



Right asset, right place, right time: improving patient safety and financial efficiency with RFID in NHS Lothian

Dr Malcolm Phillips

Head of clinical engineering
NHS Lothian

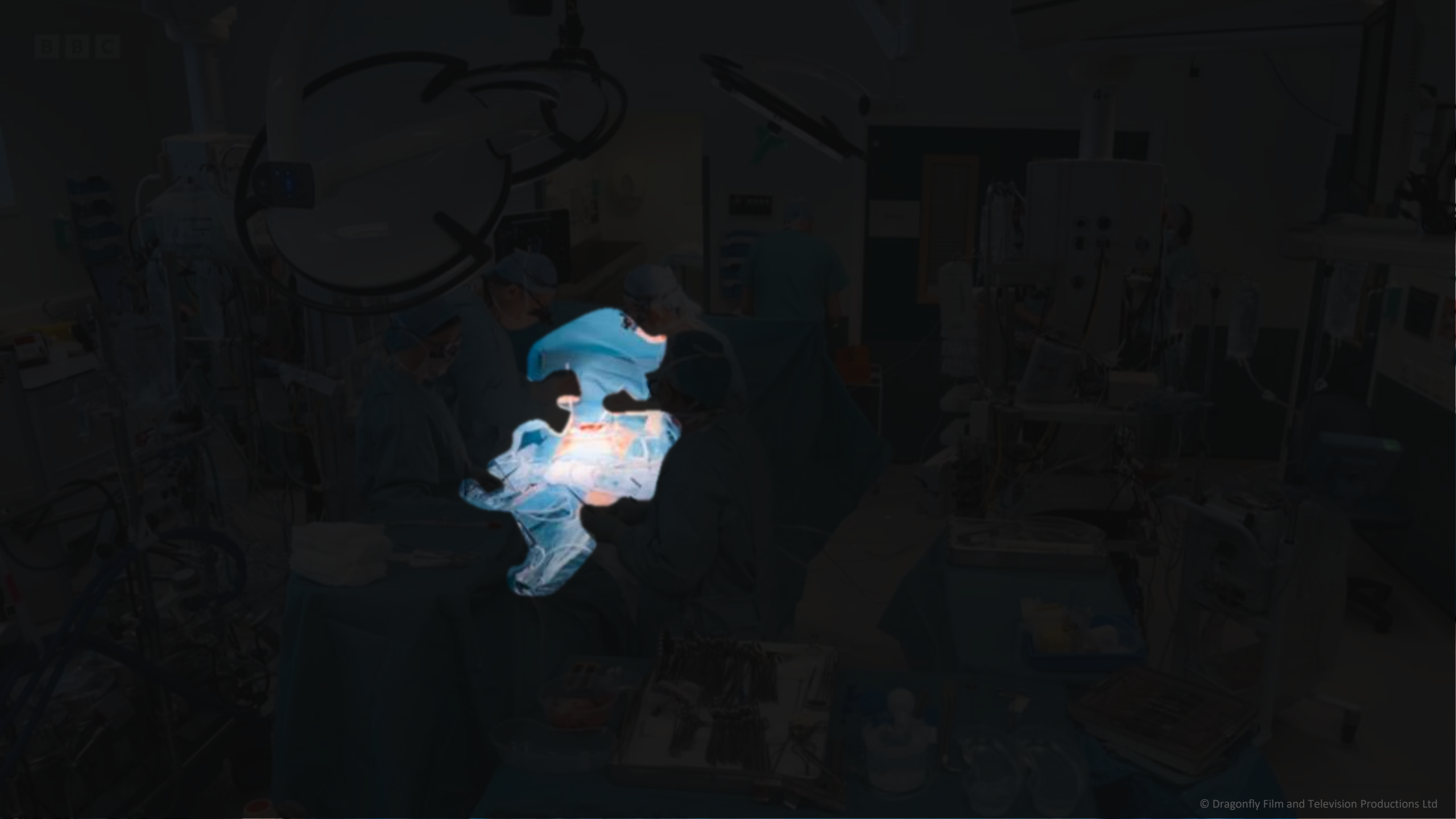
#bettercarecostsless

Right asset, right place, right time.

Improving patient safety and financial efficiency
with RFID in NHS Lothian.

