St. Cloud VA Health Care System recently conducted a study on the effectiveness of Tru-D in operating rooms, endoscopy suites, urology procedure rooms and resident rooms of a community living center.

Throughout the study, environmental swabs were done post-cleaning and prior to Tru-D, as well as after Tru-D was used in each room. A total of 40 environmental swabs were performed; twenty-three of the swabs grew organisms prior to Tru-D, and 0 out of 40 swabs showed growth after the use of Tru-D. The St. Cloud VA’s data confirms that Tru-D can eliminate colony growth of important pathogens in real-world settings.

The study also assessed ease of use and cost per patient visit. Staff were able to perform other duties while the UV cycle was running and be alerted by their cell phone when the cycle was complete. Over the course of 7 years, purchase price and annual service contract cost for 1 Tru-D machine amounted to less than 6 cents per outpatient visit.

The combined results of the study concluded that “routine use of UV disinfection is a feasible addition to current infection control and environmental management service measures and may help reduce rates or health care-associated infections and ensure our Veterans a clean, safe environment for their health care.”

St. Cloud VA Healthcare System, St. Cloud, Minnesota
Infection Prevention: Ultraviolet Disinfection Trial
Tina Schmidt, BSN, RN, CIC Infection Prevention Nurse
Paulette Masberg, BSN, RN, MDRO Coordinator
St. Cloud VA HCS

Infection Prevention: Ultraviolet Disinfection Trial
Tina Schmidt, BSN, RN, CIC Infection Prevention Nurse
Paulette Masberg, BSN, RN MDRO Coordinator

January 2017
Ultraviolet (UV) Disinfection Trial

- Utilized TRU-D Ultraviolet (UV) Disinfection, Friday 12/16/2016, thru Friday 12/23/2016
- Locations:
  - Operating Rooms
  - Endoscopy
  - Urology
  - Community Living Center (CLC), Resident Rooms (Rms)

- Adenosine Triphosphate (ATP) swabbing Prior and Post TRU-D for Bioburden testing
- Environmental Swabbing Prior and Post TRU-D for organism testing
Pre & Post ATP Swab Results Measured by Relative Light Units (RLU), Operating Rm 2 (Friday, 12/16/2016)

<table>
<thead>
<tr>
<th>Area Swabbed for Environmental Culture</th>
<th>Environmental Swabbing Pre-UV</th>
<th>Organisms</th>
<th>Environmental Swabbing Post UV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armboard (underneath on adjustment handle)</td>
<td>1 colony</td>
<td>GPC</td>
<td>No growth</td>
</tr>
<tr>
<td>Omnicell Keyboard</td>
<td>1 colony</td>
<td>GPR</td>
<td>No growth</td>
</tr>
</tbody>
</table>

Relative Light Units (RLU)

- Omnicell Keyboard: 107
- Telephone Nurses Station (back): 96
- Anesthesia Breathing Tube: 90
- Room Light Switch: 33
- OR overhead (exam) light handle: 21
- OR Bed: 16
- Boom: 11
- OR Wall Phone: 8
- Keyboard: -22
Operating Rm (OR) 2. The bottom of the Armboard grew out 1 colony: GPC prior to TRU-D disinfection (picture on left side). Post TRU-D disinfection there was no growth noted on the plate (see picture on right side).
OR 2: Close up of bottom of arm board. 1 colony shown (picture on left side) prior to TRU-D. No growth after TRU-D (picture on right side).
Pre & Post ATP Swab Results Measured by Relative Light Units (RLU),
Endoscopy Rm 251 (Friday, 12/16/2016)

### Area Swabbed for Environmental Culture

<table>
<thead>
<tr>
<th>Area Swabbed</th>
<th>Environmental Swabbing Pre-UV</th>
<th>Organisms</th>
<th>Environmental Swabbing Post UV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front Olympus Touch Screen</td>
<td>2 colonies</td>
<td>GPR, Gncoccobacilli</td>
<td>No growth</td>
</tr>
<tr>
<td>Lap Top Keyboard</td>
<td>6 colonies</td>
<td>GNR, GPR x4, GPC</td>
<td>No growth</td>
</tr>
</tbody>
</table>

