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The Impact of an Adolescent Depressive Disorders Clinical Pathway on Healthcare Utilization

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Abstract

Clinical pathways are known to improve the value of health care in medical and surgical settings but have been rarely studied in the psychiatric setting. This study examined the association between level of adherence to an adolescent depressive disorders inpatient clinical pathway and length of stay (LOS), cost, and readmissions. Patients in the high adherence category had significantly longer LOS and higher costs compared to the low adherence category. There was no difference in the odds of 30-day emergency department return visits or readmissions. Understanding which care processes within the pathway are most cost-effective for improving patient-centered outcomes requires further investigation.

Keywords

Adolescent; Depression; Clinical pathways; Costs and cost analysis; Length of stay

Introduction

In 2008, the Institute for Healthcare Improvement created the Triple Aim, a framework for healthcare performance that emphasizes three dimensions: improving the patient experience of care, improving the health of populations, and reducing the per-capita cost of health care (Berwick et al. 2008). Hospitals have responded to this charge by more extensively instituting clinical pathways to streamline care, reduce variation, and provide higher quality, more efficient care at lower costs (Chassin et al. 1986; Coffey et al. 1992; Welch et al. 1993). Clinical pathways serve as a step beyond clinical practice guidelines in that evidence-based recommendations are implemented as a defined set of processes for a particular clinical condition executed by a multidisciplinary team of providers. A recently published meta-analysis demonstrated that clinical pathways significantly reduced in hospital

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Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

complications and improved clinical documentation without adversely impacting patient care (Rotter et al. 2010).

In contrast to other care settings where implementation of clinical pathways have been associated with shorter lengths of stay and lower costs of care (Lion et al. 2016; Sylvester and George 2014; Tarin et al. 2014; Varadhan et al. 2010), evidence regarding the effectiveness of clinical pathways in psychiatric care settings has not been well established, and largely consists of studies in adult and geriatric populations (Desplenter et al. 2009; Emmerson et al. 2006; Evans-Lacko et al. 2008; Nakanishi et al. 2010). Two pediatric studies examined the impact of clinical pathways on health outcomes and health care utilization in adolescent psychiatric inpatients (Greenham and Bisnaire 2008; Lock 1999). One study found that a clinical pathway for adolescent inpatients with anorexia nervosa was associated with improved target weight gain during admission and a longer length of stay (Lock 1999). Another study found that improvement in patient acuity level over the course of inpatient treatment was similar among patients receiving varying levels of a generic inpatient psychiatric treatment pathway (Greenham and Bisnaire 2008). However, the impact of adherence to specific care processes within clinical pathways on healthcare utilization outcomes has not been critically evaluated in adolescent patients with depressive disorders. This study aimed to examine the association between the level of staff adherence to an adolescent depressive disorders clinical pathway, length of stay, costs of care, and readmission rates. Based on results from studies performed in the non-psychiatric setting (Bryan et al. 2017; Lion et al. 2016), we hypothesized that higher staff adherence to the clinical pathway would be associated with shorter length of stay, lower costs of care, and fewer readmissions.

Method

Study Design and Population

We conducted a retrospective cohort study utilizing clinical and healthcare utilization data from patients admitted to the Psychiatry and Behavioral Medicine Unit (PBMU) of a 350-bed pediatric tertiary care facility, between January 1st, 2014, and May 31st, 2015. Only patients who were eligible for the Adolescent Depressive Disorders Clinical Pathway were included in the cohort. Patients were eligible for the pathway if they met the following criteria: (1) 10–18 years of age and (2) diagnosed with a depressive disorder including major depression; depression, not otherwise specified; dysthymia; or adjustment disorder with depressed mood. Patients were excluded from the pathway if they were diagnosed with mania, psychosis, or developmental delay. We excluded any inpatient stays in which the patient was not directly admitted to the PBMU to ensure that measured outcomes were reflective of care received only in the PBMU while the patient was on the clinical pathway. We also excluded inpatient stays that occurred within 30 days of a prior PBMU admission to minimize the impact of pathway care from the previous admission on the measured outcomes.

Predictors

Level of Adherence to the Adolescent Depressive Disorders Clinical Pathway

The Adolescent Depressive Disorders Clinical Pathway is composed of 13 processes of care that address intake, diagnostic formulation, treatment decisions, and discharge planning (Table 1). The pathway was developed by a multi-stakeholder group of psychiatrists, psychologists, subspecialty providers, nurses, pharmacists, and clinical effectiveness administrators based on evidence from published studies, systematic reviews and guidelines relating to best practices for the diagnosis and treatment of depression (Birmaher et al. 1998; Cheung et al. 2007; National Collaborating Centre for Mental Health 2010; Erford et al. 2011; Hazell 2003; Henken et al. 2007; Jorm et al. 2008; Larun et al. 2006; National Guideline Clearinghouse 2010; New Zealand Ministry of Health 2008, US Preventive Services Task Force 2009; Williams et al. 2009; Zuckerbrot et al. 2007). However, due to the paucity of evidence related to effective inpatient care of pediatric patients with depressive disorders, many of the processes of care were based on expert consensus. The process of how pathways are developed and implemented at this institution is described in detail elsewhere (Lion et al. 2016).

