Review Article on Skin Cancer

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Abstract

Background: Though people of color (POC) are less likely to become afflicted with skin cancer, they are much more likely to die from it due to delay in detection or presentation. Very often, skin cancer is diagnosed at a more advanced stage in POC, making treatment difficult. The purpose of this research was to improve awareness regarding skin cancers in people of color by providing recommendations to clinicians and the general public for early detection and photo protection preventive measures.

Methods: Data on different types of skin cancers were presented to POC. Due to limited research, there are few resources providing insights for evaluating darkly pigmented lesions in POC. Diagnostic features for different types of skin cancers were recorded and various possible risk factors were considered. Results: This study provided directions for the prevention and early detection of skin cancer in POC based on a comprehensive review of available data.

Conclusions: The increased morbidity and mortality rate associated with skin cancer in POC is due to lack of awareness, diagnosis at a more advanced stage and socioeconomic barriers hindering access to care. Raising public health concerns for skin cancer prevention strategies for all people, regardless of ethnic background and socioeconomic status, is the key to timely diagnosis and treatment.

Introduction

The incidence of melanoma skin cancer has been increasing over the past few decades. Estimated 76,250 new cases of invasive melanoma were diagnosed in USA in 2012, with an estimated number of 9,180 that result in death [4]. Australia has one of the highest rates of skin cancer in the world. Over 1,890 Australians die from skin cancer each year [5]. Melanoma is capable of deep invasion. The most dangerous characteristic of melanoma is that it can spread widely over the body via the lymphatic vessels and blood vessels. Thus, early diagnosis of melanoma is a key factor for the prognosis of the disease. The color of skin in humans is primarily determined by the presence of melanin and dark skin has larger melanocytes that produce more melanin which protects the deeper layers of the skin from harmful effects of the sun (Kaidbey et al., 1979). Human skin is repeatedly exposed to ultraviolet radiation that influences the function and survival of many cell types and is regarded as the main causative factor in the induction of skin cancer (D’Orazio et al., 2013). Ionizing radiation, pollutants, chemicals and occupational exposures are also linked with skin cancers (El Ghissassi et al., 2009). The superior photo protection in people of color (POC) is related to packaging and distribution of melanosomes which are distributed individually in keratinocytes rather than in aggregates.

Melanoma is a serious skin cancer and has a rapidly rising incidence in many populations. The incidence in White populations has increased by 3–5% per annum since the mid-20th century, with rates currently at 20–60 cases per 100000 people per annum. More commonly occurring non-melanoma skin cancers include squamous cell carcinoma and basal cell carcinoma, and together are increasingly referred to as keratinocyte carcinomas. Nearly 152 000 new cases of keratinocyte carcinoma were diagnosed in...
the UK in 2017,3,4 and the age-standardized incidence rates in Germany in 2017 ranged from 147·8 to 391·4 per 100000.1
Similar to melanoma, the incidence of keratinocyte carcinomas is rising steeply.1,3 Nonetheless, an earlier diagnosis of skin cancer leads to better outcomes. For example, the 1-year survival rate for melanoma when diagnosed at American Joint Cancer Committee stage 1 is 100%, compared with only 53%

