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# Modern Times: Technology and Diabetes Care Comfortably Numb?

Dr Partha Kar

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Digital technology...  
are we falling behind?

Comfortably Numb....

*Dr Partha Kar*

Is the future here...?





# *STAR TREK*

# Digital?



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- Phones?
- Email?
- Skype?
- App?
- Self management online programmes?
- WhatsApp?
- SnapChat?





# What is Technology?

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“The application of scientific knowledge for practical purposes”

... In Diabetes this has been mainly focussed on specific areas:

- a) Towards a Cure
- b) Towards more effective treatments
  - Of Glucose Levels
  - Of Diabetes-related Complications
- c) Towards more manageable lifestyles

# BG Meters (>58 available in the UK)





# Centralising Data



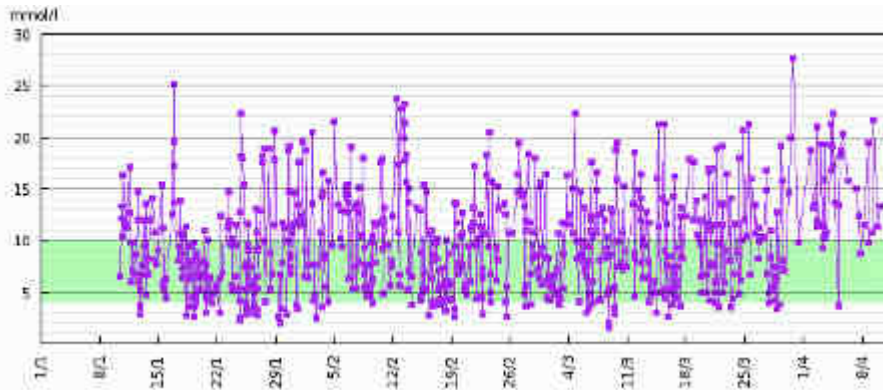
Images supplied by speaker.

# Visualising Data from SMBG

## 1 Longitudinal Analysis

### The Trend Graph

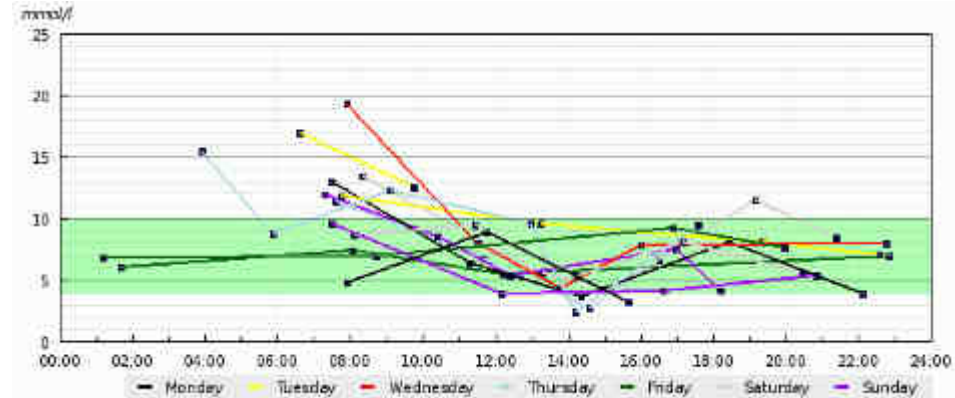
- How have things changed over time?
- How did therapy changes effect control?



## 2 Cross-sectional Analysis

### The Standard Day Graph

- Which parts of the day offer greatest / least risk?
- How reproducible is this?



