EVALUATION OF ACCURACY OF TIBOT ARTIFICIAL INTELLIGENCE APPLICATION IN TEN PREDICTION OF DIAGNOSIS OF DERMATOLOGICAL CONDITIONS

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EVALUATION OF ACCURACY OF TIBOT® ARTIFICIAL INTELLIGENCE APPLICATION IN THE PREDICTION OF DIAGNOSIS OF DERMATOLOGICAL CONDITIONS

IN

DERMATOLOGY VENEREOLOGY AND LEPROSY

LIST OF ABBREVIATIONS

AI- Artificial intelligence

CNN- Convolutional neural network

ML- Machine learning

COVID-19- Coronavirus disease of 2019

DL- Deep learning

ANN- Artificial neural network

DNN- Deep neural network

SVM- Support vector machine

ABCDE- Asymmetry, border, colour, diameter, evolving

ABCD- Asymmetry, border, colour, diameter

RNA- Ribonucleic acid

ADHD- Attention deficit hyperactivity disorder

US FDA- The United States Food and Drug Administration

NIH- National Institutes of Health

CIA- Computer image analysis

AD- Atopic dermatitis

3D- three dimensional

LHR- Laser hair removal

MP- Megapixel

PPV- Positive predictive value

ABSTRACT

Introduction:

Artificial intelligence (AI) strives to develop software that mimics human cognition and the processes involved in deciphering complex data. Dermatology is suitable for using AI image recognition for aided diagnosis because it relies on morphological traits. Tibot® is an AI programme that evaluates skin issues and utilises convolutional neural networks (CNN) as its framework. An appropriate analysis of the reliability of such applications is required.

Aim:

To assess the accuracy of Tibot® AI application in the diagnosis of dermatologic conditions

Materials and methods:

This is a hospital based cross-sectional study. Photos of lesions from individuals with various skin disorders were submitted to the programme after obtaining informed consent. Three diagnoses made by AI were compared to dermatologist diagnosis. Performance indicators for the application were accuracy, sensitivity, and positive predictive value.

Results:

There were 600 participants. Alopecia, eczema, acne, immunological diseases, psoriasis, pigmentary disorders, infestation, tumours, and infections were among the clinical conditions. The application's mean prediction accuracy for the top three projected diagnoses was 96.1%, compared to 80.6% for the precise diagnosis. The accuracy of the predictions for alopecia, eczema, and tumours was 100%. The application's sensitivity and specificity were, respectively, 97% and 98%. In every condition, there is a statistically significant correlation between the clinical and AI-projected diagnoses.

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Conclusion:

There is significant potential for practical application of AI, which has demonstrated encouraging results in the diagnosis of a number of dermatological disorders.

Keywords: Artificial intelligence, machine learning, AI-assisted diagnosis, deep learning, convolutional neural network, dermatology

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INTRODUCTION

Artificial intelligence (AI) is "the scientific knowledge of the processes underlying cognition and intelligent behaviour and its elaboration in computers." [1] It seeks to replicate qualities of human cognition.[2-4] Machine learning (ML) is a subtype of AI where computer systems learn from experience without any fixed coding instructions.[1]

Every member of the medical community may find it essential in the future to have a thorough understanding of AI, as it may be the driving force behind the transformation of health systems to boost productivity and effectiveness, provide versatility for universal health coverage, and introduce a fundamental change in how we practise medicine.[5,6]

The bulk of dermatology diagnoses are based mostly on physical characteristics and visual pattern recognition. With its extensive clinical, dermatoscopic, and dermatopathological image library, it is ideal for employing AI image recognition skills for assisted diagnosis.[1,2,7]

AI may prove to be a valuable tool for skin cancer detection and prompt diagnosis, raising the standard of treatment.[4,8-10] Additionally, it has been utilised in the evaluation and diagnosis of a variety of inflammatory ailments, pigmentary diseases, and hair abnormalities.[1,9-11] The possibilities for automating redundant tasks, streamlining laborious tasks, expanding the available clinical assets, addressing spectator reliability issues, and eventually expanding the diagnostic toolkit of dermatologists are just a few of the opportunities for AI in dermatology.[11] Additional patient assistance offered by AI applications includes reminders for appointments and treatments, details on when to visit the doctor, instructions on how to book an appointment, instructions on how to order medications, the ability to book online consultations with dermatologists, and a glossary of skin diseases that explains the causes, symptoms, and treatments.[4]

The necessity for an automated computer-aided diagnosis is driven by the fact that dermatological disorders can manifest in a variety of ways, there aren't enough qualified dermatologists, and their distribution is unequal.[12] AI is especially beneficial in developing nations where there is a large discrepancy between the supply and demand for facilities and where the cost of healthcare is high. Due to the unpredictability of pandemics like COVID-19, online consultations can be a noteworthy alternative for patients and physicians.

This study analyses the Polyfins Technology Inc.-owned Tibot® AI application. The application uses machine learning to dissect photographs, examine them, compare them to related images in its memory, and estimate the most likely diagnoses once a user shares a photo and answers a few questions about a skin lesion. There are numerous applications based on the same principle that are available and proper research is required to assess their dependability.

AIM AND OBJECTIVE OF THE STUDY

To evaluate the accuracy of Tibot® artificial intelligence (AI) application tool in predicting

the diagnosis of dermatological conditions

REVIEW OF LITERATURE

Currently, artificial intelligence in medicine entails developing a programme that can educate and train itself to carry out particular tasks, including identifying lesions or tracking therapy effectiveness. Dermatologists need to have a fundamental knowledge of artificial intelligence technique and its limits in order to evaluate the efficacy of such systems.[10]

History of Artificial intelligence:

A paper titled "On computable numbers, with an application to the Entscheidungs problem" was published by Alan Turing in 1950 which is often considered the pre-eminent archive of the computer age.[1] He developed the Turing test, which assesses a machine's ability to exhibit intelligent behaviour that is comparable to or indistinguishable from that of a human and also advanced the notion of artificial intelligence.[13] Calculus was utilised by Turing and his Princeton colleagues to create the idea of "effective calculability," which later served as the foundation for the computing paradigm known as "algorithm."[1]

The phrase "Artificial Intelligence" was first used by John McCarthy in 1956 at a renowned Dartmouth conference.[1,2,13] Medical researchers discovered the relevancy of AI in life sciences in the early 1970s.[1,2] Because of recent improvements in hardware and programming, it has become clear that AI has the potential to enhance present medical practises.[1]

But compared to more advanced medical AI applications, notably in radiology, dermatological AI is still in its infancy. The implementation of AI in dermatology is anticipated to significantly reduce the gap between physicians and patients and improve the precision of diagnosis as a result of changing circumstances and increased research in this area.[1]

Nomenclature of Artificial intelligence:

Machine learning (ML) and deep learning (DL) are subsets of the large scientific field of AI, which is devoted to creating software that exhibits human intellectual characteristics (Figure 1).[3,6,13,14]
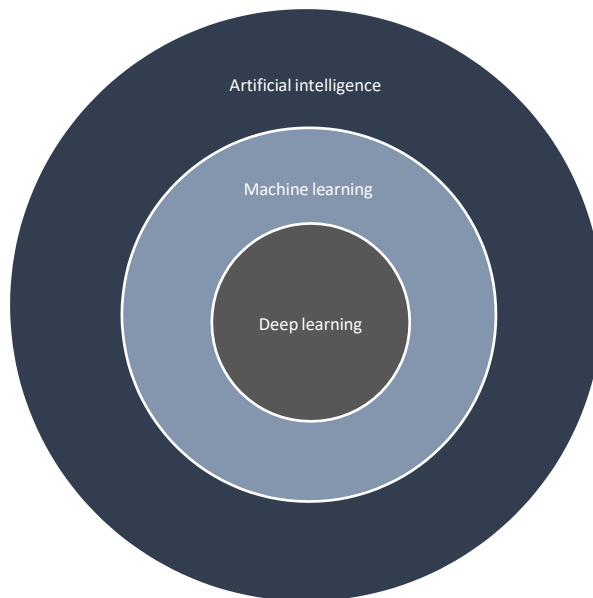
Figure 1: Artificial intelligence (AI) is a large scientific field which encompasses machine learning (ML) and deep learning (DL)

Machine learning:

The phrase "machine learning" was first used by Arthur Samuel, who defined it as "the capacity to learn without being expressly programmed."[13] Computer programmes build associations of predictive ability from examples in data in this branch of artificial intelligence. The simplest definition of ML is the use of computers to apply statistical models to data. By feeding an algorithm with input data made up of previous observations, ML creates a model for anticipating and categorising brand-new observations that are not known to the algorithm by replicating human cognition.[3,6]

Deep learning:

A subfield of ML where artificial neural networks are utilised to tackle challenging tasks.[1,10]

Neural networks:

Flexible mathematical models or algorithms, such as artificial neural networks (ANN), can be used to find complex nonlinear correlations in huge datasets.[1] They are organised in a minimum of 3 layers: one layer that acknowledges an input, one layer of yields and at least one "concealed" layer in between (Figure 2).[11]

Input
layer

Output
layer
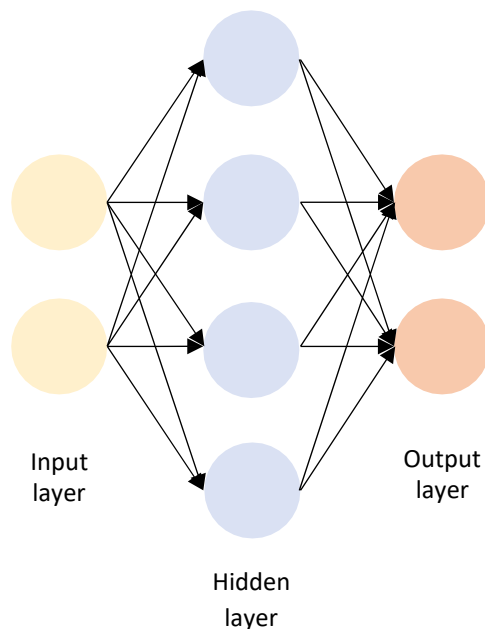
Hidden
layer

Figure 2: Neural networks consist of three layers- input layer, hidden layer and output layer

Deep neural networks:

A deep neural network (DNN) is a neural network that has three hidden layers or more. These hidden layers are where the "thinking" takes place; each one identifies a different component of the input.[10,11,13] Strikingly, the ideal number of layers and their associations in the DNN isn't dictated by people; however, by the information itself; subsequently, the DNN is said to

be able to "learn."[11] This intricate, multi-layered structure mimics the biological neural networks seen in the brain and aids the machine in carrying out difficult tasks.[14]

There are two types of DNNs: simple (one dimensional) and convoluted (two or three dimensions). In medical image analysis, convolutional neural networks (CNN) are being used to extract patterns from images. Convolutions are mathematical processes that are used to detect or filter patterns in pixel data.[13]

Support vector machine:

Support vector machines (SVM) are ML models that analyse data for classification and regression analysis. While reducing overfitting of the data, it improves predictive accuracy.[13]

Methods of machine learning (ML):

Contingent upon the kind of task desired, machines are trained using either supervised learning, semi-supervised learning, or unsupervised learning.

1. Supervised learning: This involves conditioning the machine with a set of cases (e.g., images of inflammatory lesions) and their respective labels (e.g., psoriasis, eczema etc.). The machine "learns" to identify patterns in the cases and partner these patterns with the labels with each successive case.[1,10,11]

2. Unsupervised learning: This includes analysis of input data with no definite labels. It excels in tasks where the target has not yet been identified, such as data clustering (i.e., finding cancer subtypes from genetic data that have not yet been discovered).[1,10,11]

3. Semi-supervised learning: It is a hybrid strategy that combines labelled and unlabeled data. Thus, the stress of labelling activities may be lessened.[1,10]
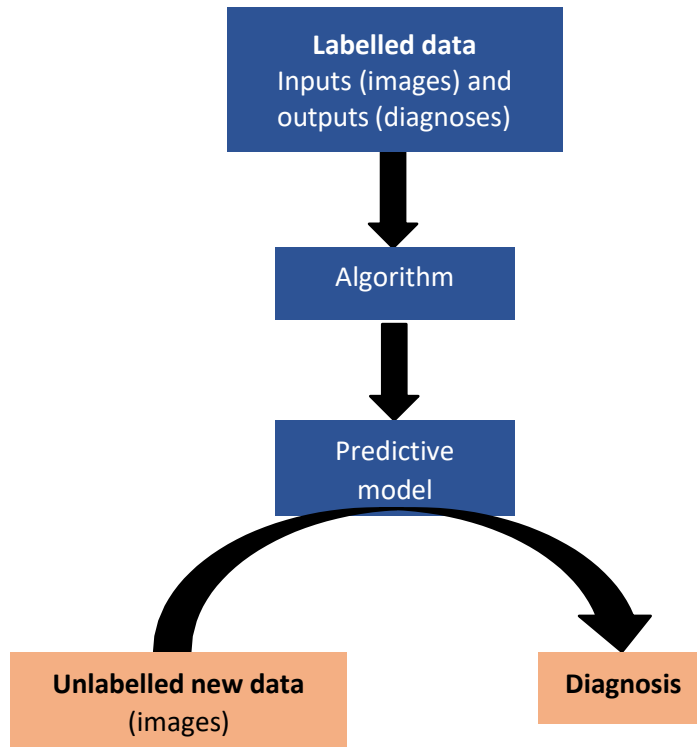
Figure 3: Supervised method of machine learning

Subtypes of AI:

AI can be categorised into

1. Super AI: It is a future technology which will allow machines to outperform people in every field.[3]

2. General AI: This is a machine with human level intelligence, also known as "artificial general intelligence". It should be possible for this sophisticated machine to develop its own ability to perform a variety of tasks.[1,3]

3. Weak or narrow AI: This is focused on completing a single goal.[1,3]

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Steps involved in computer-aided diagnosis:

Clinicians should have a thorough awareness of the procedures used in the creation and implementation of AI applications. Computer-aided diagnosis often involves the following steps:

1. *Image acquisition:* Clinical and dermoscopic images are the two main forms of dermatological imaging.[13]

2. *Image pre-processing:* Preprocessing is the initial step in improving the quality of photographs by eliminating unnecessary noises.[15] Artefact removal, lesion image enhancement and image restoration are the stages included in pre-processing in image diagnostic techniques.[13,15] The automated diagnostic process can be hampered by the presence of air bubbles, shadows, ruler markings, thin blood vessels, hair artefacts, and dermoscopic gels, all of which can confound the diagnosis. Artefact correction algorithms are used to eliminate these artefacts. A common technique for removing artefacts from a lesion image is filtering.[13,16]
Color calibration is the most significant process in image improvement. The steps in this technique are lighting correction, contrast and edge enhancement, and retrieving the true colours of a photographic lesion.[13,15]

3. *Image segmentation:* The process of segmentation involves dividing an image into separate areas that are homogeneous with regard to a specific feature, such as brightness, colour, and texture. This involves separating the region of interest from the background. The objective is to make an image representation more straightforward so that it can be more easily understood and analysed.[16] For the segmentation of lesions, various machine learning techniques have been described, out of which thresholding is the most commonly used.[13]

4. *Feature extraction:* Effective automated lesion image categorisation requires the extraction of particular features from a given lesion image. To quantify the image using a collection of finite numerical features is the main goal of feature extraction. For example, the program for melanoma evaluation uses a variety of feature identifiers that are based on clinical observations (ABCDE) or dermoscopy (ABCD or pattern analysis).[13]

5. *Classification:* Making conclusions about the data that was extracted in the earlier stages during the classification step allows for the production of a diagnosis regarding the input image.[16]

AI in medicine:

