CitiusTech

CitiusTech: PDH (Patient Data Hub)
Remote Patient Monitoring Solution: MSFT Tech Validation

Oct 2020

Remote Patient Monitoring: Key Drivers and Challenges

Key Drivers

- Increasing need for on-demand, patient-centric healthcare models
- Under-utilized potential of m-health applications to curb increasing cost of healthcare
- Growing requirement of real-time analytics for chronic condition management, wellness management and virtual care
- Inability to tracking patient's recovery post - discharge, and to provide remote care during emergencies

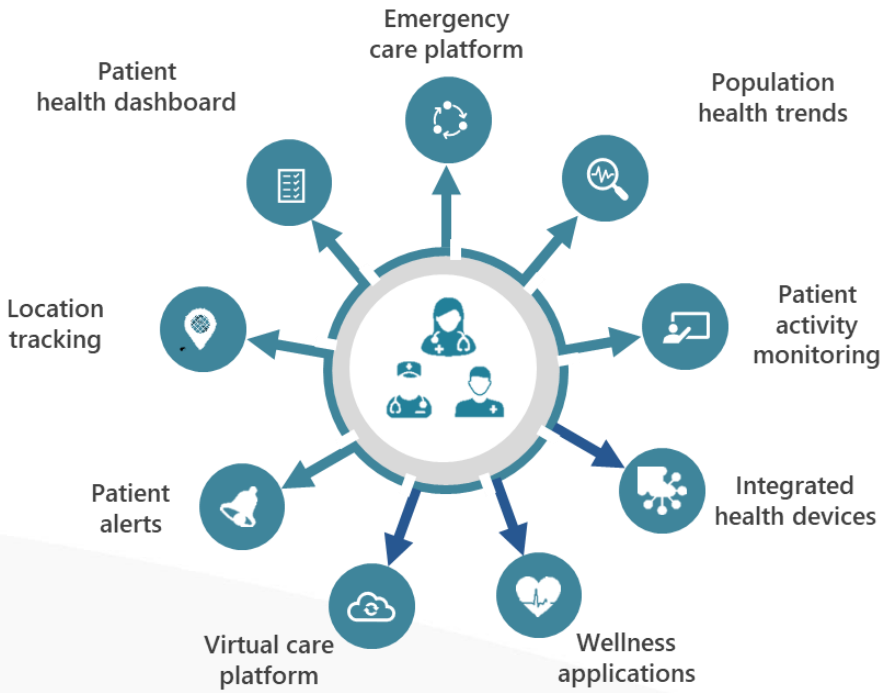
Key Challenges

- Fragmented solutions due to lack of an intermediary to collate data from multiple devices
- Lack of standardization between data from different devices, increasing storage and integration complexity
- Difficulty in integrating consent management with AD systems and EHR/EMR
- Lack of common dashboard and analytics with consolidated data from EMR / EHR and remote devices

Healthcare providers looking to align their care delivery model to the 'new normal' need **an end-to-end platform for remote patient monitoring**

