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BRIEF REPORT

Health-Related Quality of Life in Outpatient Parenteral Antimicrobial Therapy

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Health-related quality of life (HRQoL) in outpatient parenteral antimicrobial therapy (OPAT) has not been well characterized in the United States. In an OPAT cohort, the short-form-12's median physical component score and mental component score were 40.3 and 54.4, respectively. HRQoL measures could be helpful in studies of OPAT cost-effectiveness.

Keywords. cost-effectiveness; health-related quality of life; OPAT; SF-12.

Home-based outpatient parenteral antimicrobial therapy (OPAT) allows patients to receive parenteral antimicrobials outside of acute care hospitals [1]. Patients often start OPAT after a lengthy hospital stay, a major surgical procedure, or a long illness. Studies of OPAT, particularly those evaluating its cost-effectiveness, would benefit from an understanding of the patient's health-related quality of life (HRQoL). One study looked at changes in HRQoL among Canadian OPAT patients in the late 1990s [2]; however, no study has looked at HRQoL in an American population of OPAT patients. We employed a patient-reported HRQoL tool, the short-form-12 (SF-12) [3], to determine HRQoL in OPAT patients and the risk factors for lower SF-12 scores (indicative of poorer health).

METHODS

Patient Population and Setting

We performed a subanalysis of an expansion of a previously described prospective cohort of patients receiving home infusion therapy [4]. Eligible patients were ≥18 years of age and discharged from 2 tertiary care academic medical centers in Baltimore, Maryland, to home OPAT between March 2015 and October 2017. Patients were required to have peripherally inserted central catheters (PICCs), tunneled central venous catheters (CVCs), or midline catheters. Patients were ineligible if they were in hospice care, did not speak English, or could not verbally consent. Three attempts were made to contact each patient, starting 2 weeks after hospital discharge (typically midway through an OPAT course). Patients could have used any home infusion or home nursing agency for (1) antimicrobial agents and supplies and (2) training and support in CVC care, respectively.

Instrument

Consenting patients underwent a 10-minute telephone survey that included the SF-12 [3]. The electronic health record (EHR) was abstracted for demographic information and clinical data.

Variables

Age was included as a continuous variable. As few enrolled patients were Asian American, Hispanic, or other racial or ethnic groups, racial or ethnic group was categorized as white non-Hispanic, black non-Hispanic, or other. Insurer was characterized as Medicare, Medicaid, or private, as few were self-pay or uninsured. The Charlson Comorbidity Index (CCI) [5] was calculated and dichotomized at 2 based on the median score. Indications for OPAT were characterized by infection site; patients could have had more than 1 indication. Only parenteral antimicrobial agents were recorded.

The outcomes were the physical composite score on the SF-12 (PCS-12) and the mental composite score on the SF-12 (MCS-12) [3]. In the general American population, the PCS-12 and MCS-12 each have a median of 50, and lower scores indicate poorer health status [3, 6].

Data Analysis

Descriptive statistics were used for demographic, clinical, and outcome data (Stata, version 14.0, College Station, TX). Predictors included demographic and clinical variables. We coded the SF-12 questions so that higher scores indicated higher health for all items [6]. We then created indicator variables for all SF-12 questions [6]. We used published metrics to develop norm-based scoring compared with the American population [6].

Multivariable linear regression was used to estimate predictors of the PCS-12 and MCS-12. Covariates were considered if the association with the outcome was $P \leq .20$ (2-sided), and they were removed in a stepwise fashion if the covariate's association

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with the outcome was $P > .20$ (2-sided). We first attempted to include the dichotomized CCI in the models, and then in a separate series of models, the presence of diabetes, malignancy treated within the last 6 months, and history of organ transplant to test the impact of these candidate covariates on the PCS-12 and MCS-12 scores.

