Change Trajectories: Children's Patterns of Improvement in Acute-Stay Inpatient Care

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Abstract

This study estimated classes of children's acute-stay psychiatric acuity trajectories in terms of shape (i.e., linear, quadratic, cubic) and rate of change (slope). A total of 788 children served on three child units (ages 4–12) were studied. The Children's Acuity of Psychiatric Illness (CAPI) was completed each weekday by trained frontline staff on the milieu. Latent class growth analysis was applied to the data, and seven acuity trajectory classes provided the most parsimonious fit. Four classes evidenced a significant quadratic term, one class a significant linear term, and two classes did not evidence a significant change in acuity. The classes varied in survival time to rehospitalization, in pre-treatment community service use and rates of seclusion, restraint, and emergency medications during the episode. Overall, the results suggest that acute-stay patients may have distinct and identifiable psychiatric acuity change patterns during their episodes and that some may experience non-linear (i.e., quadratic) acuity trajectories.

Introduction

Inpatient psychiatric care has been transformed over the past 30 years, due largely to de-institutionalization, managed care, and a community-centered approach to behavioral health care service delivery. As a result, psychiatric hospitalization is no longer an extended treatment with episodes lasting weeks and even months or goals which often included

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structural improvement in patients' psychological and social functioning. In the current behavioral health care environment, inpatient stays for children and adolescents last an average of approximately 4.5 days,[1] and the most common goal is to efficiently reduce acute risk so that the discharge community setting can continue to work to promote patients' long-term functioning.

Unfortunately, as the inpatient care model shifted toward short-stay crisis stabilization, the empirical outcomes literature struggled to find a set of methods and statistical approaches to adequately evaluate the reconstructed psychiatric hospital system. Prior research in the inpatient care literature often conceptualized psychiatric hospital outcomes in terms of sustained improvement in long-term functioning and emotional well-being post-discharge, such as stable Child Behavior Checklist (CBCL) scores at 6 and even 12 months after care.[2] Arguably, these approaches are not well-suited to evaluating an acute-stay system designed to help patients mitigate the emergent psychiatric distress associated with current stressors and immediate risk. However, the approach adopted to replace these outmoded methods was to examine utilization variables (e.g., length of stay and hospital readmission), which have come to dominate the inpatient services research literature and dramatically so after the policy changes of the mid to late 1980s and their emphasis on reductions in bed days.[3] One effect of the increasing focus on utilization variables is that acute-stay psychiatric hospitalization is considered to have the least established research base.[4] Acute-stay psychiatric hospitalization has lagged behind other behavioral health modalities (e.g., outpatient psychotherapy) in the development and dissemination of empirically supported treatment models, outcome measurement strategies tailored specifically to the goals of care, and research seeking to identify the process variables that may mediate patient improvement across distinct patient groups.[5]

One approach to better understanding the acute-stay psychiatric hospital experience is to quantify, through repeated measurement, patients' treatment responses. The potential benefit of such an approach can be seen in the rich history of treatment response research in the outpatient psychotherapy literature. This literature produced evidence of a proto-typical dose response to psychotherapy that is log-linear, with rapid early gains that peak and then taper.[6] This initial empirical work on the log-linear dose response to psychotherapy led to the phase-model of psychotherapy, holding that improvement in well-being occurs first, followed by changes in symptoms and finally functioning.[7] Recently, researchers have used the log-linear and phase models to develop the statistical models they use to give feedback to clinicians about their patients' progress.[8]

The limitation of the early treatment response research in the psychotherapy literature is that it is unlikely that all patients respond to care with the same temporal change pattern (e.g., a log-linear response) or evidence the same change process (e.g., the phase model). However, with the popularization of group-based trajectory models (e.g., latent class growth analysis, growth mixture modeling)[9] in the behavioral health care evaluation literature, researchers now have an empirical method for estimating the number of unique responses to care and the mathematical shapes of those responses. For example, in the psychotherapy literature, group-based trajectory modeling was used to estimate five unique treatment response patterns based on patients' self-report of symptoms after every session of treatment.[10] Interestingly, only one "class" of patients, less than a third, entered treatment and experienced the quick decrease in symptom severity followed by a tapering off of improvement that is consistent with the traditional log-linear treatment response. Group-based trajectory modeling has now been used to estimate treatment response typologies across a number of mental health conditions and services, including patterns of change in symptoms of post-traumatic stress disorder following injury,[11] change trajectories among people with schizophrenia served in a long-term rehabilitation program,[12] and patterns of vocational

functioning for groups of patients with mental illness.[13] However, this relatively new approach has not been applied to the acute-stay psychiatric hospitalization literature.