For each inpatient stay, the PBMU staff recorded whether individual processes of care were completed using a standard electronic form that was stored in an internal PBMU database. Level of staff adherence to the clinical pathway was determined using the following protocol. First, processes of care that were noted to be completed by PBMU staff in the internal database were coded as “1 = completed”. Next, processes of care that were recorded as incomplete were further examined based on the reason for non-completion. Two research team members and the PBMU medical director first independently categorized reasons for non-completion into two categories, and then met to resolve any disagreements in categorization. The first category included reasons for noncompletion that were due to a failure on the part of the PBMU (e.g. not enough clinical resources to complete the process of care or the team declined to complete the process of care). In these cases, patients were assigned a score of “0 = not completed” for that specific process of care. The second category included reasons for non-completion that were related to factors outside of the control of PBMU staff (e.g. patient refused to complete the process or the caregiver was unable to attend a required meeting). In these cases, patients were deemed ineligible for that specific process of care. This approach was used to ensure level of adherence to the clinical pathway was reflective of processes of care that were reasonable to complete by PBMU staff.

For each inpatient stay, level of adherence scores were computed on a 0–100 scale, by calculating the sum of completed processes of care divided by the number of processes of care for which the patient was eligible and multiplying by 100. The adherence score therefore reflects the behaviors of the clinical staff members in implementing the processes of care during the patient’s inpatient stay. Higher adherence scores reflected better staff adherence to the pathway. We placed each inpatient stay into one of three categories: low adherence (score < 83), medium adherence (score 83–99), and high adherence (score 100)

based on the tertile distribution of scores (i.e. each category included 33% of the total inpatient stays).

Covariates

Insurance status and medical complexity were included as covariates, as these were a priori thought to be associated with both staff adherence to the clinical pathway and the measured outcomes (Cohen et al. 2012; Simon et al. 2010; Todd et al. 2006). Insurance status was collapsed into two categories for analysis: public insurance (including Medicaid, military insurance and self-pay) or private insurance. Medical complexity was determined using the Pediatric Medical Complexity Algorithm (Simon et al. 2014) which classifies patients as having no chronic illness (e.g. febrile seizure), noncomplex chronic illness (e.g. epilepsy), or complex chronic illness (e.g. epilepsy with chronic respiratory insufficiency) on the basis of up to 3 years of retrospective *International Classification of Diseases, Ninth Revision, Clinical Modification* codes, beginning with the date of admission. For this analysis, we combined patients with non-chronic and non-complex chronic disease into one category, because patients classified as “non-chronic” should have been classified as “non-complex chronic” if they were given a diagnosis of depressive disorder during this inpatient stay. Occasionally the algorithm may misclassify patients as non-chronic if the admission diagnosis coded by the provider was not consistent with a chronic disease.

Outcomes

Measured outcomes included inpatient length of stay (LOS), costs of care, 30-day emergency department (ED) return visits, and unplanned 30-day inpatient readmissions, which were all obtained from hospital administrative data. Given their skewed distributions, LOS and cost variables were winsorized at the 99th percentile. Accordingly, five inpatient stays with LOS > 26.7 days were assigned a LOS of 26.7 days and five inpatient stays with cost > \$71,605 were assigned a cost of \$71,605. Costs were obtained from our internal cost accounting system, Allscripts EPSi (Allscripts Healthcare Solutions, Chicago, IL) using industry standard cost to charge ratios. All costs were inflation-adjusted to 2014 dollars using the medical care services component of the Consumer Price Index (Basu 2017; Bureau of Labor Statistics 2013). Readmissions were marked as unplanned using the guidelines developed by Berry et al. (2013).

All study procedures were reviewed and approved by the hospital research institute’s Institutional Review Board.

Statistical Analysis

Univariate and multivariate generalized linear models were used to examine the association between adherence category and LOS and cost as continuous variables. Models examining LOS as the dependent variable used a Poisson family and a log link, and were adjusted for insurance status and medical complexity. Models examining cost as the dependent variable used a gamma family and a log link, as is typical of analyses of economic data, and were adjusted for insurance status, medical complexity, and LOS as a continuous variable (Drummond et al. 2015). The appropriate family was chosen using the Modified Park test (Buntin and Zaslavsky 2004; Manning and Mullahy 2001). Univariate and multivariate

linear regression models were used to examine the association between completion of each process of care and LOS or cost. Models were adjusted for the same covariates as noted above. Multivariate logistic regression models were used to measure the association between adherence category and dichotomous 30-day ED return visit and 30-day inpatient readmission variables, adjusting for insurance status and medical complexity. We did not conduct Bonferroni adjustments for multiple comparisons, as this method assumes that the outcomes are independent. Because our outcomes are expected to be correlated with each other, this correction would be too conservative. All analyses were conducted in Stata version 12 (StataCorp 2011).

