Clinical efficacy, cost-analysis and patient acceptability of OPAT: a decade of Sheffield OPAT service

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The Sheffield OPAT Service

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Sheffield OPAT Service

- Established in Jan 2006 – two specialist nurses & one ID physician
  - Two-bed 'side room'
- '16-bed' outpatient 'infusion centre'
- Multidisciplinary team
  - three ID physicians
  - Specialty Physician
  - Trainee doctors – SpR & SHO
  - Nursing team – 2 Nurses Specialists, 4 NPs, 1 Snr Staff nurse, 3 Reg. nurses
  - Support workers
  - Admin staff
  - Pharmacist
  - Microbiologist input

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Sheffield OPAT Service

- Models of care:
  - Outpatient ‘therapy centre’
  - Patient/carer self-administration
  - District nurses
- Means of transport:
  - Local taxis (free)
  - Self (free parking)
  - Ambulance service
- Weekly MDT virtual ward round
- Weekly OPAT Clinics

Sheffield OPAT Service

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Virtual Rounds

Admin Staff

Nurse Practitioner

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Sheffield OPAT Service

- 50+ patients at any time
- Referrals from wards, ED, primary care & self-referrals
- Patient groups:

Short-term:

- Mainly cellulitis – SSTI
- Referral from wards, MAU, A&E, GPs, self-referred
- Attend OPAT unit daily
- IV butterfly needles; Leaderflex® (short term)
- Average treatment: 4.9 days
- Daily review

Longer term:

- Wide range of infections
- Referral mainly from wards
- PICC line; Midlines
- Self-administration or district nurses
- Treatment: 2-6+ weeks
- Weekly review

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- Patients are enrolled after medical and nursing assessment
- **Prospectively maintained electronic database**

Pre-defined Criteria

- Age >16 years
- Infection require IV antibiotics
- Abx suitable for admin via OPAT
- Medically stable
- Adequate venous access
- Consent to OPAT
- Safe social circumstance

Mandatory:

- Referral letter + follow-up plan
- BBV screen
- DVT risk assessment
- Weekly MDT: with microbiologist, pharmacist, nursing team
- **Periodic patient survey**
- Database record

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Rationale/Aim

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Sheffield OPAT Service

- Many studies have demonstrated that OPAT is indeed an effective and safe service.
- Long-term cost savings of OPAT have not been fully studied in the setting of the UK National Health Service *(to our knowledge)*
- **Our study examined the clinical efficacy, patient acceptability and cost savings from the use of OPAT within the NHS**

Hitchcock J *et al*. Establishment of an OHPAT service at a London teaching hosp: a case series. *JAC* 2009; 64: 630-4.

Matthews PC *et al*. OPAT: is it safe for selected patients to self-administer at home? A retrospective analysis of a large cohort over 13 yrs. *JAC* 2008; 61:226

Barr DA *et al.* OPAT in a teaching hospital-based practice: a retrospective cohort study describing experience and evolution over 10 years. *IJAA* 2012; **39**: 407-13.

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Chapman et al. Clinical efficacy and cost-effectiveness of OPAT: a UK perspective. JAC 2009: 64: 1316-24

Nathwani D et al. Cost-minimisation analysis and audit of antibiotic management of bone and joint infections with ambulatory teicoplanin, inpatient care or outpatient oral linezolid therapy. JAC 2003; 51: 391-6

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Methods

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- A retrospective review of our electronic database
  - patients episodes between January 2006 and January 2016.
- We compared the real costs of the OPAT service with estimated costs of conventional inpatient care for these patient episodes.
- We also analysed patient feedback questionnaires that were randomly administered between January 2014 and January 2015.

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Cost-analysis

- Total costs of OPAT = Actual costs + Costs of readmissions following adverse events deemed due to OPAT

- Actual costs = Annual financial records

- Cost of **four** readmissions:
  1. Humerus fracture after falling on way to the OPAT unit
  2. Cut off end of PICC line while self-administered
  3. Line related infections – self-administered
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- Costs deflated/inflated to 2011/12 prices using the hospital and community health services pay and price index

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Cost-analysis

Costs of conventional inpatient care = Bed days saved x Unit cost

- Length of OPAT care (bed days saved) = length of inpatient stay
- An healthcare resource group (**HRG4**) code identified for each diagnosis
- Associated 2011/12 unit cost from NHS resource costs:
  - Our directorate of Communicable diseases average costs per day
  - Lowest unit cost for other departments in our hospital
  - National average non-elective inpatient unit costs
  - Lowest national average non-elective cost in each diagnostic category

