EVALUATION OF THE PAEDIATRIC UNSCHEDULED CARE (PuC) TELEHEALTH SERVICE PILOT

Final Report

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Glossary:

A&E - Accident & emergency

CRH - Centre for Rural Health

DGH - District General Hospital

EMRS – Emergency Medical Retrieval Service

EPLS – European Paediatric Life Support

APLS – Advanced Paediatrc Life Support

GP - General Practitioner

HDU – High Dependency Unit

HIS - Health Improvement Scotland

HMRC – HM Revenue & Customs

NHS – National Health Service

NoSPG – North of Scotland Planning Group

OCC - On call consultant

OOH – Out of hours

PUC - Paediatric unscheduled care

PICU – Paediatric intensive care unit

RACH - Royal Aberdeen Children's Hospital

RGH – Rural General Hospital

SAS – Scottish Ambulance Service

SCBU – Special Care Baby Unit

EXECUTIVE SUMMARY

Context and Project Aims

The Paediatric Unscheduled Care (PuC) Pilot was launched in July 2013, driven primarily by The Scottish Centre for Telehealth & Telecare, governed by NHS 24. The North of Scotland Planning Group (NosPG) took responsibility for developing the pilot project across the northern region.

A previous evaluation of paediatric services across the north of Scotland identified the need for equitable, sustainable paediatric unscheduled care. With rural hospital A&E departments primarily staffed by GPs or junior medical staff during the OOH period, challenges were identified in delivering equitable access to paediatric specialist advice in remote and rural areas during the unscheduled period.

The PuC Telehealth Service pilot attempts to address this need by providing a single point of consultant-led paediatric contact for Rural General or Community hospitals across the northern region of Scotland, providing fast and appropriate access to specialist advice and triage via video conference. This pilot aimed to use telehealth as a contribution to integrated care and embed PuC into existing working practice within the rural hospitals for unscheduled paediatric presentations.

The Centre for Rural Health, University of Aberdeen was commissioned to undertake an evaluation of the activity during the first six months of the PuC pilot. Key areas of the evaluation include the experience of consultations, rates of patient transfer to specialist centres, rural healthcare provider views, on-call consultant views, satisfaction with the technology and with quality of care, and value for money.

Evaluation

The evaluation of PuC was designed to determine the progress of the pilot against its objectives, in addition to informing opinion on whether future developments of any paediatric unscheduled care telehealth initiative are worthwhile or cost effective. A mixed methods approach was adopted during the evaluation including both quantitative and qualitative data collection, an economic analysis and literature scoping review.

The literature scoping review was undertaken by NHS Healthcare Improvement Scotland and the Scottish Health Technologies Group (SHTG). The scoping review examined published evidence on the clinical effectiveness and cost-effectiveness of telemedicine in the context of paediatric unscheduled care in rural areas.

Economic input to the evaluation was contributed by NHS Healthcare Improvement Scotland.

Site visits were conducted to the six participating Rural General and Community hospitals to understand the resources and staffing in each of the rural sites. In addition, qualitative interviews were undertaken with 10 participating on call consultants contributing to the PuC pilot. Interviews were undertaken either face to face or via telephone.

A further 17 interviews were conducted with key stakeholders, purposively selected, including key clinicians in each of the remote hospitals, paediatric representation from NHS Highland (Raigmore) and NHS Grampian (Aberdeen). Representatives (both clinical and managerial) from NHS 24, the Scottish Centre for Telehealth and Telecare, the North of Scotland Planning Group, the PICU retrieval team, a child health commissioner, a north of Scotland regional Clinical Director and a sample of remote and rural clinical staff. Finally, a small sample of interviews took place with parents who had experience of the PuC when their child presented at a rural hospital during the pilot period, these are presented in case study format.

Activity data from NHS 24 data were provided to the Centre for Rural Health for the first six month period of the pilot. These data are presented in the evaluation.

Key Findings

- A total of 98 calls were made to the PuC service between August 2013 and January 2014: approximately four per week. The largest proportion (n=36) of these calls was from Caithness hospital and the smallest proportion (n=4) from Western Isles hospital
- Most (60/98) calls were conducted by VC.
- A small majority (53%) of calls conducted by VC and involving all attendees (call hander, OCC and referrer) were progressed within a 10-minute period. This was the main NHS 24 key performance indicator for PuC.
- Nine emergency retrievals and 21 transfers took place on first contact with PuC during the first six months of the pilot, with 27 closed calls. Follow up consultations were agreed on first contact with PuC in 34 cases (resulting in a further nine agreed transfers thereafter).
- Undertaking VC during the unscheduled care period is not always appropriate, technically or logistically possible in a small remote hospital environment; the telephone was often preferred or used as an alternative.
- The views of OCCs, referrers and parents on the PuC service were generally positive:
  o Participating OCCs described the calls to the PuC pilot service as appropriate, the type of call varied according to the referrer's level of clinical experience. A substantial proportion of calls were from very junior medical staff.
  o Consultant-led VC enabled a more consistent pattern of support in comparison to previous communication pathways and may offer educational opportunities, particularly to junior staff
  o It is likely that VC support from OCCs improved the quality of local care.

- o The use of VC can be a useful mechanism for aiding decisions on discharge / transfer and for supporting staff dealing with sick children pending transfer
  - o Parents interviewed were reassured by the availability of expert advice
  - o VC OCC support improved the confidence of staff observing unwell children.

- There were however some important difficulties:

  - o Accountability, governance issues and clinical responsibility for the child during the PuC pilot caused tension in some cases, for example when the OCC's opinion differed from that of the receiving hospital or when the referring doctor was satisfied that transfer was required and was not seeking another opinion.
  - o Staff from three peripheral hospitals raised concerns that the introduction of PuC jeopardised some pre-established clinical relationships with either hub paediatric specialists or PICU retrieval teams.
  - o Some referrers and OCCs considered that lack of OCC knowledge of local workforce patterns, transport and geography may have hindered good decision making.
  - o There was evidence that PuC was deliberately bypassed on a number of occasions, although it is not possible to quantify the number of episodes. Bypass occurred where remote referrers felt consultation time would be quicker, problems with VC existed or where the appropriateness of the use of VC was questioned.
  - o One participating RGH withdrew from the pilot because of governance concerns.
  - o The process of NHS 24 call handling was highlighted as an area for improvement.

- Stakeholder views were divided about risk, clinical decision making and responsibility for children throughout the pilot.
- There have been substantial difficulties in negotiating contractual arrangements for OCCs.
- It can be difficult to observe children for lengthy periods of time in remote hospitals – the appropriateness relates to facilities, resources, access to VC, capacity and the competence / confidence of staff.
- It is not clear whether the introduction PuC produced any net impact on the number of potentially avoidable transfers for self-limiting conditions.
- The current PuC model is expensive (estimated at £1.2M per year if rolled out). Lower cost options involve models where the PuC workload is added to existing job plans.

Conclusions and recommendations

There is little doubt that consultant support offered via VC to referring clinicians in remote hospitals is valued by families, by the consultants themselves and by many referrers. There is some evidence that the quality of care delivered to children managed locally was improved by the PuC service, and clinical support given while awaiting transfer of sick children can be valuable.

Continued improvement to VC technology (in terms of video resolution and bandwidth) is likely to improve paediatric unscheduled care offered in remote hospitals in Scotland.

Some important problems with the PuC pilot model emerged, including uncertainty about governance and clinical responsibility, potential interference with existing links to receiving hospitals and high cost.

We recommend that the next phase of the PuC roll-out should involve VC links between remote and rural hospitals and an on-call consultant based in the usual receiving hospital. This will require some additional contracted on-call time for the consultants but is likely to be cost-neutral.

Further improvements to services to families would be likely if consideration could be given to provision of better locally-based accommodation for children who would benefit from a period of observation prior to a transfer decision being made. This accommodation should house VC facilities. In the meantime, an audit of local facilities, EPLS training for referring clinicians, and guidance on when it is acceptable to observe a child should be considered.

Data collected on unscheduled paediatric care is a valuable resource for informing evaluations and quality assurance of any future service. Ongoing PuC models should consider the allocation of some resource for continuing data collection at local level linked to a national-level monitoring and evaluation service.

CONTENTS

BACKGROUND & INTRODUCTION:

Remote and rural communities experience ongoing challenges in accessing specialist healthcare services[1]. The total population of Scotland is projected to rise by 10% over the next 25 years, from 5.22 million in 2010 to 5.76 million by 2035, and will continue to rise into the future[2]. This pattern will not be experienced in all areas of Scotland: Figure 1 demonstrates the projected percentage change in population by NHS Board (2010-2035).

Figure 1: Projected Percentage Change in Population (2010 based) by NHS Board
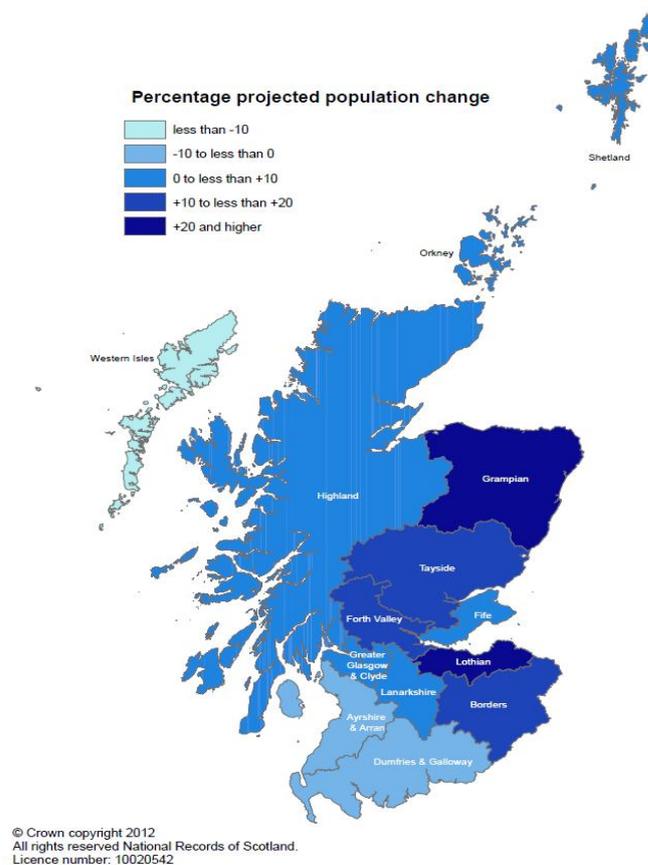
Projected population figures will also vary by age group. The projected percentage change in the 0-15 age group by NHS Board area indicates a decrease in population in the NHS Western Isles, Shetland and Orkney, some of Scotland's most remote and rural areas, by 2035[3]. Data from 2011 also reveal that 39% of children in the NHS Highland area live in remote or very remote rural areas compared to 26% living in

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[1] The Scottish Government. 2008. Delivering for Remote and Rural Healthcare. The Final Report of the Remote and Rural Workstream. Edinburgh.

[2] Population Projections for Scottish Areas, General Register for Scotland, 2012.

more urban board areas. In the Argyll and Bute area, this figure includes many children (a little over 16%) who live on remote islands[3]. Those aged under 18 comprise 19% of the population within NHS Highland[2].

Providing an appropriate level of service to remote and rural areas which have Rural General or Community hospitals with limited specialist workforces is therefore a continuous challenge, with paediatric consultant posts being difficult to sustain or justify financially in remote and rural areas. Population numbers for rural locations in the north of Scotland can increase substantially during the summer season, often putting additional pressure on local healthcare services. Maintaining service provision, particularly during the out of hours period can be problematic at a local or even regional level[4], exemplifying inequity of service availability, accessibility and often quality. In the paediatric arena, remote and rural children presenting at rural A&E departments can experience various pathways of contact with specialist services at the larger hospital centres[5]. Multiple means of communication and transport arrangements are required and families are often faced with large distances to travel for paediatric care, especially if transfer from a rural hospital to a larger hospital takes place[6]. This can have an impact upon the whole family.

1.1   eHealth in Scotland:

New and existing Information Communication Technologies (eHealth) are providing a key contribution in the delivery of health and social care services, with the Scottish Government committing to its development. The Scottish Government's budget for eHealth increased from £72.2 million in 2008/09 to £90 million in 2011/12[7] and the government released a National Delivery Plan, setting out the contributions of telehealth and telecare to health and care strategies in Scotland until 2015. This includes the normalisation of use of the technology into relevant services[8]. Overall fiscal constraints in the public sector have created further financial pressures which affect the delivery of existing services, especially remote and rural services. The value and potential of eHealth technologies has been recognised in contributing to overcoming service delivery, geographical and economical challenges. In 2006, the Scottish Executive (now Government) established the Scottish Centre for Telehealth (SCT) to support NHS boards in developing eHealth related initiatives. Following on from this, in 2010 SCT was integrated with NHS 24, and the Telecare service joined to become the Scottish Centre for Telehealth & Telecare which is now the provider of national telehealth services. In Scotland there are increasing examples of telehealth use in clinical specialities, although fewer examples of using eHealth or telehealth use for children exist.

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[3] The Annual Report of the Director of Public Health Report NHS Highland, 2013.
[4] Better Health Better Care, 2009.
[5] North of Scotland Paediatric Sustainability Review, 2011.
[6] Remote and rural paediatric project, the Scottish Executive, Crown Copyright, 2005.
[7] eHealth Strategy 2008–11, Scottish Government, June 2008.
[8] A national telehealth and telecare delivery plan for Scotland to 2015. Driving improvement, integration and innovation. Edinburgh: The Scottish Government, 2012.

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1.2   The Paediatric Unscheduled Care (PuC) Pilot Evaluation

The Paediatric Unscheduled Care Pilot was launched in July 2013 driven primarily by The Scottish Centre for Telehealth & Telecare, governed by NHS 24 and funded by NDP. The North of Scotland Planning Group (NosPG) took responsibility for developing the pilot project across the northern region. A previous independent paediatric review (2011-12) commissioned also by the NosPG examined the sustainability of paediatric services across northern Scotland[9]. This substantial review highlighted remote and rural delivery issues in the north and raised concerns about the sustainability of paediatric services. In particular, this review stated *"The unscheduled care initiative (single point of contact) pilot is afforded prime importance by all North of Scotland paediatric units and RGH partners"* (Dunhill, 2011) and recommended that Boards participate in the PuC pilot.

The aim of PuC was to provide a single point of consultant paediatric contact for rural hospitals across Scotland, linking any child requiring emergency advice and support from their local Rural General / Community hospital to a consultant, face-to-face, at the request of clinicians based in the rural hospitals. Paediatric consultants and emergency medicine consultants with a paediatric speciality were invited to participate in the 24 hour on call rota, employed as on call consultants (OCCs) for PuC. A Clinical Lead was also employed to take responsibility for rota management and clinical governance. The clinical professionals invited to participate were from the pool of existing consultants already providing paediatric decision support across Scotland.

Figure 2 displays the NHS 24 PuC process by demonstrating a basic scenario in which RGH / community hospital staff telephone the Single Point of Contact at NHS 24.

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[9] North of Scotland Paediatric Sustainability Review, Dunhill 2011.

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Figure 2: Example of NHS 24 Call Process for PuC

1	RGH/CH rings Single Point of Contact and speaks to a Call Handler
2	Call Handler, captures essential information
3	Call Handler, hands over to the OCC and facilitates the VC between them and the RGH/CH
4	VC to RGH/CH takes place with RGH/Patient/parent and OCC
5	If transfer is required, on call consultant contacts receiving centre
6	If transport is required, on call consultant contacts transport option
7	Transport unit, transports patient to receiving centre
8	OCC completes patient notes - SBAR, saves record to system, further follow up calls take place as agreed between RGH and OCC via VC if needed.

The process above begins with a telephone call from a RGH / community hospital to a dedicated paediatric unscheduled care telephone line at NHS 24. A call handler will acquire some initial basic information using an electronic form and voice recording equipment. The aim of PuC is then to set up a VC consultation (where possible) between the OCC and the referring doctor (and where required the potential receiving consultant). If a telephone consultation is required the call handler keeps the referrer on the line and connects via telephony. Decision support then takes place in the form of a consultation, if a paediatric transfer is necessary the OCC will alert the receiving centre, where a handover conversation takes place and transport arrangements are facilitated. If an emergency retrieval is required the referrer will telephone into NHS 24 and the call is then passed directly to a PICU unit.

