Medicine improved by 5G technology

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21.11.2023.

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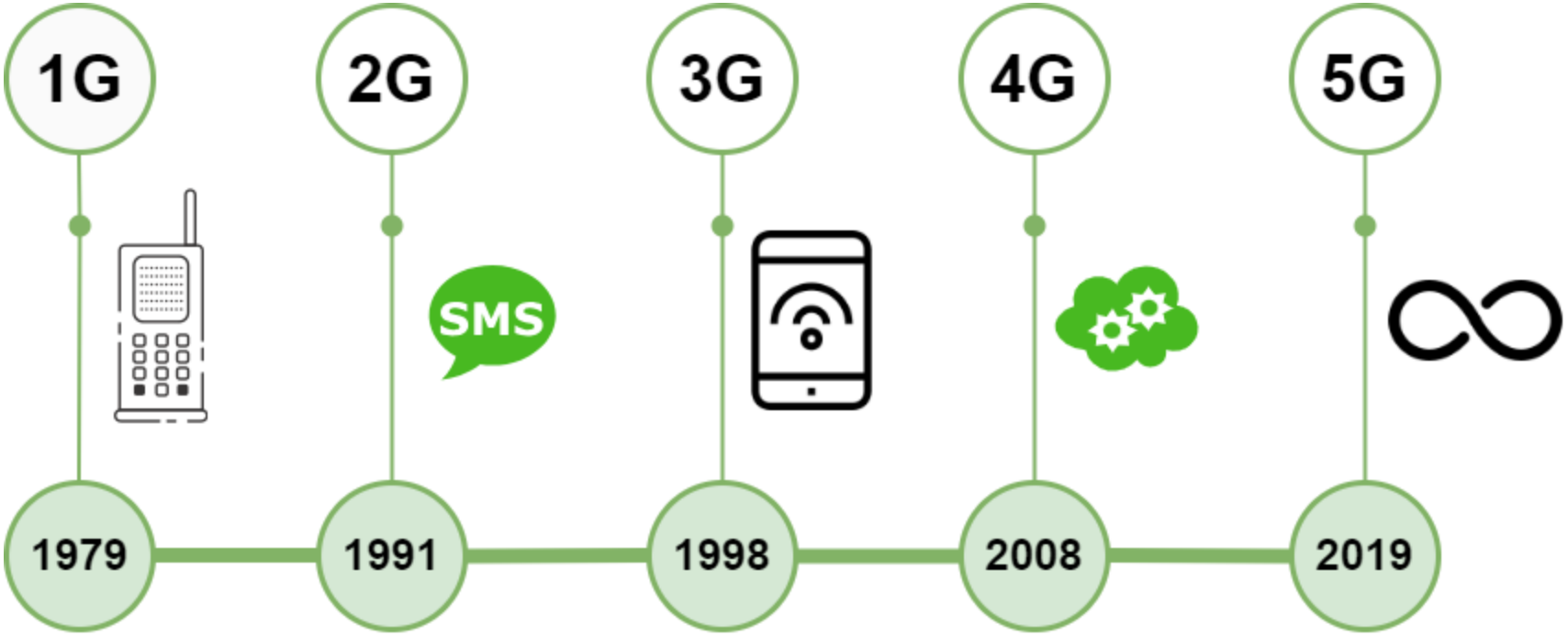
*Wireless **communications** standards evolution*



Evolution conducted by International standardization organization 3GPP

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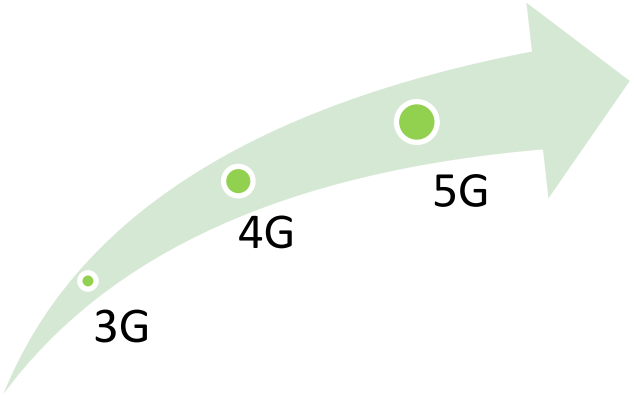
5G