Results

Descriptive Statistics

The study sample included 529 inpatient stays. Patients were predominantly aged 13–15, female, White, privately insured, and in the non-complex chronic medical complexity category (Table 2). The mean clinical pathway adherence score for the total sample was 82.0 (SD 22.4), with a mean score of 55.6 (SD 20.8) for the low adherence group and 100.0 (SD 0.0) for the high adherence group. A significantly higher proportion of publicly insured patients were in the low adherence group compared to the high adherence group. Completion percentages for each process of care for the low adherence category are presented in Table 1. Completion percentages were highest (> 90%) for the following processes: (1) collected outside medical records, (2) completed safety planning, and (3) formulated crisis prevention plan.

Association Between Level of Adherence and LOS and Cost

Unadjusted and adjusted differences in LOS and cost by adherence category are presented in Table 3. Patients in the high adherence category had significantly longer LOS and significantly higher costs than patients in the low adherence category in both the unadjusted and adjusted analyses (adjusted differences and 95% CIs: LOS—1.1 days [95% CI 0.3, 1.9 days], cost—\$1285 [95% CI \$588, \$1982]). The unadjusted and adjusted differences in LOS and cost by individual process of care completion are presented in Tables 4 and 5. Ten of the processes of care were significantly associated with longer LOS. Completion of patient care tasks (such as completing the “Mood Monitoring and Activity Chart”) and formulating a crisis prevention plan were associated with the largest differences in LOS. Nine processes of care were significantly associated with higher cost in unadjusted analyses; however, these results were no longer significant after adjusting for insurance, medical complexity and LOS.

Association Between Process of Care and ED Return Visits and Readmissions

Only 38 inpatient stays resulted in a 30-day return ED visit and 26 inpatient stays resulted in a 30-day inpatient readmission. There was no significant difference in the unadjusted odds of a 30-day ED return visit (OR 1.01 [95% CI 0.46, 2.22]) or a 30-day inpatient readmission (OR 1.22 [95% CI 0.44, 3.35]) between the low (reference) and high adherence categories. Adjusted odds ratios were similar to unadjusted results.

Discussion

This study is the first to examine the association between level of staff adherence to an adolescent depressive disorders inpatient clinical pathway and utilization outcomes. Our findings in a retrospective cohort of adolescent patients with depressive disorders demonstrate that higher staff adherence to a clinical pathway resulted in longer inpatient stays and higher associated costs of care.

The study findings were contrary to our hypothesis that higher adherence to a clinical pathway would result in shorter LOS. We hypothesized that implementing the care pathway would streamline care, thus allowing providers to avoid unnecessary interventions and provide more efficient care. This hypothesis was supported by a number of studies from non-psychiatric settings examining resource utilization in medical and surgical settings which have shown a decrease in resource utilization with the implementation of clinical pathways (Bryan et al. 2017; Lion et al. 2016; Stephen and Berger 2003; Sylvester and George 2014; Tarin et al. 2014; Varadhan et al. 2010). However, it may be that implementation of the adolescent depressive disorders clinical pathway actually added more care processes to the previous work-flow, thus increasing the time needed to complete the recommended care. These results are consistent with a study conducted in a psychiatric setting that found that implementation of an adolescent psychiatric clinical pathway for patients with anorexia nervosa resulted in longer LOS for all patients (Lock 1999). Therefore, in the case of psychiatric care, it may simply be that achieving higher quality care requires implementation of more care processes which takes more time.

In regards to demographic variables that may have contributed to this finding between adherence and LOS, we found there were a significantly larger proportion of publically-insured patients in the low adherence category compared to the high adherence category in this study sample (Table 2). However, adjusting for insurance status did not alter the association between level of adherence to the clinical pathway and LOS. This suggests that insurance status, which could potentially impact the number of days a patient is approved to stay in the hospital, does not appear to be an explanatory variable for the association between higher adherence on the clinical pathway and longer LOS.

In contrast to our initial hypothesis, higher adherence to the clinical pathway was also associated with higher costs, even after adjusting for differences in LOS. We hypothesized that the pathway would minimize extraneous care and therefore decrease costs, but pathway implementation may have actually increased the amount of care being provided to each patient, thus resulting in higher costs for patients in the high adherence group. This is in contrast to clinical pathways for conditions such as bronchiolitis, where healthcare providers are urged to minimize unnecessary care (Barben et al. 2008; Bryan et al. 2017; Mittal et al. 2014).

A strength of this study is that we identified the magnitude of association between individual processes of care and outcomes. For example, some of the largest differences in LOS were seen between patients who did and did not complete any psychotherapy models (Table 4). Although providing these processes of care within a longer time-frame may be justifiable for

patients to fully process the material presented in these modules, healthcare providers may want to consider starting these processes earlier in the hospitalization or explore ways to complete them more efficiently. However, if completion of these modules is proven to be effective only if given sufficient time to complete them, this may provide justification for reimbursement for longer LOS in order to receive effective, high-quality care.

