UC San Diego Health

Using Consumer Technology to Integrate Patient Generated Health Data in the EHR

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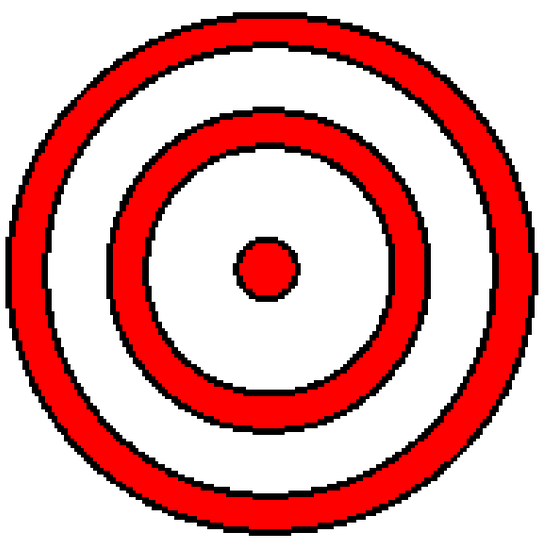
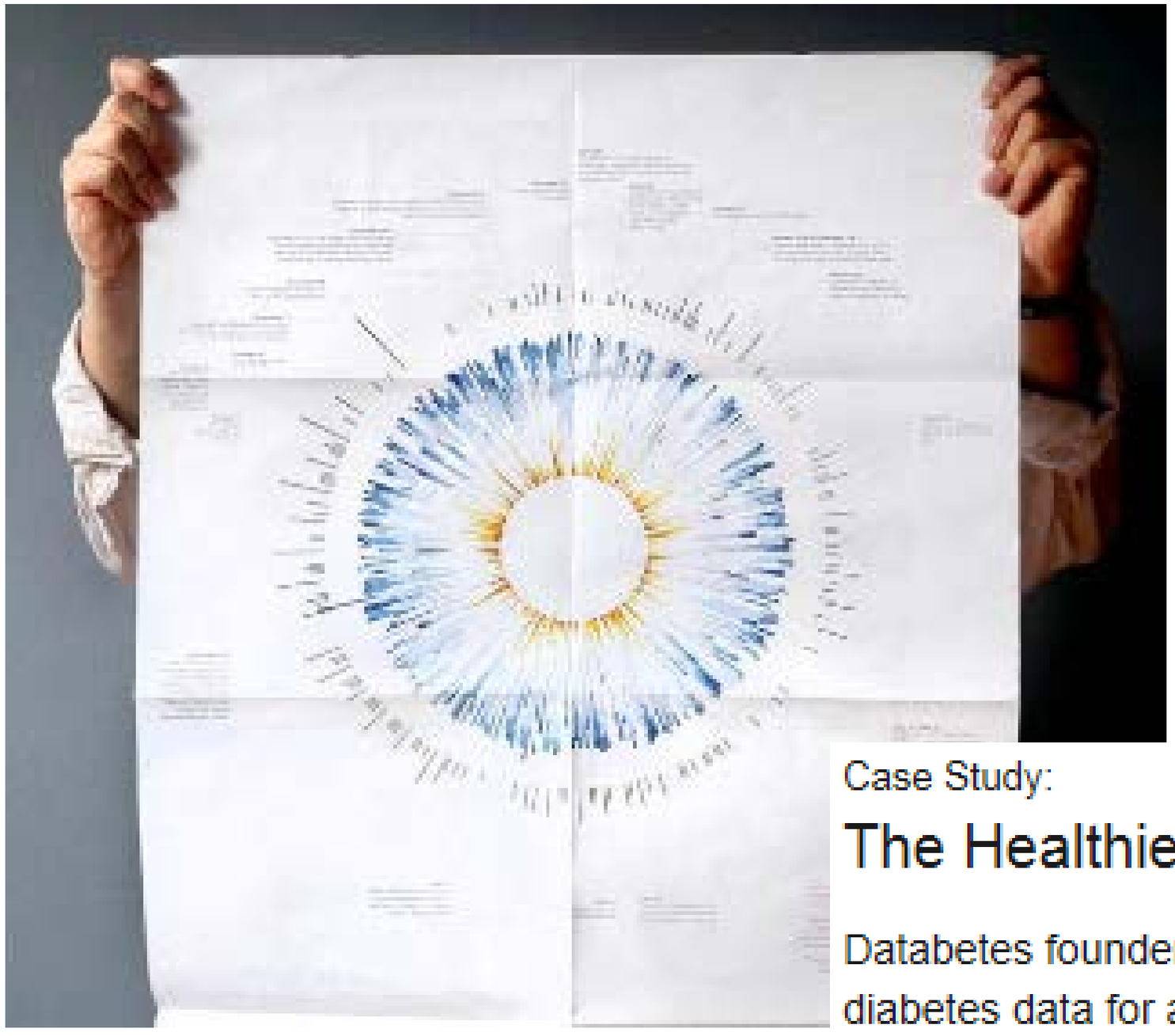
Goals

- Review current practice of managing diabetes data
- Share approach and benefits of EHR integration of home data
- Discuss future opportunities



Diabetes is “big data”

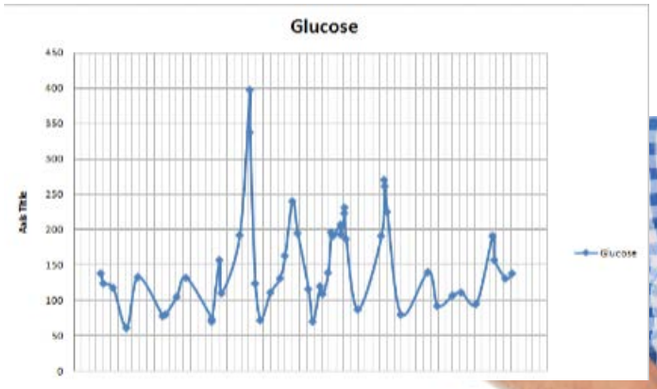


Case Study:

The Healthiest Year of My Life

Databetes founder Doug Kanter closely tracked all his diabetes data for a full year. As a result, he was able to improve his A1c readings by nearly a full point.

