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# Global Strategic Partnership in Digital Health to Fight Pandemics

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## The Role of Wellness Technology

# Wearable Technologies to Monitor High Risk Patients During Pandemics


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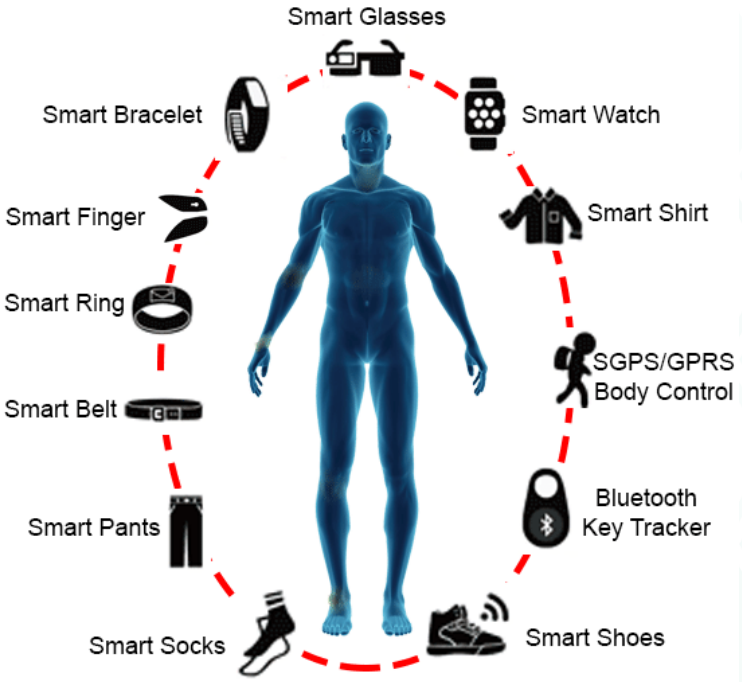
# Presentation Outline

- **Understanding Wearable Technologies**
  - What are they
  - Uses
  - Specific examples
- **Understanding High Risk Patients**
  - Who are high-risk patients
  - Needs of high-risk patients
- **Understanding Pandemics**
  - Pandemic examples
  - Factors for consideration
  - Current strategies
- **Putting All The Pieces Together: Wearable Technologies, High Risk Patients, and Pandemics**
  - Current research and studies
  - The positives and the negatives
  - What next

# Understanding Wearable Technologies

## What Are They

- Devices that are “worn” as an accessory
- Devices that collect, track, and sync data (to smartphone or computer)
- Sensors that record daily activity and biometric “patterns”
- “Health Sensors” = hardware + software + data models/analysis + artificial intelligence




Source: Rodrigues, Joel & Segundo, Dante & Arantes Junqueira, Heres & Sabino, Murilo & Prince, Rafael & Al-Muhtadi, Jalal & Albuquerque, Victor. (2018). Enabling Technologies for the Internet of Health Things. IEEE Access. PP. 1-1. 10.1109/ACCESS.2017.2789329.

# Understanding Wearable Technologies

**Uses**

- Biometrics
  Monitoring of physiological functions
  i.e., temperature, heart rate, blood pressure, motion, steps, sleep patterns, etc.
- ECG (Electrocardiogram)
- AR (Augmented Reality)
- GPS – Global Positioning System (real-time location tracking)
- RFID – Radio Frequency Identification (real-time contact tracing)

# Understanding Wearable Technologies

## Specific Examples

- Smartwatch

**Galaxy Active 2**


fitbit versa 2

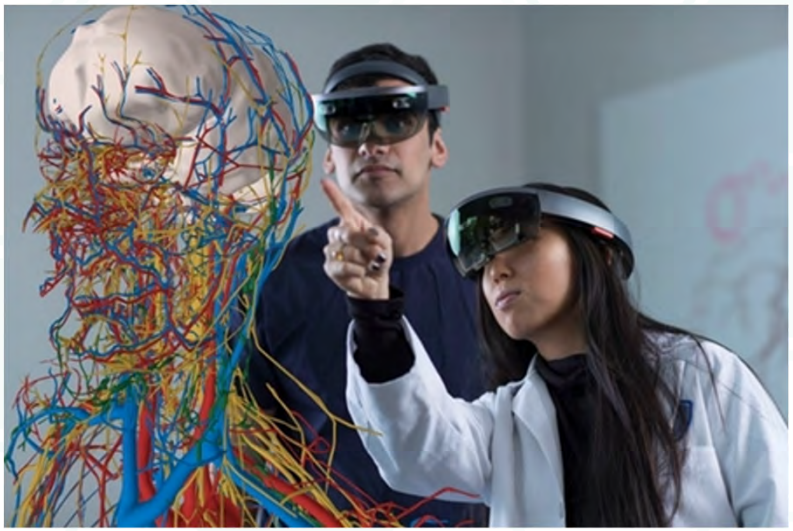
**Apple Watch**

# Understanding Wearable Technologies

**Specific Examples**

- Head mounted display

**Google Glass**



Microsoft HoloLens

# Understanding Wearable Technologies

## Specific Examples

- Smart biometric garments (in clothing, textiles, fabric)