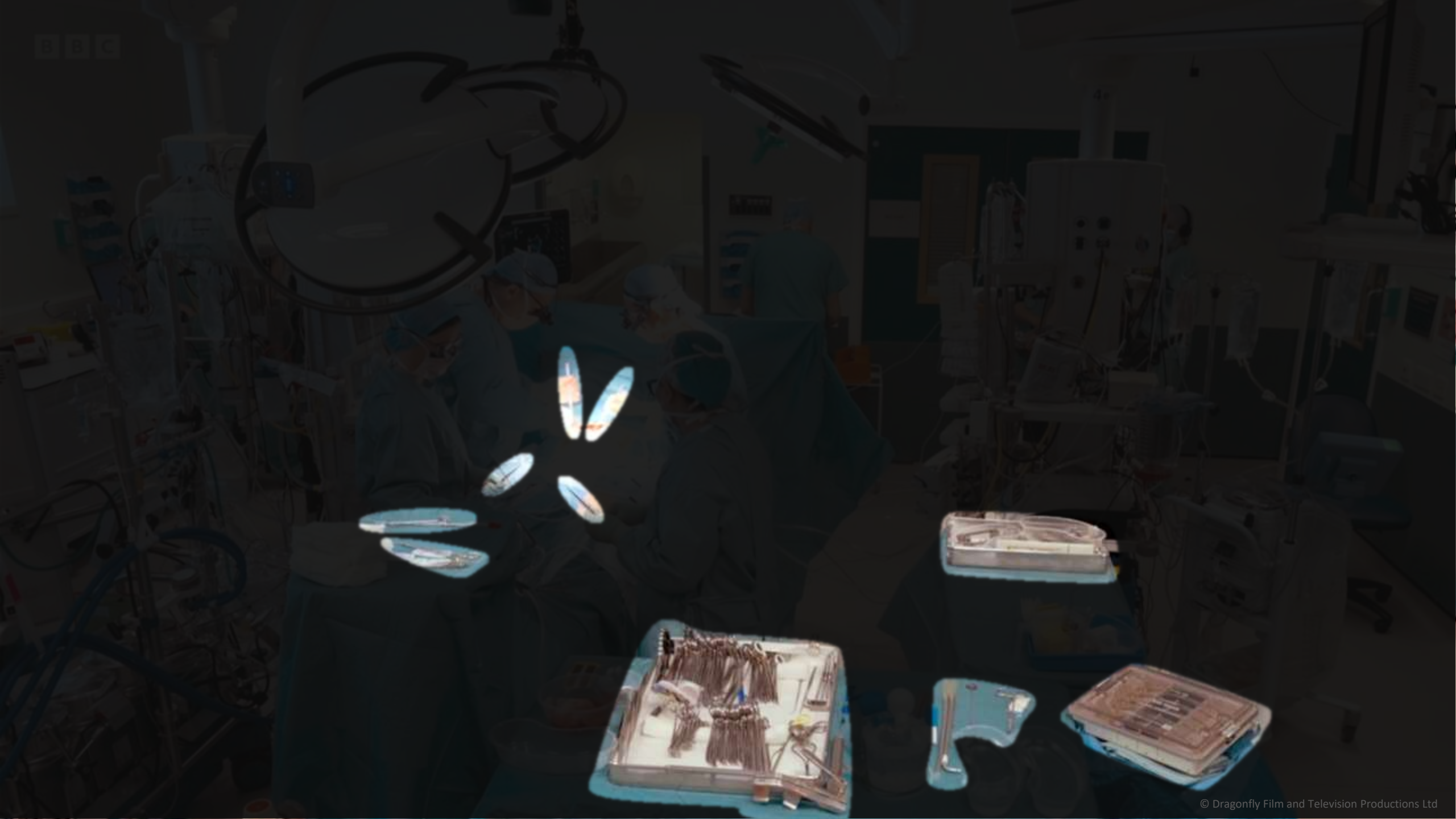
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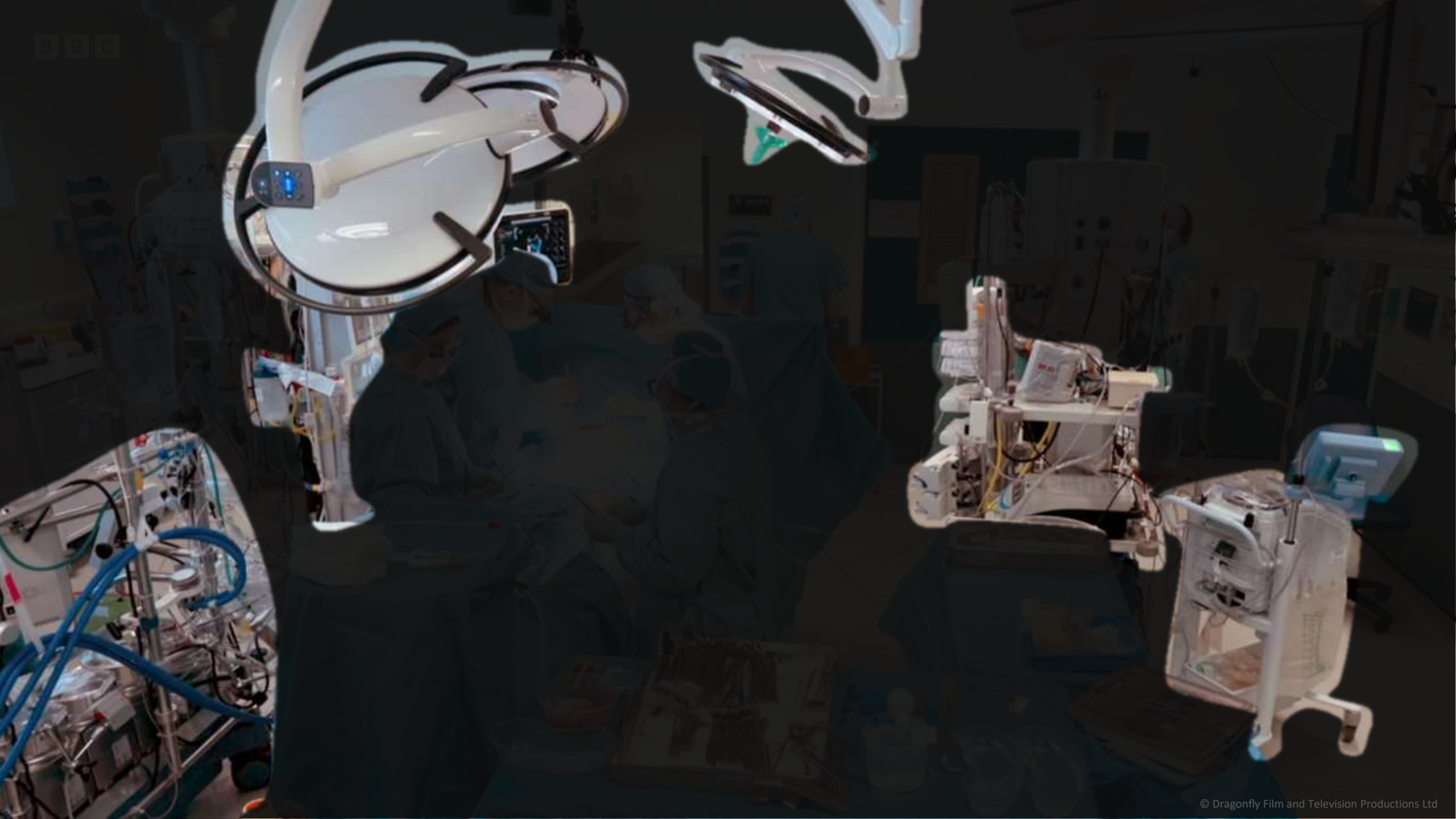












