



Reviews

Skin bleaching: A neglected form of injury and threat to global skin

Jalika C. Street¹

Department of Psychology, Georgia State University

Karie Gaska

Department of Psychology, Georgia State University

Kelly M. Lewis

Department of Psychology, Georgia State University

Michael L. Wilson

Centre for Injury Prevention and Community Safety, PeerCorps, Trust Fund Dar es Salaam

ABSTRACT

Skin bleaching is the use of creams, gels, or soaps to lighten the skin and is known to cause a number of injuries, many of which are potentially life-threatening. Despite the growing body of research identifying the harmful effects of skin bleaching, this topic has received little attention in the field of public health. This study provides a literature review of the current research documenting health risks associated with skin bleaching. Articles pertaining to skin bleaching practices and their health consequences were extracted from databases that publish research in the biomedical, public health, and social science literatures. Twenty-two articles that met search criteria were analysed and thematically coded using a priori research questions examining: (1) harms caused by skin bleaching, (2) alignment with accepted definitions of injury, and (3) suggestions for prevention and intervention. Results indicate skin bleaching poses a serious public health risk and threat to skin safety. Researchers have called for increased governmental and individual/community intervention to address this growing problem. Limitations of the study include the small number of scholarly publications on the topic, limited epidemiological study of the topic, and various selection biases in individual articles that may skew results.

Keywords: *skin safety, skin bleaching, skin lightening, injury prevention, literature review, public health*

¹ Please direct all correspondence to: Ms Jalika C. Street, Department of Psychology, Georgia State University, PO Box 5010, Atlanta, GA USA, 30302; Email: Jalika.Street@gmail.com.

INTRODUCTION

SKIN BLEACHING: AN UNDERSTUDIED AREA OF INJURY PREVENTION

Unintentional injuries represent a leading cause of morbidity and mortality around the world for people of all age groups (de Ramirez, Hyder, Herbert & Stevens, 2012; Krug, Sharma & Lozano, 2000). Efforts to prevent injuries to the skin, or skin safety, is one of the most understudied areas of public health (Krejci-Manwaring, Kerchner, Feldman, Rapp & Rapp, 2006) despite recent research documenting that dermatological threats are on the rise worldwide (Jardine et al., 2012). While exposure to ambient solar radiation among vulnerable populations accounts for a large proportion of skin traumas in the form of cancer (Armstrong & Kricger, 2001; Mahé, Ly, Aymard & Dangou, 2003) many other potential skin hazards also exist such as occupational-related skin exposures (National Institute for Occupational Safety and Health, n.d.), community skin exposures, and skin damage resulting from practices such as bleaching. Considering the potential harms that can occur from exposure to hazardous chemicals, comparatively little research attention has been given to the widespread global practice of dangerous skin bleaching.

SKIN BLEACHING: A THREAT TO SKIN SAFETY

Skin bleaching, the cosmetic application of topical ointments, gels, soaps and household chemicals to de-pigment or lighten (bleach) the skin complexion, has emerged as an increasingly frequent practice during the past three decades (Charles, 2003). The global production and marketing of skin bleaching products has become a multi-billion dollar industry, servicing all parts of the world, particularly low- and middle-income countries (Glenn, 2008) making it one of the most common forms of potentially harmful body modification practices worldwide (Charles, 2003; Hall, 1995; Pitché, Kombaté & Tchangai-Walla, 2005). Obtaining prevalence rates on skin bleaching practices is challenging, but researchers have made progress in estimating rates in different parts of the world. Estimates range from 24% of women in Japan (Glenn, 2008) and 30% of women in Ghana (Blay, 2010), to alarming rates in India where 60–65% of women use skin bleaching methods (Glenn, 2008), or even higher rates estimated in cities like Lagos, Nigeria where up to 77% of women may use skin bleaching products (Kpanake, Muñoz Sastre & Mullet, 2010). Although the use is global, African women are some of the biggest consumers of skin bleaching products, which include potentially harmful local concoctions made from household chemicals (e.g. automotive battery acid, bleach, laundry detergent, toothpaste), and over-the-counter creams, putting them at greater risk for a variety of negative health outcomes (del Giudice & Yves, 2002). In an effort to explore these negative health outcomes, an emergent body of literature is examining the potential dangers of mis- and prolonged use of bleaching agents (Ajose, 2005; Ly et al., 2007; Mahé et al., 2003; Olumide et al., 2008).