PDH (Patient Data Hub): Overview

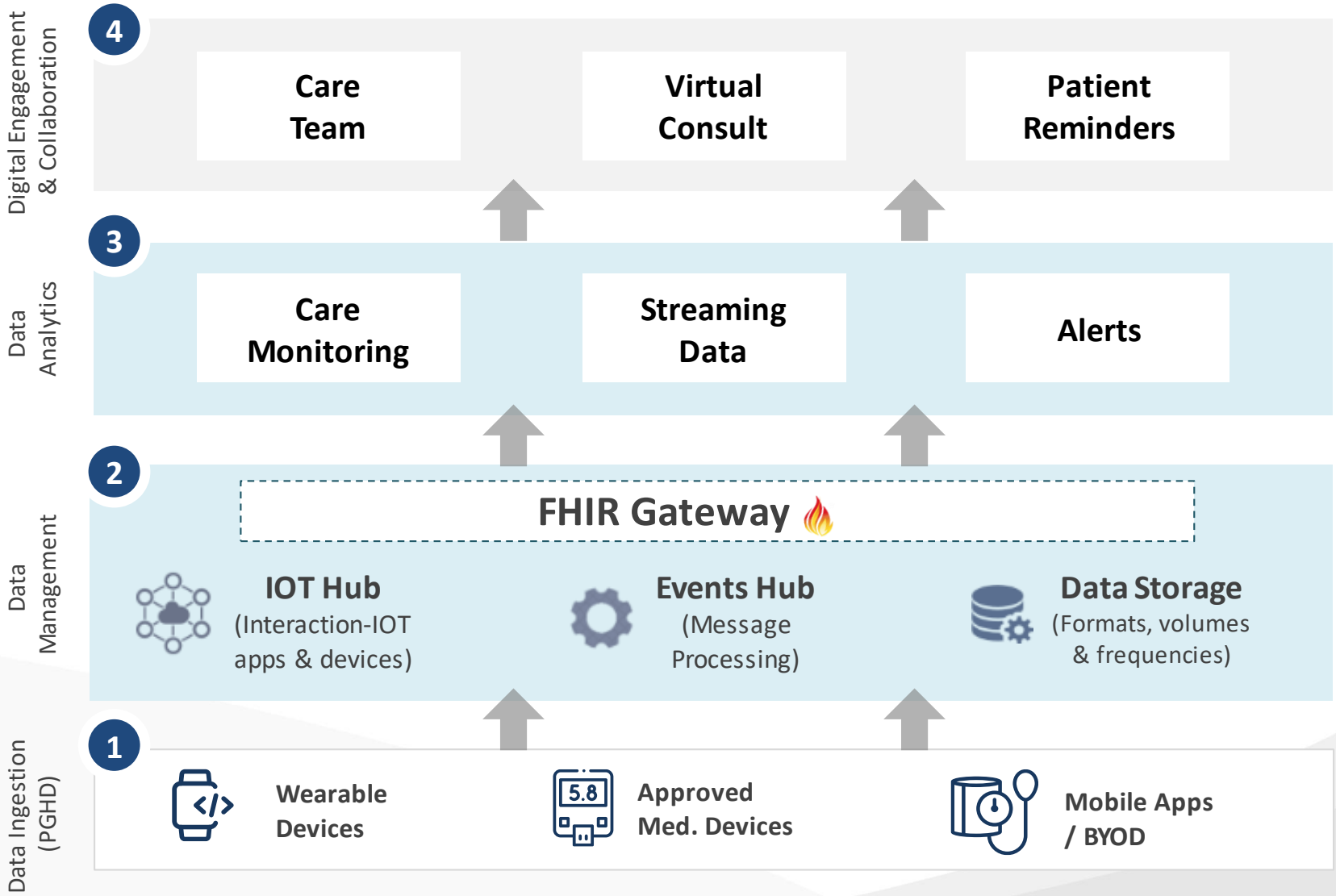
CitiusTech's PDH (Patient Data Hub) is an Azure Cloud based platform that helps providers collect and track patient vitals, identify those at risk, and provide chronic condition management and virtual care.