Primary goal: balance home blood glucose trends



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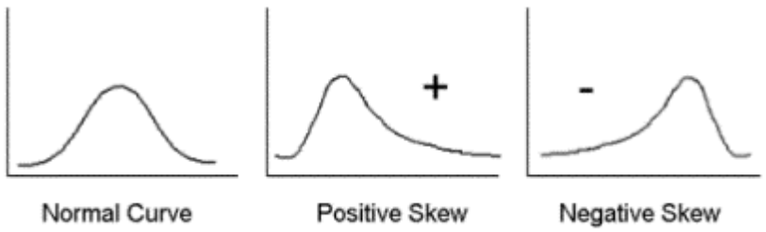
Quarterly visits with the specialist are insufficient

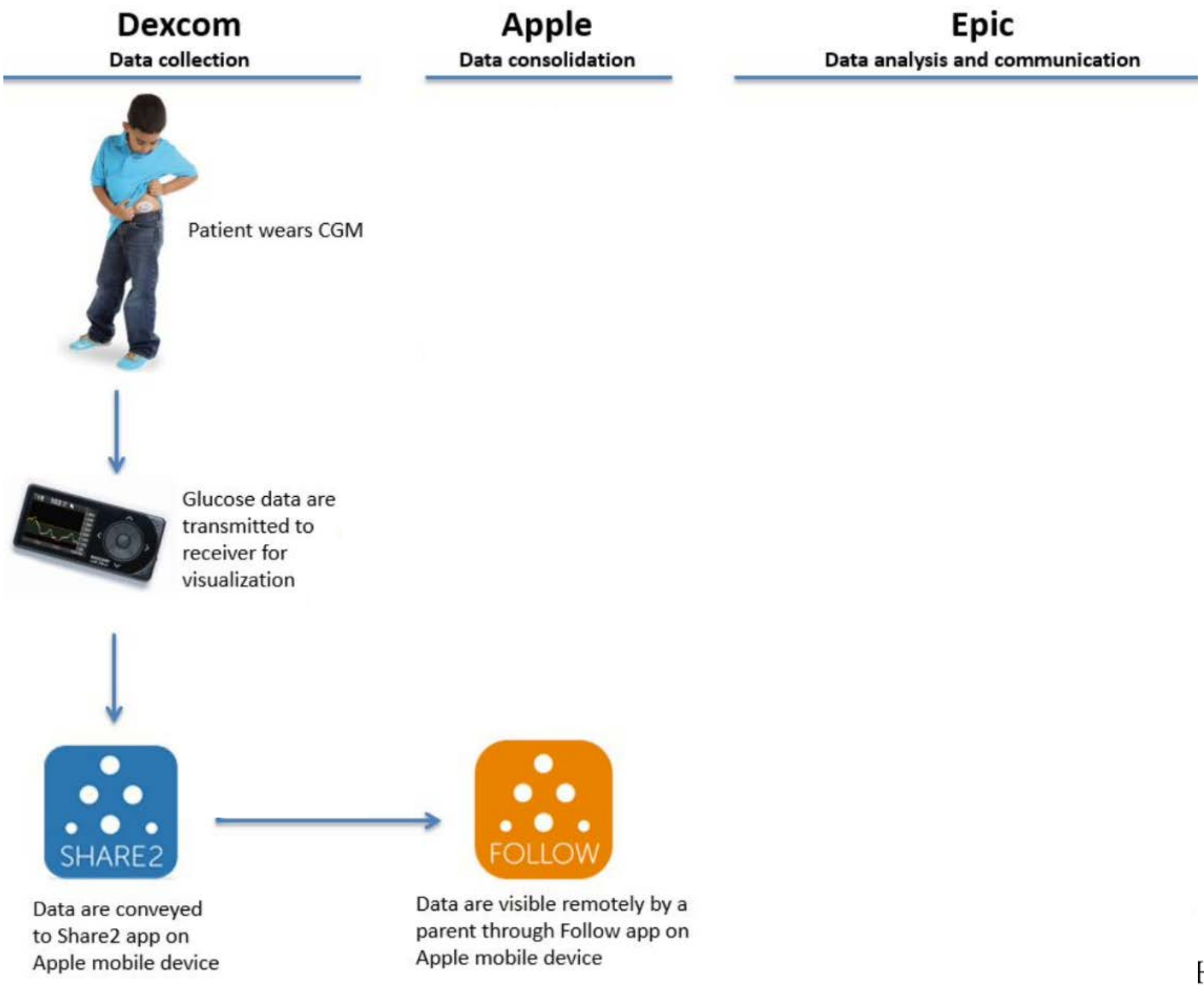


Current clinical practice

- Only active delivery of CGM data between visits
- Provider workflow outside of EHR
- Disparate outcomes data
- Workflow demand = increased activation energy

Dexcom	Apple	Epic
Data collection	Data consolidation	Data analysis and communication