# UK-Available CGM Devices



- Medtronic iPro 2
  - High initial cost, 6 day blinded diagnostic device, no patient interaction required (diary data and tds SMBG for calibration) post hoc data analysis (~£50 per sensor)



- Medtronic Mini-link / Guardian 2 Link
  - Pump integration potential (Veo / 640G), £2500pa for sensors (6days each) start-up cost for pumpers ~£500



- Dexcom (G4 / G5)
  - High cost (£4500 pa) but most “consumer friendly” unit with phone integration (G5). Sensors weekly (but often extended), potential to link to Animas Vibe Pump – can be blinded



- Freestyle Navigator 2
  - Lowest cost start-up for CGM (~£900) 5day sensors (£40) no pump integration, limited availability – can be blinded

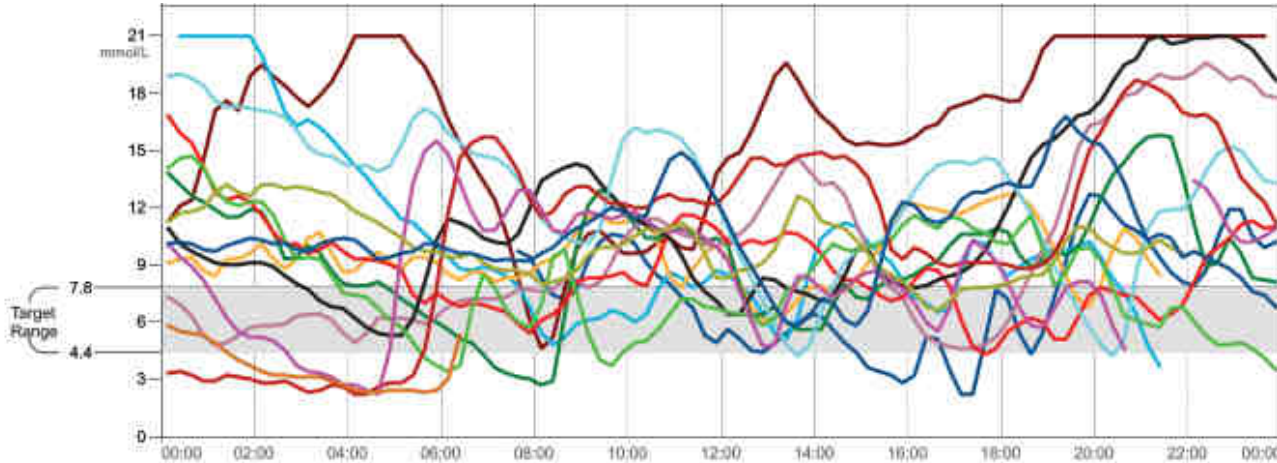


- Freestyle Libre
  - Strictly “Flash” monitoring not CGM thus no alarm option, but most financially accessible (£130 start-up, £100pm thereafter)



# Challenges of CGM data

Data density brings its own problems - interpretation



## Using the AGP

Simplifies Complex Datasets into manageable snapshots



# Flash Glucose Monitoring

- Sensor designed to be worn for *14 days*
- *No fingerstick calibration* required
- *Quick scan* of the reader over the sensor collects & displays glucose data, time reading, directional arrows, and 8 hour profile
- *Sensor automatically measures, captures and stores* glucose data
- Standard *NFC wireless protocols* (RFID)
- *Color touch-screen* reader

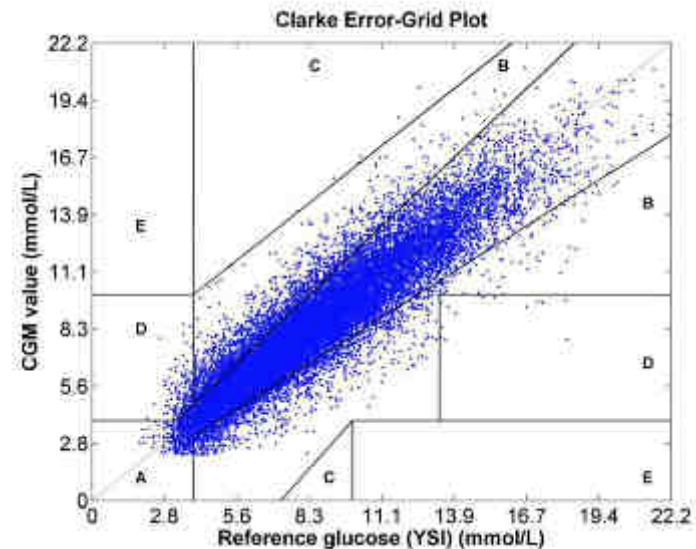


# Senseonics Implantable Glucose Sensor



Study Visit (Days)	Kaplan-Meier Survival Probability (%)
45	100%
90	82%
135	59%
180	40%

