliances for skin tanning. *J Steroid Biochem Mol Biol*. 2010; 121(1–2):331–3. [PubMed: 20398765]

74. Zaza, S.; Briss, PA.; Harris, KW., editors. Task Force on Community Preventive Services. Tobacco. The guide to community preventive services: what works to promote health?. Atlanta GA: Oxford University Press; 2005. p. 3-79.
75. Pierce JP, White VM, Emery SL. What public health strategies are needed to reduce smoking initiation? *Tob Control*. 2012; 21(2):258–64. [PubMed: 22345263]
76. Ling PM, Glantz SA. Tobacco industry consumer research on socially acceptable cigarettes. *Tob Control*. 2005; 14(5):e3. [PubMed: 16183968]
77. Chaloupka FJ, Straif K, Leon ME. International Agency for Research on Cancer, Working Group. Effectiveness of tax and price policies in tobacco control. *Tob Control*. 2011; 20(3):235–8. [PubMed: 21115556]
78. Internal Revenue Service. Affordable Care Act tax provisions. 2012. www.irs.gov/uac/Affordable-Care-Act-Tax-Provisions
79. Jain N, Rademaker A, Robinson JK. Implementation of the federal excise tax on indoor tanning services in Illinois. *Arch Dermatol*. 2012; 148(1):122–4. [PubMed: 22250250]
80. Kwon HT, Mayer JA, Walker KK, Yu H, Lewis EC, Belch GE. Promotion of frequent tanning sessions by indoor tanning facilities: two studies. *J Am Acad Dermatol*. 2002; 46(5):700–5. [PubMed: 12004310]
81. CDC. Youth Risk Behavior Surveillance System. 2013. www.cdc.gov/HealthyYouth/yrbs/index.htm
82. CDC. National Health Interview Survey. 2012. www.cdc.gov/nchs/nhis.htm
83. U.S. National Institutes of Health. HINTS. Health Information National Trends Survey. 2012. hints.cancer.gov/
84. CDC. HealthStyles Survey. Gateway to health communication & social marketing practice. 2012. www.cdc.gov/healthcommunication/ToolsTemplates/EntertainmentEd/HealthstylesSurvey.html
85. Hirst N, Gordon L, Gies P, Green AC. Estimation of avoidable skin cancers and cost-savings to government associated with regulation of the solarium industry in Australia. *Health Policy*. 2009; 89(3):303–11. [PubMed: 18760857]
86. Watson M, Johnson CJ, Chen VW, et al. Melanoma surveillance in the U.S. : overview of methods. *J Am Acad Dermatol*. 2011; 65(5S1):S6–S16. [PubMed: 22018069]
87. Rogers HW, Weinstock MA, Harris AR, et al. Incidence estimate of nonmelanoma skin cancer in the U.S. 2006. *Arch Dermatol*. 2010; 146(3):283–7. [PubMed: 20231499]
88. Hiatt RA, Breen N. The social determinants of cancer: a challenge for transdisciplinary science. *Am J Prev Med*. 2008; 35(2S):S141–S150. [PubMed: 18619394]
89. Gehlert S, Murray A, Sohmer D, McClintock M, Conzen S, Olopade O. The importance of transdisciplinary collaborations for understanding and resolving health disparities. *Soc Work Public Health*. 2010; 25(3):408–22. [PubMed: 20446184]
90. Gehlert S, Colditz GA. Cancer disparities: unmet challenges in the elimination of disparities. *Cancer Epidemiol Biomarkers Prev*. 2011; 20(9):1809–14. [PubMed: 21784956]
91. Sallis, JF.; Owen, N.; Fisher, EB. Ecological models of health behavior. In: Glanz, K.; Rimer, BK.; Viswanath, K., editors. Health behavior and health education: theory, research, and practice. 4. San Francisco CA: Jossey-Bass; 2008. p. 465-85.
92. Mozaffarian D, Hemenway D, Ludwig DS. Curbing gun violence: lessons from public health successes. *JAMA*. 2013; 309(6):551–2. [PubMed: 23295618]
93. Coups EJ, Manne SL, Heckman CJ. Multiple skin cancer risk behaviors in the U.S. population. *Am J Prev Med*. 2008; 34(2):87–93. [PubMed: 18201637]

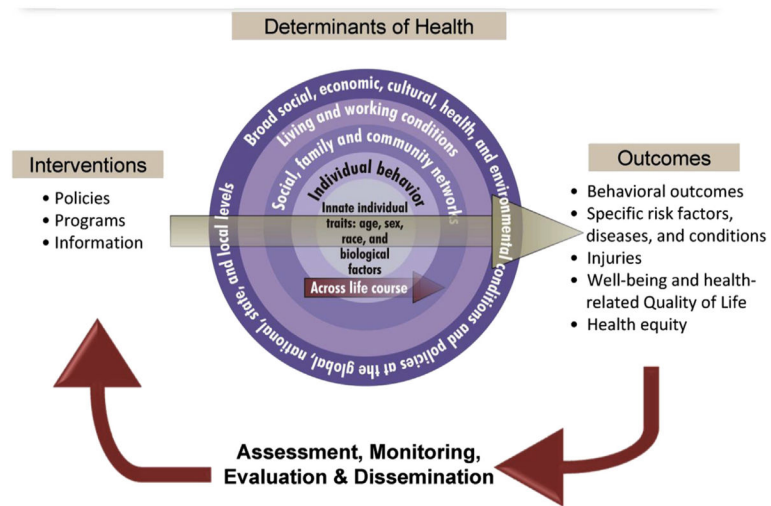


Figure 1.
Action model to achieve Healthy People 2020 overarching goals
Note: Reprinted with permission from the CDC¹²

Table 1

Future research opportunities to inform efforts to reduce indoor tanning in the U.S.

Individual-level strategies
Continue to develop and evaluate tailored and targeted messaging strategies.
Evaluate the long-term impact that messages have on indoor tanning behaviors.
Test the efficacy of behavioral counseling among groups other than female undergraduate tanners.
The roles of parents, clinicians, and schools
Assess parents' perceptions of the risks associated with indoor tanning.
Assess parents' awareness of their children's use of indoor tanning devices.
Examine the prevalence of the practice of parents doing indoor tanning with their children.
Evaluate strategies for engaging parents in prevention efforts targeting children.
Identify ways to disseminate information about and tools for behavioral counseling to clinicians.
Monitor clinicians' behavioral counseling practices.
Develop and evaluate educational, systems, and environmental interventions in school settings.
Mass media campaigns
Develop and evaluate the efficacy of mass media campaigns.
Engage celebrities and other public figures in mass media campaign efforts.
Legislation
Track the development and implementation of new indoor tanning legislation.
Compare the effects of various types of indoor tanning legislation on behaviors.
Develop informational resources for decision makers.
Monitor public support for indoor tanning legislation.
Assessment, monitoring, and evaluation
Continue surveillance efforts at the national level to track indoor tanning device use.
Increase surveillance efforts at the state and local levels to track indoor tanning device use.
Collect data on the prevalence and use of unsupervised indoor tanning devices.
Monitor indoor tanning attitudes and beliefs among the U.S. population and among indoor tanners.
Monitor trends in outdoor tanning (i.e., sunbathing).
Conduct economic analyses to quantify the impact on morbidity, mortality, productivity, and health care costs.
Monitor trends within the indoor tanning industry over time (e.g., industry size and pricing).
Continue surveillance of melanoma incidence and mortality rates.
Collect data on basal and squamous cell carcinomas using electronic medical records.
Conduct modeling studies to estimate trends in the incidence of basal and squamous cell carcinomas.