Evidence-based medicine's fundamental goal is to guide clinical judgement by drawing conclusions from facts and history. Historically, statistical approaches to this endeavour have been to characterise patterns in data as mathematical equations. AI provides ways to identify complex correlations that are difficult to summarise in an equation through machine learning. Due to their ability to carefully analyse the available data and draw logical conclusions, ML systems are now able to solve complicated problems in the same way as a doctor might.[17]

In recent years, there has been an exponential rise in the application of AI in healthcare settings. Previously restricted to limited fields such as radiology, ophthalmology and cardiology, research on AI in medicine is currently applied to many facets of health care, including dermatology and surgical robots.[13]

Radiology has been the most forward-thinking and receptive to the application of new technology. Several radiological imaging tasks, including diagnosis, prognosis, risk analysis, and therapeutic response, utilise AI. In several areas of radiography, including the diagnosis of fractures, mammography, organ laceration, pulmonary lesions, cancers, and stroke,

machine learning models have been applied.[13] This is especially useful in high volume settings and in hospitals with limited human resources.[18]

In the field of oncology, there are numerous computer programmes that use AI and offer doctors and oncologists evidence-based therapy suggestions. AI aids in the detection and classification of breast cancer metastases, skin lesions, and lung malignancies and also plays a role in analysing side effects of polypharmacy, radiation therapy and drug interactions.[13]

For ophthalmic conditions such glaucoma, diabetic retinopathy, retinopathy of prematurity, congenital cataracts and age-related macular degeneration, ML has been used in ocular imaging techniques such as fundus pictures.[13]

In cardiology, ML models have been utilised to estimate cardiovascular risks from electronic medical data, to predict acute myocardial infarction using clinical factors and proteomic data, and to estimate in-stent restenosis with plasma metabolites. Different wave morphologies in electrocardiography can be precisely identified by ML methods.[13]

The branch of surgery, particularly urology and gynaecological procedures, has been transformed by the da Vinci robotic surgical system created by Intuitive Surgicals.[18] Non-coding RNAs have been utilised in neural network models to detect epithelial ovarian cancer, and they have also been employed to enhance the effectiveness of assisted reproductive technologies. The application of ML algorithms for diagnosis, preoperative planning, such as tumour segmentation or identification of epileptogenic zone, and prognosis has increased in the field of neurosurgery.[13]

For the classification of dementia, ADHD, and schizophrenia, ML approaches have been utilised in psychiatry.[13]

In 2013, the US FDA approved SEDASYS®, the first computer-assisted customised sedation system, but was later discontinued after 3 years.[13]

The University of Massachusetts created the decision support system known as DXplain in 1986. It provides a list of potential differential diagnoses based on the symptom complex and serves as a teaching aid for medical students by filling in the knowledge gaps left by conventional textbooks.[18]

In order to lower nonadherence rates, the National Institutes of Health (NIH) created the AiCure application to track patient medicine use.[18]

Heart rate, level of physical activity, patterns of sleep, and even ECG readings are few parameters that modern health monitors can measure. These can alert the user in case of any variation and give the doctor a clearer picture of the condition.[18]

With the use of AI-enabled computer programmes, primary care professionals will be better able to identify patients who need further attention and give individualised regimens for each individual.[18] Given the numerous advancements AI has made in recent years, it's only reasonable to assume that it will advance and revolutionise the medical industry.

AI in dermatology:

In the last decade or so, AI has steadily come to recognise its significance in a variety of dermatology fields. Digitalisation, tele-health, and informatics have revolutionised this branch.

1. *Malignancy*

    Optimal outcomes for patients depend on early detection and correct diagnosis of skin malignancies. The potential for AI to enhance or supplement the cancer screening process has been the subject of extensive research.

    The first program that could detect melanoma was studied by Nasr-Esfahani *et al.*[19] They used 6120 images to train their CNN, and the sensitivity and specificity of their

proposed methodology were 0.81 and 0.80, respectively. Due to the absence of

demographic data, it is challenging to evaluate the program's external validity.

Esteva et al.[20] presented a study on the categorisation of skin cancer using DNN in

2017. They used 129,450 clinical photos representing 2032 distinct disorders to train a

CNN. With an overall accuracy of 72.1% and an efficacy that was on par with or

greater than 21 dermatologists, this application correctly identified melanomas and

keratinocyte carcinomas.

Using a dataset of 4867 pictures, Fujisawa et al.[21] compared the performance of a

CNN to that of board-certified dermatologists in categorising skin tumours as benign

or malignant. Sensitivity and specificity were 96.3% and 89.5%, and the overall

classification accuracy was 76.5%.

Using 19,398 pictures, Han et al.[22] created an automatic categorisation system for 12

recognised benign and malignant dermatoses. Comparable results were achieved by

CNN and 16 dermatologists. The average sensitivity and specificity were 85.1% and

81.3%, respectively, for all conditions.

A study conducted by Haenssle et al.[23] showed the application of AI in dermoscopy.

They matched CNN's melanoma detection prowess to that of a global panel of 58

dermatologists. Most dermatologists were outperformed by CNN.

In comparison to board-certified dermatologists, automated dermoscopic melanoma

picture categorisation was shown to be superior by Brinker et al.[24] The sensitivity and

specificity of dermatologists' classification of lesions were 67.2% and 62.2%,

respectively. A sensitivity and specificity of 82.3% and 77.9% were attained by the

trained CNN.

Hekler et al.[25] trained a CNN using 595 histopathological photos from a total of 695

lesions that were identified by a skilled histopathologist. The CNN achieved a mean

sensitivity, specificity, and accuracy of 76%, 60%, 68% in the diagnosis of melanoma as compared to 51.8%, 66.5%, 59.2% achieved by 11 histopathologists.

Han et al.[26] conducted a study to see whether AI could improve the accuracy of non-expert doctors in the diagnosis of cutaneous neoplasms in practical settings. It was discovered that the accuracy of the AI-assisted group was much higher than that of the unaided group.

Recent years have seen the availability and accessibility of smartphone applications for melanoma diagnosis. In order for individuals to seek medical guidance at an early stage, they provide an immediate risk assessment of the potential of malignancy. The potential for overlooking melanomas or providing the consumer a false sense of security is a drawback.[27] Some of the applications available are SkinVision, DermaAId, Skin 10, and MoleScope.[13] Premalignant conditions were detected by the SkinVision app with 80% sensitivity and 78% specificity, according to Thissen et al.[28] In people with concerns about suspicious skin lesions, Chuchu et al.[29] evaluated the diagnostic effectiveness of four smartphone applications to rule out cutaneous invasive melanoma and atypical intra-epidermal melanocytic variations. These apps' sensitivity ranged from 7% to 73%, while their specificity ranged from 37% to 94%.

2. *Psoriasis*

Implementation of AI in psoriasis can aid in clinical evaluation, development of individualised treatment plans, and prediction of prognosis.

Guo et al.[30] employed an AI program, which utilised microarray-based gene expression profiles from two datasets: GSE14905 and GSE13355, to predict psoriasis. A novel incremental feature selection algorithm was used in the final psoriasis classification model. Over three distinct validation strategies, this model showed remarkably consistent prediction accuracy of 99.81%.

An AI program proposed by Shrivastava et al.[31] aimed to assist in assessing psoriasis severity, using a database of 670 psoriasis images. This model achieved classification accuracy of 99.84%, sensitivity of 99.56%, and specificity of 99.99%.

Emam et al.[32] described an application for psoriasis that goes beyond image identification. The ability of a framework to predict psoriasis patients' reactions to biologic therapy was established using initial visit measurements of the patient's weight and age of beginning of psoriasis. They were able to produce a prototype model that, in theory, might be utilised to optimise patient therapy.

In an independent retrospective study, Breslavets et al.[33] compared the abilities of a board-certified dermatologist, two science students, and an artificial neural network (ANN) in calculating the percentage of the affected skin, which is typically determined by the palm method, to assess the skin areas affected by psoriasis. ANN predicted the affected proportion precisely and reliably, outperforming human participants substantially in performance and execution time.

In a study, Savolainen et al.[34] used a computer image analysis (CIA) system based on colour segmentation and human eye approach to evaluate the affected surface area of 15 psoriasis patients both before and after various anti-psoriasis medications. The values of the PASI by the human eye method were greater than those by the CIA approach because the human eye estimates were higher than those produced by the CIA method.

Few other studies have demonstrated the efficacy of machine learning methods in predicting treatment responses to biologic therapy in psoriasis.[35,36]

3. *Pigmentary disorders*

A deep learning-based hybrid model for the objective morphometric and colorimetric assessment of vitiligo lesions was established and validated in a study by Guo et al.[37]

The model produced positive results, making it appropriate for determining the severity of vitiligo in people with Fitzpatrick skin types III or IV.

By using CNNs and comparing their diagnostic accuracy to that of human raters with various levels of experience, Zhang *et al.*[38] conducted a study to evaluate the effectiveness of deep learning approaches for diagnosing vitiligo. In an experimental scenario, CNNs outperformed human raters in vitiligo diagnosis without the aid of Wood's lamp images.

Yang *et al.*[39] conducted a study to assess the ability of two CNNs in diagnosing six benign pigmentary diseases, which outperformed the skin specialists overall by a small margin.

According to the protocol established by Dreiseitl *et al.*[40], patients who presented to a dermatology clinic with unidentified pigmented lesions were independently evaluated by both non-expert clinicians using an AI device and by dermatologists with advanced training. Results indicated inferiority of automated system.

Cazzaniga et al. assessed the ability of DL to predict clinical response to excimer laser therapy in vitiligo patients.[41]

4. *Acne*

According to a study by Min *et al.*[42], the automated lesion-counting program's sensitivity and positive predictive value for papules, nodules, pustules, and whitehead comedones were greater than 70% when compared to manual counting carried out by an experienced dermatologist.

A smartphone AI tool that rates and categorises the different types of acne lesions was created by Saite *et al.*[43]

5. *Atopic dermatitis*

AI implementation could speed up and standardise atopic dermatitis (AD) evaluation processes, leading to greater efficiency.

An ML algorithm created by Gustafson *et al.*[44] diagnosed AD from electronic medical information.. The ML model attained a sensitivity of 75.0% and a positive predictive value of 84.0%.

Using data directly from photos, De Guzman *et al.*[45] created an ANN for identifying AD versus unaffected skin. This model was intended to be experimental for the disclosure of the most appropriate AI processes, and relatively small sample sizes were used

6. *Other conditions*

In a study by Wu *et al.*[46], the ability of a CNN model to diagnose inflammatory skin disorders such psoriasis, atopic dermatitis, and eczema was evaluated. 4,740 clinical photos served as the basis for training the model. The application had a 95.8% overall accuracy rate, a 94.4% sensitivity rate, and a 97.2% specificity rate.

In order to distinguish between several papulosquamous disorders like psoriasis, seborheic dermatitis, lichen planus, pityriasis, and chronic dermatitis, Huang *et al.*[47] created a multi-disease classifier that could examine 34 features (such as erythema, scaling, defined borders, etc.).

Han *et al.*[48] trained a CNN using a dataset of 49,567 photos, and it was able to diagnose onychomycosis with a diagnostic accuracy that was higher than that of the majority of the dermatologists that took part in this study.

7. *Dermatopathology*

A significant perceptual, observer-dependent component goes into histologic diagnosis of skin lesions. Particularly, relatively vague inflammatory lesions, poorly

differentiated skin cancers, or diseases with a wide range of appearances can cause significant diagnostic confusion, with disagreements even among skilled dermatopathologists.[3] AI has the potential to overcome these hurdles and provide more standardised results.

Campanella et al.[49] evaluated a DL system using a dataset of 44,372 slide images from 15,187 patients in the histopathologic classification of breast cancer metastases, prostate cancer, and basal cell carcinoma, which achieved clinical-grade performance.

A system that analyses histopathological pictures and can accurately classify basal cell carcinoma with a 98.1% accuracy was described by Arevalo et al.[50]

According to a study by Onega et al.[51], classical microscopy and digital analytic models both had comparable interpretative accuracy for melanocytic lesions.

A deep learning system that divided digitalised dermatopathology slides into four categories was validated by Ianni et al.[52] The model achieved an accuracy of 98% with confidence scoring and 78% without confidence scoring.

8. *Sensitising substances*

A significant number of studies are also available on the use of AI to reduce exposure to skin-irritating chemicals.[53-57]

Zang et al.[57] described a programme that analyses the physiochemical characteristics of compounds to determine whether or not they might be sensitisers. When the chemicals were examined in a cohort of humans, this application produced an accuracy of 81%.

Wilm et al.[58] examined recent developments in skin sensitisation testing and noted a number of other instances in which AI has provided a means of minimising animal testing.

9. *Cosmetology*

Current market-available customisable skin care and hair care products have enabled customers to make knowledgeable and personalised purchases for their skin and hair. Skin and hair care questionnaires regarding patient demographics, skin and hair traits and desired aesthetic results have been developed by companies utilising AI. Their suggestions for cosmetic items are then determined by the results of these tests.[3,59]

Another innovation that makes it possible to customise skin and hair care routines is augmented reality. By including patient photos in the decision-making process, it goes one step farther than questionnaire-based models. Wrinkles, pigmentation, elasticity and pores are few of the factors that are examined.[3,59]

In a study by Linming *et al.*[60], two skin imaging analysis tools-the ANTERA 3D® from Miravex and the VISIA® from Canfield-were evaluated for their ability to assess skin texture, wrinkles, pores, and discolouration. Results showed superiority of ANTERA 3D® in the assessment of wrinkles.

In a research assessing the viability of the VISIA Complexion Analysis System in clinical practise, 86% of patients said that the VISIA analysis had helped them comprehend their primary skin concern.[61]

LifeViz® Micro from Quantificare is a 3D photography device created for up-close views of skin microstructure for any location of the body. Its reproducibility of 3D skin imaging in atrophic acne scarring has been proven in a study by Petit *et al.*[62]

A range of expert photographic options are available from FotoFinder Systems for dermoscopy, trichoscopy, complete body photography, and face and body photography. Utilising the FotoFinder medicam and Trichovision software, this system is exceptional in its capacity to quantify hair loss and regrowth metrics such as total count, density, and proportion of anagen hair.[63]

By using DL, the optimum treatment choice can be determined according to the severity of face wrinkles.[64-66]

Robotics have been investigated as a laser hair removal (LHR) method to assure uniform distribution of laser pulses and to reduce any negative effects.[67-69]

Advantages of AI in Dermatology:

Machine learning presents the opportunity to get the best possible outcomes by utilising human abilities to develop hypotheses, interact, and supervise AI systems while utilising AI's capacity to analyse massive amounts of data and uncover relationships with predictive strength.[6]

The following are some potential uses for AI in dermatology:

1. *Automate redundant assignments*

   As opposed to human clinicians who become fatigued when performing the same activity constantly, computer algorithms actually get better at diagnosing with each new case as it is an active learning machine.[11]

2. *Cumbersome assignments*

   The majority of final algorithms typically execute in less than a few seconds, despite the fact that training a DNN might take days or weeks. This makes them valuable in many fields of dermatology and medicine.[11]

3. *Constrained tasks*

   Using a single AI platform in resource limited settings can support a whole population. Additionally, AI can function as a triage system in such areas.[17]

4. *Spectator dependability issues*

ML algorithms have a dilemma when it comes to diagnostic tasks with low inter-observer reliability: while AI has the potential to significantly increase diagnostic consistency, an AI system is only as accurate as the data labels that it "learns" from.[11]

5. *Thinking "outside the box"*

Algorithms that have been trained using unsupervised learning have the ability to think creatively and are not limited by the scope of human knowledge.[11]

Challenges to AI:

1. *Generalizability*

AI requires large amount of data and is only as reliable as the data it is trained on.[13,70] When AI is applied to uncommon conditions or when data is generalised across diverse populations, this can be a disadvantage.[13] The collection of dermatological disease image database currently available is still insufficient.[11] The diversity of medical data and the lack of institutional data sharing is another hurdle.[2,11,13] Majority of the research on AI is from the western world and developed countries and this may not be applicable to developing countries like India. Based on the local prevalence of the disease, each community should gather their own data and devise a distinctive algorithm.[27]

2. *Public acceptance*

Patient care must go beyond diagnosis and involve a human touch in a comprehensive manner that an algorithm cannot replace.[13]

3. *Interpretability*

With the help of neural networks, AI is adaptable; it creates algorithms, analyses them, and makes adjustments continuously without human interference. As a result, they are naturally vague (black-box nature of AI), and the reasoning behind the decisions may not be clear.[11,27,70]

4. *Multidisciplinary cooperation*

To create the optimal AI, close collaboration among multidisciplinary experts in the domains of computer science, biomedicine, and medicine is essential, which may pose a difficulty.[2]

5. *Legal and ethical liability*

Large amounts of data are required for the algorithms to function well, and some of this data may violate patients' privacy. It is crucial to establish uniform ethical standards where artificial intelligence can be used and when they are required. Additionally, there are still questions about accountability in the event of a negative incident that need to be resolved. This may make it difficult to obtain a medical device registration.[13]

6. *Dermatology is a complex subject*

Out of the vast array of dermatological problems, dermatological AI can only identify one or a small group of specific skin illnesses. In order to accurately diagnose dermatologic disorders, a thorough evaluation of the patient's medical history, gender, age, and other details is necessary in addition to clinical photographs. Though predominantly a visual speciality, dermatology also has a tactile component and here AI cannot compete.[2]

7. *Bias*

Algorithms may potentially acquire the programmer's prejudice, or self-learning algorithms may develop bias as a result of a lack of variety in the training data.[13]

8. *Fear of a dystopian future*

There are both sceptics and proponents of this new era of AI-enhanced practise. On the subject of whether or not artificial intelligence will cause significant job losses, there is a heated discussion among specialists. Some fear a dystopian future where AI

replaces doctors, whereas others are more welcoming as it improves diagnostic

efficacy and improves patient care.[13]

METHODOLOGY

SOURCE OF DATA

Patients of all ages attending outpatient department of Dermatology, Venereology and Leprosy, Shri B.M. Patil Medical College, Hospital and Research Centre, B.L.D.E (Deemed to be University), Vijayapura, were enrolled.