5G main benefits



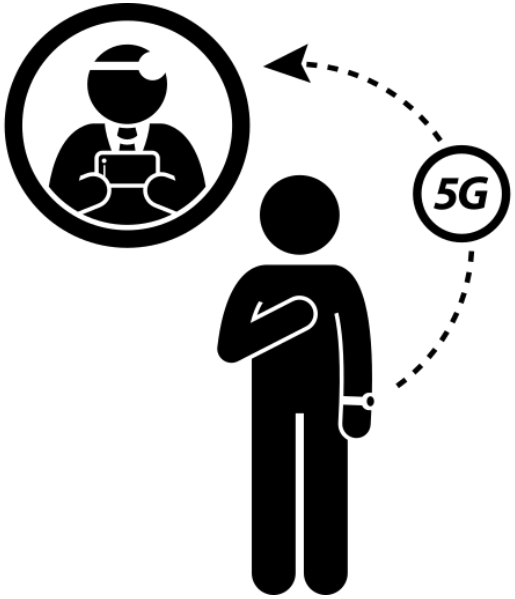
Faster speed - up to 10Gbps per device
10 to 100 times faster than 4G cellular connections

Lower latency - Significantly reduced up to 1ms end-to-end

Greater capacity - significantly greater number of connected devices

5G technology promises to revolutionize healthcare

Healthcare centers need 5G in digital transformation



Support for fast, secure, error-free real-time Monitoring Systems

•*Expansion of Telemedicine*

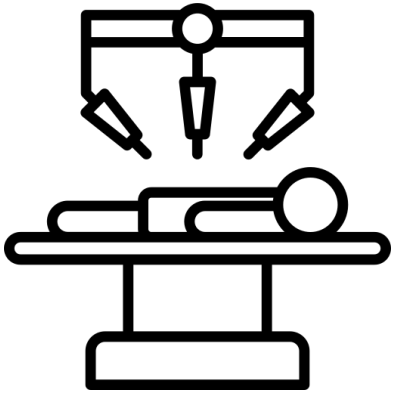
Fast Transmission of Large Files

•*Augmented Reality, Virtual Reality & Spatial Computing*

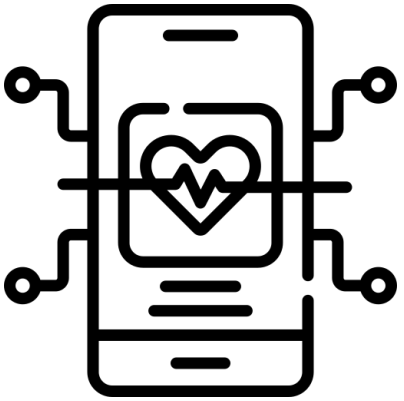
5G Mobile Technology as Game Changer In Healthcare