A consistent finding in the studies using group-based trajectory models to estimate typologies ("classes") of treatment responses is that at least one class and often multiple classes in the sample evidence a significant quadratic effect, suggesting a curvilinear treatment response. There is good reason to speculate that children in crisis receiving acute-stay services do not all experience a consistent, linear response to treatment in terms of changes in psychiatric acuity. First, children and adolescents experience dysregulation and mercurial behavior as a normal part of their developmental course.[14] Second, inpatient treatment is often thought of as an opportune time to adjust medication regimens in a safe environment, which can lead to biologically based emotional and behavioral responses that range from an over flattening of affect[15] to an intensification of the child's agitation.[16]

Finally, the hospital environment is designed to be a very different experience compared to life in the community, which is reflected in large part by the natural restrictions of the setting and the structure youth experience on the milieu. Clinical tradition has held that the increased restrictions and structure experienced on inpatient units provide an environmental support that helps to emotionally "contain" patients in acute psychiatric distress. When this containing effect happens quickly, it has been proposed that patients can experience a change pattern that has been described as the "honeymoon effect."[17] A honeymoon effect would be seen in a patient experiencing an immediate and precipitous drop in symptoms and acuity occurring in a beginning phase of treatment—presumably resulting from the significant changes brought by the treatment and the unique milieu environment—followed by a significant rise in symptoms and acuity before falling again and finally stabilizing.

There is some empirical work on the "honeymoon effect" hypothesis in the child and adolescent inpatient literature, but this research is limited to only two studies. An early study of child and adolescent psychiatric inpatients measured symptoms at 14, 60, and 90–120 days into care and found that, on average, symptoms of aggression, dependency, and behavior disorder were more severe at 60 days than they were at the first time point (14 days), but had significantly decreased upon discharge.[18] However, this study was limited in that it used a statistical analysis—*t* tests—which did not allow for an assessment of the number of trajectories youth can experience (e.g., linear, curvilinear). Further, it did not use a reliable and valid measure of symptoms, and the average length of stay ranged from 90 to 120 days, which is not representative of today's acute-stay system.

The second study measured behaviors and symptoms daily using a reliable and valid measure and reported that 34% of youth in their study demonstrated a honeymoon effect, 15% were reported to evidence a linear improvement, and 30% experienced no change according to the authors.[19] However, their approach had most of the same limitations as the earlier study.[18] For example, their approach required them to collapse daily ratings into three time points, and it was not able to inferentially test the possibility that multiple classes of honeymoon trajectories might exist, differing on their slopes. Further, the average length of stay was 80 days, which is again unrepresentative of the typical episode in today's acute stay system.

The current study uses a group-based trajectory model known as latent class growth analysis (LCGA)[9] in an attempt to model possible diversity in the courses of change in psychiatric acuity children may experience during acute-stay psychiatric hospitalization. And despite the limited research that has been conducted on the possibility of non-linear responses to inpatient care, it is hypothesized that at least one class of patients will demonstrate a significant quadratic response pattern. Further, based on the broader behavioral health care literature, it is hypothesized that at least one class of patients will demonstrate a significant linear response to treatment.

Method

This study was conducted at three psychiatric hospitals with child units (ages 4–12) in Illinois, Missouri, and Kentucky. The hospitals were owned by Psychiatric Solutions, Incorporated (PSI), a national, for-profit corporation specializing in inpatient psychiatric services. A pilot study was conducted between August 2009 and October 2009 to ensure study feasibility and measurement reliability. Data collection for this study commenced on October 1, 2009, and ended on October 1, 2010.