**Hexoskin**

# Understanding Wearable Technologies

**Specific Examples**

- Jewelry
- Medical Alert Systems

**Oura**

**PulseOx**


**Life Alert**

# Understanding Wearable Technologies

## Specific Examples

- SaMD (Software as a Medical Device

**RFID**

**Kardia Mobile**

# Understanding High Risk Patients

## Who are our high-risk patients

- There is always uncertainty in who will be most vulnerable (“high risk” groups) in a pandemic.
- Most often, the following are identified as part of the vulnerable population groups:
  - **Pregnant women**
  - **Infants, Children**
  - **Adults 65 years of age and older**
  - **Those with underlying health/chronic conditions**
    - Lung disease (i.e., Asthma, COPD)
    - Cardiac/Heart disease (CHF, MI, Hypertension, Arthrosclerosis)
    - Chronic diseases (Obesity, Diabetes, etc.)
    - Nerve & Muscular disorders
    - Cancer
    - Suppressed immune systems (those on immunosuppressants)
  - **Indigenous races**
  - **Groups that are underinsured/uninsured**
  - **Healthcare and medical services personnel**

# Understanding High Risk Patients

## Needs of high-risk patients

- Patient voice (uncovers disease manifestation as in the COVID-19 pandemic)
  - "I can't breathe"
  - "I can't smell"
- What can the healthcare professional do for the high-risk patients in pandemics?
  - Refresh strategy on identifying at-risk patients every one to two years
  - Utilize the medical home as the epicenter of patient management
  - Focus patient education on building self-management skills
  - Engage community organizations to fill care gaps
- Each year in the United States, about 18% of rising-risk patients escalate into the high-risk category when not managed properly.


Source: https://www.advisory.com/

# Understanding Pandemics

## Pandemic examples with death rates

**Certain conditions help define the criteria for a "pandemic". The disease…**

- Affects a substantial proportion of the population
- Occurs over a wide geographic area, without interruption
- Spreads easily

| Year | Illness | Death Toll |
|---|---|---|
| 1918 | Spanish Flu | ~20-50 million |
| 1957-1958 | Asian Flu | ~2 million |
| 1968 | Hong Kong Flu | ~1 million |
| 2006 | AIDS | ~36 million |
| 2009-2010 | H1N1 / Swine Flu | ~151,000-575,000 |
| 2019-2020 | COVID-19, SARS-CoV-2 | ~722,000 |

Source: https://www.cdc.gov

# Understanding Pandemics

## Factors for consideration

- **Who** contracted the illness/disease?
  - Helps determine high-risk patients
- **What** symptoms are they presenting with?
  - Helps determine spectrum of illness
- **When** did they contract it?
  - Helps determine timeline
- **Where** did it start and where is it going?
  - Helps determine geographical spread
- **Why** did they contract it?
  - Helps determine context
- **How** can we make more sense of the collected data?
  - Helps determine strategies that lead to a solution

# Understanding Pandemics

## FACTORS FOR CONSIDERATION

- Surveillance
- Hygienic/Sanitation Practices
- Wearing Personal Protective Equipment (PPE)
- Social Distancing
- Quarantine, Isolation
- Utilize Telemedicine/telehealth
- Drug Development
- Vaccine Development

# Putting All The Pieces Together:

## Wearable devices for Detecting Changes in Health Patterns

The Centre for Evidence-Based Medicine estimates that **5% to 80%** of those testing positive for SARS-CoV-2 may be **asymptomatic**. This demographic is quite important because symptom-based screening will **miss** a significant chunk of such people. The latter will unknowingly pose a public health risk as asymptomatic carriers of COVID-19.

The Scripps Research Institute launched the **DETECT study (Digital Engagement & Tracking for Early Control & Treatment)**. By opting in, users of wearables can share data about their heart rate, sleep and activity levels, as well as respiratory symptoms (like fever or coughing), medications, electronic health record data and results from a flu, strep or Covid-19 test.

