Advances in Cancer Treatment and Research

Significant progress is continually being made in the diagnosis and treatment of cancer, leading to improved survival rates for many types.

Key Treatment Modalities:

- **Surgery:** Physically removing the tumor.
- **Radiation Therapy:** Using high-energy particles or waves to kill cancer cells.
- **Chemotherapy:** Using drugs to kill fast-growing cells, including cancer cells.

Modern Advancements:

1. **Targeted Therapy:** Drugs that specifically target the genetic changes, proteins, or other molecules that drive cancer growth. These often have fewer side effects than traditional chemotherapy.
2. **Immunotherapy:** Treatments that harness a patient's own **immune system** to fight cancer.
    - **Immune Checkpoint Inhibitors (ICIs):** Drugs that block proteins (checkpoints) on immune cells or cancer cells, effectively releasing the brakes on the immune system to allow it to attack the tumor.
    - **CAR T-cell Therapy:** A personalized treatment where a patient's T-cells (a type of immune cell) are collected, genetically engineered to target specific cancer cells, multiplied, and then infused back into the patient.
    - **mRNA Technology:** Research is exploring the use of mRNA technology (similar to COVID-19 vaccines) to create personalized cancer vaccines that train the immune system to recognize and attack tumor cells.
3. **Precision Medicine:** The practice of using genetic sequencing of a patient’s tumor to identify specific mutations and select the most effective, personalized treatment plan.

Cancer mortality rates continue to decline in many countries due to a combination of lower smoking rates, earlier detection for certain cancers (like breast, colorectal, and prostate), and improved treatments. However, **alarming disparities** persist, with certain racial and socioeconomic groups experiencing higher mortality rates.