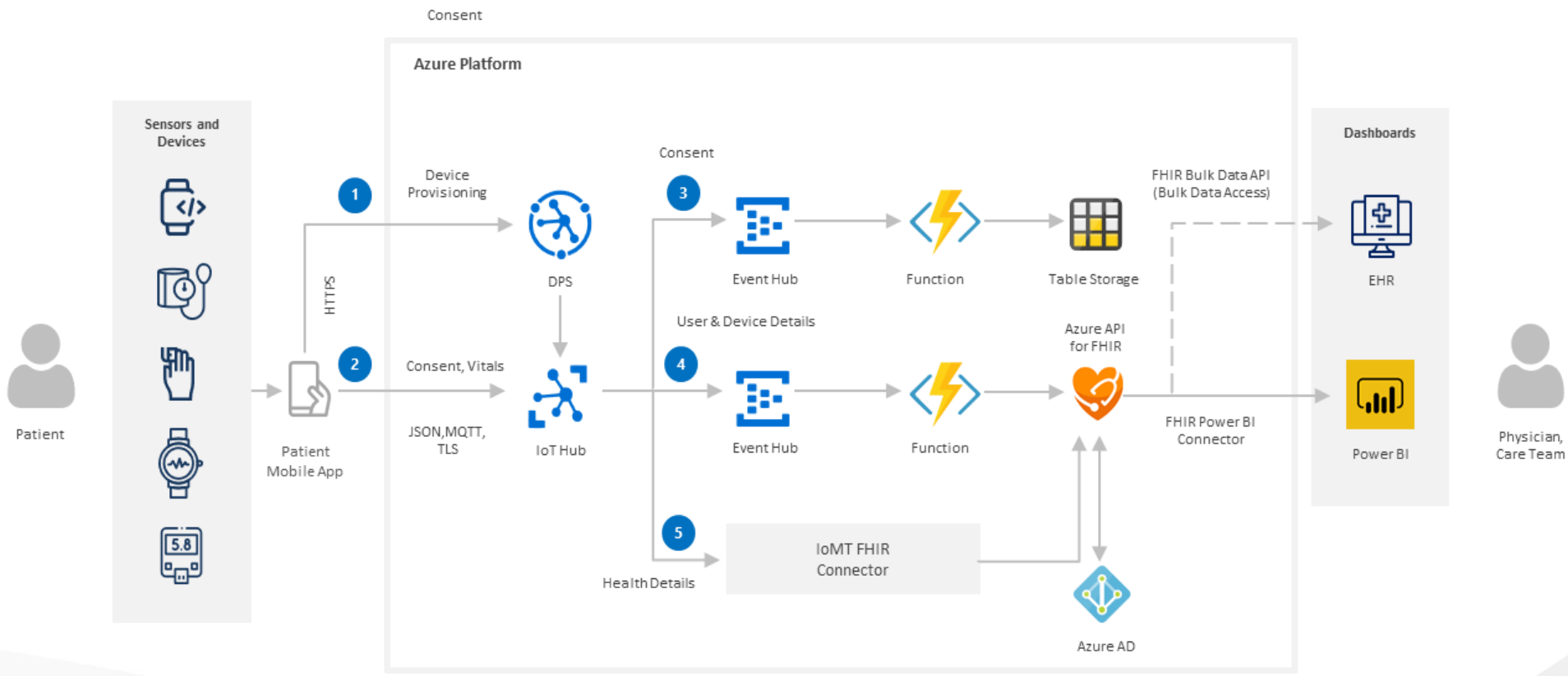
Key Highlights

- **Connected health IOT platform** to actively **track high-risk patients** and make informed decisions on clinical events
- **Capture, storage and process** vital data (BP, glucose, temperature, blood oxygenation, heart rate, etc.) across diverse healthcare devices using a white labelled mobile app
- Make informed decisions based on variations in patient's health stats and **generate necessary emergency alerts**
- **Patient-entered data capturing** on their preferred devices (BYOD), including customer surveys, social determinants of health (SDOH) etc.
- **FHIR enabled platform** to standardize data storage and interoperability across multiple devices

PDH (Patient Data Hub): Conceptual Blocks



PDH using Azure: Solution Overview



CitiusTech's Remote Patient Monitoring Solution is built on Azure platform to ensure fast-paced integration into existing Azure environments

PDH using Azure: Components Details (1/2)

Component	Description
IoT Device / Mobile App	▪ Device will send telemetry messages consisting of geo co-ordinates of the patient's current location and vital signs to IoT Central
Azure IoT Central	▪ Device provisioning, monitoring, connection to be managed using IoT central ▪ Patient real time location tracking on Azure maps integration on IoT central Dashboard ▪ Rule to notify physician/regulator and vibrate the wearable device (in case of no mobile app) in the event of no messages received since one hour
Azure Event Hub	▪ Data export from IoT hub to event hub for Azure function to run custom rules & Azure time series insights for Ad-hoc analysis
Azure Functions	▪ Python Function will have event hub trigger to have a custom rule on telemetry messages to determine if patient is leaving the perimeter defined for him/her and notify the physician/regulator and patient ▪ Functions will host query APIs executed on Time Series Insights data to be consumed in static website

