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Perspective

The Rise of Personalized Medicine: Perspective

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Introduction

Personalized Medicine (PM) focuses on creating a therapy that is as unique as the patient's illness. The strategy depends on locating genetic, epigenomic, and clinical data that enables advancements in our comprehension of how a person's particular genomic portfolio renders them susceptible to specific illnesses. The PM technique is a full extension of the old approach (One-Size-Fits-All) to improve our capacity to anticipate which medical therapies, based on the patient's particular genetic profile, will be safe and successful for them and which ones will not. The use of PM has the potential to improve patient quality of life and lengthen patients' lives while requiring less money and time.

By enhancing the use of current biomarkers and detecting early genomic and epigenomic processes in disease development, including carcinogenesis, knowledge of PM enables earlier illness identification. The PM strategy favours proactive action over just reactive behaviour and places a heavy emphasis on preventative care. This method postpones or eliminates the need for more severe treatments, which are often less tolerable and have higher quality of life and monetary implications. Globally, government-funded healthcare systems are under more strain as a result of rising healthcare expenses, particularly when it comes to end-of-life care. PM may improve the efficacy of already used therapies and eliminate the inherent drawbacks of non-PM methods.

A doctor can choose a treatment for a patient based on their genetic profile, which may not only minimise negative side effects and ensure a more successful outcome, but also be less cost-effective than a "trial-and-error" approach to disease treatment. PM is a young but rapidly expanding field of healthcare. Healthcare expenses are continuing to rise as a result of the less effective non-PM ('trial-and-error') strategy, which can result in medication toxicity, serious side effects, reactive therapy, and misdiagnosis. Increased patient classification will make it possible to use PM and proactive treatment regimens more effectively, lowering costs and improving quality of life.

Description

The first instances of personalised treatment may be found in the distant past, thousands of years ago. Since then, several therapeutic philosophies have been developed. However, even today, traditional treatments do not account for a person's unique traits and genetic makeup, failing to be effective in certain circumstances as a result. The need for a more individualised and efficient course of therapy eventually gave rise to the scientific subfield known as "personalised medicine." Personalized medicine has been recognised as the next generation of diagnosis and therapy thanks to the various technical advances in this area. Although customised medicine has received a lot of attention recently, there are still a number of barriers preventing its use in clinical settings. The COVID-19 epidemic has recently brought these limits to light.

This overview highlights significant milestones attained during the course of the "journey" of customised medicine. It emphasises the need for new diagnostic instruments and therapy regimens based on individuals' genetic backgrounds by starting with the treatment of malaria as a first more individualised therapeutic strategy. Additionally, it intends to increase public knowledge of the present drawbacks and the need for a tailored approach to get beyond healthcare issues and, in turn, the current crisis.

Breast cancer (BC) is more likely to strike women who have

Pathogenic Variants (PVs) in cancer-predisposing genes such BRCA1, BRCA2, PALB2, CHEK2 and ATM, and Epithelial Ovarian Cancer (EOC), which is the histological form of hereditary ovarian cancer that these genes are most associated with. For the three breast/ovary genes, women are now estimated to have a lifetime risk of 35%–85% for breast cancer and a lifetime risk of 5%–60% for ovarian cancer. The risk estimates provided to women also include a wide range (e.g., 65%-79% lifetime risk for BC in BRCA1) and do not presently take into account one's own genetic, lifestyle, or hormonal modifiers, despite the fact that it is well recognised that these factors affect risk.

Clinical therapy of women with high-risk PVs (BRCA1/2 and PALB2) involves chemoprevention, risk-reducing surgery, and increased monitoring. The focus is primarily on surveillance and chemoprevention than surgical risk reduction for moderate-risk PVs (i.e., CHEK2 and ATM). While interventions like chemoprevention, Bilateral Risk-Reducing Mastectomy (BRRM), and Risk-Reducing Bilateral Salpingo-Oophorectomy (RRBSO) can significantly lower the risks of breast and/or EOC, they also call for careful consideration, which includes weighing the risks of developing a potentially fatal cancer against any potential physical and mental side effects.

Individualized risk estimates are provided by multifactorial risk prediction models for the general population, women with a family history of cancer, and those with moderate- and high-risk PVs. These detailed risk models integrate data on the PV with additional genetic and non-genetic modifying variables, including family history, lifestyle (age at first pregnancy, use of oral contraceptives, BMI, and alcohol intake), and mammographic density.

Conclusion

As the amount of risk (clinical or perceived) has been demonstrated to impact the adoption of risk-management alternatives, individualised risk estimations may play a significant role in helping women make educated decisions about their clinical treatment. Individualized risk assessments can sometimes help identify those who would benefit from more aggressive early-detection methods (i.e., those at particularly high lifetime risk, or those with a high cancer risk at an early age). For instance, BRRM is typically not supplied to CHEK2 or ATM carriers, who are typically, assessed a lifetime risk of 20%–30%. Cancer Risk will often provide a lifetime risk of >35%, which would necessitate considering BRRM in accordance with UK NICE recommendations, for those carriers with a significant family history of breast cancer and accompanying risk factors. Personalized risk assessments, on the other hand, will also identify PV-carrying women who are at far reduced risk and who may choose to postpone or forego risk-reducing surgery or chemoprevention. In either case, individualised risk assessments will probably give medical practitioners more detailed knowledge about their patient's cancer risk, which might be useful throughout the counselling process.