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Technical report

Pathways of Care Longitudinal Study: Outcomes of Children and Young People in Out-of-Home Care

Human Capital Formation During Childhood: Foundations of the Pathways of Care Longitudinal Study

Pathways of Care Longitudinal Study

Technical Report No.13

Human Capital Formation During Childhood:
Foundations of the Pathways of Care Longitudinal Study

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Pathways of Care Longitudinal Study Clearinghouse

All study publications including research reports, technical reports and briefs can be found on the study webpage www.community.nsw.gov.au/pathways

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Preface

The Pathways of Care Longitudinal Study (POCLS) is funded and managed by the New South Wales Department of Family and Community Services (FACS). It is the first large-scale prospective longitudinal study of children and young people in out-of-home care (OOHC) in Australia. Information on safety, permanency and wellbeing is being collected from various sources. The child developmental domains of interest are physical health, socio-emotional wellbeing and cognitive/learning ability.

The overall aim of this study is to collect detailed information about the life course development of children who enter OOHC for the first time and the factors that influence their development. The POCLS objectives are to:

- describe the characteristics, child protection history, development and wellbeing of children and young people at the time they enter OOHC for the first time;
- describe the services, interventions and pathways for children and young people in OOHC, post restoration, post adoption and on leaving care at 18 years;
- describe children's and young people's experiences while growing up in OOHC, post restoration, post adoption and on leaving care at 18 years;
- understand the factors that influence the outcomes for children and young people who grow up in OOHC, are restored home, are adopted or leave care at 18 years; and
- inform policy and practice to strengthen the OOHC service system in NSW to improve the outcomes for children and young people in OOHC.

The POCLS is the first study to link data on children's child protection backgrounds, OOHC placements, health, education and offending held by multiple government agencies; and match it to first-hand accounts from children, caregivers, caseworkers and teachers. The POCLS database will allow researchers to track children's trajectories and experiences from birth.

The population cohort is a census of all children and young people who entered OOHC for the first time in NSW between May 2010 and October 2011 (18 months) (n=4,126). A subset of those children and young people who went on to receive final Children's Court care and protection orders by April 2013 (2,828) were eligible to participate in the study. For more information about the study, please visit the study webpage www.community.nsw.gov.au/pathways.

1 Introduction

In this paper, we propose a conceptual framework for analysing the Pathways of Care Longitudinal Study data (POCLS). It extends prior work on the same subject by Paxman, et al., (2014) by connecting the study data to a statistical model that explicitly links (a) out-of-home care experiences to the developmental trajectories of children and (b) children's developmental trajectories to their out-of-home care experiences. The conceptual model is organised around the notion of human capital and human capital formation as the trajectory of greatest interest (Heckman, 2000; NYC Children's Cabinet, 2016; Wulczyn, 2008). Human capital, defined as a diverse set of skills, accumulates over time at the intersection of risk and protective factors. State-sponsored interventions that secure a safe and stable caregiving context for children promote human capital formation by shifting the risk and protection equilibrium in favour of protection. Alignment of that family context with other protective factors is an absolute necessity but the evidence favouring safe and stable families as a bedrock of human capital is widely understood. To fulfil their mission, child protection agencies have to *first* secure safe and stable families and *then* work with other stakeholders to further promote the protective elements that reinforce human capital formation over the life course.

The argument unfolds in a progressive manner toward the goal of building a theoretical model that provides general guidance to users of the POCLS (Reiss & Wolak, 2007). For orientation, the paper first draws on the summary writings of Sampson and Laub regarding human development over the life course. In brief, Sampson and Laub contend that human development is:

'. . . inextricably tied to dynamic concerns and the unfolding of biological, psychological, and social processes through time. Rutter and Rutter (1993) propose an admittedly "fuzzy" but nonetheless useful definition of development as "systematic, organised, intra-individual change that is clearly associated with generally expectable age-related progressions and which is carried forward in some way that has implications for a person's pattern or level of functioning at some later time" (1993: 64). Development is thus focused on systematic change, especially how behaviours set in motion *dynamic processes that alter future outcomes* (emphasis added).'

In laying out a dynamic model in the POCLS context, it is important to recall the key research questions at the core of the POCLS. Children (and their families) interact with the child welfare system as a series of events: maltreatment investigations and their disposition, services of various types, placement in out-of-home care, discharge from care, and aftercare among them. Families come to interact with the system for diverse reasons. The ensuing interactions may take place in any order though they tend to follow patterns prescribed by what children and families need, regulatory requirements and best practices. Services often follow investigation. Placement in out-of-home care may follow services, but that is clearly not always the case. The exact order observed for any given child, assembled over a population of children, is one way we understand whether services provided are having their intended effect.

The temporal ordering of events is also a key to understanding how child welfare services fit within a developmental, life course perspective and vice versa. Elder (1998; 1994) notes that *when* something happens is often more important than *whether* it happens. Fundamentally, the effects of placement on wellbeing and wellbeing's effect on placement can only be understood after the two trajectories are threaded together through time and in order. Hence the notion of pathways.

The main empirical challenge rests with isolating person (i.e. child), service (e.g. placement), and contextual (e.g. family, community) effects on placement and developmental trajectories that have been woven together. Four basic questions capture what might be learned from the POCLS data when seen through this lens:

1.1. How does who the child is affect what happens to them?

Each of us starts with who we are biologically (Ellis & Boyce, 2005; J. P. Shonkoff, Richter, van der Gaag & Bhutta, 2012; J. Shonkoff, Boyce & McEwen, 2009). Some of what happens to 1 year olds is because they are 1 year old (NYC Children's Cabinet, 2016) and the fact that services have to respond to the basic biological and psychological determinants of need. Analytically, we can think of these as the main effects of a child's biographical identity. These are often but not strictly time-invariant attributes.