Participants

Participants were recruited upon intake to the hospital by the intake coordinators. Parents or legal guardians were informed by the intake coordinators that the study would measure changes in the psychiatric acuity their child was experiencing on the unit in order to monitor hospital outcomes and promote quality improvement. For children not in the child welfare system, the intake coordinator then introduced an informed consent form approved by the IRB at Loyola University Chicago. Parents or legal guardians who agreed to participate signed the form, with the intake coordinator as witness. For participants who were in state custody, consent was received by the investigators from the Guardian's office. Finally, verbal assent was obtained from the children by the intake coordinator. Over 95% of potential subjects agreed to participate in the study, and this percentage was consistent across the three participating hospitals. A total of 788 youth participated in the study across the three hospitals (hospital A n=306 [39%], hospital B n=206 [26%], hospital C n=273 [35%]) during the yearlong study period. See Table 3 for descriptives. At the request of one of the hospitals, race/ethnicity data were not reported. However, the race/ethnicity of the milieu census was reported for the year previous to beginning the study, and based on these reports, 50% of the sample can be estimated to be Caucasian, 35% African-American, 10% Latino(a), and 5% other.

Assessment and measures

Acuity of Psychiatric Illness, Child/Adolescent version

The measure of psychiatric acuity used in this study to evaluate outcomes was the Acuity of Psychiatric Illness, Child/Adolescent version (CAPI).[20] The CAPI consists of 17 items rated across three domains: risk behaviors (e.g., suicidal ideation or gesture, aggressive behavior toward people), symptoms (e.g., reality assessment, anxiety, noncompliance), and functioning (e.g., peer functioning, self-care functioning). Each item is rated on a 0–3 scale ("0"=no evidence of acuity, "1"=mild acuity, "2"=moderate acuity, "3"=severe acuity), and the items are rated based on the past 24 h. For example, a score of zero on the CAPI item self mutilation behavior would indicate that the child did not engage in self-mutilation over the past 24 h on the milieu beyond normative behaviors such as nail biting or drawing on the skin. At the extreme, a 3 rating on self mutilation behavior would indicate behavior with potentially significant medical risk such as head banging, self-biting, or cutting. Prior research has found that both the adult and child versions of the Acuity of Psychiatric Illness measures are reliable and sensitive to change over small periods of time.[20] The alpha reliability of the CAPI as a composite measure of acuity was 0.80, in the acceptable range.

The CAPI was completed by milieu therapists and psychiatric nurses at the end of each weekday shift. The clinicians completed CAPI ratings based on their experience with the youth that day and after reviewing shift notes spanning the 24-h period in which the CAPI was rated. In addition to rating the 17 CAPI items, staff also recorded whether or not the youth experienced seclusion,

restraint, or received emergency medication in the 24-h period in which the form was rated. Staff were required to complete a 2-h training in the use of the CAPI, which included rating practice vignettes and discussing actual cases. Staff then completed a certification vignette and were required to be 85% accurate in their ratings to receive certification. This led to an overall Kappa reliability of 0.80 across the trainings. Reliability was further ensured through ongoing chart reviews. The primary author and quality assurance staff rated a sub-sample of existing charts and provided feedback to staff about their reliability. Staff were awarded incentives of US$15.00 gift cards for demonstrating percent correct accuracies of 80% or higher. A Kappa reliability of 0.75 was maintained throughout the study.

Demographics and service context form

A demographics and service context form was also developed for this study, and intake coordinators/staff at the hospitals were asked to complete the form at the beginning of treatment. The form assessed demographic information (e.g., age, gender), the child's custody and placement status prior to intake (e.g., child welfare status, biological parent, home of relative, residential treatment placement), and prior hospitalization dates at current and other hospital units. The form also included a service use survey in which all outpatient services the child was receiving at the time of intake were reported. The categories of pre-treatment outpatient service use included individual therapy, group therapy, family therapy, occupational therapy, medication management, tutoring, and mentoring. However, due to the detailed and time-intensive nature of the form, intake staff found effective and comprehensive completion of the form cumbersome, and this led to less than ideal completion rates. Participation rates for the demographics and service context form were 65.03, 67.48, and 32.97% at hospitals A, B, and C, respectively.

Days to readmission

Rehospitalization status (rehospitalized or not rehospitalized) along with days to rehospitalization (right-censored) was confirmed for 610 cases using the demographics and service context form and by matching identification numbers in the dataset. Days to rehospitalization were computed as the number of days between the discharge date of the first hospitalization and the intake date of the rehospitalization. For children who did not rehospitalize in the study period, days were determined by the number of days between the hospitalization discharge date and the end of the study, October 1, 2010.

