Clinical Products

Telehealth Solutions Ltd., Regus House, 54 Clarendon Rd, Watford, WD17 1DU

+44 (0) 1923 431648

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Telehealth Solutions Clinical Products

Product range

Telehealth Solutions Ltd. ('THSL') is dedicated both to improving people's health and reducing their cost to the health service. We are doing this through the intelligent use of electronics. Much though we would all like to have our own dedicated professional carers, the demographics clearly point otherwise – over the next twenty years, the OECD [1]predicts that for every inactive person over the age of 65 in the UK (a useful pointer to the number of people who are likely to need caring for), there will be 37% fewer people in the working population (a useful pointer to the people available to deliver care). In thirty years' time, there will be 44% fewer. In order to provide improved care therefore, we need either to find a way of paying far more for healthcare...or do what other industries have done and use electronics to remove the tedious bits, to enable professionals to focus their time on providing the best service to a greater number of people.

To do this, THSL has a range of products comprising:

PharmacyPod – installed in pharmacies & chemists to enable the pharmacist to provide a wider range of services to customers, more efficiently. If it is also connected to the local GP surgery it enables pharmacists to take on (and be paid for) additional work such as simple prescribing and repeat prescriptions.

SurgeryPod – installed in GP surgeries and other similar locations, to gather factual and vital signs information from patients, often before their appointment with a clinician. By eliminating much of the manual effort in information gathering, it substantially improves the efficiency and focus of the patient: clinician meeting, improving patient outcomes and reducing the need for administrative staff.

Perfect partners for the SurgeryPod are the **CallPod** and **CheckinPod**, which respectively call patients waiting in the surgery to their appointments, and allow patients to announce their arrival without troubling reception.

CarePod – used by peripatetic care workers, typically nurses and community matrons, to assess, reassess and record important medical information from patients in their home or other community setting. The range of diagnostic equipment directly integrated with the CarePod results in much faster – and cheaper – diagnosis, for the benefit of both patient and clinician.

HomePod – installed in the homes of patients with chronic long term conditions, it collects vital signs and other health-related information to help clinicians improve patient outcomes and reduce hospital admissions and surgery visits. It does this by providing reassurance, enabling corrective action in anticipation of exacerbations, reducing anxiety, improving medication compliance and educating patients to help them become experts in their own condition(s). It is therefore suitable too, for supporting delivery of palliative care at home, where it can also for example monitor the operation of syringe pumps.

[1] http://stats.oecd.org/wbos/Index.aspx?DatasetCode=CSP2008

That telehealth brings benefits is now in little doubt – Appendix 1 summarises the types of benefit attainable especially from implementation of home-based telecare, arguably the most challenging type to implement as it requires the greatest process engineering to make a success of.

THSL's approach is to make everything as simple and as easy to use as possible. All our products therefore use touchscreen devices (and use software that, if required, can easily be reused on other devices). The patient interface to our products is able to work in any written language too, with the posting of the results to the clinical or other record being in English. Also, all our products integrate with the most appropriate existing system – we go to great lengths to avoid creating an extra system for professionals to have to use. Therefore, the PharmacyPod and SurgeryPod both, for preference, input all their data into the local GP practice management system as, if possible, do the CarePod and HomePod.

Looking to the future, THSL as a contributing member of Continua[2] will continue to work to make its systems as open as possible, such that THSL's systems can use any appropriate peripherals to monitor vital signs, and can output their results to any appropriate clinical management system.

[2]The worldwide non-profit organisation dedicated to developing standards in the telecare and telehealth industry.

The PharmacyPod

The PharmacyPod, pictured left with optional Cholestech LDX System, is a touchscreen device that is typically fitted to the wall or installed on a desk in the pharmacist's consulting room. Normally it has a blood pressure meter and scales attached, to measure vital signs. Customers are invited to use it to provide information to the pharmacist. Uses include:

Medicine Usage Reviews, where additional customer information is combined with information already held by the pharmacy to enable a professional review of that person's total medicine use. End results are a satisfied customer, and an NUR payment to the pharmacist from the NHS.

Repeat prescriptions, where by agreement with one or more of the local GP surgeries, as long as customers are able to respond appropriately to the questions asked (e.g. to check on any side-effects of the medicine) and as long as their vital signs (typically weight and/or blood pressure) remain within limits set by the doctor, the pharmacist is allowed immediately to provide the repeat prescription. End results are better customer service, reduced load on the GP surgery and increased pharmacy business.

Simple prescriptions, (e.g. for oral contraceptives), where again, if, customers are able to respond appropriately to the questions asked and as long as their vital signs are within limits set by the doctor, the pharmacist is immediately allowed to provide the required prescription without a GP visit. End results again include better customer service, reduced load on the GP surgery and increased pharmacy business.

NHS Health Checks (previously known as Vascular Health Checks), where the customer's information and vital signs inputs obtained via the PharmacyPod are complemented by the optional Cholestech LDX blood analyser providing the full range of inputs for a rapid and successful test that can be uploaded to a GP practice management system. End results are a significant payment to the pharmacist for doing the check, the possibility of additional business triggered by the visit and excellent customer service. In this mode, the Pod will have more sophisticated peripherals (see CarePod below for more details).

