The Importance of Workload Analyses and Resource Allocation Models in Child Welfare Evaluation

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Session Description

Any evaluation of child welfare practice should be sensitive to the influence of workforce issues and resources available to maximize the likelihood of desired outcomes. This workshop will examine prevailing knowledge (and evaluation models) on these two issues and explore (via the summarization of findings from two studies): 1) the positive impact that a rigorous and integrated task analysis study can have upon streamlining service delivery models and maximizing outcomes; and, 2) the need for detailed resource allocation models that are guided by principles of equity and adequacy. Discussion will expand into the role or influence that econometrics, flow models, and stock adjustment models may have for child welfare evaluation.
Introduction

Much of the information presented today is taken from or builds upon material and thoughts highlighted in the following writings:


Sources Continued:


Prior to a specific review of workforce/task and resource analysis techniques, some comment needs to be made about current state of knowledge as such relates to child welfare outcomes and influences upon them. This will serve as a foundation for discussion and reference within the presentation.

There are a multitude of research and evaluation studies that have focused upon a variety of child welfare outcomes. Child welfare practice happens within a broader context. Child welfare outcomes are impacted by a number and range of variables that serve as a filter on, or interact with, the effects of training. Any link between child welfare practice and child welfare outcomes must account/control for the influences of five variable fields:

1) Case Characteristics
2) Casework characteristics/factors
3) Community factors
4) Workforce factors
5) Administrative/work environment
Varied and Complex Influences Upon Child Welfare Outcomes

- Child welfare work is multi-faceted and potentially complex. There has been an extensive amount of research (of varied rigor) that has examined (usually in isolation of broader contextual variables) the influence of a number of factors (associated with each of the above classes of variables) on service outcomes.

- What follows is a highlight of the select factors associated with each of the above five classes of variables. A critical appraisal of the methodology used in each of the cited studies will provide the reader with a more developed understanding of the internal and external validity of generated findings. Space and time constraints prohibit such a review for this session. Subsequently, the highlighted list represents select studies that, when observed as a whole, highlight the diversity of potential influences that can affect child welfare outcomes. It is incumbent upon the research and evaluation community to engage in a critical examination of the internal and external validity of findings denoted below prior to the isolation of factors for which data should be collected for advanced analyses.

Case Characteristics and Outcomes

- Child demographics (Age, Gender, & Ethnicity)
- Child Health and Mental Health Problems
- Child Behavior Problems
- Developmental Problems
- Parental Substance Abuse
- Parental Mental Health Problems
- Parental Criminal History
- Domestic Violence
- Lack of Social Support for Parents/Families
- Unemployment and Job Stability
- Poverty
- Single Parent Families
- Homelessness

Casework Factors and Outcomes

- Case Load Size
- Workload Demands
- Frequency of contact and visits between caseworkers and children and parents.
- Insufficient Quality Contact Time (to talk with children, children’s parents, foster parents, and community service providers).
- Involvement of children and families in case plan construction.
- Inadequate time for reading case records and service provider reports.
- Worker Responsiveness


Community Factors and Outcomes

- Community Partnerships
- Family Support Services
- Neighborhood Supports/Networks
- Prevention-based Services
- Rates of poverty and unemployment
- Community Violence

Workforce Issues and Outcomes

- Recruitment
- Retention/Turnover
- Worker Qualifications, Experience, and Training
- Personal and Professional Commitment of Workers
- Burnout and Emotional Exhaustion of Workers


Administration/Work Environment and Outcomes

- Organizational Climate
- Organizational Culture
- Organizational Structure/Conditions;
- Burdensome Paperwork
- Supervisory Support
- Professional Compensation, Growth and Advancement Opportunities

Alwon & Reitz, 2000; Bednar, 2003; Child Welfare Training Institute, 1997; Conway, Shaver, Bennett, & Aldrich, 2002; Dickinson & Perry, 2002; Eisenberger et al., 1986; Ellett et al., 2003; Elgersma, 1988; Gilson, 2007; Gilson, Dukes & Green, 2006; Gilson & Green, 2006; Gilson & Durick, 1988; Mallick, 1991; National Council on Crime and Delinquency, 2006; Okaya, 1992; Perry and Ellett, 2008; Rhoades & Eisenberger, 2002; Ryerst, 1994; Smith, 2005; Weiner, 1991; Westbrook et al., 2006.
Child Welfare Outcomes

The outcomes that were the focus of the studies denoted above varied considerably, although conceptually they focused (although measurement and indicators used may have varied) on the classification structure embraced by the Child and Family Service Reviews.

The CFSR Process: Domains and Outcomes

Safety
- Safety Outcome 1: Children are, first and foremost, protected from abuse and neglect.
- Safety Outcome 2: Children are safely maintained in their homes whenever possible and appropriate.

Permanency
- Permanency Outcome 1: Children have permanency and stability in their living situations.
- Permanency Outcome 2: The continuity of family relationships and connections is preserved for children.

Child and Family Well-Being
- Well-Being Outcome 1: Families have enhanced capacity to provide for their children's needs.
- Well-Being Outcome 2: Children receive appropriate services to meet their educational needs.
- Well-Being Outcome 3: Children receive adequate services to meet their physical and mental health needs.

There are 26 indicators associated with all outcomes.
Agency Performance and CFSR Impact

The focus of much of my research (and the focus for this presentation) has addressed workforce issues and the influence of administrative/work environment factors that has been shown to be associated with child welfare outcomes.

Agencies bare much burden should CFSR (or associated) outcomes not meet established performance thresholds. Within this context, there is tremendous pressure for agencies to modify practice and administrative protocols in order to meet performance expectations.

