**SKIN DISORDER PREDICTION**

**Understand the data set:**

It is a skin disorder data set contains 34 ( 33 categorical features values varies from 0 to 4 and Age is discrete Numerical feature) features and based on this features behaviour/distribution we have to predict the class of Skin disease. We have got 6 classes of skin diseases

1- psoriasis, 2- seborrheic dermatitis, 3- lichen planus, 4- pityriasis rosea, 5- chronic dermatitis, 6- pityriasis rubra pilaris

**1. Psoriasis:** A chronic skin disease which results in scaly, often itchy areas in patches. It can  **causes a rash with itchy, scaly patches, most commonly on the knees, elbows, trunk and scalp.** Psoriasis is a common, long-term (chronic) disease.

* Very common (More than 1 crore cases per year in India)
* Treatments can help manage condition, no known cure
* Often requires lab test or imaging
* Common for ages 18-35
* Family history may increase likelihood
* Psoriasis typically results in scaly, silvery, sharply defined skin patches.
* It’s commonly located on the [scalp](https://www.healthline.com/health/scalp-psoriasis-pictures), elbows, knees, and lower back.
* It may be itchy or asymptomatic (producing or showing no symptoms).

**2. seborrheic** **dermatitis:** A common skin condition affecting the scalp and resulting in scaly skin. It causes scaly patches, red skin and stubborn dandruff. Seborrheic dermatitis can also affect oily areas of the body, such as the face, sides of the nose, eyebrows, ears, eyelids and chest.

* Rarely requires lab test or imaging
* More common in males

**3. Lichen planus:**

A chronic inflammatory condition that affects the skin, nails, hair, and mucous membranes, characterised by purplish, itchy, flat bumps.

Lichen planus (LIE-kun PLAY-nus) is a condition that can cause swelling and irritation in the skin, hair, nails and mucous membranes. On the skin, lichen planus usually appears as purplish, itchy, flat bumps that develop over several weeks. In the mouth, vagina and other areas covered by a mucous membrane, lichen planus forms lacy white patches, sometimes with painful sores.

* Purplish, flat bumps, most often on the inner forearm, wrist or ankle, and sometimes the genitals
* Itching
* Blisters that break to form scabs or crusts
* Lacy white patches in the mouth or on the lips or tongue
* Painful sores in the mouth or vagina
* Hair loss
* Change in scalp color
* Nail damage or loss
* Common for ages 35-50
* more common in females
* Rarely requires lab test or imaging
* Family history may increase likelihood

**4. Pityriasis rosea:**

A type of harmless skin rash which results in red scaly raised patches that usually occurs on chest, abdomen or back.

Pityriasis rosea is a rash that often begins as an oval spot on the face, chest, abdomen or back. This is called a herald patch and may be up to 4 inches (10 centimetres) across. Then you may get smaller spots that sweep out from the middle of the body in a shape that looks like drooping pine-tree branches. The rash can be itchy.

* Common for ages 10-35

**5. chronic dermatitis:**

Dermatitis is a general term that describes a common skin irritation. It has many causes and forms and usually involves itchy, dry skin or a rash. Or it might cause the skin to blister, ooze, crust or flake off. Three common types of this condition are atopic dermatitis (eczema), seborrheic dermatitis and contact dermatitis.

* Often requires lab test or imaging
* Family history may increase likelihood

Symptoms include

* Dry, cracked, scaly skin
* Redness
* Itching, which may be intense
* Painful lesions
* Change in colour where skin rashes appear
* Thickened skin where rashes appear
* Fluid filled blisters

**6- pityriasis rubra pilaris**

Pityriasis rubra pilaris (PRP) is a rare skin disease. It causes constant inflammation and shedding of the skin. PRP can affect parts of your body or your entire body. The disorder may start in childhood or adulthood. PRP affects males and females equally.