Table 1. Predictors of Physical and Mental Health Status

Variable	No. (% of 215)	Association With PCS-12 (95% CI)	Multivariable Association With PCS-12 (95% CI)	Association With MCS-12 (95% CI)	Multivariable Association With MCS-12 (95% CI)
Female sex	100 (46.5)	–0.24 (–1.88 to 1.39)	Not included	–3.86 (–7.00 to –0.71)	–3.91 (–6.97 to –0.84)
Age, median (IQR), y	55 (44–63)	–0.013 (–0.068 to 0.042)	Not included	–0.068 (–0.17 to 0.039)	Not included
Race/ethnicity: Caucasian	140 (65.1)	Referent	Not included	Referent	Referent
African American	58 (27.0)	0.43 (–1.42 to 2.29)	Not included	2.69 (–0.90 to 6.29)	3.58 (0.10 to 7.07)
Other	17 (7.9)	0.23 (–2.74 to 3.20)	Not included	4.36 (–1.39 to 10.11)	3.28 (–2.51 to 9.08)
Insurance (missing, 2): private	125 (58.1)	Referent	Not included	Referent	Referent
Medicaid	34 (15.8)	–0.87 (–3.23 to 1.48)	Not included	–3.36 (–7.93 to 1.22)	–3.55 (–7.99 to 0.90)
Medicare	54 (25.1)	0.56 (–1.38 to 2.51)	Not included	–0.50 (–4.23 to 3.28)	0.79 (–2.84 to 4.43)
CCI >2	125 (58.1)	–1.00 (–2.64 to 0.65)	Not included	–3.11 (–6.31 to 0.078)	Not included
Diabetes	66 (30.7)	–0.34 (–2.12 to 1.45)	Not included	0.0038 (–3.48 to 3.49)	Not included
Malignancy treated within 6 mo	54 (25.1)	–0.32 (–2.23 to 1.58)	Not included	–2.96 (–6.65 to 0.73)	Not included
History of organ transplant	24 (11.6)	0.31 (–2.24 to 2.86)	Not included	–0.40 (–5.37 to 4.57)	Not included
OPAT Indication: bacteremia	43 (20.0)	–0.68 (–2.74 to 1.37)	Not included	–3.07 (–7.05 to 0.91)	Not included
Endovascular infection	17 (7.9)	1.94 (–1.13 to 5.01)	3.14 (–0.46 to 6.33)	6.47 (0.52 to 12.42)	4.31 (–1.69 to 10.31)
Meningitis	26 (12.1)	–0.33 (–2.78 to 2.13)	Not included	7.79 (3.12 to 12.45)	6.61 (1.91 to 11.30)
Osteomyelitis	64 (29.8)	–0.33 (–2.10 to 1.45)	Not included	2.27 (–1.18 to 5.72)	Not included
Discitis/epidural abscess	9 (4.2)	–1.73 (–5.64 to 2.18)	–8.56 (–14.99 to –2.14)	2.71 (–4.92 to 10.35)	Not included
Septic arthritis	24 (11.6)	1.34 (–1.30 to 3.99)	Not included	–4.62 (–9.75 to 0.51)	–4.06 (–9.16 to 1.05)
Cellulitis	13 (6.1)	2.57 (–0.83 to 5.98)	2.85 (–0.46 to 6.16)	–1.87 (–8.54 to 4.80)	Not included
Prescribed agent: vancomycin	55 (25.6)	0.63 (–1.29 to 2.54)	Not included	–1.95 (–5.69 to 1.78)	Not included