Within many states, increased performance expectations have been enacted within an environment of dwindling resources (fiscal, workforce, etc.) or inadequate resources to meet the demand for services. The threat of resource loss when demands for services remain unchanged or high can have a major impact upon the functioning of the child welfare system.

Gauging Agency Performance

Any evaluation of child welfare outcomes (especially if results may influence funding/resource allocation decisions) must be able to distinguish the extent to which the outcomes attained (or lack thereof) were reasonably within or outside an agency’s control.
Following a critical appraisal of the CFSR (I and II) measures (and modifications used in Florida), and the research and evaluation literature on child welfare outcomes, I made a number of recommendations (see Perry, 2008) for modifying the evaluation of Community-Based Care Agencies’ performance for Florida. These recommendations have relevance for other states and can serve as a foundation for discussion in today’s presentation. These include:

I. Efforts need to be engaged in to develop alternative or supplemental measures of each CFSR outcome indicator and national standard. These supplemental measures would use data from the population of cases served and rely heavily (for relevant measures) on the use of longitudinal models using cohort and panel analyses.
Gauging Agency Performance

II. Alternative measures of performance should be developed that are sensitive and responsive to indicators of child and family well-being. This effort requires a genuine commitment on the part of state governments (DCF in Florida), provider agencies (CBCs in Florida), client advocates, and community stakeholders to work collaboratively to critically appraise (from a constructive standpoint) the current system and answer the question “What do we want our child welfare system to do?” It is imperative that any adopted measures are meaningful indicators and that "meaningful" be defined in terms of real desired change in the lives of children and families.

Gauging Agency Performance

III. An analysis of agency performance should be historical. Once agreed upon performance measures are selected, the utilization of trend (and time series) analyses is necessary to examine if performance is improving over time. Here, it is important (if data permits) to contrast change prior to and following major policy initiatives (for example, the move to the Community-Based Care model in Florida). Child welfare systems are complex systems whose functioning is impacted by a number of factors (some within and some outside any agency’s control). System change is seldom instantaneous where the effects of changes in policy and service protocols are likely to be lagged. The performance of an agency should be gauged over time and against baseline data for that agency. Improvement in performance and movement toward desired thresholds should be reinforced, especially if the context for service presents obstacles to practice.
Gauging Agency Performance

IV. An analysis of agency performance should be contextually specific. This requires an identification and itemization of factors within and outside an agency’s influence upon client outcomes. There is a multitude of influences across different agencies that can affect variance in service demands, resources available to meet demands, and outcomes observed from service interventions. It is imperative that any performance measure be examined within the context for which practice takes place. A first step in this effort is the development of community profiles for each child welfare agency. These profiles will focus on factors known to be co-relates with child maltreatment and accepted indicators (among established researchers) of child and family well-being. In addition, it is suggested these profiles include measures of available resources, socio-economic indicators, and child welfare workforce trends and forecasts. This contextual information coupled with trend analyses will provide policy makers and citizens with a holistic understanding of the historical and current factors affecting service trends and child welfare agency/system performance.

Gauging Agency Performance

The above recommendations demand:
• an appreciation for complexity theory and the complex nature of child welfare practice/systems,
• an understanding of the context for which child welfare practice takes place,
• a belief in reinforcement strategies, strengths-based perspective, and evidence-based practice
• an appreciation of the influence that resource allocations, administrative protocols, and work environments have upon workforce issues, recruitment and retention of a qualified workforce, efficient and effective practice (gauged by task completion and outcome attainment).
The Value of Workload Analyses for Streamlining Efficiency:  
*Practice Modifications without Cost Allocations*

Detailed summary of study can be found in:


### Workload/Task Analysis

**Setting:**

Partnership for Strong Families (PSF) provides services to children via contracts with three agencies (Family Preservation Services—a private for-profit agency, Children’s Home Society, and Meridian Behavioral Healthcare—both private non-profit agencies). These agencies serve a wide variety of clients in variety of communities scattered across eleven counties in mid-Florida.
Workload/Task Analysis

**Presenting Issues:**

Preliminary analysis of service and time log data suggested variation across agencies and service units with respect to:

- average number of tasks completed each month,
- demands placed upon workers,
- worker/agency response to reductions in workforce resources, and
- worker retention rates.

**Existing data and measurement of worker activities (and links to outcomes) extremely limited and not informative.**

- Among the 94,834 tasks logged between July 2005 and April 2006, 90,559 (95.5%) were identified as Case Management tasks without any itemization of what each task was. Workers failed to provide a code for 2,754 tasks completed (for which time was logged). Among data with valid task codes, Case Management tasks represent 98.3% of coded entries. This level of homogeneity in coded data (without a further breakdown into specific tasks) does not lend itself to meaningful task analysis.
Workload/Task Analysis: Presenting Issues

Existing time log instrument (endorsed state-wide tool) does not provide reliable or valid data that allows for efficiency analyses. In addition to above noted limitations, the failure to obtain valid task data was influenced by:

• the existing data collection mechanism did not capture the extent to which workers multi-task;
• the low level of worker investment or perceived value in time logging may have impacted upon the reliability and validity of collected data;
• time logging may be perceived by some workers as a burdensome task that takes away from client contact time and has no direct benefit for workers; and,
• workers may inaccurately reflect the number and type of tasks accomplished given fatigue and/or the ease of entering a general Case Management code.

Workload/Task Analysis: Need and Study Purpose

Need and Study Purpose

• To develop a comprehensive and thorough understanding of the complexities of tasks associated with child welfare practice in Mid-Florida.
• To further knowledge about what child welfare workers do and to critically examine whether tasks completed are done so in accordance with established protocols, standards of practice, and (most importantly) in the most efficient and effective manner that does not compromise quality of service and performance standards.
Workload/Task Analysis: Need and Study Purpose

- To conduct a study with full appreciation of the contexts in which service is provided and the perspective of front-line child welfare workers.
- To provide reliable and valid data that can aid with workflow analysis and recommendations for modifications in administrative and/or practice protocols.

