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# Review on Non-Communicable Diseases in India and their Respective Diagnostic Platforms

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***Abstract:*** ***Non-communicable diseases (NCDs) increasing the burden in India. NCDs are viewed as pandemic because of the expanding pace of mortality and morbidity. Urbanization in India prompts undesirable ways of lifestyle, physical inactivity, biological, behavioral risk factors, and migration of the country metropolitan populace in India, the thought of different NCDs and their danger factors shows wide varieties across the populace. It's believed the health care system can curb the situation by managing preventive measures that allow controlling the threat.***
***Keywords:*** ***Non-communicable diseases (NCDs), mortality, morbidity.***

## I. INTRODUCTION

Non-communicable diseases are becoming a growing economic and healthcare burden. The (figure1) proportional mortality (% of total deaths, all ages, both sexes) of NCDs account for approximately 38 million (68 %) worldwide and approximately 5.87 million (60 %) of all deaths in India[32]. The incidence of mortality and morbidity rate is high in low-middle income countries [30]. The non-communicable diseases contribute for high mortality rate are cardiovascular disease, chronic lung disease, cancer, and diabetes mellitus [32] . The fact is that non-communicable diseases are interconnected, and one disease can be the cause of another. Non-communicable diseases can affect anyone, irrespective of their geographic location, lifestyle, gender, or age; however, risk factors are equally responsible for the effect, as shown in (figure2), which explains disease prevalence [33]. The rate of effect of NCDs varies widely in urban and rural areas. The reasons for this can be urbanization and migration in urban areas, as well as a lack of awareness, harmful practices, inefficient health facilities, and healthcare staff [31]. Disease management will be easier once the lower healthcare system is equipped with diagnostic tools and the ability to carry out action plans.

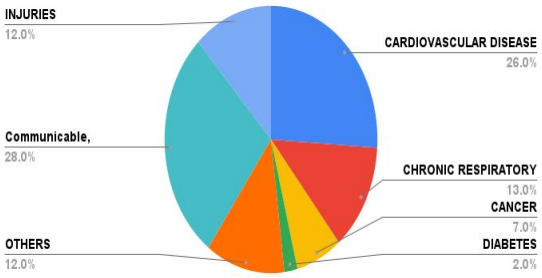


Figure1: Graphical representation of proportional (% of total deaths, all ages, both sexes)[37]

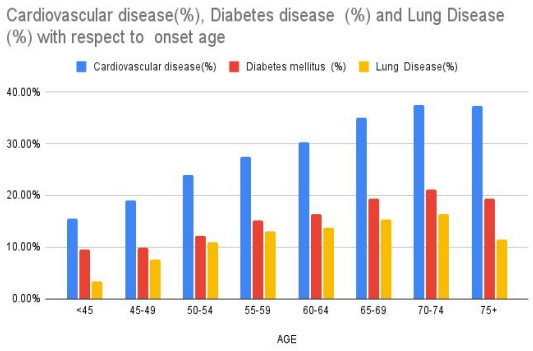


Figure2: Graphical representation of mortality Cardiovascular (%), diabetes (%) & lung diseases (%) with respect to age [31]

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## II. CARDIOVASCULAR DISEASE

Cardiovascular disease is regarded as a major cause of death and economic burden [32]. CVD refers to a group of diseases that include ischaemic heart disease (IHD), stroke, congenital heart disease, myocardial infarction, coronary heart disease (CHD), peripheral arterial disease, and rheumatic heart disease, among others[10]. According to data from the Longitudinal Ageing Study in India (LASI) – Wave 1 (2020), the occurrence of CVDs is 38% in females and 31% in males, respectively, and the population is more likely to suffer in urban areas (50%) than in rural areas (29 percent). (Figures 3, 4) show state-by-state data for stroke and ischaemic heart disease respectively. The mortality rate and chances of suffering from cardiovascular diseases are affected by factors such as poor nutrition, lack of exercise and physical activity, stress, lifestyle, urban-rural migration and obesity[22].