Although the findings of this study demonstrate that patients who receive more clinical pathway care for adolescent depressive disorders have longer LOS and higher costs of care, more clinical pathway care may translate to improvements in as-yet unmeasured clinical outcomes. For example, a study of an adolescent psychiatric clinical pathway for patients with anorexia nervosa found that although patients on the pathway had longer LOS and higher cost, all of the patients in the last 20 months of the study met their clinical weight gain goals (Lock 1999). Therefore, we may be able to accept a degree of higher overall costs if improvements in clinical outcomes outweigh the higher cost of care, thus increasing value. In an attempt to address this question, we did examine 30-day ED return visits and 30-day unplanned inpatient readmissions as clinical outcomes; however, due to their rarity of occurrence, we were underpowered to detect any difference in these outcomes between the low and high adherence categories. Demonstrating higher value may also be achieved by measuring patient-reported outcomes (PROs) such as health-related quality of life and functional status (Calla et al. 2007). PROs or patient experience measures (such as patient-provider communication), may help to determine whether the clinical pathway actually improved the patients' health and sense of well-being (Hostetter and Klein 2012). In light of the goal of PROs, it seems especially important to include them as a component of psychiatric care pathway evaluation. In future analysis, by linking these pathway processes of care to outcomes such as PROs, we may begin to understand and recommend processes of care that yield the highest value to the patient.

The implementation and evaluation of the Adolescent Depressive Disorders Clinical Pathway may also serve as a guide to development of similar pathways at other institutions as the pathway was created using an evidence-based, multidisciplinary approach. Rigorous evaluation of the effectiveness of these pathways requires careful documentation of processes of care and this should be instituted from the outset, as some of these care processes have more fluid start and end points, which may make documentation difficult or onerous. Furthermore, the following interventions may lead to improved staff adherence to processes of care that were noted to have low adherence in this study: (1) embedding computerized orders or alerts into the electronic medical record to prompt staff to complete certain processes; (2) explicitly linking certain processes of care to routine events during the inpatient stay such as the admission process or reoccurring educational sessions; and (3) hiring dedicated staff to complete certain processes such as psychoeducation. Additionally, psychiatric units planning to implement similar pathways may consider collecting PROs pre- and post-implementation of the pathway to better understand how the clinical pathway impacts the value of care that is being provided. Finally, the pathway should be continually reviewed and revised to improve efficiency in care delivery and eliminate care processes that do not improve clinical outcomes to justify any increase in costs associated with providing more care.

Limitations

This study was conducted at a single institution, which may limit the generalizability of results; however, the study institution was likely representative of other large tertiary children's hospitals with a large referral base. Process of care completion was based on staff-reported data which may have resulted in misclassification of whether processes were truly completed or not; however, this limitation may be acceptable given that level of adherence to these types of care processes cannot be ascertained from administrative data (such as laboratory or billing data). Although we used the PMCA as a measure of medical complexity, we did not have a measure of patient severity of illness at the time of admission, which may have been a predictor of level of adherence to the clinical pathway or the measured outcomes. Additionally, we were underpowered to detect differences in 30-day ED return visits and 30-day readmissions between adherence categories due to the small number of patients who experienced these events. Finally, due to the retrospective cohort study design, we were only able to examine the correlation between higher level of adherence and longer LOS. An alternative interpretation of this result is that longer inpatient stays afford more time for clinical staff to complete processes of care.

Conclusions

Patients who received care with high adherence to an adolescent depressive disorders clinical pathway in the inpatient setting incurred a longer LOS and higher costs of care. Adherence to the clinical pathway was not associated with ED return visits or readmissions; however, we may have been underpowered to detect such differences in this study. This study contributes to the limited existing literature on adolescent depressive disorder care in the inpatient setting by providing a set of care processes that were developed using an evidence-based, multidisciplinary approach; providing a greater understanding of key drivers of LOS and cost associated with these processes of care, as well as standards around minimum LOS and cost needed to complete the recommended care for these patients. Future studies should examine the impact of these clinical pathways on clinical outcomes such as PROs to determine how to maximize the value of care for adolescents who are evaluated and treated for depression in the hospital setting.

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References

- Barben J, Kuehni CE, Trachsel D, & Hammer J (2008). Management of acute bronchiolitis: Can evidence based guidelines alter clinical practice? *Thorax*, 63, 1103–1109. 10.1136/thx.2007.094706. [PubMed: 18723582]
- Basu A (2017). Estimating costs and valuations of non-health benefits in cost-effectiveness analysis In Neumann P, Sanders G, Russell L, Siegel J & Theodore G (Eds.), *Cost-effectiveness in health and medicine* (pp. 201–236). New York, NY: Oxford University Press.
- Berry JG, Toomey SL, Zaslavsky AM, Jha AK, Nakamura MM, Klein DJ, et al. (2013). Pediatric readmission prevalence and variability across hospitals. *JAMA*, 309(4), 372–380. 10.1001/jama.2012.188351. [PubMed: 23340639]