Numerous potentially life-threatening consequences of skin bleaching have been identified in the literature (Boyle & Kennedy, 1986; Mahé et al., 2003; Ramsay, Goddard, Gill & Moss, 2003). Dermatologic consequences include: skin lesions, epidermal atrophy (thinning of the skin), exogenous ochronosis (bluish black tissue discoloration), eczema, bacterial and fungal infections, dermatitis (skin inflammation), scabies (contagious skin disease), warts, acne, sun damage and body odour (Ajose, 2005; Mahé et al., 2003). Further, skin bleaching can lead to fragile skin, poor wound healing, scarring and the need for corrective surgery (Ajose, 2005). Other more serious health risks include hypertension, diabetes, infertility, leukaemia (blood cancer), skin cancer, foetal toxicity (foetal poisoning), immunosuppression (suppression of a healthy immune response), renal and liver impairment and failure, Cushing's syndrome (hormone disorder), insomnia, memory loss, tremors, speech and hearing impairment (Ajose, 2005; Lewis et al., 2010; Mahé, Ly & Perret, 2005; Petit, Cohen-Ludmann, Clevenbergh, Bergmann & Dubertret, 2006; Pitché et al., 2005). These harms extend from the acute or chronic long-term exposure to the often hazardous chemical agents that are present in bleaching products. In addition, the damage from bleaching products is often exacerbated when users mix bleaching products with household chemicals such as toothpaste, laundry bleach, detergents and even automotive battery acid, a very common practice in some settings, to try to enhance their effect (Ajose, 2005; Lewis et al., 2010; Pitché et al., 2005; Ramsay et al., 2003). However, this remains an extremely understudied practice (Lewis et al., 2012).

SKIN BLEACHING: A MISSED OPPORTUNITY IN INJURY PREVENTION

Though there are existing research studies in the medical field that have documented the health risks associated with skin bleaching, there has been little research in the scholarly public health literature on the risks associated with skin bleaching or consideration for skin bleaching as a form of injury (Lewis et al., 2012). Skin bleaching practices may, in part, be understudied because they are often not considered when injury prevention is discussed.

The U.S. Centers for Disease Control and Prevention (CDC) define nonfatal injury as, "bodily harm resulting from severe exposure to an external force or substance (mechanical, thermal, electrical, chemical, or radiant) or a submersion," that can be either "unintentional or violence-related." Further, the CDC defines poisoning as a subcategory of injury which results from being exposed to an exogenous substance that causes cellular injury, illness or death (Centers for Disease Control and Prevention, n.d.). An "unintentional poisoning" occurs when "a person taking or giving too much of a substance did not mean to cause harm" (Centers for Disease Control and Prevention, n.d.). Poisons can be inhaled, injected, or absorbed through the skin or mucous membranes and can result in death or disability and have devastating physical, psychological, and socio-economic consequences. Skin

bleaching is seemingly an important threat to skin safety, but largely remains outside the field of public health and is often not considered in injury prevention efforts. Given the potentially harmful consequences of skin bleaching, the current study aims to fill this gap in the literature by synthesising known data on the public health risk of skin bleaching and considering its place in injury prevention.

WHAT THIS STUDY ADDS

The current systematic review examines the documented health risks associated with skin bleaching and explores whether these health consequences meet the criteria, as defined by the CDC, for causing injury. This study takes a unique interdisciplinary approach by examining literature across several disciplines (e.g. biological sciences, psychology, public health) and uses qualitative content analysis to make meaning of the findings. Unlike literature reviews previously conducted on skin bleaching, the current study is methodologically rigorous and explicitly discusses the research methods and risk for bias based on the methods used. The current study examines what prevention activities have been called for by researchers to reduce the detrimental effects associated with skin bleaching. To this effect, three interrelated research questions guided this study:

- (1) What are the documented health risks associated with skin bleaching?
- (2) Do these health risks meet the public health (CDC) definition of causing injury?
- (3) What have these researchers, suggested, been doing to prevent injuries associated with skin bleaching?

Methods used to review the literature are next presented and then the findings are discussed in light of their implications for skin safety, injury prevention, and public health.

METHOD

LITERATURE SEARCH

Original articles examining the use of skin bleaching products, skin bleaching practices, and resultant skin trauma were obtained through a database search in August 2012. The search was performed using Medline, PsychINFO, Ebscohost Academic Search Complete, Google Scholar, and the Directory of Open Access Journals (DOAJ). The following English language keywords were used in the search of the literature: *skin lightening + health*, *skin bleaching + health*, *skin lightening + consequences*, *skin bleaching + consequences*, *skin lightening + epidemiology*, *skin bleaching + epidemiology*.