Fields of Medical Care that get most benefits of 5G technology

Telehealth
throughput
latency



Robotic Surgery
private networks



Internet of Medical Things
capacity

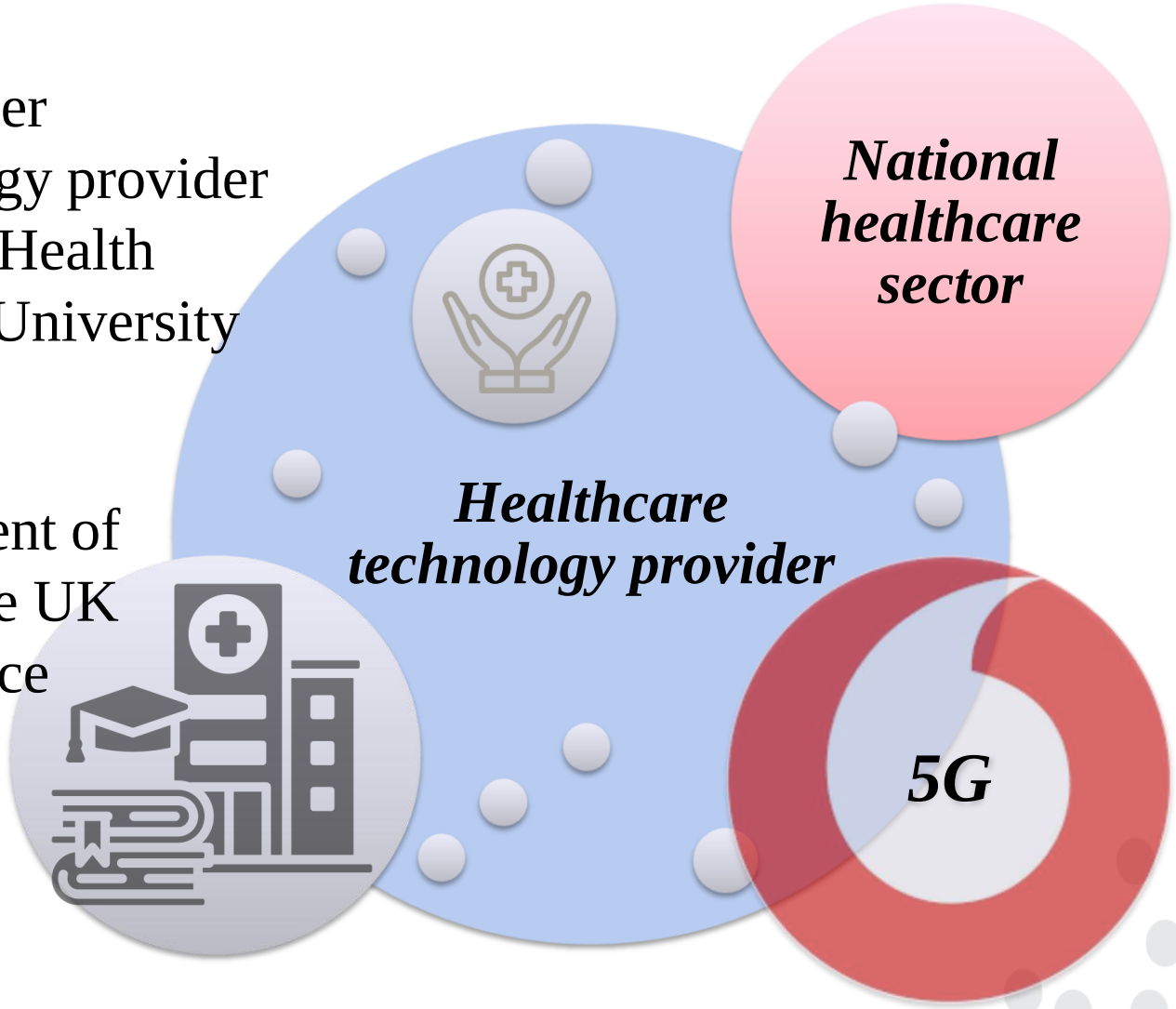
Telehealth ecosystem supported by 5G

Pilot in 2021. in UK

- Vodafone 5G provider
- Healthcare technology provider
- UK Department for Health
- Teams from Health University

Case

Diagnosis and treatment of bowl cancer across the UK National Health Service



Private 5G networks

- *dedicated for a specific organization or location*
- *smooth and efficient operations*
- *secure and reliable wireless connectivity*
- *exclusive to a single user or organization*

Cleveland Clinic

verizon

Apollo HOSPITALS

airtel

EUMC 이대목동병원 MOKDONG

SAMSUNG

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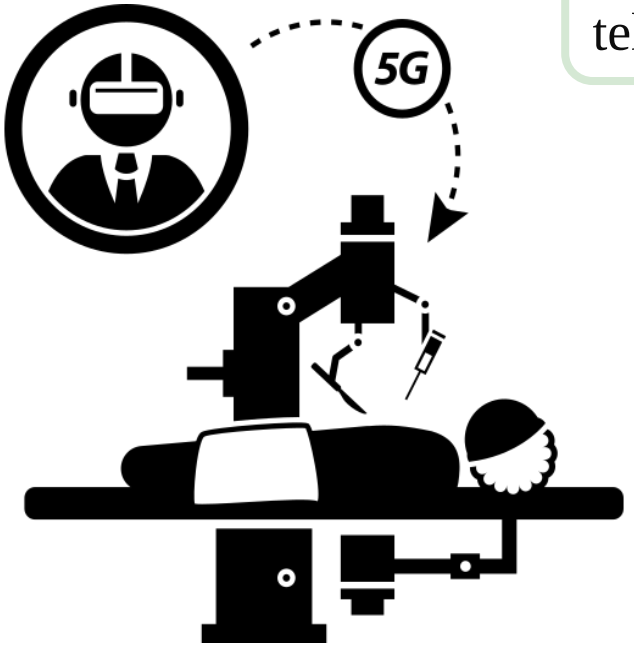
Remote Surgeries



The control deck - controller to command a telemanipulator located in a remote location.

