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Neurology®
Clinical Practice

A peer-reviewed clinical neurology journal for the practicing neurologist
An Official Journal of the American Academy of Neurology

Neurology: Clinical Practice Publish Ahead of Print
DOI: 10.1212/CPJ.0000000000200103

Cost and Return on Investment of a Team-Based Palliative Care Program for Parkinson Disease

Author(s):
Robert Brett McQueen, PhD[1]; Mark Gritz, PhD[2]; Drew Kern, MD[3]; Julienne L Bemski, DO[4]; Ian Shelton, BA[5]; Martha Meyer, PhD[2]; Benzi M. Kluger, MD, MS[6]

Corresponding Author: Robert Brett McQueen, robert.mcqueen@cuanschutz.edu

Affiliation Information for All Authors: 1. Skaggs School of Pharmacy and Pharmaceutical Sciences, University of Colorado Anschutz Medical Campus, Aurora, CO, United States; 2. Department of Health Care Policy and Research, University of Colorado Anschutz Medical Campus, Aurora, CO, United States; 3. Departments of Neurology and Neurosurgery, University of Colorado Anschutz Medical Campus, Aurora, CO, United States; 4. Swedish Medical Center, Family Residency Program, Denver CO, United States; 5. Pharmacology Graduate Program, University of Colorado Anschutz Medical Campus, Aurora, CO, United States; 6. Departments of Neurology and Medicine, University of Rochester Medical Center, Rochester, NY, USA

Equal Author Contribution:

Contributions:
Robert Brett McQueen: Drafting/revision of the manuscript for content, including medical writing for content; Major role in the acquisition of data; Study concept or design; Analysis or interpretation of data
Mark Gritz: Drafting/revision of the manuscript for content, including medical writing for content; Major role in the acquisition of data; Study concept or design
Drew Kern: Drafting/revision of the manuscript for content, including medical writing for content; Major role in the acquisition of data; Analysis or interpretation of data
Julienne L Bemski: Drafting/revision of the manuscript for content, including medical writing for content; Analysis or interpretation of data
Ian Shelton: Drafting/revision of the manuscript for content, including medical writing for content; Major role in the acquisition of data; Analysis or interpretation of data
Martha Meyer: Major role in the acquisition of data; Analysis or interpretation of data
Benzi M. Kluger: Drafting/revision of the manuscript for content, including medical writing for content; Major role in the acquisition of data; Study concept or design; Analysis or interpretation of data

Figure Count:
1

Table Count:
4

Search Terms:
[109] All Health Services Research, [110] Cost effectiveness/economic, [165] Parkinson's disease/Parkinsonism

Acknowledgment:

Study Funding:
This project was funded by the Data Science to Patient Value (D2V) initiative at the University of Colorado Anschutz Medical Campus.

Disclosures:
There are no conflicts of interest to report. The authors disclose funding for this study from the University of Colorado Data Science to Patient Value initiative. BK discloses financial support from the Patient-Centered Outcomes Research Institute (IHS-1408-20134) for unrelated work no involving the study design, collection of data, writing of the manuscript, or decision to submit the article for publication.

Preprint DOI:

Received Date:
2022-04-27

Accepted Date:
2022-09-08

Handling Editor Statement:
Submitted and externally peer reviewed. The handling editor was Associate Editor John P. Ney, MD, MPH.

Unstructured Abstract (343/350 words max)

Implementation of palliative care (PC) in neurology settings may improve symptom control, quality of life, and reduce acute care admissions. The benefitis of team-based PC for patients with Parkinson's disease (PD) has been established through rigorous evidence standards including randomized controlled trials. However, evidence on implementation costs and return on investment (ROI) are unknown and may guide other providers and systems considering this model of care.

We applied time-driven activity-based costing (TDABC) with reimbursable visits calculated using Medicare reimbursement rates in Colorado and current procedural technology codes to two outpatient clinics at the University of Colorado Hospital (UCH): neurology PC and movement disorders. Per patient ROI was calculated as the ratio of the incremental difference in financial revenues divided by the incremental difference in investment to expand PC services.

The cost per new patient was $154 and $98 for neuropalliative and movement disorders clinics, respectively. While established patient visits was $82 and $41 for the neuropalliative care and movement disorders clinics, respectively. The neurology PC clinic had per patient revenue for new and established visits of $297 and $147, respectively, as compared to $203 and $141 for new and established visits at the comparator clinic. Based on our assumptions, for every $1 invested in expanding PC services, a projected $1.68 will be recouped by the hospital system for new patient visits and $0.13 will be recouped for established patient visits. These amounts are context dependent and a calculator was created to allow other systems to estimate costs and ROI.