SELECTION OF LITERATURE

As depicted in Figure 1, the initial search resulted in 136 articles. The abstracts of these articles were then previewed by a graduate-level research assistant to determine if the studies examined the physical effects of skin bleaching. Only published articles written in English were selected for further review with no limit on date of publication. After removing articles that did not meet these criteria and any duplicate articles, 51 articles remained. These 51 articles were then further previewed to determine if their content was within the scope of the present study. Articles were excluded at this stage if they exclusively focused on laboratory procedures related to skin bleaching products (8 excluded), non-human participants (6 excluded), or focused on the sociological context of skin bleaching (15 excluded). The latter articles were considered by the authors to understand the implications of skin bleaching, but did not directly speak to the physical health consequences posed by the practice and were beyond the scope of the current review. Thus, this review comprises 22 full articles on studies pertaining to skin bleaching practices and health consequences for humans.

RISK OF BIAS

The articles systematically reviewed in this paper were subject to bias both across studies and based on the bias inherent in each individual study design. Across studies the selection criteria used may bias results; only articles written in English, published and accessible in select databases were included. This reduced the scope and diversity of information that was reviewed regarding the safety of skin bleaching products. Further, individual articles were subject to bias based on sampling procedures and study design. For example, many of the articles used non-random sampling that may not accurately represent the overall population of interest (e.g. epidemiological methods). In some studies, participants were recruited at hospitals and clinics and many of the studies included small sample sizes. These selection biases may limit generalizability of findings. Another consideration is that true experimental design is not feasible with the topic of skin bleaching since it would constitute harm to participants, limiting the ability to state direct causal links between skin bleaching and injury/disease in many cases. Further, many studies relied on participants self-report which may have skewed findings toward more socially desirable answers. Finally, because of the limited attention to skin bleaching in the scholarly literature some of the articles reviewed were published in non-peer reviewed studies or were more descriptive in nature. These potential areas for bias are further discussed as limitations of the current study in the discussion.

CONTENT ANALYSIS PROCEDURE

After the articles were compiled, they were annotated to capture key information for the study: target population, study aim, key terms, research method, identified health risks, author conclusions, recommendations for prevention, and limitations. Two additional graduate-level research assistants acted as lead coders and read the annotated article summaries and collaboratively identified initial thematic codes that answered the three research questions (i.e. health risks associated with skin bleaching, whether these health risks met the definition for causing injury, and the suggestions for prevention). Articles were assigned more than one code when appropriate. Three undergraduate research assistants then independently coded the same article summaries using the codes developed by the two lead coders. Next, these five coders (undergraduates and graduate research assistants) met to discuss the coding scheme until 100% inter-rater agreement was reached. These codes were then further reviewed by the principle investigator and a graduate level research assistant who had not been involved in the original coding process to further confirm the clarity and accuracy of the coding scheme. The identified categories which emerged from the analysis are discussed next.

RESULTS

The content analyses, based on the three research questions addressed in this study are described below.

DOCUMENTED HEALTH RISK ASSOCIATED WITH SKIN BLEACHING

The articles documented a variety of health risks associated with skin bleaching. *Harm to the skin* (n = 15, see Table 1) was most commonly identified. Additionally, skin bleaching products were cited for causing other forms of *cell and organ diseases/abnormalities* (n = 11). Seven articles coded by researchers discussed poisoning associated with high levels of toxic chemicals in skin bleaching products. Two articles described a link between skin bleaching products and *birth defects/problems with offspring health*. These findings are discussed in detail next.

HARM TO THE SKIN

Damage to the skin was the most frequently identified negative health outcome associated with skin bleaching (see Table 1). For example, numerous researchers reported cutaneous conditions such as acne, burns, and dermatitis associated with skin bleaching (Adebajo, 2002; Ajose, 2005; de Souza, 2008; del Giudice & Yves, 2002; Ly et al., 2007; Mahé et al., 2003; Mahé et al., 2005; Petit et al., 2006; Suzuki, Yagami & Matsunaga, 2012; Toombs,

2007). Additionally, researchers commonly found skin bleaching to be associated with cutaneous infections caused by bacteria, fungus, and parasites such as dermatophyte infections, skin lesions, and scabies (Ajose, 2005; Akiibinu, Arinola & Afolabi, 2010; de Souza, 2008; Ly et al., 2007; Mahé et al., 2003; Petit et al., 2006; Suzuki et al., 2012). Many researchers also found skin pigmentation abnormalities such as hypo- and hyperpigmentation, and exogenous ochronosis associated with skin bleaching (Adebajo, 2002; de Souza, 2008; del Giudice & Yves, 2002; Ly et al., 2007; Mahé et al., 2003; Petit et al., 2006; Phillips, Isaacson & Carman, 1986; Tse, 2010). Further, skin bleaching was associated with epidermal atrophy or thinning and fragility of the skin (Ajose, 2005; de Souza, 2008; Mahé et al., 2003). For example, Ajose (2005) found that Nigerians who used skin bleaching products over extended periods (6 month to 20 years) had “dermatologic consequences” including “fragile skin, for example extensive striae and telangiectasia” (p. 41).