HRG = standard groupings of clinically similar treatments which use common levels of healthcare

- used as a means of determining fair and equitable reimbursement for care services delivered by providers

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Results

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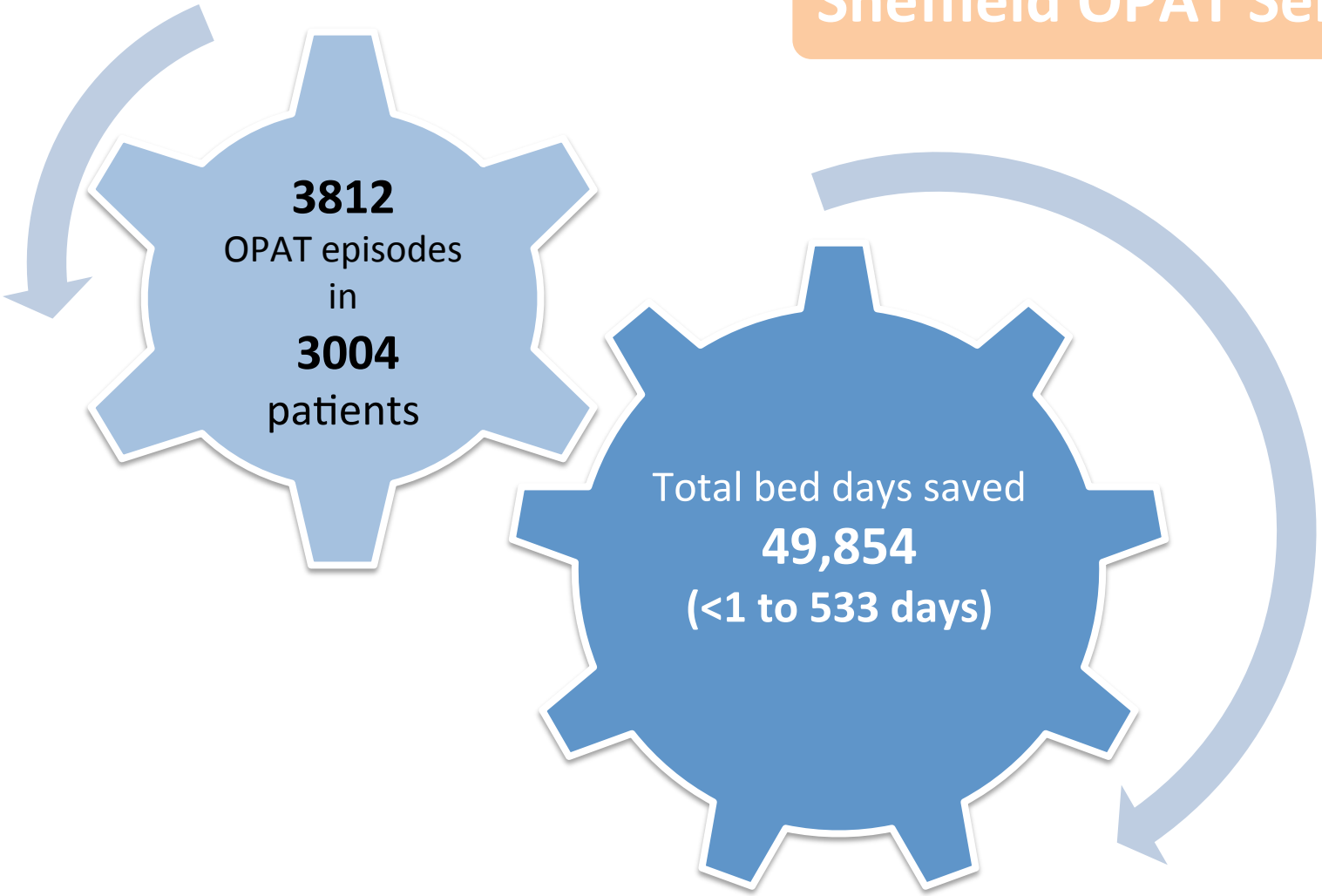