GS1 model of an episode of care



The right device(s)...
in the right place...
safe for use...
at the right time.

Real-world logistics problems

The challenge of managing surgical instruments, endoscopes and other medical equipment in Edinburgh.

Our acute hospitals



- Tertiary centre
- Acute teaching hospitals
- Approx 2,500 beds
- ~100 ITU/HDU beds
- Maternity
- Regional neonatal ITU
- Regional trauma centre
- Regional cancer centre
- Cardiothoracic surgery
- Neurosurgery
- Some transplant

- Six Clinical Engineering workshops



Clinical Engineering in numbers

Our medical equipment:

- Over 47,500 items of medical equipment
- Replacement cost ~£160M

Our team:

- ~55 clinical engineers, technologists & admin
- Presence in all acute hospitals
- Five teams of technologists
- Support to NHS Lothian and South East Region
- Medical device connectivity team
- Project and contract management team
- Two medical equipment libraries

In 2024:

- ~13,900 planned maintenance (PM) tasks
- ~18,200 other equipment tasks
- ~13% devices with overdue maintenance
- ~700 tasks per week
- ~36,500 tasks per year
- 1,275 device repairs requiring new parts
- ~£720,000 spent on replacement parts
- 34 safety notices requiring urgent work on equipment

Why bother doing maintenance?