Across the north of Scotland there are various models of care in existence for treating ill children (retrieval from all remote units is possible by the neonatal or PICU retrieval team or occasionally by the Emergency Medical Retrieval Service). Examples of existing service models in rural hospitals include:

- Rural GP-led and delivered (examples include Orkney[10] - Balfour, Dr MacKinnon hospital Skye)
- Generalist-led and delivered (examples include Shetland, Belford – Fort William, Caithness, Lorn and Island hospital - Oban). Generally delivered by a junior doctor under consultant supervision.
- Mixed Model approach (Western Isles) where hospital staff expertise are enhanced OOH when a consultant paediatrician participates in the OOH rota.
- Paediatrician-led and delivered at larger hospitals (Raigmore, Dr Gray's, RACH, Ninewells, Perth Royal Infirmary).

The remit of this report is to evaluate the PuC paediatric telemedicine pilot, across six participating rural hospitals within NHS Highland & Argyll, NHS Western Isles and NHS Orkney. Hospitals include Caithness hospital - Wick, Balfour hospital - Orkney, Belford hospital - Fort William and & Dr MacKinnon Memorial hospital, Skye. These hospitals adopt either a Rural GP led model in or a generalist led and delivered service. Western Isles Hospital and Lorn & Islands hospital – Oban also participated in this pilot, their models of care each include an employed consultant paediatrician in each hospital, (in the Western Isles this consultant participates in the OOH rota)[11]. PuC is a 12 month pilot programme that aimed to use a dedicated on OCC supported by video conference equipment for remote clinical decision making and advice. This evaluation examines the usefulness of a single point of contact for paediatric unscheduled care triage and transfer support, to remote and rural hospitals in the north of Scotland.

Methods**:** The research team at the Centre for Rural Health adopted a mixed methods approach to the service evaluation.

Methods included:

- Literature scoping
- Site visits to each of the participating rural hospitals
- Face-to-face interviews with key participants at each site
- Telephone interviews with on call paediatric consultants
- Face to face / telephone interviews with key paediatric stakeholders
- Telephone interviews with parents

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[10] Services in NHS Orkney (Balfour hospital) have recently changed from a GP to a generalist led model.
[11] During the pilot period, additional community hospitals in Skye - Portree, and Argyll & Bute joined PuC. Data relating to their use of PuC was supplied by NHS 24 and is included for reference only. Only those hospitals who participated from the launch date (July 2013) are included in the full evaluation.

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- Collection of activity data from NHS 24 data resources
- Economic analysis

1.3 Key Research Questions:

- What is the number of episodes of care leading to use of the PUC service?
- What are the trends in service use and outcomes (e.g. emergency transfers) over the time span of the pilot?
- What are the barriers to using VC and the perceived benefits?
- To what extent are Key Performance Indicators met?
- Proportion of decision support conversations with the on call consultant (OCC) conducted via videoconference (VC) during the in-hours period?
- What are the perspectives of clinicians using the service?
- What are the perspectives of key stakeholders / organisations?
- What are parental views on the videoconferencing process?
- Do any situations lead to refusal to use the service on the part of clinicians or families?
- What technical failures (or barriers) arise, and how can these be overcome?
- What are the approximate costs of delivering the service and what types of savings or additional costs are generated for the health service?
- What would be the resource requirements for an effective full implementation (if considered desirable), in terms of training, local staffing and equipment?

1.4 Evaluation Structure:

- Literature review
- Rural hospitals participating in PuC
- Data analysis
- Participating on call consultants
- Participating stakeholders
- Circumstances leading to withdrawal in PuC
- Parental views
- Economics analysis
- Conclusions & Recommendations

2   LITERATURE REVIEW:

This literature review has been prepared by NHS Healthcare Improvement Scotland. The information shared in this section of the report has been peer reviewed. References for this review are specifically displayed in a table at the end of the chapter.

What is a Scoping Report?

Scoping reports ascertain the quantity and quality of the published clinical and cost-effectiveness evidence on health technologies under consideration by decision makers within NHS Scotland. They also serve to clarify definitions related to the research question(s) on that topic. They are intended to provide an overview of the evidence base, including gaps and uncertainties, and inform decisions on the feasibility of producing an evidence review product on the topic. Scoping reports are undertaken in an approximately 1-month period. They are based upon a high-level literature search and selection of the best evidence that Healthcare Improvement Scotland could identify within the time available. The reports are subject to peer review. Scoping reports do not make recommendations for NHS Scotland, however the Scottish Health Technologies Group (SHTG) produce an Advice Statement to accompany all evidence reviews. Further information on scoping reports is available at
www.healthcareimprovementscotland.org

Key Definitions

Telemedicine: The provision of healthcare over a distance using telecommunications technologies to provide live, interactive, audiovisual communications[1, 2].

Background

Medical emergencies in children are uncommon but when they do occur there is a need for rapid and efficient communication to escalate the level of care often through transfer of the child to a more appropriate specialist care setting[3, 4].

With around 18% of the population living in remote and rural settings, there are particular challenges in Scotland in providing safe and sustainable paediatric care. In 2009 there were 264,929 children under 16 living in rural areas[4].

Telemedicine can help address disparities in access to paediatric specialists. Incorporating video conferencing allows specialists to conduct visual examinations of patients and have a virtual presence with the child and their family as well as with the attending healthcare professionals. Organisational protocols, training, and availability and maintenance of equipment are important factors in the effective use of video consultations[5]. A single point of contact for referrals may improve the utility of the technology[6]. The use of telemedicine technology in the emergency department

(ED) context has been shown to be as effective as in-person consultation in terms of diagnostic processes and treatment planning[1].

The following questions were scoped:

1. What is the evidence for the clinical effectiveness of telemedicine in the context of paediatric unscheduled care (excluding neonates) in rural areas?

2. What is the evidence for the cost-effectiveness of telemedicine in the context of paediatric unscheduled care (excluding neonates) in rural areas?

Literature Search

A search of the secondary literature was carried out between 16-25 October 2013 to identify systematic reviews, health technology assessments and other evidence-based reports. Medline, Medline in process and Embase databases were searched for systematic reviews and meta-analyses.

The primary literature was searched between 11-12 November 2013 using Medline, Medline in process and Embase databases. Results were limited to English language.

Concepts used in all searches included: paediatrics, remote consultation, telemedicine and telehealth. A full list of resources searched and terms used is available on request.

Evidence base

Table 1. Included evidence sources

Publication type	Number of publications	References
Cohort study	3	2, 3, 7
Cost effectiveness study (conference abstract)	1	8

Findings

1. What is the evidence for the clinical effectiveness of telemedicine in the context of paediatric unscheduled care in rural areas?

Three observational studies were identified. All are from the United States (US) and the applicability to the Scottish context is likely to be limited by the fact that the rural hospitals are larger, and may have staff who are more specialist than those in rural Scotland. For outcomes which involve transfer rates the nature of the healthcare funding system in the US may also limit applicability.

One study compared process outcomes following specialist paediatric consultations provided from an academic children's hospital paediatric intensive care unit (PICU) to Emergency Departments (EDs) at five rural hospitals in Northern California between 2003 and 2008[2]. The rural hospital EDs had 4,000 to 10,000 visits annually and between 10 and 30 visits annually by critically ill children.

Outcomes associated with patients, identified retrospectively, who had telemedicine consultations (n=58, consecutive) were compared with those who had telephone consultations (n=63, consecutive) or no specialist consultations (n=199, quota sampled). The mean age of the children was 6 years. Consultations were sought at the discretion of the physicians. Analysis focused on consultations for those children who were seriously ill or injured with life or limb threatening injuries requiring immediate physician assessment. The time taken for each consultation was not provided.

Quality of care was assessed from medical records by two independent reviewers using a five-item scoring instrument developed by the authors. Each item attracts between one and seven points classifying aspects of care from 'extremely inappropriate' to 'extremely appropriate'. When adjusted for age, severity of illness and year of consultation, mean overall quality of care item score difference for telemedicine consultations compared with no consultations was 0.50 points higher (95% CI 0.17 to 0.84, $p< 0.01$). The score difference for telemedicine consultation cases compared with telephone consultations was 0.38 points higher (95% CI 0.00 to 0.77, $p=0.05$). The clinical significance of these findings is unknown.

In a survey of the referrer doctors within 24 hours of the consultation, responses were recorded for all 68 telemedicine consultations sampled but only for 16 of the 27 telephone consultations (59.3%). The proportion of patients where there was perceived to be change around diagnosis (47.8% versus 13.3% $p< 0.01$) or around therapeutic intervention (55.2% versus 7.1%, $p<0.01$) was higher with telemedicine consultation compared with telephone consultation, as was the proportion of patients where there was a change in planned disposition e.g. admission or transfer (37.7% versus 20.0%, $p<0.01$). Again, the clinical significance of these differences is unknown.

In a survey of parents by questionnaire offered at time of discharge for postal submission there were responses for 48 of 68 telemedicine consultations (70.6%) and all 27 of the telephone consultations. Satisfaction score for overall ED experience was higher with telemedicine compared with telephone consultation (6.37 versus 5.33, p< 0.01).

In a linked study from the same care network (identified subsequent to the literature searches), rates of physician-related ED medication errors were compared following telemedicine consultations (n=73, consecutive) telephone consultations (n=85, random sample) or no specialist consultations (n=76, random sample) in children with mean age 5.2 years from eight rural hospitals between January 2003 and December 2009[7]. Analysis focused on consultations for those children who were seriously ill or injured with life or limb threatening injuries requiring immediate physician assessment. Medication errors were identified and classified from retrospective review of medical notes conducted independently by two paediatric pharmacists using a tool developed by the authors. The tool examined errors around medication selection, dose and route of administration. The overall rate of medication errors was 8.8%, around half of which was accounted for by dose errors. For telemedicine consultations the rate was 3.4%, for telephone consultations 10.8% and for patients receiving no specialist consultation 12.5%. After adjusting for age, risk of admission, year of consultation and hospital, the odds ratio (OR) for medication errors in patients who had telemedicine consultations was 0.13 (95% CI 0.02 to 0.74) when compared with no specialist consultation. This was a statistically significant reduction (p<0.05). The corresponding OR associated with telephone consultations was 0.82 (95% CI 0.25 to 2.67).

The third study described 63 paediatric critical care telemedicine consultations over a two year period to March 2008, between EDs of 10 rural hospitals in upstate New York and Vermont and a tertiary PICU in the region[3]. The staffing mix of the rural hospital EDs varied and there was a range of staff numbers from 2 to 26 (mean=9). The mean age of patients was 4 years and 2 months and respiratory distress or failure was the most common primary diagnosis. There were 236 specific clinical recommendations made by the specialist paediatricians. In 61 cases transfer to the tertiary centre (mean distance 75 miles) was recommended. Unnecessary transfer was avoided in one case and one patient died before transport. Unnecessary endotracheal intubation was avoided in twelve patients. Many of the clinical recommendations of the specialists were supported by direct observations such as asymmetrical chest rise post-intubation, abdominal distension and poor skin perfusion. These would not have been available by telephone. Technical difficulties were experienced in 29% of the consultations. In a questionnaire survey, intensivists recorded that for 89% of the consultations they would agree or strongly agree that the consultation improved the quality of health care for the patient. The corresponding figure for the referring providers was 88%.

2. What is the evidence for the cost-effectiveness of telemedicine in the context of paediatric unscheduled care in rural areas?

One study from the US, published as a conference abstract, was identified which compared the cost- effectiveness of critical care telemedicine consultations to children presenting at 8 rural EDs with asthma, bronchiolitis, dehydration, fever, or pneumonia with the cost effectiveness of telephone consultations[8]. A probabilistic cost-effectiveness analysis using Monte Carlo Simulation was carried out for each diagnosis with the rate of transfer of patients to a more specialist level of care providing a measure of effectiveness. Costs were derived from an inpatient database. A societal perspective was adopted. Telemedicine was more effective at reducing transfer rates (39.4% transfers avoided compared with 12.5% transfers avoided with telephone consultations). For a willingness-to-pay to avoid one transfer of $10,000 (approximately £6,000), telemedicine was more cost-effective for 74% to 87% of the cohort. The full report of this study was not available for appraisal.

Summary

This rapid review of the published literature focused specifically on studies which reported on the use of telemedicine to link generalist practitioners and paediatric specialists in the context of paediatric unscheduled care in rural areas.

Only three studies were identified, these small observational studies reported data from two care networks in the US. Comparisons were made between the use of telemedicine and telephone for consultation between health care providers treating critically ill children at rural emergency departments and paediatric specialists. When compared with telephone consultation, telemedicine consultations were associated with higher scores on measures of the quality of care processes such as data gathering, integration of information to develop a diagnosis, and treatment planning. Telemedicine was also associated with more frequent changes in proposed diagnosis and proposed treatment plans and with fewer medication errors, particularly around dose. No data was identified to indicate the clinical significance of these findings in improving patient outcomes.

Telemedicine consultations allow direct observation to support specialist recommendations around care or treatment decisions and, for most cases, clinicians surveyed in one study recorded that the quality of health care is improved by the consultation. In a survey of parents, satisfaction with the overall ED experience was higher for telemedicine than telephone consultation.

The applicability of the studies to the Scottish context is likely to be limited by differences in healthcare systems and in patient characteristics such as the severity of illness.

Only one cost-effectiveness study was identified. This was from the US and was published as a conference abstract reporting that telemedicine consultations help to reduce transfer rates and are likely to be more cost-effective than telephone consultations for children with asthma, bronchitis, dehydration, fever, or pneumonia.

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Literature included in review:

The following table displays the literature specifically included in this review:

Table 2: Literature included in the review:

1.	Marcin JP. Telemedicine in the pediatric intensive care unit. Pediatric clinics of North America 2013;60(3):581-92.
2.	Dharmar M, Romano PS, Kuppermann N, Nesbitt TS, Cole SL, Andrada ER, et al. Impact of critical care telemedicine consultations on children in rural emergency departments. Critical care medicine 2013;41(10):2388-95.
3.	Heath B, Salerno R, Hopkins A, Hertzig J, Caputo M. Pediatric critical care telemedicine in rural underserved emergency departments. Pediatric critical care medicine : a journal of the Society of Critical Care Medicine and the World Federation of Pediatric Intensive and Critical Care Societies 2009;10(5):588-91.
4.	Dunhill. North of Scotland Paediatric Sustainability Review 2011. 2011.
5.	Jarvis-Selinger S, Chan E, Payne R, Plohman K, Ho K. Clinical telehealth across the disciplines: lessons learned. Telemedicine journal and e-health : the official journal of the American Telemedicine Association 2008;14(7):720-5.
6.	Smith AC, Isles A, McCrossin R, Van der Westhuyzen J, Williams M, Woollett H, et al. The point-of-referral barrier--a factor in the success of telehealth. Journal of telemedicine and telecare 2001;7 Suppl 2:75-8.
7.	Dharmar M, Kuppermann N, Romano PS, Yang NH, Nesbitt TS, Phan J, et al. Telemedicine consultations and medication errors in rural emergency departments. Pediatrics 2013;132(6):1090-7.
8.	Yang NH. Cost-effectiveness analyses of a pediatric critical care telemedicine program. Journal of Investigative Medicine. 2013;61(1):198-9.

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3   RURAL HOSPITALS PARTICIPATING IN PUC

Participating in the PuC Pilot from the initial launch date of July 2013 were five Rural General Hospitals (RGH) in NHS Highland, Western Isles and Orkney (Balfour hospital – Orkney, Belford hospital – Fort William, Caithness General hospital – Wick, Lorn & Islands hospital – Oban and Western Isles hospital – Stornoway) and one NHS Highland Community Hospital (Dr MacKinnon Memorial hospital – Skye). A RGH, by description, serves the remote population, which is not large enough to require a District General, providing enhanced services to a Community hospital. In 2008, the Remote and Rural Steering Group for Scotland highlighted the differences in hospital service delivery models in "Delivering for Remote and Rural Healthcare" and clearly documented a description of the RGH[12]. For the purpose of this evaluation, their definition of a RGH is adhered to:

"The RGH undertakes management of acute medical and surgical emergencies and is the emergency centre for the community, including the place of safety for mental health emergencies. It is characterised by more advanced levels of diagnostic services than a community hospital and will provide a range of outpatient, day-case, inpatient and rehabilitation services." (R&R Steering Group, 2008)

Similar to a community hospital, the aim of the RGH is to provide a first line response in an emergency, including assessment, management, admission, where appropriate; or stabilisation, prior to transfer. In addition, the RGH also provides an enhanced level of service, in particular some unscheduled surgical interventions.