I have no real or apparent conflicts of interest relevant to this presentation


Dexcom
Data collection
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Data consolidation
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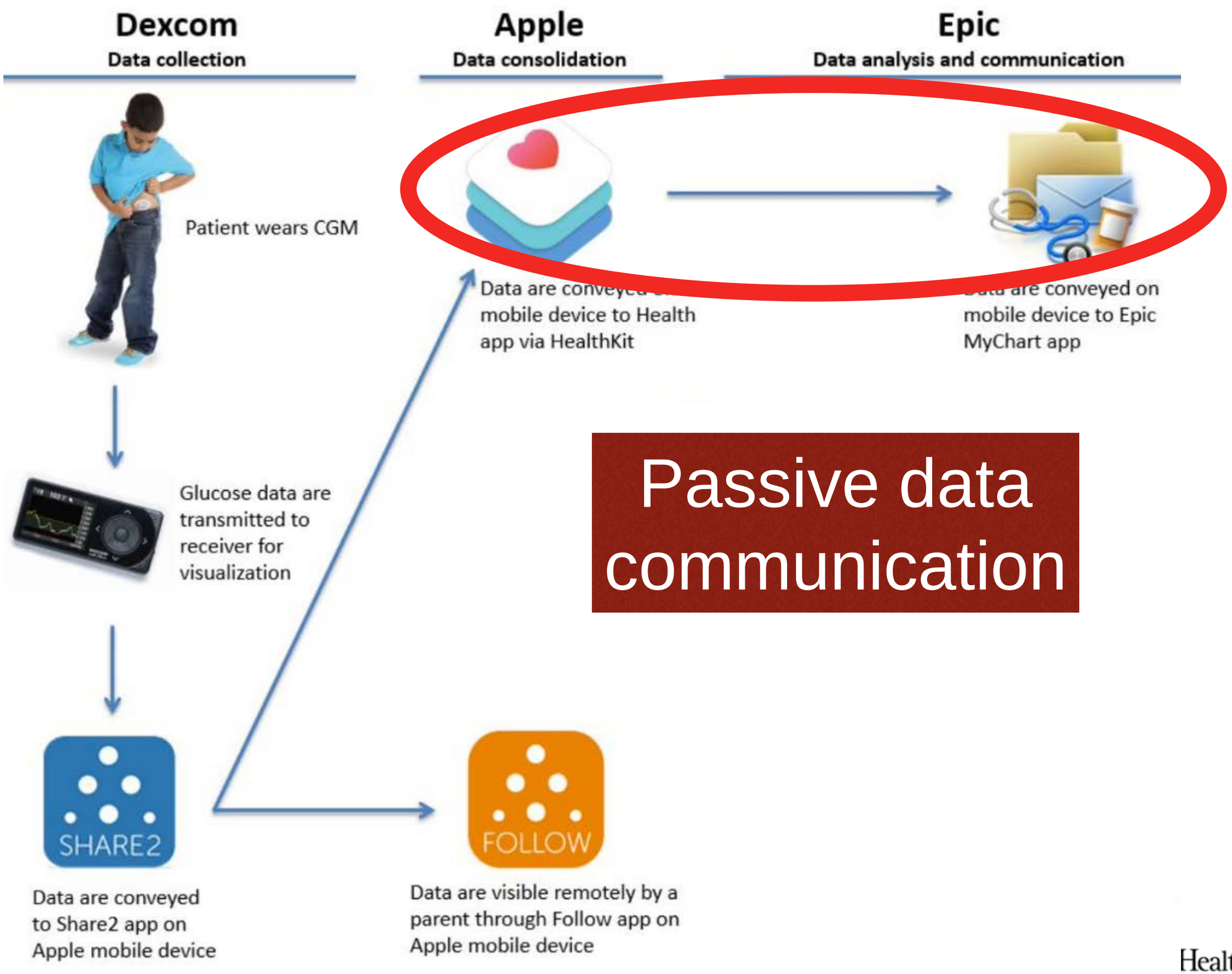
Data analysis and communication
Patient wears CGM
Glucose data are transmitted to receiver for visualization
SHARE2
FOLLOW
Data are conveyed to Share2 app on Apple mobile device
Data are visible remotely by a parent through Follow app on Apple mobile device