Furthermore, the studies revealed that genetics is an important factor, with the Low density lipoprotein receptor (LDLR) LDLR c.-139del DD genotype being considered a prognostic biomarker to detect acute myocardial infarction [24]. Patients with an acute myocardial infarction are expected to control their blood glucose, cholesterol, smoking, and systolic and diastolic blood pressure. COVID-19 patients with CVDs, on the other hand, increased the fatality rate by 6%, with complications including heart failure and acute cardiac injury [1].

Over time, as the burden of disease increased on the primary health care sector. The Real-Time ECG is an online application that monitors and detects arrhythmias in rural cardiac patients via Telemedicine rather than referring them to urban diagnostics [17]. ECG, Echocardiography, Coronary angiography, and Biomarkers are used in the other diagnosis. The pathways involved in disease progression and management of illnesses such as cardiomyopathy (HCM) and arrhythmogenic heart disease, researchers are using the CRISPR-Cas system to change illness-associated genes (ACM) [1].

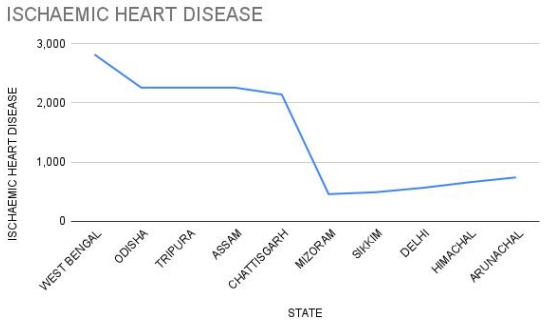


Figure 3: Graphical representation of
of disease burden in various states of India

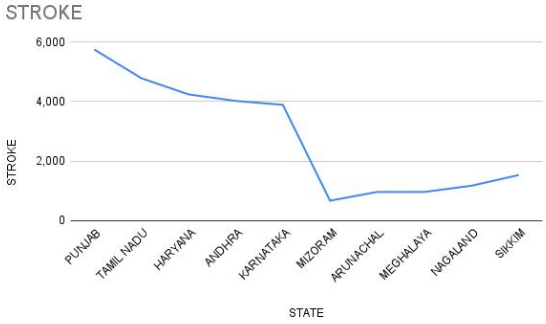


Figure 4 : Graphical representation
disease burden in various states of India

## III. CHRONIC LUNG DISEASE

Chronic lung diseases are the second most with high mortality in India. Chronic respiratory diseases increased their contribution to total disability-adjusted life year (DALYs) in India from 4.5 percent in 1990 to 6.4 percent in 2016[34] . Chronic lung diseases include chronic bronchitis, asthma, and chronic obstructive pulmonary disease (COPD) [18] .COPD and asthma were responsible for 75.6 percent and 20.0 percent of chronic respiratory disease DALYs in India in 2016, respectively[18]. According to data from the Longitudinal Ageing Study in India (LASI) – Wave 1 (2020), the occurrence of chronic lung disease is 7.7 percent in females and 8.9 percent in males, and the population is more likely to suffer in urban areas (6.6 percent) than in rural areas (6.0 percent).

COPD has been labelled a "smokers disease," and the likelihood of occurrence is higher in rural areas due to smoking habits [8]. Several studies have found that Biddi (tobacco flakes rolled in a tendu leaf), khaini, gutkha (Smokeless) (figure5). Smokers are more likely to develop lung disease and other non-infectious diseases than non-smokers [8]. The studies have shown that women are infected as a result of the use of fossil fuels in cooking, a lack of proper ventilation for non-smoking women, and the added threat to smoking women [20]. Furthermore, changes in nutrition during the neonatal period cause a metabolic-inflammatory response, which leads to COPD and asthma in the early years of life [3]. COVID-19 is another current leading factor, as patients who have been infected or are undergoing treatment (in ICU, ventilator breathing) are more likely to be diagnosed with chronic pulmonary disease [21]. As a result, in order to reduce COPD incidences, all risk factors must be considered equally. COPD is not curable, but an early diagnosis can help reduce mortality[36]. The issue with COPD diagnosis is a lack of awareness about the symptoms among both the general public and primary care physicians [15]. COPD is usually diagnosed based on the symptoms. In rural areas, the inhalation device is typically prescribed during the early stages of disease [15].