- Berwick DM, Nolan TW, & Whittington J (2008). The triple aim: Care, health, and cost. *Health Affairs*, 27(3), 759–769. 10.1377/hlthaff.27.3.759. [PubMed: 18474969]
- Birmaher B, Brent DA, & Benson RS (1998). Summary of the practice parameters for the assessment and treatment of children and adolescents with depressive disorders. *Journal of the American Academy of Child and Adolescent Psychiatry*, 37(11), 1234–1238. 10.1097/00004583-199811000-00029. [PubMed: 10075518]
- Bryan M, Desai A, Wilson L, Wright D, & Mangione-Smith R (2017). Association of Bronchiolitis clinical pathway adherence with length of stay and costs. *Pediatrics*, 139(3), e20163432 10.1542/peds.2016-3432. [PubMed: 28183732]
- Buntin MB, & Zaslavsky AM (2004). Too much ado about two part models and transformation? Comparing methods of modeling Medicare expenditures. *Journal of Health Economics*, 23, 525–542. 10.1016/j.jhealeco.2003.10.005. [PubMed: 15120469]
- Bureau of Labor Statistics. (2013). Consumer Price Index. United States Department of Labor. Retrieved from <http://data.bls.gov/timeseries/CUUR0000SAM2>.
- Calla D, Yount S, Rothrock N, Gershon R, Cook K, Reeve B, et al. (2007). The patient-reported outcomes measurement information system (PROMIS): Progress of an NIH cooperative group during its first two years. *Medical Care*, 45(5 Suppl 1), S3–S11. 10.1097/01.mlr.0000258615.42478.55.
- Chassin MR, Brook RH, Park RE, Keesey J, Fink A, Kosecoff J, et al. (1986). Variations in the use of medical and surgical services by the Medicare population. *New England Journal of Medicine*, 314(5), 285–290. 10.1056/NEJM198601303140505. [PubMed: 3510394]
- Cheung AH, Zuckerbrot RA, Jensen PS, Ghalib K, Laraque D, Stein RE, & GLAD-PC Steering Group (2007). Guidelines for adolescent depression in primary care (GLAD-PC): II. Treatment and ongoing management. *Pediatrics*, 120(5), e1313–e1326. 10.1542/peds.2006-1395. [PubMed: 17974724]
- Coffey RJ, Richards JS, Remmert CS, LeRoy SS, Schoville RR, & Baldwin PJ (1992). An introduction to critical paths. *Quality Management in Health Care*, 1(1), 45–54. Retrieved from <http://journals.lww.com/qmhcjournal/pages/default.aspx>. [PubMed: 10131646]
- Cohen E, Barry JG, Camacho X, Anderson G, Wodchis W, & Guttmann A (2012). Patterns and costs of health care use of children with medical complexity. *Pediatrics*, 130(6), e1463–e1470. 10.1542/peds.2012-0175. [PubMed: 23184117]
- Desplenter FA, Laekeman GM, & Simoens SR (2009). Path way for inpatients with depressive episode in Flemish psychiatric hospitals: A qualitative study. *International Journal of Mental Health Systems*, 3(1), 23 10.1186/1752-4458-3-23. [PubMed: 19840384]
- Drummond M, Sculpher M, Claxton K, Stoddart G, & Torrance G (2015). Using clinical studies as vehicles for economic evaluation In *Methods for the economic evaluation of health care programmes* (4th edn., pp. 267–310). New York, NY: Oxford University Press.
- Emmerson B, Frost A, Fawcett L, Ballantyne E, Ward W, & Catts S (2006). Do clinical pathways really improve clinical performance in mental health settings? *Australasian Psychiatry*, 14(4), 395–398. 10.1111/j.1440-1665.2006.02311.x. [PubMed: 17116079]
- Erford BT, Erford BM, Lattanzi G, Weller J, Schein H, Wolf E, et al. (2011). Counseling outcomes from 1990 to 2008 for school-age youth with depression: A meta-analysis. *Journal of Counseling & Development*, 89(4), 439–457. 10.1002/j.1556-6676.2011.tb02841.x.
- Evans-Lacko SE, Jarrett M, McCrone P, & Thornicroft G (2008). Clinical pathways in psychiatry. *British Journal of Psychiatry*, 193(1), 4–5. 10.1192/bjp.bp.107.048926. [PubMed: 18700210]
- Greenham SL, & Bisnaire L (2008). An outcome evaluation of an inpatient crisis stabilization and assessment program for youth. *Residential Treatment for Children & Youth*, 25(2), 123–143. Retrieved from <http://www.tandfonline.com/toc/wrtc20/current>.
- Hazell P (2003). Depression in children and adolescents. *American Family Physician*, 67(3), 577–579. Retrieved from <http://www.aafp.org/journals/afp.html>. [PubMed: 12588080]
- Henken T, Huibers MJ, Churchill R, Restifo KK, & Roelofs JJ (2007). Family therapy for depression. *Cochrane Database of Systematic Reviews*, 2007(3), 1–27. 10.1002/14651858.CD006728.