"The Telehealth Solutions PharmacyPod is perfect for providing peace of mind to customers with minor health concerns. They can easily operate the equipment themselves and, should they detect any abnormalities, a pharmacist is on hand to advise the next steps – be it a lifestyle change or a consultation with their GP." Tenille Manuele, Pharmacist Manager – The Dispensary Pharmacy and Healthstore

Detailed specification

Touchscreen

Terminal: ELO 1529L with table or wall mounting

Dimensions: width 13.97" (355 mm) x height 11.27" (286 mm) x depth 10.95" (278 mm)

Weight: 17.2 lb (7.8 kg)

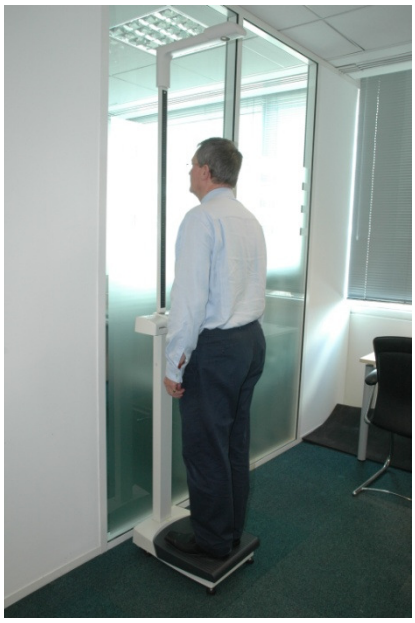
Power: 100-240 VAC, 50-60 Hz, 85W (max)

Accuracy

The peripherals used (see below) have identical accuracy to that commonly used by clinicians in their consulting rooms – for example the UA-767 sphygmomanometer achieved the British Hypertension Society grading of "A/A" (a tolerance of less than 5mm of Hg on both systolic and diastolic measures). See http://www.aandd-eu.net/clinicalvalid-p1.html. All our equipment has 'CE' certificates.

Accuracy for this equipment is typically guaranteed for three years, although in regular use a standard annual calibration check is recommended. THSL can arrange for that check, though PCTs usually have such a service to hand.

Devices



Standard

Scales (to 200kg): A&D UC321 or combined automatic height-measuring device and scales (at extra charge, see right)

Sphygmomanometer with cuff (blood pressure/pulse): A&D UA767PC or Arm-in sphygmomanometer A&D TM-2655P (at extra charge). Disposable sleeves are available to avoid any risk of infection, if required.

Additional (requiring professional supervision)

Glucometer: One Touch Ultraeasy

Pulse oximeter: Contec CMS-50E

Spirometer GE EasyOne Spirometry System B100071

ECG: GE Cardiosoft 12 Lead Interpretive ECG System N100266

Blood analyser: Cholestech LDX System (delivers a complete lipid profile and glucose, ALT, AST and hs-CRP in 5-6 minutes depending on test)

Urine Analyser: Uryxxon Relax Automated Urine Analyser

A point-of-care HBA1c and µalbumin analyser, INR, a full blood gas and a creatinine analyser are also available.

Usage

Screen response time: typically < 0.1 sec

Languages available: 20 off the shelf, any other common language within a few days

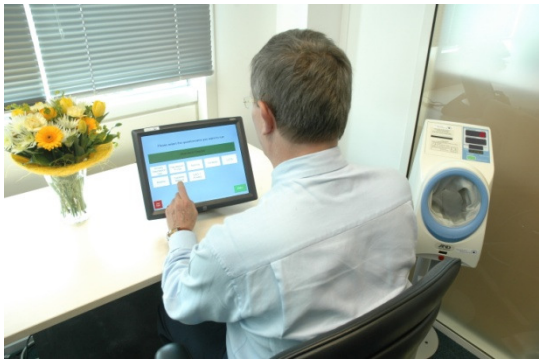
Current connections available to: EMIC LV & PCS, Vision, Adastra, GPASS – others coming shortly

SurgeryPod

The SurgeryPod, shown right, is one of the most established of THSL's products. Customers who have had the SurgeryPod for any length of time are unanimous in their comments about how it improves the efficiency of their practice(s):

"The SurgeryPod provides a very patient-friendly way of undertaking simple health monitoring and collecting health and lifestyle information." "[It] has been welcomed by patients, staff and GPs: all recognise the many benefits it brings... clearly a cost-effective solution as, promoted effectively and located well, it is an excellent way of collating data required by many QOF targets and enhanced services." Rachel Stark, Practice Manager, East Quay Medical Centre, Somerset.

"We have been using the SurgeryPod system for nearly two years now and have found that it has made a real and significant difference to the way we manage aspects of patient care...it has rapidly become a management tool as part of the monitoring of chronic disease...we are looking to broaden the amount of routine data collection managed through it so that the interactive medical consultation can focus more on the patient's agenda. I would also highlight the responsiveness of Telehealth Solutions in developing software solutions to problems that we encounter." Dr Mike Ingram, Senior Partner, Red House Practice, Radlett.



There is increasing realisation that this equipment can repay its cost within a month. Again to quote Dr Ingram, "It has been particularly useful for

- Measuring blood pressure objectively before making a decision as to whether to treat or not
- Monitoring those with chronic stable hypertension who need little intervention
- Allowing those who want basic cardiovascular screening to administer this themselves
- Using self administered questionnaires to measure and monitor anxiety and depression"

Typically SurgeryPods are installed and connected directly to the local practice management system. All fields are Read-coded, so the information can be stored immediately, for example, in EMIS or Vision. We also now integrate with Adastra as an OOH system and are rapidly moving to connect with all popular PMS, OOH and PCT management systems. Installation requirements include a small table and screen in the waiting area, and 13A & data sockets.