Health

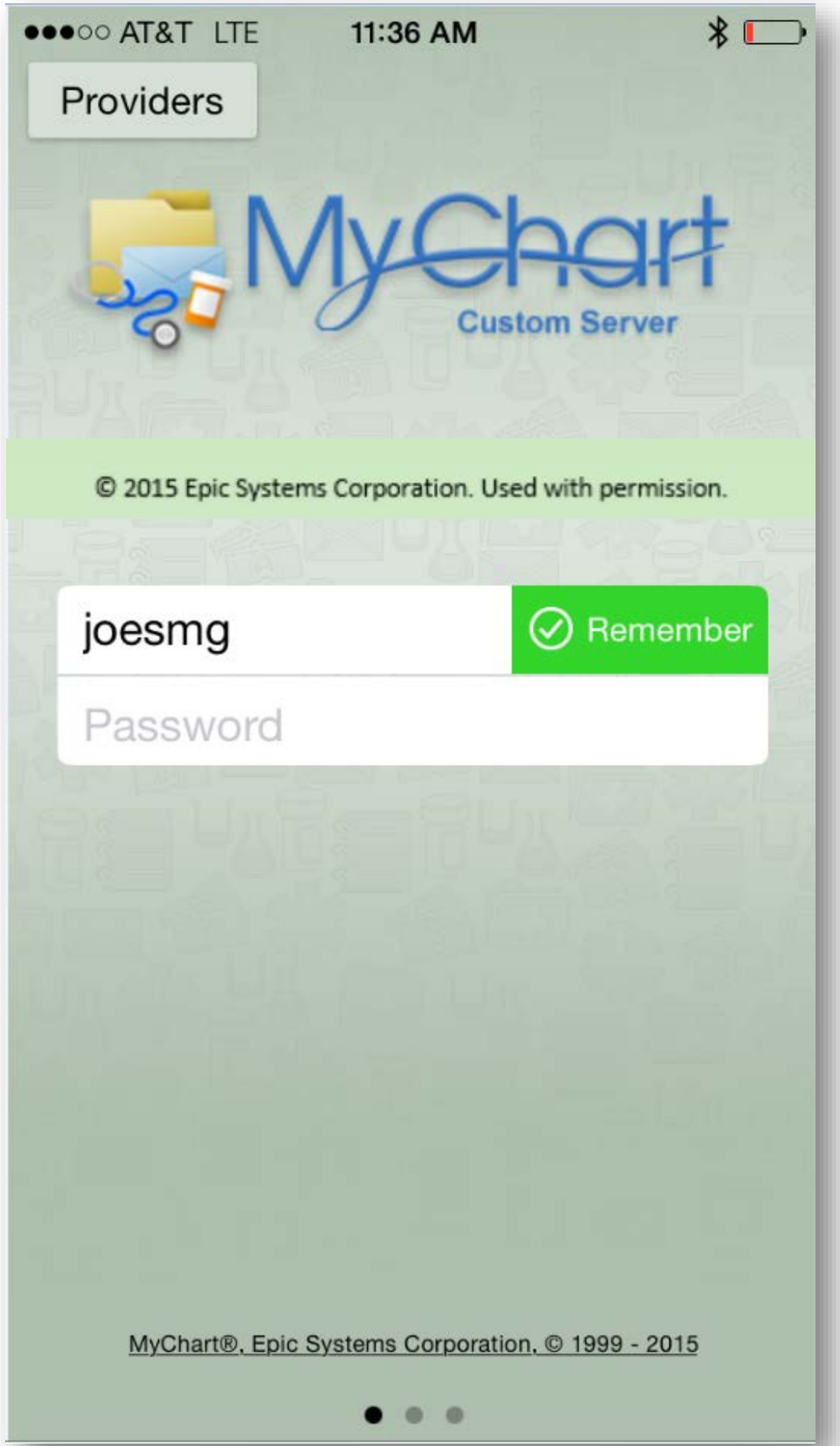


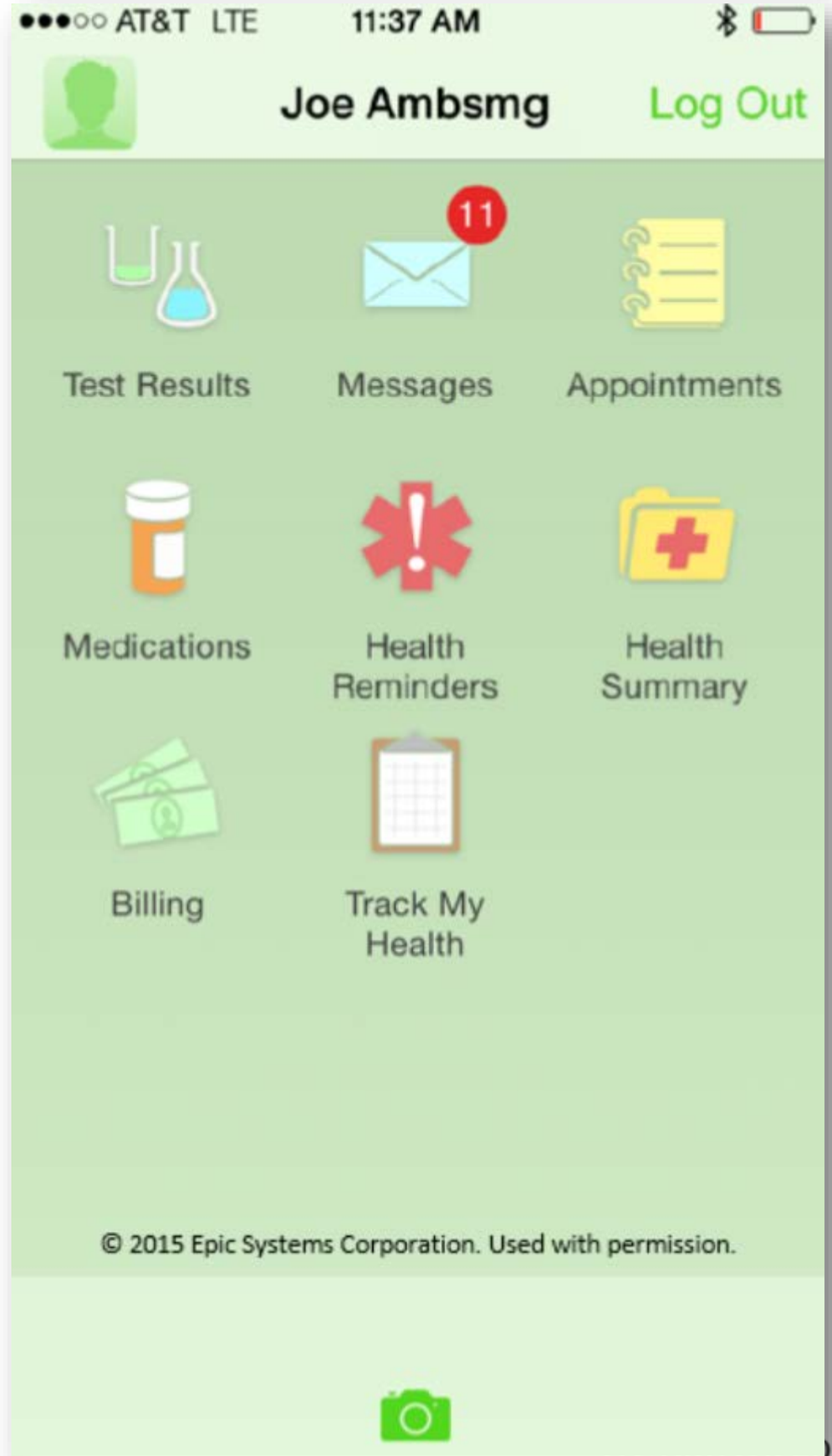
Passive data communication

Health

Mobile enables healthcare consumerism

- Mobile phones are increasingly ubiquitous among teens and healthcare proxies for young children and older adults
- Adolescents are adept with electronic media and this technology has been implemented in care models[1,2]
- Youth from low-income families are more likely to access the internet from their phone than a computer[3]


AT&T LTE 11:36 AM
Providers
MyChart
Custom Server
© 2015 Epic Systems Corporation. Used with permission.
joesmg
Remember
Password
MyChart®, Epic Systems Corporation, © 1999 - 2015


AT&T LTE 11:37 AM
Joe Ambsmg
Log Out
11
Test Results
Messages
Appointments
Medications
Health Reminders
Health Summary
Billing
Track My Health
© 2015 Epic Systems Corporation. Used with permission.

●●●○○ AT&T LTE 11:37 AM

Track My Health

Fever Diary
Fever Temperature, Associated Symptoms, M...

CHF Flowsheet
Weight, Systolic, Diastolic, Are you following a...

LPCH HealthKit
Blood Glucose (mg/dl)