Telemanipulators - remote manipulators - robotic arms consisting of electronic, hydraulic, or mechanical components that allow movements from a remote location.

Technical requirements for successful remote surgeries

- *sustainable high-speed performance*
- *minimum latency in milliseconds*
- *reliable network connection*
- *security of hardware and software*
- *stable power grid/electricity supply*

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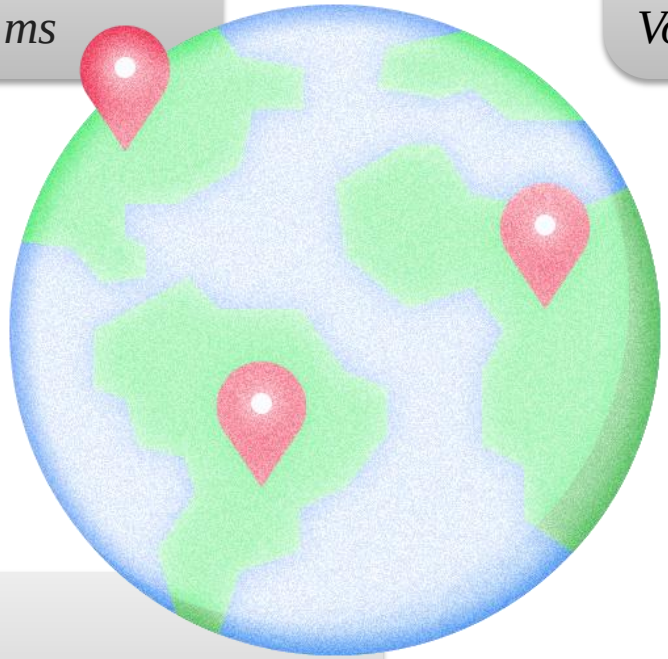
5G assisted telesurgeries studies

2018 Fujian China
remote hepatectomy in a porcine model
Kangduo robotic surgery system
average latency less than 150 ms

2019 Barcelona Spain
laparoscopic access with a medial-to-lateral approach
Vodafone 5G



2019 Munich Germany
Video streaming rate 7.2–8 Mbps
robotic control command rate 19.2–57.6 Kb/s
latency 2–60 ms

Successful 5G usage in Remote Surgeries

19 Mar 2019

China

China Mobile & Huawei 5G

deep brain stimulation (DBS) implant

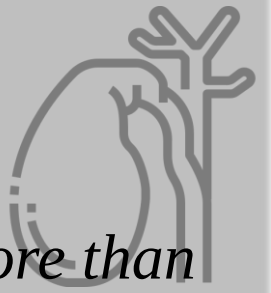
The first remote surgery on a human using 5G technology