1.2. What is the effect of context on development?

Growth and development occur within a context (Li, Mattes, Stanley, McMurray & Hertzman, 2009; Marmot, 2009; Wilensky & Satcher, 2009; Wright, Kim, Chassin, Losoya & Piquero, 2014). Proximal contextual influences are those in the home and the people who live together with children. More distal influences include neighbourhoods, towns, cities, and the communitarian institutions of schools, health care and child protection. The literature on social determinants of wellbeing (i.e. human capital) suggests that where children live reinforces or undercuts normative, age-graded developmental processes. Indeed, it is the interaction between biographical identity and contextually-based risk and protective factors that shape the rate of human capital formation.

1.3. What are the effects of services provided on development?

Societies generally provide a range of services designed to promote development. These services fall on a continuum, from those that represent what might be called primary supports (e.g. schools) to those that are ameliorative, although any given service may be thought of in both ways, depending on developmental standing and other considerations. The services are, however, a part of the risk and protective context that contributes to human capital formation.

1.4. How do the person, home, service, and community factors co-influence developmental trajectories in alignment with what theory predicts?

The underlying model - with time embedded in persons and persons embedded in contexts - brings the biological, psychological, and social influences together under one conceptual roof.

2 Human capital

The model building begins with human capital. Human capital is simply the set of skills that differentiate children from adults. The skills are diverse and include relational skills, knowledge, non-cognitive skills, and other personal qualities including ability and endowments (Aizer & Cunha, 2012; Cunha & Heckman, 2010; Heckman, 2000). Societies distinguish between adults and children, not on the basis of their health or the other, usual measures of wellbeing, but on the basis of whether they possess the skills needed to form meaningful relationships with their community, meaningful relationships with their family, and meaningful relationships with the world of work. The range of choices individuals face as they transition from childhood to adulthood are bound up in culture, religion, and socio-historical context (i.e. how we define adulthood), but the bundle of skills is distinct. Human capital is the term used to summarise what fits inside the bundle of assets that differentiates adults from children.

Human capital is a useful heuristic for thinking about what happens as the transition to adulthood begins. First, the transition to adulthood begins early in life as the 'rudimentary but foundational socio-emotional, language, and cognitive skills needed to develop healthy, adaptive coping skills' unfold for use during later stages of development (Garner, 2013, p. S65). Second, we can think of human capital as something that changes with time. The cumulative change in the level of human capital forms a trajectory that takes shape around the unfolding of biological, psychological and social processes. To a degree, these are expectable age-related processes (Michael Rutter & Rutter, 1993). Finally, human capital begets human capital. That is, the rate of human capital formation is a function of one's human capital, in the same way that small investments compound over time such that the rate of formation is a function of present value *and* the inputs (Heckman, 2000). It is through these interactions that human capital is formed.

3 Person and context

Intra-individual processes, which are attributes of the person, are characterised by a natural propensity to change over time, as reflected in the developmental changes that take place between birth and entry into school, as one of many potential examples. Change is a natural condition of people. Contextual influences are extra-individual processes that operate through the mechanisms of exposure. Children spend time in the presence of caregivers. The quality of the home and community are also important as context. The specific influence of context is a matter of what and when. Per Elder (1998), some of what happens may be relatively benign depending on what happens and when relative to current context and the human capital available to cope with prevailing risk and protective factors. As an example, toxic stress represents an extra-individual process that is particularly problematic early in the life course (Franke, 2014). Vulnerability to toxic stress is high in part because the rudimentary skills of interaction with the caregiver are being formed. There is a small but crucial set of inherent capacities that must develop as a prelude to future development along the pathway one might otherwise expect (Walker et al., 2011). There is room for individual variation (Belsky & Beaver, 2011; Ellis, Boyce, Belsky, Bakermans-Kranenburg & Van IJzendoorn, 2011; Ellis, Jackson & Boyce, 2006), but the disruptive influence of toxic stress on skill formation is what seems to matter most. At later points in the life course, the same stressors, while not benign, may have a smaller impact because their effects are moderated by skills acquired earlier in the life course.

To start the model building, Figure 3.1 depicts the basic building blocks of the theory from a cross-sectional perspective. Context is portrayed as concentric circles to reflect the proximal/distal qualities of context relative to the individual.

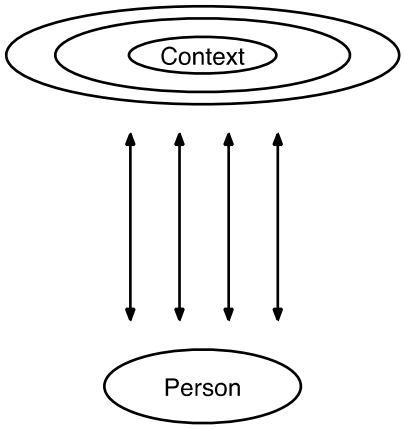

Figure 3.1 Cross-sectional model of the person-in-context

The influence of context on person and person on context is bi-directional. The person level speaks to human capital and the constructs we use to organise the

narrative around the formation of human capital over the life course. Language skills, numeracy, motor skills and self-regulation are foundational forms of human capital established early in life because they ignite the development of other, more diverse forms of human capital for use at later life stages (Walker et al., 2011). The contextual level speaks to the extra-individual processes that influence the rate of human capital formation. Some (all) of what we see over the life course is the interplay between context-, caregiver- and child-level characteristics including his or her endowments (Cunha & Heckman, 2010; Walker et al., 2011). Therein lies the need for a multi-level, mixed method design.

4 Risk and protective factors

Factors that alter the rate of human capital formation are found at the person and contextual levels. We can think of these factors as risk and protective factors. Risk factors slow the rate of human capital formation whereas protective factors promote human capital formation. On balance, the observed rate of human capital formation is the equilibrium established between opposing risk and protective factors. During times when protective factors outweigh risk factors, human capital forms at a greater rate. The reverse is also true – when the risks outweigh the protective factors, the rate of human capital formation slows.