### Results

- **E-pad Pen**: 1,126
- **Olympus monitor Pole**: 940
- **Door Handle**: 796
- **Omnicell Keyboard**: 781
- **Door Light Switch**: 260
- **Tray Table**: 253
- **Bed Rail**: 202
- **Lap Top Keyboard**: 159
- **Olympus screen**: 40
- **Treatment cart handle**: 93

### Notes
- Variance
- Pre
- Post
- Pass/Fail Threshold

**Relative Light Unit (RLU)**
12/16/2016 ENDOSCOPY Rm 251. The lap top keyboard grew out 6 different colonies: GNR, GPR x4 and GPC prior to TRU-D disinfection. After TRU-D disinfection there was no growth noted on the plates.
Close up of the 12/16/2016 ENDOSCOPY Rm 251 lap top keyboard. 6 different colonies growth prior to TRU-D on the left, and no growth noted on the plate post TRU-D on the right.
12/16/2016 ENDOSCOPY Rm 251. 2 colonies: GPR and Gnoccobacilli grew on Olympus Touch Screen panel prior to TRU-D disinfection. No growth noted on the plate after TRU-D disinfection.
Pre & Post ATP Swab Results Measured by Relative Light Units (RLU), Operating Rm 1 (Monday, 12/19/2016)

### Area Swabbed for Environmental Culture

<table>
<thead>
<tr>
<th>Area</th>
<th>Environmental Swabbing Pre-UV</th>
<th>Organisms</th>
<th>Environmental Swabbing Post UV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under OR Table</td>
<td>No growth</td>
<td></td>
<td>No growth</td>
</tr>
<tr>
<td>Omnicell Keyboard</td>
<td>1 colony</td>
<td>GPC</td>
<td>No growth</td>
</tr>
<tr>
<td>Monopolar Power Buttons</td>
<td>No growth</td>
<td></td>
<td>No growth</td>
</tr>
<tr>
<td>Storage Cart Handle</td>
<td>2 colonies</td>
<td>GPC, GPR</td>
<td>No growth</td>
</tr>
</tbody>
</table>

### Graph

- **Relative Light Unit (RLU)**

### Top Areas with Higher Pre- and Post-Swab Results

- **Room Inner Door Knob**: 488 RLU Pre, 74 RLU Post
- **Anesthesia Breathing Tube Connector**: 42 RLU Pre, 36 RLU Post
- **Boom**: 17 RLU Pre, 6 RLU Post
- **Telephone Nurses Station**: 0 RLU Pre, -1 RLU Post
- **OR Bed**: -11 RLU Pre, -57 RLU Post

**Legend**:

- **Variance**
- **Pre**
- **Post**
- **Pass/Fail Threshold**
Pre & Post ATP Swab Results Measured by Relative Light Units (RLU), Urology Rm 246 (Monday, 12/19/2016)

<table>
<thead>
<tr>
<th>Area Swabbed for Environmental Culture</th>
<th>Environmental Swabbing Pre-LU</th>
<th>Organisms</th>
<th>Environmental Swabbing Post LU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Siemens Rotator Ball</td>
<td>No growth</td>
<td>No growth</td>
<td></td>
</tr>
<tr>
<td>VS Temperature Probe Handle</td>
<td>No growth</td>
<td>No growth</td>
<td></td>
</tr>
<tr>
<td>Olympus OEP-4 Touchbutton pads</td>
<td>No growth</td>
<td>No growth</td>
<td></td>
</tr>
<tr>
<td>Left Side Bed Hand Held Controls</td>
<td>1 colony</td>
<td>GPR</td>
<td></td>
</tr>
</tbody>
</table>

Graph showing relative light units (RLU) for various areas.