PDH using Azure: Components Details (2/2)

Component	Description
Azure Time Series Insights	▪ Time series insights to perform the ad-hoc analysis on telemetry data received from IoT hub
Azure SQL Database	▪ Database to store API data, alerts triggered, telemetry messages inactivity and other supported data for static website
Azure Storage	▪ Storage to host static website showing patient and device information
Azure App Gateway	▪ App gateway to secure static website by enabling web application firewall
Microsoft flow	▪ Notify the Patient, physician/regulator about the patient activities via Microsoft Teams channel
Azure ML Service / Databricks	▪ Perform Advance analytics by creating custom data models using Jupyter notebooks

PDH (Patient Data Hub): Benefits for Key Personas

Patients

- Reduced clinic visits
- **24*7 access** to physicians / care providers
- Improvement in health data collection
- Personal health enhancement

Care Teams

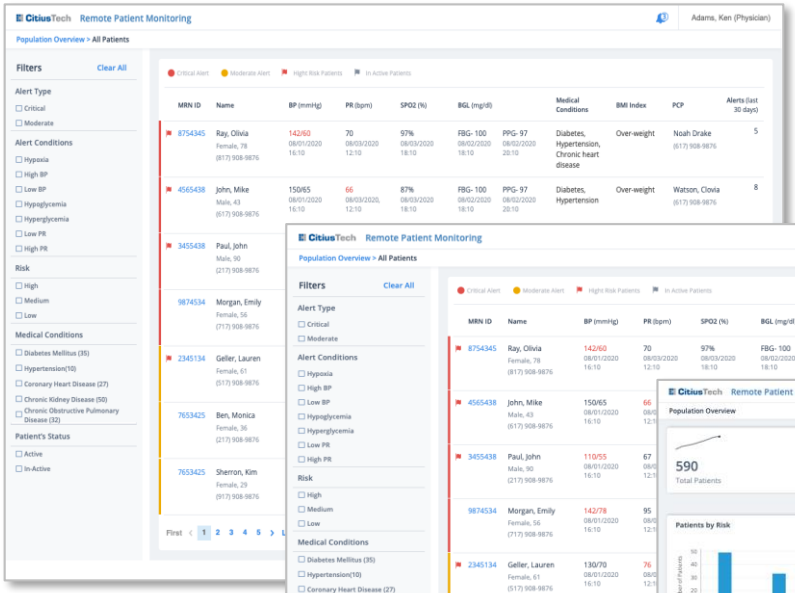
- Easier implementation of wellness programs
- Improved tracing of patient's vitals
- **Near-real time tracking** of patient location
- Emergency alerts

Physicians

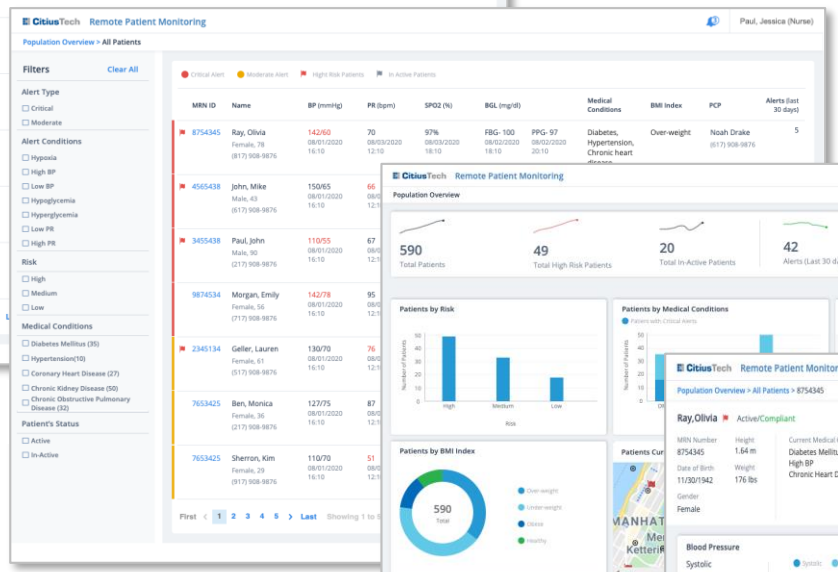
- Better monitoring of patient health
- **Ready access** to patient health trend analysis
- Near-real time tracking of patient location
- Emergency alerts