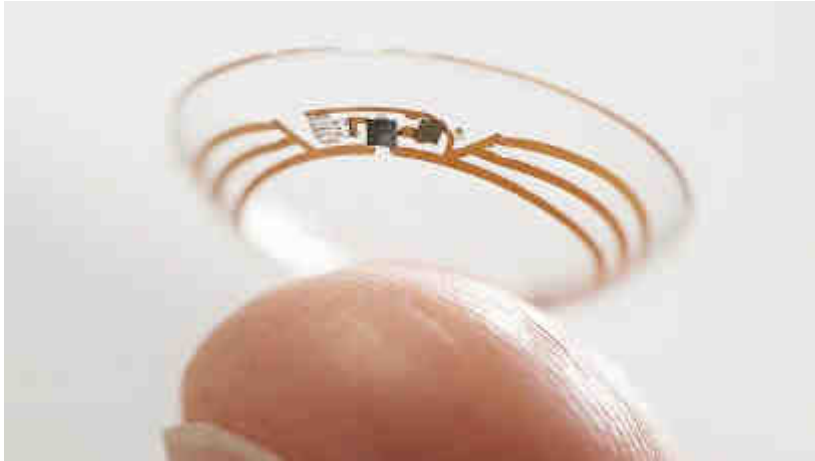
Median sensor life = 149 days



Glycemic Range	CGM to YSI (Clinic Sessions)			
	Overall (40-400 mg/dL)	Hypoglycemia (<75 mg/dL)	Euglycemia (75-180 mg/dL)	Hyperglycemia (>180 mg/dL)
MARD (95% CI)	11.6% (11.5 - 11.8%)	21.7% (20.4 - 23.0%)	11.9% (11.8 - 12.1%)	9.2% (9.0 - 9.4%)



# Lenses and Glass



# Glucose Sensing Tattoos?

- Special “inks” made from carbon nanotubes containing glucose-responsive fluorescent materials are in development
- Inks change colour (when subjected to near infrared light) depending on glucose levels



# Sensor augmented pump therapy



1: Sensor indicates glucose 100 mg/dl & declining

5: Sensor indicates declining glucose

3: Rebound hyperglycemia

7: Rebound hyperglycemia



Insulin Delivery



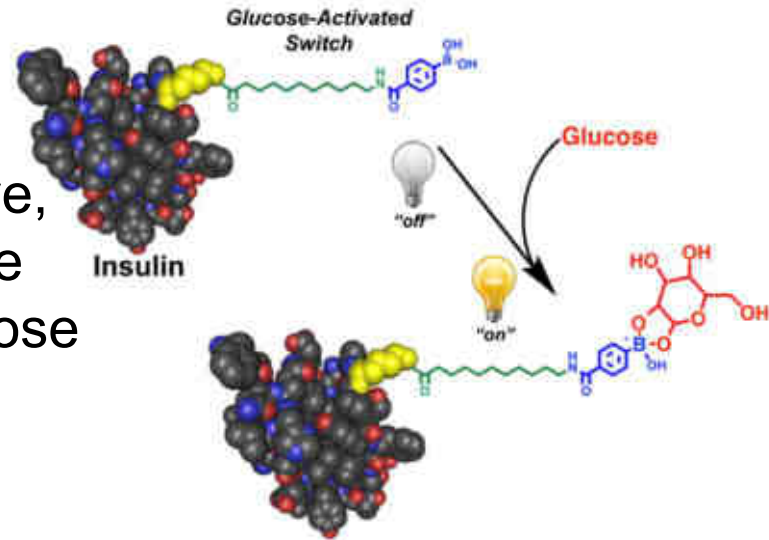
2: Suspension of basal insulin

4: Lunch bolus

6: Suspension of basal insulin

# Smart Insulins ?

Designed to be injected and inactive, the molecule is then activated in the presence of higher than usual glucose levels resulting in action only when needed



Smart, glucose-responsive insulin

# Digital?



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- Phones?
- Email?
- Skype?
- App?
- Self management online programmes?
- WhatsApp?
- SnapChat?
- “Insulin technology”?
  