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Other diagnostic tests include:

1) A pulmonary function test, which determines inhaling, exhaling, and oxygen diffusion capacity. The spirometer, a six-minute walking test is also used to determine lung capacity.
2) Chest X-rays: can be used to diagnose emphysema and heart failure.
3) CT scan: this type of scanning is used to diagnose lung cancer and COPD.
4) Genetic lab testing: This test is usually performed with COPD history in the family. The alpha-1-antitrypsin deficiency results in genetic disorders with COPD.

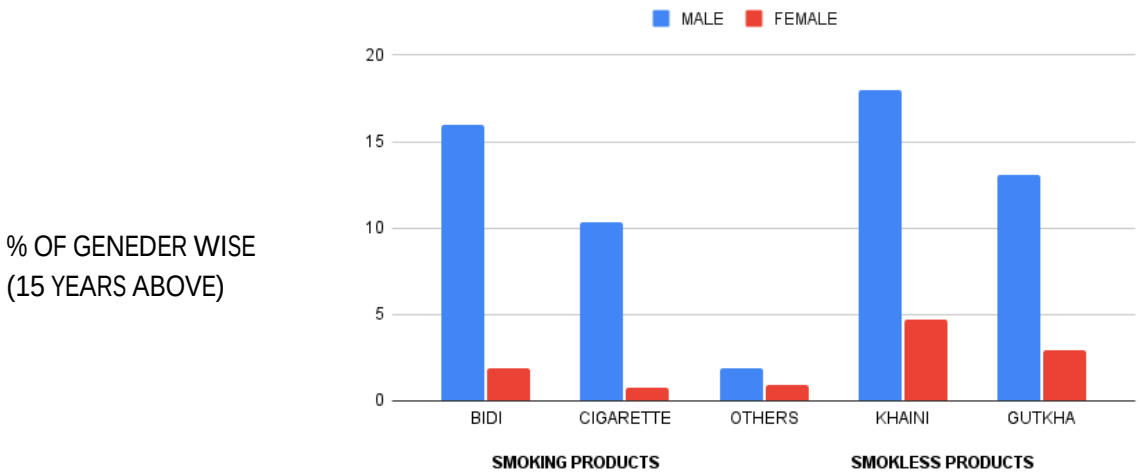


Figure5: Graphical representation of smoking and smokeless items with respect to gender (above 15 years)[36].

## IV. CANCER

Cancer is a non-communicable disease that contributes to a high morbidity and mortality rate. The number of new cases registered is approximately 11, 57,294 lakh, with a mortality rate of 7, 84,821 [11]. Genetic changes, tobacco use, radiation exposure (duration, degree, and dose), and lifestyle factors are all risk factors for cancer. Cancer prevalence varies by individual, and the risk factors are not always known [22]. As shown in (figure 6), the most common cancers are oral, lung, breast, cervical cancer and others. A trend analysis of five population-based cancer registries revealed that women contribute 39.4 percent of cancer (breast, cervix) to the country [5].

According to globocoan 2018, the population-developed breast cancers totalled 1, 62,468 cases and 87,090 deaths. The prevalence appears to be highest among women in their 30s or older [27]. Breast cancer affects 1 in every 22 and 1 in every 60 women in urban and rural areas, respectively [27].

Breast cancer can be result of inherited mutations in BRCA1 or BRCA2 gene. These genes, when mutated, can cause abnormal cell growth, which can lead to cancer [14]. Long-term HPV infection of carcinogenic types is required for cervical carcinogenesis, and host genetic differences in immune-responsive genes (IL-1B, TNFA,HLA, and IFNG,IL-10) and HPV E6/E7 interaction of oncoproteins and downstream genes may be the fundamental modifiers of cervical malignancy[13].

The cervical cancer mortality rate was 60,078 and people got affected and newly registered were 96,922 [27]. The average to get cervix cancer is mid 20's and late 50's. The woman in rural has a probability of developing cervical cancer due to lack of awareness, low sanitization practices, unprotected sex [23]. Men (16.1%) are likely to develop oral cancer than women (10.4%)[27] . The total number of deaths in both genders is 72616 [27]. Men are more prevalent to smoking tobacco and 80-90% of oral cancers [29]. The onset of oral cancer is in the early '50s and the survival rate depends on the time and stage of detection that is 82% in early-stage &27% in an advanced stage[27].