"The machine has proven popular with patients, young and old. Patients like the fact they can pop in at any time, some even come in at 8am for a blood pressure check. Some find they are more relaxed and get better readings. During our flu clinics we used the opportunity for some QoF point catch ups ... at times there was quite a queue of patients." Charlotte Blyth, Practice Manager, Elizabeth Avenue, Islington.

Detailed specification

Touchscreen

Terminal: ELO 1529L with table or wall mounting

Dimensions: width 13.97" (355 mm) x height 11.27" (286 mm) x depth 10.95" (278 mm)

Weight: 17.2 lb (7.8 kg)

Power: 100-240 VAC, 50-60 Hz, 85W (max)

Accuracy

The peripherals used (see below) have identical accuracy to that commonly used by clinicians in their consulting rooms – for example the UA-767 sphygmomanometer achieved the British Hypertension Society grading of "A/A" (a tolerance of less than 5mm of Hg on both systolic and diastolic measures). See http://www.aandd-eu.net/clinicalvalid-p1.html. All our equipment has 'CE' certificates.

Accuracy for this equipment is typically guaranteed for three years, although in regular use a standard annual calibration check is recommended. THSL can arrange for that check, though PCTs usually have such a service to hand.

Devices

Standard

Scales (to 200kg): A&D UC321 or combined automatic height-measuring device and scales.

Sphygmomanometer (blood pressure/pulse): A&D UA767PC or Arm-in sphygmomanometer A&D TM-2655P (on the right of the picture on the right, at extra charge). Disposable sleeves are available to avoid any risk of infection, if required.

Additional (requiring professional supervision)

Glucometer: One Touch Ultraeasy

Pulse oximeter: Contec CMS-50E

Spirometer GE EasyOne Spirometry System B100071

ECG: GE Cardiosoft 12 Lead Interpretive ECG System N100266

Blood analyser: Cholestech LDX System (delivers a complete lipid profile and glucose, ALT, AST and hs-CRP in 5-6 minutes depending on test)

Urine Analyser: Uryxxon Relax Automated Urine Analyser

An HBA1c and µalbumin analyser, INR, a full blood gas and a creatinine analyser are also available.

Usage

Screen response time: typically < 0.1 sec

Languages available: 20 off the shelf, any other common language within a few days

Current connections available to: EMIC LV & PCS, Vision, Adastra, GPASS – others coming shortly

Checks available

New patient

Body Mass Index

Alcohol usage

Smoking

Blood pressure

Blood chemistry

Depression – both PHQ9 and HADS

Asthma

Epilepsy

Lower Urinary Tract Symptoms

NHS Health Check (including QRISK2 health risk visualisation)

THSL will be happy to add further checks considered to be generally of value.

CallPod and CheckinPod

The CheckinPod enables patients to record their arrival at the surgery without engaging the receptionist. This frees up receptionists' time for other work and avoids queues of arriving patients if the receptionist is held up by a patient with a more significant issue.

The CallPod is a patient announcement system, to call patients waiting in a surgery to their appointments when their clinician is free. This results in optimal use of clinicians' time, focusing on delivering care as well as freeing up receptionists' time for other work.

The systems run on their own dedicated computers that integrate fully with the practice management system. The output from this CallPod is a VGA cable that can be connected to most recently-built flat-screen televisions.

Shown in the pictures below, the CallPod is triggered by a clinician recording his readiness on his PC. The patient is then called - the screen can also show other information such as room to go to. The screen is accompanied by an appropriate sound too.

Clinician Room

Waiting Room

After a period of time (typically 15 seconds), the screen reverts to the appointments screen below.

The CallPod can easily be configured by the receptionist in a number of ways to suit individual surgery requirements. For example:

- For sensitively-named clinics, such as those handling sexual health, different clinic names can be displayed on the CallPod to avoid embarrassing patients.
- If necessary patient aliases can also be used.
- The appointments screen can be changed not to show patient names
- The duration of time the call screen is shown can be adjusted

CarePod

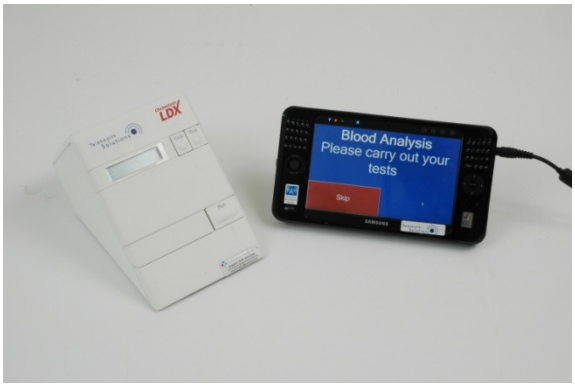
The CarePod offers extensive point-of-care diagnostic capability. It is aimed specifically at helping peripatetic workers, such a nurses and community matrons, to do, and to record automatically, the greatest amount of assessments and reassessments in the community without the need for patients to attend a GP surgery or specialist hospital clinic. It comprises a comfortable and easily portable touchscreen device, keyboard and mouse, plus a potentially huge range of peripheral equipment to plug into it.

The touchscreen enables patients – even those completely unfamiliar with keyboards – easily to answer many of the standard assessment questions. The keyboard and mouse enable important additional information, such as carer details and hospitals recently visited, to be inputted.