- Are we ready??

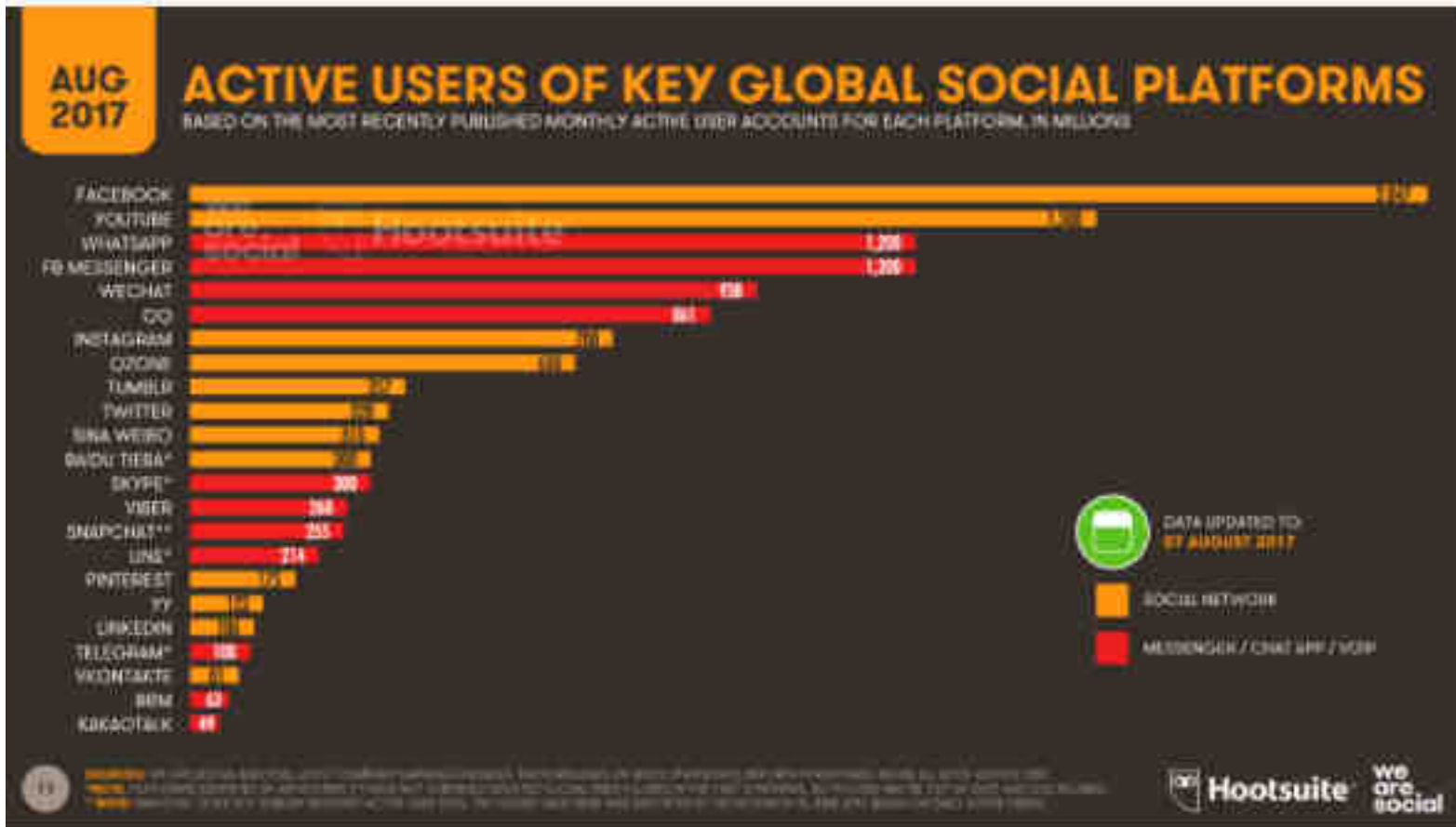
# Use of digital networks is extensive







# What is being used?



# What about Apps?



# The dread and fear...



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- What will the patient know?
- Would they know more than me?
- Expectations
- “Professor” Google