OTHER CELL AND ORGAN DISEASES/ABNORMALITIES

In addition to harm to the skin, researchers reported changes at the cellular level associated with skin bleaching. For example, stunted Purkinje cell dendrite growth was identified as a health risk associated with skin bleaching and was coded as belonging in this category (Washam, 2011). Other health risks related to the use of skin bleaching products in this category were disruption of normal DNA functioning and changes at the gene level (Akiibinu et al., 2010; Westerhof & Kooyers, 2005). Renal and neurological complications due to mercury exposure were cited (Harada et al., 2001; Mahé et al., 2005), as well as cataracts and glaucoma (Olumide et al., 2008). Additionally, researchers described organ diseases and abnormalities associated with skin bleaching such as Cushing syndrome (Ajose, 2005; Mahé et al., 2005) and cancer (Kooyers & Westerhof, 2006).

Poisoning/toxic chemical levels in skin bleaching products

Six studies tested skin bleaching products and found that they included chemicals which have been documented as toxic or causing poisoning in humans (Copan et al., 2012; Peregrino, Moreno, Miranda, Rubio & Leal, 2011; Washam, 2011). For example, researchers reported that skin bleaching products had toxic levels of mercury (Copan et al., 2012; Harada et al., 2001; Peregrino et al., 2011; Washam, 2011), hydroquinone (Kooyers & Westerhof, 2006; Petit et al., 2006), and clobetasol (Petit et al., 2006).

BIRTH DEFECTS/PROBLEMS WITH OFFSPRING HEALTH

Two of the articles also identified birth defects/problems with offspring health as health risks associated with skin bleaching. More specifically, Mahé et al. (2005) presented initial

evidence of renal dysfunction and cataracts in new-borns related to the mother's use of skin bleaching products. This was further evidenced by a study which found that pregnant skin bleachers' had smaller placenta and children born at low birth weights, low cortisol levels, and higher rates of birth defects associated with mercury exposure (Mahé et al., 2007).

COMPARISON OF HEALTH RISKS ASSOCIATED WITH SKIN BLEACHING WITH INJURY DEFINITION

For the second research question, "Do these health risks meet public health (CDC) definition of causing injury?" the health risks discussed in the articles were compared to the injury definition. All but two (which did not measure health risks associated with skin bleaching) reported ways the skin bleaching products caused "bodily harm resulting from severe exposure to an external, chemical substance" in accordance with the CDC definition of injury. Six articles further met this definition, specifically identifying how skin bleaching products contained high levels of an "exogenous substance that could cause cellular injury, illness, or death." For example, Harada et al. (2001) found that women in Kenya who used European-made skin bleaching soaps had high mercury levels "accompanied by various symptoms, such as tremor, lassitude, vertigo, neurasthenia, and black and white blots, suggesting inorganic-mercury poisoning" (p. 183). Articles made clear connections between the use of skin bleaching products and related injuries. For example, del Giudice and Yves (2002) stated that, "long-term use of these creams is responsible for a high rate of cutaneous adverse effects" (p. 69).

PREVENTING INJURIES RELATED TO SKIN BLEACHING

The third research question explored, "What have these researchers suggested should be done to prevent injuries?" All but two of the articles made suggestions for increased prevention and interventions to reduce injuries related to skin bleaching. Broadly, these researchers captured in this literature review suggested both: *government interventions* and *individual/community interventions* to reduce the prevalence of skin bleaching.

GOVERNMENT INTERVENTIONS

Researchers described the need for greater governmental bans on skin bleaching products, reduction of harmful chemicals in skin bleaching products, regulation of the sale/distribution of skin bleaching products, and research on the dangers of harmful chemicals used in skin bleaching products. For example, Kooyers and Westerhof (2006) concluded that "the risks of long-term effects (cancer) of topically applied hydroquinone may no longer be ignored. Based on the recent evidence of the potential risk, which are higher than has been assumed up until now, we plead that the use of hydroquinone as a skin lightening agent will be stopped

completely” (p. 780). Other examples include de Souza (2008) who called for increased law enforcement, surveillance and information to the consumer and Peregrino et al. (2011) who stated that “to safeguard consumer health, our research calls for an immediate mandatory regular testing program to check mercury in whitening creams and other cosmetic products that are being marketed and consumed in Mexico” (p. 2522).

INDIVIDUAL/COMMUNITY INTERVENTIONS

Researchers also called for action to reduce the prevalence of skin bleaching which included greater awareness of the dangers of bleaching (for communities, individual users, and healthcare providers), as well as the promotion of natural beauty standards, and primary prevention (prevention of skin bleaching initiation). For example, Mahé et al. (2005) indicated that skin bleaching products should not only be strictly controlled by the government but measures should be taken to inform potential users of the risks associated with these products appropriate to local cultural perceptions of the practice. Several researchers indicated that dermatologists and other health workers are critical in addressing this problem (de Souza, 2008; Westerhof & Kooyers, 2005).