Activity however, is often very similar in small rural hospitals across northern Scotland, with risk management, and assessment of logistics a constant daily challenge. The picture below provides an example of the physical size of a typical resuscitation area which can be used for paediatric emergencies:

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[12] Delivery for Remote & Rural healthcare. 2008. The Scottish Government.

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Figure 3: Typical space within resuscitation area of a small rural hospital

The information documented below provides a description of the six participating rural hospitals included in the PuC evaluation.

3.1   Balfour Hospital

Balfour hospital is a RGH, situated near the centre of Kirkwall, Orkney. NHS Orkney is the smallest health board in Scotland and lies to the north of the mainland. The total population of Orkney is just under 20,000, distributed over 17 inhabited islands, with most people living on Mainland, the main island. The population tends to increase in the during the main tourist season. Balfour hospital has approximately 48 beds. The facilities include an acute receiving area, acute ward, rehabilitation and assessment ward. Support services include laboratory and radiological services, including diagnostic ultrasound and a pharmacy. Medical services are provided by acute hospital General Practitioners. Balfour hospital participates in numerous eHealth initiatives using video conferencing methods. VC facilities are available in the emergency department resuscitation area, outpatient clinics and medical staff seminar rooms. Examples of its use include unscheduled care TIA and stroke care. Existing telehealth services in Orkney were extended to include smaller islands, where VC is also used to connect three sites across the islands with the main centre at Balfour hospital, with the option of a 3-way link to specialists in Aberdeen available. Restructure of some out of hour clinical service models are currently underway in Orkney.

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3.2 Belford Hospital

Belford is a Rural General hospital in Fort William, approximately 70 miles from Highland's District General Hospital in Inverness. The population is similar to that of Orkney, approximately 20,000; this can triple during peak summer and winter tourism months. The hospital has 34 inpatient beds, a 10 bedded day case unit and is consultant led for general medical and surgical services. Belford has an established reputation in the management of trauma, particularly from mountain accidents, and is one of the busiest mountain trauma units in Europe. The A&E area consists of five beds. Belford also undertakes a variety of appropriate elective major surgical procedures. The acute specialties of surgery, medicine and anaesthesia have 24/7 consultant cover (these consultants also cover A&E). The hospital medical staff are supported by a well-equipped HDU and comprehensive radiographic/radiological service including on-site ultrasound and CT.

New teleconference facilities in Belford now enable participation in digital educational, multi-disciplinary meetings and managed networks; the VC units are primarily used for these purposes. There are small scale examples of the use of VC for clinical consultation, such as outpatient review appointments for remote diabetes and the renal units as part of the ITTS – Implementing Transnational Telemedicine Solutions initiative[13]. A mobile VC unit also exists on the hospital wards. Such telemedicine developments are recent and small scale.

3.3 Caithness General Hospital

Caithness hospital in Wick is a Rural General hospital on the north of the Highland mainland, with 74 beds. It is approximately 100 miles from the District General hospital in Inverness, by road. Driving terrain can be particularly difficult in the winter period. Caithness General serves a catchment area with a total population of around 35,000 people. The hospital itself adopts a generalist led and delivered service, including A&E, assessment & rehabilitation, palliative care, obstetrics, renal, general surgery and general medicine. In the A&E department there are two beds in the resuscitation area, one with the fixed VC unit. The hospital actively participates in telemedicine; examples include remote renal services to Raigmore hospital in Inverness and remote exercise classes for rehabilitation, both utilising VC.

3.4 Lorn & Island Hospital

The Lorn & Islands is a 66 bed Rural General hospital which serves Oban and the surrounding Argyll & Bute area, with a catchment area of approximately 20,000 people. The hospital provides acute and community services. The service model is generalist led and delivered with approximately 8 resident consultants and junior doctor support including anaesthetics, whilst surgical sub-specialties such as orthopaedics and gynaecology are staffed by visiting consultants from Glasgow &

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[13] Heaney et al, 2013. Implementing Transnational Telemedicine Solutions (In Press).

Paisley in central Scotland. Oban employs a paediatric consultant who has participated in PuC as an OCC in the latter months of the pilot. There are several sets of VC equipment in the hospital and Lorn & Island's has significant experience in eHealth initiatives using VC, most recently a new teleneurology clinic has been launched (January 2014) linking the hospital to the Southern General Hospital in Glasgow. This new project has resulted from joint working between NHS Highland, NHS Greater Glasgow & Clyde and the Scottish Centre for Telehealth and Telecare.

3.5   Dr MacKinnon Memorial Hospital

Dr MacKinnon Memorial is a Community hospital which serves the resident population of Skye and Lochalsh, approximately 13,000. Again the population on Skye increases during the tourist months and the area is popular for mountaineering. Dr MacKinnon memorial hospital has approximately 23 inpatient beds, surgical theatre, midwife suite, radiology unit, outpatient clinic facilities and a modern emergency room. The hospital provides an A&E service, resuscitating and transferring patients primarily to the DGH Raigmore in Inverness but also to larger centres where clinically appropriate. Raigmore is approximately 100 miles - two to three hours drive depending upon road conditions. The hospital is staffed by six rural practitioners, often referred to as "contemporary generalists". They are General Practitioners with extended and enhanced resuscitation and life support training including in EPLS (European Paediatric Life support) and anaesthetics.

The service model in existence at the Dr MacKinnon Memorial hospital has been designed to specifically address remoteness with a focus on a local "nucleus" of experienced generalists to provide intermediate local care. The hospital participates in some telemedicine practices, such as remote exercise classes for rehabilitation.

3.6   Western Isles Hospital

There are three hospitals run by NHS Western Isles, the largest is the Western Isles hospital, a Rural General Hospital located in Stornoway. The Western Isles is located approximately 40 miles off the North West Coast of Scotland. The population in the Western Isles is approximately 26,500, which is spread across 280 townships. Hospital facilities at Western Isles hospital include acute specialities, diagnostic psychiatry, care of the elderly, day hospital and laboratory facilities. The A&E department has one resuscitation bed and one primary care referral room. This hospital participates in eHealth initiatives using VC, such as remote consultations for renal unit outpatients. Western Isles also participates in the Telestroke service. Radiography facilities are enhanced by an on call link to the NHS Borders radiologist for advice. This method provides the hospital with additional support. The A&E at night is staffed by GPs with additional EPLS training and neonatal life support. In addition, one consultant paediatrician is employed with responsibility for both community and hospital patients, and this consultant participates in the OOH rota.

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Table 3: Clinical resources & capabilities of each participating PuC hospital

	Belford Hospital	Dr MacKinnon Memorial Hospital	Caithness General Hospital	Balfour Hospital Orkney	Lorn & Islands Hospital	Western Isles Hospital
Eye Injury	Yes	Yes	Yes	Yes	Yes	Yes
additional information	minor eye injuries only	minor eye injuries only	minor eye injuries only	minor eye injuries only	minor eye injuries only	minor eye injuries only
Fracture Management	Yes	Yes	Yes	Yes	Yes	Yes
additional information	manipulation / reduction of fracture or dislocation under anaesthetic. Transfer to orthopaedic unit at Raigmore for complicated fractures.	manipulation / reduction of fracture or dislocation under anaesthetic. Transfer to orthopaedic unit at Raigmore for complicated fractures.	manipulation only. Transfer to orthopaedic unit at Raigmore for complicated fractures.		stabilisation. Transfer for complex fractures.	
Operative Fracture	No	no	No	Yes	Yes	Yes
additional information					uncomplicated manipulation	
Major incident response	Yes	Yes	Yes	Yes	No	Yes
additional information						
Medical emergencies	Yes	Yes	Yes	Yes	Yes	Yes
additional information			24-hour service. 3 Bed HDU facility			
Paediatrics	Yes	Yes	Yes	Yes	Yes	Yes
additional information	Minor only. If assessment is major, transfer or retrieval.	Minor only. If assessment is major, transfer or retrieval.	Minor only. If assessment is major, transfer or retrieval.	Minor only. If assessment is major, transfer or retrieval.	Minor only. If assessment is major, transfer or retrieval.	Minor only. If assessment is major, transfer or retrieval.
Stabilisation on serious conditions	Yes	Yes	Yes	Yes	Yes	Yes
additional information						
Tele-med*	Yes	Yes	yes	Yes	Yes	Yes
additional information						
Trauma Emergency	Yes	Yes	Yes	Yes	Yes	Yes
additional information						
X-Ray	Yes	Yes	Yes	Yes	Yes	Yes**
additional information	tele-radiology (CT, ultrasound, X-ray) only. X ray available 24 hrs 7 days per week. Ultrasound only 9-5pm weekdays.	Available 9-5pm. All other times emergencies only.	Weekdays 9-5pm. On call 24 hrs. Limited ultrasound / teleradiography. No consultant radiologist. 24hr CT.	Call out service availible when necessary.	Available 9-5pm. All other times emergencies only.	Available 9-5pm. All other times emergencies only.

* Examples of telemedicine include acute telestroke and teleneurology, remote cardiology or rheumatology clinic

** NHS Western isles receives remote radiology support from NHS Borders OOH .

4 DATA ANALYSIS

4.1 PuC Data Analysis

The validated dataset supplied by NHS 24 has been used to produce the quantitative information below, reporting on the activity of the PuC pilot during the first 6 months, period 31st July 2013 – 31st January 2014. These data exclude duplicate cases or any NHS 24 PuC test calls. Any missing data are displayed. Although the evaluation of PuC primarily examines the activity in the six rural hospitals which went live on the 31st July 2013, activity from additional community hospitals which joined the pilot at later dates are also captured in the data below, these include Benbecula, Campbeltown hospital and Cowal community hospital in Dunoon.

4.2 Total calls to PuC

Results indicate a total of 98 calls to the PuC service between the period 31st July 2013 to 31st January 2014, with the largest proportion (n=36) of these calls from Caithness hospital in Wick. The lowest number of calls (n=4) were received from Western Isles hospital (this may be attributed to their employment of a consultant paediatrician).

- There were 98 calls to PuC Service in the first 6 months of the pilot.
- The largest proportion of calls were from Caithness hospital, Wick. The smallest proportion of calls were from Western Isles hospital

Calls to PuC, as envisaged, increased over the winter months, with November 2013 and January 2014 being the highest activity period during the first six months of the pilot. Data from Belford hospital cease at the end of November 2013[14]. Table 4 below, displays the total calls to PuC, by participating hospital.

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[14] Belford hospital data ceases November 2013, this participating hospital withdrew from the pilot.

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Table 4: Total Calls to PuC, by participating hospital

	Missing	Balfour Hospital	Belford Hospital	Caithness Hospital	Dr MacKinnon Hospital	Lorn and Islands Hospital	Western Isles Hospital	Other Community Hospital	Total
	0	1	0	0	0	0	0	0	1
July	0	0	1	1	0	0	0	0	2
August	0	2	2	5	1	2	0	0	12
September	0	2	1	11	1	0	1	1	17
October	0	0	3	2	3	0	1	3	12
November	1	0	10	5	0	2	1	2	21
December	0	1	0	5	1	2	1	4	14
January	0	2	0	7	1	4	0	5	19
Total	**1**	**8**	**17**	**36**	**7**	**10**	**4**	**15**	**98**

*Participating period of Belford hospital - 4 months

Data excludes duplicates and NHS 24 test calls

- Calls to PuC were highest over the winter months (Nov 13 and Jan 14).

4.3   Call Performance (NHS 24)

The CRH evaluation team requested data from NHS 24 on their call performance during the first 6 months of the pilot. Table 5 displays the data supplied by NHS 24, indicating that just over half (53%) of calls undertaken by VC with all attendees (call hander, OCC and referrer) were progressed within 10 a ten minute period. This is the main NHS 24 key performance indicator for PuC. The time to handover (from call handler to OCC) within 5 minutes was reached in 73% of calls. Call handler connected to the VCU within 10 minutes was reached in 68% of calls, this indicates the % of incidents in which the information has been passed to the OCC and the call handler joins the VC. In 16% of calls, the call handler failed to connect to the OCC first time.

Table 5: NHS 24 Key Performance Indicators, during PuC Pilot

VC Calls progressed within 10 minutes	53.33%
Consultant Handover Initiated Within 5 minutes	73.33%
Call Handler Connected to VCU within 10 minutes	68.33%
Call Handler Failure to Connect to OCC 1st Time	16.66%

- 53% of VC consultations were progressed within 10 minutes.

4.4   Outcome by participating hospital

The outcomes for children who utilised the PuC service were examined. Outcome data displayed in this report are based on first contact with the PuC service. "Emergency retrieval" was detailed in 9 cases during the first six month pilot period, "call closed" was indicated in 27 cases (these data presume discharge and no further communication required between remote hospital staff and participating on call consultants)[15]. "Transfer agreed" occurred in 21 cases, on first consultation with PuC. In over a third of cases (n=34), follow up was required / requested, either by VC or by telephone / teleconference following first contact with PuC (an additional 9 transfers resulted from further follow up discussions). Table 6 below details the outcome on first contact to PuC (by participating hospital).

Table 6: Outcome (on first contact to PuC) by participating hospital

	Outcome					
	Outcome missing	**Call Closed**	**Emergency Retrieval**	**Follow up required**	**Transfer Agreed**	**Total**
Hospital missing	1	1	0	0	0	2
Balfour Hospital	1	2	1	4	0	8
Belford Hospital	3	3	4	4	3	17
Caithness Hospital	1	12	2	13	8	36
Dr MacKinnon Hospital	0	2	0	4	1	7
Lorn and Islands Hospital	1	1	1	3	4	10
Western Isles Hospital	0	1	0	2	1	4
Other community hospital	0	5	1	4	4	14
Total	**7**	**27**	**9**	**34**	**21**	**98**

*Participating period of Belford Hospital - 4 months

**Data based on first contact with PuC

- 9 Emergency retrievals and 21 transfers took place on first contact with PuC, during the first 6 months of the pilot, with 27 closed calls. 34 follow up consultations were agreed on first contact with PuC (resulting in a further 9 transferred agreed thereafter).

Clinical presentations of the 21 transfer cases agreed on first contact to PuC were examined by the CRH team and grouped into 6 key categories. Table 7 below displays these descriptive statistics:

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[15] Outcome data were incomplete in 7% of PuC cases.

Table 7: Clinical Presentation of "transfer agreed" cases on first contact to PuC:

Clinical Presentation	Number of Transfers in 6 month Period(n):
Breathing problems	6
Trauma	2
Suspected Sepsis	4
Neurological	4
Abdominal	2
Miscellaneous (including ingestion, post surgical complications)	3
Total	**21**

4.5   Daytime or OOH calls?

PuC data were categorised by call time, including daytime (9am-6pm), evening (6pm - midnight) or overnight (midnight – 9am). The purpose of this data analysis was to identify the proportion of calls undertaken during the OOH period in comparison to daytime hours. Data were categories based on the call handing time (the first contact made to PuCs by the referrer). A total of 55% of calls were taken during the full OOH (6pm-9am period), 15% overnight and 40% evening. 44% of calls were during daytime hours. Figure 4 below displays the percentage distribution by call period:

Figure 4: Percentage distribution of PuC Calls, by call period:

Distribution of all calls to Puc over a 24 hr period

- Daytime (9am-6pm) — 44%
- Evening (6pm-midnight) — 40%
- Overnight (midnight-9am) — 15%
- missing data — 1%

Excludes duplicate and NHS 24 test calls
Results produced by Centre for Rural Health
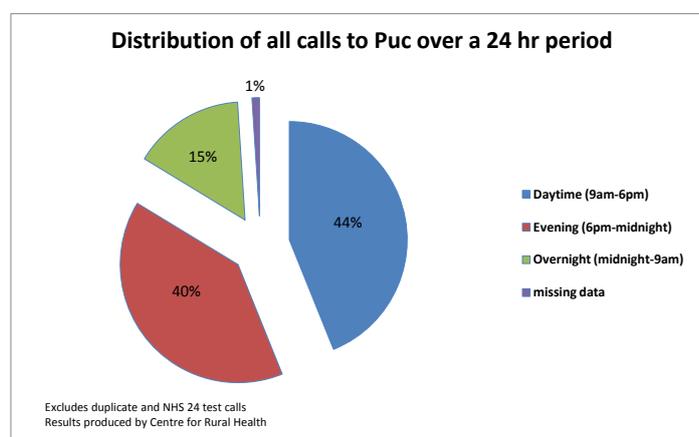
> - 55% of calls to PuC were during the OOH period, 44% during daytime hours.