- **Variance**
- **Pre**
- **Post**
- **Pass/Fail Threshold**
Pre & Post ATP Swab Results Measured by Relative Light Units (RLU), CLC 49-1 Rm 122B (Tuesday, 12/20/2016)

<table>
<thead>
<tr>
<th>Area Swabbed for Environmental Culture</th>
<th>Environmental Swabbing Pre-UV</th>
<th>Organisms</th>
<th>Environmental Swabbing Post UV</th>
</tr>
</thead>
<tbody>
<tr>
<td>O2 regulator</td>
<td>2 colonies</td>
<td>GPR, GPR</td>
<td>No growth</td>
</tr>
<tr>
<td>Nurse call Light/TV Control (red button)</td>
<td>2 colonies</td>
<td>GPR, GNR</td>
<td>No growth</td>
</tr>
<tr>
<td>Trapeze Bar</td>
<td>2 colonies</td>
<td>GPR, GNR</td>
<td>No growth</td>
</tr>
<tr>
<td>Bed Buttons</td>
<td>2 colonies</td>
<td>GPR, GPR</td>
<td>No growth</td>
</tr>
</tbody>
</table>

Relative Light Unit (RLU)
CLC 49-1, Rm 122B. The nurse call light grew 2 colonies: GPR and GNR pre TRU-D. The bed buttons grew 2 colonies: GPR and GNR pre TRU-D. After TRU-D disinfection there was no growth noted on the plate.
CLC 49-1, Rm 122B. The trapeze grew out 2 colonies: GPR and GNR pre TRU-D. The O2 regulator also grew out 2 colonies pre TRU-D. After TRU-D disinfection there was no growth noted on the plate.
Pre & Post ATP Swab Results Measured by Relative Light Units (RLU), CLC 49-1 Rm 123 (Tuesday, 12/20/2016)

### Area Swabbed for Environmental Culture

<table>
<thead>
<tr>
<th>Area Swabbed</th>
<th>Environmental Swabbing Pre-UV</th>
<th>Organisms</th>
<th>Environmental Swabbing Post UV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trapeze</td>
<td>4 colonies</td>
<td>GPR, GNR</td>
<td>No growth</td>
</tr>
<tr>
<td>Nurse Call</td>
<td>3 colonies</td>
<td>GPR, GNR</td>
<td>No growth</td>
</tr>
<tr>
<td>O2 Regulator Knob</td>
<td>No growth</td>
<td></td>
<td>No growth</td>
</tr>
<tr>
<td>Red Buttons</td>
<td>2 colonies (large growth)</td>
<td>GPR, GNR</td>
<td>No growth</td>
</tr>
</tbody>
</table>

### Relative Light Units (RLU)

<table>
<thead>
<tr>
<th>Area Swabbed</th>
<th>Pre</th>
<th>Post</th>
<th>Pass/Fail Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior Door Knob (wall mount)</td>
<td>3,624</td>
<td>539</td>
<td>-</td>
</tr>
<tr>
<td>Nurse Call Buttons</td>
<td>388</td>
<td>130</td>
<td>-</td>
</tr>
<tr>
<td>Phone Buttons</td>
<td>102</td>
<td>81</td>
<td>-</td>
</tr>
<tr>
<td>Bulletin Board</td>
<td>75</td>
<td>61</td>
<td>-</td>
</tr>
<tr>
<td>Top Drawer Handle</td>
<td>57</td>
<td>46</td>
<td>-</td>
</tr>
<tr>
<td>Yellow Thumb Tac</td>
<td>500</td>
<td>1,000</td>
<td>-</td>
</tr>
<tr>
<td>o2 regulator Knob</td>
<td>1,500</td>
<td>2,000</td>
<td>-</td>
</tr>
<tr>
<td>Trapeze Bar</td>
<td>2,500</td>
<td>3,000</td>
<td>-</td>
</tr>
</tbody>
</table>
CLC 49-1, Rm 123. The trapeze grew out 4 different colonies: GPR x2 and GNR x2 pre TRU-D. The nurse call light grew out 3 different colonies: GPR and GNR x2 pre TRU-D. After TRU-D disinfection there was no growth noted on either plate.
CLC 49-1, Rm 123. Close-up of trapeze colony growth prior to TRU-D (pic on left, right side of plate), nurse call (pic on left, left side of plate). Close up of nurse call after TRU-D (pic on right, left side of plate, and trapeze pic on right, right side of plate) after TRU-D with no colony growth.
CLC 49-1, Rm 123. The O2 regulator did not have any growth prior to TRU-D disinfection (pic on left, right side of plate). The bed buttons grew out 2 large colonies: GPR and GNR (pic on left, left side of plate).