DISCUSSION

The purpose of this study was to examine the existing skin bleaching research literature as it relates to skin safety and injury prevention. Answering the first research question, our content analysis found that skin bleaching practices are related to a range of serious health risks. Harm to the skin was the most widely cited health risk with the majority of the articles citing multiple ways that skin bleaching injured the skin, increasing rates of skin infection, epidermal atrophy, exogenous ochronosis/other skin pigmentation abnormalities, and additional coetaneous problems (e.g. scarring, burns, acne). These results indicate that skin bleaching, as it is currently practised, is a major threat to skin safety. Further, the literature documented that skin bleaching products currently contain toxic concentrations of chemicals such as mercury and hydroquinone which are known to cause damage to the body at cellular level (e.g. trophic diseases, DNA mutations) and injury to other internal organs. There was also alarming evidence that skin bleaching may not only harm users, but also foetal development, although research in this area is limited.

Although there was ample evidence that skin bleaching poses a serious health risk, there was a paucity of research on skin bleaching and its health effects. For example, researchers repeatedly cited a lack of knowledge on incidence and prevalence of skin bleaching and there is currently no tracking system to fill this gap to further understand the scope of this problem. This is alarming given the fact that there is initial evidence that skin bleaching

is harmful at a level that is comparable and/or exceeds the level of risk posed by other behaviours. A more nuanced understanding of skin bleaching practices and related health risks is urgent.

Results from the second research question clearly supported injuries associated with skin bleaching practices as meeting current public health definitions of injury. Further, skin bleaching as it is currently practised, can be classified as a practice that is associated with poisoning, as well as thermal and chemical damage. Some contended that health authorities do not see skin bleaching as a priority because people are not dying in masses from associated conditions, and in places with limited access to health resources, skin diseases can be a low priority (Kingman, 2005). However, injury associated with current skin bleaching practices will likely decrease quality of life and contribute significantly to sickness and health costs (Kingman, 2005). Further, the largely unregulated chemical content of skin bleaching products, especially in developing countries, (Peregrino et al., 2011) makes the direct marketing and promotion of such practices especially dangerous.

The third research question examined what suggestions have been already been made regarding prevention and interventions to address the harms of skin bleaching. Many noted that the public health response has been minimal. For example, Hunter (2011) called the public health response to skin bleaching a “missed opportunity” (p. 149). Some authors pointed to a need for government regulations including stricter bans on products and regulation of chemical content as well as community-based and cultural interventions that focus on why skin bleaching is so popular. Many advocated for consumer education regarding the dangers of the products. However, there was also criticism of efforts that focus solely on change at the individual level. For example, Hunter (2011) argued that the public health response to skin bleaching has been insufficient because it has focused on changing individual behaviour, often portraying women who bleach as uninformed and pathological, not acknowledging the real social benefits women may gain from a lighter skin tone, or institutionalised privilege based on skin colour. Conversely, focusing on government regulation alone has also been criticised and it has been noted that policy change alone is largely ineffective in changing health-risky behaviours such as skin bleaching (Lewis et al., 2010). In order to achieve success in addressing current harmful skin bleaching practices, both government and community-based approaches need to be considered. Perhaps using the best knowledge from other injury prevention models will give this important issue a push.

Considering skin bleaching under the umbrella of injury prevention would open up new avenues for prevention and intervention. Since worldwide injury prevention has decades of research on disease prevention and health promotion, skin bleaching prevention

champions may learn from studying similar attempts at curbing dangerous practices that cause injury and poisoning. For example, examination of legislative successes and failures in minimising harm associated with ambient solar radiation or in decreasing smoking rates in the United States through changes in legislation could be potential areas that inform public health prevention regarding skin bleaching. Additionally, interventions have been developed which help people modify behaviours that put them at risk for ambient solar radiation (e.g. tanning) (Glanz, Geller, Shigaki, Maddock & Isnec, 2002; Horsham et al., 2014). In this case, guidelines have also been developed to inform both consumers and practitioners about how to minimise the health consequences (e.g. skin cancer) related to their behaviour (e.g. Cooley & Quale, 2013). Evidence-based practices in injury prevention (e.g. Dowswell, Towner, Simpson & Jarvis, 1996) and interventions that have worked to decrease other threats to skin safety should be modified and applied to current skin bleaching practices. This could take the form of the development of safer skin bleaching products (i.e. formulas with non-toxic or less toxic chemicals), guidelines on the safe usage of skin bleaching products (i.e. coupling them with solar protection to minimise harm to skin), and educational/behavioural interventions on skin safety.