# The Three Basics...



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- Evidence
- Harm
- Cost



# A Team-Based Online Game Improves Blood Glucose Control in Veterans With Type 2 Diabetes: A Randomized, Controlled Trial

B. Price Kerfoot, David R. Gagnon, Graham T. McMahon, Jay D. Orlander, Katherine E. Kurgansky and Paul R. Conlin

Diabetes Care 2017 Jul; dc170310. <https://doi.org/10.2337/dc17-0310>

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**Article**

Figures & Tables

Suppl Material

Info & Metrics

 PDF

**CONCLUSIONS** Patients with diabetes who were randomized to an online game delivering DSME demonstrated sustained and meaningful HbA<sub>1c</sub> improvements. Among patients with poorly controlled diabetes, the DSME game reduced HbA<sub>1c</sub> by a magnitude comparable to starting a new diabetes medication. Online games may be a scalable approach to improve





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Published on 02.11.16 in [Vol 18, No 11 \(2016\): November](#)

This paper is in the following e-collection/theme issue:

**Results:** A total of 23 articles met the inclusion criteria, arranged under 11 themes according to their target behaviors. All studies were conducted in high-income countries. Of these, 17 studies reported statistically significant effects in the direction of targeted behavior change; 19 studies included in this analysis had a 65% or greater retention rate in the intervention group (range 60%-100%); 6 studies reported using behavior change theories with the theory of planned behavior being the most commonly used (in 3 studies). Self-monitoring was the most common behavior change technique applied (in 12 studies). The studies suggest that some features improve the effectiveness of apps, such as less time consumption, user-friendly design, real-time feedback, individualized elements, detailed information, and health professional involvement. All studies were assessed as having some risk of bias.

# Distal technology

Danny C Duke, Samantha Barry, Dr

Type 1 diabetes requires int

can deliver substantial

## Panel 1: Distal technology definitions

### Telehealth

Telehealth uses electronic technology (eg, telephone calls, videoconferencing) to facilitate synchronous communication between patients and providers. Such technology is meant to reduce geographic barriers without sacrificing access to tailored treatment and live interaction with health professionals.

### mHealth

#### Messaging systems

Messaging systems include short message service (SMS), text messaging, and email.

These are asynchronous communications, do not include an auditory component, and are unlikely to be personalised to the individual.

#### Mobile applications

Applications (apps) are software downloaded from a website or an app store and accessible via smartphones and tablet devices. The software is designed to fulfil a particular purpose, which can include self-management education, psychoeducation, reference sources (eg, database of nutritional content of foods), data tracking (eg, physical activity, diet, blood glucose levels), and behavioural interventions.

### Game-based support

Computer and video games have been developed to facilitate diabetes education and promote self-management. Typically, they include situational problem-solving and interactive activities and reinforce health behaviours to improve diabetes outcomes. They are largely targeted at children, adolescents, and young adults with type 1 diabetes.

### Social platforms

Web-based social platforms enable people with diabetes to access social support without geographic boundaries, forming online health communities. These platforms include widely used social media sites (eg, Facebook, Twitter), and various other discussion forums. Web-based social platforms create unique opportunities for online peer support as well as diabetes education and intervention.

