Health Policy Advisory Committee on Technology

Technology Brief

Remote presence robots in telemedicine

July 2014
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This brief was prepared by Dr. Vicki Foerster from the Australian Safety and Efficacy Register of New Interventional Procedures – Surgical (ASERNIP-S).
Technology, Company and Licensing

Register ID                   WP188

Technology name              Remote presence robots

Patient indication           Patients who do not have face-to-face access to a clinician for various reasons including their location (remote settings) or clinician shortages, on-call demands

Description of the technology

A remote presence (RP) robot is a mobile robot that assesses a patient at the bedside. The robot is under the control of a remote clinician who is located at a distant control station, either nearby or anywhere in the world. RP robots have been developed to stand in for clinicians if they cannot be at a patient’s bedside. The robots are anthropomorphic, human-sized devices that operate in a wireless environment. They use a semi-autonomous, Internet-enabled, real-time, two-way audio-visual telecommunications platform. The remote clinician uses a joystick to drive the device to the patient’s bedside and manoeuvre it around the bed. The clinician can then perform a visual physical examination, coach and observe a surrogate examiner, and review graphical information on monitors, ventilators, balloon pumps and so on. The robot can travel at speeds of about three km per hour and has an eight hour rechargeable battery.\(^1,2\)

RP robots employ electronic stethoscopes and can be enhanced with lights to illuminate the retina, pharynx, ear canal, and tympanic membrane. Bedside ultrasound transmission is also possible. The robot’s ‘head’ is a computer monitor that allows the patient and bedside providers to see the clinician, and vice versa.\(^2\)

Five types of RP devices are marketed: RP-Xpress\(^\circledR\), RP-Vantage\(^\circledR\), RP-Lite\(^\circledR\), RP-7i\(^\circledR\), and RP-VITA\(^\circledR\). The latter two are the most sophisticated offerings and are of interest to this report. RP-VITA\(^\circledR\) is the current ‘flagship’ product, although its predecessor, RP-7i\(^\circledR\) (or RP-7\(^\circledR\)), is the RP robot used in the research reported here. The advantages of RP-VITA\(^\circledR\) over RP-7i\(^\circledR\) include control via an iPad (Apple, Inc., Cupertino, CA, USA), Cloud-based infrastructure (can avoid connection issues related to in-house networks), autodrive, decreased need for telemedicine-specific staffing, and support with an array of intuitive, easy-to-use features that encourage physician adoption and clinical use.\(^3\)
Remote Presence Robots

Company or developer

The RP devices are marketed by InTouch Technologies, Inc. (Santa Barbara, CA, USA). The newest version, the RP-VITA® (Virtual + Independent Telemedicine Assistant), was recently launched under a joint development and licensing agreement between InTouch Technologies, Inc. and iRobot Corporation (Bedford, MA, USA).4

Reason for assessment

It is not uncommon for hospital-based specialist physicians to be unavailable for face-to-face patient assessments on short notice, yet prompt attention is extremely important when managing patient emergencies. The RP robot, remotely operated by a clinician, was developed to provide assessment at the bedside to facilitate urgent diagnostic and management decisions. An additional application is consultation with non-local experts by bedside clinicians, particularly in non-metropolitan or remote regions.

Stage of development in Australia

☐ Yet to emerge ☐ Established
☐ Experimental ☐ Established but changed indication or modification of technique
☐ Investigational ☐ Should be taken out of use
☐ Nearly established

Licensing, reimbursement and other approval

RP-VITA® received United States Food and Drug Administration (FDA) 510(k) clearance as a Class II device in November 2012 (number K123229) for active patient monitoring via telemedicine in high-acuity environments where immediate clinical action may be required.5,6 RP-VITA® was deemed by the FDA to be ‘substantially equivalent’ to the RP-7i® which was approved in May 2012 (number K120895). The RP robots marketed by InTouch
Technologies, Inc. received Health Canada approval beginning in 2009, with RP-VITA® being approved as a Class II device in October 2013 (license number 79050). The RP robots by InTouch Technologies, Inc. are not currently listed on the Australian Register of Therapeutic Goods (ARTG) and there is no reference to receipt of the European CE mark.