Period of study:

The study was conducted during the period of January 2021 to June 2022.

Study design:

A hospital-based cross-sectional study.

Sample size:

With the anticipated proportion of prediction accuracy of the Tibot® AI app showing the correct diagnosis 60.7% [4], the study would require a sample size of 520 with 98**%** level of confidence and 5% absolute precision**.**

Formula used

- **n=$\dfrac{z^2\ p*q}{d^2}$**

Where Z= Z statistic at α level of significance

d^2= Absolute error

P= Proportion rate

q= 100-p

METHOD OF COLLECTION OF DATA

Inclusion criteria:

1. Patients of all ages consulting for the first time to the Department of Dermatology at Shri B.M. Patil Medical College, Hospital and Research Centre, Vijayapura.

2. The skin conditions included alopecia, psoriasis, acne, pigmentary disorders, eczema, infections and infestations, immunological disorders and tumours.

Exclusion criteria:

1. Cases necessitating additional testing to confirm the diagnosis

2. Conditions where the diagnosis has been modified by earlier therapies

3. Patients not consenting for clinical photographs

Methods & methodology:

Detailed history concerning the onset, duration and associated symptoms of skin conditions was taken. Initial clinical examination of the patient was done and these findings were recorded in the proforma. After taking informed consent, clinical photographs were taken with a 12MP camera in a private well-lit room and uploaded to the Tibot® AI application along with some relevant information concerning age and sex of the patient, associated symptoms, duration and site of lesions. Based on probability, three diagnoses were projected by the AI and these were contrasted with that by a dermatologist. The capability to forecast the exact diagnosis in the top one and top three projected diagnoses was used to evaluate the AI application's effectiveness.

STATISTICAL ANALYSIS:

The data obtained was entered in a Microsoft Excel sheet, and statistical analysis was done using JMP® Pro 16 software Version 16, SAS Institute., Cary, NC, 1989-2021.

Results were presented as Mean (Median) ±SD, counts and percentages, and diagrams.

Categorical variables were compared using the Chi-square test.

AI application was analyzed using sensitivity, specificity, positive predictive value (PPV), and accuracy.

$p < 0.05$ was considered statistically significant. All statistical tests were performed two-tailed.

ETHICAL CLEARANCE:

Institutional ethical committee clearance was undertaken for the study.

RESULTS

This hospital based cross-sectional study included 600 participants.

Age distribution

The age group of the patients included in the study ranged from 1 year to 85 years. Most of the patients belonged to the third decade (167 patients- 27.8%).

Table 1: Distribution of cases according to age

Age (Years)	N	Percent
< 10	55	9.2
10 - 19	125	20.8
20 - 29	167	27.8
30 - 39	131	21.8
40 - 49	54	9.0
50 - 59	30	5.0
60 - 69	32	5.3
70+	6	1.0
Total	600	100.0

Figure 4: Distribution of cases according to age

AGE (YEARS)
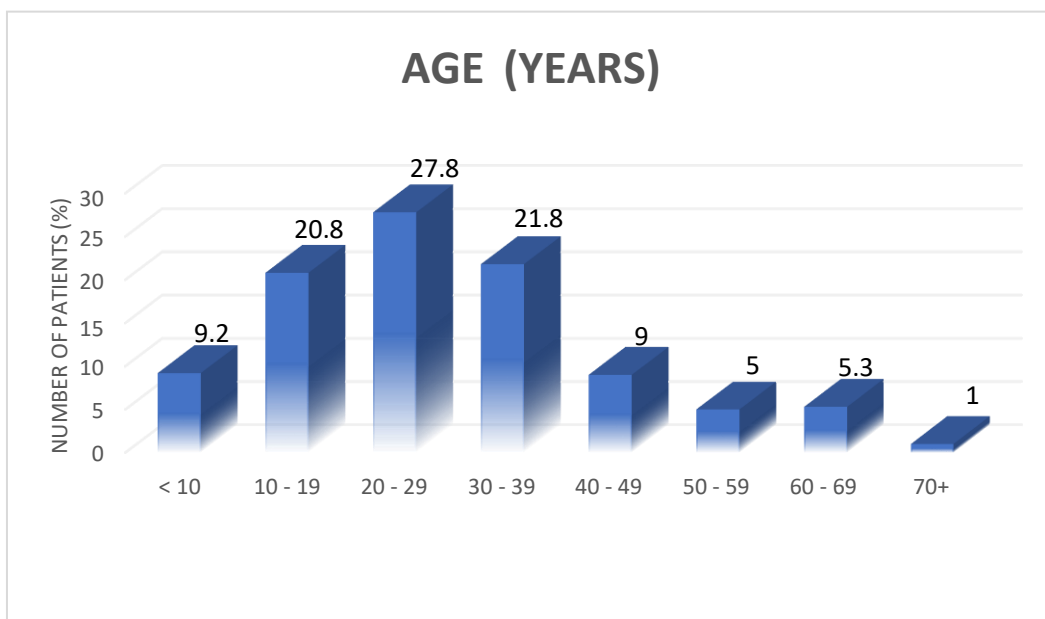
Gender distribution

Among 600 patients, 339 (56.5%) were males and 261 (43.5%) were females. Males

outnumbered females with a ratio of 1.3:1 in this study.

Table 2: Distribution of cases according to gender

Gender	N	Percent
Female	261	43.5
Male	339	56.5
Total	600	100

Figure 5: Distribution of cases according to gender
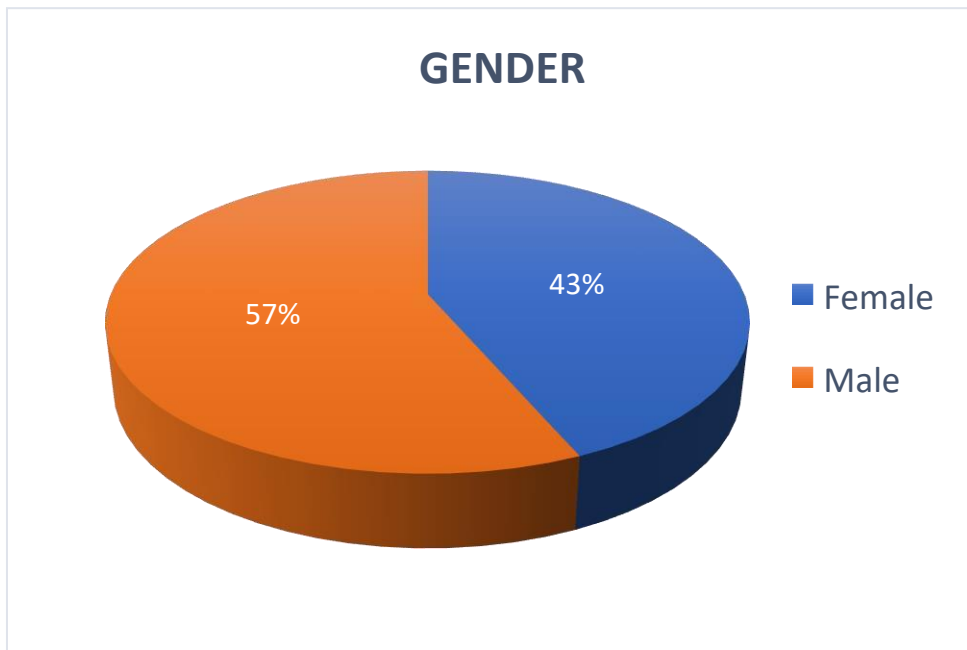
Distribution of clinical conditions

Majority of the clinical conditions included in this study were infections.

Table 3: Distribution of clinical conditions

Skin conditions	N	Percent
Acne & Rosacea	73	12.2
Alopecia	89	14.8
Bacterial Infection	6	1.0
Benign tumor	28	4.7
Eczema	24	4.0
Fungal Infection	88	14.7
Immunological skin disorder	20	3.3
Pigmentation	87	14.5
Psoriasis	47	7.8
Skin infestation	16	2.7
Suspicious tumor	11	1.8
Viral Infection	111	18.5
Total	600	100.0

Figure 6: Distribution of clinical conditions
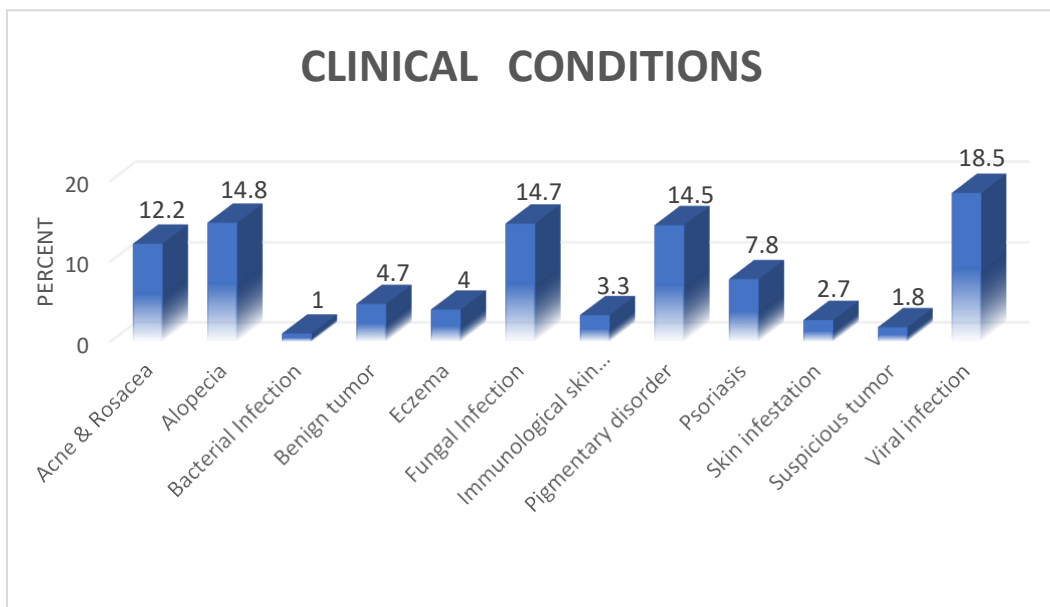
Prediction accuracy of the AI application

Ability of the application to forecast the exact diagnosis in the top one and top three

projected diagnoses was 80.6% and 96.1%, respectively.

Table 4: Prediction accuracy of the Artificial intelligence (AI) application

	N	Percent
Top one projection	484	80.6
Top three projections	577	96.1

Figure 7: Prediction accuracy of the AI application
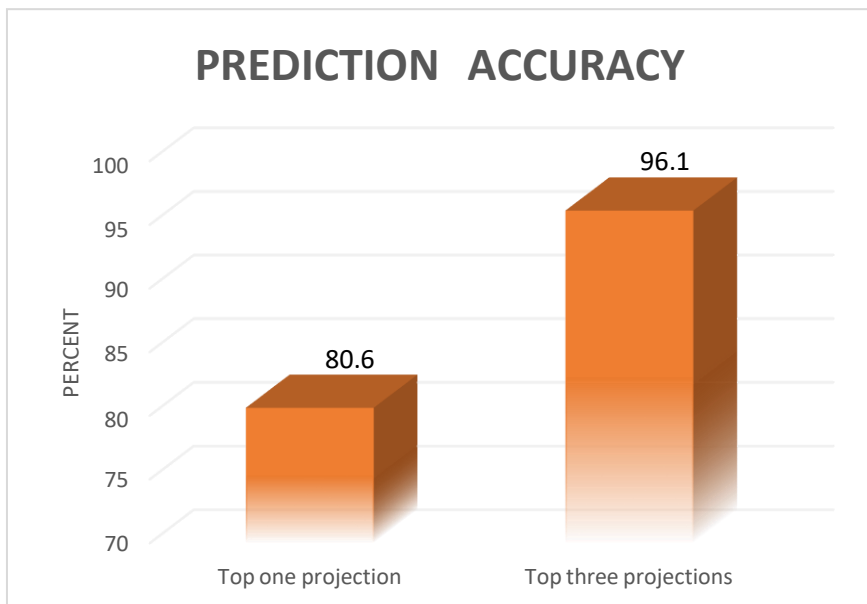
Prediction accuracy of the AI application in individual skin conditions

Accuracy of the diagnoses in top one and three projections were examined in individual skin

conditions.