Link: [Pityriasis Rubra Pilaris: Symptoms, Treatments, and More (healthline.com)](https://www.healthline.com/health/pityriasis-rubra-pilaris)

**What is histopathology?**

The science or study dealing with the cytologic and histologic structure of abnormal or diseased tissue. The microscopic study of disease processes in tissues. The study of diseased tissues at a minute (microscopic) level.

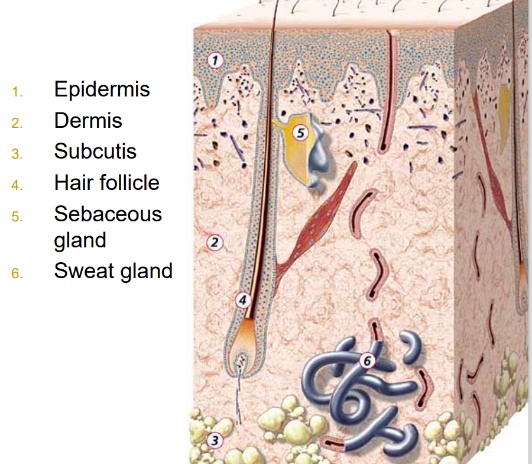
Out of 34 there are 11 Clinical features, 1 is Age and 22 are histopathological features The values of the histopathological features are determined by an analysis of the samples under a microscope

* The family history feature has the value 1 if any of these diseases has been observed in the family, and 0 otherwise
* Clinical Features are
  + 1: erythema ( 0 - 3 )
  + 2: scaling ( 0 -3 )
  + 3: definite borders (0 -3 )
  + 4: itching ( 0 – 3 )
  + 5: koebner phenomenon ( 0 – 3 )
  + 6: polygonal papules ( 0 – 3 )
  + 7: follicular papules ( 0 – 3 )
  + 8: oral mucosal involvement ( 0 – 3 )
  + 9: knee and elbow involvement ( 0 – 3 )
  + 10: scalp involvement ( 0 – 3 )
  + 11: family history, (0 or 1)
* Histopathological features are
  + 12: melanin incontinence ( 0 – 3 )
  + 13: eosinophils in the infiltrate ( 0 – 2 )
  + 14: PNL infiltrate ( 0 – 3 )
  + 15: fibrosis of the papillary dermis( 0 – 3 )
  + 16: exocytosis ( 0 – 3 )
  + 17: acanthosis ( 0 – 3 )
  + 18: hyperkeratosis ( 0 – 3 )
  + 19: parakeratosis ( 0 – 3 )
  + 20: clubbing of the rete ridges ( 0 – 3 )
  + 21: elongation of the rete ridges ( 0 – 3 )
  + 22: thinning of the suprapapillary epidermis ( 0 – 3 )
  + 23: spongiform pustule ( 0 – 3 )
  + 24: munro microabcess ( 0 – 3 )
  + 25: focal hypergranulosis ( 0 – 3 )
  + 26: disappearance of the granular layer ( 0 – 3 )
  + 27: vacuolisation and damage of basal layer ( 0 – 3 )
  + 28: spongiosis ( 0 – 3 )
  + 29: saw-tooth appearance of\_retes ( 0 – 3 )
  + 30: follicular horn plug ( 0 – 3 )
  + 31: perifollicular parakeratosis ( 0 – 3 )
  + 32: inflammatory monoluclear infiltrate ( 0 – 3 )
  + 33: band-like infiltrate ( 0 – 3 )
* 34: Age (linear)
* Here, 0 indicates that the feature was not present, 3 indicates the largest amount possible, and 1, 2 indicate the relative intermediate values

**Erythema** - superficial reddening of the skin, usually in patches, as a result of injury or irritation causing dilatation of the blood capillaries

**Scaling** -  tending to crack and come away in thin pieces on the skin

**Definite Borders:**



* Basal membrane (basement membrane) is definite border between dermis and epidermis.
* Basal cells provide continuous rejuvenation of the skin, also contains pigment cells - melanocytes

**koebner\_phenomenon**: is a psoriatic rash that appears around an injury, such as a cut or a burn. The rash can show up anywhere on the body where trauma to the skin has occurred.