Data analysis

In order to examine possible patterns of change over time, a latent class growth analysis (LCGA) was performed. LCGA has been developed extensively[21] and was estimated in the current study using the PROC TRAJ procedure[22] using SAS 9.0.[23] LCGA identifies probabilities that each person belongs to a particular trajectory, based on the similarities and differences in their scores. Unlike traditional fixed-effects approaches (e.g., analysis of variance), in which the relations among variables are fixed across individuals (most commonly, assumed to be a linear relation), latent trajectory approaches model variation in growth parameters, such as intercept and slope, over individuals.[24] The raw CAPI data were positively skewed with a high percentage of low scores, which can lead to an increase in the number of assessed trajectories. Therefore, based on the dimensions of the distribution, a square root transformation was applied, which brought the data closer to a normal distribution. However, a Kolmogorov–Smirnov test (K–S test) suggested that the data were still not completely normal (see discussion for implications).

In LCGA, models are estimated addressing classes and polynomials to assess trajectories of change. While more classes and polynomials necessarily fit the data better, they are also less parsimonious. Therefore, fit statistics in LCGA are evaluated comparatively. In addition to likelihood estimates of the model, the Akaike information criterion (AIC) and Bayesian information criterion (BIC) were examined, and in all cases, lower values indicated a better fit relative to number of parameters. The lowest value was used to judge which model had the best fit, with models varying in the number of groups estimated and the order of the classes (e.g., linear, quadratic, cubic).

To examine the potential relationships between class membership and pre-treatment service use variables (e.g., pre-treatment use of outpatient psychotherapy), chi-square tests of independence were used. Similarly, chi-square tests of independence were used to test the relationship between class membership and membership in a collapsed variable representing three categories of mean rates of seclusion, emergency medications, and restraint across the episodes.

To examine the relationship between group membership and days to readmission, a Cox proportional hazards regression model[25] was used, controlling for intake CAPI scores. All assumptions of the regression were met prior to running the model.

Results

Table 1 provides the fit statistics. A seven-class, quadratic model provided the best fit to the data using the BIC and a seven-class cubic model provided the best fit using the AIC. Given this discrepancy, the more parsimonious seven-class quadratic model was retained. Table 2 presents the coefficients and standard errors for the intercept and the slopes for the linear and quadratic effects for all seven classes. Tests of significance allowed for a determination as to whether the class change pattern could be defined as linear, quadratic, or no change. Accordingly, one class could be defined as linear, four as quadratic, and two as evidencing no change. Further, Table 2 provides the mean probability of group membership among the classes for all youth who were predicted to be in the class and for all youth predicted to be in a different class. All the classes except class six had a mean probability of membership for all predicted classes above Nagin's[9] recommended level of 0.70, and the probability for class six was close at 0.68. A conditional model was also run using hospital as a predictor. This variable was not a significant predictor of class membership, suggesting that the number of classes and proportion of children in the classes did not vary significantly across providers.

Table 1

Comparison of linear, quadratic, and cubic fit statistics: psychiatric acuity

	Linear		Quadratic		Cubic	
Number of classes	**AIC**	**BIC**	**AIC**	**BIC**	**AIC**	**BIC**
1	−8,279.90	−8,286.91	−8,279.90	−8,286.91	−8,279.57	−8,291.24
2	−7,768.17	−7,782.18	−7,768.22	−7,786.89	−7,766.82	−7,790.17
3	−7,614.67	−7,635.68	−7,614.43	−7,642.45	−7,613.97	−7,648.99
4	−7,570.69	−7,598.71	−7,542.59	−7,579.95	−7,536.94	−7,583.64
5	−7,548.07	−7,583.09	−7,496.83	−7,543.53	−7,487.02	−7,545.39
6	−7,532.70	−7,574.73	−7,478.15	−7,534.18	−7,458.42	−7,528.47
7	−7,527.00	−7,576.03	−7,453.04	−7,518.42	−7,438.24	−7519.95

AIC Akaike information criterion, *BIC* Bayesian information criterion

Table 2

Growth factor parameter estimates for seven-class unconditional model: psychiatric acuity

Class	Intercept		Linear		Quadratic		Mean probability estimate in-class, % (out-class, %)
	Est.	SE	Est.	SE	Est.	SE	
1 Moderate early increase followed by rapid decrease	−0.839**	0.267	0.725**	0.149	−0.077**	0.019	78.41 (1.10)
2 Slow continuous increase followed by slow modest decrease	−0.167	0.225	0.780**	0.111	−0.001**	0.013	77.30 (2.65)
3 Moderate intake acuity, no change	2.490**	0.107	−0.015	0.040	−0.001	0.005	75.07 (8.71)
4 Early modest increase followed by rapid decrease	1.102**	0.211	0.704**	0.126	−0.118**	0.017	77.73 (3.60)
5 Early modest decrease followed continuous rapid increase	1.690**	0.126	−0.710**	0.083	0.089**	0.011	77.74 (3.34)
6 Steady linear decrease	1.948**	0.090	−0.105*	0.053	0.007	0.006	68.84 (10.57)
7 High intake acuity, no change	3.285**	0.098	0.036	0.058	−0.007	0.007	85.52 (2.15)

