Transforming Home Dialysis Through Connected Health

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We Live in a “Smart” World

Smart Phones

Smart Homes

Smart Cars

Do we have Smart Health Care?
Practice of Medicine is not “Smart”

Health professionals struggle to keep up with latest knowledge and research.

EMR’s are only snapshots of data.

Trial and error is the universal norm in medical practice.

We lack the sensors, data, and tools for smarter care.

Patient data is episodic and sporadic.
Fear and Isolation are important factors influencing patient experience on home dialysis

- Fear of cannulation
- Fear of needle dislodgement
- Fear of ability to sleep
- Fear of machine
- Fear of inability to learn procedures
- Fear of intradialytic hypotension
- Fear of not being monitored by professionals
- Fear of hurting self

Addressing fears early in the process may mitigate their influence on the patient’s decision

Technique Failure in PD

Kolenysk et al. PDI 2010
Definition of Connected Health

‘Connected Health encompasses terms such as wireless, digital, electronic, mobile, and tele-health and refers to a conceptual model for health management where devices, services or interventions are designed around the patient’s needs, and health related data is shared, in such a way that the patient can receive care in the most proactive and efficient manner possible. All stakeholders in the process are ‘connected’ by means of timely sharing and presentation of accurate and pertinent information regarding patient status through smarter use of data, devices, communication platforms and people’

Care and information is truly coordinated around the patient to achieve optimal results

Connected Health seeks to improve care by:

• putting the patient at the center of the healthcare system
• aggregating and linking information from many different sources to enable more informed care decisions
• leveraging technology to deliver more effective and cost-efficient health

Connected health and digital health tools have the power to enhance patient engagement, patient access to care, and patient empowerment
Imagine a world where...

• ...home dialysis patients don’t have to travel to their monthly dialysis visits because they can get virtual visit at home or work
• ... single 360-degree patient view of the medical record continuously updated by care teams, devices, and self reporting, rather than sporadic clinic visits and one-off lab reports
• ...highly visual, personalized and interactive dashboards streamline home therapy nurse and physician workflow and help analyze patient data in (near) real time
• ...the complications of ESRD begin to drop as remote patient monitoring and virtual coaching/care become standard practice
• ...the cost of ESRD care is lower as a result of remote daily monitoring
• ...vast quantities of aggregated health data inform medical professionals, population health, and public policy—without compromising individual privacy
Most popular uses of Connected Health

- Transmission of medical imaging for diagnosis
- Transmission of medical data for diagnosis or disease management
- Prevention, diagnosis and treatment of diseases using remote monitoring tools
- Emergency health advice via telephone and remote monitoring devices
- Remote patient monitoring and care
- Electronic consultation
- Distance medical education
- Healthcare system integration and management
- Health data collection and management for disease surveillance
- Healthcare asset identification, listing, and patient-to-asset matching and movement
- Real-time health information and services delivery—such as teleradiology and telecardiology—via video-conferencing
**Why Connected Health**

**REDUCE COST**
Reduce unnecessary services (medical waste), estimated at 30% of all healthcare expenditure
- Interoperability of medical devices
- Improved caregiver coordination and adoption of EHR

**IMPROVE QUALITY**
- Enables caregivers to give more informed decisions for enhanced quality of care
- Improve medication and treatment adherence
- Reduce medical errors and improve administration efficiency

**BETTER ENGAGEMENT**
- Patients take responsibility for their health
- Improve the workflow of the staff and allowing them to work at the highest level of their license

**IMPROVE EXPERIENCE**
- Minimize disruptions to the patients life
- Diagnose and treat rural patients from distant medical facilities
- Allow for virtual consultation from specialists located remotely
Connected Healthcare benefits

<table>
<thead>
<tr>
<th>Patient</th>
<th>Nurse / Staff</th>
<th>Organisation</th>
<th>Health &amp; Care</th>
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<tr>
<td>• Improves QOL and independence</td>
<td>• Enables effective multidisciplinary team working</td>
<td>• Improves resourcing, capacity, productivity</td>
<td>• Reduces A&amp;E visits, hospital admissions, demand on</td>
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<td>• Supports wellbeing, safety and security</td>
<td>• Improves prioritisation and efficiency</td>
<td>• Reduces costly f2f visits</td>
<td>GPs/community teams</td>
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<td>• Improves medication adherence, self-</td>
<td>• Enables early intervention and prevention</td>
<td>• Enables continuity of care</td>
<td>• Reduces DTOC, care packages, care home admissions</td>
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<td>management, knowledge, confidence</td>
<td>• Supports staff knowledge and confidence</td>
<td>• Facilitates service diversification</td>
<td>• Suitable for numerous conditions, cohorts, pathways,</td>
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<td>• Reduces hospital visits and admissions</td>
<td>• Improves quality of interaction with patient</td>
<td>• Supports data collection</td>
<td>care environments</td>
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</table>
Additional Benefits of Connected Health