Manage Connections

●●●○○ AT&T LTE 11:37 AM

Close Health Connections

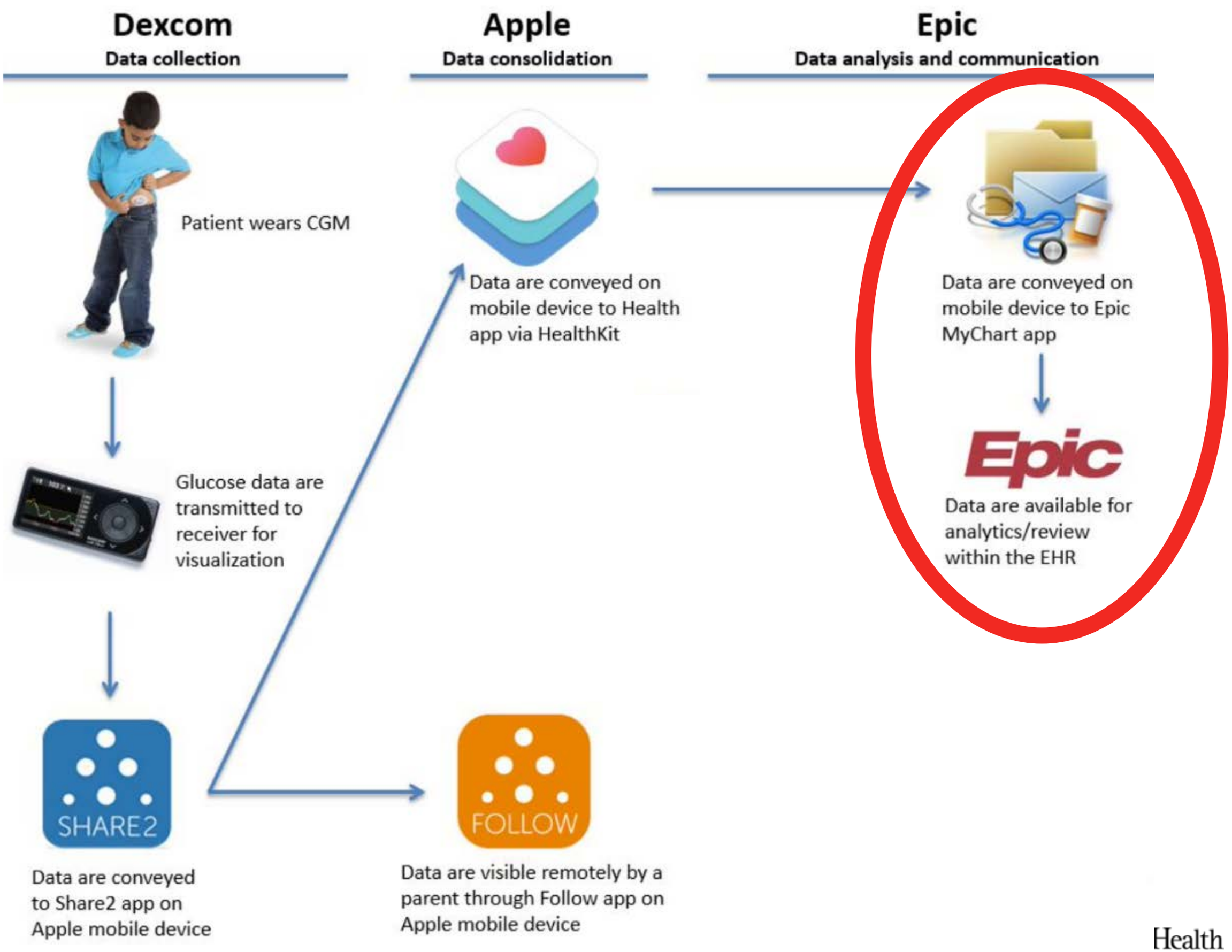
This Device → Joe Ambsmg

DATA BEING RECEIVED FROM "HEALTH"

Blood Glucose
Latest reading: 1/13/15, 10:49 AM

If the latest reading looks incorrect, check "Health" to make sure that you're allowing MyChart to request that data.

Stop Receiving Data


Dexcom
Data collection
Apple
Data consolidation
Epic
Data analysis and communication
Patient wears CGM
Data are conveyed on mobile device to Health app via HealthKit
Data are conveyed on mobile device to Epic MyChart app
Epic
Data are available for analytics/review within the EHR
Glucose data are transmitted to receiver for visualization
SHARE2
FOLLOW
Data are conveyed to Share2 app on Apple mobile device
Data are visible remotely by a parent through Follow app on Apple mobile device

Health

Diabetes triage report in the EHR

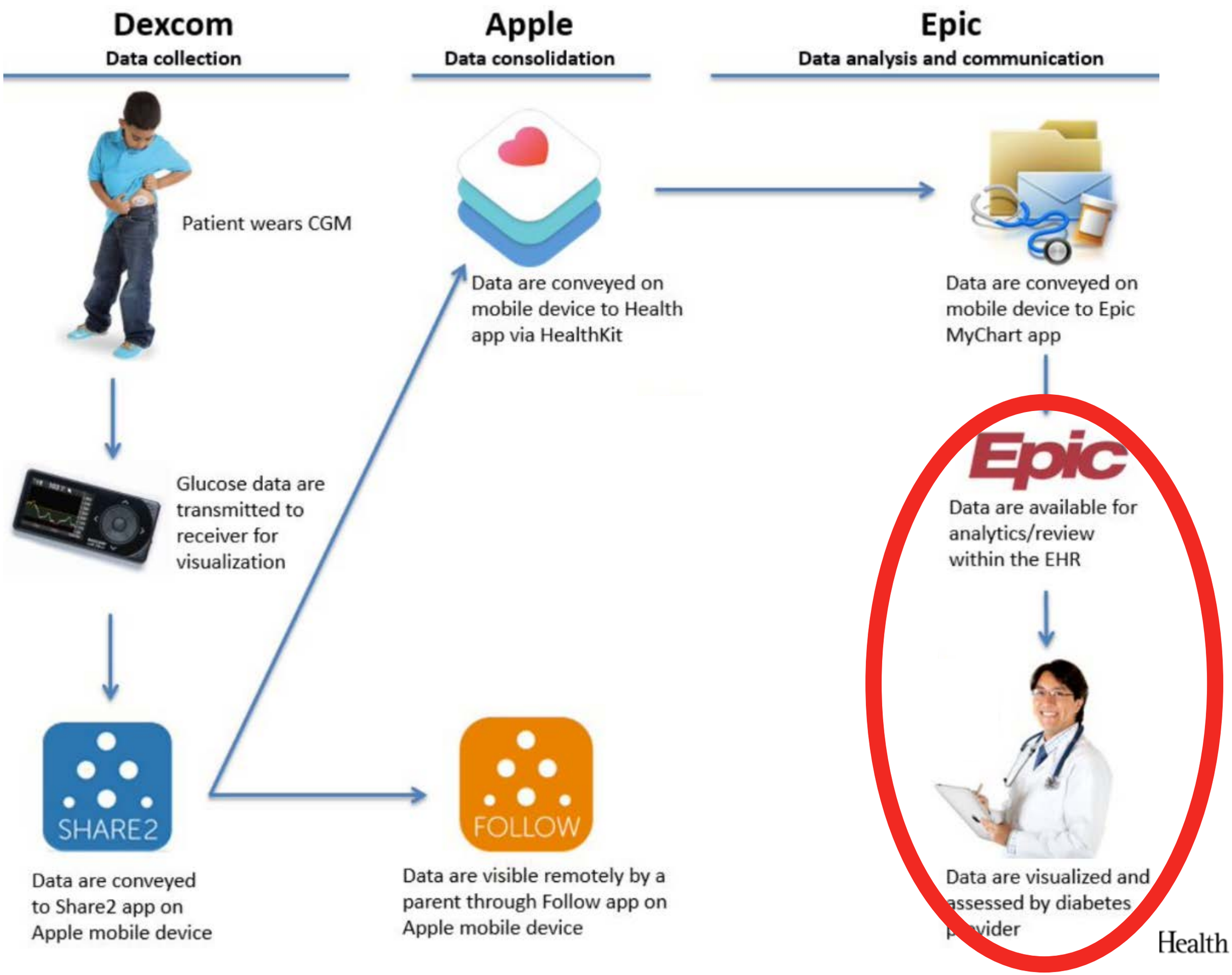
- CGM data within the EHR allows custom reporting to triage care for a large number of patients
- Auto-report generation every 2 weeks, or sooner on-demand
- Patients triaged by episodic nocturnal hypoglycemia, percent overall hypoglycemia, and estimated HgbA1c