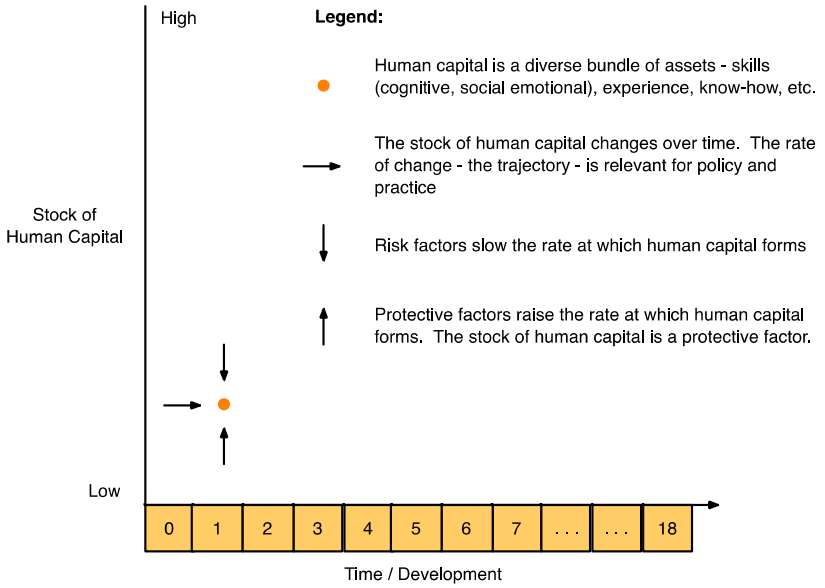

Figure 4.1 Human capital in the risk and protective context

These dynamics are illustrated in Figures 4.1 and 4.2. In this case, we might imagine numeracy, literacy, motor skills and self-regulation as forms of human capital. There is, all things being equal, a tendency for human capital (●) to change with the passage of time (→) because of basic bio-psychological processes, with the rate and nature of change affected by the presence of protective (↑) factors and risk factors (↓). For example, children enter an early care and education settings having already acquired certain numeracy, language and self-regulatory skills. The level of these skills is expected to evolve but the actual rate at which new skills are acquired is a function of the base level of skills, the baseline rate of change, the early care and education context (e.g. program quality) plus a mix of other risk and protective factors, including the family.

From measurement and conceptual perspectives, it is practical and helpful to place human capital formation in a person-period context. Person-periods are time-bounded moments in the life of a person. Person-periods might also be thought of as

measurement occasions. In case of the POCLS, the measurement occasions represent the various waves of data collection.

A person starts a person-period with a set of human capital assets (Figure 4.1) and *may* end the period with more human capital than when they started. The rate of human capital formation is a function of:

The stock of human capital at the outset of the person-period. Language is one useful example. Children start school having already mastered a certain vocabulary. This may be thought of as their stock of human capital when school starts. The vocabulary accessible at the outset of the school year raises the possibility of further language acquisition. The dynamic relationship between the human capital one has and what one acquires through time represents the autocatalytic essence of human capital. In other words, human capital is its own protective factor.

The elements of risk and protection present in the environment during the person-period. Risk and protective factors may be connected to families, communities, the service sector, and so on. Risk and protective factors are to a certain extent age-dependent in their meaning and potential influence. From a modelling perspective, the state dependencies are dynamic with respect to how person, context and time interact.

Figure 4.2 provides a graphical view of what repeated measures of human capital represent conceptually. For each measurement occasion, there are measures of human capital along with measures that capture the risk/protective factors. Among other benefits, the narrative that threads these cross-sections together speaks to how well our policies meet the needs of their intended beneficiaries.

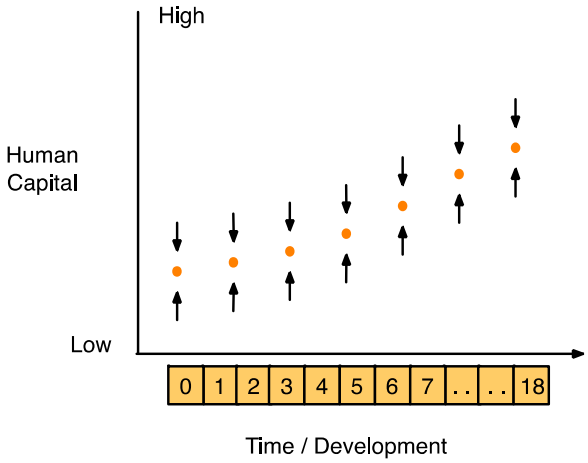

Figure 4.2 Human capital trajectory in a risk and protective context

Figure 4.3 looks more closely at the person-periods, building on the idea that risk and protective factors stand in relationship to the person and his or her human capital in a dynamic fashion. Some factors that fit in the risk and protective framework are close to the individual, family being the best example in most cases, and others are farther away physically and psychologically, but important nonetheless. It is also the case that the *influence of a factor may vary with time,*

context and the developmental processes underway. Again, the idea is that human capital lies at the intersection of the risk and protective context, with the change in human capital representing the equilibrium of all risk and protection factors. In general, policies and interventions are intended to tip the equilibrium of risk and protective factors in the favour of protective factors and human capital formation. In this model, the focus is on the risk/protective equilibrium rather than their presence or absence.