Est. estimate, *SE* standard error
*$p<0.05$; **$p<0.01$

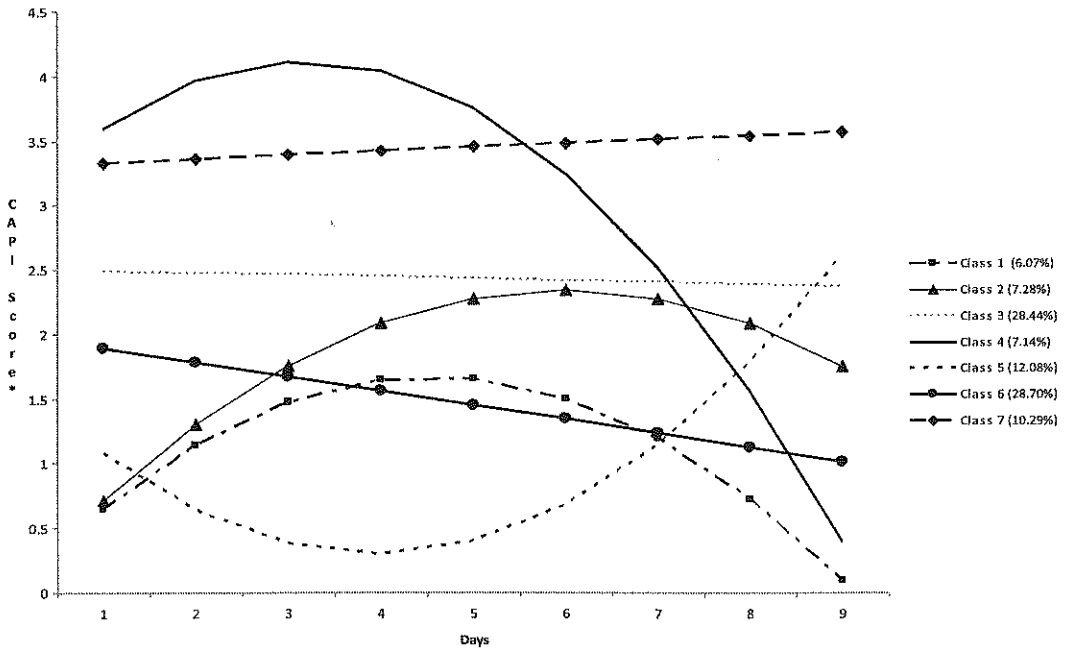
Figure 1 provides a visual depiction of the shape and rate of change for the seven classes. Class one (6.07% of cases) was one of the four quadratic classes and can be described as a class of patients who show a moderate early increase in acuity during the episode followed by rapid decrease. Class two (7.28% of cases), a quadratic, demonstrated a slow continuous increase in acuity followed by slow modest decreases in acuity. Class three (28.44% of cases) entered care with moderate intake acuity, but children in this class demonstrated no significant change. Class four (7.14% of cases) demonstrated an early modest increase followed by the quickest decrease of any class. Class five (12.08% of cases) was the fourth class evidencing a quadratic effect but in the opposite direction compared to the other quadratic classes. This group evidenced early modest decreases in acuity followed by continuous rapid increases. Class six (28.70% of cases) demonstrated steady linear decreases in acuity. Finally, class seven (10.29% of cases) had relatively high intake acuity and no significant change.

Demographic and service use comparisons

The seven classes were compared across demographic variables (age, gender, custody status) and outpatient services prior to admission (i.e.., individual therapy, group therapy, family therapy, medication management, tutoring, and mentoring). Demographic characteristics for the overall sample and by class can be seen in Table 3. For demographic variables, while the mean age was 8.85 (SD=2.22), the classes varied significantly in age, $F(6, 421)=2.99$, $p<0.01$. However, post hoc analyses did not yield any significant comparisons between any two classes on age. For gender, in the overall sample, approximately one third was female, and this rate did not differ significantly across the classes. Child welfare status varied across class membership χ^2 (6, N=404)=12.64, $p<0.001$. In the overall sample, 13.6% was in the child welfare system. However, this percentage varied from 3.2% for class two to 40.5% for class seven.