With standard peripherals such as scales, blood pressure, pulse oximeter and glucometer, the basic vital signs information can be captured too. But the CarePod can do much more! The devices currently working on the Pod include:

- ECG – 12 lead or other combinations
- Spirometer
- Sophisticated blood analysis including HBA1c, µalbumin, complete lipid profile, glucose, ALT, AST, hs-CRP, creatinine etc.
- Full blood gas analysis
- Coagulometer (INR)
- Urine analysis

In short, what needed a lab test two years ago can now be done in minutes!

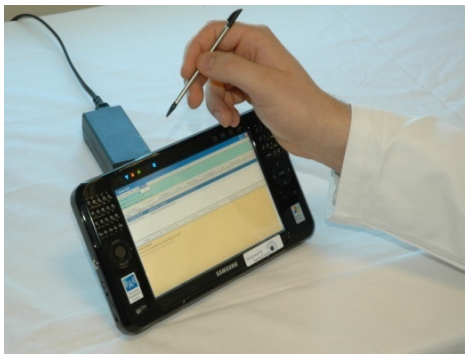


Like other devices in the THSL family, the CarePod can upload information into practice management systems. Excitingly, it can also take a copy of patient records held in a surgery, suitably securely protected, for reference by the professional carer during the day.

As a result, CarePods are now being used by THSL customers, for example, to perform NHS Health Checks (previously known as vascular health checks) and other community clinics.

The system also now incorporates the QRISK2 calculation of heart failure risk complete with 'smiley faces' animation and a sensitivity analysis to show patients the impact of changing their lifestyle on their heart attack risk.

Detailed specification



Touchscreen Tablet: Samsung NP-Q1U

(Pictured right) Weight (tablet only): 0.69kg

Dimensions: width 227.5mm x height 123.9mm x depth 22.9 ~23.9mm

Memory: 1 GB (DDR2 667 MHz / 1 GB x 1)

Power: 100-240 VAC, 50-60 Hz, 60W

Battery: 4 Cell (c 3 hours on battery)

Display: 7" WSVGA (1024 x 600) Gloss, Super Bright, LED Back Light

Reliability

The CarePod tablet has a quoted failure rate of less than 1.0% when used in a school environment – expected to be rather harsher than most CarePod users subject it to!

Accuracy

The peripherals (see below) have identical accuracy to that commonly used by clinicians in their consulting rooms – for example the UA-767 sphygmomanometer achieved the British Hypertension Society grading of "A/A" (a tolerance of < 5mm of Hg on both systolic and diastolic measures). See http://www.aandd-eu.net/clinicalvalid-p1.html. All our equipment has 'CE' certificates.

Accuracy for this equipment is typically guaranteed for three years, although in regular use a standard annual calibration check is recommended; it is replaced if outside the accepted tolerances. THSL can arrange for that check, though PCTs usually have such a service to hand.

Devices

Standard

Scales (to 200kg): A&D UC321

Sphygmomanometer (blood pressure/pulse): A&D UA767PC Disposable sleeves are available to avoid any risk of infection, if required.

Glucometer: One Touch Ultraeasy

Pulse oximeter: Contec CMS-50E

Additional

Spirometer GE EasyOne Spirometry System B100071

ECG: GE Cardiosoft 12 Lead Interpretive ECG System N100266 (pictured right)

Blood analyser: Cholestech LDX System (delivers a complete lipid profile and glucose, ALT, AST and hs-CRP in 5-6 minutes depending on test)

Urine Analyser: Uryxxon Relax Automated Urine Analyser

Additional analysers available for HBA1c, µalbumin, INR, creatinine and full blood gases

Patient assessments currently available

Standard; Over 65; NHS Health Check (vascular risk)

HomePod

The HomePod, pictured right, is THSL's other longer-running product, which, like the SurgeryPod, is also proving to be very appealing to customers.

The HomePod is classic telehealth: it is the same touchscreen device used by the CarePod, plus peripherals. Placed in the homes of people with long term conditions, the HomePod gathers answers to questionnaires and patient vital signs. It transmits the information to a secure server behind the NHS firewall which analyses the data and instantly informs the appropriate care provider via text, email or practice management system of any answers or vital signs that are outside the limits set previously by their care manager.

Feedback to users is instant, including a graphing facility to show users the recent trend in their vital signs, to encourage compliance.

Currently protocols exist on the machine for monitoring CHF, COPD, diabetes, obesity, hypertension, and depression. More are being added at the request of existing customers. The HomePod is designed to enable clinicians also to create their own protocols for their patients, and to share such protocols with colleagues.

Like the CarePod, the HomePod has complete device flexibility, so a wide range of devices can be added without the need to reengineer the home-based devices. Standard peripherals include scales, blood pressure meter, pulse oximeter (for those with lung conditions) and glucometer (for those with diabetes). Additional devices include coagulometers for those with hypertension and urine analysers to give early warning of a UTI.

THSL are also beginning to add videos to the Pod so that in addition to anxiety reduction, exacerbation and medication management, the Pod will also encourage improved patient self-care.

It can also monitor syringe pumps so, allied with a simple pain management protocol, it is ideal for supporting palliative care at home too.

The device uses encrypted wireless (3G, GPRS – the same as mobile phones use for data transmission) to transmit information, for preference, and can also use standard broadband (including WiFi). If all else fails the device can be supplied with a dial-up modem too. The combination of the slim size and wireless communications means that the Pod can easily be taken when visiting friends, going to work, and on holiday (worldwide), supporting users in maintaining as active a life as they want.

Another advantage is that the Pod accepts multiple choice answers to questions so that, for example, PHQ9 for detecting and managing depression can be run at appropriate intervals – depression is normally treatable and reducing it has a dramatic impact on the cost of treating LTCs and on patient outcomes.