- Hostetter M, & Klein S (2012). Using patient-reported outcomes to improve health care quality. Quality matters. The Commonwealth Fund. Retrieved from <http://www.commonwealthfund.org/Newsletters/Quality-Matters/2011/December-January-2012/In-Focus.aspx>.
- Jorm AF, Morgan AJ, & Hetrick SE (2008). Relaxation for depression. Cochrane Database of Systematic Reviews, 2008(4), 1–53. 10.1002/14651858.CD007142.pub2.
- Larun L, Nordheim L, Ekeland E, Hagen K, & Heian F (2006). Exercise in prevention and treatment of anxiety and depression among children and young people. Cochrane Database of Systematic Reviews, 2006(4), 1–38. 10.1002/14651858.CD004691.pub2.
- Lion L, Wright D, Spencer S, Zhou C, Del Beccaro M, & Mangione-Smith R (2016). Standardized clinical pathways for hospitalized children and outcomes. Pediatrics, 137(4), e20151202 10.1542/peds.2015-1202. [PubMed: 27002007]
- Lock J (1999). How clinical pathways can be useful: An example of a clinical pathway for the treatment of anorexia nervosa in adolescents. Clinical Child Psychology and Psychiatry, 4(3), 331–340. Retrieved from <http://journals.sagepub.com/loi/ccp>.
- Manning WG, & Mullahy J (2001). Estimating log models: To transform or not to transform? Journal of Health Economics, 20, 461–494. Retrieved from <https://www.journals.elsevier.com/journal-of-health-economics>. [PubMed: 11469231]
- Mittal V, Darnell C, Walsh B, Mehta A, Badawy M, Morse R, et al. (2014). Inpatient Bronchiolitis guideline implementation and resource utilization. Pediatrics, 133(3), e730–e737. 10.1542/peds.2013-2881. [PubMed: 24534398]
- Nakanishi M, Sawamura K, Sato S, Setoya Y, & Anzai N (2010). Development of a clinical pathway for long-term inpatients with schizophrenia. Psychiatry and Clinical Neurosciences, 64(1), 99–103. 10.1111/j.1440-1819.2009.02040.x. [PubMed: 20416029]
- National Collaborating Centre for Mental Health. (2010). Depression: The treatment and management of depression in adults (updated edition). Leicester: British Psychological Society and The Royal College of Psychiatrists.
- National Guideline Clearinghouse. (2010). Best evidence statement (BEST): Screening of children and adolescents for major depressive disorder (MDD). Retrieved from <http://www.ngc.gov/content.aspx?id=16308&search=major+depression>.
- New Zealand Ministry of Health. (2008). Identification of common mental disorders and management of depression in primary care. An evidence-based practice guideline. Wellington, NZ: New Zealand Guidelines Group Retrieved from <http://www.health.govt.nz/publication/identification-common-mental-disorders-and-management-depression-primary-care>.
- Rotter T, Kinsman L, James E, Machotta A, Gothe H, Willis J, et al. (2010). Clinical pathways: Effects on professional practice, patient outcomes, length of stay and hospital costs. Cochrane Database of Systematic Reviews, 2010(7), 1–121. 10.1002/14651858.CD006632.pub2.
- Simon TD, Berry J, Feudtner C, Stone BL, Sheng X, Bratton SL, et al. (2010). Children with complex chronic conditions in inpatient hospital settings in the United States. Pediatrics, 126(4), 647–655. 10.1542/peds.2009-3266. [PubMed: 20855394]
- Simon TD, Cawthon ML, Stanford S, Popalisky J, Lyons D, Woodcox P, et al. (2014). Pediatric medical complexity algorithm: A new method to stratify children by medical complexity. Pediatrics, 133(6), e1647–e1654. 10.1542/peds.2013-3875. [PubMed: 24819580]
- StataCorp. (2011). Stata statistical software: Release 12. College Station, TX: StataCorp LP.
- Stephen AE, & Berger DL (2003). Shortened length of stay and hospital cost reduction with implementation of an accelerated clinical care pathway after elective colon resection. Surgery, 133(3), 277–282. 10.1067/msy.2003.19. [PubMed: 12660639]
- Sylvester AM, & George M (2014). Effect of a clinical pathway on length of stay and cost of pediatric inpatient asthma admissions: An integrative review. Clinical Nursing Research, 23(4), 384–401. 10.1177/1054773813487373. [PubMed: 23676186]
- Tarin T, Feifer A, Kimm S, Chen L, Sjoberg D, Coleman J, & Russo P (2014). Impact of a common clinical pathway on length of hospital stay in patients undergoing open and minimally invasive kidney surgery. The Journal of Urology, 191(5), 1225–1230. 10.1016/j.juro.2013.11.030. [PubMed: 24270130]