The Koebner phenomenon describes the appearance of new skin lesions of a pre-existing dermatosis on areas of cutaneous injury in otherwise healthy skin. It is also known as the Köbner phenomenon and isomorphic response.

The production of inflammatory substances and neuropeptides has been postulated as a non-specific first step, triggering a secondary disease-specific process. The role of chemical messengers such as nerve growth factor (NGF) may be important.

Skin conditions that regularly manifest Koebner phenomenon are psoriasis, vitiligo and lichen planus. There have been reports of possible Koebner phenomenon in many other conditions.

A pseudo-Koebner response occurs with infections arising in an area of trauma, but represent transfer of virus into the damaged skin:

**Polygonal papules:**

* It is mostly affecting age group between 30 to 60 years
* It appear in the case of **lichen planus skin disease**

**Follicular hyperkeratosis:**

Folliculitis is a common skin condition that happens when hair follicles become inflamed. It's often caused by an infection with bacteria. At first it may look like small pimples around the tiny pockets from where each hair grows (hair follicles).

* It can cause due an adverse reaction to a medicine also

Types of folliculitis, with the most common listed first, include:

* **Bacterial folliculitis.** This common type is a rash of itchy, pus-filled bumps. It occurs when hair follicles become infected with bacteria, usually Staphylococcus aureus (staph). Staph bacteria live on the skin all the time. And they can cause problems when they enter the body through a cut or other wound.
* **Hot tub rash (pseudomonas folliculitis).** This type is a rash of round, itchy bumps that can show up 1 to 2 days after exposure to the bacteria that causes it. Hot tub folliculitis is caused by pseudomonas bacteria, which can be found in hot tubs, water slides and heated pools in which the chlorine and pH levels aren't correct.
* **Razor bumps (pseudofolliculitis barbae).** This rash can look like folliculitis but it's caused by ingrown hairs, not infected follicles. It mainly affects people with curly hair who shave too close and is most noticeable on the face and neck. People who get bikini waxes may get razor bumps in the groin area.
* **Pityrosporum (pit-ih-ROS-puh-rum) folliculitis.** This type is a rash of itchy, pus-filled bumps, most often on the back and chest. It's caused by a yeast infection.
* **Gram-negative folliculitis.** This type causes pus-filled bumps around the nose and mouth. It sometimes develops in people who are receiving long-term antibiotic therapy for acne.
* **Eosinophilic (e-o-sin-o-FILL-ik) folliculitis.** This type causes intense itching and recurring patches of bumps and pimples that form near hair follicles of the face and upper body. It mainly affects people with HIV/AIDS. The cause of this condition isn't fully understood.
* **Boils (furuncles) and carbuncles.** These occur when hair follicles become deeply infected with staph bacteria. A boil tends to appear suddenly as a painful inflamed bump. A carbuncle is a cluster of boils.
* **Sycosis barbae.** This type affects people who shave

**Oral mucosal involvement:**

Oral mucosal lesions range from mere alteration in color, variations in surface characteristics, swelling, or loss of integrity of the oral mucosal surface.

Multiple etiologic factors contribute to these group of lesions, including microbial infections, local trauma or irritation, [systemic diseases](https://www.sciencedirect.com/topics/medicine-and-dentistry/systemic-disease), and consumption of tobacco, [betel](https://www.sciencedirect.com/topics/medicine-and-dentistry/betel) quid, and alcohol

The prevalence of oral mucosal lesions widely varies among different countries and populations and with age, systemic health of the individuals and tobacco habits. Epidemiologic studies, though fewer compared with reports on dental caries or [periodontal diseases](https://www.sciencedirect.com/topics/medicine-and-dentistry/edentulism), provide information on the prevalence of mucosal lesions in global population which range from 4.9% to 64.7%. The overall prevalence reported in a Chinese population was 10.8%, while in Lebanese sample was 61.8%. Amarodi et al. reported a prevalence of 31.7% of [oral mucosal lesion](https://www.sciencedirect.com/topics/nursing-and-health-professions/oral-mucosal-disease) in the teenager group [21–23].