Our results suggest in an academic medical setting both neurology PC and movement disorders clinics provided increased revenue to the health system. Opportunities to improve ROI include efficient allocation of personnel to new and established visits, expanding telemedicine, and other cost offsets for complex patients not estimated in this analysis. ROI may also be greater in health systems that benefit from cost savings such as accountable care organizations. Our approach may be applied to other novel care models. Future research efforts will focus on estimating the continued sustainability of this innovative outpatient care model.

Introduction

In the United States, more than 50% of all health care costs are attributable to 15% of individuals with life-limiting conditions and functional limitations.[1] The disproportionately higher costs in this population reflects the complexity of care, with many patients forced to rely on acute hospital care given a lack of alternative options.[1-5] In response to poor

health outcomes and inefficient care for patients with life-limiting conditions, there is broad support to invest in innovative and sustainable care models.[6-9]

Palliative care (PC) improves symptom control, quality of life, and coordination of complex care for patients with life-limiting conditions.[2,4,10-12] Evidence suggests strong benefits when involving interdisciplinary PC teams early in the course of illness.[13,14] Notably, a small group of academic centers now offer interdisciplinary outpatient PC for patients and caregivers with neurologic disorders such as Parkinson's Disease (PD) and there is mounting evidence of benefit including randomized controlled trials.[14-16] Evidence of implementation costs, cost-effectiveness, and return on investment potential may aid healthcare systems considering interdisciplinary PC models of care for PD and other neurologic conditions.

Previous evidence on costs, cost-effectiveness, and return on investment from expanding PC services is mixed and depends on the setting (i.e., hospital-based, outpatient, and home-based), timing of interventions, outcomes measured, and payment models, among other factors.[11-13,17-25] Specific challenges include measuring all costs and outcomes from expanding PC services to establish the link between resources expended and the full patient care cycle.[26,27] While billing and reimbursement data are available from provider financial systems, a methodological challenge is to accurately estimate how much services actually cost to the provider.[28] Billed and reimbursed services are not necessarily reflective of what a particular service costs in terms of the utilization of resources and the unit prices of those resources. In competitive reimbursement environments, providers and health policy initiatives are

searching for accurate cost measurement solutions capable of informing value-based health care calculations.[29]

One novel approach that has recently been adopted in health care is time-driven activity-based costing (TDABC). TDABC is a costing approach that engages clinical and financial teams to accurately estimate resources and costs involved to treat patients over their care cycle.[27,30] Organizations can use TDABC to understand the costs of generating health outcomes regardless of location (i.e., inpatient, outpatient, home-based). TDABC is estimated using the unit price for providing a service and how much time is involved in providing that service. Knowing the time and price involved in providing care, TDABC can then be used to inform costs used in cost-effectiveness analyses and opportunities for reimbursement in various payment models to ensure sustainability from a health system perspective.[26,29,31,32] However, the use of TDABC in neurological conditions is limited.[32]

Given emerging evidence on the clinical benefits of interdisciplinary outpatient PC services and a lack of cost and ROI evidence, we applied TDABC to an academic outpatient setting at the University of Colorado Hospital (UCH) to estimate relative costs for expansion and sustainability scenarios. Specifically, the goal of this project was to estimate the incremental costs and opportunities for return on investment (ROI) of UCH neurology PC clinic as compared to a neurology clinic without PC services.

Methods

Setting

This study was performed within the UCH outpatient neurology clinics for PC and movement disorders. Data for PC clinics were derived from outpatient interdisciplinary PC clinics from July 2017-June 2018. The UCH neuropalliative care clinics follow an embedded and integrated model of PC where clinics are co-located with other neurology services and led by two neurologists with additional expertise in PC and an interdisciplinary team including a nurse, physicians assistant, social worker and chaplain. Patients and their family care partners will typically see all members of the team on new visits following a standard checklist and may see fewer team members on follow-up visits depending on their ongoing issues. Patients are referred based on needs perceived by referring clinicians or patients/families (e.g. difficulty coping with diagnosis, chronic pain, caregiver distress, assistance with defining goals of care) rather than strictly defined stages or prognosis, although the majority of patients do have advanced PD or related disorders, often with dementia.[33] This clinic was subsequently compared with the UCH movement disorders clinic which consisted of a physician, physician assistant and access to a nurse. We included patients with PD or related disorders from both clinics. The analyses are from a provider or hospital system perspective with a 1 year time horizon.

