

# Innovating Healthcare

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## Embracing the Future

**HITACHI**  
Inspire the Next

# Digitally Enabled Pathway Personalisation: Data-Driven Insights, Dynamic Intelligence & Prevention 3.0

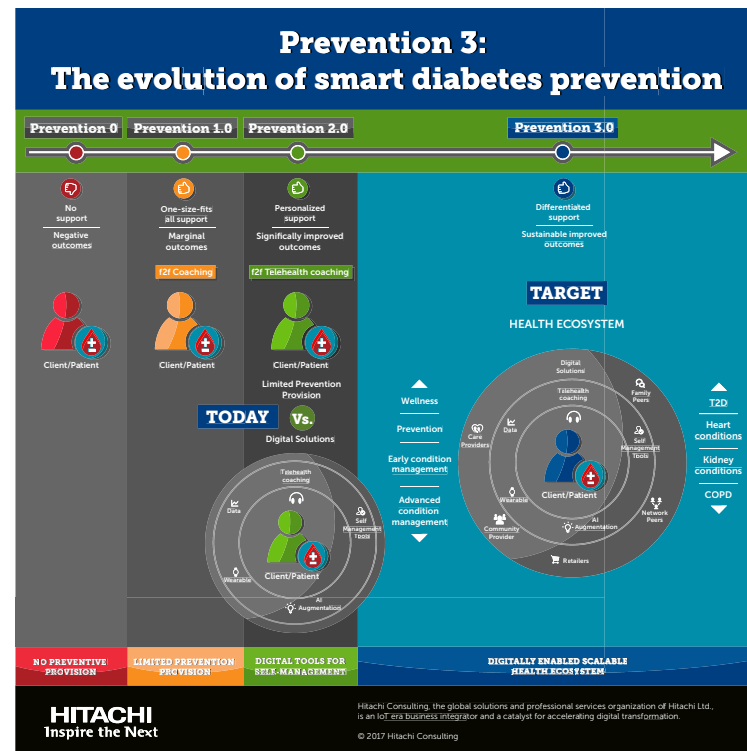
## From Diabetes Prevention 1.0 to Prevention 3.0

### The Case for Diabetes Prevention

The rising global prevalence of type 2 diabetes has placed acute strain on healthcare budgets, attracting the attention of US and UK policy-makers. The US National Diabetes Prevention Program established credible evidence linking lifestyle change with reducing risk of type 2 diabetes onset, leading policy-makers in the UK to establish the NHS Healthier You Diabetes Prevention Programme. Prevention 1.0, was geared to helping those identified with elevated blood sugar levels to create a lifestyle change plan in face-to-face settings. Prevention 2.0 built on this by leveraging telehealth and nascent digital-enablement to reinforce face-to-face provision with remote support.

### Pushing the Boundaries of the Possible

Hitachi's diabetes prevention journey started in 2010, when the company developed its first digitally-enabled service to support its employees in meeting their wellness goals. Hitachi's programme attempted to move provision towards telehealth and digital-enablement (Prevention 2.0). By bringing together a blend of telehealth coaching and digital tools, Hitachi was able to personalise the provision of care, whilst giving their employees the means to effectively self-manage



their lifestyle changes. Since 2010, the solution has been rolled-out to other Japanese corporates and used as a foundation for Hitachi's collaboration with the NHS in England, aimed at leveraging clinical knowledge, remote telehealth and digital solutions to create a new model of provision, or prevention 3.0.

### The Value of Data-Driven Insights

Hitachi's approach to digitising diabetes prevention established both data-driven insights and dynamic intelligence at the centre of its digital strategy. Leveraging the latest in data technology reinforced Hitachi's collaborations with the NHS in England, by showing commissioners, providers and researchers its impact. Commissioners showed a quick willingness to engage with population-level data that could enable them to configure services for hard-to-reach population cohorts. Providers were equally as eager to engage with patient-level data in order to personalise pathways to maximise outcomes for their patients. Researchers saw the future potential that new data-points could bring future service studies.