Methods
Search strategy and selection criteria
This systematic review adheres to PRISMA guidelines;40 for the PRISMA checklist see the appendix (p 12). As the review did not evaluate a direct health-related outcome, it did not meet criteria for registration of the protocol with PROSPERO.41 Searches were conducted on MEDLINE, Google, and Google Dataset Search, on Sept 4, 2020. The MEDLINE search was updated on Sept 1, 2021. The database was searched from inception with MeSH terms and keywords including “dataset” OR “database”, “artificial intelligence” OR “machine learning”, “skin cancer”, and “imaging” OR “dermoscopy”. The full search strategy is given in the appendix (p 2). Two independent reviewers (DW and AJX) screened titles and abstracts for articles describing skin cancer image datasets, studies using datasets to train or test machine learning algorithms for skin cancer diagnosis, or review articles detailing any skin cancer image datasets. Two independent reviewers (AJX, DW, HI, or SMK) subsequently reviewed full-text articles for publicly available datasets and attempted to access them at source. Full texts were reviewed for publications where abstracts were unavailable. Google Translate was used for seven non-English articles (four in German, one in French, one in Spanish, and one in Chinese). Google and Google Dataset searches were completed by two independent reviewers (DW and AJX) to identify publicly available skin cancer image datasets. These searches were completed using the search term “skin cancer image dataset”, and repeated with “melanoma image dataset” (appendix p 2). The number of new skin cancer image datasets found on each search result page were recorded. Reference lists of any online articles were also reviewed for named publicly available datasets. Once 20 consecutive search results no longer mentioned any new datasets, the number of search results for review was rounded up to the nearest multiple of 50, and no further webpages were reviewed beyond this point. To be included for data extraction, datasets had to contain images of either cutaneous melanoma, basal cell carcinoma (BCC), or cutaneous squamous cell carcinoma (cSCC). Datasets could contain any form of non-radiological skin lesion images, such as macroscopic clinical photographs or dermoscopy. There was no restriction on geographical origin, patient population, or language. Datasets were excluded if they did not contain images of skin cancers (eg, skin rashes or benign lesions only). Histopathological image and radiological image datasets were also excluded. Datasets containing text or numerically data and images of non-human subjects were excluded, as were inaccessible datasets that were described as open access but were either inactivated or unable to be found by two reviewers (DW and SMK). All datasets included in the review were agreed by consensus by three authors (DW, AJX, and SMK). Data analysis Identified datasets meeting inclusion criteria were grouped into categories based on a system used by Khan and colleagues.14 These included open access datasets (freely accessible or easily accessible via registration or email) and regulated access datasets (requiring payment, formal institutional agreements, or ethical approval). A data collection template was designed to evaluate dataset characteristics, including number of images, number of participants (ie, individuals from whom images were taken, regardless of whether their active consent was reported), country of origin, publication date, imaging modality, image capture device, image format, and number of skin lesion categories. Further items reviewed for reporting are listed in the appendix (p 3). Metadata labels associated with individual images were also reviewed for included datasets. Images and metadata
of included datasets were manually reviewed by two independent reviewers (DW and SMK), together with corresponding articles or supplementary information describing the dataset. Discrepancies were resolved by discussion between reviewers, and a third party with methodological expertise (RNM) if required. All images and accompanying data from open access datasets were imported into Databiology Lab (LS, JC, LZ, and CdBP), a data management and analysis platform. Wherever possible, image files were registered without downloading to reduce data duplication. Metadata was recorded in entities with a number of attributes and values. Search queries were created to evaluate metadata associated with images.
Different Types of Skin Cancers
Risk factor
Acknowledgements

AKG (First author) acknowledges Department of Science and Technology (DST, New Delhi) for financial support under Women Scientist Project Scheme (WOS-A).

The views expressed in this publication are those of the author(s) and not necessarily those of NHSX, the Health Foundation, the National Institute for Health Research, or the Department of Health and Social Care. We would like to thank Adewole Adamson for his critical review of the manuscript.
Concluding Comments
Our study gives an important contribution to this research area for several reasons. First, it is a study that combines the research being done related to all the steps needed for developing an automatic diagnostic system for skin cancer detection and classification. Second, it presents knowledge that help the researchers judge the importance of high level feature extraction and proper feature selection methods which needs more effort for making correct diagnosis of melanoma. Third, it proposed a framework that highlights the importance of developing benchmarks and standard approaches for model validation which is generally overlooked in the previously published studies.

Results
The searches identified 14224 studies, with 14 additional studies identified from other sources (ie, identified from references in the included studies; appendix p 24). After removing duplicates, the titles and abstracts were screened for 11296 studies, with subsequent full-text screening of 638 studies. Only two studies used data originating from unreferral populations with a low prevalence of skin cancer to develop and test their AI/ML algorithms (table 1). Roffman and colleagues28 used data from the National Health Interview Survey in the USA for non-melanoma skin cancer risk prediction, and differed from most studies in this Review because they did not use image data. Udrea and colleagues29 used data from previous specialist care studies in referred populations, and also from the SkinVision user database that contains images of skin lesions taken on smartphones by non referred users. We therefore chose to review the data for all 272 studies (appendix p 5; table 2) that applied AI/ML techniques to the evaluation of skin lesions, and although these studies have not been developed using data from low-prevalence populations, they still have relevance for the application of these technologies in primary care settings.

References
43. S. E. Umbaugh, Computer Vision in Medicine: Color Metrics and Image Segmentation Methods for Skin Cancer Diagnosis, Electrical Engineering Department, University of Missouri, Rolla, Mo, USA, 1990.