Why bother doing maintenance?


B News > Reading & Berkshire News > Royal Berkshire Hospital


Royal Berkshire Hospital fined £200,000 after Dunkirk veteran's death following trolley fall

90-year-old Major James Fyfe was in the hospital for a routine X-ray when he fell and broke his neck

NEWS By [Hugh Fort](#) Reporter
10:35, 2 JUN 2016

Bookmark 



 Royal Berkshire Hospital

The debt-stricken [Royal Berkshire Hospital](#) has been fined £200,000 after a war veteran died after falling from a trolley.

Dunkirk veteran Major James Fyfe was 90 when he fell from the trolley and broke his neck.

[TOP STORIES](#)

“The manufacturer’s guidelines stated these trolleys should be maintained twice a year. However, this device was only looked at three times in four years.”

Medical equipment operational models of use

1. “Traditional”

Each clinical area is allocated and “owns” their own equipment

- Utilisation
- “Can I just borrow your bladder scanner briefly?...” 😂
- Equipment moves with the patient

2. Medical equipment library

A central store provides equipment to clinical areas on demand



Hospital Sterilisation and Decontamination Unit (HSDU)

In numbers:

- 275,000 surgical cases per year
- 18 surgical disciplines
- 5 million instruments, value ~£43M
- 26,000 different types of instrument
- ~15,000 sets
- Supplemental sets