### **The Role of Self-Reported Data**

The global digitisation of healthcare has the potential to provide vast volumes of data generating insights needed to personalise, enhance and optimise healthcare services at a time when healthcare systems are coming under increasing strain. The International Data Corporation has estimated that healthcare data volumes are likely to expand from 153 exabytes (1 exabyte = 1 billion gigabytes) in 2013 to 2,314 exabytes in 2020.<sup>1</sup> The development of IoT and wearable technologies, digitisation of the electronic health record (EHR) as well as the electronic medical record (EMR), together with generic healthcare data generated by patients will profoundly change the primacy of self-reported data. Clinical data alone, will no longer act as the sole determinant of how digital services are shaped in the future.

**Hitachi's Smart Digital Diabetes Prevention leverages data-driven insights, dynamic intelligence and data capabilities to reimagine how diabetes prevention services are personalised, enhanced and optimised in the future.**

## **The Anatomy of Data**

### **Cohort Data**

The first, and perhaps most important, building block of a credible data model provides a detailed profile of patients being referred to digital services. This provides information on key patient demographics, such as age, gender, ethnic association and broad geographic and socio-economic groupings. A detailed digital profile of the patient also provides a detailed picture of patients' presenting clinical needs at the point of referral.

Hitachi's Smart Digital Diabetes Prevention solution captures cohort data, building-up a detailed picture of patient needs, including clinical (weight, bloods, waist circumference, BMI) and demographic data (age, gender, geographical location, ethnic group etc). Cohort data can be

analysed at population-level, to inform assessment of regional/local population needs, or at a patient-level, to drive service personalisation.

### **Progress Data**

The second building block making-up a credible data model provides a comprehensive log of patient activity data. This block is built up from self-reported patient datapoints automatically reported by smart IoT devices such as wearables and scales. Data captured through IoT devices can, at first, be seen as providing more credible data than manually self-reported patient data, however, a small number of patients who intentionally set out to 'game' the system are equally as likely to manipulate data reported through such devices. This is one of the key reasons why digital tools should be regarded as enabling the interaction between health professionals and patients rather than replacing it altogether. Validating self-reported data becomes an important aspect of maintaining data integrity.

Hitachi's Smart Digital Diabetes Prevention solution is designed to capture progress data, building-up a detailed picture of patient progress against 'hard' goals such as weight loss and blood sugar levels (as measured by HbA1c indicators), as well as 'soft' goals such as agreed dietary and activity goals. Progress data is used dynamically by Health Advisors to drive the support provided to patients during their time in service, focusing on the greatest areas of patient needs.

### **Engagement Data**

The third building block making-up a credible data model provides information on how the patient engages with the digital service and its enabling tools. This includes a detailed log of digital usage - including the time and patterns of engagement with the solution, usage of particular features, and any other patient interactions with the digital tools, including patient satisfaction/feedback loops. This data, outside 'hard' clinical data, provides the best proxy indicator for patient engagement with the digital service.

Hitachi's Smart Digital Diabetes Prevention solution helps to build up a detailed picture of patient engagement throughout their time with the digital service. A detailed profile of patient engagement at a population- or cohort-level helps to develop a picture of engagement trends across the pathway, highlighting focus areas for the Health Advisor dialogue with the patient as well as opportunities for future service improvement.

**Hitachi's Smart Digital Diabetes Prevention solution leverages cohort, progress and engagement analytics to help surface actionable insights at population, cohort and patient-specific levels in order to personalise, enhance and optimise the digital service.**

## Co-Creation of Data-Driven Insights

### Building Working Trends Through Correlation Analysis

Hitachi's extensive experience in analytics, data science, user-centric design and digital engineering has enabled it to construct a rich data model where diverse data sets are combined and analysed through various means to surface actionable data insights. Hitachi's multidisciplinary team combine qualitative and quantitative analysis to evaluate insights and identify potential opportunities for improvement; correlational analysis is leveraged to develop 'working trends' that can then be taken forward into service design workshops. Some of the 'working trends' surfaced through Hitachi's Smart Digital Diabetes Prevention solution are:

- Positive correlation between age, presenting BMI and weight-loss probability.
- Positive correlation between log-on frequency, proxy engagement and lifestyle goal achievement rate.
- Positive correlation between presenting BMI, log-on frequency in first eight weeks following acceptance into service and weight-loss probability.