### Australian Therapeutic Goods Administration approval

- [ ] Yes  
- [x] No  
- [ ] Not applicable

**Technology type**  
Device

**Technology use**  
Diagnostic

### Patient Indication and Setting

Telemedicine has been in use for several decades in Australasia although experts note continuing issues with low uptake, fragmented services, and a lack of sustainability, illustrated by the comment that Australian telehealth “has more pilots than Qantas.” Delays in wider implementation of telemedicine have been attributed to the need for changes in physician practice including rethinking how services are delivered. It has also been acknowledged that there is a need for increased organizational support across a wide range of settings.

It is unclear how many or which types of patients could benefit from the use of RP robots as the technology has been approved for use across multiple in-hospital clinical situations. Specifically mentioned settings for RP robots are preoperative, perioperative and post-surgical settings including cardiovascular, neurological, prenatal, psychological and critical care assessments and examinations.

### Number of patients

There is uncertainty around how widely telehealth and telemedicine have been implemented in Australia. One source reported in an early 2014 publication that about 87,000 telehealth consultations had been billed, with numbers gradually increasing to over 5000 per month. It was stated that about half were dual consultations with both a GP and specialist involved. Government statistics reported that between July 2011 (the beginning of a telehealth incentive program) and December 2013, more than 9,200 Medicare providers and 211 eligible Residential Aged Care Facilities provided more than 144,000 Medicare telehealth services to over 55,000 patients.

Alternative and/or complementary technology

RP robots are a complementary technology designed to stand in for a bedside physician when clinical expertise is urgently needed but the physician cannot be physically present, or when providing consultation for remote or less sophisticated clinical settings.

Current technology

If the appropriate specialist physician is not immediately available in person due to on-call demands, physician shortages and so on, telephone communication with nurses, generalist physicians or trainee physicians can be used to allow the specialist to assess the patient in urgent bedside situations. The disadvantage of telephone-based communication, however, is that the expert is not able to visually assess the patient or the various equipment monitors. In addition, patients and health care providers in remote settings do not have access to specialist care or advice in urgent or emergent clinical situations.

Telemedicine can bring the expertise of specialists to locations where their physical presence is not possible and therefore has the potential to improve health care delivery and outcomes for patients in these situations.

Several forms of telemedicine, particularly videoconferencing, are being encouraged in Australia. Medicare fee items for video consultations to rural areas and aged care facilities (55 in total) have been billable since July 2011 by general practitioners (GPs) and specialists with a focus on videoconferencing; at that time, AUD $620 million was committed by the Commonwealth Government. The Government’s target was for 495,000 video consultations with specialists to take place in rural, remote and outer metropolitan areas from 2011 to 2015. In addition to the new Medicare rebates for telehealth services, a cash incentive of $6000 has been available to every GP (although the incentives program ended in June 30, 2014).

Advocates aim to embed telemedicine in everyday care as a way of doing business and they claim that use of the technology can be boosted by developing new models of care, building clinician acceptance, and expanding services to include chronic disease management in the home. RP robots may overcome some of the current limitations.

Diffusion of technology in Australia

No publications or internet information suggested the technology is being tested or is in use in Australia.
International utilisation of remote presence robots

<table>
<thead>
<tr>
<th>Country</th>
<th>Trials underway or completed</th>
<th>Limited use</th>
<th>Widely diffused</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>✓</td>
<td>✓</td>
<td></td>
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<tr>
<td>Mexico</td>
<td></td>
<td>✓</td>
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<td>United States</td>
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<tr>
<td>Europe</td>
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</table>

Cost infrastructure and economic consequences

The RP devices are available on a lease basis at a cost of between US $4000 and $6000 (AUD $4262 to $6393 on April 9, 2014) per month.\textsuperscript{14, 18, 19} A recent Canadian publication reported that the purchase cost for the device was US $145,000 (AUD $154,482 on April 9, 2014).\textsuperscript{1} Advocates claim that the technology costs can be offset by improvements in patient and health system care such as reducing hospital length of stay (LOS), complications, and patient transfers from remote sites. A number of the clinical publications discussed in this report examined costs and potential savings and this information is presented under ‘Economic Evaluation’.

Ethical, cultural or religious considerations

No specific ethical, cultural or religious considerations were identified in the published literature.