Stanford Children's Health Assessment of Diabetes Information in the EHR (SADIE) Report — **Report Date: 6/30/2015**

Joshua F. Ninja	**24682468**	**15-year old**	**M**				
	Ave # readings/day	Mean BG (mg/dL)	SD (mg/dL)	%nighttime BGs <70 mg/dL	%total BGs <70 mg/dL	%total BGs >250 mg/dL	Estimated HgbA1c (%)
2 weeks	*250*	155	67	18	11	16	7.0
4 weeks	*260*	189	82	9	5	24	8.6
12 weeks	*144*	151	86	16	7	10	6.9
Tom M. De'Man	**12365412**	**22-month old**	**M**				
	Ave # readings/day	Mean BG (mg/dL)	SD (mg/dL)	%nighttime BGs <70 mg/dL	%total BGs <70 mg/dL	%total BGs >250 mg/dL	Estimated HgbA1c (%)
Simrat							
	Ave # readings/day	Mean BG (mg/dL)	SD (mg/dL)	%nighttime BGs <70 mg/dL	%total BGs <70 mg/dL	%total BGs >250 mg/dL	Estimated HgbA1c (%)
2 weeks	*223*	132	40	4	5	1	6.2
4 weeks	*200*	120	38	9	5	1	5.8
12 weeks	*180*	180	60	11	4	3	6.9
Rosalia S. Socool	**72365412**	**4-year old**	**F**				
Amit B. Phenom	**94682468**	**17-year old**	**M**				
	Ave # readings/day	Mean BG (mg/dL)	SD (mg/dL)	%nighttime BGs <70 mg/dL	%total BGs <70 mg/dL	%total BGs >250 mg/dL	Estimated HgbA1c (%)
2 weeks	*250*	155	67	4	11	16	7.0
4 weeks	*260*	189	82	15	5	24	8.6
12 weeks	*144*	151	86	3	7	10	6.9
Rajesh S. Fantastik	**28365412**	**3-year old**	**M**				
	Ave # readings/day	Mean BG (mg/dL)	SD (mg/dL)	%nighttime BGs <70 mg/dL	%total BGs <70 mg/dL	%total BGs >250 mg/dL	Estimated HgbA1c (%)
2 weeks	*100*	212	100	0	3	20	9.0
4 weeks	*50*	250	97	0	3	22	10.3
12 weeks	*10*	300	167	1	5	30	12.1
Arash A. Mazin	**54354354**	**11-year old**	**M**				
	Ave # readings/day	Mean BG (mg/dL)	SD (mg/dL)	%nighttime BGs <70 mg/dL	%total BGs <70 mg/dL	%total BGs >250 mg/dL	Estimated HgbA1c (%)
2 weeks	*223*	132	40	9	5	1	6.2
4 weeks	*200*	120	38	9	5	1	5.8
12 weeks	*180*	150	60	11	4	3	6.9

Population health within the EHR

Outcome data in a unified database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Data are visible remotely by a parent through Follow app on Apple mobile device
Data are visualized and assessed by diabetes provider
Health

SnapShot

SnapShot | Encounters | Notes/Trans | Letters | Anes | Surg/Periop | Proced

Chart Review
Care Everywhere
Growth Chart
Results Review
Synopsis
History
Allergies
Problem List
Medications
Immunizations

PCHA Snapshot | After Visit Summary

Web Resources

Problem List

New problems from outside sources are available for reconciliation

Endocrine

Type 1 diabetes mellitus

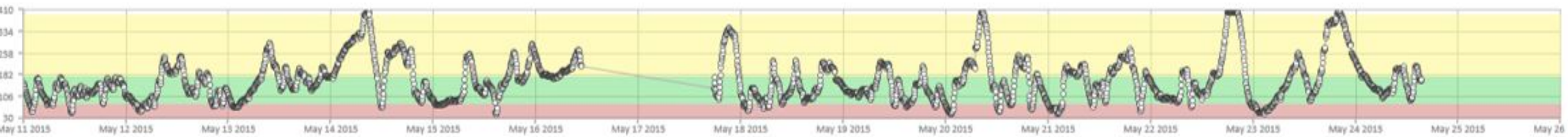
Mark as Reviewed | Reviewed by You on 7/20/2015