19 Feb 2023

China

gallbladder remove

orchestrated from more than 4,500km away



SEPTEMBER 20TH, 2023

Bari Polyclinic in Italy

laser corneal surgery

TIM Group 5G infrastructure

latency less than 50ms

5G radio modules inside surgeon's room and in the operating theatre

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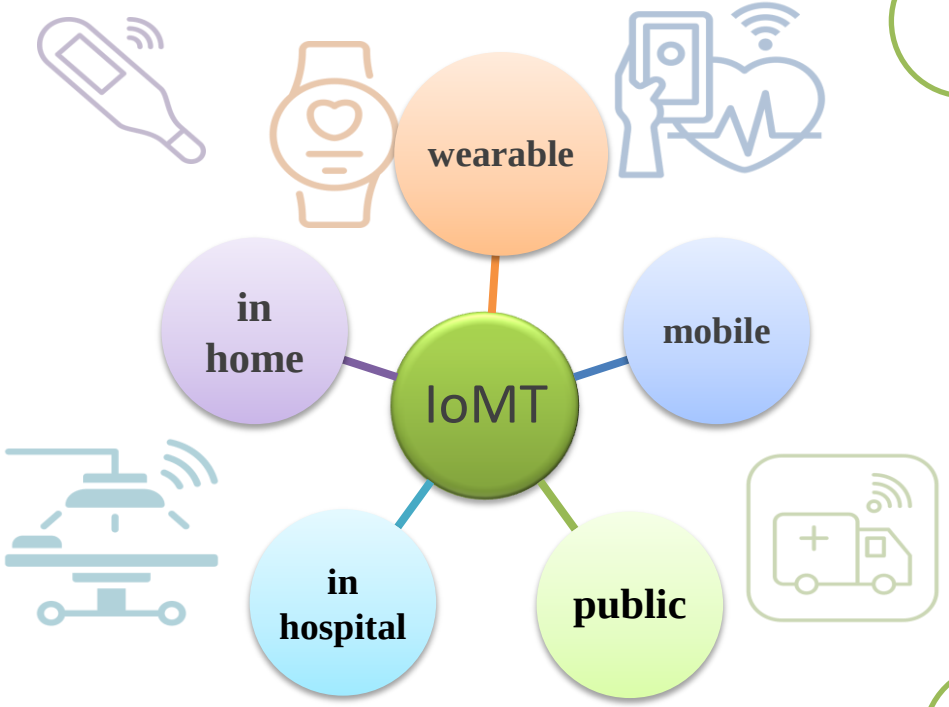
Internet of medical things (IoMT) - healthcare IoT

IoMT devices → ***IoMT networks*** → ***healthcare IT systems***



- ***remote patient monitoring (RPM) for people with chronic diseases and long-term conditions***
- ***tracking patient medication orders***
- ***•tracking the location of patients admitted to hospitals***
- ***•collecting data from patients' wearable mobile health devices***
- ***•connecting ambulances route to medical facilities & healthcare professionals***

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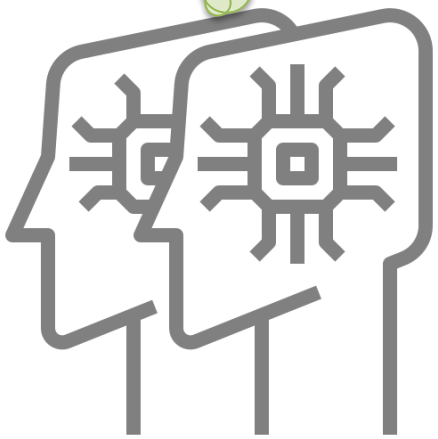
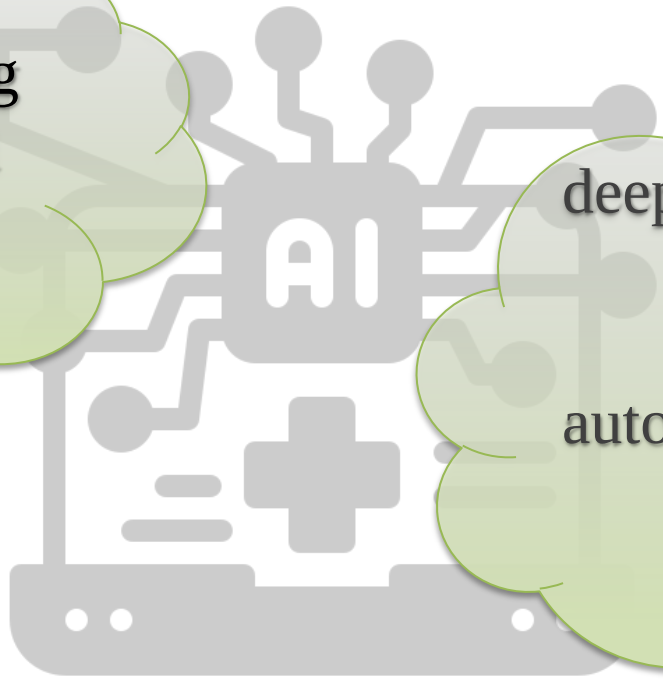
Artificial intelligence and digital twin in medicine

health monitoring
personalized
medication





deep learning
personalized
surgical plan
automatic control
adjustment

Digital twin is a digital representation of real-world entities or systems, creating virtual models of physical entities in a digital way that can describe the process of “symbiosis” between physical objects and their dynamic processes throughout their lifecycle.