In addition, calls to PuC over the 24 hour period were broken down by participating hospital. Figure 3 below displays the percentage distribution of these results.

Figure 3: Percentage distribution of PuC calls over a 24hr period, by participating hospital

Distribution of Calls to Puc over a 24hr Period, by Rural Hospital

	Balfour	Belford	Caithness	Dr MacKinnon	Lorn & Island	Western Isles	Community Hospitals	All hospitals
Overnight	0%	29%	3%	30%	20%	0%	33%	15%
Evening	25%	47%	50%	14%	40%	25%	27%	40%
Daytime	62.5%	24%	47%	57%	40%	75%	40%	44%
Missing	12.5%	0%	0%	0%	0%	0%	0%	1%

Excludes duplicates and NHS 24 test calls
Results produced by the Centre for Rural Health
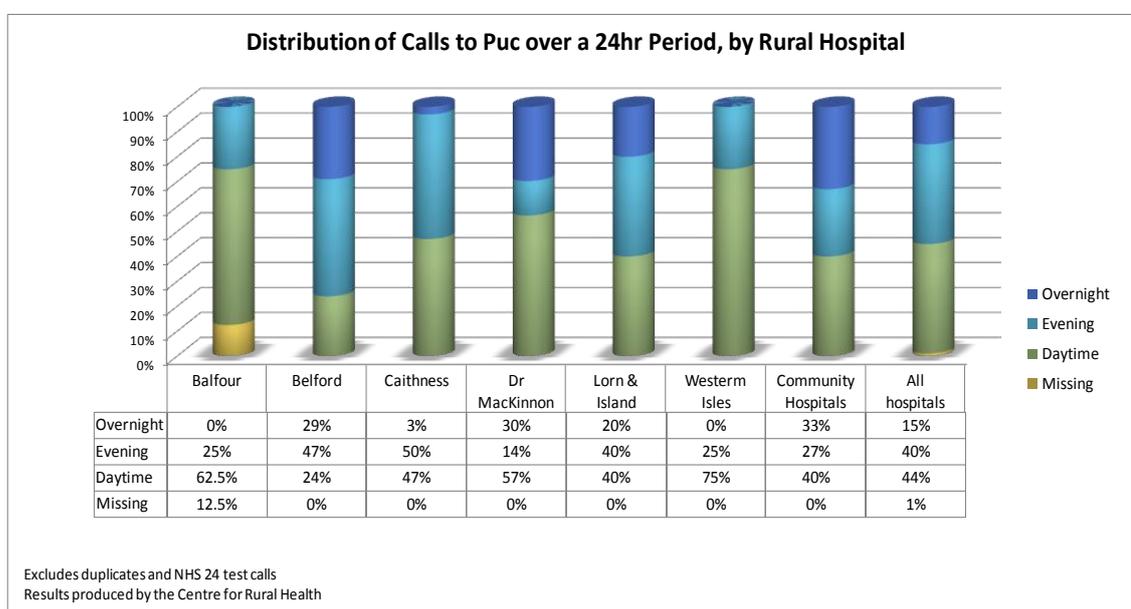
Results demonstrate that the proportion of daytime calls to PuC ranged from 24-75% of the calls by individual hospital, during the first six month period. Evening calls to PuC ranged from 14–50% of calls to PuC by individual hospital. Overnight calls had the smallest percentage range (0-33%) of calls to PuC by individual hospital during the first six months of the pilot. There were no calls received overnight from Western Isles hospital in Stornoway, or Balfour hospital in Orkney.

Table 8: Calls over a 24 hr period by outcome & participating hospital:

Hospital Reference	24hr Period				
Outcome	Daytime	Evening	Overnight	*Missing (24hr data)*	Total
Balfour Hospital					
Close call	1	1	0	0	2
Emergency retrieval	1	0	0	0	1
Follow-up required	3	1	0	0	4
missing (outcome data)	*0*	*0*	*0*	*1*	*1*
Total	*5*	*2*	*0*	*1*	*8*
Belford Hospital					
Close call	0	3	0	0	3
Emergency retrieval	1	3	0	0	4
Follow-up required	1	1	2	0	4
Transfer agreed	1	1	1	0	3
missing (outcome data)	1	0	2	0	3
Total	*4*	*8*	*5*	*0*	*17*
Dr MacKinnon Memorial					
Close call	1	1	0	0	2
Follow-up required	2	0	2	0	4
Transfer agreed	1	0	0	0	1
Total	*4*	*1*	*2*	*0*	*7*
Caithness General Hospital					
Close call	6	6	0	0	12
Emergency retrieval	1	1	0	0	2
Follow-up required	5	8	0	0	13
Transfer agreed	4	3	1	0	8
missing (outcome data)	1	0	0	0	1
Total	*17*	*18*	*1*	*0*	*36*
Lorn and Islands Hospital					
Close call	1	0	0	0	1
Emergency retrieval	1	0	0	0	1
Follow-up required	1	2	0	0	3
Transfer agreed	1	2	1	0	4
missing (outcome data)			1	*0*	*1*
Total	*4*	*4*	*2*	*0*	*10*
Western Isles Hospital					
Close call	1	0	0	0	1
Follow-up required	1	1	0	0	2
Transfer agreed	1	0	0	0	1
Total	*3*	*1*	*0*	*0*	*4*
Other community hospital					
Close call	3	1	2	0	6
Emergency retrieval	0	0	1	0	1
Transfer agreed	2	0	2	0	4
Follow-up required	1	3	0	0	4
Total	*6*	*4*	*5*	*0*	*15*
All hospital data					
Close call	13	12	2	0	27
Emergency retrieval	4	4	1	0	9
Follow-up required	14	16	4	0	34
Transfer agreed	10	6	5	0	21
missing (outcome data)	2	1	3	1	7
Missing (hosp ref)	*0*	*1*	*0*	*0*	*1*
All Hospital Total	**43**	**39**	**15**	**1**	**98**

Of the total of 9 "Emergency Retrieval Calls" experienced during the first 6 months of the pilot, one call occurred during the overnight (midnight – 9am) period, 4 calls were during daytime hours and 4 calls were in the evening.

Of the total of 21 "transfer agreed" after first consultation with PuC, transfer occurred in 5 cases during the overnight period, 6 cases during the evening period and 10 cases during daytime hours.

4.6 Use of technology

Results indicate that 61% of the PuC consultations were undertaken via video conferencing, with 33% undertaking consultation via telephone conferencing methods or telephone. Reasons for requesting or using teleconference varied (from challenges or inaccessibility to VC, to referrer preference). One telephone call to PuC was received directly from a consultant paediatrician at Raigmore DGH, wishing to consult with the OCC regarding a child potentially bypassing the system, one call originally planned for VC resorted to telephone, and a third was telephone only (no teleconference), again, reasons for this were primarily due to technical challenges. Two videoconferencing consultations resulted in emergency retrieval.

 Table 9 below details the relevant outcome data by technology type:

Table 9: Outcome of calls to the PuC service, by technology used:

	Missing outcome	Call Closed	Emergency Retrieval	Follow up required	Transfer Agreed	Total
Missing conftype	1	**0**	**3**	**0**	1	5
Resorted to telephone	0	0	0	1	0	1
Telephone (Raigmore)	1	0	0	0	0	1
Telephone Conference	3	8	3	9	7	30
Telephone only	0	0	1	0	0	1
Video-Conference	2	19	2	24	13	60
Total	**7**	**27**	**9**	**34**	**21**	**98**

*Participating period of Belford Hospital - 4 months

** Data excludes duplicates and NHS 24 test calls

- Of the 98 PuC consultations during the first six months of the pilot, 61% were via VC, 33% via telephone.

4.7 Age of children - PuC calls from the rural hospitals

Toddlers (age 1-3) contributed to the largest proportion of calls to the PuC service. Infants (age 0-1) constituted a quarter (25%) of the calls to the PuC service. A total of 56% of calls to PuC were therefore for children aged three and under. Middle childhood children (age 5-10) contributed to the smallest proportion (10%) of calls to the service. Figure 5 below demonstrates the percentage distributions by age:

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Figure 5: Percentage distribution- age of children

Percentage distribution - Age of children included in PuC

Age 0-1
Age 1-3
Age 3-5
Age 5-10
Age 10-16
missing

1%
16%
25%
10%
17%
31%

Excludes duplicates and NHS 24 test calls
Results produced by Centre for Rural Health
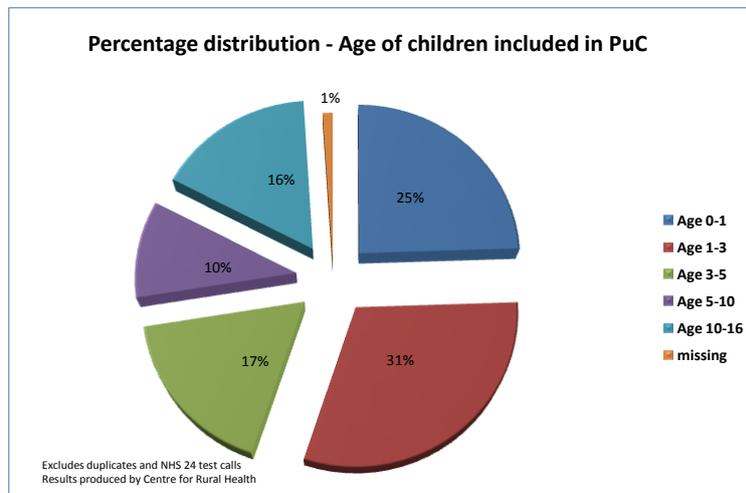
- Toddlers (age 1-3) contributed to the largest proportion of calls (31%) to PuC by age group. More than half (56%) of calls were for children aged 0-3.

4.8 NHS Shetland Data

Data from NHS Shetland has been included in this report, as additional information on the number of transfers of children from a remote hospital to central services occurring outwith the PuC Service. NHS Shetland adopts a generalist led service model and serves a population of approximately 23,000. A&E attendances of children were collected by NHS Shetland for a four month period (December 2013 – March 2014).

The data below indicate that a total of 54 children were admitted during the four month period, with 4 retrievals and 18 transfers taking place.

In addition NHS Shetland identified the cases in which consultation with a paediatric member of staff took place. Results demonstrate that for all children transferred / retrieved during the four month period, consultations with a member of paediatric staff took place prior to decision making.

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Table 10: Shetland data & outcomes

Outomes	December			January			February			March			Total
	Consulted	Not Consulted	Unknown	Consulted	Not Consulted	Unknown	Consulted	Not Consulted	Unknown	Consulted	Not Consulted	Unknown	
Went Home	3	71	9	3	93	1	2	120	0	2	161	0	**465**
Admitted	2	3	2	4	11	2	3	12	1	1	13	0	**54**
Retrieved	1	0	0	3	0	0	0	0	0	0	0	0	**4**
Transferred	9	0	0	1	0	0	5	0	0	3	0	0	**18**
Total	**15**	**74**	**11**	**11**	**104**	**3**	**10**	**132**	**1**	**6**	**174**	**0**	**541**

Results above suggest that Shetland may have a higher rate of transfer / retrieval than the hospitals participating in the PuC pilot. Caution however should be taken when drawing any firm comparisons. During the evaluation of the PuC pilot, it was not possible to identify the total number of children who may have bypassed the PuC service.

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5 PARTICIPATING ON CALL CONSULTANTS

5.1 The Process of Employment of On Call Consultants (OCCs)

Background information on the logistics of employing on call consultants for the period of the pilot is documented below. Associated risks and barriers are also highlighted which should be considered in relation to any potential future service redesign.

Numerous options were explored to employ the OCCs for the period of the PuC pilot:

- Secondment from their own Health Board to NHS Tayside (as the host Health Board for the North of Scotland Planning Group's staff) and paid via their existing payroll for sessions completed
- Employed directly by NHS Tayside as locums and paid via NHS Tayside's payroll
- Employed as contractors and paid via submission of invoices

Lengthy discussions with NHS Tayside HR department, and briefly with NHS Grampian HR department (only two Health Boards were engaged due to time limiting factors), resulted in the preferred option being to employ the OCCs as secondees. There was a particular unease about HM Revenue & Custom's view on the employed/contractor status of doctors which meant contractor status appeared non-tenable.

Due to budgetary constraints during the pilot period, reimbursement of the OCCs was limited to £100 per session; a reduced payment compared with the normal terms and conditions of medical staff. To pay this rate a variation order had to be granted by the Scottish Government to allow OCCs to be paid via their normal payroll. Underestimation of the time frame and complexities of the process, coupled with communication difficulties, resulted in a variation order not being authorised in time. The secondment option was therefore unable to be progressed with each of the substantive Health Boards.

NHS Tayside therefore agreed to employ the OCCs and pay via the payroll using an invoice system. An agreement was drawn up between NoSPG and each OCC specifying their role, expected standards of working and acknowledgement that their substantive employer was aware of their OCC work. The overall process of establishing employment status of the OCCs took considerable time before and during the pilot period.

In addition the original budget, which had been agreed by the NoSPG Executive Team, was exclusive of payment of a 2nd on call consultant. During the pilot the PuC Clinical Lead and SCTT Clinical Lead therefore covered the majority of the 2nd on call voluntarily. A few participating OCCs have also volunteered to take the

occasional 2nd on call session, and agreement was subsequently made to pay them a nominal payment.

Reflections on the process of recruitment:

- Underestimation of the time frame and complex process to obtain a variation order.
- Unsuccessful variation order despite the rate of pay being reduced.
- Risk of Health Boards not allowing their consultants to participate on the pilot.
- Risk of Health Boards withdrawing from inclusion in the pilot due to uncertainty of governance arrangements on employment of OCCs.
- Lack of funding to pay the 2nd on call consultation.

The information above demonstrates the hurdles faced in employing OCCs as part of the PuC pilot and the difficulties of implementing innovative pilots when challenges exist in enabling flexible employment across health board boundaries or agreeing different terms and conditions. The risks and barriers associated with employment would need to be accounted for and built into the finances of any future paediatric unscheduled care telehealth model.

- The ongoing situation with employment of OCCs is a high priority issue.
- Process of payment of OCCs is a key consideration in any service design ongoing.

5.2   What are the views of the On Call Consultants (OCCs)?

This phase of the research was designed to generate rich qualitative data from the participating on call consultant paediatricians using videoconferencing to support the participating remote hospitals. Data collection involved semi-structured interviews, either face-to-face or arranged via telephone. Interviews took place between the first five months of the pilot (August – December 2013). A total of ten on call consultants participated, nine by formal interview. One participant declined a formal telephone interview, but was happy to discuss their experience of PuC informally. Eight participating OCCs are employed within their NHS Board as consultant paediatricians; two are employed as consultants in Emergency Medicine with dual accreditation in paediatric emergency medicine. OCCs participated in the interview sample were from across Scotland, including NHS Forth Valley, Grampian, Greater Glasgow & Clyde, Highland and Lothian. All OCCs interviewed have experience of eHealth in some form, from adhoc use of video conferencing to extensive experience in telemedicine, with some having prior

experience of conducting paediatric clinics using VC. The table below summarises the specific interests of the interviewed OCCs:

Table 11: Special Interests of interviewed OCCs:

Participating OCCs	Specialist Interests / Experience
NHS Forth Valley NHS Grampian NHS Greater Glasgow & Clyde NHS Highland NHS Lothian	Fracture management
	Paediatric intensive care retrieval
	Remote & rural emergency medicine
	Emergency medicine and ambulatory care
	Allergy and respiratory paediatrics
	eHealth & telemedicine
	Diabetes and endocrinology

Interviews lasted between 20 minutes and 1 hour 20 minutes, depending upon the experience and extent of involvement with the PuC pilot. Interviews took place via telephone or face-to-face.

With the explicit consent of participants (see appendix 1) all the interviews were digitally recorded and transcribed verbatim. Interviews were semi-structured, following a broad topic guide, but were informal enough to allow respondents to raise their own issues (see appendix 2). Analysis took an iterative framework approach[16] involving familiarisation with the data, identification of a thematic framework, charting, and finally mapping and interpreting the qualitative results. Transcripts were coded by Anne Roberts from the PuC evaluation team and the coding framework was developed collaboratively between Anne Roberts and Philip Wilson. All interview transcripts were analysed and managed using NVivo 10 software.