Oxacillin/nafcillin	10 (4.7)	–1.07 (–5.22 to 3.07)	Not included	–1.34 (–9.42 to 6.75)	Not included
Piperacillin-tazobactam	13 (6.1)	–0.59 (–4.02 to 2.83)	Not included	–0.036 (–6.71 to 6.64)	Not included
Penicillin	13 (6.1)	1.20 (–2.09 to 4.49)	Not included	6.09 (–0.28 to 12.46)	Not included
Ampicilin/ampicillin-sulbactam	19 (8.8)	0.10 (–2.74 to 2.94)	–2.90 (–7.16 to 1.37)	0.76 (–4.78 to 6.30)	Not included
Cefazolin	7 (3.3)	–0.44 (–5.64 to 4.77)	Not included	–1.13 (–11.28 to 9.02)	Not included
Ceftriaxone	41 (19.1)	–1.36 (–3.40 to 0.69)	Not included	4.78 (0.83 to 8.73)	3.35 (–0.63 to 7.33)
Cefepime	16 (7.4)	2.13 (–1.04 to 5.30)	Not included	2.90 (–3.29 to 9.10)	Not included
Ceftazidime	10 (4.7)	3.45 (–0.44 to 7.34)	3.73 (–0.056 to 7.51)	4.45 (–3.17 to 12.07)	Not included
Aminoglycoside[a]	14 (6.5)	–1.65 (–4.94 to 1.64)	Not included	1.37 (–5.05 to 7.80)	Not included
Daptomycin	6 (2.8)	1.02 (–3.74 to 5.78)	Not included	–5.29 (–14.55 to 3.97)	Not included
Carbapenem[b]	36 (16.7)	0.11 (–2.10 to 2.33)	Not included	–3.99 (–8.27 to 0.30)	–1.80 (–6.07 to 2.47)
Micafungin	5 (2.3)	4.32 (–0.85 to 9.49)	4.65 (–0.37 to 9.66)	–8.16 (–18.24 to 1.93)	Not included
≥1 antimicrobial agents	42 (19.5)	0.94 (–1.17 to 3.05)	Not included	–1.36 (–5.39 to 2.86)	Not included
Organism being treated: MRSA	19 (8.8)	–0.77 (–3.69 to 2.13)	Not included	0.89 (–4.79 to 6.58)	Not included
MSSA	22 (10.2)	–1.07 (–3.78 to 1.64)	Not included	–2.87 (–8.14 to 2.40)	Not included
Coagulase-negative *Staphylococcus*	19 (8.8)	2.02 (–2.83 to 3.84)	Not included	–2.80 (–8.32 to 2.73)	Not included
Streptococcus	29 (13.5)	0.25 (–2.10 to 2.59)	Not included	2.30 (–2.26 to 6.85)	Not included
Enterococcus	18 (8.4)	–0.95 (–3.94 to 2.04)	Not included	0.24 (–5.61 to 6.08)	Not included
Gram-negative rod[c]	59 (27.4)	0.55 (–1.29 to 2.38)	Not included	1.77 (–1.79 to 5.34)	Not included
Borrelia or spirochete	11 (5.1)	–1.58 (–5.31 to 2.14)	Not included	3.56 (–3.70 to 10.81)	Not included
Empiric	43 (20.0)	0.49 (–1.57 to 2.54)	Not included	–1.86 (–5.86 to 2.13)	Not included
>1 organism	47 (21.9)	–0.70 (–2.67 to 1.26)	Not included	0.15 (–3.68 to 3.98)	Not included