LIMITATIONS

While these findings may be helpful in advancing the knowledge on skin bleaching and prevention, a number of limitations of the current study should be noted. First, this study was based on the textual analysis of articles written across a variety of disciplines which may be a strength but also poses a potential limitation. Because new research is constantly being published and database searches can be nuanced regarding how articles are categorised and accessed, it is unlikely that the current study is exhaustive. Second, the limited number of articles that examine skin bleaching may represent only a small part of the picture on the subject. The literature more than likely represents the issue from the viewpoint of a small segment of those most affected while the practice is a global phenomenon. Third, to make textual analysis more feasible, annotated article summaries were textually coded rather than the full articles. This may have led to the loss of some article content. However, to minimise the changes of misinterpretation, the original full text articles were referenced frequently to insure the most accurate interpretation. Finally, although there is evidence that skin bleaching poses a serious health risk, many of the studies employed methods that do not allow causal conclusions to be made. As recommended by the researchers, further research is needed to more fully understand the adverse health effects of skin bleaching products. Studies of the health consequences of homemade skin bleaching products are especially lacking.

PREVENTION IMPLICATIONS

Given the paucity of research conducted on skin bleaching, future directions in research, policy, and practice are limitless. In particular, given the initial evidence that it is a potentially life threatening practice, further research documenting the long-term consequences is necessary. Moreover, understanding even basic information on the practice of skin bleaching is needed. The incidence and prevalence of skin bleaching remains largely unknown and injury caused by these practices is not tracked. Initial studies have attempted to estimate the prevalence of skin bleaching practices in specific countries and areas (Adebajo, 2002; Dadzie & Petit, 2009), however, no large-scale and comprehensive epidemiological surveys have been conducted to date.

Given the fact that skin bleaching should be examined under injury prevention in public health, future recommendations for practice may include incorporating skin bleaching into injury prevention efforts in areas where the practice is most prevalent. Finally, researching similar models of injury prevention may provide new ways to advance skin bleaching prevention efforts. The global phenomenon of skin bleaching remains prevalent worldwide. The serious public health risks that these practices pose cannot be ignored and incorporating efforts to prevent skin bleaching under the umbrella of global injury prevention may give this understudied topic a necessary boost.

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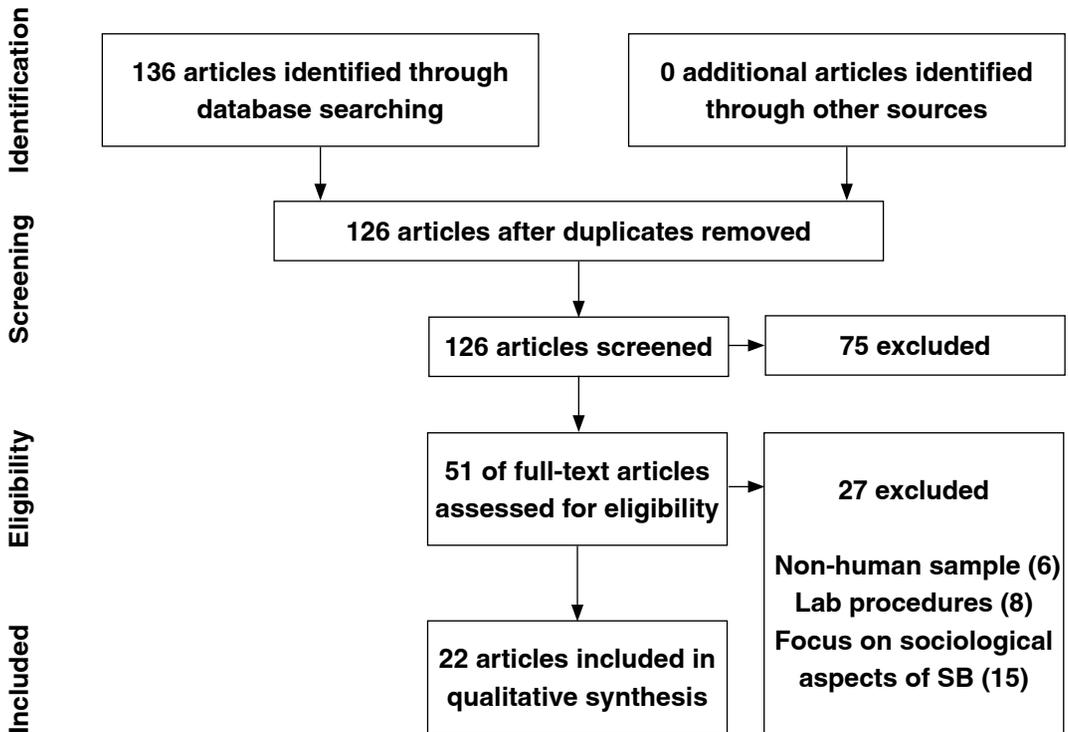