OCC Findings:

The following themes are presented in this section of the report. These are the key issues which emerged furthering analysis of the qualitative material.

- appropriateness of PuC calls
- barriers & perceived benefits of using VC
- quality of care
- making the decision on a child

Asked about their motivations for participating, all ten OCCs were generally very supportive of the initiative of using telehealth to support decision making for paediatric unscheduled care. Most described having prior experience in either

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[16] Yin. 2003. *Case study research: design and methods* 3rd edition London, Sage.

telehealth / eHealth or a key interest in remote and rural service delivery for paediatrics. It should also be acknowledged that a degree of patience and goodwill was demonstrated by the consultants during the period of the pilot as bureaucratic obstacles impacted upon the developments of contractual arrangements for a substantial period.

- All participating OCCs were generally supportive of the initial use of telehealth.

Appropriateness of PuC calls

OCCs discussed the appropriateness of the PuC calls received from remote hospitals during the pilot period. All felt they had experienced calls which were appropriate for the service. There were no references to inappropriate use of PuC. Three OCCs specifically described variability in the seriousness of illness, or the stage of presentation of the child which, they believed was dependent upon on the level of experience of the physician making the call.

> *"I think the appropriateness depends on the physician on the other side….so the appropriateness of the calls from the more senior GP were for more serious cases, in that case one was a septic child, whereas the other two, one was just bronchiolitis and the other was ingestion of a tablet. They're all appropriate…for their grade it was appropriate in all three calls."* OCC1

> *"It depends who's referring. I think there have been 3 or 4 phone calls from [remote hospital X] for example, where it's been the FY2 doctors on their own so they don't really have experience with children, they're a little bit nervous so they phone you quite early which is good."* OCC10

- Participating OCCs described the calls to the PuC pilot service as appropriate, the type of call depended on the referrers level of clinical experience.

What are the barriers to using VC and the perceived benefits?

In all OCC interviews, the notion of using remote consultation via a video conferencing facility for unscheduled paediatrics was generally supported. OCCs made reference to feeling *"pleasantly surprised"* about the experience of conducting video consultations, with some originally being sceptical of any real

benefits of VC in comparison to the telephone. Two participating OCCs, with extensive experience in the use of telehealth (both in Scotland and internationally) were particularly keen to promote the use of VC as an ongoing method for remote paediatric consultation.

The success of and experience with the technology was however described as unpredictable. Video consultations were conducted in various forms throughout the pilot period. Where hospital to hospital consultation took place using video conferencing units via the NHS N3 Network, (an IP network which enables the NHS to have fast, high quality broadband and video conferencing) interactions should have been good quality. However, there were individual incidents where sound and / or pixel quality was suboptimal. This appeared to vary from call to call, with examples provided where consultations reverted to professional-to-professional telephone discussion only.

> *"It wasn't clear to me [pixel quality] and I didn't ask how much of me she could see."* OCC12

> *"There's been a couple of occasions where it hasn't worked, a couple of times from the referring centre end then once my internet at home failed but on those occasions we were able to just do a telephone consultation."* OCC10

- OCCs described resorting to telephone consultation where VC technical challenges occurred.

A third of OCCs discussed the need for finer quality video conferencing to enable closer observation, for example to observe a child's skin tone or a child presenting with a rash on the skin. The quality of the VC appears to be at an acceptable level for OCCs to successfully undertake "conversational" consultations, but close examination of paediatric patients is more difficult.

> *"I wanted to actually see the patient, to see what they look like, to see the colour of the skin and things like that, so I didn't feel that the quality was excellent for that sort of thing, it was good enough to have a conversation, see the other person but perhaps not as good as it could be to make a close assessment of a baby and looking at the colour and the fine detail."* OCC1

- Continued improvement to bandwidth to facilitate high quality VC interaction for paediatric unscheduled care to remote hospitals in Scotland is necessary.

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When conducting "conversational" consultations from home, the quality of MOVI / JABBER (compatible with both Mac and PC) internet videoconferencing software was also discussed positively. This level of quality enabled general paediatric observation, verbal interaction and an opportunity to engage visually. Reference was made to the benefit of the consultant being able to physically observe a child, and in addition, to have interaction with the parent.

> *"Paediatrics is a little bit like being a vet; you have a puppy that can't tell you what's wrong with them. By observing them and listening and using your other senses that you have that's where some of your information comes from. And so actually a video link may serve paediatrics more effectively than perhaps other specialties."* OCC9

- The use of MOVI / JABBER was discussed positively for consultations involving general observation and verbal interaction.

It should be noted that awareness of the limitations of video consultation was demonstrated in a number of OCC discussions, but, in comparison to the variable nature of pre PuC referral pathways most felt that PuC was making a contribution towards a more consistent pattern of support for paediatric unscheduled care.

> *"Obviously you can't have hands on the patient you are relying very much on the examination that somebody else is doing and you don't know how good they are at examining and how they are at identifying signs, you have to be very wary of that. And aware of the limitations that that has, but in fact it is better than just having a description via telephone."* OCC11

- OCCs felt that consultant led VC enabled a more consistent pattern of support in comparison to previous communication pathways.

The telephone was used predominantly where video technology failed. In addition, telephone was also described as more appropriate when clinicians felt professional-to-professional discussion only was required (e.g. in suspected child protection cases). In a small number of cases telephone consultations also took place where the logistics of access to VC units within the remote hospital resuscitation area were difficult or inappropriate for the child (e.g. when adult

trauma was admitted to A&E or a child was already a patient on a hospital ward). OCCs felt aware of the challenges with local resources in small, remote hospitals and understood that in some cases the ability to VC was not always possible.

"what happened was that a doctor was trying to give me a background story at the first exchange but there was so much background noise that neither the doctor could hear me because of feedback noise nor could I hear them properly so it was eventually agreed that the doctor go into another room and I would link up with them [via telephone], I also got the story and then used the video and linked with the patient and carried on there." OCC9

- Undertaking VC during the unscheduled care period is not always appropriate or logistically possible in a small remote hospital environment; the telephone was often preferred or used an alternative.

The option for OCCs to undertake visual observation post consultation (where appropriate) before deciding on discharge / transfer or further treatment or decision making was described as a useful mechanism. An example is provided by one OCC below:

"There was one patient quite recently where even though the initial video conferencing was over, we didn't break the link. I let them carry on with their work and I left the link on, and so I just had to observe them in real time as to how they were progressing. And only when I felt something had to be said if they were doing something inaccurate or incorrect I then spoke up so they had the microphone on. But that was over several hours and it was invaluable as I was seeing it in real time." OCC9

- Using VC before deciding on discharge / transfer can be a useful mechanism.

Tele education for remote colleagues and ongoing digital support tools for OCCs was highlighted as beneficial, but not available as part of the pilot. OCCs suggested access to PACS radiology and Toxbase clinical toxicology archive and national poisons database would be an advantage. Reference was also made to the potential for using the existing VC units in the remote hospitals to conduct paediatric tele-education sessions. Examples included specific sessions on how to use decision mechanism support, or paediatric simulated scenarios.

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- Access to support tools for OCCs such PACS and the toxicology archive would be beneficial.

What are OCC views about quality of care?

The introduction of a single point of consultant led contact for unscheduled paediatric support to remote hospitals was described by OCCs as a key contribution to the equity of access to paediatric advice during the out of hour period. Although, most OCCs agreed it was difficult to measure whether the quality of care itself had actually changed, all OCCs described the uniform pathway of accessing a consultant through the PuC service an advantage for the patient and a supportive tool for interaction with a parent.

"I don't think there's been any question raised about the quality of the clinical care that's being delivered, it's all about process."
OCC3

- OCCs thought one of PuC's key contributions was equity of access to paediatric advice OOHs.

Transfer scenarios and modes of informing a receiving centre of a transfer were discussed with OCCs. Two options are possible in this instance, a three-way videoconference or telephone conference with the OCC, referring physician and receiving hospital physician (set up by the NHS 24 call handler), or the OCC himself / herself can arrange the transfer of a child. In the latter situation the OCCs described how their contribution was enhancing the service.

"because we are making the referral process and arranging the transport, most of the time they're busy at their [referring hospital] end where we started the referral in the first place, so they would either put the VC on hold, or hang up and get on with what they're doing clinically, and then in the background we'll sort out all the logistic side of things get back to them with instructions as to what's happening. And that's proved to be helpful because when that sick child was being dealt with and a transfer being arranged, the doctor at the far end turned out to have to deal with a really sick adult next door, so that freed him up to do that." OCC1

- OCCs arranging the transfers of patients to receiving centres can free up the time of remote hospital staff caring for the unwell child.

Potential improvements to quality of care include during the learning period of the pilot could have been a mechanism for accessible clinical patient feedback to be provided to OCCs and follow ups of children undertaken where necessary. OCCs only obtained feedback on an adhoc basis, for example, if a child was being transferred to their particular hospital. No follow up was conducted nor feedback given to participating OCCs regarding the health of the child once that child was transferred. This is also apparent for children that were not transferred and are discharged home from local A&E.

"For those children that are being treated and then not transferred, at the moment we haven't got a formal process to say, for example, we will follow up tomorrow…clinically I don't think we've got a system whereby we say "we saw a child, they weren't transferred, do we put down some sort of formal arrangement to say if we changed a process from transfer to not transfer, should we put in a formal agreement to say we'll arrange a follow-up within, for example, 12 hours." OCC1

- A mechanism for accessible clinical feedback regarding transfer / follow ups would be welcomed by OCCs

A further indicator of quality of care discussed with the OCCs included the value attached to engagement with parents during VC consultations. OCCs described parents as generally very pleased with the PuC service. In addition, the OCCs discussed the advantages of using VC to engage.

"When I was on the camera the mother was there with the child, I was talking to the doctor and the mother at the same time. I had a direct involvement with the parent." OCC11

"The VC effectively allows me to have a proper consultation with a parent and I've certainly found that there's been a really good dialogue that been able to take place between me and the parent." OCC4

"I think that's another major thing that seems to be coming from the other on-call consultants that I've spoken to, saying that the feedback is that the parents really enjoyed the fact that they could speak to a senior clinicians if they had any worries." OCC2

- OCCs felt their own interaction with parents via VC was positive.

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Making the decision on the child

A number of OCCs highlighted the importance of understanding local workforce patterns, geography and transport arrangements in remote hospitals as key to aiding the decision making process for a child. Although ultimately it was the recognised responsibility of the senior referring doctor to be able to identify when a child's needs could not be managed locally, nevertheless clearer OCC inductions to the rural configurations within each of the participating rural hospitals, was described as useful for understanding risk profile.

"With PUC because you do have consultants that don't know the areas very well. I do get a bit anxious when I'm on call if it's from a place from which I don't know. I got a very good debrief from the clinical leader about each area, but maybe some rural practitioners feel that because they are not talking to people that they are used to, they are thinking that they don't really understand us...I can understand that" OCC6

- Clear inductions to rural configurations will assist OCC consultation; good knowledge of local workforce patterns, transport and geography are crucial to decision making and establishing relationships with rural hospital referrers.

OCCs recognised, that ultimate responsibility for the child lay with the referring physician at the remote hospital, although, there was recognition that who "actually" makes the decision differs depending upon the seniority of the physician making the call and the complexity of the clinical presentation.

"I think that the decision making is made by the remote site and that I am providing them with advice about what I would consider to be appropriate management in the circumstances and that why I will always clarify with them, are they happy with that advice are there any further questions." OCC4

"If he [referring physician] says, 'No, even if I do all of this stuff, I would still want the patient to be transferred', we will transfer the patient." OCC3

"I've had a couple of phone calls from GPs in [X remote hospital] who I know are very good anyway and they have a plan to probably to keep them in for observation, and just wanted to have a wee chat about it to see if there was anything else they would add or do differently." OCC10

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OCCs highlighted issues around the governance and professional liability for children and described a feeling of unease and increased accountability on their part if a transfer is felt unnecessary by a receiving hospital. This can complicate decision making during the unscheduled care period:

> *"Obviously there are potentially issues around governance because you could have a situation where if you suggest that a transfer is indicated then that can be fairly straight forward in that it's recognised that the doctor on site still has responsibility for the patient and then until the transfer team arrives but if the transfer team then potentially say that they don't feel that it is merited that potentially make it much more difficult."* OCC4

- Accountability, governance issues and clinical responsibility for the child during the PuC pilot caused some tension.

6   PARTICIPATING STAKEHOLDERS

In addition to interviews with participating OCCs, a number of key stakeholder representatives were invited to contribute their views to the evaluation team. A purposive sample of 17 individual stakeholders was identified from across the region including each of the participating rural hospitals and paediatric representation from NHS Highland (Raigmore) and NHS Grampian (Aberdeen). Representatives (both clinical and managerial) from NHS 24 the Scottish Centre for Telehealth and Telecare, the North of Scotland Planning Group, the PICU retrieval team, a child health commissioner, a north of Scotland regional Clinical Director and a sample of remote and rural clinical staff (including two paediatric consultants not participating as OCCs, consultant physicians, nursing staff and GPs) were also interviewed. Interviews lasted between 33 minutes and 90 minutes, and were conducted either face-to-face or via telephone. Interviews took place between September 2013 and January 2014. All stakeholders consented to interview, and being digitally sound recorded. All interviews were transcribed verbatim and analysed thematically.

A topic guide was constructed prior to interview, which included inquiry into perspectives on the patient pathways, problems encountered during PuC, new learning / skills acquired, training needs, governance / clinical responsibility issues and suggestions for improvement to the pilot service. Challenges in the delivery of local paediatric care was also discussed (see appendix 3). The following key topics are discussed amongst the views of stakeholders:

- use of technology in paediatric care
- disruption of pre-established relationships
- models of OOH service delivery in peripheral hospitals
- observation of a presenting child
- future of PuC

6.1   What are the views of the Stakeholders?

The use of technology in paediatric care

The use of Information Communication Technologies to support decision making in paediatric care was discussed with all interviewed stakeholders. In keeping with the views of the participating OCCs, all stakeholders spoke positively about the concept of using telehealth as a method of communicative support for remote paediatric care or advice. Acknowledged by the majority was a recognised need for change, most notably in the consistency of pathways of accessing treatment or referral advice for children presenting at remote hospitals. Stakeholders described identifiable differences prior to PuC in mechanisms for remote clinicians to obtain appropriate paediatric opinion for acute emergency care for children:

"Well the path [sigh], the path was varied there was no guarantee you could speak to who you needed to speak to at the level of seniority and in the time frame that was deemed necessary by the referring clinician." (Stakeholder 5)

> • Stakeholders described variable mechanisms prior to PuC for referring staff to obtain clinical support for paediatric emergencies.

Various communicative technologies were described as being useful. For those who had experienced successful remote video consultations, the use of VC was described as beneficial for enhancing communication and reducing risk for the unwell child. The benefits of VC were described as i) visual advantages of a specialist being able to see the patient ii) face-to-face digital interaction with the family / relatives iii) improved quality of interaction to support decision making.

Numerous scenarios however were also described where the telephone was utilised as an alternative to a video conferencing consultation, most notably when the VC technology failed or remote hospital logistics prevented access to the VC equipment (e.g. when A&E resuscitation areas were busy). Telephone was also described as the preferred method of communication by some referring staff, where issues of patient sensitivity and confidentiality were of concern, or a one-to-one professional discussion was required:

"You can't always give all the information you want to give in front of the parents all of the time…that was the patient where the parent was particularly anxious…we were phoning and discussing about a possible transfer because the patient was quite unwell and there were nuances and subtleties that you may want to be able to pass over and discuss with the clinician at the other end privately." (Stakeholder 7)

"The other thing was that the child was taken back down to the resuscitation room from the ward. Although we've got the video conferencing facility on the ward partly people didn't know about it and partly that bay that you saw in A&E, that big bay already had two patients in it so it would have been somewhat less than confidential there." (Stakeholder 10)

Stakeholders who had used PuC were keen to acknowledge that the type of ICT utilised for communication in paediatric cases was of secondary importance to the quality of conversation taking place. Two examples from the interviews are provided below:

"The central thing here what this system guarantees is a rostered paediatrician that is the single most important part of the whole thing it's not the technology it's the quality of the person at the other end and that the paediatricians have been uniformly helpful." (Stakeholder 2)

"I think that you've got to remember that the technology is there as a support tool. It's there to facilitate clinician to clinician conversation and decision making. It's not there to replace clinical judgement; it's there to enhance it." (Stakeholder 5)

- Technology is a support tool and of secondary importance to the quality of clinical interaction.
- Some referrers resorted to using the telephone, where VC technical challenges occurred, or where logistics or confidentiality issues rendered it more appropriate. Where VC was successful, opinions were generally complimentary.