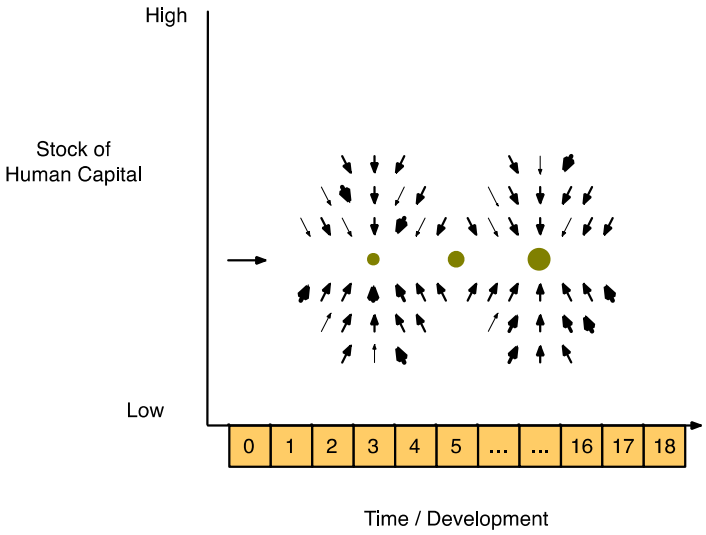

Figure 4.3 Risk and protection as distal and proximal factors

Figure 4.4 extends the model one last step, incorporating a more formal person, place and time structure. Time in this case is along the z-axis. Development happens through time, with the changes in human capital forming a life course trajectory through the state space portrayed in Figure 4.4. Along the x-axis are the developmentally homogeneous age groupings that fit with the notion of expectable age-graded progressions. They share a starting point in the state space based on something the members share. Analytically, it is important to see how the narrative unfolds from that common starting point for the groups of children organised that way. Birth is the most obvious starting point but for the POCLS sample the starting point is the day in the child's life when the Minister assumed what is generally regarded as permanent legal custody. From that shared starting point, these children experience life going forward. The y-axis represents the family context in which those lives went forward. There are other ways to represent context. The choice here – family settings – represents an important proximal influence as the place where a child grows up. In the model, place may be physical, administrative, social or psychological. Communities, families, homes and service agencies all fit within this notion of settings where children and young people live out some aspect of their lives.

When arrayed in a person-place-time structure, the person-periods form the building blocks of life course narrative. What remains is measurement – what does one need to know about each person-period to make sense of the interlocking experiences? A basic measurement strategy, not unlike the one used for the POCLS, is described in

Figure 4.5. It starts with the child as the basic unit of analysis. Other units of analysis are found in the POCLS data, but the fundamental unit of analysis is the child. Children (i) are described in terms of their biographical information such as gender, date of birth, race/ethnicity, their physical health, their social/emotional health, their cognitive development, their experiences and their skills. Skills, which are age- and context-sensitive in their meaning, are interpreted broadly to include the relational skills that are an important part of development along with education, know-how, and experience. Human capital ties these skills together into a bundle of assets the young person uses to navigate the transitions that lie ahead. How young people cope with the expectable progressions of their lives, using their human capital, is the narrative captured with the data. When children are old enough, the data collected represent their own perceptions (Schafer, Ferraro & Mustillo, 2011).

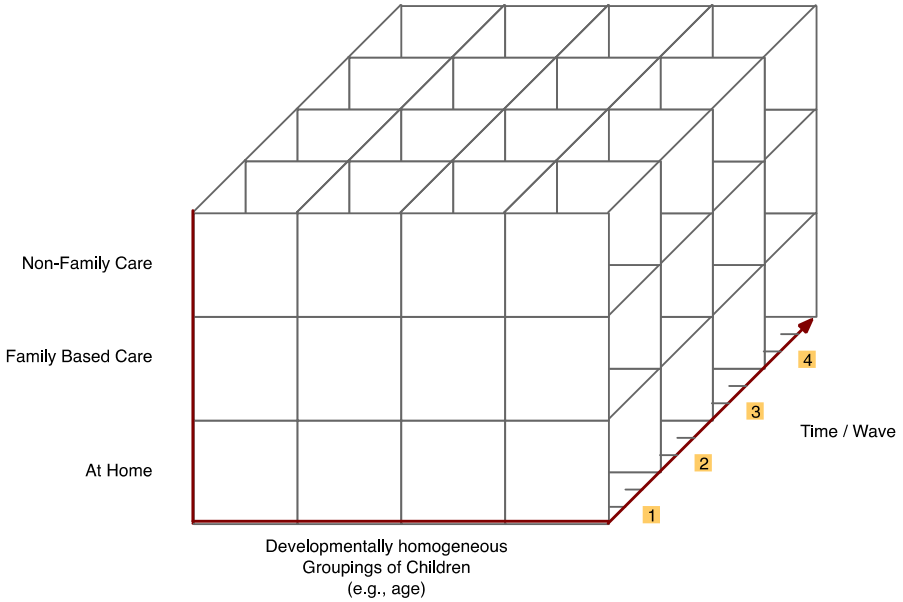

Figure 4.4 Human capital in person, place and time repose

Each measurement occasion also represents an opportunity to learn about context (j). Conceptually, context is most efficiently thought of as layered, with some layers coming closer to the person than others. Children are interesting because the caregiver plays such an important, proximal role in childhood. Through their interactions with children, caregivers are both a direct and mediating/moderating influence on the developing child. Who the caregivers are and in what context the caregivers are providing care help us see how life progresses and why. Home is a physical and psychological construct and so is community. In the case of the POCLS, the caregiver context is acutely important because the State has had a hand in establishing the caregiver/child relationship. In most cases, caregiving on behalf of children is a private matter managed by families. When the State becomes involved, the benefits of its involvement say something about how well the system of policy, finance and services come together as a coherent child protection system responsive to the needs of children, families and communities.

To this last point, the measurement occasions also provide a window into the services (k) children and caregivers receive. The structures that define the service

system are part of context. What this data represents conceptually is whether children and families receive services from those systems. The quality of the services provided is also of interest. Services are divided in their respective clusters: school, health (including behavioural health), and child protection. The data captures the service history in its temporal order so that it too can be woven together with what happens developmentally. Insofar as the young people in the POCLS study are with foster carers, a service of primary interest is the care provided through the out-of-home care system and its impact on human capital formation.