### Patient portals

Online interactive treatment environments are systems that facilitate sharing of personal health records between the individual with type 1 diabetes and their health professionals and provide multiple methods for self-managing health information. Portal functions can include online appointment scheduling, appointment reminders, prescription refill requests, journaling and tracking tools, opportunities for health professional support, psychoeducational tools, and the ability to upload, view, and manage health information.



ist Lancet Diabetes Endocrinol 2017

# Social media...the donut analogy

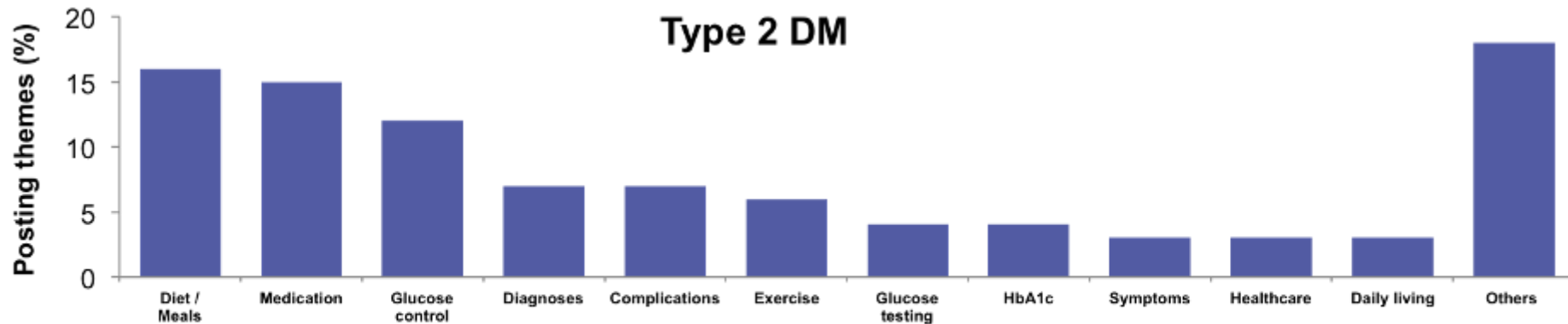
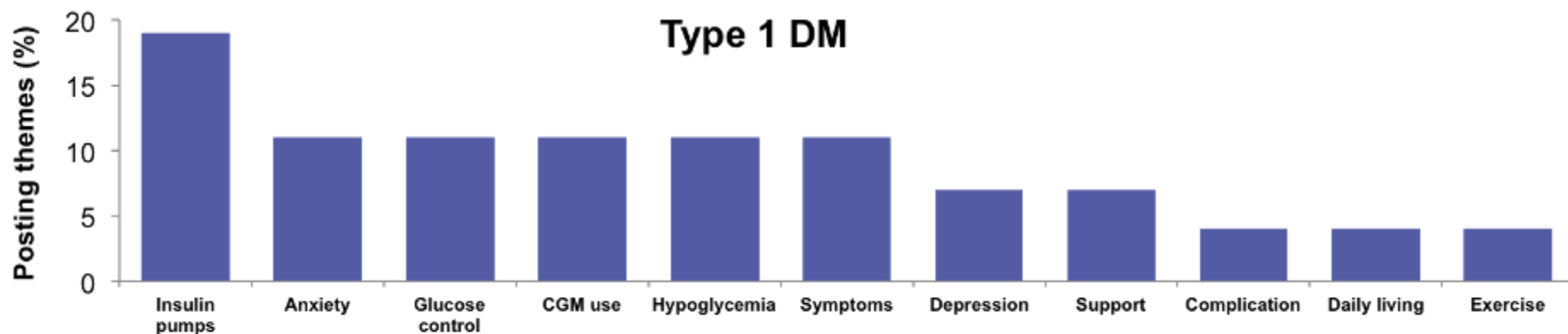


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- *Twitter...*                      *I am eating a #donut*
- *Facebook...*                      *I like donuts*
- *Youtube....*                      *Here I am eating a donut*
- *Instagram...*                      *Here's a vintage picture of me eating a donut*
- *Linked In...*                      *My skills include donut eating*
- *Pinterest...*                      *Heres a donut recipe*
- *Google plus..*    *I am a Google employee who eats donuts*

# What can we learn from social media?

- Data sourced from 125 members of a diabetes online community (78% T2DM, 22% T1DM)
- Posts analysed for major themes