Abbreviations: CCI, Charlson comorbidity index; CI, confidence interval; IQR, interquartile range; MCS-12, mental composite score on the short-form-12; MRSA, methicillin-resistant *Staphylococcus aureus*; MSSA, methicillin-sensitive *Staphylococcus aureus*; OPAT, outpatient parenteral antimicrobial therapy; PCS-12, physical composite score on the short-form-12.

[a]Gentamicin: n = 2; tobramycin: n = 7; amikacin: n = 5.

[b]Meropenem: n = 9; imipenem: n = 3; ertapenem: n = 24).

[c]*Escherichia coli*: n = 16; *Serratia*: n = 1; *Proteus*: n = 3; *Pseudomonas*: n = 12; *Enterobacter*: n = 7; *Klebsiella*: n = 17; *Burkholderia*: n = 2.

The study was approved as expedited with oral consent by the Johns Hopkins University School of Medicine Institutional Review Board.

RESULTS

Two hundred fifteen patients were enrolled in the study. Of these, just under half (n = 100, 46.5%) were women, and almost 1 in 4 were ≥65 years of age (23.3%) (Table 1). Comorbidities were common; 58.1% had a CCI score >2. Almost 1 in 5 was on more than 1 parenteral antimicrobial agent (n = 42, 19.5%). The median PCS-12 score (interquartile range [IQR]) was 40.3 (36.1–43.3). The median MCS-12 score (IQR) was 54.4 (44.9–60.7). Only discitis or epidural abscess was associated with lower PCS-12 scores on adjusted analyses ($P = .01$). Women had a lower median MCS-12 score when compared with men, and African Americans had a higher median MCS-12 score when compared with white Americans ($P = .013$ and $P = .044$, respectively). Patients with meningitis (including indications such as neurosyphilis and neuroborreliosis, as well as community-acquired meningitis), meanwhile, had higher MCS-12 than others in the study ($P = .006$). Neither the CCI nor diabetes, malignancy, or solid organ transplant met prespecified criteria to remain in the model.

DISCUSSION

We saw that in home-based OPAT, patients had a median PCS-12 score of 40.3, lower (and indicative of poorer physical health) than in the general American population, and a median MCS-12 score of 54.5, similar to that (and indicative of similar mental health) of the general American population [3, 6]. These data could be useful in calculations of the cost-effectiveness of OPAT, as this is a measure that could be included in determining quality-affected life-years (QALYs). The lower PCS-12 scores are likely due not just to the need for OPAT but also to their underlying conditions. Lower PCS-12 scores have also been reported in conditions commonly requiring OPAT, such as diabetic foot osteomyelitis [7], orthopedic device–related infections [8], septic failure of revision total knee arthroplasty [9], and infected total hip arthroplasty [10]. In addition, in a Canadian study of OPAT patients in the late 1990s, OPAT patients had a HRQoL score lower than the Canadian mean [2].

Meanwhile, patients on OPAT have an MCS-12 score that is similar to the population median (54.4), indicating that their mental HRQoL is similar to the general population [6]. Patients being treated for infected total hip arthroplasties similarly have mental health–related HRQoL near the population mean [10]. Of note, these patients had already been at home on OPAT for 2 weeks when answering the questions, and it is possible that by this point staying in their homes had improved their mental health.

Discitis/epidural abscess was associated with a lower PCS-12. Patients with discitis or epidural abscess may suffer from decreased mobility and significant pain from spinal impingement.

Female sex was a risk factor for a lower MCS-12. This has been shown in other studies as well, including among women undergoing total hip arthroplasty [11]. This may also be impacted by fewer caregivers present for women than for men. Patients with meningitis, interestingly, had higher MCS-12 scores. This was unexpected, as one would expect a central nervous system infection to negatively impact psychological outcomes [12]. However, it is possible that meningitis, which may not require surgery or as long of an OPAT course and may have been due to conditions such as neuroborrelliosis or neurosyphilis, has lower cumulative impacts on patients.

Our study has several limitations. OPAT patients receive this therapy for a number of conditions, and the conditions themselves likely play a large role in HRQoL. Our study involved 2 academic hospitals in 1 metropolitan area and may not reflect experiences in other locales. Our study may have been impacted by response bias, although 30-day readmissions were similar among patients who did and did not consent for the study. In addition, the SF-12 focuses on HRQoL over the previous 4 weeks. For many patients, the preceding 4 weeks could have been relatively uneventful (a brief hospitalization followed by a discharge on OPAT) or eventful (procedures, complications, readmissions, and finally discharge on OPAT). We were not powered to produce estimates for MCS-12 and PCS-12 scores for individual conditions.

Ours is the first study to focus on the patient-reported HRQoL for patients on OPAT in the United States. We assessed MCS-12 and PCS-12 scores prospectively and had patient-level data to assess predictors of HRQoL. Evaluations of OPAT should include patient-reported outcomes such as HRQoL. These data can be used to calculate QALYs for cost-effectiveness studies.

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