Evidence and Policy

Safety and effectiveness

Five comparative studies were located (Table 1).\textsuperscript{1, 13-15, 20}
<table>
<thead>
<tr>
<th>Author, year; country; study period (duration)</th>
<th>Clinical setting</th>
<th>Study type; evidence level</th>
<th>Comparison</th>
<th>Outcomes</th>
<th>Author conflicts of interest COI; study funding</th>
</tr>
</thead>
</table>
| Mendez¹, 2013; Canada; 2008 to 2010 (34 months) | Programming of implanted neuro-modulating devices (in hospital) | Randomized (non-blinded) prospective parallel groups Level II evidence | Device programmed by a nurse with no programming experience under guidance from a remote expert (n=10) Hands-on expert programming (n=10) | • Programming accuracy  
• Clinical outcomes  
• Adverse events  
• User satisfaction | No COI reported; funding NR |
| Garingo¹⁵, 2012; USA; 2007 to 2009 (16 months) | Level 3 neonatal ICU | Prospective non-randomised comparative study Level III-2 evidence | On-site neonatologists (n=39) Remote neonatologists with RP-7 (n=304) | • Agreement (kappa value) between neonatologists wrt physical examination observations | No COI reported; funding from faculty telemedicine grant |
| McNelis¹³, 2012; USA; 2008 to 2010 (34 months) | Surgical intensive care unit | Prospective non-randomised comparative study Level III-2 evidence | Evening rounds via RP-7 (n=145) Evening rounds via telephone (n=154) | • Unexpected events  
• Length of rounds  
• No. of therapeutic interventions  
• No. of follow-up calls  
• User satisfaction  
• LOS | No COI reported; funding NR |
| Gandsas²⁰, 2007; USA; 2004 to 2006 (30 months) | Surgery (post-laparoscopic gastric bypass) | Retrospective non-randomised comparative study (chart review) Level III-3 evidence | Additional daily rounds by RP-7 (n=92) Surgeon at the bedside (n=284) | • LOS | No COI reported; funding NR |
| Vespa¹⁴, 2007; USA; 2005 to 2006 for robot (12 months) | Neuro-intensive care unit | Retrospective before vs. prospective after robot Level III-3 evidence | RP-7 (n=640) Pre-robot experience (n=578) | • Time to response to paging  
• Time to response to brain ischemia and elevated ICP  
• LOS | COI NR; funding from USA Dept of Defence |

COI=Conflict-of-interest; ICP=Intracranial pressure; ICU=Intensive Care Unit; LOS=Length of stay; NR=Not reported; wrt=With respect to
Mendez et al (2013)\(^1\)

Expansion of neuromodulation and its indications (e.g. spinal cord and deep brain stimulation) has resulted in increasing numbers of patients with implanted devices. The need for periodic device programming has created a heavy burden on neuromodulation centres. This randomised controlled trial (level II intervention evidence – method of randomisation not stated) tested the feasibility of remotely programming a neuromodulation device using RP-7 with 20 patients randomly assigned to either conventional programming by a hands-on expert or a robotic session with an expert (in the same building). Ten nurses with no previous programming experience (one nurse per patient) were mentored remotely. There was no information comparing patient characteristics at baseline.

Safety

No adverse events occurred in any sessions.

Effectiveness

Mean programming time was slightly longer for the RP-7 group (33 minutes versus 26 minutes). There were no detectable differences in programming accuracy (using a 16-item checklist) or achieving the clinical goals of the programming session (not clearly defined) between the groups (statistics not provided). Mean satisfaction scores were measured for the clinician, nurses and patients who participated in the RP-7 group and results ranged from 4 to 5 on a 5-point scale. Some technical difficulties were noted by the remote physician and the nurses, such as the position of the robot’s arm, line of sight and intermittent audio disruption. No negative patient comments were recorded.

Garingo et al 2012\(^1\)

In a US neonatal ICU, researchers prospectively tested whether RP-7 could provide remote neonatologists with visual and auditory information comparable to that obtained at the bedside (level III-2 intervention evidence). All admitted neonates were enrolled if parental consent was given. Mean birth weight was 1,697 (SD 114) grams and median postnatal age was 13 (SD 3) days; 52 per cent of the neonates were male, and five sets of twins and one set of triplets were included in the study. Each neonate was eligible for as many study encounters as possible but with only one encounter allowed per day until discharge home or transfer out of the NICU. The median number of encounters per individual patient was five (SD 1.6, range 1 to 56 encounters).