Figure 1

Latent class growth analysis: psychiatric acuity. *CAPI* child and adolescent acuity of psychiatric illness. *Class 1* (*N*=49), moderate early increase followed by rapid decrease; *Class 2* (*N*=52), slow continuous increase followed by slow modest decrease; *Class 3* (*N*=233), moderate intake acuity, no change; *Class 4* (*N*=39), early modest increase followed by rapid decrease; *Class 5* (*N*=93), early modest decrease followed continuous rapid increase; *Class 6* (*N*=248), steady linear decrease; *Class 7* (*N*=74), high intake acuity, no change. *Increasing scores on the CAPI* indicate higher acuity



In terms of outpatient service use, only tutoring χ^2 (6, N=132)=39.34, p<0.001 and occupational therapy χ^2 (6, N=135)=12.72, p=<0.05 were associated with class membership. Class seven received tutoring at a level of 40% and received occupational therapy at a level of 30%, compared to rates of less than 5% for the remaining classes. Finally, the overall length of stay

Table 3

Comparison of psychiatric acuity trajectory classes across demographics (*N*=430)

	Class									
	Overall	1	2	3	4	5	6	7		*p*
Age M (SD)	8.85 (2.22)	9.52 (1.89)	8.81 (2.19)	8.51 (2.23)	9.65 (2.25)	9.48 (1.93)	9.04 (2.31)	8.07 (2.00)	*F*=2.99	<0.01
Gender: female % (*n*)	34.2 (147)	57.1 (12)	34.4 (11)	28.9 (41)	33.3 (7)	33.3 (14)	36.8 (49)	33.3 (13)	χ^2=13.43	0.34
Custody status: child welfare % (*n*)	13.6 (55)	25.0 (5)	3.2 (1)	10.4 (14)	5.9 (1)	12.5 (5)	11.3 (14)	40.5 (15)	χ^2=12.64	<0.001

Class 1 moderate early increase followed by rapid decrease; *Class 2* slow continuous increase followed by slow modest decrease; *Class 3* moderate intake acuity, no change; *Class 4* early modest increase followed by rapid decrease; *Class 5* early modest decrease followed continuous rapid increase; *Class 6* steady linear decrease; *Class 7* high intake acuity, no change

(LOS) varied across the seven classes, $F(6, 736)=6.23$, $p<0.001$. Post hoc analyses indicated that class three had a higher mean LOS ($M=13.19$, $SD=10.90$) than class one ($M=8.20$, $SD=5.21$), class five ($M=8.91$, $SD=8.55$), or class six ($M=9.65$, $SD=7.20$).

Seclusion, restraint, emergency medication, and days to rehospitalization comparisons

Staff recorded on the CAPI forms whether or not the youth received a seclusion, emergency medication, or restraint in the 24-h period in which the form was rated. These behavior management strategies were averaged across the children's episodes. However, due to the predominance of zeros in the data, average scores were collapsed into three categories. For the seclusion mean, zero was designated a zero, mean scores ranging from 0.01 to 0.09 were designated a one, and scores 0.10 and above were designated a two. A significant chi-square emerged, χ^2 (12, $N=788$)=44.73, $p<0.001$. For the emergency medications mean, zero was designated a zero, mean scores ranging from 0.01 to 0.24 were designated a one, and scores 0.25 and above were designated a two. A significant chi-square emerged, χ^2 (12, $N=788$)=72.97, $p<0.001$. For the restraints mean, zero was designated a zero, mean scores ranging from 0.01 to 0.09 were designated a one, and scores 0.10 and above were designated a two. A significant chi-square emerged, χ^2 (12, $N=788$)=63.68, $p<0.001$. Class seven stood out as the primary driver of the significant chi-square results. Fourteen percent of youth in class seven were designated in the highest seclusion rate group, 26% in the highest emergency medications group, and 14% in the highest physical restraint group, compared to an overall group rate of 4, 10, and 3% respectively.