Breast cancer can be detected using morphological reference while cervical cancer can be detected only through regular Pap smear tests. Oral cancer is diagnosed evaluating by physical morphology, endoscopy, CT, MRI, PET& barium swallow test. Cost-effective procedures for treating different type of cancers are mentioned in Table1.

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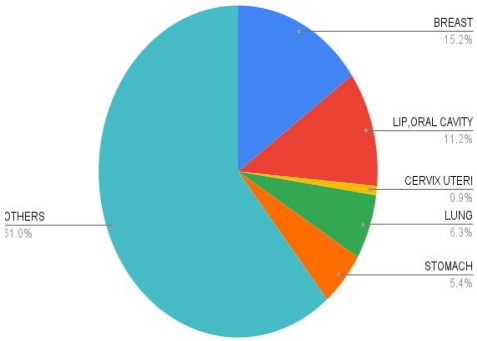


Figure6: Graphical representation of cancers in India (Globocoan 2018)

| Cancers | Cost of Treatment in India |
|---|---|
| Breast cancer | 2000-7000 USD |
| Cervical cancer | 291 – 617 USD |
| Oral Cancer | 3153 -6709 USD |

Table1: Cost-effective treatment of cancers in India

## V. DIABETES MELLITUS

Diabetes Mellitus is a group of metabolic disorders that can lead to chronic complications. The statistics depict the eventual rise over the last two decades. According to the International Diabetes Federation (IDF), this disease has affected 463 million people worldwide, with 77 million of them being Indians [26].The distribution of disease in the population varies in male and female with respect to age (fig7). The trend of the disease was high in urban when compared to rural [16].

As shown in the (figure 8) survey was conducted for diabetic maculopathy, diabetic retinopathy, and sight-threatening diabetic retinopathy for age ≥50 years were 7, 16.9, and 3.6 respectively. According to statistical data by the Longitudinal Ageing Study in India (LASI) – Wave 1 the occurrence of disease in population was more likely to suffer in urban areas(19.6%) when compared to rural areas(7.6%).

The disease risks are multifactorial it involves obesity, family history, stress, age, polycystic ovarian syndrome, environmental factors for diabetes type I, diabetes typeII, gestational diabetes. The low consumption of dietary fibres with zinc and serum zinc is one of the risk factors for diabetes [6]. The evidence states that there is a high prevalence of cancer among the population with diabetes [2]. The reason behind this connection was to share risk factors like obesity and this lead to study the of diabetic oncopathy [2]. According to literature around 11million people are to develop diabetic retinopathy in rural areas, so in order to curb the situation, telemedicine is introduced. In telemedicine, smartphones are used to take retina photographs and this process is soon to become functional [15]. The diabetic retinopathy test involves the evaluation with eye drops to observe symptoms like swelling, scare, etc. A contrast dye with Fluorescein angiography, Optical coherence tomography (OCT). The yearly expenditure for diabetes was INR 10,000 in urban areas and INR 6,260 in rural areas [19].