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Possible challenges and limitations

- advancement in telecommunications
- use of blockchain technology
- virtual reality (VR) applications
- augmented reality (AR) applications

- regulatory variants across regions
- cyber security
- artificial intelligence (AI) system development
- costing

- new health ecosystem
- precision medicine in public health
- cloud healthcare platforms

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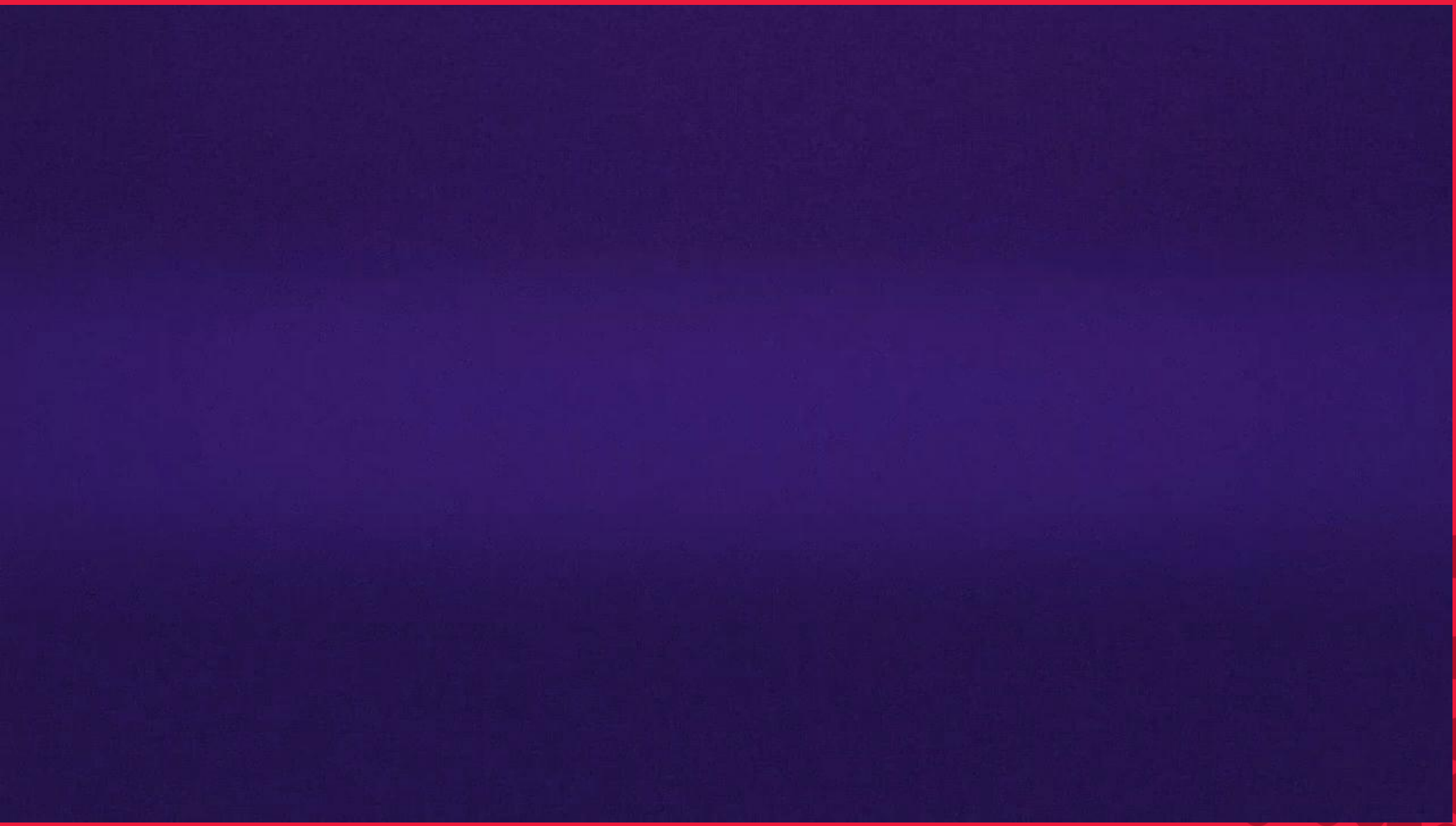
Conclusion

evolved patient care

added years of good health

better quality of life