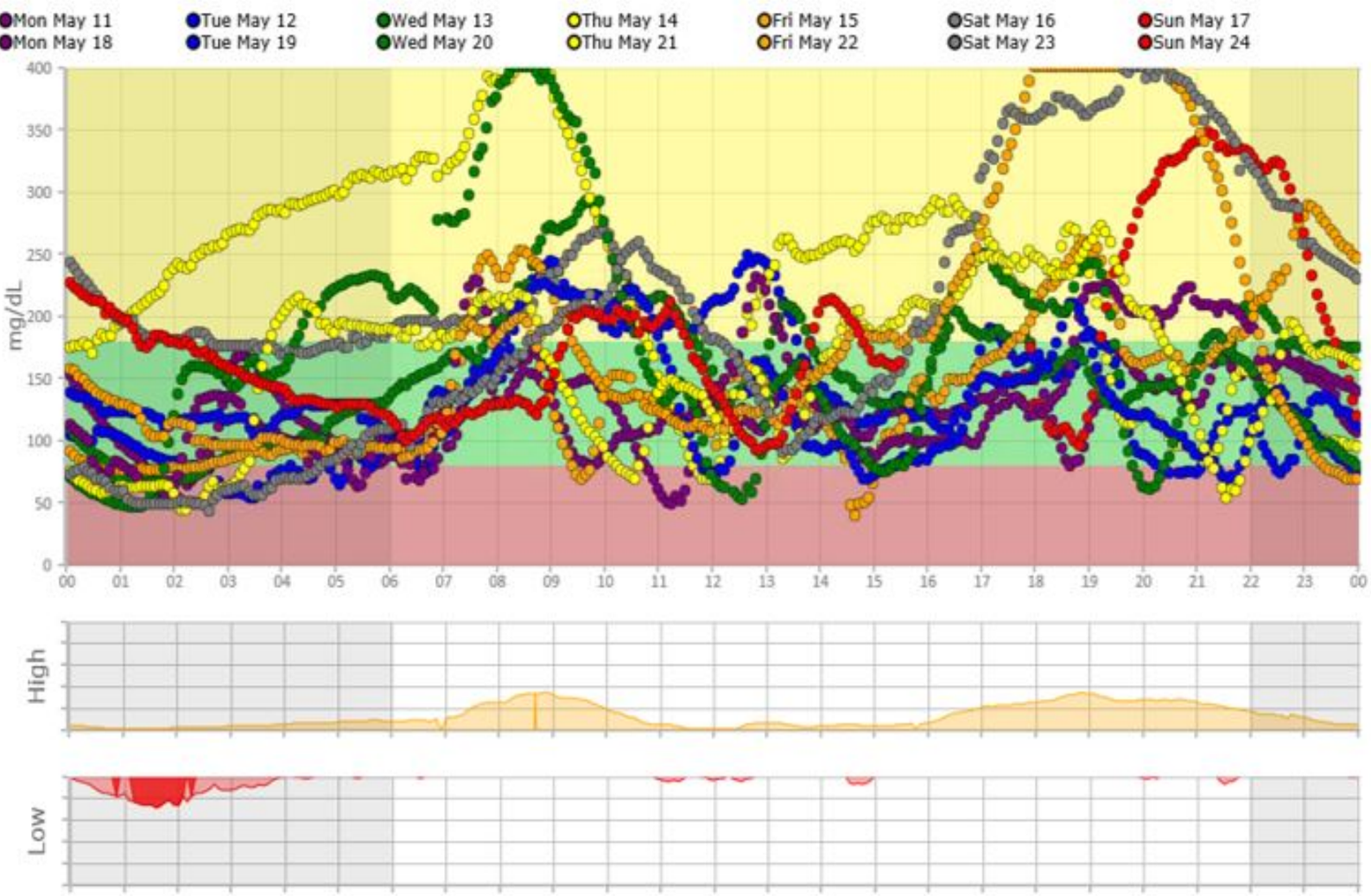
Clinical Decision Support

GluVue

Night Starts 22:00 | Night Ends 06:00 | Target = 80 to 180

Lookback 14 Days | From 05/25/2015 | Go!





Cumulative

Glucose Average	163.8 mg/dL
Standard Deviation	± 76.4 mg/dL
Estimated HgbA1c	7.3 mg/dL

Daytime

Glucose Average	179.3 mg/dL
Standard Deviation	± 78.2 mg/dL
Estimated HgbA1c	7.9 mg/dL

Significant Lows 01:10 to 02:05

Nighttime

Glucose Average	134.5 mg/dL
Standard Deviation	± 63.2 mg/dL
Estimated HgbA1c	6.3 mg/dL

Significant Lows 01:10 to 02:05

gluvue.stanfordchildrens.org

lth

EMR Integration

Introduction

Integrating GluVue with an Electronic Medical Record (EMR) is a relatively straight forward process. There are three principle steps: extract the glucose data for a given timeframe from the backend, format the data into a JavaScript Object Notation (JSON) string, and then post that string to the GluVue site, which will automatically process the data and take the user directly to the GluVue Dashboard. *No protected health information is transmitted.* The following steps provide guidelines for successfully linking an EMR to GluVue.

Extract the Data

Exactly how to extract the data will be contingent upon the specific EMR in use at your organization. See the section Integrating With Specific EMRs below for more detailed instructions for several of the most popular EMRs. Now we will go over the data to pull and how to go about pulling it.

Before extracting the data, a timeframe must be specified. For instance, a range of the past seven to fourteen days is a good place to start. This can be statically set within the code, or in more advanced builds, an HTML form could be created to allow a user to select the timeframe that they would like to see. Although GluVue can handle very large timeframes, they will of course take longer to load from the EMR and to process once loaded.

The three data elements to send to GluVue are:

- The start date of the desired lookback timeframe
- The end date of the desired lookback timeframe
- The measurement data-set (in the form of a JSON string)

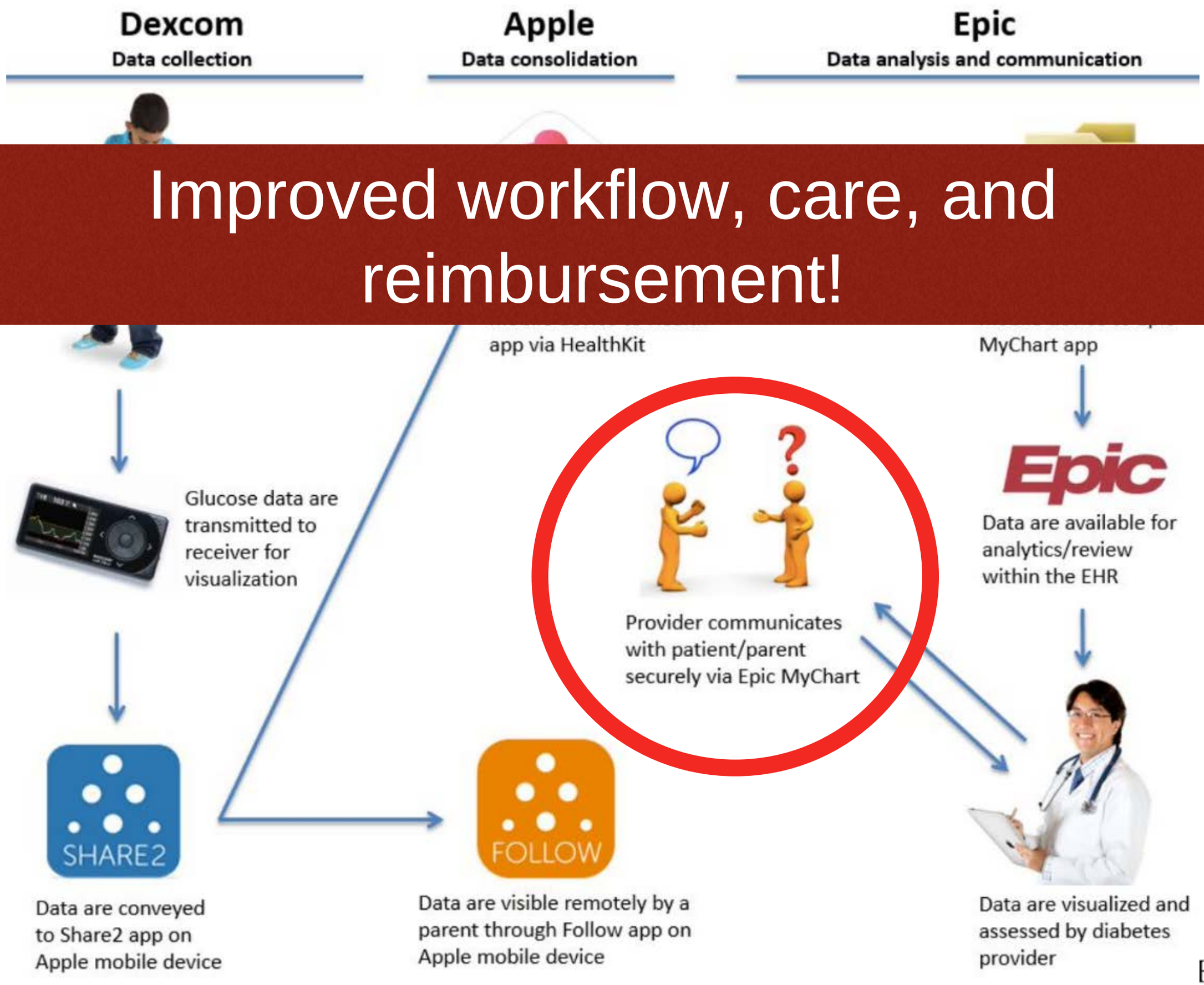
Basically, the measurement data-set to pull is just a big list of glucose measurements and a timestamp of when the measurement was taken. Exactly which types of measurements to use should be decided by your organization. For example, types of measurements to use could include: Continuous Glucose Monitoring (CGM) results, Ser/Plas Glucose, Fasting Glucose, Nonfasting Glucose, etc. The list does not have to be in chronological order.