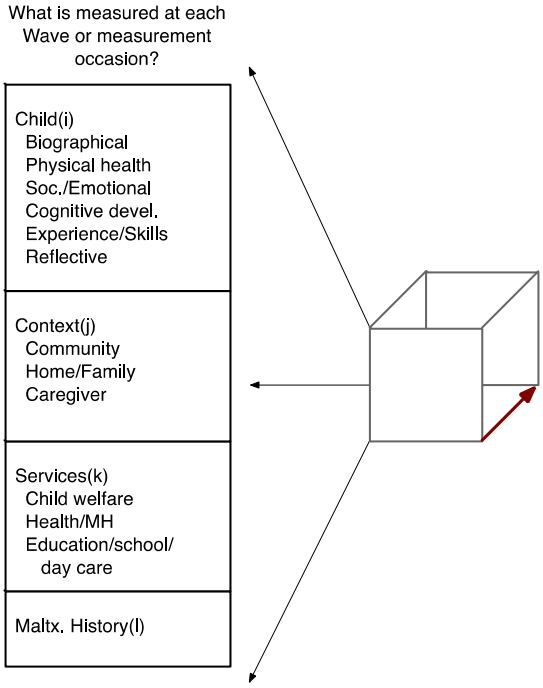

Figure 4.5 The POCLS measurement framework

The last cluster of data collected concerns maltreatment history. The maltreatment history is isolated in the measurement plan because a shared maltreatment history is one of the things that ties the POCLS sample together. To varying degrees, each child in the POCLS sample had contact with the child protection system before the Minister assumed legal responsibility on a long-term order. Calling out that history to see how it shapes what happens to young people is among the important contributions the POCLS can make.

When the POCLS data collection is finished, children who started together will have moved on through childhood, together in some instances and apart in others. In the narrative that emerges, some things change, other things stay the same. Across the waves, each child will find his or her place within the person, place and time structure shown in Figure 4.5. From each starting point, shared narrative forms around common starting points, the common end points, and the experiences in between that give meaning to the lives lived.

5 The hierarchical model

In general, a framework should connect explicit theories with statistical models that provide a way to test the theory (Reiss & Wolak, 2007; Collins, 2006). In this case, the theory being applied connects change in human capital to the individual child and the context in which the life course unfolds. The theory also connects changes in caregiving contexts to those same individual and contextual factors. Together, the two views reveal how context affects development and how development shapes context.

Although it is not necessary to illustrate the model using separate levels, the model as illustrated here uses the hierarchical form, with separate equations for the child person-period level (Level 1), the child level (Level 2), and the contextual level (Level 3), before a combined form is introduced. Either approach - the hierarchical model or the mixed effects model - follows the typical exposition on multilevel models (Hedeker & Gibbons, 2006; Raudenbush & Bryk, 2001). When applied to the same data, the results are identical.

To illustrate how the model works, we have selected a model that considers changes in human capital measured as language skills, child-level effects that influence the rate at which words are learned, and contextual effects tied to place[1]. In this case, place refers to a structural element of the underlying child protection system, as it often does. We are interested in whether human capital forms at rates that differ by administrative region because the reasons behind administrative variation may offer clues about improvements the public agency might undertake. The hierarchical model we propose has other useful applications. For readers interested in how caregiver and foster child and youth characteristics interact (Figure 4.4), the analysis of caregiver/child dyads follows the same statistical argument (Campbell & Kashy, 2002; McMahon, Pouget & Tortu, 2006). Generally, to develop robust parameters, the nested structure of the data has to be considered not because the nested structure is a statistical nuisance but because the variation in parameters as a function of the nested structure is often linked to practical, actionable insights.

5.1 The child person-period level model (Level 1)

Insofar as the basic unit of analysis is the child, we start with asking how changes in language unfold. Language ability is multi-dimensional, so in the interest of simplicity we will model changes in the number of spoken words per person-period. At each measurement occasion (interview waves), we expect the number of spoken words to rise relative to earlier measurements, in part because growth and development is

[1] The POCLS measures language skills for very young children in the POCLS sample as part of the infant/toddler checklist.

governed by inherent bio-psychological processes but also because risk and protective factors influence the acquisition of new words. To stay connected to the overarching argument, the changes from one person-period to another in the number of spoken words is the measure of human capital and the ensuing trajectory is the process of human capital formation. In order to measure the changes in human capital formation, multiple data points for each child are needed. Those multiple observations become clustered within a child. Multiple child observations for the same child are more similar to each other (i.e., correlated) than multiple observations between different children. As such, when the number of child observations in each child differs, each child provides different amount of information.

The Level 1 model has this form[2]:

$$Y_{ijt} = \beta_{0ij} + \Sigma\tau_t \, Time_t + \beta_1 X_{ijt} + \beta_2 Y_{ijt-1} + \varepsilon_{ijt}, \qquad (1)$$

Y_{ijt} is a measure of human capital (spoken words) for child i in District Office j at discrete measurement time t. β_{0ij} is the model intercept for child i in District Office j. When it is by itself in the model, β_0 refers to the (unconditional) average level of human capital in the population being considered, whereas β_{0ij} refers to the average level of human capital for child i nested in District Office j. X_{ijt} represents time-varying child level covariates for child i in District Office j at discrete time t. Y_{ijt-1} indicates accumulated human capital for child i in District Office j at discrete time $t-1$. Inclusion of the lagged human capital Y_{ijt-1} variable makes it a dynamic model. Y_{ij0} is the human capital at birth if $Time_t$ represents age, so it represents initial stock of skills (endowments). β_1 and β_2 refer to the coefficients for X_{ijt} and Y_{ijt-1}, respectively. $Time_t$ represents the fixed effect of time at discrete time t. τ_t estimates the change in human capital relative to discrete time intervals (i.e. ages, person-periods or the interviews at each wave). Finally, ε_{ijt} is the error term for child i in District Office j at discrete time t.[3]

When τ_t is arrayed against $Time_t$ on the x-axis, the model produces the human capital trajectory as portrayed in Figures 4.1 and 4.2. The intercept is represented in Figure 4.1; Figure 4.2 shows the trajectory through $Time_t$. The functional form of the

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[2] In the literature, models of the form shown in equations 1 and 2 are known interchangeably as mixed effects models, random effects models or hierarchical models. In some applications, this is also known as a growth curve model. See, for example, Hedeker & Gibbons (2006) and Raudenbush & Bryk (2001).