A Cox proportional hazards regression model[25] was next used to predict days to rehospitalization with class membership entered as a categorical predictor. Of the 610 cases examined, 93 (15%) rehospitalized, and the mean number of days to rehospitalization for this group was 193.72 (SD=104.20). All assumptions of the test (e.g. the proportionality assumption) were met. A significant model emerged, χ^2 (6, $N=610$)=14.12, $p<0.05$, indicating that the classes varied significantly in their survival curves. Inspection of the survival curves suggested that class four (early modest increase followed by rapid decrease) and class five (early modest decrease followed continuous rapid increase) experienced longer times to rehospitalization compared to the remaining five classes. A subsequent Cox regression model comparing classes four and five with the remaining classes was also significant χ^2 (1, $N=610$)=6.83, $p<0.001$, 95%. Mean survival time estimates were 344.07, 95% confidence interval (CI) [329.21, 358.93] for classes four and five and 310.99, 95% CI [300.76, 321.26] for the remaining classes.

Discussion

Very little is empirically known about the way people in crisis respond to acute-stay psychiatric inpatient care in terms of identifiable change patterns. This study was the first to use group-based trajectory modeling, LCGA, to model the courses of change in psychiatric acuity children experience during acute-stay psychiatric hospitalization, and only the third known study to test the hypothesis that some patients may have a non-linear response to inpatient care. A model with seven classes provided the best fit to the data. One trajectory was linear, four were quadratic, and two trajectories were not associated with a significant linear or quadratic change. The finding of significant quadratic response patterns—with a more refined statistical approach than has been previously used—is consistent with the prior research suggesting that response to inpatient care may at times be non-linear (e.g., the honeymoon effect).

Overall, these results appear broadly consistent with Blader and colleagues'[19] report of three general treatment response categories: linear responders, honeymoon effect responders (quadratic), and non-responders. By using LCGA, this study was able to provide more specific estimates of the average slopes among the children in the four quadratic groups. However, unlike Blader and

colleagues, the results here suggest there may be some patients that evidence a negative quadratic slope (classes one, two, and four) and others that demonstrate a positive quadratic slope (class five), begging the question as to which, if any, quadratic slope direction can or should be considered representative of a honeymoon effect. For example, comparing the two types of quadratic functions found, class four experiences a small increase over the first 3 days but then a much more quick and drastic drop in scores in CAPI scores, while class five children enter care and begin to experience a drop in acuity over the first 4 days on average, followed by a steady increase in acuity for the next 5 days. Without examining in richer detail what these children were experiencing as their acuity was fluctuating, it is imprudent to speculate about which, if any, group was experiencing what has been termed a honeymoon effect. This represents a goal for future research and one that might be accomplished by employing treatment process measures and qualitative methods.

The identification of such diverse treatment response typologies may have a number of implications for training, practice, and research, much of which must await future research. For example, in terms of training, these results can be used to inform professionals regarding the types of treatment responses they may encounter on the milieu. For example, new professionals to the field might not necessarily be discouraged when they do not find steady, consistent linear progress from patients on the milieu. In fact, this type of linear response to treatment made up less than a third of the sample in this study. Research in the burnout literature suggests that it is not education per se that predicts burnout among frontline professionals in congregate care settings but rather training and knowledge about the specific setting one works in and the patients one serves.[26,27] In terms of practice, these results support a flexible model for when units discuss specific patients at inter-disciplinary clinical staff meetings, when psychiatrists conduct rounds, or when unit therapists communicate to families. Finally, in terms of research, these results suggest that class membership should be taken into consideration when conducting and analyzing the results of treatment studies (e.g., medication trials). It may be that the classes respond differently to pharmacological and psychosocial interventions and that the classes vary in which interventions are most optimal. Future research on the use of behavioral management strategies on the milieu (e.g., seclusion and restraint) might also seek to study the potential link between higher rates of these strategies and the lack of change in acuity for class three and seven. For example, it might be that the lack of consistent improvement among these classes leads to increased frustration among the staff or, alternatively, that it is the greater use of these strategies that leads to less treatment success.

Subsequent analyses found that the classes varied significantly across a number of service context variables, suggesting that these possible typologies may represent not just distinct patterns of treatment response within the episode itself but also groups of patients with distinctive service needs. For example, class seven is not only characteristic for its high intake acuity and lack of significant change over the first 9 days, but it is also a group with an over-representation of children in child welfare. This class stands out as a particularly high-need group of children who, if identified early in the episode, might require more case management support to coordinate the multiple systems challenges they likely experience (e.g., educational, child welfare).