Table 5: Prediction accuracy of the AI application in individual skin conditions

Skin conditions	Actual	Top 1		Top 3	
		N	Percent	N	Percent
Acne	73	67	91.7	72	98.6
Alopecia	89	87	97.7	89	100
Bacterial infection	6	3	50	5	83.3
Benign tumor	28	20	71.4	28	100
Eczema	24	18	75	24	100
Fungal infection	88	73	82.9	85	96.5
Immunological skin disorder	20	15	75	19	95
Pigmentary disorder	87	77	88.5	86	98.8
Psoriasis	47	33	70.2	43	91.4
Skin infestation	16	11	68.7	15	93.7
Suspicious tumor	11	9	81.8	11	100
Viral infection	111	70	63	105	94.5
Total	600	484	80.6	577	96.1

Figure 8: Prediction accuracy of the AI application in individual skin conditions
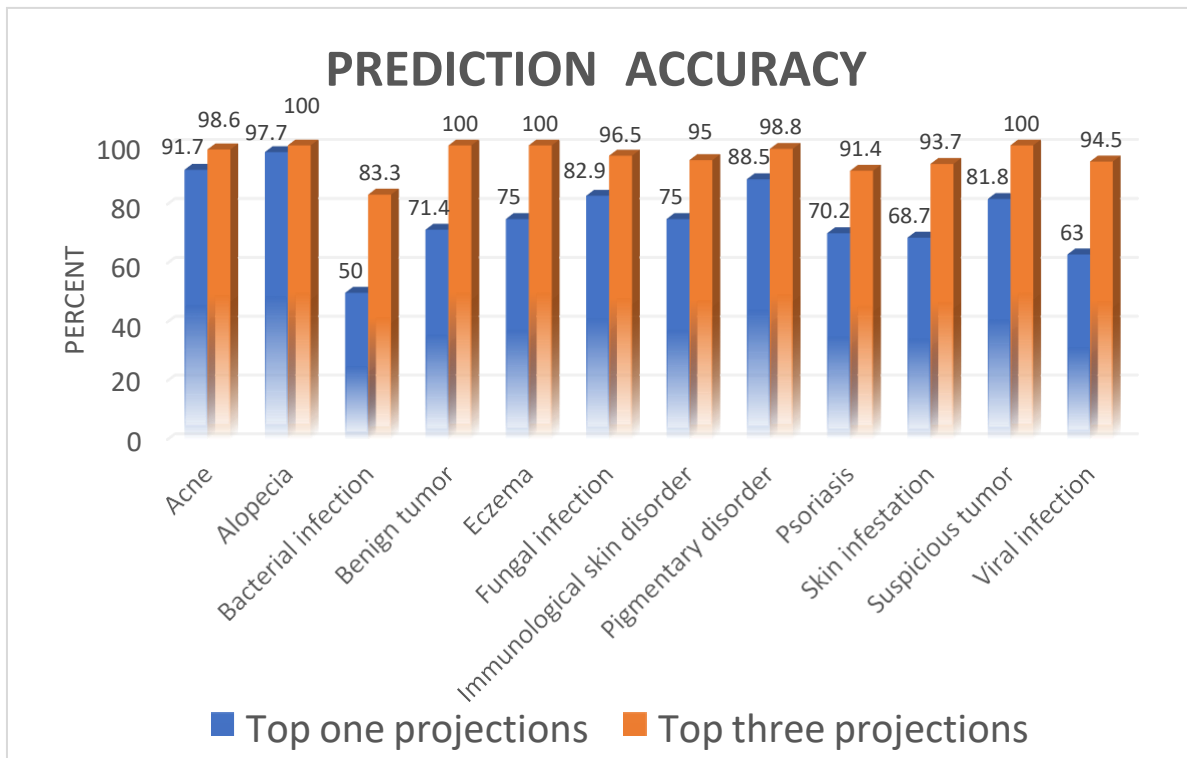
Sensitivity, specificity, PPV and p-value of the AI application in individual skin conditions

There is statistically significant association between clinical diagnosis and projected top diagnosis in all the conditions.

Table 6: Sensitivity, specificity, PPV and p-value of the AI application in individual skin conditions

Skin conditions	Clinical diagnosis			Parameters	95% CI	Chi-square test
	Yes	No	Total			
1. Acne						
Projected Top 1						
Yes	67	7	74	Sensitivity=92%	83 to 97%	$\chi^2 = 485.15$
No	6	520	526	Specificity=99%	97 to 99%	p<0.00001
Total	73	527		PPV=91%	82 to 95%	
Projected Top 3						
Yes	72	74	146	Sensitivity=99%	93 to 99%	
No	1	0	1	PPV=40%	49%	
Total	73	74				
2. Alopecia						
Projected Top 1						
Yes	87	4	91	Sensitivity=98%	92-99%	$\chi^2=553.95$
No	2	507	509	Specificity=99%	98-99%	p<0.00001
Total	89	511		PPV=96%	89-98%	
Projected Top 3						
Yes	89	18	107	Sensitivity=100%	96-100%	
No	0	0	0	PPV=83%	83%	
Total	89	18				
3. Bacterial Infection						
Projected Top 1						
Yes	3	4	7	Sensitivity=50%	12-88%	$\chi^2=125.34$
No	3	590	593	Specificity=99%	98-99%	p<0.00001

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Total	6	594		PPV=43%	17-77%	
Projected Top 3						
Yes	5	87	92	Sensitivity=83%	36-99%	
No	1	0	1	PPV=5%	4-8%	
Total	6	87				
4. Benign tumor						
Projected Top 1						
Yes	20	9	29	Sensitivity=71%	51-87%	χ^2=283.18
No	8	563	571	Specificity=98%	97-99%	p<0.00001
Total	28	572		PPV=69%	53-82%	
Projected Top 3						
Yes	28	174	202	Sensitivity=100%	88-100%	
No	0	0	0	PPV=14%	14%	
Total	28	174				
5. Eczema						
Projected Top 1						
Yes	18	31	49	Sensitivity=75%	53-90%	χ^2=148.89
No	6	545	551	Specificity=95%	92-96%	p<0.00001
Total	24	576		PPV=37%	28-47%	
Projected Top 3						
Yes	24	216	240	Sensitivity=100%	86-100%	
No	0	0	0	PPV=10%	10%	
Total	24	216				
6. Fungal Infection						
Projected Top 1						
Yes	73	18	91	Sensitivity=83%	73-90%	χ^2=368.30
No	15	494	509	Specificity=96%	94-98%	p<0.00001
Total	88	512		PPV=80%	72-87%	
Projected Top 3						
Yes	85	150	235	Sensitivity=97%	90-99%	
No	3	0	3	PPV=36%	35-37%	
Total	88	150				
7. Immunological skin disorder						
Projected Top 1						

Yes	15	21	36	Sensitivity=75%	51-91%	χ^2=174.65
No	5	559	564	Specificity=96%	95-98%	p<0.00001
Total	20	580		PPV=42%	30-54%	
Projected Top 3						
Yes	19	252	271	Sensitivity=95%	75-99%	
No	1	0	1	PPV=7%	6-7%	
Total	20	252				
8. Pigmentary disorder						
Projected Top 1						
Yes	77	3	80	Sensitivity=89%	80-94%	χ^2=497.59
No	10	510	520	Specificity=99%	98-99%	p<0.00001
Total	87	513		PPV=96%	89-99%	
Projected Top 3						
Yes	86	22	108	Sensitivity=99%	94-99%	
No	1	0	1	PPV=80%	79-80%	
Total	87	22				
9. Psoriasis						
Projected Top 1						
Yes	33	5	38	Sensitivity=70%	55-83%	χ^2=350.77
No	14	548	562	Specificity=99%	98-99%	p<0.00001
Total	47	553		PPV=87%	73-94%	
Projected Top 3						
Yes	43	40	83	Sensitivity=91%	80-98%	
No	4	0	4	PPV=52%	50-54%	
Total	47	40				
10. Skin Infestation						
Projected Top 1						
Yes	11	4	15	Sensitivity=69%	41-89%	χ^2=295.99
No	5	580	585	Specificity=99%	98-99%	p<0.00001
Total	16	584		PPV=75%	50-89%	
Projected Top 3						
Yes	15	20	35	Sensitivity=94%	70-99%	
No	1	0	1	PPV=43%	40-46%	
Total	16	20				

11. Suspicious tumor						
Projected Top 1						
Yes	9	3	12	Sensitivity=82%	48-98%	χ^2=364.23
No	2	586	588	Specificity=99%	98-99%	p<0.00001
Total	11	589		PPV=75%	48-91%	
Projected Top 3						
Yes	11	86	97	Sensitivity=100%	70-100%	
No	0	0	0	PPV=11%	11%	
Total	11	86				
12. Viral Infection						
Projected Top 1						
Yes	70	8	78	Sensitivity=63%	53-72%	χ^2=301.81
No	41	481	522	Specificity=98%	97-99%	p<0.00001
Total	111	489		PPV=90%	81-95%	
Projected Top 3						
Yes	105	79	184	Sensitivity=95%	89-98%	
No	6	0	6	PPV=57%	56-58%	
Total	111	79				

Sensitivity and specificity of the AI application

The AI application's sensitivity and specificity were determined to be 97% and 98%,
respectively.

Figure 9 shows the confusion matrix between the top diagnoses projected by AI and the
actual diagnoses, as well as the sensitivity (top one) and PPV for specific skin disorders.

Figure 9: Confusion matrix of AI-projected top diagnosis versus actual diagnosis with sensitivity and positive predictive value (PPV) for specific skin disorders

Confusion matrix

		Actual diagnosis												
		Acne & Rosacea	Alopecia	Bacterial infection	Benign tumor	Eczema	Fungal infection	Immunological skin disorder	Pigmentary disorders	Psoriasis	Skin infestation	Suspicious tumor	Viral infection	Total	PPV
P r o j e c t e d d i a g n o s i s	Acne & Rosacea	67	1	0	0	0	0	0	3	0	0	0	3	74	91%
	Alopecia	0	87	0	1	0	2	0	0	0	0	0	1	91	96%
	Bacterial infection	1	0	3	0	0	0	0	0	0	0	0	3	7	43%
	Benign tumor	0	0	0	20	0	0	1	3	0	0	0	5	29	69%
	Eczema	0	0	2	1	18	9	3	1	5	3	0	7	49	37%
	Fungal infection	1	1	0	1	2	73	0	0	3	0	0	10	91	80%
	Immunological skin disorder	2	0	0	0	0	1	15	2	6	0	2	8	36	42%
	Pigmentary disorders	2	0	0	0	0	0	0	77	0	1	0	0	80	96%
	Psoriasis	0	0	0	0	3	2	0	0	33	0	0	0	38	87%
	Skin infestation	0	0	0	0	1	0	0	0	0	11	0	3	15	73%
	Suspicious tumor	0	0	0	2	0	0	0	0	0	0	9	1	12	75%
	Viral infection	0	0	1	3	0	1	1	1	0	1	0	70	78	90%
	Total	73	89	6	28	24	88	20	87	47	16	11	111	600	
	Sensitivity	92%	98%	50%	71%	75%	83%	75%	89%	70%	69%	82%	63%		

Figure 10: Clinical photographs with actual diagnosis (AD) and projected diagnosis (PD)- Last two conditions were incorrectly predicted by the application (red boxes)

AD- Alopecia | PD- Alopecia
AD- Fungal infection | PD- Fungal infection
AD-Suspicious tumour | PD-Suspicious tumour
AD- Benign tumour | PD- Viral infection
AD- Psoriasis | PD- Psoriasis
AD- Viral infection | PD- Viral infection
AD- Acne | PD- Acne
AD- Viral infection | PD- Eczema

DISCUSSION

Man has been reliant on machines to simplify his life and to help him survive since the beginning of time. Medical professionals employ inferential statistics to support or challenge assumptions that have been established through patient observation and evaluation. By identifying patterns that are challenging for humans to discover, artificial intelligence builds on this approach.[5] Although early uses of AI in dermatology concentrated on the identification of melanoma and pigmented skin lesions, more recent algorithms have been created with a wide variety of applications, including gathering photos, decoding, assessing, generating reports, and planning for follow-up.[11,14]

In the current study, we compared the diagnostic accuracy of the Tibot® AI application to that of a dermatologist for a number of dermatological conditions. The purpose of this application is to increase awareness of various skin disorders and categorise them according to their criticality. It also urges users to seek medical assistance from a skin care specialist for appropriate treatment whenever necessary. Additionally, it provides a comprehensive database of various skin, hair, and scalp conditions so that patients can read and understand information about the sickness they are dealing with. It operates on the principle of CNN, which converts images into numerical representations and compares them to analogous images stored in its memory to determine the likely diagnosis. Multiple firewalls are used to protect the patient data, and users have total control over the encrypted information.[4,8]

The majority of the patients in this study had infections, alopecia, and pigmentary diseases. Prediction accuracy of the application to forecast the exact diagnosis in the top one and top three projected diagnoses was 80.6% and 96.1%, respectively. For alopecia, benign and suspicious tumours, and eczema, the prediction accuracy (Top 3) was 100%. For pigmentary disorders and alopecia, the PPV was 96%; for viral infections, psoriasis, and acne, it was

91%, 90%, and 87%, respectively. Sensitivity and specificity of the AI application were determined to be 97% and 98%, respectively.

Patil *et al.*[4] evaluated skin conditions of 398 patients using Tibot® application. According to the study, the application's average prediction accuracy to forecast the actual diagnosis was 60.7% in top one projection and 85.2% in top-three projections. Our study exhibited an improved mean prediction accuracy of 80.6% and 96.1% in top one and top three projections, respectively. Table 7 compares the prediction accuracy and PPV of the current study to their study. Also considerably improved in our investigation was the ability to predict specific skin disorders. In most cases, PPV was comparable. In contrast to our study, which found that the AI application's sensitivity was 97%, their study showed a sensitivity of 86%, whereas specificity was 98% in both the studies.

Table 7: Comparison of prediction accuracy and PPV of our study to that of Patil *et al.*[4]

Comparison of prediction accuracy and PPV				
	Our study		**Patil *et al.***	
	Prediction accuracy	**PPV**	**Prediction accuracy**	**PPV**
Acne & Rosacea	98.6%	91%	84%	87.5%
Alopecia	100%	96%	100%	100%
Bacterial infection	83.3%	43%	78.9%	78.9%
Benign tumour	100%	69%	71.4%	83.3%
Eczema	100%	37%	91.7%	94.3%
Fungal infection	96.5%	80%	95.6%	90%
Immunological skin disorder	95%	42%	88.9%	42.1%
Pigmentary disorders	98.8%	96%	75%	75%
Psoriasis	91.4%	87%	73.7%	82.3%
Skin infestation	93.7%	73%	63%	94.4%
Suspicious tumour	100%	75%	-	-
Viral infection	94.5%	90%	26.7%	80%

The active learning process of AI enables the programme to grow its database, which enhances its capacity for prediction and diagnosis.[4] This active learning nature, as well as changes in the application's software and differences in the quality of the images uploaded, could be credited for the superior outcomes in our study. These dermatoses are

assessed through the submission of clinical pictures and the response to a few basic inquiries regarding the location, duration, and severity of the related symptoms of the lesions. The variation in accuracy can be related to the subjective character of symptoms and the varying visual appearances of the same illness among different individuals.

A CNN model's performance in identifying inflammatory skin disorders such psoriasis, atopic dermatitis, and eczema was evaluated by Wu *et al.*[46] 4,740 clinical photos were used to train the model. CNN had an accuracy of 95.8%, sensitivity of 94.4% and specificity of 97.2%. The accuracy for eczema and atopic dermatitis was 92.57%, and 89.46% for psoriasis

Fujisawa *et al.*[21] evaluated the performance of a CNN trained on a dataset of 4867 pictures at categorising skin tumours as benign or malignant. 76.5% was the classification accuracy overall.

Efficacy of AI at classifying benign and malignant conditions was demonstrated by Esteva *et al.*[20] and Han *et al.*[22] where the CNN performed comparably to or better than the dermatologists included in the study.

39 skin tumours were included in our study, of which 28 were benign and 11 were malignant. For both benign and malignant tumours, AI had a 100% predictive accuracy (top three), 100% sensitivity, and PPV of 69% and 75%, respectively.

The inability to capture skin type and the absence of image consistency in terms of focus, angle, and lighting are both drawbacks of our study. To verify the results, evaluation in different Fitzpatrick skin types is necessary.

According to the findings of our study, there is a large window of opportunity for the successful application of AI technologies. With the help of these applications, people may evaluate and learn more about the diseases of their skin, choose to have an online consultation, or seek out medical care for any additional evaluation and necessary

treatment. Additionally, it frees up dermatologists' time to examine, counsel, and treat patients rather than spending it sorting through a large quantity of data from electronic health care records and labeling diagnostics. In the near future, general practise will combine advanced diagnostic capabilities employing AI-based medical services. Images of different skin conditions from patients visiting at any hospital can be uploaded to an expert dermatological AI software, and if found sufficient, an immediate review would be performed with swift findings.