Time-Driven Activity-Based Costing

We used components of the TDABC method to estimate the cost of implementing the neurology PC outpatient clinic as compared to movement disorders clinic that has fewer resources and available patient care time. TDABC estimates cost using the unit cost of resource inputs (labor and non-labor) and the time and quantity of resources used to perform an activity.[26,27,30,34] First, we developed a process map to detail administrative and clinical processes involved in treating PD patients with PC needs. Second, we directly observed the proportion of visits spent with patients by provider and the time spent to treat PD patients for each provider over the course of five clinic days. In order to expand beyond our observation period, we used administrative and financial data to identify the number of visits per year stratified by new and established patient visits (July 2017 – June 2018). In addition, we estimated the proportion of visits by level of complexity for the neurology PC outpatient and comparator clinics. Third, we contacted financial teams to identify salary, benefit, and full-time equivalent (FTE) information for each provider in the neurology PC and movement disorders clinics. We use FTE information to identify how much clinic time providers were spending in each clinic, however, the final calculations depend on the total sum of salary plus benefits paid for clinical time. Where salary information was not available, we used national United States pay and benefit information from the Bureau of Labor Statistics.[35] Finally, we calculated total direct costs of all of the resources used for each patient visit and validated our numbers with providers. Our calculation includes the total square footage required to run the clinic. We used market research on occupancy costs by region to estimate a cost per square foot which then was translated into a cost per patient based

on the annual occupancy costs and total patient visit count for the year.[36] We assumed the same number of visits and the same size clinic in order to isolate the return on investment of the care model being evaluated. In other words, revenue or costs were not driven by factors unrelated to the neuro-palliative care model.

The calculation of total per patient cost was:

Per patient cost = minutes spent with each provider x proportion of visits seen by provider x the unit cost per minute and summed across all providers for each clinic type.

*Where unit cost per minute = total salary + benefits/(2080 working hours*60 minutes)*

Resources devoted to research were removed from the cost estimation. We did not exclude patient-visits based on characteristics of patients seen at either clinic. All costs are in 2018 US dollars.

Financial Revenues and Return on Investment

Similar to the TDABC methods, we used a time-driven medical visit reimbursement approach to calculate financial revenues from both new and established visits. Each reimbursable visit was calculated using a weighted average of Medicare reimbursement rates in Colorado and the proportion of patient visits by current procedural technology (CPT) codes (e.g., 99204, 99205) as shown in Table 1. Additional opportunities for financial revenue included advanced care planning (i.e., 99497) for all new patient visits.

We used the following formula to calculate per patient visit reimbursement for new and established visits separately:

Per patient visit reimbursement = Medicare allowable payment x proportion of visits by procedure codes

Where Medicare allowable payment is a function of total RVUs with the appropriate Medicare conversion factor applied.

Per patient visit ROI was calculated as the ratio of the incremental difference in financial revenues divided by the incremental difference in investment made by UCH for each patient visits. When ROI is greater than 1, the returns generated by the additional investment actions are greater than the costs of the investment and are considered positive revenue to the system. When the ROI is less than 1, the returns generated by the additional investment yield a net loss and are considered negative to the system, deficits. Our calculations are available in a user-friendly Excel® spreadsheet to tailor cost and expected revenue to other care settings, healthcare systems and patient populations (contact the corresponding author to access the spreadsheet). Further details of our calculations can be found in the technical appendix (eAppendix 1).

Given uncertainty in our results as compared to other clinic settings, we provide targeted sensitivity and scenario analyses to inform readers on the most influential inputs on our outcome of incremental ROI. The sensitivity and scenario analyses hold the comparator arm fixed and only vary the neuro-palliative care inputs. The scenarios include: altering reimbursement rates for advanced care planning, physician time spent

with patients, proportion of visits providers spent with patients, proportion of visits by severity level, and space costs.

This project was deemed IRB-exempt as quality improvement by the Colorado Multiple Institutional Review Board.