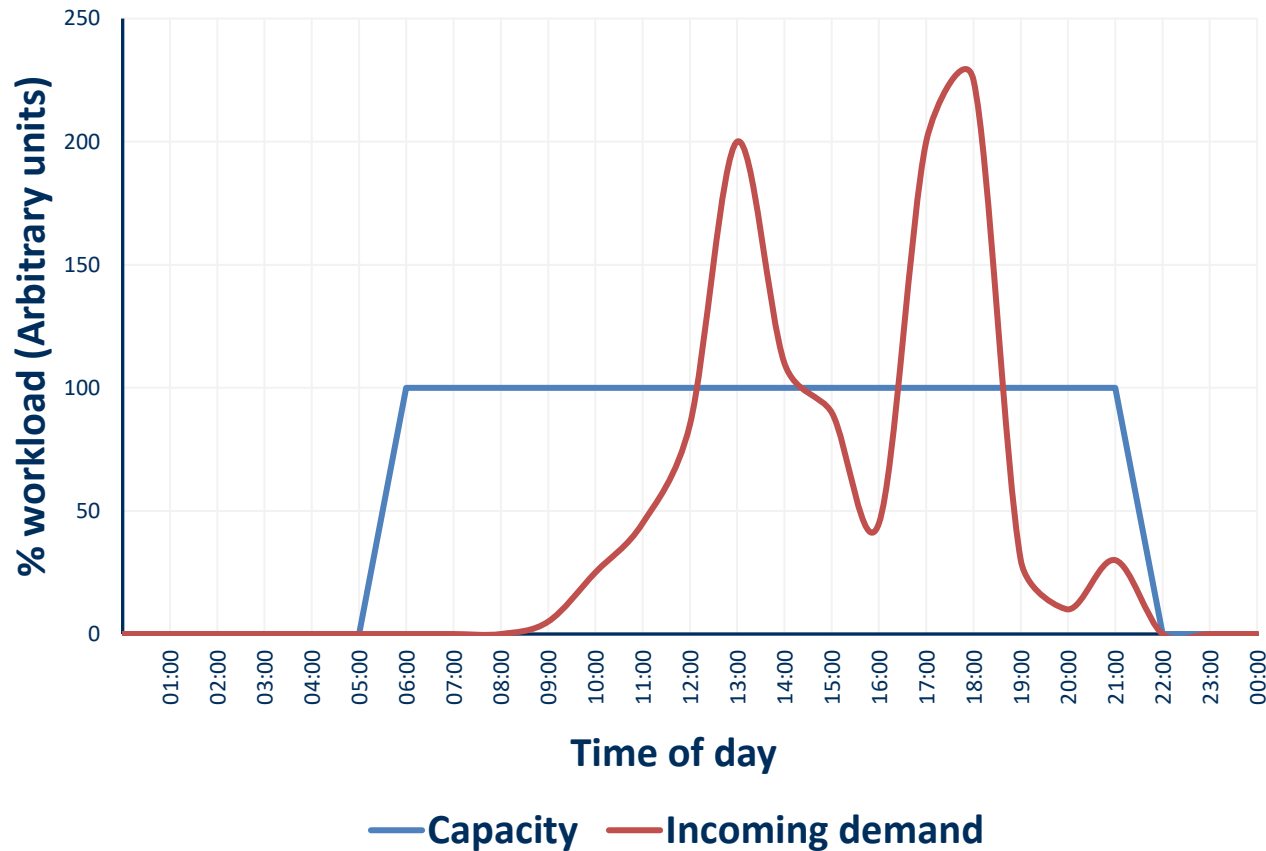


Lifecycle of a surgical instrument set



HSDU challenges

Illustrative HSDU capacity versus incoming demand



Problem:

- ! Barcodes often not scanned
- ⇒ Manual prioritisation using paper
- ⇒ Sets processed first-in, first-out
- ⇒ No “closed-loop” check in clean stores
- ⇒ No monitoring of sterile shelf-life
- ⇒ **Delays to surgery**

Solutions:

- New Canexis IT system (X-Line)
- How to identify trays without relying on barcode scanning?

 *“Have you thought about RFID?”*

Why Radio Frequency Identification (RFID)?

The problems

- Equipment goes missing
- Person-reliant process verification
- Reactive to *actual* events
 - Time wasted searching for devices
 - Cancellations
 - Delays to treatment
 - Patient harm
 - Legislative non-compliance

Benefits of an RFID solution

- Automated capture of device/location/time
- Proactive to *potential* events
 - Free-up staff time
 - Improved patient flow, operating theatre utilisation, efficiency and effective capacity
 - Reduced delays
 - Better patient outcomes?
 - Well-maintained equipment
 - **A smaller inventory?**
 - **Reduced rental costs?**

Design, planning and implementation of RFID

Technology selection

RFID tracking technology options

**Active:
(WiFi)**



Passive:



- ✓ Spatial resolution
- ✓ “Real-time”
- ✗ Inadequate infrastructure
- ✗ Infrastructure running costs
- ✗ Tag cost
- ✗ Ongoing tag management
- ✗ Range of “taggable” assets

- 😊 Spatial resolution
- 😞 “Last seen”
- ✗ No existing infrastructure
- 😊 Infrastructure running costs
- ✓ Tag cost
- ✓ Ongoing tag management
- ✓ Range of “taggable” assets

Reader infrastructure: Deployment



- Phase 1: Core areas
 - Operating rooms
 - HSDU
 - Clinical Engineering workshops
 - Medical equipment libraries
- Phase 2: Side-wide hospital pilot
 - St John's Hospital
 - How many readers and antennas?
- Phase 3: Wider deployment

Reader infrastructure: Spatial resolution

Where do we put the antennas?

- Cost versus spatial resolution
- SJH: Ward/department level
 - Building exits
 - Ward/Department/Store/Library area
 - Some “pinch points”
 - 75 readers and 150 antennas
- Tracking within each ward?



Reader infrastructure: HSDU process improvement



RFID antenna locations



Design, planning and implementation of RFID

Asset tagging

Medical equipment asset labels



Considerations:

- Pre-printed: ~£0.60 each
- Use of colour?
- Careful placement:
 - Adhesion
 - Visibility
 - Orientation and surface material both affect read distance (avoid metal)
- GS1 Global Individual Asset Identifiers

Why use a GS1 GIAI identifier?



Medical equipment asset tags



Tracking beds

- Over 2,700 new beds
- Cargo tags (~£3.50)



- Mounting
 - Infection control
 - Bed warranty



Endoscope tags



Tags for surgical instrument trays



Benefits and lessons learned

Reflections after year one...

- Re-labelling is very time consuming
- The RFID cart is an excellent audit tool
- Qualitative evaluation is easy...

Comments from clinical colleagues

“We can find our missing equipment so much easier!”

“It saves so much time.”