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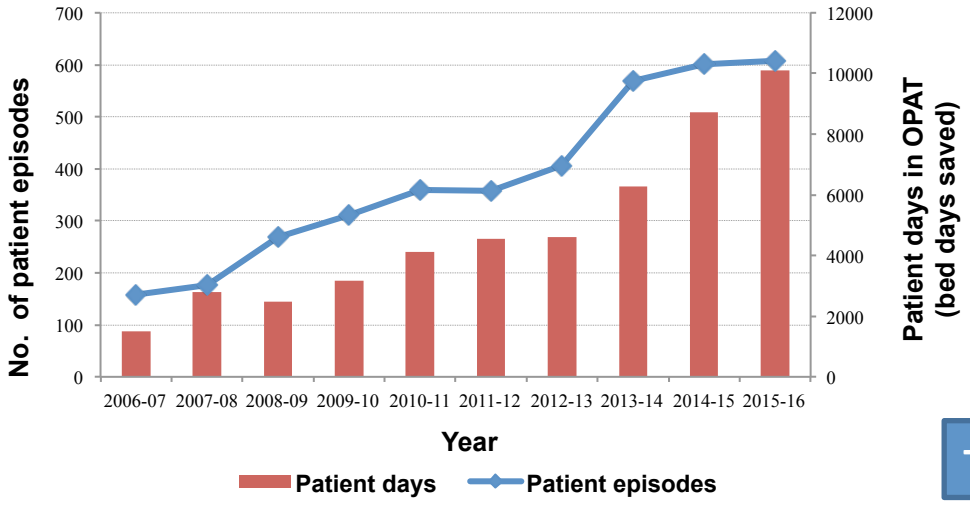
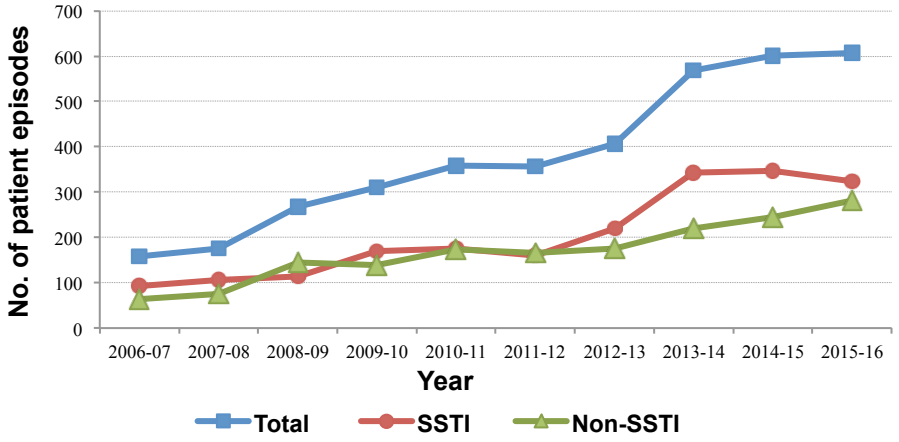
OPAT patient episodes & days by year: 2006-2016



Trends in patient episodes by diagnostic category



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Number of patient episodes, patient days in OPAT (bed days saved) and estimated costs of inpatient care for patients receiving OPAT