### Co-Creation

'Working trends' are subsequently ratified through service design workshops, which leverage co-creation with commissioners, digital teams and front-line Health Advisors. These workshops draw upon a wide array of clinical, operational and user-led multi-disciplinary capabilities to explore the 'working trends', scrutinise findings and verify opportunities. The emergent improvement strategies represent a consensus of opinion across those participating in the workshops and provide the basis for service and solution improvement initiatives. Applying user-centric design methods and leveraging the power of co-creation as part of Hitachi's Smart Digital Diabetes Prevention offering, have produced some of the following insights:

- Patients with a BMI over 38 generally require more intensive support during the first 3 months of their lifestyle change pathway.
- Patients showing low engagement with the digital service in the first 2-4 weeks of service are often less likely to meet their lifestyle goals.
- Patients in the 60+ age cohort may require more support to engage with digital tools in the first 2-4 weeks of service but generally tend to engage positively where this support is provided.

### Bringing Together Insights to Build Dynamic Intelligence

Data insights surfaced from a critical mass of credible data, provide the basis for delivering 'dynamic intelligence' to commissioners (whether national, regional or local), providers (whether clinical or digital) and researchers. Access to a reliable source of real-time insights can empower stakeholders to take appropriate and timely actions which help them improve delivery against their respective goals. Similarly, front line staff can leverage intelligence in real-time as they deliver the service to their patients, personalising the experience to presenting needs, cohort characteristics and stated preferences.



## Future of Data-Driven Insights & Dynamic Intelligence

### Application of Data-Driven Insights & Dynamic Intelligence

Hitachi's Smart Digital Diabetes Prevention solution is geared to help support future commissioning decision-making at both population and cohort-level. Actionable data-insights surfaced through dynamic intelligence can help enable commissioners to:

- Determine the scope of support to be provided, considering factors such as pathway duration, frequency of active engagement and types of lifestyle support required to address particular cohort needs.
- Commission services which support both dominant and minority cohort groups, such as groups with particular accessibility needs (audio-visual needs), low levels of digital maturity or specific cultural / ethnic needs.
- Consider flexible pathways where the level of support offered to patients can be personalised and flexed dynamically during the pathway.

Hitachi's Smart Digital Diabetes Prevention solution is also designed to help:

- Personalise services to the presenting needs and preferences of the patients and enable Health Advisors to respond to identified patient needs during of the pathway.
- Further develop capabilities to support specific cohorts, whether demographic, clinical or otherwise.
- Leverage insights to help drive continuous improvement and respond to the changing patient needs over time.

### Data Privacy & Machine Learning

Generating working trends through correlation analysis, data-driven insights through co-creation

workshops and dynamic intelligence through continuous multi-disciplinary/cross-organisational engagement is predicated on patients consenting to their data being processed for the purpose of future service improvement and provision of personalised services. Patients who decide not to consent to this use of their data, or who withdraw their consent, would not be included in the above analysis.

Hitachi's experience and knowledge in data analytics, data science, user-led design and digital solution design make it ideally placed to work with partners and clients to leverage technological developments in the nascent machine learning (ML) space. This will allow Hitachi's Smart Digital Diabetes Prevention to further benefit from future developments in ML to identify and propagate viable correlation analysis and so as to inform future insights on patient needs, allowing for more effective care to be delivered at the right time, through the most appropriate channels.

**Hitachi's Smart Digital Diabetes Prevention makes use of cutting-edge technologies and data capabilities to leverage multi-dimensional data to inform data-driven trends and dynamic intelligence needed to personalise, enhance and optimise diabetes prevention services of the future within the context of Hitachi's vision of 'Prevention 3.0.'**

1 "The Digital Universe of Opportunities: Rich Data and the Increasing Value of the Internet of Things," EMC Digital Universe with Research and Analysis by IDC, April 2014. Cited in in <https://med.stanford.edu/content/dam/sm/sm-news/documents/StanfordMedicineHealthTrendsWhitePaper2017.pdf>

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