While AI can appear to be a danger to dermatologists' diagnosis abilities, it's vital to keep in mind that AI can only offer a probability of broad diagnoses and most definitely cannot offer the actual treatment or humane care. In order for AI to reach its full potential, programmers must work to design algorithms that accurately represent a range of patient populations, guarantee that the output is ultimately understandable, prospectively verify the performance, offer doctor-patient communication when necessary, and prove their credibility to the regulatory authorities.

CONCLUSION

The Tibot® AI application has demonstrated promising outcomes in the diagnosis of a number of dermatological disorders. There is a lot of potential for practical implementation, but more development is needed before it can be used in clinical practise. Its capacity to learn on its own without assistance from a human is its strongest asset.

Given how quickly AI is evolving and how frequently it is used in daily life, it is essential to have a basic understanding of its underlying ideas, potential uses, and limitations. More studies from developing nations are crucial because AI can be a significant addition to such areas as they have limited resources.

Although AI is a useful tool for dermatologists and their patients, it in no way replaces the relationship between medical professionals and their clients. While it aids in the broad classification of diseases, in-depth understanding of the topic and its application in the correlation of various illnesses would still be required for specific diagnosis and further care. We must embrace AI and incorporate it into patient care paradigms, not give in to the fear of a dystopian world where dermatologists are replaced by machines.

<u>SUMMARY</u>

A hospital based cross-sectional study was conducted from a period of January 2021 to June 2022 to assess the accuracy of Tibot® AI application in the diagnosis of dermatologic conditions. Photographs of various skin lesions were uploaded to the application and the results portrayed were compared with that by a dermatologist. A total of 600 participants were included in this study.

The following observations were made:

- Male patients were slightly predominant in this study.

- Age of the patients ranged from 1-85 years, with most of the patients belonging to the third decade.

- Majority of the clinical conditions included in the study were infections

- Prediction accuracy of the AI application to forecast the exact diagnosis in the top one and top three projected diagnoses was 80.6% and 96.1%, respectively.

- For alopecia, benign and suspicious tumours, and eczema, the prediction accuracy (Top 3) was 100%.

- For pigmentary disorders and alopecia, positive predictive value was 96%; for viral infections, psoriasis, and acne, it was 91%, 90%, and 87%, respectively.

- AI application's sensitivity and specificity were determined to be 97% and 98%, respectively.

- There is a statistically significant correlation between the clinical and AI-projected diagnoses for every clinical condition.

This study shows that the AI application was reliable at diagnosing various dermatologic conditions, albeit they were non-specific. Consequently, AI can support clinical practise

but human interaction and clinician correlation will always be necessary for providing

patients with acceptable care.

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ETHICAL CLEARANCE CERTIFICATE

IEC/no-09/2021
Date-22/01/2021

B.L.D.E. (DEEMED TO BE UNIVERSITY)

(Declared vide notification No. F.9-37/2007-U.3 (A) Dated. 29-2-2008 of the MHRD, Government of India under Section 3 of the UGC Act, 1956)

The Constituent College

SHRI. B. M. PATIL MEDICAL COLLEGE, HOSPITAL AND RESEARCH CENTRE

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Institutional ethical committee of this college met on 11-01-2021 at 11-00 am to scrutinize the synopsis of Postgraduate students of this college from Ethical Clearance point of view. After scrutiny the following original/corrected and revised version synopsis of the Thesis has been accorded Ethical Clearance

Title: Evaluation of accuracy of Tibot ™ Artificial intelligence application in the prediction of diagnosis of dermatological conditions

Name of PG student: Dr Marri Shiva Shankar, Department of Dermatology

Name of Guide/Co-investigator: Dr Arun.C.Inamadar, Professor & HOD of Dermatology

DR .S.V.PATIL
CHAIRMAN, IEC
Institutional Ethical Committee
B L D E (Deemed to be University)
Shri B.M. Patil Medical College,
VIJAYAPUR-586103 (Karnataka)

Following documents were placed before Ethical Committee for Scrutinization:

1. Copy of Synopsis / Research project
2. Copy of informed consent form
3. Any other relevant documents.

1

INFORMED CONSENT FORM

B.L.D.E. (Deemed to be) University

SHRI B.M PATIL MEDICAL COLLEGE, HOSPITAL AND RESEARCH CENTRE, VIJAYAPURA-586103

TITLE OF RESEARCH   : EVALUATION OF ACCURACY OF TIBOT®

ARTIFICIAL INTELLIGENCE

APPLICATION IN THE PREDICTION OF

DIAGNOSIS OF DERMATOLOGICAL

CONDITIONS

GUIDE   : DR. ARUN C. INAMADAR

P.G. STUDENT   : DR. MARRI SHIVA SHANKAR

PURPOSE OF RESEARCH:

I have been informed that this project will EVALUATE THE ACCURACY OF TIBOT®
ARTIFICIAL INTELLIGENCE APPLICATION IN THE PREDICTION OF DIAGNOSIS
OF DERMATOLOGICAL CONDITIONS at Shri BM Patil Medical College and Research
Centre, VIJAYAPURA.

BENEFITS:

I understand that my participation in this study will help the investigator to know the accuracy
of the Tibot® Artificial Intelligence Application in the prediction of diagnosis of dermatological
conditions.

PROCEDURE:

I understand that relevant history will be taken and proper photographs will be uploaded into the AI application along with answers to a few important questions and that the personal data will be protected.

CONFIDENTIALITY:

I understand that medical information produced by this study will become a part of my hospital records and will be subjected to the confidentiality and privacy regulation of the said hospital. Information of a sensitive personal nature will not be a part of the medical records but will be stored in the investigator's research file.

If the data are used for publication in the medical literature or for teaching purposes no names will be used and other identifiers such as photographs and audio or videotapes will be used only with my special written permission. I understand I may see the photographs, videotapes, and hear the audiotapes before giving this permission.

REQUEST FOR MORE INFORMATION:

I understand that I may ask more questions about the study at any time concerned. Dr. Marri Shiva Shankar is available to answer my questions or concerns. I understand that I will be informed of any significant new findings discovered during the course of this study, which may influence my continued participation.

REFUSAL OR WITHDRAWAL OF PARTICIPATION:

I understand that my participation is voluntary and I may refuse to participate or may withdraw consent and discontinue participation in this study at any time without prejudice. I also understand that Dr. Marri Shiva Shankar may terminate my participation in this study at any

time after he has explained the reasons for doing so and has helped arrange for my continued care by my own physician if this is appropriate.

INJURY STATEMENT:

I understand that in the unlikely event of injury to me resulting directly from my participation in this study and if such injury were reported promptly, then medical treatment will be available to me, but no further compensation will be provided. I understand that by my agreement for my participation in this study, I am not waiving any of my legal rights.

I have explained to (patient's / relevant guardian's name) the purpose of the research, the procedures required, and the possible risks and benefits to the best of my ability in the patient's own language.

———————————————   ———————————————

Investigator / P. G. Guide   Date

STUDY SUBJECT CONSENT FORM:

I confirm that Dr. Marri Shiva Shankar explained to me the purpose of this research, the study procedure that I will undergo, and the possible discomforts and benefits that I may experience, in my own language.

I have been explained all the above in detail in my own language and I understand the same. I agree to give my consent to participate as a subject in this research project.

_____   _____

SIGNATURE OF PARTICIPANT/ GUARDIAN   DATE

_____   _____

SIGNATURE OF WITNESS   DATE

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PROFORMA

B.L.D.E. (Deemed to be University)

SHRI B. M. PATIL MEDICAL COLLEGE HOSPITAL AND RESEARCH CENTRE,

VIJAYAPURA.

DEPARTMENT OF DERMATOLOGY, VENEREOLOGY, AND LEPROSY

SCHEME OF CASE TAKING

"EVALUATION OF ACCURACY OF TIBOT® ARTIFICIAL INTELLIGENCE

APPLICATION IN THE PREDICTION OF DIAGNOSIS OF

DERMATOLOGICAL CONDITIONS"

S.No: **Date:**

Name: **Hospital Number:**

Age / Sex:

Address and Contact Details:

Presenting Complaints & duration:

History of Present Illness:

Personal History:

Family History:

Examination:

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AI Diagnosis:

Diagnosis	Probability

Clinical Diagnosis:

KEY TO MASTERCHART

AI- Artificial intelligence

M- Male

F- Female

1- Exact diagnosis predicted in the top one/ top three projections

0- Exact diagnosis not predicted in the top one/ top three projections

MASTERCHART

S. No.:	Age (in yrs)	Sex	AI projected diagnosis 1	AI projected diagnosis 2	AI projected diagnosis 3	Clinical Diagnosis	Top one projections	Top three projections
1	30	F	Eczema	Fungal Infection	Psoriasis	Eczema	1	1
2	58	F	Immunological skin disorder	Eczema	Fungal Infection	Immunological skin disorder	1	1
3	38	F	Fungal Infection	Immunological skin disorder	Viral	Fungal Infection	1	1
4	30	M	Alopecia	Immunological skin disorder	Fungal Infection	Alopecia	1	1
5	35	M	Viral	Benign tumor	Immunological skin disorder	Viral	1	1
6	32	M	Alopecia	Acne & Rosacea	Immunological skin disorder	Alopecia	1	1
7	17	M	Psoriasis	Eczema	Suspicious tumor	Psoriasis	1	1
8	35	M	Psoriasis	Eczema	Immunological skin disorder	Psoriasis	1	1
9	22	M	Acne & Rosacea	Viral	Bacterial Infection	Acne & Rosacea	1	1
10	24	M	Fungal Infection	Pigmentation	Alopecia	Fungal Infection	1	1
11	62	M	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
12	24	M	Viral	Benign tumor	Immunological skin disorder	Viral	1	1
13	33	F	Psoriasis	Eczema	Fungal Infection	Psoriasis	1	1
14	20	M	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
15	40	M	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
16	50	F	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
17	63	M	Psoriasis	Eczema	Immunological skin disorder	Psoriasis	1	1
18	17	M	Skin infestation	Eczema	Fungal Infection	Skin infestation	1	1
19	60	F	Fungal Infection	Viral	Immunological skin disorder	Fungal Infection	1	1
20	40	M	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
21	32	F	Fungal Infection	Immunological skin disorder	Psoriasis	Fungal Infection	1	1
22	11	M	Fungal Infection	Eczema	Psoriasis	Fungal Infection	1	1
23	8	M	Alopecia	Fungal Infection	Benign tumor	Alopecia	1	1
24	18	F	Eczema	Skin infestation	Fungal Infection	Skin infestation	0	1
25	19	F	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1

26	36	M	Fungal Infection	Acne & Rosacea	Viral	Viral	0	1
27	26	M	Eczema	Skin infestation	Fungal Infection	Skin infestation	0	1
28	38	F	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
29	39	M	Alopecia	Acne & Rosacea	Eczema	Alopecia	1	1
30	28	F	Fungal Infection	Eczema	Bacterial Infection	Fungal Infection	1	1
31	40	M	Fungal Infection	Eczema	Bacterial Infection	Fungal Infection	1	1
32	1	F	Benign tumor	Suspicious tumor	Viral	Benign tumor	1	1
33	46	M	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
34	22	M	Acne & Rosacea	Immunological skin disorder	Benign tumor	Acne & Rosacea	1	1
35	34	F	Viral	Immunological skin disorder	Suspicious tumor	Viral	1	1
36	33	F	Fungal Infection	Eczema	Viral	Viral	0	1
37	16	M	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
38	13	F	Fungal Infection	Eczema	Psoriasis	Fungal Infection	1	1
39	38	M	Psoriasis	Eczema	Suspicious tumor	Eczema	0	1
40	13	M	Eczema	Fungal Infection	Psoriasis	Eczema	1	1
41	16	F	Alopecia	Benign tumor	Eczema	Alopecia	1	1
42	64	M	Eczema	Psoriasis	Immunological skin disorder	Psoriasis	0	1
43	21	M	Psoriasis	Immunological skin disorder	Fungal Infection	Psoriasis	1	1
44	4	M	Viral	Bacterial infection	Skin infestation	Viral	1	1
45	34	M	Viral	Bacterial infection	Fungal Infection	Viral	1	1
46	30	F	Viral	Benign tumor	Bacterial Infection	Viral	1	1
47	28	F	Acne & Rosacea	Bacterial infection	Fungal Infection	Acne & Rosacea	1	1
48	15	F	Psoriasis	Skin infestation	Eczema	Psoriasis	1	1
49	20	M	Acne & Rosacea	Eczema	Immunological skin disorder	Acne & Rosacea	1	1
50	60	M	Pigmentation	Suspicious tumor	Immunological skin disorder	Pigmentation	1	1
51	29	M	Alopecia	Acne & Rosacea	Benign tumor	Alopecia	1	1
52	56	M	Pigmentation	Immunological skin disorder	Psoriasis	Pigmentation	1	1
53	26	M	Viral	Fungal Infection	Eczema	Fungal Infection	0	1
54	60	F	Fungal Infection	Suspicious tumor	Viral	Viral	0	1
55	22	F	Alopecia	Eczema	Bacterial Infection	Alopecia	1	1

56	50	F	Immunological skin disorder	Suspicious tumor	Benign tumor	Immunological skin disorder	1	1
57	7	F	Psoriasis	Fungal Infection	Immunological skin disorder	Psoriasis	1	1
58	21	M	Psoriasis	Eczema	Immunological skin disorder	Psoriasis	1	1
59	39	M	Immunological skin disorder	Fungal Infection	Eczema	Psoriasis	0	0
60	53	M	Eczema	Immunological skin disorder	Fungal Infection	Fungal Infection	0	1
61	32	F	Benign tumor	Acne & Rosacea	Fungal Infection	Benign tumor	1	1
62	15	M	Eczema	Psoriasis	Fungal Infection	Fungal Infection	0	1
63	29	M	Acne & Rosacea	Pigmentation	Immunological skin disorder	Pigmentation	0	1
64	19	F	Benign tumor	Acne & Rosacea	Eczema	Benign tumor	1	1
65	25	F	Suspicious tumor	Benign tumor	Eczema	Benign tumor	0	1
66	15	F	Pigmentation	Fungal Infection	Benign tumor	Pigmentation	1	1
67	35	M	Acne & Rosacea	Viral	Alopecia	Alopecia	0	1
68	27	M	Fungal Infection	Eczema	Viral	Fungal Infection	1	1
69	21	F	Alopecia	Benign tumor	Immunological skin disorder	Alopecia	1	1
70	25	F	Acne & Rosacea	Viral	Benign tumor	Viral	0	1
71	19	F	Acne & Rosacea	Bacterial infection	Eczema	Acne & Rosacea	1	1
72	15	F	Fungal Infection	Psoriasis	Eczema	Psoriasis	0	1
73	52	M	Immunological skin disorder	Fungal Infection	Psoriasis	Psoriasis	0	1
74	34	M	Alopecia	Benign tumor	Immunological skin disorder	Alopecia	1	1
75	23	M	Viral	Benign tumor	Suspicious tumor	Benign tumor	0	1
76	20	M	Acne & Rosacea	Benign tumor	Bacterial Infection	Acne & Rosacea	1	1
77	16	M	Viral	Benign tumor	Immunological skin disorder	Benign tumor	0	1
78	11	F	Viral	Benign tumor	Immunological skin disorder	Benign tumor	0	1
79	65	F	Immunological skin disorder	Benign tumor	Eczema	Immunological skin disorder	1	1
80	27	M	Alopecia	Acne & Rosacea	Immunological skin disorder	Alopecia	1	1
81	43	M	Psoriasis	Immunological skin disorder	Eczema	Psoriasis	1	1
82	11	M	Fungal Infection	Eczema	Psoriasis	Fungal Infection	1	1
83	22	F	Benign tumor	Immunological skin disorder	Suspicious tumor	Benign tumor	1	1
84	27	M	Alopecia	Benign tumor	Acne & Rosacea	Alopecia	1	1
85	48	F	Eczema	Bacterial infection	Viral	Immunological skin disorder	0	0