CitiusTech's PDH (Patient Data Hub) helps create consolidated patient records, integrated with clinical workflows and population health tools

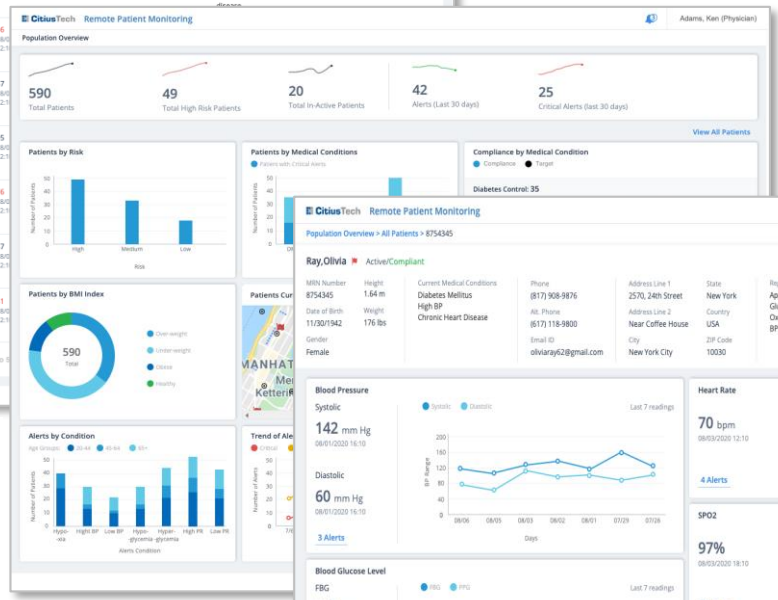
PDH (Patient Data Hub): Screenshots



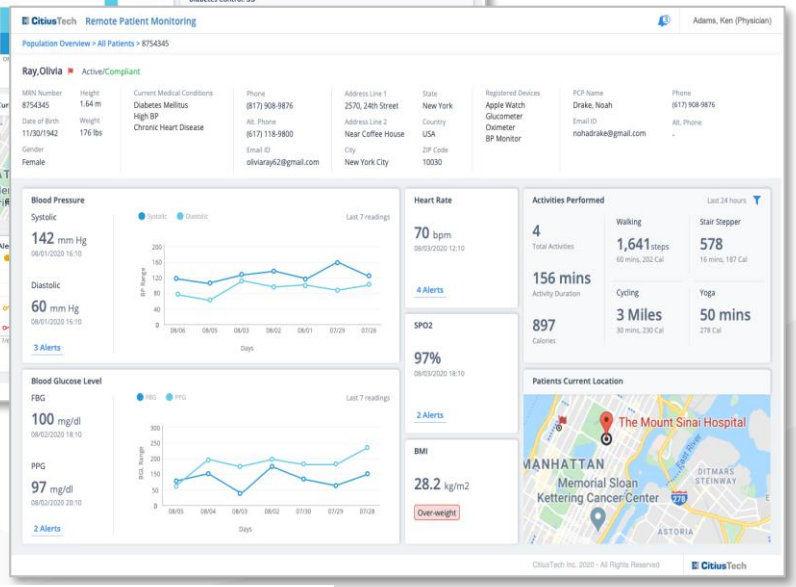
Patient List View



Command Center Page



Summary View



Patient Detail View

Thank You

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PDH using Azure: Proposed Phased Approach