Six academic neonatologists participated. Two neonatologists evaluated each patient; one at the patient’s bedside and the other using RP-7 remotely (including a digital stethoscope). Simultaneously, both neonatologists reviewed the patient’s demographic information, laboratory data, imaging studies and predefined aspects of the clinical condition (e.g. heart and respiratory rates, arterial oxygen saturation and blood pressure). Communication
between the neonatologists was forbidden. (Detail was not provided as to how decisions were made about when to launch a session.)

To provide a reference standard, pairs of bedside neonatologists also assessed the patients. Between pairs of physicians, inter-rater reliability was calculated using the kappa statistic. Ultimately 46 neonates were assessed in 343 sessions via 304 bedside-remote physician pairs and 39 bedside-bedside physician pairs.

Safety

RP-7 safety was specifically assessed to determine the ability of remote physicians to evaluate patient identifiers (such as name, medical record number and date of birth) and to ensure that the RP-7 caused no direct harm to patients, parents, staff or hospital equipment. No safety concerns were identified.

Effectiveness

- For the bedside-remote physician pairs, the median duration of sessions was 13 (SD 5) minutes. Excellent to perfect agreement was noted for patient identifying information, recorded vital signs from nursing notes, real-time physiologic parameters obtained from patient monitors and ventilator settings, and some physical findings (presence of respiratory support, central lines and feeding tubes, level of activity and the genitourinary examination). Intermediate to good agreement was achieved for subcostal retractions. Poor agreement was noted for abdominal distension, capillary refill times, and assessments using the electronic stethoscope (i.e. heart, breath and bowel sounds).

- For the bedside-bedside physician pairs (the reference standard), the median duration of sessions was not statistically different from the bedside-remote experience at 11 (SD 4) minutes (P-value not provided). Intermediate to good or excellent agreement was noted for most assessments except for capillary refill time and stethoscope findings.

- Overall, agreement between physicians (bedside-remote and bedside-bedside) was intermediate to good or excellent for all findings except abdominal distension, capillary refill times and assessments using the electronic stethoscope. The researchers concluded that differences in physician assessments were due to human interpretation, not the RP-7 technology.

- Technical difficulties, including poor audio or video and difficulty maintaining an Internet connection, were experienced in 77 (25%) of the bedside-remote sessions. However, interactions were still possible and subsequent technology upgrades are proposed to reduce these problems.

McNelis et al (2012)\textsuperscript{13}

A shortage of intensivists (physicians who specialise in the care and treatment of intensive care patients), coupled with an increased demand for 24/7 ICU physician care, was the
catalyst for this level III-2 study. In a 14-bed US surgical ICU (SICU), four intensivists were present from 8:00 am to 5:00 pm, but patient rounds at 10:00 pm were performed either via RP-7 or telephone. (It was not clear why one modality was used versus the other). Evenings when no rounds occurred, where physicians conducted on-site rounds or where there were patient documentation issues, were excluded. The outcomes tracked were: time spent and the numbers of patients evaluated, interventions undertaken, discussions with patients or family regarding care plan, signal drops, subsequent calls, and overnight unexpected events (deteriorations or crises). A user evaluation was performed, as were measurements of LOS in SICU and in hospital.

Safety

Safety of the use of RP-7 was not discussed.

Effectiveness

Over the study interval, RP-7 data were available for 145 nights versus 154 for telephone rounds. Patients in the two groups did not differ significantly in age, APACHE II score or mortality. A mean number of 14 patients was seen in both groups, but RP-7 rounds took almost twice as long (33 [SD 15] minutes versus 18 [SD 13] minutes). RP-7 rounds also led to a higher average number of therapeutic interventions (5 [SD 2] versus 1 [SD 1]) (no details on the interventions were provided). RP-7 rounds were associated with more patient and family interactions, fewer overnight calls, fewer unexpected events and higher user satisfaction. These findings led the researchers to conclude that communication between attending physicians and staff members was enhanced when RP-7 evening rounds were performed. The RP-7 cohort was also found to have a shorter LOS, both in SICU (4.8 [SD 2.6] days versus 5.6 [SD 2.2] days; \( p < 0.05 \)) and in hospital (10.2 [SD 4.3] days versus 12.3 [SD 4.4] days) (Table 2). The main RP-7 limitation was wireless signal loss.