Diagnostic category	HRG4 codes	No. (%) of patient episodes	No. (%) of bed days saved	STH ID unit cost (£)	Minimum STH cost (£)	National cost (£)	Minimum national cost (£)
Bacteraemia	WA09Y, WA03Y, FZ36C	94 (2.5)	1210 (2.4)	703559	316391	274967	271656
Bone and joint infections (Spinal infections)	HD25C, HD21C	180 (4.7)	7302 (14.6)	4968813	3693715	1741649	1707738
Bone and joint infections (Others)	HD31C	171 (4.5)	6632 (13.3)	1610794	1403306	1443507	1427028
Cardiovascular System infections	EB01Z, EB02Z, QZ20Z	160 (4.2)	3759 (7.5)	758933	375698	937679	875636
Central Nervous System infections	AA22B, WA07Z	364 (9.5)	3233 (6.5)	3163005	257282	869873	568123
ENT infections	CZ22Y, CZ21Y, WA09Y	40 (1.0)	1646 (3.3)	1240109	423582	395149	369541
Intra-abdominal infections (hepatobiliary)	GC15D, GC16D	32 (0.8)	904 (1.8)	774597	166119	205127	205065
Intra-abdominal infections (other)	FZ45B, FZ47B, FZ36C, LA04F, LB06F, WA06Y	27 (0.7)	507 (1.0)	400466	107319	129291	116832
Invasive fungal infections	WA09Y	24 (0.6)	303 (0.6)	142565	55325	68026	68026
Leishmaniasis	WA07Z	20 (0.5)	250 (0.5)	117628	59783	43932	43932
Lyme disease	CZ21Y	23 (0.6)	595 (1.2)	457948	161679	142955	142955
Respiratory tract infections	DZ10C, DZ11C	151 (4.0)	2188 (4.4)	1233793	528539	509697	436959
Skin and soft tissue infections	HD21C, JD02C, JD04C, WA09Y	2183 (57.3)	15973 (32.0)	13300000	2505355	4187729	3586003
Tuberculosis (including MDR-TB)	DZ14B	22 (0.6)	1499 (3.0)	922440	701157	391232	391232
Urogenital infections	LB37B, LB28B, LB35B, MB04B	295 (7.7)	3530 (7.1)	2615305	1121921	839392	767137
Unrecorded	WA09Y	2 (0.1)	20 (0.1)	9410	3652	4490	4490
Others[a]	WA09Y, FZ47B, CZ21Y, CZ22Y, WA07Z, WA08Z, DZ29B, SA12F, JD03C	24 (0.6)	303 (0.6)	296628	80258	79693	63426
Total		**3812**	**49854**	**32715992**	**11961081**	**12264388**	**11045779**

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OPAT Model & Mode of Transport

	Number (%)
Model of antimicrobial administration (*n* = 3812)	
Daily attendance at OPAT unit	2948 (77.3)
Self/carer administered at home	458 (12.0)
Community nurses administered at home	305 (8.0)
Not recorded	101 (2.6)
Mode of transportation to OPAT (*n* = 3812)	
Taxi	2054 (53.9)
Self	1592 (41.8)
Ambulance	88 (2.3)
Not recorded	78 (2.0)

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Antimicrobials & Vascular Access

	Number (%)
Antimicrobial agent (*n* = 3936)	
Ceftriaxone	2565 (65.2)
Ertapenem	328 (8.3)
Teicoplanin	228 (5.8)
Flucloxacillin	202 (5.1)
Ceftazidime	150 (3.8)
Amphotericin B	67 (1.7)
Daptomycin	64 (1.6)
Meropenem	55 (1.4)
Piperacillin/tazobactam	44 (1.1)
Vancomycin	26 (0.7)
Other agents	205 (5.2)
Type of vascular access device (*n* = 3581)	
Butterfly needle	2188 (61.1)
Peripheral IV cannula – Venflon®	391 (10.9)
Peripherally inserted central catheter	897 (25.0)
Hickman®	98 (2.7)
Portacath	7 (0.2)

Variable	No. (%) of patient episodes
Outcome (*n* = 3812)	
Improved	3327 (87.3)
Cure	30 (0.8)
Readmitted	265 (7.0)
No change	27 (0.7)
Change of plan	34 (0.9)
Death	2 (0.1)
Not recorded	127 (3.3)

Clinical Outcomes

Variable	No. (%) of patient episodes
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OPAT Outcomes Criteria

Patient Outcome	
Cure	Completed OPAT therapy +/- oral step down for defined duration with resolution of infection and no requirement for long term antibiotic therapy (usually relates to less severe infections eg SSTI).
Improved	i. Complete OPAT therapy +/- oral step down with partial resolution of infection but need for further follow up OR ii. Completed OPAT therapy but required escalation of antimicrobial therapy during OPAT (without admission) +/- oral step down with ultimate cure or partial improvement (as above).
Failure	Progression or non-response of infection despite OPAT, required admission, surgical intervention or died for any reason

BSAC OPAT National Outcomes Registry - NORS

OPAT Outcome	
Success	Completed therapy in OPAT with no change in antimicrobial agent, no adverse events, cure or improvement of infection and no readmission
Partial Success	Completed therapy in OPAT with either change in antimicrobial agent or adverse event not requiring admission
Failure of OPAT	Readmitted due to infection worsening or due to adverse event. Death due to any cause during OPAT
Intermediate Outcome	Readmission due to unrelated event e.g. chest pain