Like all THSL equipment, the HomePod has multi-language capability so that patients can use the device in their preferred language.

The clinical user interface (CUI) is used by professionals to access the data on the secure server, to look at trends (a sophisticated graphing facility is included), record actions, change alert trigger points, adjust protocols etc., and to determine which information is to be automatically uploaded onto the local practice management system. The care plans set up on the CUI are extremely flexible – those supplied with the device are based on NICE guidelines and Map of Medicine (e.g. that on COPD uses NICE CG12) but professionals can readily change them as they wish.

Finally, again like all THSL devices, the HomePod is available at a low price and has great reliability because we use only tried and tested hardware that is mass produced to very high standards – there is no significant manufacturing design/set-up cost in our hardware.

"We are looking forward to forthcoming months of the pilot and eagerly await the findings from our evaluation." Andrea Healey, Scottish Primary Care Collaborative (SPCC) Project Manager, NHS Greater Glasgow & Clyde

Specification

Touchscreen Tablet: Samsung NP-Q1U

(Pictured right) Weight (tablet only): 0.69kg

Dimensions: 227.5 x 22.9 ~ 23.9 x 123.9mm

Display: 7" WSVGA (1024 x 600) Gloss, Super Bright, LED Back Light

Memory: 1 GB (DDR2 667 MHz / 1 GB x 1)

Power: 100-240 VAC, 50-60 Hz, 60W

Battery: 4 Cell (c 3 hours on battery)

HomePod Functionality

Touchscreen plus plug-in peripherals; no need to enter text; no keyboard or mouse required or provided

The data transmission modes in order of preference are 3G, GPRS, WiFi, broadband and finally dialup modem (on request)

Patients can take vital signs without information being transmitted, if they want

Patients can see their own vital signs readings for the previous month, both in a table and as a graph, to help encourage self-care

Each HomePod is set up for a single person, so a couple both being monitored need two Pods.

Both audio and visual warning is given when a scheduled test is due (see below for setting)

Shortly a selection of the appropriate videos from NHS Choices will be available on the HomePod to enhance self-care, together with other instructional material such as on inhaler use.

CUI functionality

Secure access is via a standard Internet-connected PC running Internet Explorer 7 or above for anyone with the appropriate authorisation. This therefore would allow appropriately trained staff e.g. from Out of Hours, A&E, ambulance etc. to access the information.

A maximum of four alerts can be set per vital sign or questionnaire: 'Warning' & 'Abnormal' on both high and low figures

Readings with agreed parameters are shown green, those breaching the warning parameter are amber and those above the warning threshold are red. After an action had been recorded against an alert, it is cancelled and changes colour. Follow-up actions can also be set, which are then automatically alerted when their time is reached.

User tests can be scheduled at any interval from 1 minute upwards, by day of the week or combination of days of the week (e.g. weekdays, weekend)

NHS standard patient details are recorded and stored on a secure server behind the N3 firewall, including: known name, date of birth, address, GP, NHS Number and Social Care number. NHS number is the unique patient identifier

Patient data can be displayed by alert, by summary, in detail & by device; individual vital signs can be shown as graphs or as tables. Patient data is not stored on the HomePod once it has been transmitted to the secure server.

Diagnosis(es) can be recorded; shortly it will also be possible to add the origin of the diagnosis

Patients are associated with a specific clinician who can also be added as a caregiver to receive alerts; additional caregivers, who can also receive alerts, can be added

Equipment is allocated and recorded against patient name – the process of allocation automatically aligns the chosen HomePod with that patient's care plan(s) and historical data

The CUI provides multiple role based access levels that can only be changed by authorised system administrators

Notification will be given if no patient data is received, with a user-variable period

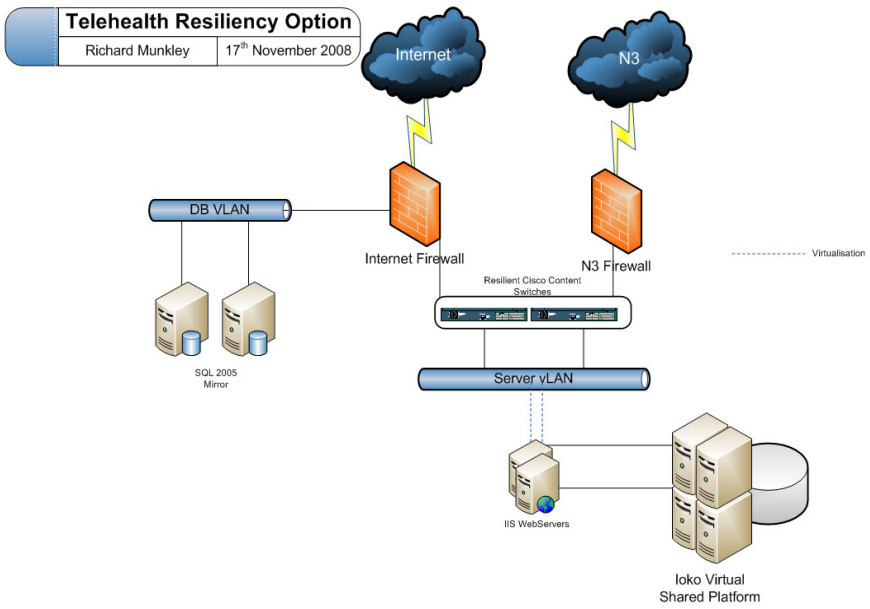
Patient death can be displayed, which will deactivate any non-receipt of data notification.