“This is brilliant, why didn't we have this before?”

“We make better use of our medical equipment.”

“Now that we have this, why aren't we using it to track everything?”

Real-time tracking reports

Workbook RFID Movements

https://waw-tableau.hlt.scot.nhs.uk/.../RFIDMovements/Detail?c3aembed=y&c3auiGuardRedirectFromVizportal=y&c3aorigin=card_share_link

Filters: Status: (All), Equipment No.: (All), serialnumber: (All), devicetype: (All), model: (All), User Group: (All), Last Xtrack RFID Scan: (All), Scanned Location: (All), Site: (All), senerdescription: (All), PM Status: (All)

Detail Data : User Group - All
 PM Status - All : Scanned Location - All : Model - All
 Last data refresh 16/04/2025 10:46:23

Equipment	serialnumber	model	Site	Scanned Location	Next PM Date	Last Scan time	PM Status
80003954	P0736703	ENTERPRISE 5000K	SJH	WARD 24 - CCU	06/08/2023	16/04/25 09:45:08	Overdue
92025939	FB-48007090	SENEVIEW T1 TDS MONITOR	SJH	THEATRES	27/03/2026	16/04/25 09:39:12	Due > 1 month
92047064	FB-3C004274	SENEVIEW T1 TDS MONITOR	SJH	THEATRE RECOVERY	18/09/2025	16/04/25 09:37:43	Due > 1 month
92022710	165730	775 BAID HUMBER	SJH	THEATRES 2 & 3 SET STORE OUT	27/03/2026	16/04/25 09:35:26	Due > 1 month
20002383	2310438	CPV	SJH	THEATRES 2 & 3 SET STORE OUT	Null	16/04/25 09:33:01	No PM Data
92030154	032635	MAA F/METER 0-15 LPM PROBE	SJH	MEDICAL PHYSICS	07/10/2020	16/04/25 09:13:48	Overdue
92024005	A38287	MAA F/METER 0-15 LPM PROBE	SJH	MEDICAL PHYSICS	20/10/2027	16/04/25 09:13:31	Due > 1 month
92025498	329981	O2 F/METER 0-15 LPM PROBE TWIN	SJH	MEDICAL PHYSICS	24/12/2028	16/04/25 09:18:43	Due > 1 month
92025486	329959	O2 F/METER 0-15 LPM PROBE TWIN	SJH	MEDICAL PHYSICS	24/12/2028	16/04/25 09:18:41	Due > 1 month
92025964	328194	O2 F/METER 0-15 LPM PROBE	SJH	MEDICAL PHYSICS	24/12/2028	16/04/25 09:18:11	Due > 1 month
80003947	P071899T	ENTERPRISE 5000K	SJH	THEATRE RECOVERY	06/08/2023	16/04/25 09:18:27	Overdue
92023446	FB-8C024545	SENEVIEW T1 TDS MONITOR	SJH	THEATRE RECOVERY	27/03/2026	16/04/25 09:15:34	Due > 1 month
92090338	F242810048	O2 F/METER 0-15 LPM PROBE TWIN	SJH	CORRIDOR	16/10/2021	16/04/25 09:15:06	Due > 1 month
92017409	125969	TEM 3000	SJH	MEDICAL PHYSICS	Null	16/04/25 09:09:48	No PM Data
80002951	P075738T	ENTERPRISE 5000K	SJH	RESERVATION WARD	06/08/2023	16/04/25 09:09:58	Overdue
20002361	2961120	SIF-H0290	SJH	DIRTY ZONE	Null	16/04/25 09:08:38	No PM Data
92096269	5042410035WA	MAC F	SJH	DAY SURGERY - CONSULTING ROOMS	10/09/2025	16/04/25 09:04:05	Due > 1 month
80003949	P0718238	ENTERPRISE 5000K	SJH	PAEDIATRICS	06/08/2023	16/04/25 09:03:49	Overdue
92017132	0028830	COUGH ASSIST E70	SJH	CORRIDOR	24/10/2024	16/04/25 09:01:47	Overdue
92023411	FB-3602002T	SENEVIEW T1 TDS MONITOR	SJH	THEATRES	02/02/2026	16/04/25 09:00:07	Overdue
92099476	0401V2	HFL394	SJH	CORRIDOR	Null	16/04/25 08:55:00	No PM Data
92099475	0400V5	C604	SJH	ITU	Null	16/04/25 08:55:49	No PM Data
92022796	CYNL813980	TC10	SJH	CORRIDOR	16/02/2024	16/04/25 08:52:52	Overdue
80003817	P072620T	ENTERPRISE 5000K	SJH	WARD 11	06/08/2023	16/04/25 08:50:26	Overdue
92025765	FB-44007633	SENEVIEW T1 TDS MONITOR	SJH	THEATRE RECOVERY	28/03/2026	16/04/25 08:47:17	Due > 1 month
92004966	163043	O2 DIAL-RBS 0-15 LPM & SSV	SJH	MEDICAL PHYSICS	25/03/2026	16/04/25 08:43:46	Due > 1 month
92025485	328975	O2 F/METER 0-15 LPM PROBE TWIN	SJH	WARD 9	24/12/2028	16/04/25 08:43:03	Due > 1 month
92017964	F250270002	O2 F/METER 0-15 LPM PROBE TWIN	SJH	WARD 6 - STROKE UNIT	25/02/2022	16/04/25 08:40:06	Due > 1 month
92025503	329988	O2 F/METER 0-15 LPM PROBE TWIN	SJH	WARD 4 - STROKE UNIT	24/12/2028	16/04/25 08:40:06	Due > 1 month
92025489	330004	O2 F/METER 0-15 LPM PROBE TWIN	SJH	WARD 4 - STROKE UNIT	24/12/2028	16/04/25 08:40:06	Due > 1 month
92017938	328936	O2 F/METER 0-15 LPM PROBE TWIN	SJH	WARD 4 - STROKE UNIT	24/12/2028	16/04/25 08:40:05	Due > 1 month
92017989	328960	O2 F/METER 0-15 LPM PROBE TWIN	SJH	WARD 8 - STROKE UNIT	24/12/2028	16/04/25 08:40:05	Due > 1 month
20002212	5023508	ENF-VR	SJH	WARD 194 - E-N-T	Null	16/04/25 08:40:34	No PM Data
20002398	2300795	ENF-VH	SJH	WARD 194 - E-N-T	Null	16/04/25 08:40:35	No PM Data
20002394	2300790	ENF-VH	SJH	WARD 194 - E-N-T	Null	16/04/25 08:41:32	No PM Data
20002197	2300794	ENF-VH	SJH	WARD 194 - E-N-T	Null	16/04/25 08:41:32	No PM Data