- Todd J, Armon C, Griggs A, Poole S, & Berman S (2006). Increased rates of morbidity, mortality, and charges for hospitalized children with public or no health insurance as compared with children with private insurance in Colorado and the United States. *Pediatrics*, 118(2), 577–585. 10.1542/peds.2006-0162. [PubMed: 16882810]
- US Preventive Services Task Force. (2009). Screening and treatment for major depressive disorder in children and adolescents: US Preventive Services Task Force recommendation statement. *Pediatrics*, 123(4), 1223–1228. 10.1542/peds.2008-2381 [PubMed: 19336383]
- Varadhan KK, Neal KR, Dejong CH, Fearon KC, Ljungqvist O, & Lobo DN (2010). The enhanced recovery after surgery (ERAS) pathway for patients undergoing major elective open colorectal surgery: A meta-analysis of randomized controlled trials. *Clinical Nutrition*, 29(4), 434–440. 10.1016/j.clnu.2010.01.004. [PubMed: 20116145]
- Welch WP, Miller ME, Welch HG, Fisher ES, & Wennberg JE (1993). Geographic variation in expenditures for physicians' services in the United States. *New England Journal of Medicine*, 328(9), 621–627. 10.1056/NEJM199303043280906. [PubMed: 8429854]
- Williams SB, O'Connor EA, Eder M, & Whitlock EP (2009). Screening for child and adolescent depression in primary care settings: A systematic evidence review for the US Preventive Services Task Force. *Pediatrics*, 123(4), e716–e735. 10.1542/peds.2008-2415. [PubMed: 19336361]
- Zuckerbrot RA, Cheung AH, Jensen PS, Stein RE, & Laraque D (2007). Guidelines for adolescent depression in primary care (GLAD-PC): I. Identification, assessment, and initial management. *Pediatrics*, 120(5), e1299–e1312. 10.1542/peds.2007-1144. [PubMed: 17974723]

Table 1

Percent completion of individual processes of care within the Adolescent Depressive Disorders Clinical Pathway

Short description	Long description	All patients		Low adherence category	
		N	Percent completion	N	Percent completion
Admission					
Collected outside medical records	Staff collected outside medical records from primary care and psychiatric providers	511	91	159	75
Administered self-report measures	Staff administered empirically-validated self-report measures of depressive and other associated symptoms (e.g. anxiety)	520	76	168	55
Patient tasks					
Completed chain analysis of problem behavior	Staff completed psychotherapy module in which patient and therapist complete an in-depth analysis of the behavior that led to hospitalization	494	88	166	78
Completed "Mood Monitoring and Activity Chart" task	Staff completed psychotherapy module focused on looking at how mood is impacted by situations and events in patient's life	507	85	166	63
Completed "Automatic Thoughts and Cognitive Distortions" task	Staff completed psychotherapy module focused on looking at impact of automatic negative thoughts on patient's mood, different types of cognitive distortions, the importance of challenging cognitive distortions with evidence to the contrary	507	82	165	58
Diagnosis and education					
Clarified diagnosis and educated patient	Staff clarified the patient's diagnosis through clinical interviews and provided information to patients regarding their diagnosis	529	70	172	24
Clarified diagnosis and educated caregiver	Staff clarified the patient's diagnosis through clinical interviews and provided information to caregivers regarding the patient's diagnosis	529	69	172	23
Assessed need for new medication or medication changes	Staff assessed the potential benefit of a medication trial or adjustment of current medication(s)	529	81	172	41
Educated patient and caregivers about new medications or medication changes	Staff solicited consent regarding new medications or medication changes and educated the patient and family regarding these changes	529	74	172	35
Caregiver tasks					
Completed safety planning with caregiver	Staff provided patients/caregivers with psychoeducation regarding how to mitigate the risk of suicide and other safety concerns in the home	506	91	165	74
Reviewed chain analysis of problem behavior with caregiver	Staff facilitated a discussion between patient and caregivers in which patient shared his/her in-depth analysis of the behavior that led to hospitalization	392	70	118	52
Discharge					
Formulated crisis prevention plan	Staff collaborated with patient and family to formulate a plan to prevent crisis situations	503	92	162	79
Informed outpatient providers about patient's discharge	Staff informed outpatient providers about the patient's discharge from the unit	506	88	161	70

Table 2

Patient demographic characteristics overall and by adherence category

	All patients N = 529	Low adherence category N = 172	High adherence category N = 183
Age (y)			
Mean (standard deviation)	14.7 (1.67)	14.7 (1.72)	14.7 (1.64)
10–12 y	11%	12%	8%
13–15 y	54%	53%	57%
16–18 y	35%	34%	36%
Gender			
Female	74%	73%	77%
Race/ethnicity			
White	68%	64%	74%
Black	5%	6%	6%
Hispanic	11%	12%	6%
Asian	3%	4%	2%
Other	13%	14%	13%
Insurance status			
Public	35%	40% *	27% *
PMCA ^a			
Non-chronic	2%	2%	2%
Non-complex chronic	72%	71%	75%
Complex chronic	26%	27%	24%

y years

* Significant difference between adherence categories ($P < .05$)^a The non-chronic and non-complex chronic Pediatric Medical Complexity Algorithm (PMCA) categories were combined in all analyses (Simon et al. 2014)

Table 3

Unadjusted and adjusted length of stay and cost by adherence category

Outcome	No. of eligible patients	Adherence category	Unadjusted (95% CI)	Unadjusted difference (95% CI)	Adjusted (95% CI)	Adjusted difference (95% CI)
Length of stay	529	Low	6.4 days	1.1 [*]	6.5 days ^a	1.1 [*]
			(5.8, 7.1)	(0.3, 1.9)	(5.8, 7.1)	(0.3, 1.9)
		High	7.6 days		7.6 days ^a	
Cost	529	Low	(7.1, 8.1)		(7.1, 8.1)	
			\$16,948	\$2,612 [*]	\$18,515 ^b	\$1,285 [*]
		High	(\$15,575, \$18,320)	(\$795, \$4,430)	(\$17,414, \$19,617)	(\$588, \$1982)
			\$19,560		\$19,800 ^b	
			(\$18,369, \$20,751)		(\$18,912, \$20,689)	