Study Population and Sample

- Population: Eighty-four workers employed in member agencies of the Partnership for Strong Families (in Gainesville).

- Sampling Frame: Forty-eight workers with at least six months experience at the time of the study. This ensured that those workers shadowed were not in training and are carrying a full caseload.

- Sample: Stratified random sample of 26 workers. Stratum included agency employed and service unit. Twenty-four workers (50% of the sampling frame) agreed to participate with at least two workers selected from each service unit.
Study Method

• Selected workers would be shadowed for one full day on-the-job (over a two-month period) by a research associate whom was an experienced child welfare worker (employed at a different agency).

• Each associate was provided a booklet of tasks logs to record data while in the field shadowing a worker.

• Associates were required to document the start and end time of each task. These times can overlap if the worker multi-tasked at any point in time.

• Each associate was required to document whether each task involve direct contact with a client (child, parent, or family), was associated with the direct provision of in-home services, or was associated with the direct provision of out-of-home care services. These distinctions would aid in analyses, calculating the ratio of time worked that is affiliated with each category.

• Field notes were subjected to content analysis and tasks itemized in accordance with a standardized task list constructed over a two-month period in consultation with research associates, administrative staff and focus groups of front-line staff. A final typology of 115 individual tasks within 6 service categories and 20 task categories was identified for child welfare workers in this study.
Task Typology for Child Protective Service Work

For more details on methods utilized to develop task typology and full list and description of service categories, task categories, and individual tasks associated with each, see:

The Typology of Child Protection Service (CPS) Worker Tasks

Service and Task Categories
I. Initial Response and Investigation (Aiding initial investigation)

II. Removal and Placement/Replacement of Child
   - Removal and Placement of Child
   - Medical and Mental Health Assessments
   - Placement of Indian and Military Child
Service and Task Categories

III. Case Planning and Reunification Activities
   Case Plan/Case Planning Conference
   Service Planning Activities
   Reunification Activities

Service and Task Categories

IV. Court Services and Case Supervision
   Court Services
   Case Supervision
Service and Task Categories

V. General Tasks – Case Management
  Case Contacts
  Legal Issues and Background Checks
  Child/Safety Risk Assessment (Not Affiliated with Initial Investigation)
  Case Consultations
  Case Recording and Referrals
  Transportation
  Care and Contact with Child
  Other

VI. General Tasks – Administrative
  Paperwork
  Meetings
  Training and Professional Development
  Other

VII. Non-Case Related Activities
The Typology of Child Protection Service (CPS) Worker Tasks

Final Task List Comprised of:

115 individual tasks itemized within
7 service categories and
20 task categories

Task Analysis Study Findings

Refer to Supplemental Tables in Word Document
Study Recommendations and Impact

If workers think and/or feel a particular activity (such as time logging) has no particular value for their job, then investment of time and energy will lag and reactivity issues will impact upon the reliability and validity of collected data. It is very important that workers be invested in providing accurate data that reflects what they do.

Recommendation 1: Partnership for Strong Families should redesign the daily time log used by workers. This time log should include a more detailed list of potential tasks and allow for the itemization of multi-tasking. Data entry should be user-friendly and web-based. Workers should be consulted with respect to design features and information/reports garnered from time logs that they think will be of value toward informing their practice.

Recommendation 2: Partnership for Strong Families should examine and consider the implementation of mechanisms that reinforce/ensure the timely entry of time log data. This effort should first start with the survey/interview of workers where adverse trends in rates of reporting are denoted. Once the identification of variables (e.g. workload-based, worker-based, administrative factors, supervision concerns, etc.) affecting upon reporting rates is determined, corrective action can place. For example, should workload demands be uncharacteristically high and logging of time is perceived as burdensome, pilot studies could be conducted to test the efficiency and cost-effectiveness of using technological tools (e.g., PDAs, voice dictation, etc.) for task tracking and time logging.
Study Recommendations and Impact

Impact:
Workers were consulted with respect to design features and information/reports garnered from existing time logs and their value and utility. Based on the feedback received from workers, discussion with the Florida Department of Children and Families, and additional work and reflection on this matter, the use of the time log (as structured) was stopped and no longer a requirement of workers to complete. Workers are still required to enter information regarding cases and their actions into the Florida SACWIS system (i.e., HomeSafeNet). Instead of adding an additional time log for workers to complete (perceived as burdensome with limited value and utility by workers), PSF is currently exploring the efficiency and cost-effectiveness of using mobile devices (e.g., PDAs, voice dictation, etc.) to help reduce dual entry of case data and tasks on the part of case management staff.

Study Recommendations and Impact

Recommendation 3:
Workforce resources across member agencies of Partnership for Strong Families need to be stabilized and resources allocated in accordance with service demands. Partnership for Strong Families should conduct a trend analysis that clearly itemizes the differential demand for services across member agencies over the past year. Should trends be associated with identified demographic patterns or other variables for which secondary data is available, service demands should be forecasted and appropriate plans for the allocation of resources should be made.
Study Recommendations and Impact

Impact:
In response to these recommendations, Partnership for Strong Families engaged in the following actions:

• Unbundling of services
• Development of an automated Utilization Management System
• Created positions to support referral process and follow up
• Redirection of service dollars based on demand
• Flexibility to Case Management Agencies so they can reorganize their work based on demand.