A level III-3 intervention evidence study retrospectively reviewed the charts of 376 patients who underwent laparoscopic gastric bypass surgery for morbid obesity by a single United States (US) surgeon. Hospital LOS was the primary outcome. Patients with postoperative complications (n=11; primarily postoperative bleeding) were excluded from the analysis to avoid skewing the LOS data. Postoperatively, the first 284 patients were assessed at the bedside by a surgeon three times daily (early morning, morning and at 5:00 pm), while the subsequent 92 patients had the same three surgeon visits plus four additional visits by an RP-7 robot (midday, 2:00 pm, 7:00 pm and 10:00 pm). (Patient characteristics between the two groups were not compared.) RP ‘telerounding’ took place the night of the surgery to identify situations that could delay discharge such as dehydration, inadequate pain control and poor ventilation status. RP assessment included real-time audio and visual communication with the patient, electronic chart review, spirometry for lung function, and discussion with nursing staff about patient treatment. Patients left hospital once the
discharge criteria – oral intake, adequate nausea and pain control, afebrile and ambulatory, and acceptable pulse rate, urine output and spirometry results – were met.

**Safety**

Safety directly related to use of the robot was not mentioned. Seven patients required readmission: six in the surgeon-only group (for dehydration [n=5] and pneumonia [n=1]) and one in the robot group (for postoperative bleeding).

**Effectiveness**

RP rounds reduced the mean LOS from 2.3 to 1.3 days (Table 2). In particular, RP rounds facilitated discharge of 71 of the 92 patients (77%) on postoperative day one, compared with none of the patients in the surgeon-only group. On postoperative day two, an additional 13 RP group patients (20%, cumulative total 97%) were discharged, compared with 218 of 284 of the surgeon-only group (77%). The last three of the RP group patients (3%) were discharged on day three versus 48 patients in the surgeon-only group (17%). The last 18 patients in the surgeon-only group were discharged four to seven days after surgery. The researchers noted that robotic telepresence, combined with clinical pathways, could also improve quality of care by reducing practice variability.

**Vespa et al 2007**

In a US neuro-intensive care unit (ICU), the experiences pre-RP (n=578) and post-RP (n=640) were compared (level III-3 intervention evidence). For the RP experience, in consecutive patients, researchers prospectively assessed time to response to paging, time to response to brain ischaemia and elevated intracranial pressure (ICP), ICU LOS, and cost, compared with retrospective data from an age-matched 2003 to 2004 pre-robot cohort. They hypothesised that using RP-7 robot technology would improve physician response to unstable ICU patients. Patient characteristics in the two groups were similar (mean age 53 years), with the most common diagnoses being subarachnoid haemorrhage (SAH), tumour, traumatic brain injury (TBI), intracranial haemorrhage (ICH) and stroke.

The prospective study phase involved RP-7 evening rounds. At a home office, the attending physician would visit each patient for at least 5 minutes and discuss the patient’s care with the bedside nurse (e.g. trends in physiologic variables such as ICP and treatment goals such as glycemic control). Questions from the nurses were encouraged. The attending physician completed a structured questionnaire including the following: time to response to a page; the principal diagnosis; the clinical problem; data evaluated by the physician via RP; the principal intervention; and the usual delay in face-to-face response when a RP robot is not available.

**Safety**

RP-7 safety information was not reported. However, Internet availability was tracked, including downtimes by the service provider and interruption of the hospital’s wireless
system which collectively accounted for less than one per cent downtime for all available times of need.