Results

The process map details the flow for an average established patient visiting the neurology PC outpatient clinic (Figure). The process map documents the personnel and average time spent with each patient recorded at the neurology PC outpatient clinic. For example, after checking in and rooming each patient, the average established patient spends 25 minutes with a physician or physician's assistant, 10 minutes with a social worker, and 25 minutes with a chaplain. We linked the process map with administrative and financial data from the University of Colorado to calculate average production costs that inform implementation of neurology PC services into ambulatory settings not currently offering PC services. Table 1 details the visit characteristics, proportion of visits by level of complexity, and space characteristics. On average, the number of visits per day over a 1-year period was 26 (95% CI: 21, 30) with 19 (95% CI: 16, 22) as established visits and 7 (95% CI: 6, 9) as new patient visits. The clinic operated on a weekly basis over the course of 50 weeks for an annual number of clinic days of 50 and visits totaling to approximately 1,300 from July 2017 to June 2018. The proportion of new and established patient visits for levels 3 and above were similar between the neurology PC and movement disorders clinic in terms of total percentages. However,

we did observe a higher proportion of level 5 visits in the neurology PC outpatient clinic for PD patients.

Visit time costs were estimated using the data collection on minutes per provider, the proportion of provider interaction with patients on each visit, and the salary per minute per FTE across providers (Table 2). The primary driver of cost between the neurology PC clinic and the comparator clinic was the time spent with each provider and the number of providers. For example, the neurologist spent more time with the patient in both the new and established patient visits. As expected, the number of providers in the neurology PC clinic exceeded the number of providers in the movement disorders clinic through the use of a social worker and chaplain. The additional time and number of providers resulted in a time and space cost per visit of $154 and $82 for new and established visits, respectively, at the neurology PC clinic (Table 3). In contrast, the movement disorders clinic visit time cost was $98 and $41 for new and established visits, respectively. Extrapolating time costs over 50 clinic days per year, the total costs of new and established patient visits, including space costs was approximately $125,000 for the neurology PC clinic as compared to approximately $90,000 for the movement disorders clinic for an incremental cost difference of approximately $35,000 (not shown in tables).

Financial revenue and return on investment was calculated based on the Medicare reimbursement rate and the proportion of visits by each code (Table 3). The neurology PC and comparator clinics had new per patient visit revenue that exceeded per patient

visit costs by $143 and $105 per patient visit, respectively. The neurology PC and comparator clinics had established per patient visit revenue that exceeded per patient visit costs by $65 and $100 per patient visit, respectively. Small differences for reimbursement between clinics were a function of billing for advanced care planning for an incremental revenue difference between clinics of $94 and $6 per new and established patient visits, respectively. Extrapolating revenue over 50 clinic days per year, the total revenue of new and established patient visits was approximately $250,000 for the neurology PC clinic as compared to approximately $210,000 for the movement disorders for an incremental added revenue of approximately $40,000 (not shown in tables). Return on investment at the patient level for new and established patient visits was $1.68 and $0.13, respectively. In other words, for every $1 invested in the neurology PC clinic $1.68 cents will be recouped by the hospital system for new patient visits and $0.13 will be recouped for established patient visits.

The results of the targeted sensitivity and scenario analyses (Table 4) found that key drivers of incremental ROI include reimbursement for advanced care planning with a reduced ROI to 0.51 assuming 25% reimbursement rate; less physician time spent with patients which improved ROI to 7.19 when physician spends 25 minutes with patient instead of 50 minutes; and space costs which improved ROI to 2.53 for new visits and 0.24 for established visits when assuming the same space as comparator clinic. These inputs influence the incremental ROI calculation, but must be interpreted in context to patient care. We provide all calculations in the technical appendix and interested readers can request the ROI tool from the corresponding author to plug in clinic- and setting-specific inputs.

Discussion

This cost and return on investment analysis highlights the importance of assessing and managing sustainability of health care delivery by estimating costs at the patient level. Often cost analyses performed by health systems or researchers use dollar amounts charged for medical services, which is not an accurate representation of the true cost of providing the services.[27,30] The full cycle of care can include treating patients with multiple specialties, not all of whom are reflected in charges, such as through the neurology PC clinic. Our results suggest neurology services with and without additional PC services generate positive revenue. However, the most sustainable use of resources may be efficient allocation of FTE based on new versus established visits.

A recent comprehensive review on the value of PC services suggests both home-based and hospital-based interventions were cost-effective.[25] Specifically, home-based PC reduced aggressive treatments at the end-of-life which improved quality of life and reduced utilization. Hospital-based PC was associated with reduced admissions and associated costs. However, many of those studies in the hospital setting were specific to cancer patients at end of life. The review found mixed evidence for other approaches. Further, results suggested a need for greater consistency in costs and outcome measures reported, among other pragmatic issues. Our study contributes to this body of literature by providing resources and potential reimbursement scenarios that are practical for neurologists to implement in their own settings.