Study Recommendations and Impact

Recommendation 4:
Efforts should be made to maximize the amount of quality contact time workers have with clients (children and families) as a means of obtaining plan of care objectives and goals. Workers and supervisors should be consulted on strategies that will enhance the likelihood that workers have contact with clients. The level of obtaining service goals in a timely manner should be contrasted against time log data that denotes if tasks are associated with client contacts. This will enable a more thorough understanding of the impact of client contact time upon service outcomes and staff morale.
Study Recommendations and Impact

Impact:
This recommendation led to the revision and development of a case management system that helped reduce the overall caseload (district wide) from 2100 to 1700 by controlling the front end of services, as well as ensuring children are exiting the system in a timely and effective manner. Here, there was a concentrated effort to remove many administrative barriers to the casework process and increase automation to free up worker time for more contacts with clients.

Study Recommendations and Impact

Recommendation 5:
Partnership for Strong Families should conduct a survey or solicit feedback from current clients (receiving in-home services) in order to determine the extent to which desired outcomes and service needs are met in a timely fashion. If current clients demand or need more services (in order to strengthen families and minimize risk of maltreatment and/or further placement), an itemization of staff and resources needed to meet this demand can be the first step toward determining funding needed to adequately serve children and families in mid-Florida.
Study Recommendations and Impact

Impact:
In response to this recommendation, PSF developed a Service Referral Coordinator system. This system has heightened the likelihood that clients get the services they need for the appropriate duration of time. PSF is currently engaged in the process of surveying both our consumers/clients and caseworkers to see if these changes have had the desired impact.

Study Recommendations and Impact

Recommendation 6:
PSF should conduct an analysis that will provide a descriptive profile of the number of placement failures or removal and re-placement of children in care or those receiving other services. Attempts should be made to identify the contexts and circumstances associated with these events. A needs assessment should be conducted to identify what specific resources are needed to enhance the availability of appropriate placement settings for children, stabilize existing placements, and maximize the amount of time workers can spend working with children and families outside of a crisis intervention framework.
Study Recommendations and Impact

Impact:
The following actions occurred based on the above recommendation:

- A review of shelter placements was conducted on a weekly basis to ensure immediate contacts within 24 hours of placement to inform the caregiver of the child’s current status and associated placement circumstances, as well as the means and mechanisms for accessing available services;

- A review of all placement disruptions was made to ascertain what services/actions might have prevented disruption; and,

- The establishment/assignment of specialized assessment workers who do a CAFAS on each child entering foster care as a means of accurately assessing needs and ensuring the appropriate level of care is provided.

Study Recommendations and Impact

Recommendation 7: Immediate efforts should take place to ensure that PSF member agencies have sufficient resources (staffing, qualified workers, time, etc.) that will enable the workers to maximize the time needed to focus on case planning and family reunification activities.
Study Recommendations and Impact

**Impact:**

The redesign of key administrative systems, redefinition of the casework system, creation of specialized worker positions, and other innovations/actions described above have provided front-line staff more time to focus on case planning and family reunification activities. In addition to above noted activities, the following has occurred as a response to this recommendation:

- Additional training of both case workers and supervisors was provided;
- A focus on specialization has ensued in some of our service centers with the development of drug court workers, permanency specialists, and voluntary services workers; and,
- The development of scanning system whereby all paper files are inputted into a data base that allows workers to access client/case records in a more timely and organized fashion.

Linking Changes in Administrative Practices with Practice Outcomes: *The Value of Econometrics with Complex Systems and Longitudinal Data*

Suggested References:


Much information in following select slides taken from above resources.
What is Econometrics?

• The application of statistical and mathematical methods to the analysis of economic data, with a purpose of giving empirical content to economic theories and verifying or refuting them.” (Maddala, 1992, p.2)

What is Econometrics?

• “What distinguishes an econometrician from a statistician is the former’s preoccupation with problems caused by violations of statisticians’ standard assumptions; owing to the nature of economic relationships and the lack of controlled experimentation, these assumptions are seldom met. Patching up statistical methods to deal with situations frequently encountered in empirical work in economics has created a large battery of extremely sophisticated statistical techniques” (Kennedy, 1996, p.1)
Model Building in Econometrics

Econometric Models are Stochastic or Probabilistic
There are a number of considerations that need to be made prior to the selection and development of statistical models.

• Role of the assumptions
• Sharpness of inferences
• Parameterizing the model
  – Nonparametric analysis (e.g. Kernel Regression)
  – Semiparametric analysis (e.g. Least Absolute Deviations)
  – Parametric analysis (e.g. Least Squares Regression)

Estimation Platforms (coefficients)

• Model based
  – Kernels and smoothing methods (nonparametric)
  – Moments and quantiles (semiparametric)
  – Likelihood and M-estimators (parametric)
    (Least squares etc. – OLS, GLS, LAD, quantile;
     Maximum likelihood, Formal ML, Maximum simulated likelihood, Robust and M-estimation)

• Methodology based
  – Classical – parametric and semiparametric
  – Bayesian – strongly parametric
    (Markov Chain Monte Carlo methods)
Classical Inference

Imprecise inference about the entire population - sampling theory and asymptotics.

Bayesian Inference

Sharp, ‘exact’ inference about only the sample - the ‘posterior’ density.

Classical vs. Bayesian Inference

• Both posit a “relationship” among variables
• They differ on the nature of “parameters”
• Classical can be nonparametric and robust; Bayesian is strongly parametric, and fragile
• Bayesian can accumulate knowledge; every classical application is the first.