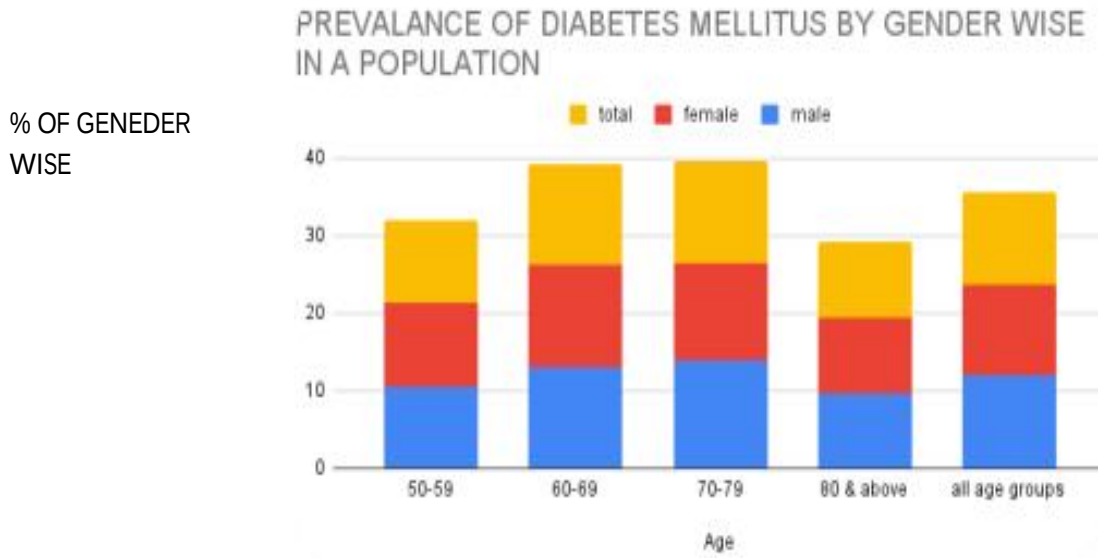


Figure 7: The graphical representation of diabetes mellitus by gender wise(%) in population

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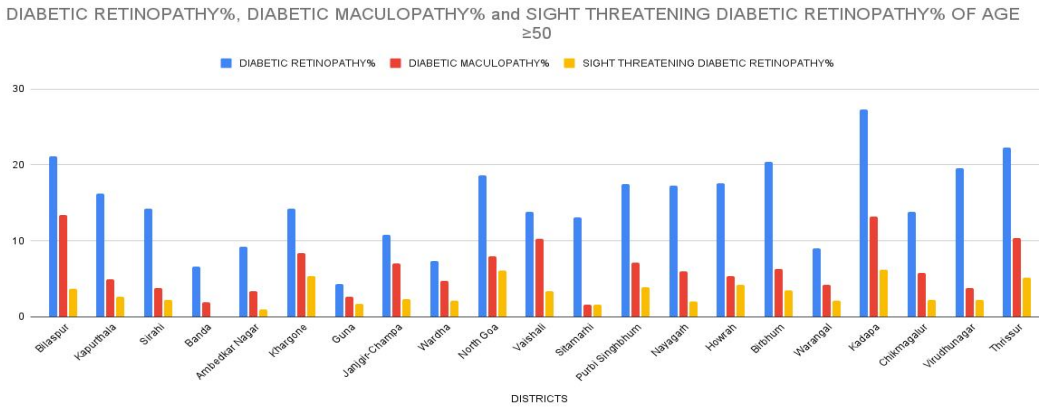


Figure8: The graphical representation of prevalence of diabetic retinopathy (%),diabetic maculopathy (%) and sight threatening diabetic retinopathy (%), of age ≥50

## VI. HEALTH CARE SYSTEM IN INDIA

In lower-middle-income nations, there is a rapid growth in non-communicable diseases and their fatality rate [30]. Many countries, including India, are concerned about the situation. NCD cells are provided by the Ministry of Health in districts for improved reach and awareness among the community, particularly in rural regions [28]. Although the system works with curing and disease prevention at health facilities, some states and districts still do not have the luxury of using health facilities. Even with NCD cells and hospitals, they lack essential medicines, and providing good facilities in lower health systems may yield positive results [7].In the health care system, the annual expenditure spent on non -communicable diseases in government & private hospitals varies in a wide range from past to future as shown in Table2 [7]. The training of doctors and nurses about NCD while assuring their experience. Providing basic diagnostic equipment and implementing all the health plans and strategies to manage non-communicable diseases [7].

| Non- Communicable Disease | 2006 | 2026 | 2051 |
|---|---|---|---|
| Government | 8,424 | 13,294 | 20,722 |
| Private | 45,734 | 72,535 | 114,413 |

Table 2: The tabular representation of non-communicable disease expenditure investment by health care sector[7]

## VII.CONCLUSION

The review focuses on non-communicable diseases, which pose a significant threat to high-income and lower-middle-income countries such as India. NCDs can affect any part of the population, regardless of gender, and are inherited genetically. People should eat a healthy diet and avoid tobacco and alcohol consumption. Screening and diagnosis from time to time will reduce the impact, tele-medicine will facilitate future processes, as well as preventive measures and the management of government plans and investments, all of which will help reduce the health burden.