Key Deliverables

Phase 1 (MVP)

- Integrate PGHD from a multitude of connected health devices
- Enable ingestion of PGHD via mobile apps
- Activate Geo-fencing
- Set up business rules to trigger alerts & notifications
- Build framework for dashboards
- Setup dashboards to interpret data, Command Center to stratify / track patients

Future Enhancements

- Derive insights into high cost outliers
- Build models to give real alerts
- Encourage care plan adherence through automated contact
- Set up tips and reminders to patients / families
- Generate EMR-ready data – HL7, FHIR APIs, etc.
- Integrate PGHD with EHRs
- Integrate PGHD into existing clinical workflows, population health tools, etc.
- Leverage automated bots for data entry into EMRs
- Enable virtual collaboration using MSFT Teams
- Capture SDOH data via mobile apps

Partner with CitiusTech to custom-build end-to-end Remote Patient Monitoring capabilities

PDH (Patient Data Hub): Patient Persona

John Smith (78 years old, Professor, living in NY)

John is living in Seattle for 17 years along with his family of four. He worked as a Physics professor in Seattle University. Recently he was admitted to the ER for chest pain and difficulty in breathing. Physicians diagnosed John with hypertension and prescribed medication. They also advised him to keep a track of his blood pressure at regular intervals and contact them in case of any deviation from the defined blood pressure range. His busy work schedule makes it difficult to monitor the blood pressure at regular intervals.

Focus

Maintain good health status

Important Tasks

- Notify care teams / physicians in case of any emergency situations for timely care
- Seek timely medical assistance to avoid complications in future
- Adhere to care plan designed by the physician / care team
- Manage her healthcare needs along with her busy lifestyle

Goals

- Maintain good health status

Challenges

- Need to visit physician's office for frequent monitoring of blood pressure
- Cannot co-relate the readings captured by wearable devices / no alerts raised in case of anomalies
- Lack of platform that facilitates active involvement in care / wellness plan
- Report exact location during emergency

PDH (Patient Data Hub): Physician Persona

Jessica Jones (45 years old, Diabetologist, living in NY)

Jessica is a diabetes expert who diagnoses and treats patients with diabetes. She is with NY hospital from last 15 years. She is committed to helping her patients and seeks to improve the quality of her patient's well-being by collaborating and setting attainable health goals. She has undergone specialized training in metabolic disorders and works with patients to bring their high blood sugar under control through diet, exercise, and medications. She received her MD from the University of Pittsburgh and completed her residency from NYU Medical Center.

Focus

Provide patients with a well-structured care plan for management of diabetes & other vitals.

Important Tasks

- Monitor population health parameters & guide care teams for necessary intervention
- Capture blood glucose level / vital readings of patients through wearables / certified medical devices
- Monitor patient vitals remotely & timely intervention for patients with trend of unstable health data

Goals

- Manage patient population health remotely jointly with care teams
- Ensure immediate intervention in case of urgent care needs
- Ensure close monitoring of vitals of high-risk patients

Challenges

- To track real-time patient vitals
- Analyze trends of patient health data to prevent future complications
- Real-time alert mechanism to respond to emergency situations
- Platform to contact patients for immediate intervention
- Track exact location of patients in case of emergency

PDH (Patient Data Hub): Care Giver Persona

Adam Kelso (38 years old, Care Giver, living in NY)

Adam is registered nurse (RN) associated with NY hospital for 7 years and is an integral part of the care team. He is committed to helping his patients and seeks to improve the quality of his patient's well-being by collaborating and helping them achieve their health goals. As a part of care team member, Adam's responsibility involves monitoring of patient's health outside the clinical setting via call or email. He needs to be diligent towards patients who are categorized as high risk by physicians or patients with chronic disease.