Stochastic Models

• A stochastic process, or sometimes random process, is the counterpart to a deterministic process (or deterministic system) in probability theory. Instead of dealing with only one possible ‘reality’ of how the process might evolve under time (as is the case, for example, for solutions of an ordinary differential equation), in a stochastic or random process there is some indeterminacy in its future evolution described by probability distributions. This means that even if the initial condition (or starting point) is known, there are many possibilities the process might go to, but some paths are more probable and others less. (Wikipedia)
Stochastic Models

• “It is necessary to incorporate stochastic elements into our empirical models. As a consequence, observations on the dependent variable will display variation attributable not only to differences in variables we have explicitly accounted for, but also to the randomness of human behavior and the interaction of countless minor influences that we have not. It is understood that the introduction of a “random” disturbance into a deterministic model is not intended to merely to paper over its inadequacies. It is essential to examine the results of the study, in a sort of postmortem, to ensure that the allegedly random, unexplained factor is truly unexplainable….A deterministic theory will be invalidated by a single errant observation. The introduction of stochastic elements into the model changes it from an exact statement to a probabilistic description about expected outcomes and carries with it an important implication.” (Greene, 1997, p. 2)

Stochastic Models

“The basic problem before social services researchers is to understand “what works?”, for whom?”, “under what conditions?”, and “at what cost?” A universal condition is that there are no simple answers to these questions. To the extent that they are attributable determinants to this answer, they are described by client, environment, and service characteristics; a multitude of them. Understanding is needed about the magnitude and certainty of the effects of these characteristics on outcomes.” (Miller, 1994)
The Linear Model (Gauss-Markov Theorem)

\[ y = X\beta + \varepsilon, \text{ N observations, } K \text{ columns in } X, \]
including a column of ones.

- **Standard assumptions about X** (\(X\) values are fixed
numbers, \(X\) is of full rank, i.e., there are no linear dependencies between
the observations of the RHS variables)
- **Standard assumptions about \(\varepsilon|X\)**
- \(E[\varepsilon_i|X]=0\), \(E[\varepsilon_i]=0\) and \(\text{Cov}[\varepsilon_i,x]=0\)
- \(\text{V}[\varepsilon_i] = \sigma^2 \text{ Cov}[\varepsilon_i,x]=0\)

Econometric Models

Model Types include:
- Linear; static and dynamic
- Discrete choice
- Censoring and truncation
- Structural models and demand systems
Econometric Models

Models can be classified as:
• Single equation model
• System of equations model
• Simultaneous equation model

Many of the specifications for remainder of presentation come directly (or were modified) from Greene (2008) or Miller (1994; 1997).

Single equation model

\[ y_i = \beta_0 + \beta_1 x_{1i} + \ldots + \beta_k x_{ki} + u_i \]

Can be written as \[ y_i = x_i \beta + u_i \]
System of equations model

\[
y_1 = x_1 \beta_1 + u_1 \\
y_2 = x_2 \beta_2 + u_2 \\
\vdots \\
y_m = x_m \beta_m + u_m
\]

Simultaneous equations

\[
y_1 = \gamma_{12} y_2 + \cdots + \gamma_{1m} y_m + x_1 \beta_1 + u_1 \\
y_2 = \gamma_{21} y_1 + \cdots + \gamma_{2m} y_m + x_2 \beta_2 + u_2 \\
\vdots \\
y_m = \gamma_{m1} y_1 + \cdots + \gamma_{mm} y_m + x_m \beta_m + u_m
\]
Example

Building/developing a Stochastic model with panel data (dependent variable a composite measure of child well-being) using log-likelihood functions (simultaneous equations), density functions, attrition controls (specifications) using modified latent probits.

Ordered probability models (as a discrete choice model) where the interest is upon the decisions made by front-line workers and the impact of these decisions upon service outcomes.

Example: Stochastic Model Development

The situation and conditions for building this model are as follows:

- The dependent variable represents a composite measure of child well-being. This variable is measured repeatedly but data is missing for select cases at either the 6 or 12 month measurement time.
- Following the completion of training, composite measures/scores of critical knowledge and transfer of learning among those workers that participated in a specialized training module (re: development of strengths-based and systemic plans of care) are made.
- A measure (1/0) of whether worker participated in specialized training is imbedded within an integrated personnel and service database.
- Other independent variables include composite measures of key classes of contextual variables (chosen via preliminary analyses).
- Data includes longitudinal panel data on cases collected via a SACWIS system.
- Data elements include client and worker IDs that are matched over time.
- Interest/question: Does child well-being vary over time (6 and 12 months post training) and how much variation is a result of whether workers received training AND if training received, variation in training outcome scores.
- Issue: Missing data exists for select cases at each of the points of interest for measurement (6 and 12 months).
Step 1 and 2

- Creation of two variables with expected values generated from a latent index of a probit measuring the probability that data on child well-being exists versus doesn’t exist at the 6 months measurement period given case characteristics and dynamics. These include maltreatment type at case commencement (physical abuse, neglect, sexual abuse, other), case demographics (age and sex of child), case type (in-home versus out-of-home care), whether placement change in past six months, and whether worker change in past six months.

- Creation of two variables with expected values generated from a latent index of a probit measuring the probability that data on child well-being exists versus doesn’t exist at the 12 months measurement period given case characteristics and dynamics. These include maltreatment type at case commencement (physical abuse, neglect, sexual abuse, other), case demographics (age and sex of child), case type (in-home versus out-of-home care), whether placement change in past six months, and whether worker change in past six months.

A latent index using the results of a probit analysis on observed data is created before variables are specified to offset sample selection/attrition bias.