Our results suggest a positive ROI when seeing new patients with expansion of PC services while the negative ROI corresponds to established visits. It's important to note that both clinics are revenue positive, therefore additional PC services offered will not lose money from a health provider perspective, at least in this model system. Given that expansion of PC services to neurology clinics will be revenue positive, there are multiple opportunities to improve ROI. First, expansion of PC services may be allocated most efficiently for new patient starts with existing patients requesting PC services during established visits on an as needed basis. For established patients, based on the complexity of their care, we have found that only certain patients require a full team approach and many can be managed by an APP with occasional consults from other team members. There are further opportunities to shift these healthcare provider meetings to a telemedicine format which would free up space in the clinic for additional patient visits. Moreover, the clinics included in this analysis are housed at an academic medical center with a complex set of patients increasing the time spent with patients for each visit. The opportunity to improve ROI may be targeted differently for community settings versus academic medical centers. Our online calculator provides users the ability to increase or decrease personnel time by provider to efficiently allocate time and maximize reimbursement based on the complexity of their patient population.

To demonstrate some opportunities to improve ROI, we provided sensitivity and scenario analyses on key inputs based on expert opinion of providers. Influential inputs included reimbursement for advanced care planning, physician time spent with patients during new visits, and space costs. Other inputs with less influence on incremental ROI

included visits by severity level and proportion of visits seen by a particular provider. These results suggest providers have multiple opportunities to improve ROI without sacrificing patient health outcomes. However, these analyses should be interpreted with caution and we encourage others to plug in their own inputs for clinic-specific ROI calculations.

Second, there may be other opportunities for cost savings that are not included in our analysis and may further improve the ROI for established patient visits specifically. Evidence from multiple studies suggests palliative care services provides significant cost savings to the health system from avoiding hospitalizations and other costly care.[11,13,20,23] For established patients in particular, this may result in cost offsets to other types of patient visits and may have benefits in tems of cost-sharing models (e.g. accountable care organizations) or access (e.g. increased inpatient beds).
Finally, PC services may have a different ROI depending on the payment system.[18] Given efforts to shift payment models from volume to value-based payment systems, outpatient PC services may move from an optional addition to a necessary addition in order to manage potentially high cost patients. In addition, changes in reimbursement (e.g. Centers for Medicare & Medicaid Services revisions in evaluation and management coding) may also change, and potentially improve, ROI. Our online calculator is adaptable and may be useful to addressing both cost and reimbursement issues that providers may face under value-based payment system.

There are important additional limitations that may impact our findings. Our analysis reflects sustainability to the health system, not societal value which may include improvements to quality of life and symptom burden to patients and caregivers. In other words, value does not equate to reimbursement alone. Rather value is defined as outcomes relative to costs.[28] Outcomes vary dramatically across patient populations and recent research ROI evidence in other areas of neurology have defined additional outcomes not included here.[37,38] For example, Willis et al. performed a social return on investment analysis (SROI) for peer support among dementia patients. SROI makes use of financial proxies to establish the value of themes, such as reductions in loneliness and isolation, to estimate a market price for improving these themes where no market exists.[37] The study found a positive SROI, suggesting peer groups for people with dementia produces a greater social return on investment than the investment cost. Many themes from this research overlap with PD patients and their caregivers needing further PC services. Given the positive clinical trial evidence on health outcomes,[14] an SROI analysis would improve the ROI estimate found here. Moreover, other analyses are available to estimate the value of PC services, including cost-effectiveness analysis. Cost-effectiveness analyses have largely been performed on pharmaceutical interventions, however, value-based analyses are very relevant to health services which account for the majority of health care spending in the United States. Our research team has plans to expand to a cost-effectiveness analysis to estimate a societal value of expanding PC services. This could also include doing more specific comparisons in this and other neuropalliative care clinics, for example with matching by diagnosis and comparing to other subspecialty and teambased clinis (e.g. progressive supranuclear

palsy, amyotrophic lateral sclerosis). Additionally, time horizon may impact the ROI over time. Specifically, there was a “ramp up” period of referring patients to the clinic. Some of these patients may have been more complex than others, requiring additional average time with patients which may be reduced in the future with a diverse mix of patients.