Format the Data

GluVue can accept the start and end dates in most common formats, such as "MM/DD/YYYY", "YY-MM-DD", "YYYY-MM-DD", etc. For processing and display purposes, the start *time* will be midnight (00:00:00) on the start date and the end *time* will be 11:59:59pm on the end date. Note that if using two digit years the format "XX/XX/XX" will be treated as "MM/DD/YY", while "XX-XX-XX" comes out as "YY-MM-DD". Unix Timestamps are accepted but must be proceeded by the @ symbol - i.e. "@1215282385". If an invalid format is passed for either the start or end dates, an error message will be generated and processing will stop.

As previously mentioned, the glucose measurement data should be passed in the form of a JSON string. For a

Improved workflow, care, and reimbursement!



Health

Evolving care model

2015 Continuous Glucose Monitoring (CGM) Coding Reference

Description	RVU[1] Non-Facility*	Medicare[1] Physician Fee Schedule	Medicare[2] Outpatient Diabetes Center	Private Payer[3]
95251: Ambulatory continuous glucose monitoring of interstitial tissue fluid via a subcutaneous sensor for a minimum of 72 hours; interpretation and report. (Do not report more than once per month)	1.22	$44	Paid under physican fee schedule	$85

In support of At-Risk and Telehealth models providing convenience and enhanced access to multi-disciplinary teams, particularly in locations without pediatric endocrinologists

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Ask the patients about their data

- Goal of enhanced self-management skills and improved provider interpretation of data[4]
- Patient portal facilitates bidirectional asynchronous communication about data
- Adolescents need to be involved in their care and have special needs for security/privacy[5,6]

Current clinical practice

- ~~Only active delivery of CGM data between visits~~
- ~~Provider workflow outside of EHR~~
- ~~Disparate outcomes data~~
- ~~Workflow demand = increased activation energy~~

- Passive data communication
- Population health within the EHR
- Outcomes data unified
- Improved workflow, care, and reimbursement

and

Less documentation + no device downloads in clinic = more time to interact with patients at visits!

Journal of American Medical Informatics Association, April 2016

Automated integration of continuous glucose monitor data in the electronic health record using consumer technology

RECEIVED 31 May 2015
REVISED 29 October 2015
ACCEPTED 8 December 2015

RB Kumar,[1,2,*] ND Goren,[1] DE Stark,[3] DP Wall,[1] and CA Longhurst[4]

ABSTRACT

The diabetes healthcare provider plays a key role in interpreting blood glucose trends, but few institutions have successfully integrated patient home glucose data in the electronic health record (EHR). Published implementations to date have required custom interfaces, which limit wide-scale replication. We piloted automated integration of continuous glucose monitor data in the EHR using widely available consumer technology for 10 pediatric patients with insulin-dependent diabetes. Establishment of a passive data communication bridge via a patient's/parent's smartphone enabled automated integration and analytics of patient device data within the EHR between scheduled clinic visits. It is feasible to utilize available consumer technology to assess and triage home diabetes device data within the EHR, and to engage patients/parents and improve healthcare provider workflow.

Keywords: electronic health records, patient generated health data, mobile applications, blood glucose, clinical informatics

INTRODUCTION

Type 1 diabetes is one of the most common chronic diseases of childhood, and its incidence and prevalence continue to rise.[1–3] Tight control of hyperglycemia (high blood glucose) with intensive insulin therapy, including in early childhood, decreases the risk of serious long-term diabetes complications.[4–6] However, aggressive insulin dosing may result in hypoglycemia (low blood glucose) with risk of adverse changes in the central nervous system.[7,8] As a result, self-monitoring of blood glucose is critical for affected children and their parents to guide mealtime insulin dosing and to facilitate interventions

announced that its patient portal app ("MyChart") would be HealthKit compatible, our team recognized the opportunity to use this platform for integration of patient device data into the EHR.[19] Subsequently, a major continuous glucose monitor (CGM) device company (Dexcom, San Diego, CA, USA) announced compliance of its patient-facing app with the described platform, and we launched a pilot initiative to assess the feasibility of EHR integration of home-based continuous glucose monitoring. Our Institutional Review Board exempted this quality improvement initiative from oversight.

On the horizon

- Currently we set patient/proxy expectation that we do not have the people-power to monitor all patient data in real-time
- Implications disrupt the current care model to facilitate stronger (real-time) support for our patients, and to optimize our understanding of their disease at individual and population levels
- Broad applicability to all age groups and disease

Technology | Mon Sep 15, 2014 7:56am EDT

Related: HEALTH, TECH, MEDIA

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'We've had physicians basically knocking down my door to say, "When can we use this?"'

March 12, 2015

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Conclusions

- Technology-enabled care models improve value for patients
- Updated reimbursement strategies incentivize adoption

References

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Questions?

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