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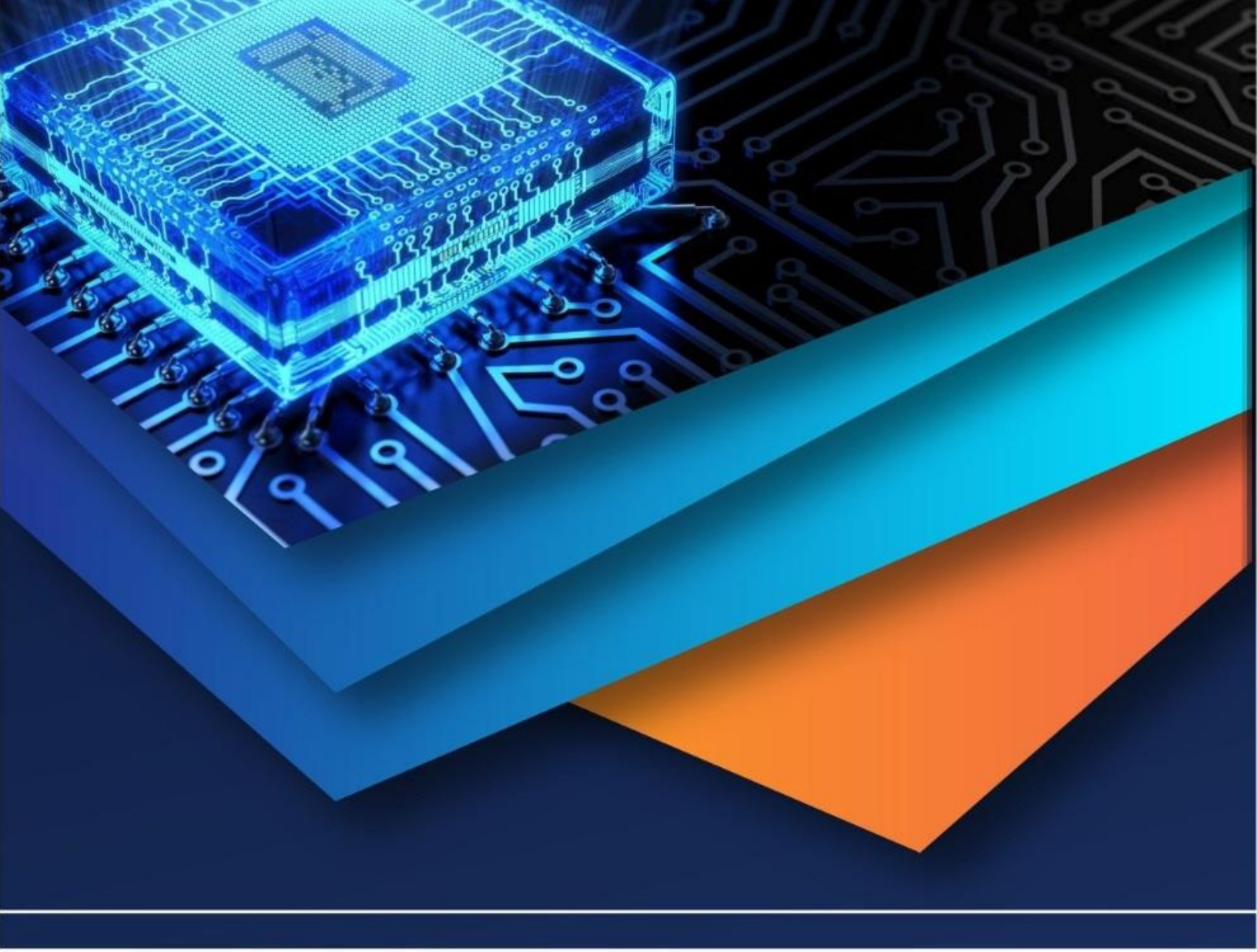

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