Despite this limitations, findings will inform other outpatient settings across the United States on the cost of expanding neurology clinics to include PC services. Additionally, these findings will inform future efforts to estimate the societal cost-effectiveness of neurology PC to patients and caregivers by combining the time cost information with effectiveness from trial-based results and these methodologies could be applied to other novel clinic models. Our results suggest in an academic medical setting both neurology PC and movement disorders clinics provided increased revenue to the health system. Implications of these findings can inform efficient and sustainable clinic implementation for PC services. Future research should focus on opportunities to improve ROI including efficient allocation of personnel to new and established visits, expanding telemedicine, and other cost offsets for complex patients not estimated in this analysis.

CPJ-2022-200102_eapp1 -- http://links.lww.com/CPJ/A384

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Tables and Figures

Table 1: Annual Visit and Clinic Characteristics for Neuro-Palliative Care and Comparator Clinics

Category	Sub-Category	Neuro-Palliative Care	Comparator
Visit Characteristics			
	Mean number of visits per day (95% CI)	26 (21, 30)	Assumed same as Neuro-Palliative Care
	Mean new patient visits per day (95% CI)	7 (6, 9)	
	Mean established patient visits per day (95% CI)	19 (16, 22)	
	Mean number of visits per year at 50 clinic days per year (95 % CI)	1,300 (1,050, 1,500)	
Proportion of Office Visits by Level (average of new and established)			
	1	0%	0%
	2	0%	1%
	3	1%	2%
	4	4%	15%
	5	95%	82%
Space Characteristics			
	Square footage of clinic	1,123	Assumed half the space as Neuro-Palliative Care
	Number of exam rooms actively used each clinic day	8 rooms and 1 command center room	

Table 2: Provider Time Costs and Interaction with Patients

	Neuro-Palliative Care			Comparator		
Provider†	Minutes†	$/min/FTE	Proportion of visits provider interacted with patient†	Minutes	$/min/FTE **	Proportion of visits provider interacted with patient†
New Patient Visit						
Medical Assistant	5	$0.26 (1 FTE)	100%	5	$0.26 (1 FTE)	100%
Registered Nurse	10	$0.56 (1 FTE)	75%	5	$0.56 (1 FTE)	15%
Physician	50	$1.72 (0.8 FTE)	100%	45	$1.72 (1 FTE)	100%
Physician's Assistant	0	$0.99 (0.8 FTE)	0%	0	$0.99 (0.8 FTE)	0%
Social Worker	30	$0.29 (0.43 FTE)	100%	-	-	
Chaplain	45	$0.42 (1 FTE)	85%	-	-	
Established Patient Visit						
Medical Assistant	5	$0.26 (1 FTE)	100%	5	$0.26 (1 FTE)	100%
Registered Nurse	5	$0.56 (1 FTE)	30%	5	$0.56 (1 FTE)	15%
Physician	25	$1.72 (0.8 FTE)	50%	15	$1.72 (1 FTE)	50%
Physician's Assistant	25	$0.99 (0.8 FTE)	50%	15	$0.99 (0.8 FTE)	50%
Social Worker	10	$0.29 (0.43 FTE)	55%	-	-	
Chaplain	25	$0.42 (1 FTE)	70%	-	-	

FTE = full-time equivalent

† Not every provider saw patients for each patient visit; proportion of visits further indications how often each provider saw patients

*Lower and upper range based on lower and upper patient visits from Table 1

*While FTE is presented, we relied on total salary and benefits directly from the Department of Neurology at University of Colorado Hospital

Table 3: Per Patient Visit Time Costs, Financial Revenues, and Return on Investment