[3] In order to have consistent covariate estimates, ε_{ijt} is assumed to be orthogonal to the other covariates. However, the orthogonality condition may be violated when there are relevant omitted variables and/or measurement errors. In particular, the lagged term (Y_{ijt}) can cause an identification issue because the lagged baseline variable can be sensitive to endogeneity. Therefore, this strong assumption can be relaxed to allow a first order autoregressive (AR (1)) structure. (Todd & Wolpin, 2007).

heterogeneous trajectories (for each child *i*) is how human capital tends to form from the baseline (or intercept). X_{ijt} and Y_{ijt-1} are time-varying child-level covariates. At the child level, the individual factors group into risk and protective factors plus already accumulated human capital. Protective factors are associated with positive coefficients. Risk factors have negative coefficients. The reference to j different District Offices is a reminder to consider how the Level 1 parameters vary by District Office. Vocabulary may be lower in some districts than others because of exposure to contextual effects that are correlated with the location of administrative structure (i.e. District Offices). These contextual effects are taken up in a subsequent section.

5.2 The child level model (Level 2)

The Level 1 model captures change in human capital over time for a single child whereas the level 2 model captures variation *between* children.

$$\beta_{0ij} = \delta_{00j} + \delta_{010}C_{ij} + \gamma_{0ij}, \quad (2)$$

δ_{00j} is the average level of human capital for the children nested within community *j*. C_{ij} represents time invariant child level covariates for child *i* in community *j*. δ_{010} represents the coefficient for the child-level covariate, C_{ij}. Protective time-invariant factors are associated with positive coefficients and risk time-invariant factors have negative coefficients. γ_{0ij} refers to any unobserved factors. γ_{0ij} is assumed to be orthogonal to both X_{ijt} and C_{ij} and multivariate normally distributed with a mean of 0 and a general variance-covariance matrix. These unobserved intercept differences in child level make the model structure a random effects model.

5.3 The context model (Level 3)

If context has an effect on human capital and human capital formation, the effects are realised as variation in the intercept of the Level 2 model. Differences in the intercept (δ_{00j}) suggest that there are differences in the average level of human capital among the children clustered by the District Office organising their services. Level 3 covariates are used to explain the between office differences. For example, if the person-periods are three months in duration, the human capital trajectory comprised of the intercepts of three month person-periods varies depending on Level 3 covariates.

In the risk/protective framework, the relationship between age and vocabulary depends on attributes measured at the contextual level as follows:

$$\delta_{00j} = \theta_{000} + \theta_{010}D_j + \eta_{00j}, \quad (3)$$

where δ_{00j} is the intercept for the District Office *j* at initial discrete time 0;[4] θ_{000} is the average intercept across District Offices; and θ_{010} is the adjusted difference in child outcome Y associated with District Office variables of D_j. δ_{00j} includes District Office level fixed variables, D_j, so that δ_{00j} becomes the adjusted intercept for children in District Office *j* for outcome Y. In order to see how attributes of the District Office affect human capital, θ_{010} should be considered. θ_{010} illustrates intercept effects of District Offices associated with D_j. . Children served by urban District Offices (a District Office covariate) may know more (or fewer) words than children in non-urban offices for reasons having to do with District Office differences. A subscript of *j* in δ_{00j} indicates that each District Office has a unique intercept, η_{00j}. The existence of η_{00j} makes this model another random effects model, which allows the District Office intercepts to vary. As such, this model has three levels (child person period – child – District) with two random variables (child random variables and District Office random variables).

This model can be extended to a three level random coefficients model, which requires stronger assumptions. Regarding the difference between a random effects model and a random coefficients model, the random effects model allows only the District Office intercepts to be random. It assumes that District Offices follow the same overall slope, but only differ in the average outcome. However, the random coefficients (slopes) model allows the District Office slopes to differ by District Office. In terms of distributions, District Office random intercepts are assumed to be independent from X_{ija}, C_{ij} , and D_j and are assumed to be multivariate normally distributed with a mean of zero and a general variance-covariance matrix. Individual District Office intercepts are, therefore, deviations from zero.

The assumptions of this model are considered strong. The strict exogeneity condition of the error term and the zero correlation between lagged human capital and unobserved heterogeneity at Level 2 and Level 3 can be violated when the lagged term is included regardless of the random effects model or the fixed effects model (Wooldridge, 2010). However, the purpose of this chapter is to present the estimation strategy in human capital within the standard random effects framework. For readers interested in other empirical approaches and solutions to these issues, further details can be found in literature (Todd & Wolpin, 2003; Cameron & Trivedi, 2005; Hsiao, 2014). Wulczyn and Chen (2018) used this model to explore District Office differences in placement stability.

4 Note that there are time dummies for time 1 to *t* in equation (1). Therefore, District Office intercepts for other time periods (from time 1 to *t*) are the combination of δ_{00j} and the coefficient of each time variable.