The experience of using PuC was discussed by those stakeholders who had participated in the pilot as remote referrers. Opinion from such participants was generally very complimentary to the participating OCCs in terms of their professionalism and quality of interaction. The NHS 24 call handling aspect of the consultation was however raised as an element of the process which could be improved upon. Some stakeholders questioned the requirement for call handling; others supported it but described the process as "clunky".

"Apart from the clunkiness of getting through in the first place, because with the old system you spoke to a doctor and established rapport straight away. Now you're going through this with the call handler taking all the details and setting up and then calling then maybe there's a call back." (Stakeholder 10)

"If I can video link then that is a help but before I can get to that stage there is a lot of talking on the phone before I have the video running." (Stakeholder 12)

- Stakeholders held complimentary views on the professionalism of interaction with OCCs.
- The process of NHS 24 call handling was highlighted as an area for improvement.

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Disruption of pre-established relationships

The introduction of the PuC pilot impacted upon pre-established working relationships. Some senior clinicians from NHS Highland and NHS Orkney felt PuC disrupted decision making between referring staff and the PICU retrieval team and / or paediatric consultants in both north of Scotland hub hospitals (Inverness & Aberdeen) where children with more serious conditions, (e.g. requiring high dependency care) are often transferred. Staff from three peripheral hospitals (Dr MacKinnon, Belford, and Balfour) raised concerns that the introduction of PuC jeopardised some pre-established clinical relationships with either hub paediatric specialists or PICU retrieval teams.

- The introduction of the PuC pilot has introduced new working relationships with OCCs, sometimes impacting negatively upon pre-established relationships between referrers and the PICU retrieval teams / consultant paediatricians from the hub hospitals in the north of Scotland.

Confidence was high in local consultant paediatricians from hub hospitals who were more aware of local geography (this is also reflected in the views expressed in some OCC interviews), knowledge of remote service delivery and transport challenges and limitations of remote hospital facilities.

In addition remote referrers felt hub paediatricians had a better grasp of competence amongst remote and rural colleagues. The lack of local knowledge of these nuances was described as *"understandable"* in the introduction of a new service. Nevertheless, the introduction of PuC created some nervousness regarding the change in established relationships; the traditional means of local support via telephone to the paediatric hub unit was replaced with NHS 24 call handling interaction and a national consultant led on-call paediatric advice via telehealth methods. Examples of the disruption to established relationships are described below:

"It's disrupted our normal working relationship and it's disrupted our working relationship with people we normally speak to and it's put up a barrier between us." (Stakeholder 2)

- Referring staff felt hospital paediatricians had a better knowledge of remote services, transport issues, local geography and competence amongst remote and rural colleagues.

- OCC lack of local knowledge of these nuances was described as *"understandable"*.

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Two stakeholders specifically described the impact on pre-established relationships in the context of consultation time – it was less time consuming to speak to a paediatric colleague where you have an established relationship:

"I've always felt that they have an understanding of who I am, what my clinical skills are and therefore the consultations have been much shorter." (Stakeholder 7)

"They (hub paediatricians) are extremely supportive and because of their awareness of us you don't have to go through the same explaining of who you are, you can cut to the nub of the problem. While the project and aspiration is very noble and worthwhile my one fear was as long as it doesn't undermine that relationship with that support that we already get." (Stakeholder 1)

The impact of the disruption to pre-established working relationships resulted in evidence of remote hospital staff bypassing the PuC system when they considered it was more appropriate to directly liaise with paediatric colleagues at a hub hospital, or directly with the PICU retrieval team. One example was provided of a 5 week old baby who had previously spent time in a DGH special care baby unit:

"Recently we had a child who was 5 weeks old and 4 of those 5 weeks they had spent in SCBU, they had only been discharged 3 days earlier. When you look at a beautifully normal healthy looking baby feeding really well handling reasonably well but breathing at a rate of 60 -80 breaths a minute! Maybe I should have called PuC but I made a judgement not to use PuC and directly called the paediatric team at Raigmore. My justification for doing it was this child had already spent 4 weeks in a SCBU." (Stakeholder 1)

Other incidences of bypassing PuC were provided during the interview discussions where limited space and local resources in remote hospitals often prevented access to the video conferencing equipment. A number of examples were provided where clinicians bypassed PuC due to challenges with access to VC in the resuscitation area, or issues of the appropriateness of VC use whilst resuscitation areas were occupied with other patients. One episode is described by a stakeholder below:

"I was called in by one of my colleagues to see a croupy child it might have been the sort of thing you might have discussed with PUCs but I was called to see the child direct at one o'clock in the morning because there was an adult being intubated in the emergency room where the VC unit was set up so it just wasn't possible, my doctor was busy with a sick adult." (Stakeholder 2)

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- Qualitative evidence was provided of cases where children had bypassed the PUC pilot. Bypass occurred where remote referrers felt consultation time would be quicker, challenges with VC existed or appropriateness of the use of VC was questioned.

Models of OOH service delivery in rural hospitals

"If you have seen one rural hospital….you have seen ONE rural hospital"

Discussion about existing models of care in remote hospitals across the north of Scotland continually dominated many of the interview conversations, with stakeholders highlighting that PuC had exposed a wider question in relation to service delivery in the north, which is *"what is an acceptable level of clinical service delivery during the OOH period in Scotland's remote / peripheral hospitals?"* Across the six participating hospitals, differences existed in the model of unscheduled care each hospital adhered to - some adopted the rural General Practitioner (GPs with additional training in anaesthetic - stabilisation and transfer of critically unwell, EPLS and A&E related work) model. This model does not employ junior doctors in the out of hour period. Other RGHs adopted a generalist led and delivered service where junior doctors will participate in out of hours clinical provision. Two participating hospitals (Oban and Western Isles) also employ a consultant paediatrician, encompassing daytime hours or daytime plus OOH contributions. The variation in all existing models was evident during the evaluation. Stakeholders raised this wider topic as a key issue of importance in relation to any OOH unscheduled service re-design for children.

> *"So one night it's a consultant who's on is up here and the next night one of the GPs who's on is down there, you know, we're aiming at questioning what's the skill level of the system?...They had problems at this end with trying to get capillary gas off a child and that was I think people's inexperience so that illustrates the need for people be able to do certain practical techniques."* (Stakeholder 10)

> *"With a very junior doctor there it does seem that the whole telehealth thing can offer something, what we need to work out how best to support them. It does seem if the current model doesn't work but there must be a way of supporting a unit better."* (Stakeholder 4)

- What is an acceptable level of clinical service delivery during the OOH period in remote / peripheral hospitals?

Discussion also indicated some advantages of the introduction of PuC in hospitals which adopt the Rural General Practitioner model. Those stakeholders felt that the threshold for unscheduled paediatric transfer is often higher within this type of service delivery. One particular participant described remote decision making worked "best" in the hospitals that arguably require the PuC service least:

"Our doctors being relatively more senior know when to say no, I am keeping this child or I am not keeping this child, I'm sending it home I'm not sending it home. We can have that sort of conversation where as the junior doctors can't." (Stakeholder 2)

Most were in agreement that the threshold for transfer was lower in the hospitals which adopt a generalist led and delivered service where junior doctors cover out of hours rotas. One hospital which adopts this model describes their low threshold for managing sick children:

"If we pick up the phone we are not usually looking for advice we are usually telling you that we have a reached our threshold and this child is coming your way, it's not advice that we are looking for." (Stakeholder 1)

- The threshold for transfer was described as low in rural hospitals which adopt a generalist   led model where junior doctors cover OOH A&E.

Views however were divided about decision making and responsibility within the remote peripheral hospitals that adopt a generalist led service model. Such complexities over decision making muddied the actual conversation of *"who is the best person to consult with the patient?"* Two stakeholders from the remote hospitals described being "delighted" with PuC in general and felt it was a supportive mechanism for remote clinicians, especially for foundation year doctors or A&E nursing staff. One example below is provided by an A&E nurse:

"I can't think of a negative point with this service at all. The three times I have used it I've just thought it was great, just the reassurance and knowing that they're at the other end of a phone. As I say, that night when the doctor was called away on an emergency, it was great to know. He had said to call back in an hour, but he said if you need me before then just pick up the phone. It was great to know that they were there advising us." (Stakeholder 13)

For others, the introduction of PuC intensified the complexity of decision making and introduced a new level of risk for managing an unwell child that a junior doctor may otherwise not had responsibility for. With the overarching governance agreements for the PuC pilot emphasising responsibility for the patient remained with a remote doctor, there was recognition that junior doctors were torn between choices on where to accept advice and how to carry risk.

"We have in our rural general hospital senior nurses and really quite junior doctors who are in general manning the A&E particularly out of hours and they do not have that level of experience or skill to carry that risk comfortably… delaying any definitive care for the child while the consultant asks the junior member of staff to carry more risk than they may be willing or comfortable to has caused issues." (Stakeholder 3)

- Stakeholder views were divided about risk, clinical decision making and responsibility for children throughout the pilot.

Some felt PuC made communication more complex, and one clinician considered that the issue will continue to remain complex as junior staff may feel a level of loyalty to their local senior colleagues. Other stakeholders felt that OCCs should also take responsibility in decision making:

"I would rather have more local educated people to make these decisions…but if we don't the PUCs model has to adapt to realise that we are phoning in for OCCs to make decisions not phoning in to encourage local people to make the decisions. (Stakeholder 2)

- Clearer local level guidance on decision making, governance and clinical responsibility during the PuC pilot would have been beneficial.

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Observation of a presenting child

Observation of an unwell child within a remote hospital setting appeared to be a contentious issue for the some stakeholders. The clinical pathway for a child who is very sick and requires retrieval remained largely unchanged. All stakeholders agreed that it was clinically most appropriate to manage a child pending retrieval, even if this meant numerous hours within the resuscitation area of a remote hospital A&E department. The introduction of PuC however, has created the opportunity for the OCC to observe a child for a period of time whilst determining whether to transfer or discharge. This new opportunity proved useful where VC consultations were of good visual and sound quality, equipment was available for use and confidentiality was not compromised. A short period of local observation was also accepted.

Observation within A&E appeared to be a concern for those children where there was a sense of uncertainty about their condition, often described as "neither the well or unwell child". The anxiety is described below:

"Am I confident for watching a child where quite rightly so I have no experience in this area, this is out with my area of confidence?" (Stakeholder 1)

Concern also occurred where VC equipment failed and remote staff were observing a child without OCC virtual assistance (i.e. using the telephone to communicate). Observation was also discussed in the terms of resources - both space and facilities to house a child and the impact on clinical A&E staff.

"It depends how busy the unit is. There's a little paediatric room a bay cubicle, resuscitation number 2 which is kitted out the for paediatrics you could observe them but we have 5 cubicles in our entire A&E department, 2 of which are resuscitation. If you were to have trauma you are going to need to resus you don't know how it evolves, you have to try and manage contingencies… it depends on the period of observation and what needs observing" (Stakeholder 1)

"There have been some concerns that if a child is kept for observation that it is a future drain on the staffing of the peripheral unit that isn't set up to look after kids specifically." (Stakeholder 6).

- There are challenges for some remote hospitals in observing children for lengthy periods of time – appropriateness relates to facilities, resources, access to VC, capacity and competence / confidence of staff.
- The use of VC OCC support impacted on how confident staff felt to observe.
- Clearer guidance on when it is acceptable to observe a child should be offered.

Ongoing use of Telehealth for Paediatric Unscheduled Care

It is worth noting the concept of remote paediatric advice via telehealth has been widely supported. The PuC pilot was described as "essential" or "paramount" and a "major asset" for remote support. One remote hospital which employs a paediatrician described the benefits PuC could bring if their consultant paediatrician is on annual leave or off duty.

The future potential of linking to PuC for children on wards (such as those who have undergone surgical treatment) was suggested as a possible ongoing development. For most, the future model of remote hospital services was critical - how these are delivered in the future determines how paediatric unscheduled care will develop.

A smoother process of implementation of the PuC pilot and enhanced communication ongoing between the PuC Project team and remote peripheral hospital staff could resolve some of the issues that have been highlighted above.

7 CIRCUMSTANCES LEADING TO WITHDRAWAL FROM PARTICIPATION IN PUC

One participating remote hospital withdrew from the PuC pilot in December 2013. Geographically this participating hospital is the closest drive time to the nearest District General being 70 miles away. Prior to PuC the majority of paediatric care was carried out in Raigmore Hospital and Belford hospital did not interfere with the direct referral from General Practice to Raigmore. Stabilisation of critically ill paediatric patients prior to transfer is undertaken in Belford A&E department with the assistance of anaesthetists. This has remained unchanged (see appendix 4).

Clinical staff at Belford Hospital raised concern that the PUC pilot led to the retention of paediatric patients in a unit with no paediatric staff, little paediatric experience and only distant advice available, rendering them nervous about agreeing to observe a child within the hospital over a period of time. Furthermore, the responsibility and accountability for such paediatric patients remaining with the referring clinician was an issue; predominantly a foundation year junior doctor or non-paediatric trained nursing staff. Clinical staff at Belford hospital felt cases during the PuC pilot highlighted the vulnerability of local staff and the risk of delay and harm to patients. The outcome has resulted in consultant colleagues in Belford returning to their traditional pathway for paediatric patients and withdrew from the PUC pilot.

8 PARENTAL VIEWS

A very small sample of five parents provided views about their experience of using VC to link with a consultant paediatrician during an episode whilst their child was unwell. The sample was small due to delays in the data sharing agreement and challenges obtaining parental telephone numbers. Telephone interviews took place with consenting parents, which were digitally sound recorded. Interviews took place between February & March 2014.

Due to sample size, these interviews have been written in a case study format, to provide more detailed descriptive and contextual material on the VC experience. The accounts below provide detail on the child's clinical presentation, patient journey, outcome, experience with VC, and any additional relevant information:

Parent 1: Child 1(middle childhood age) presents at rural hospital with a respiratory condition.

Presentation: At middle childhood age, child 1 attended a RGH with respiratory distress, arriving at the RGH in the early hours, following a call to NHS 24. This child was then seen by a local GP at approximately 3am. Parent 1 described the initial consultation with the GP as very good, diagnosing "*acute asthma*".

Patient Pathway: Following the GP consultation, parent 1 described their child being administered treatment, and discussion began regarding transfer, initially taking place via telephone with a DGH. At approximately 6am the VC link to PuC occurred, taking approximately 10 minutes to link to the OCC. Transfer was agreed during the first VC, with the parent describing the OCC advised the DGH would be appropriate. A follow-up VC was then agreed. Parent 1 described local disagreement about transfer (complicated by staff change over). This resulted in delayed transfer decision. Further discussion took place between the OCC, Aberdeen and PICU retrieval team.

"There was a lot of politics going on; the on call anaesthetist had been called in. He took over from the GP. When they decided they would transfer they were going to do so by ambulance but the anaesthetist disagreed totally and requested air transfer. The anaesthetist said "the child can't be here, he needs to be airlifted".

Outcome: Child 1 was transferred by road after weather conditions hampered helicopter landing, and arrived at a central children's hospital approximately 24 hours after attending the RGH, spending 12 hours in HDU, and a further two days on a ward. Outcome data records the final diagnosis as respiratory infection.

VC experience: Parent 1 describes the VC experience with the PuC consultant very positively and professionally, although initial challenges with audio were noted. Parent 1 quotes: *"I think it's a great thing because obviously it was needed for my child, I think it was useful and they were able to talk to me."* and *"Looking back now I could see it was extremely helpful"*

Additional relevant information: The parent described hearing unnecessary local conversations and felt decision making locally was fragmented. Final comments during the interview related to nervousness of length of time to organise transfer, described as "significantly delayed".

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Parent 2: Child 2 (age group 3-5) presents at a rural hospital with a skin rash.