Outcomes

Readmissions

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Readmitted	265 (7.0)
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Change of plan	34 (0.9)
Death	2 (0.1)
Not recorded	127 (3.3)
Reasons for readmission (*n* = 265)	
Elective admission	17 (6.4)
Inappropriate referral	17 (6.4)
Clinical deterioration/no improvement	115 (43.4)
New event, not related to infection	73 (27.5)
Adverse drug reaction	24 (9.1)
Line-related complications	3 (1.1)
CDAD	2 (0.8)
Logistics/transport	4 (1.5)
Not recorded	10 (3.8)

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- 15 cases of line-related infections
  - 0.4%; cumulative risk 0.3 events per 1000 OPAT patient days
- Two of 458 self-administer had line-related infections
  - 0.4%; cumulative risk 0.1 events per 1000 OPAT patient days
- 27 other line-related complications (e.g. phlebitis, thrombosis)
  - 0.7%; cumulative risk 0.5 events per 1000 OPAT patient days

Sheffield OPAT Service

- Database: no prospective data on healthcare-associated infections

- Aberdein et al retrospectively reviewed Sheffield OPAT service between April 2006 and December 2011:
  - 7 cases of CDI following OPAT
  - All but one had other possible cause for their CDI
  - Reported 6 cases of CDI per 100,000 OPAT-days

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Aberdein J, Chapman AL. *Clostridium difficile* infection following OPAT. J Hosp Infect 2015; 90: 171-2

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Sheffield OPAT Service

	Cost (£)	Relative Cost
Total Cost of OPAT	**£4,824,507**	-
STH's Directorate of Communicable Diseases unit cost	£32,715,992	**14.7%**
Minimum STH unit cost (non-ID)	£11,961,081	**40.3%**
National average unit cost	£12,264,388	**39.3%**
Minimum national unit cost within each diagnostic category	£11,045,779	**43.7%**

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Not considered:

- Indirect benefits and cost savings to patient and health care (e.g. HCAIs, QoL, ↑ productivity etc)

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Patient satisfaction survey: 2014-15 (n = 147)

Variable	No. (%) of responses
Model of antimicrobial delivery	
Daily attendance at OPAT unit	117 (79.6)
Self/carer administration	13 (8.8)
Community nurse	14 (9.5)
Not completed	3 (2.0)
Use the help/advice line	
Yes	10 (6.8)
No	130 (88.4)
Not completed	7 (4.8)
Expectations met	
Yes	143(97.3)
No	1 (0.7)
Not completed	3 (2.0)
Would choose the service again	
Yes	144(98.0)
No	1 (0.7)
Not completed	2 (1.3)
Overall rating of the OPAT service	
Poor	0 (0)
Good	0 (0)
Very good	16 (10.9)
Excellent	130 (88.4)
Not completed	1 (0.7)

Patient satisfaction survey: 2014-15 (n = 147)

Variable	No. (%) of responses
Model of antimicrobial delivery	
Daily attendance at OPAT unit	117 (79.6)
Self/carer administration	13 (8.8)
Community nurse	14 (9.5)
Not completed	3 (2.0)
Use the help/advice line	
Yes	10 (6.8)
No	130 (88.4)
Not completed	7 (4.8)
Expectations met	
Yes	143(97.3)
No	1 (0.7)
Not completed	3 (2.0)
Would choose the service again	
Yes	144(98.0)
No	1 (0.7)
Not completed	2 (1.3)
Overall rating of the OPAT service	
Poor	0 (0)
Good	0 (0)
Very good	16 (10.9)
Excellent	130 (88.4)
Not completed	1 (0.7)

Sheffield OPAT Service

Patient feedback

"It allowed me time with my baby daughter"

"They trained my wife so we did not have to visit every day."

"It gave me my life back …. being able to contribute towards my treatment felt so great."

"Clear and concise information – security of knowing that advice and support was readily available but still feeling empowered."

"The nurses were like angels, nothing was too much trouble for them. A smile, a friendly word and even a cup of tea."