Data storage

All data is held in the secure Carelink hosting environment, provided by IOKO. The servers for this environment are physically situated in Docklands in London. IOKO have a full Statement of Compliance, are subject to audit by Connecting for Health (CfH) and have been providing N3 hosting services for 10 years. Over 200 NHS trusts use the Carelink service, including applications and data bound by the requirements of both the DPA and Caldecott Guardians. IOKO also are accredited to the ISO27001 security standard.

In more detail

The user volumes can be readily supported on a simple application plus database architecture, however for resilience a standard 2x2 architecture is employed with a pair of load balanced front end application servers and a 2 server SQL cluster. See the architecture in the figure below. This takes advantage of the enterprise class security and monitoring provision within the Carelink



platform as well as implementing sub networks between the front end and SQL servers to provide an additional layer of security for the data.

Reliability

System availability significantly exceeds 99%

System recovery is provided by a VMware solution employing VMotion technology. This provides automatic recovery by means of an almost instant transition of running servers between physical servers within the Carelink environment, giving a very high level of resilience in the event of a hardware failure. VMotion proactively migrates virtual machines away from failing or underperforming servers. More detail on the operation of this is available here: http://www.vmware.com/pdf/vmotion_datasheet.pdf.
The migration of a virtual machine with VMotion preserves the precise execution state, the network identity, and the active network connections; the result is zero downtime and no disruption to users.

A full events log is kept for the CUI. The HomePods retain a log of all communications attempted/made.

The system is agnostic to the communication layer so is unaffected by migration to BT 21CN.

Accuracy

The peripherals used (see below) have identical accuracy to that commonly used by clinicians in their consulting rooms – for example the UA-767 sphygmomanometer achieved the British Hypertension Society grading of "A/A" (a tolerance of less than 5mm of Hg on both systolic and diastolic measures). See http://www.aandd-eu.net/clinicalvalid-p1.html. All our equipment has 'CE' certificates.

Accuracy for this equipment for home use is typically guaranteed for three years, after which a calibration check is recommended; it is and replaced if outside the accepted tolerances. THSL can arrange for that check, though PCTs usually have such a service to hand.

All our equipment is wired directly to the Pod that collects it before transmission – unlike some other telehealth suppliers, we do not allow manual entry of any vital signs data so the data transmitted is the data recorded. (Our software is specifically designed to be as uncorruptable as possible so THSL believe there to be a vanishingly small possibility of a digital infection that might change the readings in transmission...and even then any significant change would be immediately obvious)

The analytical equipment at the server end likewise is merely a conduit for the data which is displayed unchanged on the Clinical User Interface (CUI) – the only manipulation is in checking against the alert levels (if any) preset by the clinician. The server itself is behind the NHS firewall, so as unlikely as any NHS kit to be affected by computer viruses etc.

The accuracy and integrity of the readings and of the automated analysis for THSL's telehealth equipment is therefore excellent.

What cannot be controlled so easily though is how patients take the readings – an incorrectly fitted cuff will obviously give an incorrect reading and testing another person's blood for glucose concentration will not give a good measure of one's own blood glucose level. For that reason THSL takes all opportunities to show patients how to use the devices and encourages organisations rolling out telehealth to focus considerable effort on selling the importance of compliance (both in terms of

regular use and correct use). It also helps if clinicians are alert to unusual patterns of readings – they have after all had some experience already with diabetic paper diaries!

Any consideration of accuracy of home vs. controlled vital signs measurement should of course also balance the 'white coat' impact on some patients and the benefit of the greater frequency, typically, of home-based readings.

Peripherals

Standard

Scales (to 200kg): A&D UC321

Sphygmomanometer (blood pressure/pulse): A&D UA767PC

Pulse oximeter: Contec CMS-50E

Glucometer: One Touch Ultraeasy

Additional

Peak flow meter: Ferraris Piko-1

ECG, accelerometer, temperature and activity monitor, with optional GPS: Hidalgo Equivital Sensor EQ-01

A coagulometer is also available.

The HomePod can also monitor syringe pumps, such as the IVAC PCAM range

Care plans currently available

COPD

CHD

Diabetes

Hypertension

Obesity

Depression (PHQ9)

Anxiety (HADS)

Asthma

All the above can be varied by clinician for individual patients if necessary and if required

THSL will be happy to add further care plans considered to be generally of value.

Reporting

The CUI currently provides reports that include:

- All outstanding alerts in a surgery
- All actions outstanding/completed for each patient
- Vitals signs by device
- A calendar of future actions, per patient

The CUI reports can be text and, for vital signs, tabular and graphical format.

The CUI's reporting capability can be further enhanced by the addition of an SQL reporting tool such as Crystal Reports for the creation of user generated reports, as the datastore is an SQL database and is designed to be responsive to SQL queries.

Every clinical action and change is recorded with a date and time stamp in the database. This information can readily be accessed e.g. reporting or audit purposes.

As mentioned above, the CUI will very shortly notify when a home device has not communicated within (user) definable time limits.

Training

Training is provided for the CUI and, if the customer wants to install kit in users' homes, installation. A searchable electronic guide is also provided, which is available in paper form too.

The HomePod is designed to be intuitive to use – a laminated card is however provided too, with pictures showing how to use the equipment and how to set it up if the user is going away with it.

Appendix 1 – Definitions and Context

Terminology

The Department of Health defines the different types of remote monitoring as:

eHealth Health services, information and education delivered or enhanced through the internet and related technologies. eHealth encompasses telecare, telehealth and telemedicine.