Our Example

Let \( Z_i^* = X_i \beta + \epsilon_i \)

If \( Z_i^* > 0 \), then \( Z_i = \{1/0\} \)

where \( Z_i = \{1/0\} \) according to whether child well-being data is/is not available at 6 months Time 6 (\( Z_6 \)) or 12 months Time 12 (\( Z_{12} \));

\( \epsilon_i \sim N [0,1] \)

and \( X_i \beta \) represents:

- Physical Abuse
- Sexual Abuse
- Other Maltreatment
- Age
- Male
- Out-of-Home Care
- Placement Change Last Six Months
- Worker Change Last Six Months
Our Example

If $Z^*_i = X_i\beta + \epsilon_i$
then $\epsilon_i = Z^*_i - X_i\beta$

If $Z^*_i > 0$ (i.e. $Z_i=1$), then $\epsilon_i < X_i\beta$,
where $\text{Prob}[\epsilon_i < X_i\beta] = \Phi[X_i\beta]$

If $Z^*_i \leq 0$ (i.e. $Z_i=0$), then $\epsilon_i < -X_i\beta$,
where $\text{Prob}[\epsilon_i < -X_i\beta] = \text{Prob}[\epsilon_i > X_i\beta] = [1-\Phi[X_i\beta]]$

$\Phi$ is the cumulative density function of the standard normal

Therefore the $E(Z^*_i \mid Z_i=1) = X_i\beta + E[\epsilon_i \mid Z_i=1]$
$= X_i\beta + E[\epsilon_i \mid \epsilon_i > -X_i\beta]$
$= X_i\beta + \lambda_+ (-X_i\beta)$

and the $E(Z^*_i \mid Z_i=0)$
$= X_i\beta + E[\epsilon_i \mid Z_i=0]$
$= X_i\beta + E[\epsilon_i \mid \epsilon_i < -X_i\beta]$
$= X_i\beta + \lambda_- (-X_i\beta)$

where $\lambda_+$ and $\lambda_-$ represent inverse mills ratios truncated from below and above as:

$\lambda_+ (-X_i\beta) = \phi(-X_i\beta) / (1-\Phi[-X_i\beta])$
$\lambda_- (-X_i\beta) = -\phi(-X_i\beta) / \Phi(-X_i\beta)$

$\phi$ is the probability density function of the standard normal,
$\Phi$ is the cumulative density function of the standard normal.

(Above procedures adapted from Heckman (1979) and utilized on the Time 6 and Time 12 data separately resulting four variables meant to correct for sample selection/attrition bias (the probability that data exists on well-being for each case).
Our Example

There are three possible models/situations that require specification in the final likelihood function.

Given that:
\[ Z^*_1 = X_1 \beta_1 + \epsilon_1 \] where \( Z_1 = \{1/0\} \) according to whether a measure of child well-being exists at 6 months

\[ Z^*_2 = X_2 \beta_2 + \epsilon_2 \] where \( Z_2 = \{1/0\} \) according to whether a measure of well-being exists at 12 months.

The three situations include:

1. Cases where data exists on well-being only at 6 months. Here \( Z^*_1 > 0 \) and \( Z^*_2 \leq 0 \).
   \[ Y_{j \text{ 6 months}} = X_3 \beta_3 + \lambda_3 (X_1 \beta_1) \sigma_{13} + \lambda_3 (X_2 \beta_2) \sigma_{23} + \epsilon_3 \]

2. Cases where data exists on child well-being only at 12 months. Here \( Z^*_1 \leq 0 \) and \( Z^*_2 > 0 \).
   \[ Y_{j \text{ 12 months}} = X_4 \beta_4 + \lambda_4 (X_1 \beta_1) \sigma_{14} + \lambda_4 (X_2 \beta_2) \sigma_{24} + \epsilon_4 \]

3. Cases where data exists on well-being for both 6 and 12 month periods. Here \( Z^*_1 > 0 \) and \( Z^*_2 > 0 \).
   \[ Y_{j \text{ 6 months}} = X_3 \beta_3 + \lambda_3 (X_1 \beta_1) \sigma_{13} + \lambda_3 (X_2 \beta_2) \sigma_{23} + \epsilon_3 \]
   \[ Y_{j \text{ 12 months}} = X_4 \beta_4 + \lambda_4 (X_1 \beta_1) \sigma_{14} + \lambda_4 (X_2 \beta_2) \sigma_{24} + \epsilon_4 \]
Our Example

Statistical Assumptions for Example Model:

- $\sigma_{13} = \text{cov}(\varepsilon_{1}, \varepsilon_{2})$, $\sigma_{23} = \text{cov}(\varepsilon_{2}, \varepsilon_{3})$, $\sigma_{14} = \text{cov}(\varepsilon_{1}, \varepsilon_{4})$, and $\sigma_{24} = \text{cov}(\varepsilon_{2}, \varepsilon_{4})$

- $X_3 \beta_3$ refers to all independent variables measured at 6 months and their related effects on principal dependent variables.

- $X_4 \beta_4$ refers to all independent variables measured at 12 months and their related effects on principal dependent variables.

- $Y_{6\text{ months}}$ and $Y_{12\text{ months}}$ refer to the principal dependent variable (child well-being composite score) measured at 6 months and 12 months.

- $\text{cov}(\varepsilon_{3}, \varepsilon_{4}) > 0$ and $f(\varepsilon_{3}, \varepsilon_{4})$ are assumed to be bi-variate normal.

- Coefficients are maximum likelihood coefficient estimates using log-likelihood functions.