Figure 1: Flow chart of articles included in analysis (42)

Table 1: Broad thematic codes: Skin bleaching health risks and recommendations for intervention

Author Name	Year	Type of Study/ Subjects	Health Risk	Prevention Recommendation	Limitations/ Risk of Bias
Adebajo	2002	<ul style="list-style-type: none"> Survey randomly administered to 450 traders of skin bleaching products in Lagos, Nigeria regarding their usage and side effects of skin bleaching products 	<ul style="list-style-type: none"> Harm to the skin 	<ul style="list-style-type: none"> Government interventions Individual/Community interventions 	<ul style="list-style-type: none"> Selection bias: recruitment limited to traders of skin bleaching products (not operationally defined) recruited from select market places in Nigeria Self-report questionnaire
Akibiinu	2010	<ul style="list-style-type: none"> Correlational study which examined the levels of C-reactive protein, albumin, total antioxidant potential total plasma peroxides, oxidative stress index, and malondialdehyde in 30 people who used skin bleaching products for approximately 5 years as compared "controls" who did not use skin bleaching products 	<ul style="list-style-type: none"> Harm to the skin Cell and organ diseases/abnormalities 	<ul style="list-style-type: none"> Individual/Community interventions 	<ul style="list-style-type: none"> Selection bias: recruitment limited to schools/markets within the city of Ibadan, Oyo State, Nigeria Biased comparison group: comparison group recruited in different setting (university staff) likely to be dissimilar to treatment group in other ways, not discussed as a limitation

Ajose	2005	<ul style="list-style-type: none"> Survey administered to male and female patients at skin clinics in Lasuth, Lagos, and Nigeria regarding their usage and side effects of skin bleaching products 	<ul style="list-style-type: none"> Harm to the skin Cell and organ diseases/abnormalities 	<ul style="list-style-type: none"> Individual/Community interventions 	<ul style="list-style-type: none"> Non-empirical study Selection bias: recruitment limited to one clinic Sample size not identified
Copan et al.	2012	<ul style="list-style-type: none"> Case study which investigated the mercury levels in urine samples of 22 participants in 5 households where unlabelled skin bleaching products were found in the United States 	<ul style="list-style-type: none"> Poisoning risk 	<ul style="list-style-type: none"> Individual/Community interventions 	<ul style="list-style-type: none"> Case-study design limits generalizability
del Guidice et al.	2002	<ul style="list-style-type: none"> Epidemiological survey and clinical study of 685 women from Dakar, Senegal regarding their usage and side effects of skin bleaching products 	<ul style="list-style-type: none"> Harm to the skin 	<ul style="list-style-type: none"> Individual/Community interventions 	<ul style="list-style-type: none"> Selection bias: recruitment limited to hospital (outpatient and emergency department)
de Souza	2008	<ul style="list-style-type: none"> Discussion of the history and implications of skin bleaching in Africa 	<ul style="list-style-type: none"> Harm to the skin 	<ul style="list-style-type: none"> Government interventions Individual/Community interventions 	<ul style="list-style-type: none"> Non-empirical

Godlee	1992	<ul style="list-style-type: none"> ▪ Descriptive (non-scholarly) article discussing research on skin bleaching conducted in Southwark, London 	<ul style="list-style-type: none"> ▪ Harm to skin 	<ul style="list-style-type: none"> ▪ Government interventions ▪ Individual/Community interventions 	<ul style="list-style-type: none"> ▪ Non-empirical
Harada et al.	2001	<ul style="list-style-type: none"> ▪ Mercury levels were tested both skin bleaching soaps and the hair samples of 65 soap-users in Kenya 	<ul style="list-style-type: none"> ▪ Cell and organ diseases/abnormalities 	<ul style="list-style-type: none"> ▪ Government interventions 	<ul style="list-style-type: none"> ▪ Limited sample size ▪ Non-equivalent comparison group
Kooyers & Westerhof	2006	<ul style="list-style-type: none"> ▪ Literature review regarding the biochemistry and toxicology of skin bleaching agents hydroquinone, benzene and related molecules 	<ul style="list-style-type: none"> ▪ Cell and organ diseases/abnormalities 	<ul style="list-style-type: none"> ▪ Government interventions 	<ul style="list-style-type: none"> ▪ Non-empirical ▪ Methods and limitations not discussed
Olumide et al.	2008	<ul style="list-style-type: none"> ▪ Literature review regarding the health consequences of skin bleaching 	<ul style="list-style-type: none"> ▪ Harm to skin ▪ Cell and organ diseases/abnormalities ▪ Poisoning risk 	<ul style="list-style-type: none"> ▪ Individual/Community interventions 	<ul style="list-style-type: none"> ▪ Non-empirical ▪ Methods and limitations not discussed
Ly et al.	2007	<ul style="list-style-type: none"> ▪ Descriptive study regarding patient characteristics of 86 female recruited in 	<ul style="list-style-type: none"> ▪ Cell and organ diseases/abnormalities 	<ul style="list-style-type: none"> ▪ Individual/Community interventions 	<ul style="list-style-type: none"> ▪ Selection bias: clinic based study