Class five was the only quadratic class of the four identified with a quadratic slope term in the positive direction, indicated in Figure 1 by a decrease in acuity over the first phase of treatment, but followed by a continuous increase in acuity through the ninth day of treatment. It is interesting that this class entered with lower acuity at intake, followed by slight decreases over the first few days, but with increasing acuity beginning on the third day of treatment on average. This finding might allow for any number of tentative speculations and future hypotheses about the unique response this group experienced. For example, the congregate care literature has consistently found that some youth in these settings can begin to experience a rise in symptoms as a result of their exposure to other youth with more mental health needs;[28] this explanation might imply that hospitalization was inappropriate for this class of youth. However, it may also be the case that this

class represents youth who enter care and experience a "containing" effect as a result of the restrictive environment, which occurs over several days until this effect is mitigated by the child's over-arching mental health issues, leading to a steady rise in acuity. This hypothesis might suggest that an early discharge would be premature for this class of youth, leaving them with rising acuity as they re-enter the community setting. Further complicating an interpretation of class five is the finding that this class experienced longer times to readmission, despite increasing acuity. Clearly, future research seeking to discern possible explanations for class membership might employ pre- or post-discharge qualitative methods (e.g., therapist, staff, child, and family interviews) to provide a richer exegesis of the quantitative results.

It is noteworthy that three classes—class three, class five, and class seven—experienced acuity levels at day nine that were not significantly different from their acuities at intake. Given the proportion of children in the three classes, this finding suggests that over 50% of the sample did not significantly improve after 9 days of care. Notably, this finding is remarkably similar to Blader and colleagues' (1994) finding that 48% of their inpatient sample either did not improve or worsened on at least one symptom measure. However, it might not be the case that the percentages of improved versus not improved patients are a function of the specific setting studied here—acute-stay inpatient care—since similar patterns have also been found in the residential treatment literature[29] and in the adult psychotherapy literature.[30] The adult psychotherapy literature may have implications for how to increase the improvement patients experience in acute-stay care; despite studies suggesting that high percentages of patients do not reliably change, other research has shown that strategies aimed at identifying these patients early and maintaining consistent monitoring and feedback throughout care can significantly increase the probability of patient success.[8]

This study was limited in that it only evaluated three hospitals. Future work should study more hospitals and age ranges to determine if these findings are generalizable. Further, this study employed only one measure of treatment response, the CAPI, and it was based on the perspective of frontline staff and therapists, not the range of mental health professionals involved in care on a typical unit (e.g., psychiatrists). The ideal study would involve multiple informants, use more than one measure of outcome, and capture treatment variables possibly relevant to patients' acuity status, such as family functioning as observed during visits and staffings and response to pharmacological treatment, which might be associated with treatment response processes unique to the classes. It is also important to note that the CAPI is a composite, broadband measure of psychiatric acuity and scores are not meant to indicate a child's readiness to be discharged or his/her current level of risk in the community, a decision that should obviously remain the physician's in consultation with the treatment team.

Finally, there has been extensive literature[31,32] on violations of distributional assumptions and how this is likely to lead a researcher to over-extract the number of latent trajectories. Indeed, despite transforming the data, the data were not normal, and it is possible that fewer groups than were illustrated may truly exist in the population. The results warrant replication in new hospital settings and among other populations of patients (e.g., adult inpatients). However, it is important to note that a significant quadratic effect emerged in every model with three or more classes (i.e., model three through seven), which may suggest that at least one quadratic response occurs in the population.

Implications for Behavioral Health

It has now been over 20 years since Pfeiffer and Strzelecki[33] published their influential review of residential treatment and inpatient outcomes, where they argued for more rigorous methodological and statistical evaluation approaches and more sophisticated research questions. More recent reviews have come to the same conclusions.[4] The results here suggest that acute-stay

hospitalization may be associated with a set of patterned response trajectories, similar to what has been found in other behavioral health modalities. And, as other modalities (e.g., outpatient psychotherapy) began to study treatment response patterns, a significant expansion of the research base followed, informing both the treatment process and outcome prediction literatures.

Future research should seek to determine if these results replicate with other samples and different measures and measurement strategies. If the findings replicate, future research could then examine the static and process variables associated with children in the classes and the potentially optimal treatment strategies for patients in the classes. Finally, future work should seek to develop effective a priori prediction strategies so that the optimal treatments are targeted to the right patients.

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