Please note that independent variables at $X_3 \beta_3$ (6 months) and $X_4 \beta_4$ (12 months) includes individual estimators for all independent variables (including whether training was received and other contextual/control variables) deemed of value (via preliminary analyses) for inclusion in the final model. In the end, this model gauges the impact of specialized training upon child well-being while controlling for contextual variable influences, sample attrition, and missing data on the dependent variable. Further, the model gauges whether this affect intensifies or dissipates over a 12 month period.
Following the determination of independent variables to be used in the final models (via preliminary multiple regression runs), separate multiple stochastic regression procedures are conducted for each principal dependent variable using six month and twelve month data separately. Incorporated into these models are the applicable inverse mills ratio variables denoted above. A scaler of coefficients of independent variable effects generated via ordinary least squares regressions can be saved and used as starting values toward generating maximum likelihood estimates of independent variable effects in the final models. The standard errors of dependent variables at six months and twelve months (generated using ordinary least squares regressions) can also be saved for utilization in the final model. Finally, a set of three mutually exclusive and exhaustive variables was created to identify whether or not (1/0) data exists for a case only at six months (T1 only), only at 12 months (T2 only), or both the Time 1 and Time 2 periods (In Both).

The principal goal in developing final models is to maximize coefficients—so the likelihood or probability of what was observed is not accounted for by randomness—that measure independent variable effects while controlling for sample selection bias and attrition while accommodating co-variance between errors of panel cases and the bi-variate distribution of exogenous and endogenous variables for panel cases. Toward this end, the general form of the log likelihood function used with each principal dependent variable is as follows:
Our Example

\[
\log \left[ \text{T1 only} \ * \ \frac{1}{\sigma_{\text{time } 1}} \ * \ \varphi[E_{\text{time } 1}] \right] \\
+ \ \text{T2 only} \ * \ \frac{1}{\sigma_{\text{time } 2}} \ * \ \varphi[E_{\text{time } 2}] \\
+ \ \text{In both} \ * \ \left( \frac{1}{\sqrt{2\pi}} \ * \ \frac{\sigma_{\text{time } 1} \ * \ \sigma_{\text{time } 2} \ * \ \text{sqr}(1-\rho^2))}{\text{exp} \left[ (-1/2) * \left( \frac{E_{\text{time } 1}^2 + E_{\text{time } 2}^2 - (2\rho \ * \ E_{\text{time } 1} \ * \ E_{\text{time } 2})}{(1-\rho^2)} \right) \right]} \right]
\]

Our Example

where \( \frac{1}{\sqrt{2\pi}} \ * \ \frac{\sigma_{\text{time } 1} \ * \ \sigma_{\text{time } 2} \ * \ \text{sqr}(1-\rho^2))}{\text{exp} \left[ (-1/2) * \left( \frac{E_{\text{time } 1}^2 + E_{\text{time } 2}^2 - (2\rho \ * \ E_{\text{time } 1} \ * \ E_{\text{time } 2})}{(1-\rho^2)} \right) \right]} \)

is the logarithm of the probability density function \( f(Y_{\text{time } 1}, Y_{\text{time } 2}) \) for the joint distribution of the dependent variable measured at Time 1 (6 months) and Time 2 (12 months) for cases with child and family well-being measurements. This specification was obtained from Maddela (1997).

\[ E_{\text{time } 1} = \frac{(Y_{j\text{ time } 1} - \mu_{Y_{\text{time } 1}})}{\sigma_{\text{time } 1}} \]
\[ E_{\text{time } 2} = \frac{(Y_{j\text{ time } 2} - \mu_{Y_{\text{time } 2}})}{\sigma_{\text{time } 2}} \]
Stochastic Model Development

Stochastic (and any econometric model for that matter) are built and adapted to the context for which social dynamics occur. Different contexts and different questions demand different procedures and adjustments to models. For example, ordered probability (discrete choice) models would be of value should a researcher not accept the absolute thresholds (established by the CFSR) for measurement of success on select outcome variables. Here, success/progress is measured in steps/stages or levels. Model results will enable the measurement of factors that affect movement across quartiles/quintiles (an ordered variable) and help determine the likelihood/probability of movement given changes in independent variable influences. The more advanced/sophisticated the model the greater the need for larger samples. Hence, the emphasis earlier upon developing large representative data sets across contexts and the need for preliminary analyses before refining the selection of key control or confounding variables. The use of composite measures of select variables assures parsimony in the model. However, theory, existent evidence, and preliminary analyses and models should guide final variable selection for more advanced models.

Discrete Choice Models

- Probit Model & Logit Model
- Multinomial Choice Model
- Multinomial Logit Model
- Nested Logit Model
- Mixed Logit Model
- Multinomial Probit Model
- Bivariated Probit Model
- Multivariate Probit Model
- Sequential Choice Model
- Ordered Probability/Probit Model
Ordered Probability Model

• Value and Utility
  – Concerns about absolute thresholds (CFSR) for measure of success on outcome variables.
  – Success/progress measured in steps/stages or levels.
  – Interest in knowing factors that impact movement across quartiles/quintiles (ordered variable) and likelihood of movement given changes in independent variable influences.

Utilizing Flow Models to Understand the Complexities of Child Welfare Practice

• Child Welfare Practice is Complex
• Defining the dimensions of these complexities is important.
• Child welfare workers are sanctioned to complete a series of tasks and assume an array of (legislated and professional) responsibilities in the fulfillment of their roles (see Task Analysis Section).
• Flow Models (Process) aid with an understanding of the complexities of practice and the steps and stages where variations in decisions (adherence or non-adherence to established protocols) impact upon outputs and outcomes.
Flow Models

One of the most comprehensive review and itemization of child welfare practice via process flow models was developed by the Department for Children, Schools, and Families in the United Kingdom.


Process/Workflow Analysis

The United Kingdom has developed a comprehensive flow model for understanding the interrelationship, interplay, and interdependence of case management activities (i.e. direct practice tasks), the supply of services and other resources to meet demands, and management/administrative functions and decisions.
Process/Workflow Analysis: UK Model

Three “high level” processes are identified:
• Core Case Management Operations;
• Supply of Services; and
• Management of Children’s Social Care Services.