After TRU-D disinfection there was no growth noted on the plate on either the O2 regulator or the bed buttons.
CLC 49-1, Rm 123. The O2 regulator showed no growth prior to (picture on left, left side of plate) or after TRU-D disinfection (picture on right, left side of plate). The bed buttons had large growth of 2 colonies: GPR and GNR (picture on left, right side of plate), and no growth post TRU-D (picture on right side, right side of plate).
CLC 49, Rm 123. Close up view of colony growth from bed buttons prior to TRU-D (picture on left, left side of plate), and no growth shown after TRU-D (picture on right, left side of plate). No growth noted to O2 regulator prior to (picture on left, right side of plate) or after TRU-D (picture on right, right side of plate) as noted on images below.
CLC 49-1, Rm 123. The trapeze grew out 4 different colonies: GPR x2 and GNR x2 prior to TRU-D (picture on left side, left side of plate). No growth after TRU-D (picture on right, left side of plate). The nurse call light grew out 3 different colonies: GPR, GNR x2 prior to TRU-D (picture on left side, right side of plate), and no growth after TRU-D (picture on right, right side of plate).
CLC 49-1, Rm 123. Close-up of the 4 different colonies grown on Trapeze prior to TRU-D (picture on left, left side of plate), no growth after TRU-D (picture on right, left side of plate). Image of the 3 different colonies grown on nurse call after to TRU-D (picture on left, right side of plate), and no growth after TRU-D (picture on right, right side of plate).
Pre & Post ATP Swab Results Measured by Relative Light Units (RLU), Dental Procedure Rm (Wednesday, 12/21/2016)

### Area Swabbed for Environmental Culture

<table>
<thead>
<tr>
<th>Area</th>
<th>Environmental Swabbing Pre-UV</th>
<th>Organisms</th>
<th>Environmental Swabbing Post UV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sentry Sedate Flow Knob</td>
<td>1 colony</td>
<td>GPC</td>
<td>No growth</td>
</tr>
<tr>
<td>Tray Table</td>
<td>2 colonies</td>
<td>GNR (large), GPC</td>
<td>No growth</td>
</tr>
<tr>
<td>VS Monitor Knob</td>
<td>No growth</td>
<td></td>
<td>No growth</td>
</tr>
<tr>
<td>Inner Rm Door Handle</td>
<td>No growth</td>
<td>GPR, GNR</td>
<td>No growth</td>
</tr>
</tbody>
</table>

### Relative Light Units (RLU)

- **Inner Room Door Handle**: 547
- **Keyboard Mouse**: 393
- **Right Arm Board**: 163
- **Telephone Keypad**: 150
- **Alaris Pump**: 138
- **DCI International Drill Tool**: 121
- **Tray Table**: 66
- **VS Monitor (Grey Knob)**: 43
- **DCI International H20 Flush Tool**: 40
- **Exam Light Handle**: 16

**Variance**

- **Pre**
- **Post**
- **Pass/Fail Threshold**
Pre & Post ATP Swab Results Measured by Relative Light Units (RLU), Operating Rm 3 (Thursday, 12/22/2016)