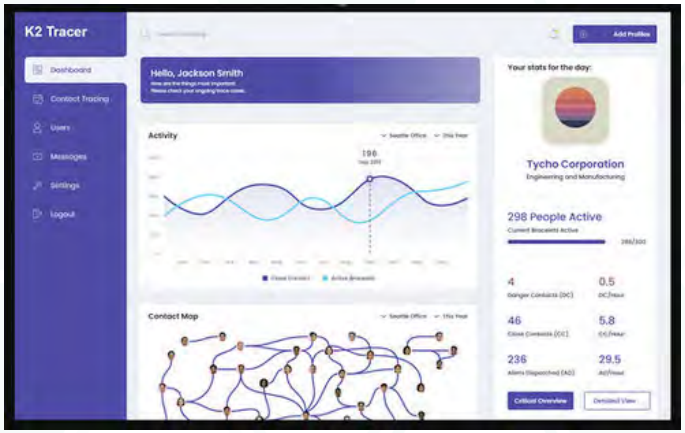
The reasoning behind the study is that infected people experience **changes** in **health patterns**; all of which can be **measured by wearables**. **Monitoring the trends** can spot an outbreak before patients overload emergency wards.

Source: https://detectstudy.org

# Putting All The Pieces Together:

## Wearable devices for Proximity Alert/Contact Tracing (Wireless Body Area Network)

- **Wearable devices** are being used **for proximity alerts** and **contact tracing**
- When two or more wearables are in **range of less than 6 feet**, **device will** begin to **vibrate** - alerting users to keep safe distance
- Contacts can be registered onto a cloud system to view and track

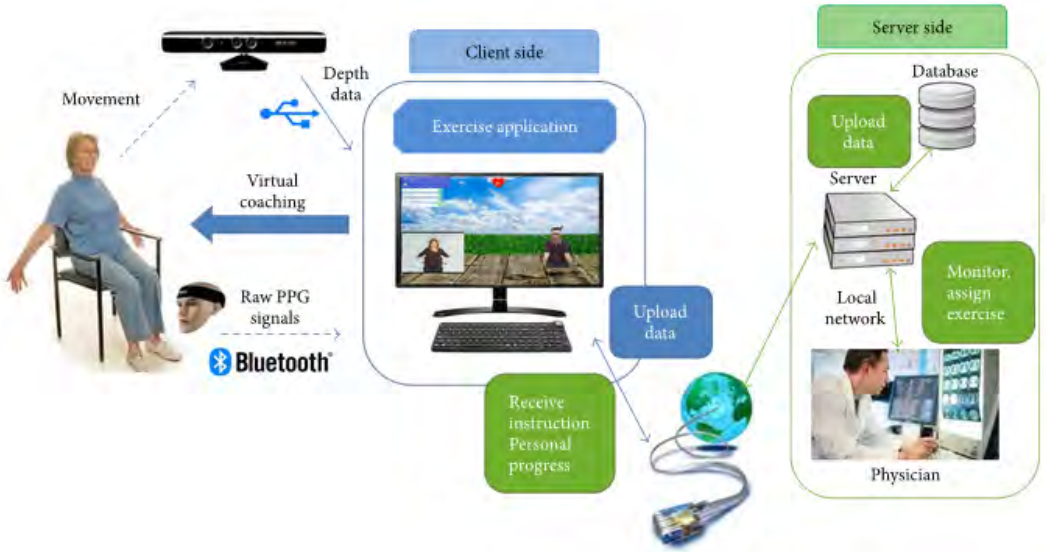




Source: https://www.k2.life

# Putting All The Pieces Together:

## Studies for Pulmonary Patients

- A group of researchers **designed a remote rehabilitation system for a multimodal sensors-based application for patients who have chronic breathing difficulties** (Tey, An, & Chung, 2017).
- The **system** included a set of rehabilitation exercises specific for pulmonary patients, and **provided**
  - exercise tracking progress
  - patient performance
  - exercise assignments
  - Exercise guidance




https://www.himss.org/resources/wearable-technology-applications-healthcare-literature-review#_ENREF_56

# Putting All The Pieces Together:

**Study for Immunocompromised/Cancer Patients**

- Physical inactivity and sedentary behavior are common amongst immunocompromised patients.
- A study used **wearable activity trackers (WATs)** as behavioral interventions **to increase physical activity and reduce sedentary behavior** within this population (Nguyen et al., 2017).
- They found that **wearable** technique **programs** have the **potential** to **provide effective, intensive, home-based rehabilitation**.