5.4 Combined model

Level 1, Level 2 and Level 3 may be combined into a single, mixed-effects model, as shown below. This model contains (1) fixed components of time intercepts, lagged human capital, Level 1, Level 2, and Level 3 covariates, (2) child random intercepts and District Office random intercepts, and (3) random errors.

$$Y_{ijt} = \theta_{000} + \Sigma\tau_t \, Time_t + \theta_{010}D_j + \delta_{010}C_{ij} + \beta_1 X_{ijt} + \beta_2 Y_{ijt-1} + \eta_{00j} + \gamma_{0ij} + \varepsilon_{ijt}. \quad (4)$$

Although the hierarchical model and mixed effects model are identical, the hierarchical model, with its emphasis on the distinct Level 1 and Level 2 equations may prove easier to follow, especially when attention turns to the effect of policy and practice on human capital and other dependent variables.

5.5 Extensions

The focus thus far has been on human capital, in its various forms, as the dependent variable. The main question posed asks what does it take for human capital to grow? The model expresses one answer to that question by dividing influence into its risk and protection components and then showing, on balance, how human capital changes in contexts defined by the risk and protective factors present. Human capital is allowed to vary in the model because human capital formation is its own protective factor bound up in the dynamics of development. When the person-periods are stitched together, the life course narrative is what emerges.

The model is also useful for portraying the chances something positive, such as restoration, will happen in the life of a child. Through policy and practice, child welfare agencies are always, in ways big and small, trying to improve the chances a child will go home or achieve some other positive outcome. The impact of that effort is best displayed as changes in the conditional probability of experiencing the next event of interest as time passes. The map of those changes (see Figure 4.2) aggregated over all children and then sorted into groups based on their common experiences yields the kind of insights that are closely aligned with strategies for improving outcomes. Policies, which are embedded in the risk/protective context as structures and processes, work if they change the chances of what happens next for the better. If that does not happen, it will be harder to show a positive impact of policy and the sort of practices policy generates. Moreover, the closer policy analysis is to the underlying probabilities, the more likely we are to devise policies that achieve the intended effect.

The child-level model (see above) can accommodate a binary dependent variable through the log transformation of Y_{ijt} into a probability that reflects the chances a child will return home once placed in foster care, as one example of an event of interest. The possible events of interest are as diverse as the type of events that define the life course. The model parameters then translate into effects on the probability the event of interest (restoration) will happen within the specified person-period (Singer & Willet, 1993), net of the risk and protective factors used in the

model. β_0 refers to the (unconditional) average probability of restoration in the population being considered, whereas β_{0ij} refers to the average probability for child i in District Office j. . When τ_t from this model is arrayed against time on the x-axis, the model shows how the likelihood of restoration changes from one person-period to the next (see Figures 4.1 and 4.2). When the probabilities change from one observation to the next, theory suggests that it is because the risk and protection balance shifts. When the shift in risk and protection is induced by policy and the practices policy inspires, then the model generates observational evidence that connects the policy and practice regime to changes in outcomes. As one example, treatment effects on permanency associated with the implementation of evidence-based interventions have been tested using this framework (Chamberlain, Feldman, Wulczyn, Saldana & Forgatch, 2016; Wulczyn & Feldman, 2018).

6 Summary

When the last wave of the POCLS data is collected, FACS will be left with a unique collection of data about the life course of children and young people placed in out-of-home care. To realise the full value of its investment, FACS will have to organise the results from the various studies it commissions into an overarching framework that reveals how the policies and practices of FACS affect human capital formation. Returning to the key study question: How do the policies and practices of FACS, net of the other risk and protective factors, shape the wellbeing of those whose lives are touched by FACS and vice versa?

The proposed framework bundles together various notions of wellbeing into a human capital framework. Human capital is a flexible construct organised around the assets a young person has at their disposal when meeting the everyday challenges in front of them. The principal assets are the skills acquired through interaction with the risk and protective context. Skills are broadly defined to include the rudimentary skills associated with serve and return interactions between a child and parent in the earliest days of life, the ability to regulate behaviour in a classroom setting, and the capacity to form and maintain healthy relationships with peers, to mention a few.

In time, the collection of skills a young person has will translate into labour force participation but the meaning of human capital in the POCLS context is meant to be a bit broader. The key assertion connects human capital with the distinction made between children and adults. Although the point at which a child becomes an adult is not a discrete moment in time, the process of maturation does imply a line of demarcation. In some cases, this is a legal distinction, with the problem of ageing out of out-of-home care a case in point. When children reach the age of 18, the legal age of majority, the question is whether they have accumulated enough human capital to conclude the transition to adulthood given the expectations placed on adults. Increasingly, as the social meaning of adulthood has stretched adolescence into the mid to late 20s, the obligations of the State to extend foster care represents a policy meant to give a young person additional time to curate the skills needed to complete the transition (Courtney, 2009; Courtney, Piliavin, Grogan-Kaylor, & Nesmith, 2001; Keller, Cusick, & Courtney, 2007). More broadly, childhood is the time when the suite of skills needed across the life span are being formed.

Another key assertion characterises human capital as its own protective factor that operates within an overarching risk and protective framework. Put simply, the capacity to manage transitions is a function of accumulated human capital in combination with other risk and protective factors. The transition to school is easier when the available assets include greater language proficiency, numeracy, self-regulation and motor skills. Moreover, what one learns during the first year of school – the additions to human capital – are likely larger among the young people who start the year having already accumulated a broader, deeper human capital profile. This dynamic – the positive feedback effects of human capital – is the basis of cumulative advantage; cumulative disadvantage is the flipside of that coin (Sampson & Laub, 1997).

Analytically, the POCLS fits within this framework as follows. The sample includes children on final orders. This means that, all else being equal, the Minister has assumed legal guardianship, with all that implies as it pertains to providing a context that meets the needs of young people. From a measurement perspective, the initial conditions are set at the time of the Wave 1 interview, which was aligned as closely as possible to time when custody was transferred. In essence, the question being asked is: from the time long-term custody was transferred to the Minister, how do children fare? The policy argument behind the sample selected recognises the unique obligations of the State when it assumes long-term responsibility. Children may return home after the final order has been entered, but the policy and practice framework must respect a range of other possibilities. With the POCLS, leadership will have a much clearer view of what happened, the impact of what happened on human capital, and the role played by the services organised by FACS and other stakeholders on the unfolding life course trajectory.