<table>
<thead>
<tr>
<th>Area Swabbed for Environmental Culture</th>
<th>Environmental Swabbing Pre-UV</th>
<th>Organisms</th>
<th>Environmental Swabbing Post UV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bed Control</td>
<td>No growth</td>
<td>No growth</td>
<td>No growth</td>
</tr>
<tr>
<td>Under Arm Board Adjustment Handle</td>
<td>No growth</td>
<td>No growth</td>
<td>No growth</td>
</tr>
<tr>
<td>Anesthesia Phillips Monitor Button</td>
<td>No growth</td>
<td>No growth</td>
<td>No growth</td>
</tr>
<tr>
<td>Omnicell Keyboard</td>
<td>1 colony</td>
<td>GPR</td>
<td>No growth</td>
</tr>
</tbody>
</table>

VETTERANS HEALTH ADMINISTRATION
Pre & Post ATP Swab Results Measured by Relative Light Units (RLU), Operating Rm 2 (Friday, 12/23/2016)

<table>
<thead>
<tr>
<th>Area Swabbed for Environmental Culture</th>
<th>Environmental Swabbing Pre-UV</th>
<th>Organisms</th>
<th>Environmental Swabbing Post UV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bed Controls</td>
<td>No growth</td>
<td>No growth</td>
<td>No growth</td>
</tr>
<tr>
<td>Under Arm Board Adjustment Handle</td>
<td>No growth</td>
<td>No growth</td>
<td>No growth</td>
</tr>
<tr>
<td>Anesthesia Phillips Monitor Button</td>
<td>No growth</td>
<td>No growth</td>
<td>No growth</td>
</tr>
<tr>
<td>Omnicell Keyboard</td>
<td>1 colony</td>
<td>GPR</td>
<td>No growth</td>
</tr>
</tbody>
</table>

- Anesthesia Breathing Tube Connector
- Boom
- Omnicell Keyboard
- ARC Keyboard
- OR Bed
- OR overhead (exam) light handle
- OR Wall Phone
- Room Light Switch
- Glidescope
- Room Inner Door Knob (going to clean core)
Pre & Post ATP Swab Results Measured by Relative Light Units (RLU), Endoscopy Rm 251 (Wednesday, 12/21/2016)

No Environmental Cultures obtained due to lack of swab availability.
Pre & Post ATP Swab Results Measured by Relative Light Units (RLU), CLC 50-2 (Wednesday, 12/21/2016)

### Area Swabbed for Environmental Culture

<table>
<thead>
<tr>
<th>Area</th>
<th>Environmental Swabbing Pre-UV</th>
<th>Organisms</th>
<th>Environmental Swabbing Post UV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulletin Board Thumb Tac</td>
<td>No growth</td>
<td>No growth</td>
<td></td>
</tr>
<tr>
<td>Bulletin Board</td>
<td>No growth</td>
<td>No growth</td>
<td></td>
</tr>
<tr>
<td>Lift Controls</td>
<td>No growth</td>
<td>No growth</td>
<td></td>
</tr>
<tr>
<td>Nurse Call (green wall button)</td>
<td>1 colony</td>
<td>GPC</td>
<td>No growth</td>
</tr>
</tbody>
</table>

### Relative Light Units (RLU)

- **Sink Handle (HOT):** 767 RLU
- **Drawer Handle (top):** 130 RLU
- **Light Switch by Bathroom:** 85 RLU
- **Telephone keypad:** 72 RLU
- **Door Handle (inner):** 64 RLU
- **Bed Rail Handle:** 41 RLU
- **VCR Power Button:** 10 RLU
- **Bed Control Buttons:** 8 RLU
- **Lift Control Buttons:** 7 RLU
- **Nurse/TV Control:** 44 RLU

**Variance**

- **Pre:** Red
- **Post:** Green
- **Pass/Fail Threshold:** Yellow
Pre & Post ATP Swab Results Measured by Relative Light Units (RLU), Urology Rm 244 (Wednesday, 12/21/2016)

