

Case Study 5 – Diabetes

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1. *Diabetes is at pandemic levels. Describe two areas of technology innovation (not described in this lecture) from any of these areas: Diabetes Prevention, Diabetes Monitoring, Diabetes Treatment, Population Level / Public Health Diabetes efforts?*

Diabetes is disease which is categorized by blood sugar levels which are too high. The cause of this disease is a malfunctioning pancreas which is not producing the insulin needed to help glucose properly enter the cells, needed for cellular functioning. Type 1 Diabetes is characterized when the pancreas does not create any insulin and the patient is forced to uptake artificial insulin, daily, in order to survive. Type 2 Diabetes is more common in older people who's insulin generation degrades with age. As of 2015, almost 10% of the US population had diabetes with over 90% of adults cases presenting as Type 2 diabetes [1].

One area undergoing leaps of technological innovation is diabetes treatment. Mostly targeted at diabetes Type 1 patients, with some applications for Type 2 patients, diabetes treatment is evolving with advances in artificial pancreas, diabetic vaccines, and cell regeneration technologies. Artificial Pancreas, or Closed Loop Systems, rely on constant monitoring of a patient's glucose levels and automatically injecting or suppressing the amount of insulin delivered into the body. "Diabetes vaccines" take advantage of side effects bacilli Calmetter-Guerin vaccine with a booster, showing a restorative effect of insulin production lasting almost five years. Cell regeneration takes advantage of drugs which regenerate pancreatic cells which are concerned with insulin production [2].

Diabetes Monitoring is another area undergoing technological innovation. Skin mounted sensors, which communicate with smartphones can produce data for individual glucose monitoring, avoiding regular blood draws by the patient. Additionally, smart pens can connect to smartphones and keep track of use, schedule reminders, and sound alarms as reminders for users to check or take their insulin injections [3].

2. *Explain what is novel and what will be required for these innovations to succeed.*

Previously, a user would have to prick their finger each time they needed to test their blood for glucose level and then inject themselves with another needle to deliver the required amount of insulin to keep their blood sugar down. The technological advances on the horizon will provide convenience, simplify, and liberate people to stop thinking about their disease, and enjoy their life to its full potential.

The novel treatment technologies can provide relief for days, months, and eventually years of injection-free life with either an artificial pancreas or some form of cell regeneration. From a user perspective, diabetic treatment will extend from a daily habit, to a yearly maintenance.

Additionally, monitoring innovation will put the control of the disease in the hands of the patient. Continuous monitoring, warning systems, and pain-free analyzers will enable patients to better track their health and their glucose level, preventing missed injections or unforeseen spikes in blood glucose.

3. *How could this chronic illness be prevented on a pandemic level and what technologies could be used to do so?*

Diabetes Type 1 usually presents itself early in a patient's life and is genetic in nature. Diabetes Type 2 is generally preventable through a series of life choices which can be greatly improved through technological advancements.

Diabetes prevention stems from avoiding processed sugars, regular workouts, drinking water and keeping weight in a healthy region. To aid in these tasks, wearables technology and a connected medical network can immensely curb the rise in diabetes occurrence. More specifically, modern wearables help keep track of exercise routines, remind us to stand and walk on a regular basis, can track our water intake, weight loss, and food rationing. Wearables can also share that data with our doctors [4].

Furthermore, doctors can collaborate and share their data amongst each other in order to better serve each individual patient. Nutritionists can collaborate with endocrinologists and hospital rehabilitation and fitness professionals in order to tailor a regiment of prevention and maintenance for at-risk patients, before diabetes even sets in.

4. *Share and describe 5 solutions for prevention, monitoring, or treating Diabetes for either type.*

One solution for treating diabetes is increasing the ease of use of "treatment delivery systems". Moving away from injections to transdermal patches, insulin pumps, or artificial pancreas increases the chance of a patient applying the treatment properly, timely, and successfully in order to curtail diabetic side-effects in a timely manner [5].

Another solution for treating Diabetes is pushing the health care system to a patient-centered system. The care providers would focus on prevention, rather than treatment. Interdisciplinary coordination, communication, and collaboration would allow for complex treatment plans which focus on a patient's overall wellbeing. Treatment plans would focus not only on lowering glucose, but also on improving the patient's quality of life with innovative glucose monitoring, nutritional plans, and exercise regimens [5].

A solution for monitoring the disease is the latest innovation in wearable devices. Minimally invasive patches and sensors which can share data for days, weeks, and sometimes months, allowing the user to take control of their health in continuous monitoring, management, and alert system. Wearables can also improve monitoring of patient health by their healthcare providers in allowing doctors to alter prescriptions or dosages on-the-fly [5].

A prevention solution for diabetes is advances in technological innovation in patient Electronic Medical Record storage, sharing, and analyzing. By utilizing machine learning, researchers can identify new trends in patient data which may help in predetermining at-risk populations before they present diabetic symptoms. Additionally, this technology can help in determining individual based treatment plans, tailored for each patient instead of following one generic set of treatment plans developed for a general public [5].

Finally, another solution for diabetic prevention is focusing on population disparities as part of medical professional responsibility and health care prescriptions. Identifying and focusing on at-risk individuals which lack health insurance, access to healthy foods, language or cultural barriers, or other cognitive dysfunction patients instead of relying on self-reported and visiting patients will greatly reduce the occurrence of diabetes in the general population [5].

References

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