Mahé et al.	2003	<ul style="list-style-type: none"> ▪ Descriptive study of product use among adult women at a dermatology clinic in Dakar, Senegal. (<i>n</i> = 599) 	<ul style="list-style-type: none"> ▪ Harm to the skin 	<ul style="list-style-type: none"> ▪ Individual/Community interventions 	<ul style="list-style-type: none"> ▪ Selection bias: clinic based study
Mahé et al.	2005	<ul style="list-style-type: none"> ▪ Description of the practice, dangerous chemicals, and hazardous consequences 	<ul style="list-style-type: none"> ▪ Harm to the skin ▪ Cell and organ diseases/abnormalities ▪ Birth defects, offspring health 	<ul style="list-style-type: none"> ▪ Government interventions ▪ Individual/Community interventions 	<ul style="list-style-type: none"> ▪ Non-empirical ▪ Authors associated with dermatology clinic
Mahé et al.	2007	<ul style="list-style-type: none"> ▪ Study of 99 pregnant women (6-9 months pregnant) in Dakar, Senegal who were examined during standard clinical examination (including blood sample for plasma cortisol levels) and surveyed regarding their usage of skin bleaching products 	<ul style="list-style-type: none"> ▪ Birth defects, offspring health 	<ul style="list-style-type: none"> ▪ Government interventions ▪ Individual/Community interventions 	<ul style="list-style-type: none"> ▪ Small sample size limits the relevance dose-related effects
Phillips et al.	1986	<ul style="list-style-type: none"> ▪ Described ochronosis and other skin conditions caused by use of skin bleaching products by black South Africans 	<ul style="list-style-type: none"> ▪ Harm to the skin 	<ul style="list-style-type: none"> ▪ Did not mention interventions 	<ul style="list-style-type: none"> ▪ Non-empirical

Peregrino et al.	2011	<ul style="list-style-type: none"> Chemical study of 16 available skin bleaching agents in Mexico 	<ul style="list-style-type: none"> Poisoning risk 	<ul style="list-style-type: none"> Government interventions 	<ul style="list-style-type: none"> Location-specific procedures (i.e. one market in Chihuahua)
Petit	2006	<ul style="list-style-type: none"> Descriptive study of 46 patients of African descent with skin complications in Paris, France 	<ul style="list-style-type: none"> Harm to the skin Cell and organ diseases/abnormalities 	<ul style="list-style-type: none"> Government interventions 	<ul style="list-style-type: none"> Selection bias: only those that developed complications at a particular clinic
Suzuki et al.	2011	<ul style="list-style-type: none"> Case study of a 45-year-old woman in Japan with contact dermatitis from skin bleaching agents 	<ul style="list-style-type: none"> Harm to the skin 	<ul style="list-style-type: none"> Did not mention interventions 	<ul style="list-style-type: none"> Case study: limited generalizability
Toombs	2007	<ul style="list-style-type: none"> Non-empirical discussion on hydroquinone and compilation of cases of exogenous ochronosis in the US 	<ul style="list-style-type: none"> Harm to the skin Cell and organ diseases/abnormalities 	<ul style="list-style-type: none"> Government interventions 	<ul style="list-style-type: none"> Non-empirical
Tsz Wah Tse	2010	<ul style="list-style-type: none"> Non-empirical reviewing the safety profile of hydroquinone 	<ul style="list-style-type: none"> Harm to the skin 	<ul style="list-style-type: none"> Government interventions Individual/Community interventions 	<ul style="list-style-type: none"> Non-empirical
Washam	2011	<ul style="list-style-type: none"> Non-empirical report regarding 13 women with elevated mercury levels found in NYC 	<ul style="list-style-type: none"> Cell and organ diseases/abnormalities Poisoning risk 	<ul style="list-style-type: none"> Government interventions 	<ul style="list-style-type: none"> Non-empirical
Westerhof & Kooyers	2005	<ul style="list-style-type: none"> Non-empirical review of long-term side effects of continued use of hydroquinone 	<ul style="list-style-type: none"> Poisoning risk Cell and organ diseases/abnormalities 	<ul style="list-style-type: none"> Government interventions Individual/Community interventions 	<ul style="list-style-type: none"> Non-empirical