- Reduction in healthcare costs
- Increased patient access to healthcare—especially in underserved areas
- Improved quality and continuity of care
- Improved access to healthcare colleagues by remote care providers
- Increased accuracy in care delivery
- Optimized use of digital health assets
- Greater access to continuing medical education
- Reduced time to diagnosis and treatment with expedited consultations
- Improved gathering of digital health data in remote areas
- Increased productivity of healthcare staff
Connected Health in home dialysis is designed to help with

01 Monitor and support patient adherence and potentially reduce complications

02 Reduce patient burden and enhance patient confidence

03 Increase patient retention through compliance monitoring and enhanced connection with patients

04 Reduce effort involved in collecting flowsheets
Benefits of Connected Health in Dialysis

- Remote monitoring of PD and HHD patients, including mood and early detection of complications
- Empowers patients and improves their sense of safety
- Increases engagement between patients and nurses
- Provides high-quality information to improve clinical decision making
- Improves efficiencies by reducing home visits by staff and clinic visits by patients
- Potentially reduces hospitalizations and unplanned readmissions
- Increases patient satisfaction through better interactions with healthcare staff
- Improves timely access to care and supports patients at home and in the community
Top Connected Health tools include

- Telehealth
- Remote patient monitoring tools
- Wearable technology
- Secure messaging tools
- Mobile apps
- and other digital tools that help connect patients to their providers
We are bringing it all together

- CRM Systems
- Liberty Modem
- Acumen 2.0
- Secure Messaging
- COMPASS
- Patient & Clinician Portal
- Nx2me
- Patient Communities
- Telehealth
- My eCube Rounder
Patient Portal

• keeps patients connected with their care teams by allowing them to share key treatment data in real time
• provides clinical information and education at the point of care
• builds a sense of community among our patients
  • Isolation is a common feeling among dialysis patients
  • concept of “community” is one of the key social determinants of health
## Benefits of Patient Portal

### Convenience
- Clinical data collection
- Scheduling
- Viewing appointments/orders
- Ordering supplies
- Maps and directions
- Online bill viewing and payment
- Prescription refills

### Results
- Lab results
- Radiology results
- Visit summary
- Open notes
- Immunization and allergies
- Discharge instructions

### Communication
- Secure messaging
  - Appointment follow up questions
  - Non urgent or technical questions
- Sign up for text and phone reminders
- Patient education
Patients want high quality personalized care and assurance that their personal information will be safe

- The care could be lower-quality than if I saw a provider in person: 35% (Telemedicine), 43% (Remote patient monitoring)
- My personal health information could be leaked: 35% (Telemedicine), 37% (Remote patient monitoring)
- I would worry that my information (health, falls, or GPS location) would be misused*: 34% (Telemedicine), 25% (Remote patient monitoring)
- Telemedicine/remote patient monitoring seems impersonal; I would prefer to have these types of visits in person: 33% (Telemedicine)
- I would miss the social aspect of going to the doctor’s office*: 15% (Telemedicine)
- It would be difficult to learn how to use the technology: 15% (Telemedicine)
- None: 29% (Telemedicine), 28% (Remote patient monitoring)

Source: Deloitte 2016 Survey of US Health Care Consumers. Chart shows percentage who say they are concerned. Responses with a * were asked only regarding remote patient monitoring.
What do Patients and care team want from healthcare apps?

Which of the following would convince you to use health apps regularly? (per cent)

- Provide trustworthy, accurate information: 69
- Is easy to use/simple/well designed: 66
- Provide guarantees that my personal data is secure: 62
- Be free of charge: 56
- Contain no advertisements: 51
- Work effectively and consistently over time: 44
- Not expensive to buy, and provide value for money: 28
- Allow me to network with other people important to me: 26
- Be packed with detail (I don’t mind complex apps): 23

What is the single most important service you think health apps should provide? (per cent)

- Give me understandable info on symptoms/medical conditions: 23
- Help me communicate with my doctor/nurse: 17
- Allow me to examine my health records/medical tests online: 16
- Help me track my medical symptoms: 14
- Help track activities to improve my health, or keep me healthy: 13
- Give me understandable info about how to live a healthier life: 7
- Help me communicate with other people important to me: 6
- Allow me to comment about, or rate, local healthcare services: 3

Source: PatientView survey of 1,130 people with a long term condition, 2014
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**Output:**
- Urine
- Other
- Efficient
- Net
- Net desired
- Net cumulative

**Net:**
- Pressure
- Active
- CRI
- PI
- CRI
Siloed applications overwhelm nurses
Closing the Loop with Daily Monitoring
Patient-clinician Messaging

Clinician Dashboard
Parameters of PD Exchange to be Monitored Remotely

- Fill and drain volumes
- Fill and drain times
- BP and pulse rate
- Oxygen saturation
- Weight or bioimpedance
- Time and duration of treatment dwell
- Prescription of dialysis
- Number of exchanges
- Symptoms during therapy
- Alarms and patients response to alarms
- Activities during the day

Nayak KS et al. Perit Dial Int. 2016: 36(4); 362-366
Sharesource by Baxter
Nx2Me
Data captured from the patients on Nx2me and available to clinicians include:

- Patient’s weight and blood pressure (captured via Bluetooth® technology)
- Fluid weight removed during treatment
- Medications taken
- Dialysis fluid delivered
- Notes, and health assessments
  - Two-way messaging system, similar to text messaging, enhances communication and care coordination
Remote Monitoring System

Benefits of Remote Monitoring in PD

- Less calls to technical support (1)
- Longer duration on PD (2, 3, 4)
- More RN time available for proactive patient related tasks (3)
- Dropout rate is lower (4)
- Annual cost of care is lower (4)

1 Quoted by Baxter leadership, 3/28/18, Edison, NJ
2 Blinded data from Baxter from multiple countries for new pt starts June ‘15 – Apr ’16
3 Findings were shared at the 54th Congress of the ERA and EDTA, June 3-6, 2017
4 RTG Study on FKC patients with Liberty Modems, Fresenius Kidney Care Internal Study, 2018
Patient Portal Findings:

- **20%**
  - Lower risk of hospitalization
  - For patients who submit 5 (or more) flowsheets per week compared to patients who do not submit flowsheets

Liberty Modem Findings:

- **2.4**
  - Month increase in time on therapy

Nx2Me Findings:

- **30%**
  - Lower drop rate
Relative risk of home hemodialysis attrition in patients using a telehealth platform

Cumulative incidence of technique failure in Nx2me users and matched controls

Quality of Care: Key Benefits

**Compliance:** Clinicians may monitor and support adherence to treatment and potentially reduce complications and hospitalizations associated with non-compliance.

**Early intervention:** Clinicians may identify health problems before unscheduled care is needed (e.g., blood pressures, arterial or venous pressures running too high).

**Notifications:** Alerts patients and nurses when key clinical parameters deviate from pre-established norm to help support patient case management.
Nx2me has shown to improve patient retention by monitoring compliance, early intervention and education

• 29% lower therapy discontinuation rates due to controllable causes
• 34% reduction in technique failure, relative to match controls in patients who began using Nx2me within 3 months of initiating HHD
Rounding Tools for Physicians

• enable provider access to patient care tools and data when they’re on the go or making rounds
• offer access to patient vital signs, lab results, treatment data, communications with staff members, order signing and visibility into the plan of care, all of which make the rounding experience so much more meaningful for physicians
To Enable Intelligent Care, Data Needs to be...

- Connected
- Continuous
- (near) Real time
- Private and secure
- Reliable
- Liquid
**Telemedicine** versus **Telehealth**

**Telemedicine:** The use of technologies to remotely diagnose, monitor, and treat patients

**Telehealth:** The application of technologies to help patients manage their own illnesses through improved self-care and access to education and support systems

Connected Health: A Review of Technologies and Strategies to Improve Patient Care with Telemedicine and Telehealth; Health Affairs 2014
History of Telemedicine: 1924
Telemedicine Legislation

- The CHRONIC Care Act allows application of the Next Generation ACO telehealth waiver criterion to the Medicare Shared Savings Program (MSSP) Track II, MSSP Track III, and the Pioneer ACO programs

- This legislation
  - eliminates the geographic component of the originating site requirement
  - allows beneficiaries to receive telehealth services in the home

- Telehealth and remote monitoring technologies enable providers to assess and manage home dialysis patients without requiring frequent in-person clinic encounters

- These technologies
  - enable clinicians to see patients’ treatment data in real time
  - make adjustments and interventions more frequently based on real time monitoring
  - ensure that the patient is adherent to the prescribed treatment
Ideal Requirements for Telemedicine Monitoring of Home Dialysis

- Allows user flexibility in movement and activities
- 2-way rapid and real time communications with high definition video or image capture
- Simple and intuitive alarm systems with high degree of specificity
- Modifiable and customizable
- Generate useful reports
- Non intrusive and portable
- Ability to periodically provide educational content to retrain patients to perform optimal technique

Nayak KS et al. Perit Dial Int. 2016: 36(4); 362-366
Aims for Telehealth in home dialysis

• Support patients living in remote areas
• Lead to better patient satisfaction and experience
• Higher acceptance of home modalities
• Improve patient supervision
• Improve overall quality of life
• Reduced incidence of peritonitis and exit site infections (PD)
• Improve BP and fluid management
• Reduce hospitalization and ED visits
• Reduce unscheduled home clinic visits
• Reduce overall cost of care
• Increased adherence to treatments
Connected Health and new technologies in health care don’t come without concerns and risks:

- Data quality and reliability
- Regulatory and privacy compliance risks
- Data overload
- Patient information security

These concerns and risks can be mitigated by:

- Advanced security for secure communication between devices and systems
- Data integrity verification
- Data encryption
- User authentication
“Before you become too entranced with gorgeous gadgets and mesmerizing video displays, let me remind you that information is not knowledge, knowledge is not wisdom, and wisdom is not foresight. Each grows out of the other, and we need them all.”

- Arthur C. Clarke