**Introduction**:

Genetic disease prediction represents a modern healthcare which prioritize holistic (i.e., patient’s physical, mental, emotional, social and spiritual health where being unwell in one area can affect other’s) patient well-being and integrates technology for better care, processes and outcomes. Where deep learning and machine learning improves diagnostic accuracy, speed and efficiency by analysing medical images and patient data. As our understanding of genetic deepens, the ability to predict disease like diabetes, Polycystic Ovary Syndrome (PCOD) and conditions like hair loss has grown significantly. The diseases like these often have complex genetic components, making early detection and personalized intervention which helps in identifying the best treatment option for a patient based on their characteristics, also increases the likelihood of successful treatments, reduces side effects, allows better disease prevention and most importantly increases patient engagement, reduce health care costs, also promotes research and innovation.

PCOD/PCOS is a condition that affects the ovaries of women during their reproductive years (ages 15 to 45), 5 to 10% of women in this age group experience PCOS [1]. It occurs due to imbalance of hormones, specifically when there’s an increase in androgens (male hormones) in women which leads to formation of small cysts (i.e., fluid- filled sacs that develop on (or) with in the ovaries), it can gradually grow and interface with the ovulation. In result, women with PCOS may be have trouble getting pregnant. Women with PCOS might have a chance of developing type 2 diabetes. Common symptoms include irregular periods, heavy menstrual bleeding, acne, oily skin, weight gain, headaches, mood swings, sleep problems and excessive hair growth on the face, chest, back and stomach [1] Where PCOS is considered as one if life style – related condition, the exact causes were unclear. Although there isn’t a complete cure, regular exercise maintains a proper weight and healthy diet can help managing the symptoms. Early prediction can help slow or stop the progression of PCOS/PCOD and also enables more proactive, preventive, and personalized healthcare approaches, resulting in better long-term outcomes for patients.

Machine Learning algorithms are trained on large dataset of genetic information, where they can identify patterns and markers associated with these conditions. Genetic markers can help link an inherited disease with the responsible gene where DNA segments close to each other on a chromosome tend to be inherited together. For instance, in diabetes, specific genetic variants may predispose individuals to higher risks and machine learning techniques can analyse these variants alongside other factors to predict the chances of person will develop a disease. This helps in enhancing early detection and also enables more personalized treatment strategies.

Deep learning offer’s greater potential by processing and analysing complex data set’s, such as entire genomes (or) multi-omics data which helps in understanding of molecular changes in biology by combining data from multiple “omens” (i.e., which means including genome, epigenome, transcriptome, proteome, metabolome and microbiome etc.,). In case of PCOD, where multiple genes and environmental factors interact, deep learning techniques can ably understand this complexity to identify individuals at risk with greater accuracy. Hence, this predictive capability empowers healthcare providers to recommend proactive lifestyle changes long before the condition manifests.

Similarly, Genetic predisposition to hair loss is a natural condition that’s caused by a combination of genetics, hormone levels and aging. It’s the most common causes of hair loss and affects about 50% of men and women. People with a genetic predisposition to hair loss have a higher chance of developing it if their parent’s or grant parents have also experienced it. Genetic predisposition to hair loss is a condition that can impact self-esteem and quality of life, can be analysed using these technologies. By identifying specific genetic marker’s associate with hair thinning (or) baldness, deep leaning models can help predict the like hood of hair loss. This allows us for early intervention, such as targeted therapies (or) lifestyle modification which can significantly delay (or) mitigate the effects