**Fitbit Alta**


https://www.himss.org/resources/wearable-technology-applications-healthcare-literature-review#_ENREF_56

# Putting All The Pieces Together:

## Study for Elderly Patients (Fall Detection)

- **Wearable devices** have great **potential** to be used in **fall prevention** among older adults.
- **Falls occur in 30% to 60% of older adults each year**, and 10% to 20% result in injury, hospitalization or death (Rubenstein, 2006).
- For the elderly people in the USA, **falls lead to four to 12 days of hospital stay per fall** (Bouldin et al., 2013).
- Hsieh, Liu, Huang, Chu, & Chan (2017) developed a novel hierarchical **fall detection system using accelerometer devices on the waist**. The results showed that the system achieved a high accuracy at 99% in identifying fall events.


https://www.himss.org/resources/wearable-technology-applications-healthcare-literature-review#_ENREF_56

# Putting All The Pieces Together:

## The positives and the negatives of wearable technologies

**POSITIVES:**

- Real-Time data capture
- Continuous monitoring
- Predict and Alert
- Patient engagement

# Putting All The Pieces Together:

## The positives and the negatives of wearable technologies

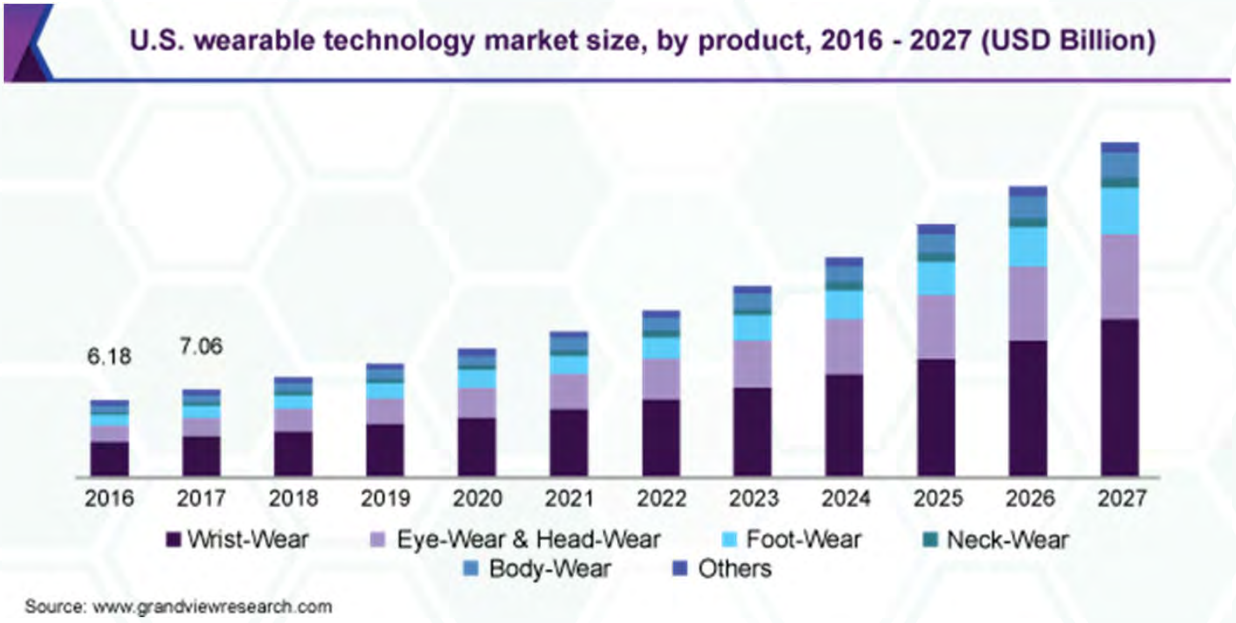
**NEGATIVES:**

- Cost / Affordability
- Privacy issues (location data, contact data, etc.)
- Security issues (unprotected data / low-level security)
- Ethical issues

# Putting All The Pieces Together:

## What next: Growth of wearable technologies

According to Grand View Research, Inc., the global wearable technology market size was valued at USD 32.63 Billion in 2019 and is projected to expand at a compound annual growth rate (CAGR) of 15.9% from 2020 to 2027.



# Putting All The Pieces Together:

## What next: Final thoughts

Most “studies” and “technology” are generally what is called **forward-looking.**.

Meaning, these entities use words like “**our goal is**”, “**we hope that**”, “**might someday**”, “**we would like to**”, “**could**”, “**eventually**”, “**might help**”, “**potential to**”, etc.

***We should strive towards work that is conclusive.***

# شكرا جزيلا

# THANK YOU

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