**Effectiveness**

A mean of two RP sessions occurred per day, with evening rounds averaging about an hour in length. Mean ICU LOS decreased from 8.0 (standard deviation [SD] 8.3) to 7.5 (SD 8.8) days compared with pre-RP (no comparative statistics were provided) (Table 2). The decrease was particularly marked for patients with SAH (11 versus 9 days) and TBI (8 versus 7 days). There was also an increase in the proportion of ICU patients who stayed for seven or fewer days (rising from 5% to 8%). The main reasons for paging a physician were: brain ischaemia (20% of pages), respiratory/hypoxemia (19%), ICP (16%), ICU discharge (11%) and seizure (9%). The attending physician judged the main types of critical data acquired from RP-7 to be 67% visual (physical examination [41%], monitor graphics [11%], printed information from the medical record [6%], nurse body language [5%] and information about a tube or catheter [4%]) and 33% verbal information. The main interventions were haemodynamic resuscitation using fluids or vasopressors and treatment of respiratory failure. There was a marked reduction in the attending physician response latency using RP (9.2 [SD 9.3] minutes versus pre-RP 218 [SD 186] minutes), particularly for patients with brain ischaemia (7.8 [SD 2.8] minutes versus 152 [SD 85] minutes) and elevated ICP (11 [SD 14] minutes versus 108 [SD 55] minutes) (p < .001 for both comparisons).

Three of the included studies reported LOS, this data is presented narratively above and summarised below in Table 2.

<table>
<thead>
<tr>
<th>Study</th>
<th>Length of stay (mean [SD] days)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>McNelis</td>
<td>RP-7 group: ICU 4.8 (2.6) Hospital 10.2 (4.3)</td>
<td>Comparator: ICU 5.6 (2.2) Hospital 12.3 (4.4)</td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gandsas</td>
<td>Hospital 1.26</td>
<td>Hospital 2.33</td>
</tr>
<tr>
<td>Vespa</td>
<td>ICU 7.5 (8.8)</td>
<td>ICU 8.0 (8.3)</td>
</tr>
</tbody>
</table>

SD: standard deviation; ICU: intensive care unit

**Economic evaluation**

There do not appear to be any full economic evaluations of RP robots, but a number of publications have reported on economic aspects of device use.

In the surgical study by Gandsas et al 2007, the mean hospital LOS dropped from 2.3 to 1.3 days and researchers calculated that this created capacity for an additional 71 patient-days and represented a total financial gain of US $220,000 annually in 2007 dollars (US $250,000 or AUD $266,600 in 2014), including reduced variable cost (room and board) and increased opportunity cost (beds freed). In this study the lease cost of RP-7 was US $5000 per month (US $5660 or AUD $6036 in 2014).
In the neuro-intensive care unit study by Vespa et al 2007, annual ICU cost savings of US $1.1 million in 2006 dollars (US $1.28 million or AUD $1.37 million in 2014) were attributed to the use of RP-7, primarily due to reduced LOS for patients with SAH and TBI. The shorter LOS for some patients increased ICU capacity by 11 per cent, although the cost savings calculation did not account for the income generated by the resulting new admissions.\(^7\)

In the surgical SICU study by McNelis et al 2012, a 0.8 day decrease in SICU LOS was observed with use of the RP-7. At a daily SICU cost of almost US $4000 per patient in 2011 (US $4175 or AUD $4455 in 2014), the authors projected a possible cost saving of more than US $1.1 million annually in 2011 (US $1.15 million or AUD $1.23 million in 2014), excluding the additional financial gains possible owing to increased patient throughput. They noted that although a manpower increase in intensivists was desirable, use of RP-7 offered a cost-effective alternative.\(^13\)

**Ongoing research**

No ongoing or planned studies were identified in ClinicalTrials.gov or the Australian and New Zealand Clinical Trials Register.

**Other issues**

**Deployment in remote areas**

In a small Inuit community (population 1200) in Canada’s Arctic, accessible only by air for much of the year (and in daylight hours only), researchers installed an RP-7 robot in an outpatient community health centre staffed by nurses.\(^16\) The system linked to a physician at the referral centre several hours away. For 15 months in 2010–2011 a prospective feasibility study examined the impact on air transport services and the satisfaction of patients, caregivers, nurses and physicians. Up to that point, physician support for the nurses was via telephone, supplemented in the previous five years with videoconferencing equipment and a telehealth coordinator stationed at the referral centre.

Data collection included the number and duration of RP-7 activations (clinical, education and technical/maintenance); number and cost of air transport; accommodation and meal costs for patients and caregivers; and extent of use of the videoconferencing system. Care providers and patients completed evaluation forms after each encounter.