Telecare The continuous, automatic and remote monitoring of real-time emergencies and lifestyle changes over time in order to manage the risks associated with independent living

Telehealth The delivery of healthcare at a distance using electronic means of communication usually from service user/patient to clinician e.g. a patient measuring their vital signs at home and this data being transmitted via a telehealth monitor to a clinician.

Telemedicine The delivery of healthcare at a distance using electronic means of communication usually from one clinician to another e.g. a non-specialist GP undertaking an ECG on a patient suspected of heart disease and the transfer of that data electronically to another specialist clinician for discussion/comment.

In practice of course, the differences are not always clear cut.

Context

eHealth alone does not yield benefits; it is best seen as a catalyst to enable a substantial change in the way patients are treated. This also involves:

- Coordination of care across all providers
- Appropriate care delivery mechanisms
- Continuity of care
- Full patient and carer engagement
- Health & social care records accessible by all providers
- Decision support tools
- All substantial care needs being met
- A shorter time with a better informed clinician being seen as better care

This is close to what the US is coming to call the patient centred 'Medical Home' concept. The name they give to the service delivered is 'guided care' which works well. A couple of quotes help make the point:

"The key to health care reform is transformational primary care, the kind delivered in a medical home by a physician-led patient-centred team of clinicians whose mission is health, not health care." Paul Grundy MD, Global Director of Healthcare Transformation, IBM

"The [excellent telehealth ROI] results are not really about the technology, but about how using it helps coordinate the full scope of care our patients need. It permits us to give the right care in the right place at the right time." Dr. Adam Darkins, Chief Consultant, Veteran's Association, USA

It is therefore very important to recognise that any business case needs full engagement of all parties affected. In order to achieve this, each must therefore have a high level champion in the organisation(s) most affected to ensure the process changes are achieved.

Appendix 2 – Telehealth Benefits

Purpose

The purpose of this appendix is to describe the principal benefits of telehealth, and summarise the existing evidence to support these claims.

Benefits

Telehealth benefits arise for five main reasons, ranked below in terms of immediacy:

1) **Greater professional focus** – by automating the gathering of routine information and vital signs readings, telehealth enables clinicians to focus totally on delivering care, engaging their professional judgement. For example, surgeries using SurgeryPod-type equipment are able to improve patient outcomes whilst reducing staff; nurses using home telehealth are able to prioritise their visits at the start of the day, and to manage more patients.
2) **Anxiety reduction** – the classic example here is use of a SpO_2 meter to reassure an anxious patient that their O_2 blood saturation is close to their ambient level and therefore avoiding a potentially expensive unnecessary hospital visit. More generally though the knowledge that a patient's health is being watched by experts greatly reduces anxiety in those with chronic conditions.
3) **Exacerbation avoidance** – the simplest example here is weight gain in those with heart failure, as a predictor of a heart attack, readily avoided by increasing the dose of diuretic to remove excess fluid from their bodies: a major way of avoiding both hospital admission and surgery visits.
4) **Medication management** – this covers both reminding on timely medication compliance, (avoiding one of the principal causes of hospital admission for older people), and titrating dosage for drugs such as beta-blockers that can affect more than one condition (beta-blockers affect both heart behaviour and blood glucose level).
5) **Self-care** – a potentially vast area that begins with helping people to understand their bodies & minds better and focuses on getting them to take full responsibility for their own health. The benefits are potentially huge – even simple examples like COPD patients checking O_2 blood saturation levels before deciding whether to go out offers significant savings in hospital admission avoidance. Changing exercise & diet regimes, identifying & reducing stress levels, and diagnosing & treating depression (including use of computer-delivered Cognitive Behavioural Therapy) can have a far more dramatic effect.

One of the key points that emerge from the above is that few if any of these benefits arise from simply giving the kit to professionals or to patients. As all research into the benefits of IT have shown, benefits only arise when substantial changes are made to operational processes. The current attempt therefore by the DH to 'prove' the benefits of telehealth (and telecare) using a randomised control trial is fundamentally flawed because the randomisation requires the principal actors – in this case community matrons and district nurses – to behave in the 'old' way to their control patients and in the 'new' way to their trial patients, and flip between those ways in their daily round. (There are other problems with RCTs for technology trials too – as evidenced by Professor Sir Michael Rawlins, Chairman of NICE, at the Harveian Oration at the Royal College of Physicians, when he recently questioned the reliance on randomised control trials (RCTs) when

assessing health technology, and praised the potential benefits of other forms of evidence such as case control studies and case reports.)

Getting clinicians to adopt new ways of working is another potential problem in demonstrating benefits. Some conservatism is clearly justified when lives are at risk, and some reluctance is understandable as control of the patient will move more to nursing staff, though some experience in the UK suggests doctors have also sought pecuniary advantage from the NHS for adopting new ways of working.

Another point is that the benefits of telehealth (and telecare) fall across central government (e.g. as higher tax payments due to higher earnings), local government (e.g. as reduced social care, residential care payments) and the NHS (e.g. lower hospital, doctors' costs). Therefore measuring these is extremely fraught as parties other than the original investor typically have a lower interest in proving the merits of the investment, at least in part because if proven, the investor may seek reimbursement of the benefits.

A final point to be made is that until recently, telehealth equipment has been extremely expensive. As a consequence, trials have typically been small, focused on small enthusiastic groups of clinicians and so have not been statistically significant.