86	23	M	Fungal Infection	Eczema	Psoriasis	Fungal Infection	1	1
87	13	F	Immunological skin disorder	Benign tumor	Bacterial Infection	Immunological skin disorder	1	1
88	36	M	Eczema	Fungal Infection	Immunological skin disorder	Eczema	1	1
89	45	M	Eczema	Fungal Infection	Psoriasis	Eczema	1	1
90	24	M	Alopecia	Immunological skin disorder	Suspicious tumor	Alopecia	1	1
91	28	M	Viral	Pigmentation	Acne & Rosacea	Viral	1	1
92	35	F	Immunological skin disorder	Eczema	Viral	Immunological skin disorder	1	1
93	42	M	Acne & Rosacea	Benign tumor	Immunological skin disorder	Acne & Rosacea	1	1
94	24	M	Alopecia	Immunological skin disorder	Eczema	Alopecia	1	1
95	16	F	Alopecia	Acne & Rosacea	Immunological skin disorder	Alopecia	1	1
96	1	F	Fungal Infection	Eczema	Benign tumor	Benign tumor	0	1
97	23	M	Alopecia	Benign tumor	Immunological skin disorder	Alopecia	1	1
98	27	F	Benign tumor	Suspicious tumor	Pigmentation	Benign tumor	1	1
99	54	F	Eczema	Fungal Infection	Immunological skin disorder	Immunological skin disorder	0	1
100	29	M	Acne & Rosacea	Eczema	Viral	Acne & Rosacea	1	1
101	28	F	Acne & Rosacea	Immunological skin disorder	Benign tumor	Pigmentation	0	0
102	26	M	Fungal Infection	Eczema	Psoriasis	Fungal Infection	1	1
103	9	F	Pigmentation	Immunological skin disorder	Viral	Pigmentation	1	1
104	25	M	Pigmentation	Immunological skin disorder	Fungal Infection	Pigmentation	1	1
105	7	M	Pigmentation	Bacterial infection	Fungal Infection	Pigmentation	1	1
106	10	M	Immunological skin disorder	Alopecia	Eczema	Fungal Infection	0	0
107	13	F	Viral	Acne & Rosacea	Bacterial Infection	Viral	1	1
108	18	F	Alopecia	Acne & Rosacea	Benign tumor	Benign tumor	0	1
109	16	M	Fungal Infection	Eczema	Bacterial Infection	Fungal Infection	1	1
110	16	M	Immunological skin disorder	Psoriasis	Bacterial Infection	Psoriasis	0	1
111	12	M	Alopecia	Immunological skin disorder	Suspicious tumor	Alopecia	1	1
112	12	M	Eczema	Psoriasis	Suspicious tumor	Eczema	1	1
113	16	M	Fungal Infection	Viral	Immunological skin disorder	Viral	0	1
114	55	F	Fungal Infection	Eczema	Psoriasis	Psoriasis	0	1
115	36	M	Alopecia	Benign tumor	Acne & Rosacea	Alopecia	1	1

116	27	M	Benign tumor	Immunological skin disorder	Suspicious tumor	Viral	0	0
117	1	M	Psoriasis	Fungal Infection	Eczema	Fungal Infection	0	1
118	55	M	Psoriasis	Eczema	Immunological skin disorder	Psoriasis	1	1
119	15	M	Alopecia	Benign tumor	Immunological skin disorder	Alopecia	1	1
120	25	F	Fungal Infection	Acne & Rosacea	Benign tumor	Acne & Rosacea	0	1
121	22	M	Viral	Benign tumor	Suspicious tumor	Viral	1	1
122	67	M	Immunological skin disorder	Bacterial infection	Benign tumor	Immunological skin disorder	1	1
123	36	M	Immunological skin disorder	Suspicious tumor	Viral	Viral	0	1
124	27	F	Benign tumor	Suspicious tumor	Alopecia	Benign tumor	1	1
125	40	F	Pigmentation	Benign tumor	Immunological skin disorder	Pigmentation	1	1
126	9	M	Alopecia	Fungal Infection	Eczema	Fungal Infection	0	1
127	17	M	Viral	Immunological skin disorder	Eczema	Immunological skin disorder	0	1
128	42	F	Immunological skin disorder	Viral	Suspicious tumor	Viral	0	1
129	45	M	Immunological skin disorder	Fungal Infection	Viral	Immunological skin disorder	1	1
130	18	M	Immunological skin disorder	Viral	Eczema	Immunological skin disorder	1	1
131	26	M	Viral	Fungal Infection	Immunological skin disorder	Viral	1	1
132	59	F	Viral	Bacterial infection	Fungal Infection	Viral	1	1
133	50	M	Viral	Acne & Rosacea	Bacterial Infection	Viral	1	1
134	44	M	Eczema	Fungal Infection	Immunological skin disorder	Fungal Infection	0	1
135	78	F	Immunological skin disorder	Suspicious tumor	Acne & Rosacea	Immunological skin disorder	1	1
136	23	M	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
137	30	F	Acne & Rosacea	Eczema	Viral	Acne & Rosacea	1	1
138	45	M	Psoriasis	Fungal Infection	Eczema	Psoriasis	1	1
139	45	M	Psoriasis	Immunological skin disorder	Eczema	Psoriasis	1	1
140	22	F	Alopecia	Acne & Rosacea	Suspicious tumor	Alopecia	1	1
141	22	F	Fungal Infection	Eczema	Psoriasis	Fungal Infection	1	1
142	18	M	Fungal Infection	Eczema	Psoriasis	Fungal Infection	1	1
143	19	M	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
144	34	F	Alopecia	Benign tumor	Immunological skin disorder	Alopecia	1	1
145	30	F	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1

146	5	F	Viral	Benign tumor	Immunological skin disorder	Viral	1	1
147	20	M	Eczema	Suspicious tumor	Benign tumor	Viral	0	0
148	9	M	Benign tumor	Viral	Fungal Infection	Benign tumor	1	1
149	5	M	Eczema	Fungal Infection	Psoriasis	Fungal Infection	0	1
150	19	F	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
151	30	F	Fungal Infection	Immunological skin disorder	Eczema	Fungal Infection	1	1
152	24	M	Fungal Infection	Pigmentation	Immunological skin disorder	Fungal Infection	1	1
153	70	M	Fungal Infection	Eczema	Psoriasis	Fungal Infection	1	1
154	26	F	Viral	Pigmentation	Immunological skin disorder	Viral	1	1
155	1	F	Benign tumor	Suspicious tumor	Fungal Infection	Benign tumor	1	1
156	33	M	Immunological skin disorder	Suspicious tumor	Eczema	Viral	0	0
157	30	M	Skin infestation	Eczema	Viral	Skin infestation	1	1
158	14	F	Alopecia	Benign tumor	Viral	Alopecia	1	1
159	33	M	Benign tumor	Fungal Infection	Viral	Viral	0	1
160	35	F	Pigmentation	Benign tumor	Suspicious tumor	Pigmentation	1	1
161	24	M	Eczema	Skin infestation	Immunological skin disorder	Eczema	1	1
162	32	M	Skin infestation	Fungal Infection	Viral	Viral	0	1
163	24	M	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
164	54	M	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
165	22	M	Alopecia	Benign tumor	Immunological skin disorder	Alopecia	1	1
166	11	F	Acne & Rosacea	Benign tumor	Viral	Acne & Rosacea	1	1
167	35	F	Eczema	Fungal Infection	Viral	Eczema	1	1
168	42	F	Pigmentation	Acne & Rosacea	Suspicious tumor	Pigmentation	1	1
169	46	F	Psoriasis	Eczema	Fungal Infection	Eczema	0	1
170	45	M	Psoriasis	Immunological skin disorder	Fungal Infection	Psoriasis	1	1
171	1	F	Alopecia	Benign tumor	Viral	Alopecia	1	1
172	18	F	Eczema	Fungal Infection	Immunological skin disorder	Fungal Infection	0	1
173	28	M	Eczema	Fungal Infection	Skin infestation	Eczema	1	1
174	19	M	Acne & Rosacea	Skin infestation	Immunological skin disorder	Acne & Rosacea	1	1
175	23	M	Pigmentation	Acne & Rosacea	Alopecia	Pigmentation	1	1

176	18	M	Acne & Rosacea	Benign tumor	Pigmentation	Acne & Rosacea	1	1
177	52	F	Pigmentation	Immunological skin disorder	Viral	Pigmentation	1	1
178	50	F	Pigmentation	Benign tumor	Eczema	Pigmentation	1	1
179	37	F	Alopecia	Benign tumor	Immunological skin disorder	Alopecia	1	1
180	42	M	Fungal Infection	Suspicious tumor	Eczema	Fungal Infection	1	1
181	17	M	Benign tumor	Acne & Rosacea	Immunological skin disorder	Immunological skin disorder	0	1
182	19	M	Acne & Rosacea	Alopecia	Immunological skin disorder	Acne & Rosacea	1	1
183	32	M	Alopecia	Benign tumor	Immunological skin disorder	Alopecia	1	1
184	25	M	Pigmentation	Fungal Infection	Psoriasis	Pigmentation	1	1
185	55	M	Pigmentation	Benign tumor	Immunological skin disorder	Pigmentation	1	1
186	32	F	Alopecia	Acne & Rosacea	Viral	Alopecia	1	1
187	48	F	Pigmentation	Suspicious tumor	Benign tumor	Pigmentation	1	1
188	20	F	Acne & Rosacea	Benign tumor	Suspicious tumor	Acne & Rosacea	1	1
189	20	F	Acne & Rosacea	Viral	Benign tumor	Acne & Rosacea	1	1
190	28	M	Alopecia	Benign tumor	Immunological skin disorder	Alopecia	1	1
191	26	F	Pigmentation	Benign tumor	Immunological skin disorder	Pigmentation	1	1
192	22	M	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
193	48	F	Pigmentation	Acne & Rosacea	Benign tumor	Pigmentation	1	1
194	24	M	Acne & Rosacea	Benign tumor	Bacterial Infection	Acne & Rosacea	1	1
195	28	F	Benign tumor	Acne & Rosacea	Pigmentation	Pigmentation	0	1
196	32	F	Pigmentation	Immunological skin disorder	Acne & Rosacea	Pigmentation	1	1
197	28	M	Fungal Infection	Immunological skin disorder	Benign tumor	Fungal Infection	1	1
198	25	F	Pigmentation	Benign tumor	Immunological skin disorder	Pigmentation	1	1
199	3	F	Psoriasis	Immunological skin disorder	Eczema	Psoriasis	1	1
200	40	M	Suspicious tumor	Eczema	Viral	Suspicious tumor	1	1
201	48	F	Immunological skin disorder	Psoriasis	Eczema	Psoriasis	0	1
202	29	M	Alopecia	Bacterial infection	Viral	Alopecia	1	1
203	23	M	Viral	Acne & Rosacea	Fungal Infection	Viral	1	1
204	23	F	Alopecia	Benign tumor	Suspicious tumor	Alopecia	1	1
205	48	F	Eczema	Acne & Rosacea	Viral	Viral	0	1

206	41	M	Psoriasis	Eczema	Fungal Infection	Psoriasis	1	1
207	33	F	Immunological skin disorder	Acne & Rosacea	Benign tumor	Viral	0	0
208	9	F	Viral	Eczema	Benign tumor	Viral	1	1
209	3	M	Viral	Benign tumor	Bacterial Infection	Bacterial Infection	0	1
210	55	M	Psoriasis	Immunological skin disorder	Fungal Infection	Psoriasis	1	1
211	52	M	Viral	Acne & Rosacea	Immunological skin disorder	Viral	1	1
212	32	M	Alopecia	Acne & Rosacea	Viral	Viral	0	1
213	22	F	Acne & Rosacea	Benign tumor	Bacterial Infection	Acne & Rosacea	1	1
214	22	F	Acne & Rosacea	Immunological skin disorder	Bacterial Infection	Acne & Rosacea	1	1
215	34	F	Psoriasis	Eczema	Immunological skin disorder	Psoriasis	1	1
216	40	F	Fungal Infection	Viral	Acne & Rosacea	Viral	0	1
217	48	F	Fungal Infection	Viral	Eczema	Eczema	0	1
218	40	M	Alopecia	Immunological skin disorder	Fungal Infection	Alopecia	1	1
219	13	F	Fungal Infection	Immunological skin disorder	Viral	Fungal Infection	1	1
220	55	F	Immunological skin disorder	Fungal Infection	Psoriasis	Psoriasis	0	1
221	41	M	Alopecia	Acne & Rosacea	Immunological skin disorder	Alopecia	1	1
222	40	M	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
223	68	M	Pigmentation	Fungal Infection	Eczema	Pigmentation	1	1
224	17	F	Alopecia	Acne & Rosacea	Eczema	Alopecia	1	1
225	38	F	Psoriasis	Eczema	Suspicious tumor	Psoriasis	1	1
226	22	F	Acne & Rosacea	Benign tumor	Suspicious tumor	Acne & Rosacea	1	1
227	20	F	Acne & Rosacea	Suspicious tumor	Pigmentation	Acne & Rosacea	1	1
228	22	M	Viral	Acne & Rosacea	Bacterial Infection	Viral	1	1
229	6	F	Eczema	Fungal Infection	Skin infestation	Eczema	1	1
230	31	F	Alopecia	Benign tumor	Bacterial Infection	Alopecia	1	1
231	17	F	Acne & Rosacea	Immunological skin disorder	Bacterial Infection	Acne & Rosacea	1	1
232	12	M	Viral	Benign tumor	Fungal Infection	Viral	1	1
233	12	M	Pigmentation	Immunological skin disorder	Eczema	Pigmentation	1	1
234	69	M	Pigmentation	Eczema	Immunological skin disorder	Pigmentation	1	1
235	21	F	Pigmentation	Benign tumor	Bacterial Infection	Pigmentation	1	1

236	12	M	Pigmentation	Immunological skin disorder	Fungal Infection	Pigmentation		1		1
237	4	F	Pigmentation	Benign tumor	Immunological skin disorder	Pigmentation		1		1
238	6	M	Pigmentation	Immunological skin disorder	Eczema	Pigmentation		1		1
239	4	F	Pigmentation	Immunological skin disorder	Fungal Infection	Pigmentation		1		1
240	30	M	Pigmentation	Immunological skin disorder	Benign tumor	Pigmentation		1		1
241	53	M	Pigmentation	Benign tumor	Viral	Pigmentation		1		1
242	47	F	Pigmentation	Suspicious tumor	Immunological skin disorder	Pigmentation		1		1
243	64	M	Pigmentation	Suspicious tumor	Fungal Infection	Pigmentation		1		1
244	13	M	Pigmentation	Benign tumor	Suspicious tumor	Pigmentation		1		1
245	24	F	Pigmentation	Benign tumor	Immunological skin disorder	Pigmentation		1		1
246	18	F	Eczema	Pigmentation	Immunological skin disorder	Pigmentation		0		1
247	26	M	Pigmentation	Benign tumor	Immunological skin disorder	Pigmentation		1		1
248	38	F	Pigmentation	Eczema	Immunological skin disorder	Pigmentation		1		1
249	16	F	Pigmentation	Benign tumor	Bacterial Infection	Pigmentation		1		1
250	14	F	Pigmentation	Immunological skin disorder	Fungal Infection	Pigmentation		1		1
251	24	F	Viral	Pigmentation	Bacterial Infection	Pigmentation		0	25	1
252	25	F	Pigmentation	Benign tumor	Immunological skin disorder	Pigmentation		1		1
253	68	M	Pigmentation	Suspicious tumor	Immunological skin disorder	Pigmentation		1	25	1
254	42	F	Alopecia	Benign tumor	Immunological skin disorder	Alopecia		1		1
255	56	M	Pigmentation	Benign tumor	Eczema	Pigmentation		1		1
256	22	F	Pigmentation	Fungal Infection	Viral	Pigmentation		1		1
257	22	M	Pigmentation	Immunological skin disorder	Bacterial Infection	Pigmentation		1		1
258	18	M	Pigmentation	Immunological skin disorder	Benign tumor	Pigmentation		1		1
259	30	F	Viral	Benign tumor	Fungal Infection	Viral		1		1
260	40	F	Skin infestation	Fungal Infection	Eczema	Eczema		0		1
261	18	M	Bacterial infection	Eczema	Fungal Infection	Acne & Rosacea		0		0
262	26	M	Alopecia	Benign tumor	Immunological skin disorder	Alopecia		1		1
263	25	M	Acne & Rosacea	Viral	Immunological skin disorder	Acne & Rosacea		1		1
264	41	M	Eczema	Suspicious tumor	Fungal Infection	Psoriasis		0		0
265	27	F	Pigmentation	Immunological skin disorder	Viral	Pigmentation		1		1