Presentation: A young child aged between 3-5 years presents at a remote hospital with a rash, around 5pm. It was recommended by the local GP surgery that the child attends A&E. The child was seen in the resuscitation area of the local A&E department around 5.30pm, with a suspected "viral rash".

Patient Pathway: A single VC consultation took place between the local clinician, parent, child and PuC OCC. Furthering discussions, both professionals (referrer and OCC) agreed the child could be discharged. The call was closed by NHS 24.

Outcome: The final diagnosis was confirmed as a "viral rash". During the interview, the parent felt the referrer used PuC to put minds at rest and as a measure of reassurance for discharge, with the decision made locally.

VC experience: Parent 2 described the experience of using VC relatively positively, with the picture quality being "*not too bad*". This parent stated the resolution of the VC may not have been good enough to observe visual subtleties and did not know how much of the rash the OCC could examine. Despite this, the parent described the OCC conducted an examination of their child's rash (in addition to referrer). This parent described their child as being *"fascinated"* by the VC screen; it captivated their attention. In addition the parent felt a sense of relief speaking to a paediatric specialist:

> *"It put my mind to rest; obviously it put their (referrers) mind to rest too. I don't know how much of it they did for me and how much of it was for them."*

Additional relevant information: Parent 2 described having personal challenges with transport (attending A&E on foot with child in a buggy), with no family car. They discussed the potential impact transfer to a DGH would have had on the family.

> *"It was very stressful, we don't have the money to be put up overnight, and the idea of having going there (travel to a DGH), I don't drive, I haven't passed my test. So the idea of transfer would have been a nightmare."*

In addition, during the VC experience numerous nurses from the referring hospital observed the VC as a means of introduction to PuC.

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Parent 3: Child 3 (age 0-1), with Down syndrome, presents at a rural hospital with severe croup.

Presentation: A young child aged 9 months presents at a rural hospital with severe croup. This child also has Down Syndrome and a number of associated health problems. On assessment at the remote hospital, child 3 had noisy breathing, and a recent history of poor feeding and vomiting. It was agreed that a VC should take place with PuC.

Patient Pathway: A number of VC consultations took place to discuss child 3's progress. The first around 5pm, then, ongoing on and off until approximately 1am. Following signs of deterioration on follow up, it was agreed that child 3 be transferred to a central children's hospital. Parent 3 described both the OCC and local referrer being in agreement. Continuous dialogue occurred between the family, the OCC and local referrer. The transport team arrived at approximately 4am.

Outcome: Child 3 was transferred by air around 5am, to a central children's hospital, spending approximately 12 hours in intensive care and 3 days on a ward before being discharged home.

VC experience: Parent 3 described the OCC using VC for "lengthy periods" to observe child 3's breathing whilst waiting for the PICU retrieval team, zooming in regularly on the chest area and watching child 3 breathe. Parent 3 described the OOC as:

"Fantastic. He was giving instructions to the doctors and nurses, stating what would be best to do and reassuring us about things."

In addition, parent 3 mentioned that the local remote staff had challenges achieving IV access. This was undertaken at the remote hospital on arrival of the PICU retrieval team.

Additional relevant information: Parent 3 described writing a thank you card to the PuC OCC, describing the interaction as reassuring and professional. It is worth noting that the OCC involved in this consultation had previously seen this child as patient whilst working at a remote hospital. Hence, rapport had already been established between the OCC and the family.

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Parent 4: Child 4 (age 0-1), with a congenital heart defect, is brought into A&E of remote hospital by ambulance, with cold and flu symptoms.

Presentation: Child 4 (aged <12 months) has an underlying congenital heart defect. The child presents to a remote hospital with cold and flu symptoms. On assessment the local referring doctor used PuC to inform decision making prior to (already arranged) transfer to the DGH.

Patient Pathway: Child 4 was taken to a remote hospital A&E department by ambulance crew. A transfer for this child to the DGH had already been agreed (readmission) however, on arrival of the ambulance at the child's home the crew were not satisfied the child was well enough to travel by road, informing parent 4 that their child had a high temperature. Child 4 was then transported via the ambulance service to the nearest remote hospital A&E. The referring doctor (locum SHO) then used the PuC service to obtain advice about treatment prior to transfer. The first attempt to link via VC failed and a teleconference was conducted at approximately 5pm. Child 4 was prescribed ibruprofen and paracetamol. Parent 4 then described a VC taking place around an hour later at 6pm. Following the second successful VC, the child was also given and an antibiotic.

Outcome: Child 4 was transferred to by road to the DGH at approximately 8pm, the parent felt happier their child's temperature had reduced. Diagnosed with RSV bronchiolitis, child 4 spent 3 nights in the DGH before being discharged.

VC experience: Parent 4 described the use of VC during this episode, primarily to make decisions regarding treatment prior to a previously agreed road transfer. Parent 4 felt the VC experience was "*very good*", "efficient" and the OCC "*dealt with things quickly*". Parent 4 also felt the remote doctor required decision support in the case of their child's care.

It is worth noting Parent 4 explained that their child had been admitted to hospital on numerous occasions prior to their experience with PuC, they therefore found the VC service a reassuring mechanism and additionally supportive.

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Parent 5: Child 5 (age 0-1) presents OOH with Bronchiolitis

Presentation: Child 5 (aged <12 months) presents to their local GP, at around 5pm with suspected bronchiolitis. Child 5 had not been eating well and had a temperature. The local GP then uses the PuC service within the hospital A&E to link to a paediatric specialist to help decide on transfer.

Patient Pathway: Parent 5 described their child as being unwell over a number of days, visiting the GP on the day prior to using PuC. Child 5 was experiencing respiratory distress, a temperature and was not eating well. Parent 5 visited the GP at around 5pm. The local GP was also covering the OOH period and made the decision to use PuC for advice. This was the first time the local GP had used PuC. On advice of the on call consultant the decision was made to transfer child 5 to a central hospital.

Outcome: Child 5 is transferred to a central hospital for 3 days.

VC experience: Parent 5 described the experience of VC as very positive *"the VC gave us confidence about the decision; also, when we got to the hospital they were expecting us so the whole process felt very smoothe."* Parent 5 mentioned it was the first time the GP had used PuC. No technical challenges were noted with sound or visual quality. Parent 5 felt that the VC was excellent, for the remote location they lived in, describing it as a 2.5hr drive to a central hospital.

Additional relevant information: Parent 5 informed the CRH team that the consultant had been in the shower when the PuC service tried to make contact (the consultant was on call from home). This slowed the VC time by a few minutes.

Child 5 happened to be transferred to the hospital where the OCC was employed. Parent 5 described the OCC visiting child 5 *"off his own back"* when the OCC was on shift in the hospital. Parent 5 described this informal follow up in a very positive manner and was very complimentary of the PuC service.

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9 ECONOMIC EVALUATION

9.1 Introduction

In recent years, increasing pressure on NHS budgets has created a growing demand for evidence to support decision making. An economic evaluation considering both the costs and outcomes of an intervention is one approach to gathering and presenting evidence. This makes it possible to weigh up whether any benefit from the intervention is worth the cost and provides valuable information to decision-makers as they seek to make best use of resources.

As described within this report, the PuC telehealth service pilot was launched in July 2013. In order to help evaluate the PuC pilot, an economic evaluation in the form of a 'cost consequence analysis' was requested. In such analyses, the incremental costs and consequences may be laid out including, where possible, a quantitative analysis of monetary costs. Although costs and benefits are not combined into a single ratio such as cost per QALY (quality adjusted life year), the transparent nature of the analysis is useful for informing decision makers.

Non-monetary consequences, for example clinician, patient and family experience, have been presented in Sections 5 and 6 of this report, therefore the focus in this section will be on the relative monetary costs associated with PuC.

9.2 Aims

In order to assess the cost implications of the introduction of the PuC pilot, costs associated with PuC were compared with potential cost savings resulting from the introduction of the new service.

For the costs of PuC, the focus is on the additional costs associated with the service. For example, the costs of employing OCCs, clinical leads, NHS24 call handlers and technical equipment such as additional videoconferencing facilities.

The key aim of the PuC telehealth service is to improve patient care, with the hope that using videoconference to link to a paediatric specialist would reduce the number of unnecessary patient transfers to the receiving hospitals. A reduction in unnecessary patient transfers will lead to a cost saving both in terms of patient transport and hospital stay. The savings are then compared to the costs of the PuC provision and ultimately provide an indication surrounding the cost effectiveness of current PuC service model.

Here we also present an analysis of various other potential PuC service delivery models that have been put forward by stakeholders during the pilot period. This will enable an assessment of the relative cost effectiveness between the different types of PuC service delivery models available for consideration. It must be noted that these other potential service delivery models may be subject to change, and

their inclusion in this analysis is simply to illustrate the likely monetary variations between the various PuC service models.

The key components of the analyses are described under the following headings:

9.3   Data set to inform analysis

In order to fully assess any changes to patient transfer rates attributable to the introduction of PuC, it is necessary to have a suitable comparative data set. Unfortunately, owing to a paucity of data, particularly in relation to patient outcomes prior to the introduction of PuC it was not possible to accurately assess the PuC impact on patient transfer and length of stay (LoS) rates from standard NHS hospital data collection systems.

However, a validated dataset (see Section 4) set up by NHS 24 to collect PuC activity data was supplied for the first six month period of the pilot. This dataset captured a comprehensive amount of information for each patient pathway and therefore the dataset was used to inform the cost analysis.

It was agreed that the economic analysis would be based upon the expert opinion of clinicians who reviewed the appropriateness of the PuC activity captured within by the dataset. In addition to their clinical review of the PuC cases, clinicians were asked to describe whether or not PuC had altered the patient pathway, since this would allow the identification of the number of transfers that had been avoided following the introduction of the service. These figures are used to estimate a potential cost saving.

Hospital stay costs

The costs of a stay in hospital were drawn from Information Services Division (ISD) Scotland cost data. The cost used in this analysis is that of an average day case cost (£890), under the conservative assumption that the admissions that have been 'avoided' through the use of PuC are more likely to be less serious cases.

Patient transport / emergency retrieval costs

The costs of patient transfers were based on ISD cost data, using the average cost per emergency transfer for road (£266) and air (£3,771). Based on PuC activity data, 30% of transfers were by air.

Staff costs

PuC consultant on call rates and the costs to cover NHS 24 call handlers were agreed prior to the introduction of the pilot. Costs associated with the employment of a clinical lead and administration staff costs have been based upon hourly rates of respective salaries, with staff salaries based on the pre-penultimate pay point of the relevant pay scale.

Equipment costs

Videoconferencing equipment costs included the initial capital costs associated with the television, the videoconferencing software, and delivery (£5,158 per unit). An ongoing annual system support cost (£316 per unit) was also incorporated into

the analysis. It should be noted that additional videoconferencing equipment may be required at some hospitals that has not be taken into account in this analysis. Where the analysis may benefit from the addition of extra videoconferencing equipment costs, the costs presented should be considered in conjunction with the analysis presented.

9.4 Results

Base case analysis

As previously stated, the main aim of the analysis is to assess the costs surrounding the PuC telehealth service pilot. In doing so, the potential cost savings resulting from the introduction of PuC will be compared with the costs of providing the service.

Potential cost savings

The clinical expert group was able to review 20 cases from the PuC dataset, and found that PuC may have led to the avoidance of two transfers (2/20, 10%). However, their analysis indicated that PuC may have also initiated two transfers which might not have taken place otherwise and which were associated with very brief admissions.

Based on the optimistic assumption that PuC avoided two transfers (i.e excluding the initiated transfers), the estimated cost savings resulting from avoiding these transfers and the associated hospital stay costs are displayed in Table 12. The annual cost saving is estimated to be £43,264 per year.

Owing to the fact that PuC may also have initiated two transfers, these savings represent an upper estimate which may be cancelled out by the initiated transfers.

Table12: Estimated costs savings resulting from introduction of PuC telehealth service

Rate of transfers avoided (%) [1]	Estimated number of PuC calls per year [2]	Number of transfers avoided per year	Cost per transfer and hospital stay [3]	Cost saving per year
10	196	19.6	£ 2,207	£ 43,264

[1] clinical expert opinion following review of PuC dataset. [2] PUC data analysis based on 6 month data [3] ISD daycase and emergency transfer costs (30% of emergency transfers by air)

- Potential cost savings from PuC = £43,264 per year

Cost of PuC

The costs associated with PuC are based on the current PuC pilot service. However, it must be noted at this stage that the costs of the current pilot may not be representative of the service were it to be rolled out beyond the pilot phase. As

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such, the base case analysis includes two cost scenarios, one for the PuC pilot costs and one for the costs of the same service model beyond the pilot period.

Pilot cost

The costs of the PuC pilot include a consultant fee of £100 per four hour session (£25 per hour), with a second on-call consultant providing the service at no cost. These fees were agreed prior to the introduction of the pilot. Also included is the cost of the clinical lead for PuC (£68,000 per year), and the costs paid to NHS24 (£32,000) to cover call handling costs – as agreed prior to the PuC pilot. Finally, the cost of one set of videoconferencing equipment was included for Broadford Hospital, with videoconferencing equipment already available in the other participating hospitals.

The annual cost of PuC pilot is estimated to be £324,474. Comparing the costs of the PuC pilot with the potential cost savings (Table 12), results in an estimated overall incremental cost associated with PuC of £281,210 per year.

Table13: Costs associated with PuC telehealth service pilot

Current PuC pilot	Key cost component	One-off cost	Ongoing cost/salaries	Total annual cost
	On call consultant 1	n/a	£ 219,000	£ 219,000
	On call consultant 2	n/a	£ 0	£ 0
	Clinical lead	n/a	£ 68,000	£ 68,000
	NHS24 call handlers	n/a	£ 32,000	£ 32,000
	Videoconference equipment	£ 5,158	£ 316	£ 5,474
			TOTAL	**£ 324,474**

Cost of PuC pilot service model beyond pilot period

The above costs are unlikely to be representative of the service model beyond the duration of the pilot. As such, the expected full costs associated with the same service are presented below.

During the pilot, reimbursement of OCCs was limited to £25 per hour. Standard consultant on-call rates are likely to be in the region of £65 per hour, which would apply to both the first and second on-call consultant. Incorporating these amendments into the analysis shows that the full cost of the PuC pilot service model is estimated to be in the region of £1.244m in the first year and £1.239m each year thereafter (Table 14). Combining these figures with the expected cost savings associated with PuC (Table12), shows that PuC is associated with incremental costs of over £1m per year.

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Table 14: Costs associated with current PuC service model beyond pilot period

Current PuC pilot	Key cost component	One-off cost	Ongoing cost/salaries	Total annual cost in first year	Total annual cost thereafter
	On call consultant 1	n/a	£ 569,400	£ 569,400	£ 569,400
	On call consultant 2	n/a	£ 569,400	£ 569,400	£ 569,400
	Clinical lead	n/a	£ 68,000	£ 68,000	£ 68,000
	NHS24 call handlers	n/a	£ 32,000	£ 32,000	£ 32,000
	Videoconference equipment	£ 5,158	£ 316	£ 5,474	£ 316
			TOTAL	**£ 1,244,274**	**£ 1,239,116**

Summary of base case analysis

Based on the optimistic assumption that PuC avoided two unnecessary admissions, the cost savings associated with PuC may reach £43,264 per year. The cost of providing PuC was estimated to be £324,474 per year. Combining these figures suggests that PuC resulted in an incremental cost of £281,210 per year.

However, the costs of the PuC pilot are not reflective of the full service model costs. Accounting for these additional costs demonstrates that PuC may be associated with an incremental cost of over £1m per year.

- Full costs of PuC service model = £1.2m per year

9.5   Costs of alternative PuC service models

So far, the costs associated with PuC have been based upon the pilot service delivery model. However, a number of alternative service models have been proposed by stakeholders, were PuC to be rolled out beyond the pilot phase.