However in spite of the above problems, there is an increasing body of evidence demonstrating clear benefits including:

The Evidence

Newham

In research dated March 2006 carried out by Susan Procter, Public Health and Primary Care Unit, St Bartholomew School of Nursing and Midwifery, on a trial run by a joint Newham PCT/Acute Trust project in 2005/6, she showed a 38% reduction in unplanned hospital bed usage and a 56% reduction in total costs of managing people with long term conditions. For the reasons given above, the size of the group was too small to be statistically significant.

Kent

In a presentation given in the Houses of Parliament on 23rd June 2008, Hazel Price, Kent Telehealth Project Manager quoted the following findings from Kent's pre-Whole System Demonstrator telehealth work:

- Generalist Community Matron: within 4-6 weeks of starting to use telehealth equipment, 60 patients with LTCs showed a 60% reduction in acute care costs and a 40% reduction in GP contacts
- Specialist Community Matron model: within a similar time period, 60 patients satisfying matron case load criteria had run up a total of 870 emergency bed days in the period 12 months prior to acceptance onto caseload. After implementation of telehealth and community matron involvement, usage dropped to 85 bed days for a similar period, including the managed avoidance of over 50 exacerbations.
- Average costs per patient prior to community matron and telehealth involvement was £174,000 pa which dropped to £17,000 pa resulting in a saving of £157,000 pa *per patient*.

See also *Telehealth – scaling up the benefits*, a publication by the NHS Institute for Innovation. This can be found at http://www.institute.nhs.uk/option,com_joomcart/Itemid,26/main_page,document_product_info/products_id,337.html which also gives more detail to the Kent figures quoted above. It includes the introductory quote:

"While telehealth technologies are still new in the UK, there is already good evidence of their positive impact for people with long-term conditions. Where telehealth technologies are in use, people are seeing real benefits in terms of their health outcomes and quality of life – which, in turn, is reducing pressures on clinicians and emergency care departments."

Medway

Medway's original telehealth trials were of similar size to Newham's and showed similar percentage benefits to Newham with a 67% reduction in unplanned hospital admissions (see http://tunstallap.com/_assets/58-09-07-2008-11-28-19.pdf). A total of 133 hospital days and 117 nursing hours were saved by 31 patients. Tunstall's press release on this has some slightly confusing statistics, but some good case studies. (See http://tunstallap.com/_assets/58-09-07-2008-11-28-19.pdf)

Sheffield

The article at http://www.publictechnology.net/modules.php?op=modload&name=News&file=article&sid=15207&mode=thread&order=0&thold=0 includes the quote:

"Sheffield's innovative approach to managing the condition saw COPD-related hospital admissions dramatically decrease by 50%, saving the PCT between £30,000 to £40,000..."

Veterans Association

The Veterans Association is the largest of its type in the world, managing, amongst other things, the healthcare of the current 25 million US veterans (some three quarters of whom have seen active service). With the recognition of the need to control spiralling healthcare costs, they established a Care Coordination/Home Telehealth (CCHT) team to explore the best way of using telehealth to improve patient outcomes and reduce costs..

Writing in *US Medicine* about the VA's early implementation of telehealth, Stephen Spotswood said even in 2002, "the outcomes analyses of the pilot programs showed a 40 per cent reduction in emergency room visits, 63 per cent reduction in hospital admissions, 60 per cent reduction in bed days of care, 63 per cent reduction in VA nursing home admissions and an 88 per cent reduction in nursing home bed days of care when care coordination was used to help treat the patients in the home environment. The most telling statistic of all was patient satisfaction rates, which topped 90 per cent." http://www.usmedicine.com/article.cfm?articleID=811&issueID=59

This has now been followed up with a very large study, recently published, that concludes: "Routine analysis of data obtained for quality and performance purposes from a cohort of 17,025 CCHT patients shows the benefits of a 25% reduction in numbers of bed days of care, 19% reduction in numbers of hospital admissions, and mean satisfaction score rating of 86% after enrolment into the program. The cost of CCHT is $1,600 per patient per annum, substantially less than other NIC

programs and nursing home care. VHA's experience is that an enterprise-wide home telehealth implementation is an appropriate and cost-effective way of managing chronic care patients in both urban and rural settings." Darkins et al, Telemedicine and e-Health, December 2008 pp1118-1126.

Perhaps the most interesting comment, by Dr. Adam Darkins, chief consultant to the Veteran's Association, in the press release to launch the paper is "The results are not really about the technology, but about how using it helps coordinate the full scope of care our patients need. It permits us to give the right care in the right place at the right time."

Nursing Informatics Dee McGonigle & Kathleen Mastrion

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http://www.publictechnology.net/modules.php?op=modload&name=News&file=article&sid=15207&mode=thread&order=0&thold=0 Page 271 et seq. gives an extremely thorough review of telehealth benefits and their origins. It includes the two summary sentences: "The use of telemonitoring has been demonstrated to dramatically reduce the need for hospital and other acute services. Reductions of between 40 and 75% in the use of inpatient resources and emergency transport are routinely documented for chronic patients with diagnosis such as CHF and COPD."

Telehealth Solution's own experience

THSL is a very young company and only recently began shipment of our four products. Of these the SurgeryPod has been out in the market longest and therefore unsurprisingly is the product where customers are reporting the biggest saving. Typical savings for substantial practices are one assistant care professional at savings of the order of £40k pa – not bad for a £3k pa investment! Plus of course improved patient outcomes – indeed, patients really like using the system.