Focus	Help patients & seeks to improve the quality of their well-being.
Important Tasks	▪ Monitor patient level health status & alerts for urgent care need ▪ Notify care team / physician in case of alerts raised during emergency situations ▪ Perform intervention with physician in-charge to prevent complications for high risk patients ▪ Track the activity goal of patients & connect them for timely screening of vitals as per care plan

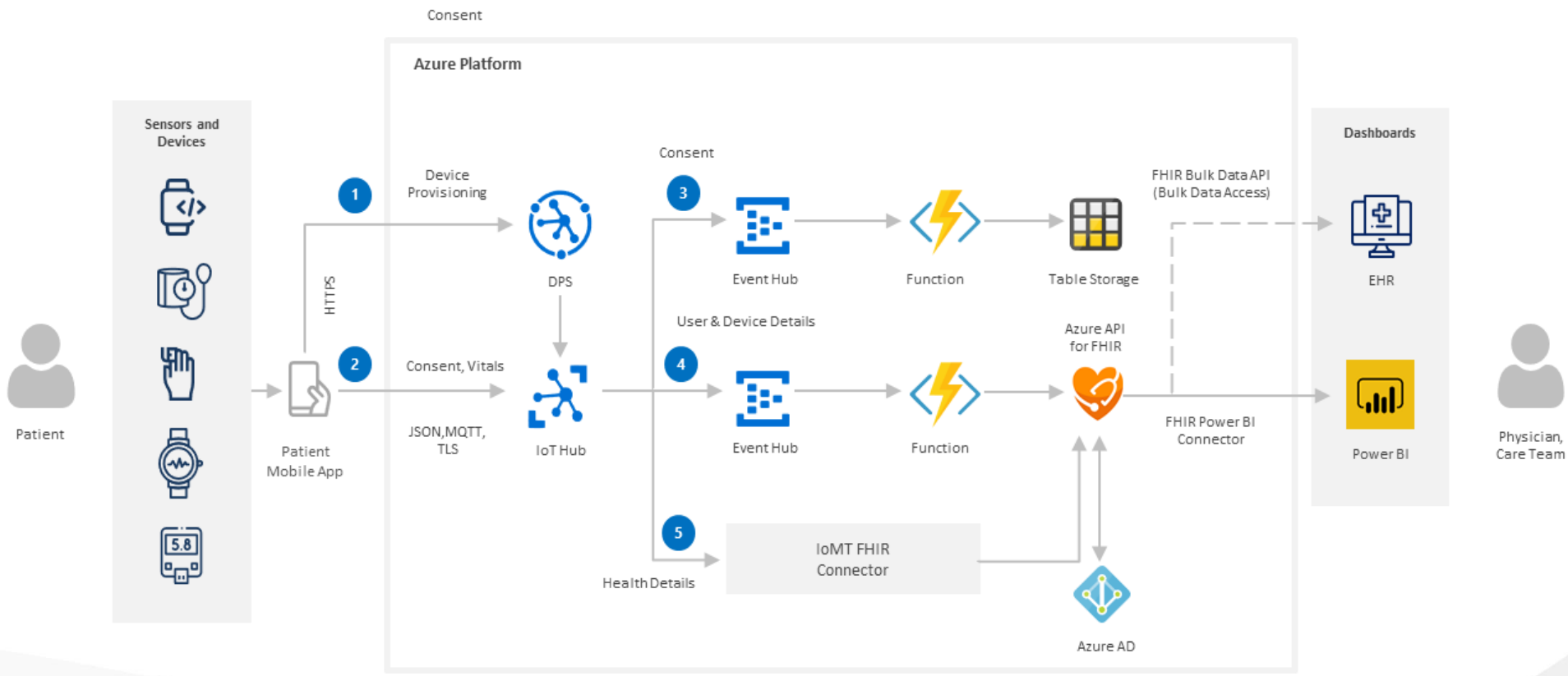
Goals

- Ensure vital screening are performed regularly
- Avoid complication due to delayed reporting of vitals
- Manage medical conditions remotely

Challenges

- Monitor & track the activity goals of patients as per care plan
- Real time alert mechanism to respond to emergency situations
- Platform to contact patients for immediate intervention
- Track exact location of patients in case of emergency

PDH using Azure: Solution Overview



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