The epidemiologic studies have demonstrated diverse prevalence rates in habits related oral mucosal lesions in different populations. Prevalence of these diseases are more in Indian population owing to the increased tobacco consumption. Along with various tobacco related oral mucosal lesions such as nicotinic [stomatitis](https://www.sciencedirect.com/topics/medicine-and-dentistry/stomatitis), tobacco pouch [keratosis](https://www.sciencedirect.com/topics/medicine-and-dentistry/keratosis), smoker’s [melanosis](https://www.sciencedirect.com/topics/nursing-and-health-professions/melanosis), mild keratosis of the [palate](https://www.sciencedirect.com/topics/medicine-and-dentistry/palate), and chewer's [mucosa](https://www.sciencedirect.com/topics/medicine-and-dentistry/mucosa), high prevalence of the oral potentially malignant disorders such as [leukoplakia](https://www.sciencedirect.com/topics/medicine-and-dentistry/leukoplakia" \o "Learn more about leukoplakia from ScienceDirect's AI-generated Topic Pages) (10.1%), and oral submucous [fibrosis](https://www.sciencedirect.com/topics/nursing-and-health-professions/fibrosis) (4.7%) also have been reported [24,25].

**Knee and elbow involvement:**

The knees and elbows are target spots for**psoriasis**, and the itch could be the start of the problem.

**Causes of Dark Knees and Elbows:**

Several factors might be responsible for the overproduction of melanin which causes hyperpigmentation or darkening of knees and elbows.

* Inflammatory skin diseases such as **atopic dermatitis or psoriasis**.
* Side-effects of certain medicines such as contraceptive pills.
* Hyperpigmentation due to a previous wound or inflammation.

**Scalp involvement:**

Some of the skin disease can cause on scalp are

* Seborrhoeic Dermatitis (Dandruff)
* Psoriasis Of The Scalp
* Contact Dermatitis and Skin Allergies
* Lichen Planus
* Discoid Lupus Erythematosus (DLE)
* Alopecia Areata

**HISTOPATHOLOGICAL ATTRIBUTE:**

**melanin incontinence:**

Spillage of melanin from the basal \*keratinocytes into the underlying connective tissue. It is commonly found in inflammatory lesions

**eosinophils in the infiltrate:**

Eosinophils are a type of white blood cell (i.e., leukocytes) that are secreted in response to allergic reactions, skin conditions, parasitic and fungal infections, and autoimmune diseases, as well as certain cancers and bone marrow disorders. Eosinophils are specifically granulocytic leukocytes produced in the bone marrow, and can usually be found in the connective tissues, especially in the thymus, gastrointestinal tract, spleen, lymph nodes, ovaries, and uterus.

Eosinophils play a role in the immune system by helping fight infections and increasing inflammation in the body. In the typical day-to-day functioning of the body, the absolute eosinophil count (i.e., a type of blood test that tells you the number of eosinophils circulating in the body) can be found in relatively low numbers, usually around 1-4% of the total white blood cell count in circulation. When the immune system is activated, the number of eosinophils released increases, and the eosinophils flock to the site of an infection to help combat the infectious agent or help incite an inflammatory reaction.

**PNL infiltrate:**

The term **pulmonary infiltrate** is considered a context-dependent, non-specific and imprecise descriptive term when used in radiology reports (plain film or CT).

From a pathophysiological perspective, the term "infiltrate" refers to “an abnormal substance that accumulates gradually within cells or body tissues” or “any substance or type of cell that occurs within or spreads as through the interstices (interstitium and/or alveoli) of the lung, that is foreign to the lung, or that accumulates in greater than normal quantity within it”

**fibrosis of the papillary dermis:**

The papillary dermis is composed of loose connective tissue and form papillae the intertwine with the rete ridges of the epidermis

fibrosis is characterized by increased levels of growth factors and profibrotic molecules, activation and differentiation of fibroblasts into myofibroblasts, and aberrant formation of extracellular matrix.