Others = anxiety, comorbidities, hypoglycemia, insulin pumps, smoking, and support (each 2%); and CGM, insurance, pre-diabetes, pregnancy, supplements, and weight loss (each 1%)



# Why bother with social media?

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- Education / CPD
- Interacting with colleagues
- Interacting with patients
- Information gathering
- Fun

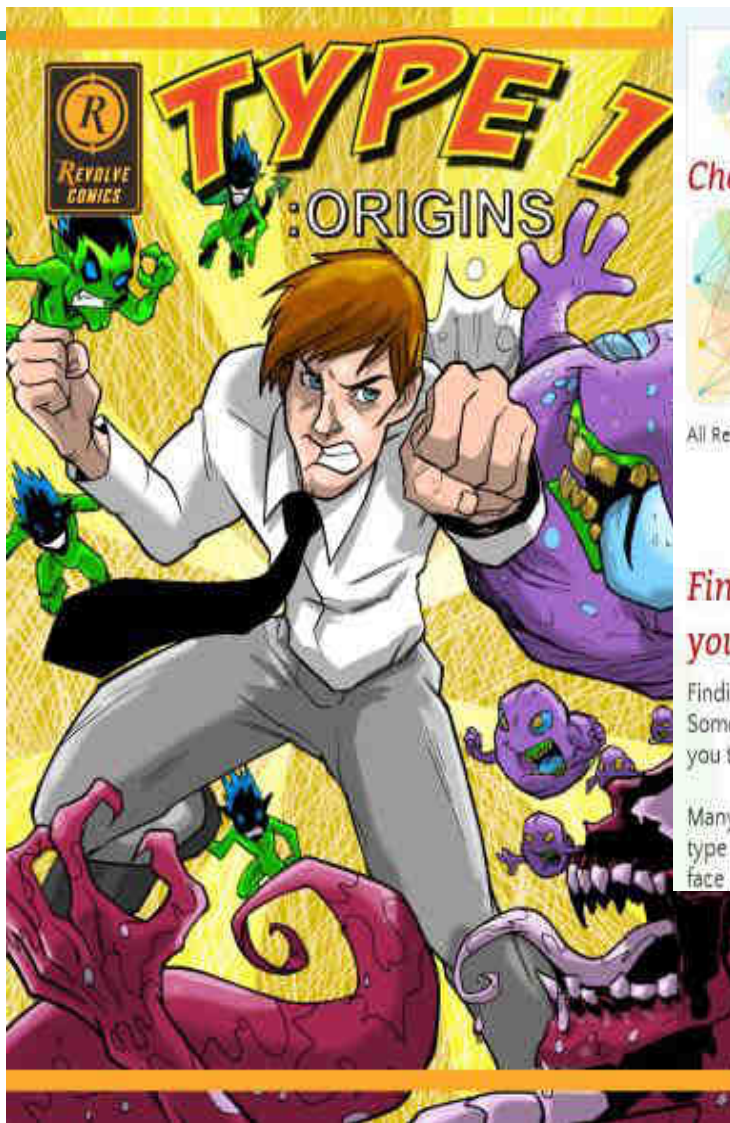
# So....



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- An exciting space
- Huge potential
- Jury still out
- UK Diabetes Digital programme
- Self management is the key
- Working with patients....





## T1 Resources

Site search

Choose a section

- All Resources
- Introduction to T1
- Managing T1 Diabetes
- Managing Life
- Managing Complications
- Future Diabetes

### Find support and information to help you manage Type 1 Diabetes

Finding information on the internet can be a bit bewildering. Some of it is good. Some of it is utter nonsense – but how can you tell which is which?

Many people find interacting online with others living with type 1 diabetes can really help them feel less isolated and to face the daily ups and downs of living with a long term health

### Getting started

If you have never had much to do with *Social Media* it can all seem a bit confusing and slightly scary. So here's a quick guide to some of the channels, what they offer and what to expect.







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8760

0.02%

*Thank you*



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