When all processes and sub-processes are identified, there are a total of
• 260 Processes associated with Core Case Management Operations;
• 76 Processes associated with the Supply of Services; and
• 41 Processes associated with the Management of Children’s Social Care Services.

Process/Workflow Analysis: UK Model

Refer to select figures and process model itemization contained in:

Assessment Dimensions and Domains: UK Model

**Child’s Developmental Needs**
- Health
- Education
- Emotional and Behavioural Development
- Identity
- Family and social relationships
- Social presentation
- Self-care skills

**Parenting Capacity**
- Basic care
- Ensuring safety
- Emotional warmth
- Stimulation
- Guidance and Boundaries
- Stability
Assessment Dimensions and Domains: UK Model

Family and Environmental Factors

• Family history and functioning
• Wider family
• Housing
• Employment
• Income
• Family’s social integration
• Community resources

Flow Model Considerations

• Use an understanding of processes (and factors impacting upon processes) to gauge demand upon the system.
• Isolate influences that impact upon the likelihood (probabilities) that children and families are engaged at different process levels (i.e. receive different services for different needs or in accordance with legislative mandates).
• Ensure data collection to monitor process flow and factors (e.g. agency environment & culture, worker competency, resource allocation, knowledge-flow dynamics, etc.) that impact upon flow.
Flow Model Considerations

• Identify costs/resources needed to adequately serve demand and ensure smooth flow of processes (create feedback loops to identify breach in flow).

• Relate costs to desired (realistic and expected) outcomes of service at different process levels (cost-benefit and cost-effectiveness analyses).

• Consider macro analysis where child welfare services (a flow variable/perishable public good) are examined in relation to the accumulated outcomes of services (upon child and family well-being) as public capital (accumulated public good; a stock variable) (stock-flow models).

Example of an Equity Model

Assessing Factors that Impact Upon Demand for Services (Flow of Cases) as Means for Establishing Equitable Distribution of Resources

For more details see:

Building an Equity Model: Steps

Survey of Florida Stakeholders

The directors of all Community Based Care Agencies that have and would be providing child protective services for Florida’s children.

District administrators for the Department of Children and Families.

Members of the Family Safety Allocation Workgroup

Member agencies and representatives from the Miami-Dade Community-Based Care Alliance.

The Chairs or Vice Chairs of Community Alliances.

Survey Variables

• Number of children served in one year.
• Number of children in care.
• Length of time that children are in out-of-home care.
• Percentage of alleged victims founded.
• Number of new admissions.
• Caseload size.
• Percentage of found victims of maltreatment placed in out-of-home care.
Survey Variables Continued

• Net increase in foster parent recruitment within one year.
• Percentage of population served that is rural versus urban.
• Average cost per day for out-of-home care.
• Number of children in foster care compared with number of children in group-care facilities.
• Change in the number or rate of adoptive placements.

Survey Variables Continued

• Re-abuse rates for children.
• Success of agency in meeting A.S.F.A. standards.
• Rate of calls per 1000 population received by Hotline.
• Number of investigations conducted.
• Percentage of Hotline calls that are reportable.
• Number of alleged victims per report.
• Child population in geographic area served.
The Three Component Model

- Prevalence Component

- In-Home Service Utilization Component

- Out-of-Home Care Component

Prevalence Component Variable Considerations

1) **Number of Own Children in Single-parent Households** (United States Census Bureau, CY2000)

2) **Behavioral-Health Prevalence Data** (Substance Abuse and Mental Health Service Administration).

3) **Behavioral-Health Prevalence Data** (Substance Abuse and Mental Health Service Administration).
Prevalence Component Variable Considerations

4) **Births to Mothers Under 18 as a rate per 1000** (Florida Department of Health)

5) **Live Births Under 2500 Grams to All Mothers as a percentage of all live births** (Florida Department of Health).

6) **Infant Deaths as a rate per 1000** (Florida Department of Health).

7) **Percent of Population Ages 18 to 24 who are Not High School Graduates** (United States Census Bureau, CY2000).

8) **Children ages 5 to 17 who speak a language other than English and speak English less than very well** (United States Census Bureau, CY2000).

9) **Total Child Population that is below the poverty line** (United States Census Bureau, CY2000).

10) **Total Child Population** (United States Census Bureau, CY2000).
Final Prevalence Model Variables

- Total Child Population (beta=1.20)
- Children ages 5 to 17 who speak English less than very well. (beta=-1.037)
- Number of Own Children in Single-parent Households (beta=0.684)

In-Home Services Component

- Average monthly number of children receiving in-home services (using composite data from 2002 and 2003) across service districts/regions as represented by a proportion of the state-wide monthly average.
In-Home Services Include:

• any child receiving services that was not placed by DCF officials (or designate); and,

• any child receiving post-placement services

Out-of Home Care Component

• Average monthly number of children receiving out-of-home services (using composite data from 2002 and 2003) across service districts/regions as represented by a proportion of the state-wide monthly average.
Out-of-Home Services Include:

- children placed in shelter homes and facilities;
- children placed in approved relative (kinship) and non relative care settings;
- children placed in licensed substitute care such as foster homes and residential group care facilities;
- children in adoption placements;
- children in subsidized independent living programs; and,
- children in “other” settings not denoted above.

Equity Model Calculations and Discussions

Refer to Supplemental Excel File entitled *Perry Allocation Model*
Next Steps

Need to Move to An Adequacy Model (using econometric, cost-benefit, stock-adjustment models).