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266	26	M	Alopecia	Acne & Rosacea	Eczema	Alopecia	1	1
267	27	M	Immunological skin disorder	Eczema	Psoriasis	Immunological skin disorder	1	1
268	23	M	Alopecia	Acne & Rosacea	Eczema	Alopecia	1	1
269	1	F	Benign tumor	Suspicious tumor	Bacterial Infection	Benign tumor	1	1
270	13	F	Pigmentation	Immunological skin disorder	Bacterial Infection	Pigmentation	1	1
271	40	F	Pigmentation	Immunological skin disorder	Viral	Pigmentation	1	1
272	35	M	Fungal Infection	Eczema	Psoriasis	Psoriasis	0	1
273	12	M	Viral	Bacterial infection	Fungal Infection	Viral	1	1
274	46	M	Viral	Acne & Rosacea	Bacterial Infection	Viral	1	1
275	55	F	Fungal Infection	Viral	Eczema	Viral	0	1
276	21	M	Alopecia	Eczema	Fungal Infection	Alopecia	1	1
277	22	F	Alopecia	Benign tumor	Immunological skin disorder	Alopecia	1	1
278	56	M	Immunological skin disorder	Fungal Infection	Acne & Rosacea	Psoriasis	0	0
279	6	F	Viral	Skin infestation	Benign tumor	Viral	1	1
280	70	M	Suspicious tumor	Viral	Immunological skin disorder	Viral	0	1
281	30	F	Immunological skin disorder	Pigmentation	Acne & Rosacea	Pigmentation	0	1
282	36	M	Viral	Immunological skin disorder	Benign tumor	Viral	1	1
283	14	M	Immunological skin disorder	Acne & Rosacea	Benign tumor	Acne & Rosacea	0	1
284	8	M	Viral	Eczema	Skin infestation	Skin infestation	0	1
285	28	M	Skin infestation	Viral	Bacterial Infection	Viral	0	1
286	32	F	Bacterial infection	Viral	Benign tumor	Viral	0	1
287	34	F	Psoriasis	Eczema	Immunological skin disorder	Psoriasis	1	1
288	22	M	Acne & Rosacea	Immunological skin disorder	Fungal Infection	Acne & Rosacea	1	1
289	24	M	Alopecia	Immunological skin disorder	Eczema	Alopecia	1	1
290	28	F	Acne & Rosacea	Benign tumor	Bacterial Infection	Acne & Rosacea	1	1
291	28	M	Alopecia	Benign tumor	Fungal Infection	Alopecia	1	1
292	32	M	Alopecia	Acne & Rosacea	Fungal Infection	Alopecia	1	1
293	17	M	Alopecia	Benign tumor	Immunological skin disorder	Alopecia	1	1
294	1	F	Benign tumor	Suspicious tumor	Viral	Benign tumor	1	1
295	22	F	Immunological skin disorder	Viral	Benign tumor	Immunological skin disorder	1	1

296	11	M	Fungal Infection	Immunological skin disorder	Bacterial Infection	Fungal Infection	1	1
297	19	M	Acne & Rosacea	Bacterial infection	Eczema	Acne & Rosacea	1	1
298	24	M	Viral	Fungal Infection	Eczema	Viral	1	1
299	2	F	Viral	Fungal Infection	Acne & Rosacea	Viral	1	1
300	35	F	Viral	Skin infestation	Eczema	Viral	1	1
301	42	F	Alopecia	Benign tumor	Suspicious tumor	Alopecia	1	1
302	15	F	Eczema	Suspicious tumor	Bacterial Infection	Eczema	1	1
303	35	M	Pigmentation	Suspicious tumor	Immunological skin disorder	Pigmentation	1	1
304	35	F	Benign tumor	Pigmentation	Acne & Rosacea	Pigmentation	0	1
305	14	M	Skin infestation	Eczema	Viral	Skin infestation	1	1
306	19	M	Skin infestation	Eczema	Viral	Skin infestation	1	1
307	22	M	Acne & Rosacea	Benign tumor	Suspicious tumor	Acne & Rosacea	1	1
308	19	M	Eczema	Skin infestation	Viral	Skin infestation	0	1
309	15	M	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
310	13	M	Viral	Fungal Infection	Immunological skin disorder	Viral	1	1
311	29	M	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
312	20	M	Viral	Fungal Infection	Bacterial Infection	Viral	1	1
313	65	F	Fungal Infection	Acne & Rosacea	Viral	Viral	0	1
314	35	F	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
315	19	M	Eczema	Fungal Infection	Pigmentation	Fungal Infection	0	1
316	20	M	Pigmentation	Benign tumor	Acne & Rosacea	Acne & Rosacea	0	1
317	21	F	Acne & Rosacea	Bacterial infection	Eczema	Acne & Rosacea	1	1
318	22	F	Pigmentation	Acne & Rosacea	Fungal Infection	Acne & Rosacea	0	1
319	12	M	Fungal Infection	Viral	Immunological skin disorder	Viral	0	1
320	7	M	Eczema	Viral	Immunological skin disorder	Eczema	1	1
321	16	M	Acne & Rosacea	Suspicious tumor	Pigmentation	Acne & Rosacea	1	1
322	14	M	Skin infestation	Immunological skin disorder	Viral	Skin infestation	1	1
323	20	F	Acne & Rosacea	Bacterial infection	Viral	Acne & Rosacea	1	1
324	31	M	Alopecia	Acne & Rosacea	Immunological skin disorder	Alopecia	1	1
325	29	M	Alopecia	Immunological skin disorder	Viral	Alopecia	1	1

326	19	M	Skin infestation	Viral	Eczema	Skin infestation	1	1
327	14	M	Skin infestation	Viral	Eczema	Skin infestation	1	1
328	18	M	Skin infestation	Viral	Eczema	Skin infestation	1	1
329	17	M	Acne & Rosacea	Benign tumor	Suspicious tumor	Acne & Rosacea	1	1
330	22	M	Acne & Rosacea	Alopecia	Immunological skin disorder	Acne & Rosacea	1	1
331	12	M	Skin infestation			Skin infestation	1	1
332	38	M	Fungal Infection	Eczema	Psoriasis	Fungal Infection	1	1
333	35	M	Pigmentation	Immunological skin disorder	Alopecia	Pigmentation	1	1
334	17	F	Acne & Rosacea	Pigmentation	Benign tumor	Acne & Rosacea	1	1
335	52	M	Pigmentation	Eczema	Benign tumor	Pigmentation	1	1
336	30	M	Pigmentation	Suspicious tumor	Immunological skin disorder	Pigmentation	1	1
337	24	M	Pigmentation	Immunological skin disorder	Fungal Infection	Pigmentation	1	1
338	19	F	Acne & Rosacea	Benign tumor	Suspicious tumor	Acne & Rosacea	1	1
339	17	M	Acne & Rosacea	Benign tumor	Bacterial Infection	Acne & Rosacea	1	1
340	21	F	Acne & Rosacea	Suspicious tumor	Fungal Infection	Acne & Rosacea	1	1
341	26	M	Viral	Bacterial infection	Fungal Infection	Viral	1	341
342	48	F	Psoriasis	Eczema	Fungal Infection	Psoriasis	1	1
343	29	F	Fungal Infection	Pigmentation	Eczema	Fungal Infection	1	1
344	35	F	Eczema	Immunological skin disorder	Psoriasis	Psoriasis	0	1
345	17	M	Acne & Rosacea	Benign tumor	Fungal Infection	Acne & Rosacea	1	1
346	28	M	Viral	Fungal Infection	Immunological skin disorder	Viral	1	1
347	22	F	Acne & Rosacea	Benign tumor	Suspicious tumor	Acne & Rosacea	1	1
348	22	F	Acne & Rosacea	Suspicious tumor	Bacterial Infection	Acne & Rosacea	1	1
349	30	F	Pigmentation	Immunological skin disorder	Eczema	Pigmentation	1	1
350	35	F	Pigmentation	Immunological skin disorder	Bacterial Infection	Pigmentation	1	1
351	11	F	Pigmentation	Benign tumor	Suspicious tumor	Pigmentation	1	351
352	14	F	Pigmentation	Immunological skin disorder	Suspicious tumor	Pigmentation	1	1
353	8	M	Pigmentation	Immunological skin disorder	Suspicious tumor	Pigmentation	1	353
354	9	M	Pigmentation	Benign tumor	Suspicious tumor	Pigmentation	1	1
355	50	M	Psoriasis	Eczema	Suspicious tumor	Eczema	0	1

356	35	F	Pigmentation	Acne & Rosacea	Suspicious tumor	Pigmentation	1	1
357	30	F	Pigmentation	Viral	Fungal Infection	Pigmentation	1	1
358	3	M	Viral	Benign tumor	Bacterial Infection	Viral	1	1
359	5	M	Benign tumor	Viral	Acne & Rosacea	Viral	0	1
360	28	M	Alopecia	Benign tumor	Immunological skin disorder	Alopecia	1	1
361	30	F	Benign tumor	Viral	Pigmentation	Viral	0	1
362	10	M	Eczema	Viral	Benign tumor	Viral	0	1
363	28	M	Alopecia	Benign tumor	Acne & Rosacea	Alopecia	1	1
364	9	M	Viral	Fungal Infection	Bacterial Infection	Viral	1	1
365	8	M	Viral	Acne & Rosacea	Bacterial Infection	Viral	1	1
366	3	M	Fungal Infection	Benign tumor	Eczema	Fungal Infection	1	1
367	9	M	Viral	Eczema	Bacterial Infection	Viral	1	1
368	35	F	Pigmentation	Fungal Infection	Immunological skin disorder	Pigmentation	1	1
369	11	M	Viral	Fungal Infection	Bacterial Infection	Viral	1	1
370	24	F	Eczema	Viral	Fungal Infection	Viral	0	1
371	1	F	Benign tumor	Viral	Eczema	Benign tumor	1	1
372	26	M	Eczema	Benign tumor	Suspicious tumor	Viral	0	0
373	32	M	Pigmentation	Acne & Rosacea	Immunological skin disorder	Pigmentation	1	1
374	40	F	Alopecia	Benign tumor	Immunological skin disorder	Alopecia	1	1
375	34	M	Immunological skin disorder	Pigmentation	Acne & Rosacea	Pigmentation	0	1
376	32	M	Fungal Infection	Eczema	Viral	Fungal Infection	1	1
377	29	F	Alopecia	Benign tumor	Immunological skin disorder	Alopecia	1	1
378	65	F	Fungal Infection	Eczema	Psoriasis	Fungal Infection	1	1
379	30	F	Psoriasis	Eczema	Pigmentation	Fungal Infection	0	0
380	45	F	Fungal Infection	Eczema	Psoriasis	Fungal Infection	1	1
381	38	F	Pigmentation	Suspicious tumor	Fungal Infection	Pigmentation	1	1
382	13	F	Alopecia	Benign tumor	Eczema	Alopecia	1	1
383	4	F	Alopecia	Benign tumor	Acne & Rosacea	Alopecia	1	1
384	35	F	Alopecia	Benign tumor	Immunological skin disorder	Alopecia	1	1
385	10	M	Fungal Infection	Immunological skin disorder	Eczema	Fungal Infection	1	1

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386	71	M	Viral	Fungal Infection	Eczema	Viral	1	1
387	20	F	Alopecia	Benign tumor	Acne & Rosacea	Alopecia	1	1
388	60	M	Fungal Infection	Viral	Eczema	Viral	0	1
389	35	M	Fungal Infection	Viral	Eczema	Viral	0	1
390	65	M	Immunological skin disorder	Psoriasis	Eczema	Immunological skin disorder	1	1
391	50	F	Eczema	Immunological skin disorder	Suspicious tumor	Eczema	1	1
392	36	F	Pigmentation	Acne & Rosacea	Benign tumor	Pigmentation	1	1
393	1	F	Benign tumor	Suspicious tumor	Viral	Benign tumor	1	1
394	1	F	Benign tumor	Fungal Infection	Viral	Benign tumor	1	1
395	1	F	Benign tumor	Viral	Fungal Infection	Benign tumor	1	1
396	8	M	Alopecia	Eczema	Immunological skin disorder	Fungal Infection	0	0
397	1	F	Benign tumor	Acne & Rosacea	Suspicious tumor	Benign tumor	1	1
398	19	M	Immunological skin disorder	Eczema	Viral	Immunological skin disorder	1	1
399	19	M	Fungal Infection	Eczema	Psoriasis	Fungal Infection	1	1
400	19	F	Viral	Bacterial infection	Psoriasis	Viral	1	1
401	35	M	Eczema	Fungal Infection	Immunological skin disorder	Eczema	1	1
402	30	F	Benign tumor	Acne & Rosacea	Pigmentation	Pigmentation	0	1
403	20	F	Viral	Acne & Rosacea	Bacterial Infection	Viral	1	1
404	30	F	Acne & Rosacea	Pigmentation	Benign tumor	Pigmentation	0	1
405	30	M	Eczema	Psoriasis	Fungal Infection	Eczema	1	1
406	22	F	Viral	Suspicious tumor	Bacterial Infection	Viral	1	1
407	39	M	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
408	25	F	Bacterial infection	Viral	Eczema	Viral	0	1
409	24	F	Acne & Rosacea	Fungal Infection	Eczema	Acne & Rosacea	1	1
410	30	M	Psoriasis	Fungal Infection	Eczema	Psoriasis	1	1
411	38	M	Alopecia	Benign tumor	Bacterial Infection	Alopecia	1	1
412	18	M	Acne & Rosacea	Viral	Immunological skin disorder	Acne & Rosacea	1	1
413	24	M	Alopecia	Benign tumor	Acne & Rosacea	Alopecia	1	1
414	26	F	Viral	Bacterial infection	Fungal Infection	Viral	1	1
415	29	M	Fungal Infection	Eczema	Bacterial Infection	Fungal Infection	1	1