^{*} $P < .05$,^{**} $P < .01$,^{***} $P < .001$ ^a Adjusted for insurance status and medical complexity^b Adjusted for insurance status, medical complexity, and length of stay

Table 4

Difference in length of stay based on process of care completion

Process of care	Unadjusted difference in LOS ^a (95% CI)	Adjusted difference in LOS ^{a,b} (95% CI)
Collected outside medical records	1.56 ^{**} (0.41, 2.71)	1.53 ^{**} (0.38, 2.67)
Administered self-report measures	0.44 (−0.31, 1.19)	0.41 (−0.33, 1.16)
Completed chain analysis of problem behavior	1.91 ^{***} (0.90, 2.92)	1.84 ^{***} (0.82, 2.85)
Completed “Mood Monitoring and Activity Chart” task	2.52 ^{***} (1.67, 3.38)	2.48 ^{***} (1.63, 3.33)
Completed “Automatic Thoughts and Cognitive Distortions” task	1.91 ^{***} (1.08, 2.74)	1.85 ^{***} (1.02, 2.68)
Clarified diagnosis and educated patient	0.61 (−0.10, 1.32)	0.59 (−0.11, 1.30)
Clarified diagnosis and educated caregiver	0.72 [*] (0.01, 1.43)	0.70 [*] (−0.001, 1.41)
Assessed need for new medication or medication changes	1.34 ^{**} (0.53, 2.15)	1.29 ^{**} (0.48, 2.10)
Educated patient and caregivers about new medications or medication changes	1.44 ^{***} (0.68, 2.21)	1.41 ^{***} (0.64, 2.17)
Completed safety planning with caregiver	0.64 (−0.51, 1.78)	0.63 (−0.52, 1.78)
Reviewed chain analysis of problem behavior with caregiver	1.24 ^{**} (0.49, 1.99)	1.13 ^{**} (0.37, 1.89)
Formulated crisis prevention plan	2.10 ^{**} (0.89, 3.31)	1.98 ^{**} (0.76, 3.20)
Informed outpatient providers about the admission	1.35 ^{**} (0.37, 2.33)	1.37 ^{**} (0.39, 2.35)

LOS length of stay

^{*} $P < .05$;^{**} $P < .01$;^{***} $P < .001$ ^a Positive values reflect longer length of stay for patients who received the process of care compared to patients who did not receive the process of care (reference group)^b Adjusted for insurance status and medical complexity [using the Pediatric Medical Complexity Algorithm (Simon et al. 2014)]

Table 5

Difference in cost based on process of care completion

Process of care	Unadjusted difference in cost (95% CI) ^a	Adjusted difference in cost (95% CI) ^{a,b}
Collected outside medical records	\$3658 ** (\$1052, \$6264)	\$163 (–\$228, \$555)
Administered self-report measures	\$914 (–\$783, \$2610)	–\$90 (–\$348, \$168)
Completed chain analysis of problem behavior	\$4448 *** (\$2155, \$6740)	\$146 (–\$210, \$501)
Completed “Mood Monitoring and Activity Chart” task	\$5719 *** (\$3781, \$7658)	\$52 (–\$271, \$376)
Completed “Automatic Thoughts and Cognitive Distortions” task	\$4213 *** (\$2334, \$6092)	–\$111 (–\$407, \$184)
Clarified diagnosis and educated patient	\$1372 (–\$239, \$2982)	\$4 (–\$241, \$249)
Clarified diagnosis and educated caregiver	\$1565 (–\$39, \$3169)	–\$50 (–\$295, \$195)
Assessed need for new medication or medication changes	\$2874 ** (\$1028, \$4719)	–\$145 (–\$429, \$138)
Educated patient and caregiver about new medications or medication changes	\$3133 *** (\$1391, \$4875)	–\$118 (–\$388, \$151)
Completed safety planning with caregiver	\$1525 (–\$1071, \$4121)	\$82 (–\$313, \$477)
Reviewed chain analysis of problem behavior with caregiver	\$2798 ** (\$1100, \$4497)	–\$12 (–\$291, \$267)
Formulated crisis prevention plan	\$4989 *** (\$2244, \$7734)	\$229 (–\$200, \$658)
Informed outpatient providers about the admission	\$2988 ** (\$767, \$5210)	–\$21 (–\$358, \$315)

* $P < .05$;** $P < .01$;*** $P < .001$ ^a Positive values reflect higher costs for patients who received the process of care compared to patients who did not receive the process of care (reference group)^b Adjusted for insurance status, medical complexity [using the Pediatric Medical Complexity Algorithm (Simon et al. 2014)], and length of stay