Owing to the complexities surrounding the provision of a PuC service, there are likely to be a number of potential service delivery models. In generating potential options, there are three broad factors to take into account;

1) Provision of clinical advice – access to consultants' time. Considerations include;
   - Rota paid for separately (i.e. as per agreement for the PuC pilot)
   - Rota populated by multiple consultants from across boundaries who are currently on a paediatric rota – paying no attention to how busy the unit is they are currently working in
   - As above with some refinement perhaps to the more quieter departments, where you are more likely to get a timely response
   - Rota populated by a single team by funding an additional consultant
   - More formalised arrangements building on current linkages across boundaries (for example, Aberdeen / Shetland / Orkney or Inverness / Belford and Wick)

2) Hosting and facilitating of PuC service
   - Nationally through, for example, NHS 24 or SCOTSTAR (Scottish Specialist Transport and Retrieval)
   - Local arrangements across existing / more formalised links between health boards
   - Regionally – one board takes it on for the region / national area

3) Accessing / using the service
   - Local board decisions which may result in some deciding there is a local need and not others.
   - All boards nationally
   - Regionally, for example, North of Scotland only
   - Paramedics
   - General Practitioners

In combining these factors, there may be a number of permutations surrounding the future PuC service model. However, to facilitate discussion surrounding the potential options, an overview of service models that have been proposed so far has been provided below. The respective cost impact of each proposed option is then estimated, which will enable a comparison to be made between the costs of these service models and the original PuC pilot model. Ultimately, this analysis will help decision making surrounding the most cost effective service model.

At this stage is must be clarified that the details surrounding the proposed alternative service models will be subject to change, and the inclusion of the proposals in the analysis is simply to illustrate the likely cost variations between the different kinds of service models.

Option 1

Option 1 is simply the current PuC pilot service as presented above.

Option 2

Option 2 is based on the assumption that the delivery of PuC could be added to OCC existing job plans. In Option 2, it is assumed that PuC would be provided from one hospital within the current PuC pilot area. Key points for the cost analysis include;

- One hospital (with both a paediatric in-patient unit and robust existing on-call services) takes on all PuC provision
- Paediatric OCC PuC workload added to existing job plans
- Additional clinical lead and administrative support incorporated within current work plans
- Hospital providing PuC service and rural hospitals assumed not to require additional videoconferencing equipment
- Call handling provided by NHS switchboard[17]

Table 15: Costs associated with Table 15 presents the potential costs associated with PuC Option 2. Based on the number of PuC calls made during the pilot (98 over 6 months), it is estimated that staff will need to handle approximately 4 PuC calls per week, with each call assumed to require an hour of staff time. This additional workload will be incorporated into work plans, the cost of which has been based upon respective hourly on-call and salary rates. The total annual cost of Option 2 is estimated to be £28,729.

Table 15: PuC Option 2

Option 2	Key cost component	One-off cost	Ongoing cost/salaries	Total annual cost
	On-call consultant 1[1]		£ 13,520	£ 13,520
	On-call consultant 2[2]		£ 3,380	£ 3,380
	Clinical Lead support[1]		£ 9,562	£ 9,562
	Administrative support[1]		£ 2,268	£ 2,268
	Videoconference equipment	n/a	n/a	n/a
			TOTAL	**£ 28,729**

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[17] No costs have been assigned to NHS switchboard call handing. Local data may be required to supplement the analysis presented.

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Option 3

As with Option 2, Option 3 is based on the assumption that the delivery of PuC could be added to OCC existing job plans. The key difference with Option 3 is that the PuC service would be provided from a number of receiving centres based on the pre-established links between receiving centres and their corresponding rural hospitals. Key points for the cost analysis include;

- Each receiving centre provides a PuC service to their linked rural hospitals
- Paediatric OCC PuC workload added to existing job plans
- Additional clinical lead and administrative support added to existing work plans
- Assuming no additional videoconferencing equipment
- Call handling provided by NHS switchboard[18]

Table 16 presents the potential costs associated with PuC Option 3. Based on the number of PuC calls made during the pilot from each of the rural hospitals, it was possible to estimate the expected workload for staff in each of the receiving centres. The largest volume of calls during the pilot period came from the rural hospitals linked with DGH Raigmore in Inverness (64), with relatively few calls made to Glasgow Yorkhill (10) and Aberdeen RACH (8). The number of calls per week was rounded up for each receiving centre, with each call assumed to require an hour of staff time. This additional workload will be incorporated into work plans, the cost of which has been based upon respective hourly on-call and salary rates. The total annual cost of Option 3 is estimated to be £41,827.

It is considered necessary to draw attention to the additional cost of Option 3 compared to Option 2. Although the total number of calls coming into PuC will be the same for both options – which suggests that the costs should be the same - the costs for Option 3 are higher because the overall number of staff required to provide the service is higher, and one team providing the entire PuC service (Option 2) offers economies of scale.

Table 16: Costs associated with PuC Option 3

Option 3	Key cost component	One-off cost	Ongoing cost/salaries	Total annual cost
	On-call consultant 1[1]		£ 16,900	£ 16,900
	On-call consultant 2[1]		£ 10,140	£ 10,140
	Clinical Lead support[1]		£ 11,952	£ 11,952
	Administrative support[1]		£ 2,835	£ 2,835

[18] No costs have been assigned to NHS switchboard call handing. Local data may be required to supplement the analysis presented.

	Videoconference equipment	n/a	n/a	n/a	
				TOTAL	**£ 41,827**

[1] costs based on staff time required to handle workload at each receiving centre. Number of calls rounded up to 1 where average calls per week <1.

Option 4

Option 4 is intended to capture the proposal that funding for an additional full time consultant may be provided to one hospital –potentially outwith current PuC pilot –who would then take on responsibility for all PuC provision. Key points for the cost analysis include;

- One hospital (not necessarily in the north of Scotland) with both a paediatric in-patient unit and robust existing on-call services would provide PuC service nationally
- Requirement for an additional consultant to cover PuC workload and additional administrative support
- No requirement for additional clinical lead support
- Likely requirement for additional videoconferencing equipment at the hospital providing the PuC service
- Call handling provided by NHS switchboard[19]

Table 17 presents the potential costs associated with PuC Option 4. This service model was expected to offer an additional consultant for the hospital providing the PuC service, with the hospital then expected to pool their resources to provide the national PuC service. As such, no additional clinical lead or administrative support has been included for this option. Additional videoconferencing equipment costs have been assumed for the hospital providing the PuC service. The total annual cost of Option 4 is estimated to be £95,155 in the first year and £89,956 thereafter.

Table 17: Costs associated with PuC Option 4

Option 4	Key cost component	One-off cost	Ongoing cost/salaries	Total annual cost in first year	Total annual cost thereafter
	Full time consultant[1]		£ 89,640	£ 89,640	£ 89,640
	Videoconference equipment (receiving hospital)	£ 5,158	£ 316	£ 5,474	£ 316
	Videoconference equipment (rural hospitals)	n/a	n/a	n/a	n/a
			TOTAL	**£ 95,155**	**£ 89,956**

[19] No costs have been assigned to NHS switchboard call handing. Local data may be required to supplement the analysis presented.

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Option 5

Option 5 is based on the assumption that the PuC service will be incorporated with ScotSTAR (Scottish Specialist Transport and Retrieval). Points for consideration include;

- 24/7 dispatch team at control centre
- Videoconference equipment required at control centre
- No separate rota for paediatricians within ScotSTAR, so no additional medical rota costs

Option 5 remains a plausible option for the PuC service. However, owing to the fact that some of the key features of this option are still to be finalised, the costs for Option 5 have not been presented.

Summary of cost analyses

The various analyses have shown that the cost of PuC will vary dramatically depending on the model of care. To help illustrate this, a summary of the costs for each option is provided in Table 17, with the costs also compared to the potential cost savings from PuC.

Table 17: Summary of costs associated with each option

Option	Annual cost	Potential cost saving[1]	Incremental cost
1 (pilot cost)	£ 324,474	£ 43,264	£ 281,210
1 (pilot model)	£ 1,244,274	£ 43,264	£ 1,201,010
2	£ 28,729	£ 43,264	£ -14,535
3	£ 41,827	£ 43,264	£ -1,437
4	£ 95,155	£ 43,264	£ 51,891
5	n/a	n/a	n/a

[1]As described above, these potential cost savings are based on the optimistic assumption that PuC avoided an unnecessary admission in 2 of 20 cases.

The current PuC pilot model is likely to be the most expensive service delivery model, particularly beyond the pilot phase, with costs of over £1m per year.

Options 2 and 3 are the lowest cost options with costs of £28,729 and £41,827 respectively. Once again, it is worth highlighting that although the total number of calls incorporated into work plans will be the same, the lower cost of Option 2 (one PuC centre) compared to Option 3 (many PuC centres) is calculated based on the likely economies of scale from only having one PuC centre.

Table 8 also shows that the potential cost saving from PuC may in fact offset the additional costs for Options 2 and 3. However, once again it must be noted that the cost savings are an optimistic upper estimate.

- Current PuC model most expensive. Lowest costs options are Options 2 and 3 where PuC workload added to existing job plans.

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Cost effectiveness assessment

The purpose of this economics analysis is to provide an assessment of the cost effectiveness of PuC. As such, the relative costs of the PuC service models will now be considered in light of their respective consequences. This will help to guide decision makers as to which model is likely to be the most cost effective option.

Consequences of PuC

As described previously, the consequences (i.e. relative benefits) of PuC have not been quantified for this evaluation. However, it is worth re-iterating the various impacts that the introduction of PuC had on patient care and service provision – as presented in Section 5 and 6 of this report - primarily the enhanced consistency in the patient pathway, with specific reference made to an improved consistency in the pattern of clinical decision support (equality of access) and the usefulness of enhanced visual communication via videoconferencing, for this patient group.

Limitations however were also identified to the PuC service, regarding connectivity and technical videoconferencing (poor picture or audio) quality noted, as was the fact that undertaking videoconferencing during unscheduled care can be logistically difficult. Finally, one key concern surrounding the introduction of PuC more locally relates to the impact that it may have on pre-established relationships between the rural centres and their respective regional centres.

Combining costs and consequences

Options 2 and 3 are the options associated with the lowest cost. Under a very general assumption that all options will provide a similar level of service to patients, then these options are most likely to be cost effective.

Furthermore, based on the figures presented in Table 8, an optimistic conclusion would be that even if PuC provided no additional benefits over the previous 'pre-PuC' model of care, then options 2 and 3 may be considered more cost effective since the associated savings may be greater than the additional costs.

Focussing upon Options 2 and 3, the analysis shows that Option 3 is £13,097 more costly than Option 2. If PuC were to be rolled out beyond the pilot period, it will be worth considering whether the additional cost of Option 3 is worth any additional benefit the option provides. For example, since Option 3 assumes that each of the regional receiving centres will be linked with their respective rural hospitals, this will negate some of the concerns surrounding the view that PuC disrupts some of the pre-established relationships. On the other hand, it may be that providing PuC from one regional centre in Option 2 will lead to benefits surrounding continuity of service provision.

- Option 3 associated with slightly higher cost than Option 2. Is the additional cost justified by, for example, maintaining pre-established links between hospitals?

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9.6   Economic Conclusion

The aim of this analysis was to provide economic evidence to support the decision making surrounding the future provision of PuC telehealth service. The costs of various service delivery models have been established, and considered alongside the estimated cost savings resulting from PuC. Account has then been taken of the benefits of PuC, to help guide decision makers surrounding the likely cost effectiveness of each option.

In summary, the analysis has illustrated that the current PuC pilot is considerably more expensive relative to some of the other proposed service models. Owing to the fact that the difference in service provision is unlikely to be sufficient to justify the additional costs associated with the PuC pilot model, then the options most likely to be considered cost effective are Options 2 and 3 where the provision of PuC is assumed to be added to existing job plans.

As a final point it is worth noting that the data collected by NHS 24 on unscheduled paediatric care is a valuable resource for informing evaluations of the service. Ongoing PuC models may want to look at costs associated with continuing collecting this material at a local level.

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10 CONCLUSIONS & RECOMMENDATIONS

The PuC pilot was developed in line with national eHealth policy in Scotland, and represents a logical response to the challenges laid out in the Dunhill report. There is sparse evidence of the costs and benefits of similar paediatric models in the international literature which could have been used to guide implementation. The pilot highlights the complex system-wide and local issues which occur with any type of service re-design. As with many pilot projects, the initial stages have proved to be particularly challenging.

There are important limitations to this evaluation. The quality of data prior to PuC was very poor, particularly because of inconsistencies in policies for recording short hospital admissions, and we can not be sure how many children bypassed the PuC service during the pilot. It is difficult to measure differences in quality of care attributable to PuC, given that there is no credible pre-pilot or concurrent data for comparison. Other limitations of the evaluation relate to delays in receipt of accurate data, impacting in particular on samples sizes for the family interviews and on the quality of evidence for or against any changes in clinical management attributable to PuC.

A total of 98 calls was made to the PuC service between August 2013 and January 2014: approximately four per week. The largest proportion (n=36) of these calls was from Caithness hospital and the smallest proportion (n=4) from Western Isles hospital. Most (60/98) calls were conducted by VC, most of the remainder by telephone. A small majority (53%) of calls conducted by VC and involving all attendees (call hander, OCC and referrer) were progressed within a 10-minute period. This was the main NHS 24 key performance indicator for PuC. Nine emergency retrievals and 21 transfers took place on first contact with PuC, during the first six months of the pilot, with 27 closed calls. Follow up consultations were agreed on first contact with PuC in 34 cases (resulting in a further nine agreed transfers).

The views of OCCs, referrers and parents on the PuC service were generally positive. Participating OCCs described the calls to the PuC pilot service as appropriate, but the type of call depended on the referrer's level of clinical experience. A substantial proportion of calls was from very junior medical staff who appeared to be particularly positive about the support they received.

Consultant-led VC allowed a more consistent pattern of support than was possible with previous communication pathways and it may offer educational opportunities, particularly to junior staff. VC can act as a useful mechanism for aiding decisions on discharge / transfer and for supporting staff dealing with sick children pending transfer. VC OCC support improved the confidence of staff observing unwell children.

There were however some important difficulties. Accountability, governance issues and clinical responsibility for the child during the PuC pilot caused tension in some cases,

for example when the OCC's opinion differed from that of the receiving hospital or when the referring doctor was satisfied that transfer was required and was not seeking another opinion. One participating RGH eventually withdrew from the pilot because of governance concerns. Stakeholder views were divided about risk, clinical decision making and responsibility for children throughout the pilot.

Staff from three peripheral hospitals raised concerns that the introduction of PuC jeopardised pre-existing clinical relationships with either hub paediatricians or PICU retrieval teams. Furthermore, some referrers and OCCs considered that lack of OCC knowledge of local workforce patterns, transport and geography may have hindered decision making. There was evidence that PuC was deliberately bypassed on a number of occasions, although it is not possible to quantify the number of episodes. Bypass occurred when remote referrers felt consultation time would be quicker, problems with VC existed or where the appropriateness of the use of VC was questioned. Undertaking VC during the unscheduled care period was not always considered appropriate, technically or logistically possible in a small remote hospital environment; the telephone was often preferred or used as an alternative.

At the local level, it can be difficult to observe children for lengthy periods of time in remote hospitals – and there is variation in availability of facilities, VC, staff capacity and the competence / confidence of these staff.

The process of NHS 24 call handling was highlighted as an area for improvement. The negotiation of contractual arrangements for OCCs has also proved particularly challenging.

It is not clear whether the introduction PuC produced any net impact on the number of potentially avoidable transfers for self-limiting conditions. Costs associated with the current PuC model are however high (estimated at £1.2M per year if rolled out). Lower cost options are available which involve models where the PuC workload is added to existing job plans.

PuC has introduced a systematic way of recording clinical data on the unscheduled patient pathway for children. The data collected by the call handler, coupled with the (SBAR) OCC information recorded are useful sources of information to further understand transfer, referrals, and retrieval patterns.

Recommendations

Continued improvement to VC technology (in terms of video resolution and bandwidth) is likely to improve paediatric unscheduled care offered in remote hospitals in Scotland.

We recommend that the next phase of the PuC roll-out should involve VC links between remote and rural hospitals and an on-call consultant based in their usual receiving

hospital. This will require some additional contracted on-call time for the consultants but is likely to be roughly cost-neutral.

Further improvements to services to families would be likely if consideration could be given to provision of better locally-based accommodation for children who might benefit from a period of observation prior to a transfer decision being made. This accommodation should be able to house the VC facilities. In the meantime an audit of local capacities and competencies, and guidance on when it is acceptable to observe a child should be offered. There is a strong case for offering EPLS training to all clinicians seeing acutely unwell children in remote settings.

Data collected on unscheduled paediatric care is a valuable resource for informing evaluations of any future service. Ongoing PuC models should consider the allocation of some resource for continuing data collection at local level linked to a national-level administrative and evaluation resource.

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