A total of 252 sessions were tracked (a mean of 11.8 per month), 89% for patient assessment or monitoring. Results showed that monthly use of the regular videoconference clinical sessions remained relatively stable from 9.3 pre-project to 7.8 during the project. During the project, air transport decreased by an estimated 60% over the number of transports that would have been considered. Patients, caregivers, nurses and physicians all expressed high levels of satisfaction and believed RP robots improved patient care, workload and job satisfaction.
All participating physicians noted that the technical capabilities of the RP-7 robot were superior to that of the conventional videoconference set-up, particularly for real-time clinical decisions, patient follow-up and enhanced interaction with nurses and patients. The nurses reported that improved access to physician support in real-time could facilitate retention and recruitment of nurses to Canada’s remote communities.

**Training in system use**

Several studies reported details about the training required to use an RP robot system. In a neonatal ICU study, four- to five-hour training sessions were provided by InTouch Health, which included instruction on manoeuvring the device, evaluating patients and troubleshooting for potential equipment problems. In addition, ICU nursing and respiratory staff were educated about the equipment, the research protocol, and their roles in assisting, including use of the digital stethoscope. The SICU study reported that one or two training sessions were required and that younger physicians and surgeons skilled in laparoscopic surgery were more rapid learners. In the study in Canada’s north, remote physicians received an hour of training and this was deemed to be adequate.

**Summary of findings**

As technology advances there are increasing opportunities to integrate telemedicine systems into patient care to overcome the impracticality of expert physician presence at the bedside, including in urgent ICU situations where assessment is required quickly, community hospital locations where subspecialist care is desirable but not possible, and remote locations where the transport of patients is challenging and costly and access to specialist clinical expertise may be limited. In summary, the aim is for RP devices to serve as the eyes and ears of a physician in urgent situations when the physician has limited or no access to the patient’s bedside.

One small randomised controlled trial and four non-randomised comparative studies were identified on the RP-7 remote presence robot. Study designs were variable, as were the outcomes tracked. With respect to efficacy, good to excellent performance and high rates of satisfaction for physicians, nurses and patients were noted. Several studies reported decreased LOS for patients assessed by RP devices, primarily due to an increased presence and timely patient assessment (e.g. evening rounds following surgery). However, in one study it is not clear whether the reduced LOS was due to the RP-7 or the fact that the patients in this treatment group had additional visits compared with the control group. Adverse events attributable to RP devices were not reported.

The RP-7 was developed to provide assessment at the bedside to facilitate urgent diagnostic and management decisions, although none of the identified studies provided evidence for this type of use. Further exploration of areas such as comparison with other forms of video telemedicine, time commitment and acceptability for physicians and other
staff members, practical extent of actual use, cost considerations, and patient outcomes is required before the utility of RP robots can be fully understood.

**HealthPACT assessment**

Although this device may provide improved mobility compared to traditional video telemedicine technologies, it is likely that alternative models of care and e-health technologies would be more acceptable to both clinicians and patients in Australia and New Zealand. Based on the scant body of evidence and the cost of this device compared to the common alternatives of the use of fixed or mobile video telemedicine equipment, HealthPACT recommended that no further research on this technology is currently warranted.

**Number of studies included**

All evidence included for assessment in this Technology Brief has been assessed according to the revised NHMRC levels of evidence. A document summarising these levels may be accessed via the HealthPACT web site.

<table>
<thead>
<tr>
<th>Total number of studies</th>
<th>5</th>
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<tbody>
<tr>
<td>Total number of Level II studies</td>
<td>1</td>
</tr>
<tr>
<td>Total number of Level III-2 studies</td>
<td>2</td>
</tr>
<tr>
<td>Total number of Level III-3 studies</td>
<td>2</td>
</tr>
</tbody>
</table>

**Search criteria to be used (MeSH terms)**

PubMed: RP-7 OR RP7 OR “remote presence AND robot” OR “remote presence AND robotic” OR “telemedicine AND robot” OR “telemedicine AND robotic” OR “telemonitoring AND robot” OR “telepresence AND robot” OR “telepresence AND robotic” OR “telementoring AND robot” OR “telementoring AND robotic”

TRIP: RP-, RP7, telehealth, telemedicine

**References**