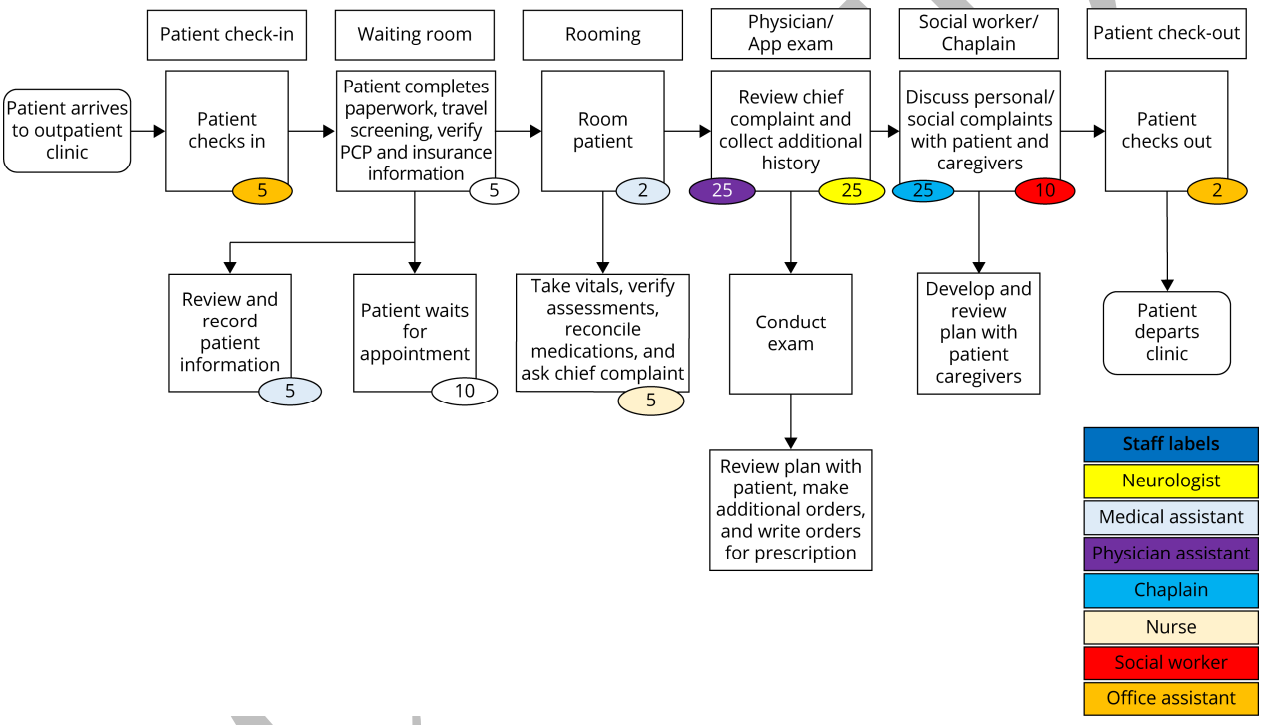
	Neuro-Palliative Care	Comparator	Incremental
Time Cost Per Patient Visit			
New patients only	$154	$98	$56
Established patients only	$82	$41	$41
Reimbursement Per Patient Visit			
New patients only	$297	$203	$94
Established patients only	$147	$141	$6
Projected return on investment for new patient visits (incremental revenue/incremental cost)	**-**	**-**	**1.68**
Projected return on investment for established patient visits (incremental revenue/incremental cost)			**0.13**

Table 4. Sensitivity and Scenario Analyses

Input	Base Input	Sensitivity Analyses	Incremental ROI (new visit) [1.68 base value]	Incremental ROI (established visit) [0.13 base value]
Reimbursement Rate for Advanced Care Planning (new visits only)	100%	25%	0.51	N/A
		50%	0.9	N/A
Physician time spent with patients (new visits only)	50 minutes	25 minutes	7.19	N/A
		60 minutes	1.29	N/A
Proportion of visits spent with Physician's Assistant (established visits only)	50% with Physician and 50% with Physician's Assistant	25% with Physician/75% with Physician's Assistant	N/A	0.14
Proportion of Office Visits by Level (average of new and established)	See Table 1	Neuro-Palliative Care set to comparator	1.56	0.0
		100% level 5 visits	1.74	0.2
Space costs	Comparator assumed half size	Set equal to comparator	2.53	0.24

*All inputs changes were applied to the neuro-palliative care arm while fixing the comparator arm

Figure: Outpatient Neurology Palliative Care Process Map for Established Patient Visits. The process map details the flow for an average established patient visiting the neurology PC outpatient clinic. The process map documents each activity (rectangles), the personnel type assigned to the activity (color codes), and the average time to complete the activity in minutes (circles). The top row of rectangles is an example of a PD patient's complete cycle of care through the University of Colorado neurology PC clinic. The middle boxes detail specifics of each patient interaction and include small circles to indicate the number of minutes spent with each patient. The color within each bubble indicates the time spent with each provider. Within each activity, patients may see both or only one of the providers listed in the activity box.



Neurology® Clinical Practice

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Neurol Clin Pract published online October 26, 2022
DOI 10.1212/CPJ.0000000000200103