<table>
<thead>
<tr>
<th>Area Swabbed for Environmental Culture</th>
<th>Environmental Swabbing Pre-UV</th>
<th>Organisms</th>
<th>Environmental Swabbing Post UV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bladder Scan Touch Screen</td>
<td>No growth</td>
<td>GPCR, GPC x2, GP diplococci</td>
<td>No growth</td>
</tr>
<tr>
<td>EPAD Pen</td>
<td>4 colonies</td>
<td>GPR x3, GPC x2, GNR</td>
<td>No growth</td>
</tr>
<tr>
<td>COW Mouse</td>
<td>Numerous growth</td>
<td>GPR</td>
<td>No growth</td>
</tr>
<tr>
<td>Head Rest Handle</td>
<td>No growth</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Relative Light Units (RLU)
Urology Rm 244. The COW mouse showed numerous growth: GPR x3, GPC x2 and GNR prior to TRU-D disinfection. There was no growth noted on the plate after TRU-D disinfection. The head rest handle showed no growth prior to or after TRU-D disinfection.
Close up of the colony growth on the COW mouse prior to TRU-D disinfection (picture on the left, left side of plate); no growth after TRU-D (picture on the right, right side of plate).
Urology Rm 244. The EPAD Pen grew out 4 colonies: GPCR, GPC x2, and GP diplococci prior to TRU-D disinfection. No growth present on the plate after TRU-D. The bladder scanner touch screen buttons showed no growth prior to or after TRU-D.
Urology Rm 244, Close up of colony growth on EPAD Pen prior to TRU-D (pic on the left side of the left plate). No growth noted to EPAD Pen after TRU-D disinfection (pic on right side of right plate).
UV Disinfection Trial: ATP Swapping Summary

- 130 total ATP swabs performed (10 swabs before TRU-D, and 10 swabs after TRU-D per room)
- 121 ATP swabs out of the total 130 ATP swabs showed a reduction in bioburden (as measured by relative light units (RLU) after the use of TRU-D.
- 9 swabs showed an increase in bioburden
- 1 of the nine was inadvertently re-touched after TRU-D before post-ATP swab, which would increase the RLU.
- 121/130=93% reduction in RLU
UV Disinfection Trial: Environmental Swabbing Summary

- 40 environmental swabs were performed (2-4 swabs before TRU-D and 2-4 swabs after TRU-D per room). Endoscopy Room 251 on 12/21/2016 did not have environmental swabbing performed due to swab supply availability at the time.
- 23 of the 40 environmental swabs grew organisms before the use of TRU-D.
- 40 out of 40 environmental swabs showed no growth after the use of TRU-D.
- 51 total colonies were identified out of the total 40 environmental swabs obtained before the use of TRU-D UV Disinfection.
- Gram-positive Cocci, Gram positive rods, Gram negative coccobacilli, Gram-positive diplococci and GPCR were identified pre TRU-D.
- 0 colonies grew after the use of TRU-D UV Disinfection.
UV Disinfection (TRU-D) Cycle Time & Ease of Use

- Varies with:
  - Size of Room
  - How Much/Type equipment is in the room
  - Disinfection time ranged from 21 minutes, to 1 hour 20 minutes

- Ease of Use:
  - Room prepped by opening drawers and pulling equipment away from walls (≤5 min)
  - Device tells you if placement is ideal or a move is recommended.
  - Staff can set up the device to alert you by cell phone when disinfection is complete
  - Staff able to perform other duties while UV cycle is running
  - Automatically turns off when someone enters the room (safety device)
**Conclusion**

- Our data confirms that UV Disinfection (TRU-D) can decrease the bioburden of important pathogens in real-world settings as demonstrated by the operating rooms, Endoscopy Suites, urology procedure rooms, and the CLC.
- Our data also confirms that UV Disinfection (TRU-D) effectively eliminated all colony growth that was present on our environmental surfaces prior to the utilization of TRU-D.
- After using UV Disinfection (TRU-D) the environmental swabs showed “no colony growth”.
- Routine use of UV disinfection is a feasible addition to current infection control and EMS measures, and may help reduce rates of healthcare associated infections and ensure our Veterans a clean, safe environment for their healthcare.