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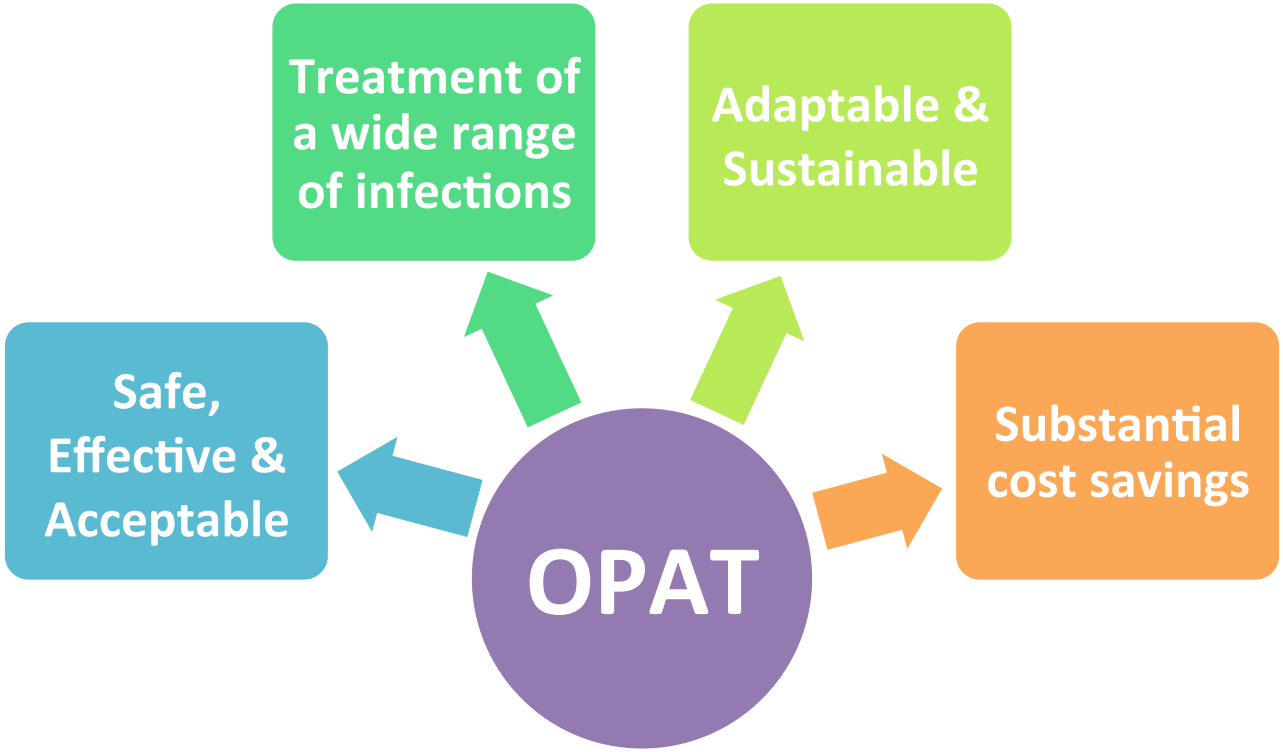

Conclusion

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Final Note

- Cost savings could be maximised with closely monitoring to prevent complications and readmissions
- Risk assessment, management and quality assurance systems – in accordance with existing practice guidelines
- Studies into cost-effectiveness and patient preference for the different models of OPAT service
- Single OPAT tariff – since no single funding mechanism supports OPAT across the UK

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- **Dr Helen Bell** - Research Assistant in Health Economics, Health Economics & Decision Science (HEDS) School of Health & Related Research (ScHARR), University of Sheffield
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- **Dawn Andrew** - Lead Clinical Nurse Specialist, OPAT Sheffield
- **Dr Fotinie Ntziora** - Specialty Physician in Infectious Diseases and OPAT
- **Ann Chapman** - Consultant / Honorary Clinical Associate Professor in infectious diseases Monklands Hospital, Airdrie, Scotland

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- **Kathryn Eaves** – Clinical Nurse Specialist
- **Adele Field** – Nurse Practitioner
- **Nidge Kendrick** – Nurse Practitioner
- **Val Miles** – Nurse Practitioner
- **Claire Shaw** – Nurse Practitioner
- **Julie Thornton** - Senior Staff Nurse
- **Cath Roper** – Registered Nurse
- **Pat Silverwood** -– Registered Nurse
- **Lynne Cotton** - Registered Nurse
- **Mandy Tivey** - Phlebotomist/Support worker
- **David Niven** – Phlebotomist/Support worker
- **Katy Curtis** - Admin Staff
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THANKS FOR YOUR LISTENING...