Reflections after year one...

- Re-labelling is very time consuming
- The RFID cart is an excellent audit tool
- *Qualitative* evaluation is easy...

Reflections after year one...

- Re-labelling is very time consuming
- The RFID cart is an excellent audit tool
- *Quantitative* evaluation is difficult!
 - Baseline measures?
 - Measure “time to find”?
 - Detect improvements in other processes

Non-cash releasing benefits so far...

- Data from St John's Hospital
 - ~200 device movements per day (~3% of inventory)
 - Clinical staff perform more than 100 online searches each week
 - Phone calls asking for equipment ↓ 90%
 - Maintenance backlog: ↓ from 14% to 12%
- Safety alert: Find three infusion pumps (in a fleet of 310)
 1. With no RFID (2 weeks = £1,400)
 2. With RFID hand scanner and mobile capture cart (1 day = £130)
 3. With ward-level tracking and hand scanner (<1 hour = £19)

Initial cash releasing benefits

- Lack of movement = unused equipment?
 - Removed 10 flexible endoscopes from use
 - Immediate recurring maintenance saving: ~£97k
 - Save ~£170k at next replacement cycle
- Feasibility study to reduce specialist equipment rental days
 - Potential savings >£100k /year
 - Interoperability with rental supplier's RFID tags?
 - “Off-rental zones”?

Future plans

- Completion of instrument set tagging
- Successful proof of concept to track laundry items
- Tag other items:



Future plans

- Deployment to other hospital sites (RIE, WGH, RHCYP)
- RHCYP and WGH equipment libraries
 - Real-time stock levels
 - Evidence-based reduction in stock levels
- RIE
 - Mitigate Emergency Department equipment shortages
- Fusion with data from other sources
 - Idle infusion pumps?
- GLNs

Edinburgh and the Lothians



Photos: © Visit Scotland/Kenny Lam/Stuart Brunton

Using the RFID trolley in the ITU