416	24	F	Acne & Rosacea	Suspicious tumor	Bacterial Infection	Acne & Rosacea	1	1
417	30	M	Eczema	Fungal Infection	Psoriasis	Psoriasis	0	1
418	29	M	Alopecia	Benign tumor	Acne & Rosacea	Alopecia	1	1
419	18	M	Acne & Rosacea	Immunological skin disorder	Viral	Acne & Rosacea	1	1
420	24	M	Alopecia	Benign tumor	Immunological skin disorder	Alopecia	1	1
421	40	M	Viral	Fungal Infection	Bacterial Infection	Viral	1	1
422	24	F	Alopecia	Benign tumor	Immunological skin disorder	Alopecia	1	1
423	17	M	Acne & Rosacea	Suspicious tumor	Fungal Infection	Acne & Rosacea	1	1
424	1	F	Benign tumor	Eczema	Viral	Benign tumor	1	1
425	32	F	Pigmentation	Benign tumor	Viral	Pigmentation	1	1
426	24	F	Pigmentation	Eczema	Fungal Infection	Pigmentation	1	1
427	52	F	Pigmentation	Fungal Infection	Benign tumor	Pigmentation	1	1
428	32	F	Pigmentation	Benign tumor	Fungal Infection	Pigmentation	1	1
429	30	F	Pigmentation	Immunological skin disorder	Suspicious tumor	Pigmentation	1	1
430	32	F	Pigmentation	Benign tumor	Suspicious tumor	Pigmentation	1	1
431	30	F	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
432	29	M	Psoriasis	Fungal Infection	Eczema	Psoriasis	1	1
433	40	M	Psoriasis	Eczema	Immunological skin disorder	Psoriasis	1	1
434	30	M	Immunological skin disorder	Viral	Bacterial Infection	Viral	0	1
435	30	F	Pigmentation	Benign tumor	Viral	Pigmentation	1	1
436	28	M	Alopecia	Immunological skin disorder	Pigmentation	Alopecia	1	1
437	32	F	Pigmentation	Eczema	Benign tumor	Pigmentation	1	1
438	30	M	Psoriasis	Eczema	Fungal Infection	Psoriasis	1	1
439	9	M	Alopecia	Fungal Infection	Immunological skin disorder	Alopecia	1	1
440	36	F	Eczema	Fungal Infection	Immunological skin disorder	Psoriasis	0	0
441	40	F	Psoriasis	Fungal Infection	Eczema	Psoriasis	1	1
442	30	F	Pigmentation	Benign tumor	Alopecia	Pigmentation	1	1
443	36	M	Psoriasis	Eczema	Immunological skin disorder	Psoriasis	1	1
444	30	M	Psoriasis	Fungal Infection	Immunological skin disorder	Psoriasis	1	1
445	30	F	Bacterial infection	Viral	Eczema	Viral	0	1

446	20	M	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection		1		1
447	40	F	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection		1		1
448	20	F	Alopecia	Fungal Infection	Eczema	Alopecia		1		1
449	36	F	Psoriasis	Fungal Infection	Eczema	Psoriasis		1		1
450	20	M	Fungal Infection	Eczema	Psoriasis	Fungal Infection		1		1
451	13	F	Alopecia	Immunological skin disorder	Suspicious tumor	Alopecia		1		1
452	31	F	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection		1		1
453	30	F	Fungal Infection	Immunological skin disorder	Eczema	Fungal Infection		1		1
454	30	M	Viral	Benign tumor	Eczema	Viral		1		1
455	45	M	Psoriasis	Immunological skin disorder	Eczema	Psoriasis		1		1
456	60	M	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection		1		1
457	20	M	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection		1		1
458	31	M	Alopecia	Pigmentation	Viral	Alopecia		1		1
459	65	M	Viral	Fungal Infection	Bacterial Infection	Viral		1		1
460	22	F	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection		1		1
461	9	F	Alopecia	Benign tumor	Acne & Rosacea	Alopecia		1		1
462	31	M	Alopecia	Benign tumor	Immunological skin disorder	Alopecia		1		1
463	24	F	Acne & Rosacea	Fungal Infection	Eczema	Acne & Rosacea		1		1
464	35	F	Viral	Bacterial infection	Fungal Infection	Viral		1		1
465	65	M	Eczema	Pigmentation	Viral	Eczema		1		1
466	64	F	Pigmentation	Benign tumor	Eczema	Pigmentation		1		1
467	24	F	Eczema	Viral	Fungal Infection	Viral		0		1
468	10	M	Viral	Bacterial infection	Eczema	Viral		1		1
469	61	M	Psoriasis	Eczema	Suspicious tumor	Psoriasis		1		1
470	19	F	Acne & Rosacea	Benign tumor	Suspicious tumor	Acne & Rosacea		1		1
471	16	F	Acne & Rosacea	Suspicious tumor	Alopecia	Acne & Rosacea		1		1
472	33	M	Viral	Fungal Infection	Bacterial Infection	Viral		1		1
473	35	M	Alopecia	Immunological skin disorder	Pigmentation	Alopecia		1		1
474	45	M	Viral	Suspicious tumor	Immunological skin disorder	Viral		1		1
475	34	M	Alopecia	Immunological skin disorder	Fungal Infection	Alopecia		1		1

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476	30	M	Viral	Immunological skin disorder	Eczema	Viral	1	1
477	36	F	Viral	Fungal Infection	Immunological skin disorder	Viral	1	1
478	1	F	Eczema	Viral	Benign tumor	Bacterial Infection	0	0
479	1	F	Eczema	Benign tumor	Bacterial Infection	Bacterial Infection	0	1
480	40	M	Alopecia	Benign tumor	Immunological skin disorder	Alopecia	1	1
481	9	M	Fungal Infection	Alopecia	Pigmentation	Alopecia	0	1
482	28	F	Alopecia	Benign tumor	Acne & Rosacea	Alopecia	1	1
483	74	M	Suspicious tumor	Immunological skin disorder	Benign tumor	Suspicious tumor	1	1
484	63	M	Immunological skin disorder	Suspicious tumor	Benign tumor	Suspicious tumor	0	1
485	39	M	Viral	Eczema	Bacterial Infection	Viral	1	1
486	30	M	Acne & Rosacea	Viral	Immunological skin disorder	Viral	0	1
487	17	M	Viral	Bacterial infection	Fungal Infection	Viral	1	1
488	25	F	Pigmentation	Benign tumor	Suspicious tumor	Pigmentation	1	1
489	60	M	Eczema	Immunological skin disorder	Skin infestation	Immunological skin disorder	0	1
490	27	F	Eczema	Fungal Infection	Immunological skin disorder	Fungal Infection	0	1
491	38	M	Benign tumor	Viral	Fungal Infection	Viral	0	1
492	31	M	Viral	Bacterial infection	Fungal Infection	Viral	1	1
493	60	F	Suspicious tumor	Benign tumor	Immunological skin disorder	Suspicious tumor	1	1
494	58	F	Immunological skin disorder	Suspicious tumor	Benign tumor	Suspicious tumor	0	1
495	19	M	Viral	Bacterial infection	Psoriasis	Viral	1	1
496	18	M	Acne & Rosacea	Suspicious tumor	Bacterial Infection	Acne & Rosacea	1	1
497	38	M	Psoriasis	Eczema	Immunological skin disorder	Psoriasis	1	1
498	38	F	Alopecia	Acne & Rosacea	Immunological skin disorder	Alopecia	1	1
499	15	M	Viral	Immunological skin disorder	Bacterial Infection	Viral	1	1
500	15	M	Viral	Bacterial infection	Fungal Infection	Viral	1	1
501	23	F	Alopecia	Immunological skin disorder	Fungal Infection	Alopecia	1	1
502	18	M	Viral	Eczema	Immunological skin disorder	Viral	1	1
503	14	M	Viral	Fungal Infection	Immunological skin disorder	Viral	1	1
504	40	F	Alopecia	Benign tumor	Immunological skin disorder	Alopecia	1	1
505	60	M	Pigmentation	Viral	Immunological skin disorder	Pigmentation	1	1

506	16	M	Viral	Skin infestation	Immunological skin disorder	Viral	1	1
507	61	M	Suspicious tumor	Benign tumor	Immunological skin disorder	Suspicious tumor	1	1
508	69	M	Eczema	Fungal Infection	Psoriasis	Eczema	1	1
509	65	M	Eczema	Immunological skin disorder	Psoriasis	Eczema	1	1
510	22	M	Alopecia	Fungal Infection	Bacterial Infection	Alopecia	1	1
511	21	F	Acne & Rosacea	Alopecia	Suspicious tumor	Acne & Rosacea	1	1
512	24	M	Viral	Acne & Rosacea	Immunological skin disorder	Viral	1	1
513	24	F	Acne & Rosacea	Suspicious tumor	Skin infestation	Acne & Rosacea	1	1
514	30	M	Alopecia	Benign tumor	Acne & Rosacea	Alopecia	1	1
515	30	M	Acne & Rosacea	Viral	Immunological skin disorder	Viral	0	1
516	35	F	Viral	Eczema	Fungal Infection	Viral	1	1
517	24	M	Viral	Eczema	Immunological skin disorder	Viral	1	1
518	24	M	Acne & Rosacea	Benign tumor	Bacterial Infection	Acne & Rosacea	1	1
519	35	F	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
520	30	F	Eczema	Skin infestation	Fungal Infection	Fungal Infection	0	1
521	45	F	Viral	Fungal Infection	Eczema	Viral	1	1
522	17	F	Acne & Rosacea	Fungal Infection	Benign tumor	Acne & Rosacea	1	1
523	41	M	Fungal Infection	Eczema	Psoriasis	Fungal Infection	1	1
524	16	M	Acne & Rosacea	Immunological skin disorder	Benign tumor	Acne & Rosacea	1	1
525	16	M	Acne & Rosacea	Viral	Benign tumor	Acne & Rosacea	1	1
526	40	F	Viral	Fungal Infection	Benign tumor	Viral	1	1
527	16	M	Eczema	Benign tumor	Fungal Infection	Benign tumor	0	1
528	15	M	Acne & Rosacea	Suspicious tumor	Immunological skin disorder	Acne & Rosacea	1	1
529	26	M	Alopecia	Bacterial infection	Viral	Alopecia	1	1
530	35	M	Viral	Benign tumor	Immunological skin disorder	Viral	1	1
531	15	F	Acne & Rosacea	Benign tumor	Alopecia	Acne & Rosacea	1	1
532	22	M	Acne & Rosacea	Benign tumor	Suspicious tumor	Acne & Rosacea	1	1
533	13	F	Alopecia	Benign tumor	Acne & Rosacea	Alopecia	1	1
534	50	F	Fungal Infection	Skin infestation	Eczema	Eczema	0	1
535	15	M	Skin infestation	Eczema	Viral	Skin infestation	1	1

536	20	M	Acne & Rosacea	Fungal Infection	Viral	Acne & Rosacea	1	1
537	9	M	Fungal Infection	Alopecia	Eczema	Fungal Infection	1	1
538	10	F	Alopecia	Immunological skin disorder	Viral	Alopecia	1	1
539	6	M	Alopecia	Benign tumor	Eczema	Alopecia	1	1
540	22	M	Acne & Rosacea	Immunological skin disorder	Viral	Acne & Rosacea	1	1
541	15	F	Acne & Rosacea	Suspicious tumor	Benign tumor	Acne & Rosacea	1	1
542	15	M	Skin infestation	Immunological skin disorder	Fungal Infection	Skin infestation	1	1
543	14	F	Alopecia	Benign tumor	Immunological skin disorder	Alopecia	1	1
544	10	M	Alopecia	Benign tumor	Immunological skin disorder	Alopecia	1	1
545	10	M	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
546	14	M	Pigmentation	Immunological skin disorder	Eczema	Skin infestation	0	0
547	16	F	Fungal Infection	Viral	Immunological skin disorder	Fungal Infection	1	1
548	30	F	Benign tumor	Eczema	Immunological skin disorder	Benign tumor	1	1
549	35	M	Viral	Benign tumor	Immunological skin disorder	Viral	1	1
550	24	F	Immunological skin disorder	Benign tumor	Bacterial Infection	Immunological skin disorder	1	1
551	30	M	Pigmentation	Immunological skin disorder	Suspicious tumor	Pigmentation	1	1
552	73	M	Suspicious tumor	Psoriasis	Benign tumor	Suspicious tumor	1	1
553	23	F	Acne & Rosacea	Benign tumor	Immunological skin disorder	Acne & Rosacea	1	1
554	14	F	Immunological skin disorder	Acne & Rosacea	Benign tumor	Acne & Rosacea	0	1
555	63	M	Suspicious tumor	Pigmentation	Immunological skin disorder	Suspicious tumor	1	1
556	14	M	Alopecia	Acne & Rosacea	Immunological skin disorder	Alopecia	1	1
557	20	F	Acne & Rosacea	Benign tumor	Viral	Acne & Rosacea	1	1
558	18	M	Alopecia	Acne & Rosacea	Immunological skin disorder	Alopecia	1	1
559	40	M	Fungal Infection	Benign tumor	Eczema	Fungal Infection	1	1
560	55	M	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
561	10	M	Alopecia	Acne & Rosacea	Psoriasis	Alopecia	1	1
562	1	F	Benign tumor	Eczema	Fungal Infection	Benign tumor	1	1
563	20	M	Alopecia	Benign tumor	Acne & Rosacea	Alopecia	1	1
564	35	F	Viral	Bacterial infection	Fungal Infection	Viral	1	1
565	5	F	Viral	Bacterial infection	Immunological skin disorder	Viral	1	1

566	20	F	Acne & Rosacea	Benign tumor	Immunological skin disorder	Acne & Rosacea	1	1
567	35	F	Immunological skin disorder	Bacterial infection	Fungal Infection	Viral	0	0
568	13	M	Alopecia	Benign tumor	Fungal Infection	Alopecia	1	1
569	23	F	Acne & Rosacea	Benign tumor	Fungal Infection	Acne & Rosacea	1	1
570	30	M	Pigmentation	Immunological skin disorder	Bacterial Infection	Pigmentation	1	1
571	20	F	Skin infestation	Viral	Suspicious tumor	Viral	0	1
572	19	F	Fungal Infection	Immunological skin disorder	Benign tumor	Fungal Infection	1	1
573	4	M	Immunological skin disorder	Fungal Infection	Viral	Viral	0	1
574	25	M	Alopecia	Viral	Fungal Infection	Alopecia	1	1
575	26	F	Acne & Rosacea	Benign tumor	Viral	Acne & Rosacea	1	1
576	24	M	Immunological skin disorder	Suspicious tumor	Viral	Viral	0	1
577	26	F	Viral	Psoriasis	Benign tumor	Viral	1	1
578	18	M	Acne & Rosacea	Alopecia	Bacterial Infection	Acne & Rosacea	1	1
579	22	M	Acne & Rosacea	Immunological skin disorder	Viral	Acne & Rosacea	1	1
580	26	F	Acne & Rosacea	Benign tumor	Alopecia	Acne & Rosacea	1	1
581	66	M	Suspicious tumor	Immunological skin disorder	Eczema	Suspicious tumor	1	1
582	6	F	Eczema	Viral	Benign tumor	Viral	0	1
583	35	F	Psoriasis	Eczema	Immunological skin disorder	Psoriasis	1	1
584	66	F	Suspicious tumor	Skin infestation	Benign tumor	Suspicious tumor	1	1
585	26	M	Immunological skin disorder	Eczema	Bacterial Infection	Immunological skin disorder	1	1
586	68	M	Suspicious tumor	Benign tumor	Skin infestation	Suspicious tumor	1	1
587	7	M	Viral	Immunological skin disorder	Bacterial Infection	Viral	1	1
588	28	M	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
589	28	M	Psoriasis	Fungal Infection	Eczema	Psoriasis	1	1
590	30	M	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection	1	1
591	40	M	Eczema	Immunological skin disorder	Fungal Infection	Fungal Infection	0	1
592	28	M	Fungal Infection	Eczema	Psoriasis	Fungal Infection	1	1
593	28	F	Eczema	Psoriasis	Fungal Infection	Eczema	1	1
594	48	M	Bacterial infection	Eczema	Benign tumor	Bacterial Infection	1	1
595	28	M	Bacterial infection	Acne & Rosacea	Viral	Bacterial Infection	1	1

596	30	F	Fungal Infection	Eczema	Immunological skin disorder	Fungal Infection		1		1
597	27	M	Benign tumor	Suspicious tumor	Fungal Infection	Benign tumor		1		1
598	36	F	Benign tumor	Suspicious tumor	Fungal Infection	Benign tumor		1		1
599	48	F	Suspicious tumor	Benign tumor	Fungal Infection	Benign tumor		0		1
600	56	M	Bacterial infection	Skin infestation	Fungal Infection	Bacterial Infection		1		1