**Exocytosis:**

a process by which the contents of a cell vacuole are released to the exterior through fusion of the vacuole membrane with the cell membrane.

**Acanthosis**: A skin pigmentation problem characterised by dark, velvety, and thick patches of skin usually formed in the skin folds and creases.

More common in females

Family history may increase likelihood for some types

**Hyperkeratosis:**

Hyperkeratosis refers to thickening of your skin's outer layer. This layer is made of a protein called keratin. Keratin can start to overgrow in many different conditions

* **Calluses**: A callus is an area of thickened skin that usually occurs on the feet, but can also grow on the fingers. Unlike a corn (see below), a callus is usually of even thickness.
* **Corns**: A lesion that typically develops on or between the toes. A corn usually has a center lesion of very hard keratin with an outer ring of hard tissue that is slightly softer.
* **Eczema**: This condition causes red, itching skin that may appear in patches or as small bumps
* **Epidermolytic hyperkeratosis**: This condition causes very red skin and severe blistering of the skin at birth. As the baby ages, they will develop areas of thickened skin (hyperkeratosis), particularly over their joints.
* **Leukoplakia**: This condition causes thick, white patches to build up inside the mouth.
* **Plaque psoriasis**: This condition can cause an excess buildup of skin cells that are often silvery and scaled.

**Parakeratosis:**

Parakeratosis is characterized by the formation of small red patches and scales (tiny skin scales) on the skin. This lesion is found in patients with psoriasis, eczema, or Gibert’s pink tincture. In infants, it is often associated with diaper rash or cephalic dermatitis.

**Clubbing** **of the** **rete** **ridges:**

means downgrowths of epithelium surrounding the connective tissue papillae in the irregular internal surface of the epidermis.

**Elongation of the rete ridges:**

it can happen if psoriasis is the disease

**Thinning of the suprapapillary epidermis**

Epidermal changes in**Dowling-Degos disease** include hyperkeratosis, often with small horn cysts and thinning of the suprapapillary epidermis.

**Spongiform pustule**

spongiform pustule of Kogoj a focal area of spongiosis beneath the stratum corneum of the epidermis, lined with edematous cells and containing neutrophils in the intercellular spaces; it is a cardinal sign of active psoriasis and is also found in other dermatoses such as seborrheic dermatitis. Cf. *Munro microabscess.*

**Munro microabcess**

Munro's microabscess is an**abscess (collection of neutrophils) in the stratum corneum of the epidermis** due to the infiltration of neutrophils from papillary dermis into the epidermal stratum corneum. They are a cardinal sign of psoriasis where they are seen in the hyperkeratotic and parakeratotic areas of the stratum corneum.

**Focal hypergranulosis**

Hypergranulosis is an**increased thickness of the stratum granulosum**. It is seen in skin diseases with epidermal hyperplasia and orthokeratotic hyperkeratosis

**Disappearance of the granular layer**

**granular layer**) is a thin layer of cells in the epidermis lying above the stratum spinosum and below the stratum corneum (stratum lucidum on the soles and palms

**Vacuolisation and damage of basal layer**

**Spongiosis**

Spongiosis is**mainly intercellular edema between keratinocytes in** the epidermis. The edema may cause keratinocytes to become elongated and stretched, eventually producing spongiotic intraepidermal vesicles

**Saw-tooth appearance of retes**

Typical findings include hyperparakeratosis or hyperorthokeratosis with thickening of the granular layer, acanthosis with intracellular edema of the spinous cells in some instances, the development of a ‘saw tooth’ appearance of the**rete pegs**.

It appears in Lichen Planus

**Follicular horn plug**

**Perifollicular parakeratosis**

perifollicular\_parakeratosis:**keratinization** characterized by the retention of nuclei in tissues surrounding skin follicles.

**Inflammatory monoluclear infiltrate**

inflammatory\_mononuclear\_inflitrate: increase in the number of infiltrating mononuclear cells in the skin.

**Band-like infiltrate**

basal epidermis in a banded pattern