To observe the trajectories as they unfold, one needs a model that places measures of human capital along the axis of time together with other measures of risk and protection. Changes in human capital from one measurement occasion to the next (i.e. the POCLS waves) will be a function of the expectable, normative, age-graded patterns of development, the stock of human capital, and the balance of risk and protective factors. The services provided by FACS and other stakeholders rest within the risk and protective context. The value of those services – i.e. their effect – can be thought of as the extent to which the risk/protective balance shifts in favour of the protective qualities of context because the services are present. In summary form, the model produces an estimate of the effect child welfare services have on human capital formation. Conversely, if the goal shifts to understanding how human capital influences the service trajectory, the model produces the estimated transition probability given the set of risk and protective factors plus human capital. A policy and practice framework that flows from these insights should raise the return on the investment in the POCLS.

7 References

Aizer, A. & Cunha, F. (2012). The Production of Human Capital: Endowments, Investments and Fertility.

Belsky, J. & Beaver, K. M. (2011). Cumulative-genetic plasticity, parenting and adolescent self-regulation. Journal of Child Psychology and Psychiatry, 52, 619–626.

Cameron, A. C. & Trivedi, P. K. (2005). Microeconometrics: Methods and Applications, Cambridge University Press, New York.

Campbell, L. & Kashy, D. A. (2002). Estimating Actor, Partner, and Interaction Effects for Dyadic Data Using PROC MIXED and HLM: A User-Friendly Guide. Personal Relationships, 9, 327–342.

Chamberlain, P., Feldman, S. W., Wulczyn, F., Saldana, L. & Forgatch, M. (2016). Implementation and Evaluation of Linked Parenting Models in a Large Urban Child Welfare System. Child Abuse & Neglect, 53, 27–39.

Collins, L. M. (2006). Analysis of Longitudinal Data: The Integration of Theoretical Model, Temporal Design, and Statistical Model. Annual Review of Psychology, 57(1), 505–528.

Courtney, M. E. (2009). *The Difficult Transition to Adulthood for Foster Youth in the US: Implications for the State as Corporate Parent and commentaries*. *Social Policy Report* (Vol. 23, pp. 1–20). Wiley-Blackwell.

Courtney, M. E., Piliavin, I., Grogan-Kaylor, A., & Nesmith, A. (2001). Foster Youth Transitions to Adulthood: A Longitudinal View of Youth Leaving Care. *Child Welfare*, *80*, 685–717.

Cunha, F., & Heckman, J. J. (2009). Investing in Our Young People. *Rivista Internazionale Di Scienze Sociali*, *117*(3/4), 387–417.

Elder, G. H. (1998). The Life Course as Developmental Theory. Child Development, 69, 1–12.

Elder, G. H., Jr. (1994). Time, Human Agency, and Social Change: Perspectives on the Life Course. Social Psychology Quarterly, 57, 4–15.

Ellis, B. J. & Boyce, W. T. (2005). Biological sensitivity to context. Current Directions in Psychological Science, 183–187.

Ellis, B. J., Boyce, W. T., Belsky, J., Bakermans-Kranenburg, M. J. & Van IJzendoorn, M. H. (2011). Differential susceptibility to the environment: An evolutionary–neurodevelopmental theory. Development and Psychopathology, 23, 7–28.

Ellis, B. J., Jackson, J. J. & Boyce, W. T. (2006). The stress response systems: Universality and adaptive individual differences. Developmental Review, 26, 175–212.

Franke, H. A. (2014). Toxic Stress: Effects, Prevention and Treatment. Children (Basel, Switzerland), 1, 390–402.

Garner, A. S. (2013). Home Visiting and the Biology of Toxic Stress: Opportunities to Address Early Childhood Adversity. Pediatrics, 132 Suppl 2, S65–73.

Hsiao, C. (2014), Analysis of Panel Data, Cambridge University Press, Cambridge

Heckman, J. (2000). Policies to foster human capital. *Research in Economics*, *54*, 3-56.

Hedeker, D. & Gibbons, R. D. (2006). Longitudinal Data Analysis (pp. 1–360). New York: Wiley.

Keller, T. E., Cusick, G. R., & Courtney, M. E. (2007). Approaching the Transition to Adulthood: Distinctive Profiles of Adolescents Aging out of the Child Welfare System. *Social Service Review*, *81*, 453–484.

Li, J., Mattes, E., Stanley, F., McMurray, A., & Hertzman, C. (2009). Editorial: Social determinants of child health and well-being. Health Sociology Review, 18, 3-11.

Marmot, M. (2009). Social determinants and adolescent health. International Journal of Public Health, 54, 125–127.

McMahon, J. M., Pouget, E. R. & Tortu, S. (2006). A guide for multilevel modeling of dyadic data with binary outcomes using SAS PROC NLMIXED. Computational Statistics and Data Analysis, 50, 3663–3680.

NYC Children's Cabinet. (2016). Growing Up NYC: A Policy Framework (pp. 1–99). City of New York: Office of the Mayor.

Paxman, M., Tully, L., Burke, S. & Watson, J. (2014). Pathways of Care: Longitudinal Study on Children and Young People in Out-of-Home Care in New South Wales. Family Matters, 15–28.

Raudenbush, S. & Bryk, A. (2001). Hierarchical Linear Models: Applications and Data Analysis Methods (2nd ed.). Newbury Park, Ca: Sage.

Reiss, P. C. & Wolak, F. A. (2007). Structural Econometric Modeling: Rationales and Examples from Industrial Organization (Vol. 6, pp. 4277–4415). Elsevier.

Rutter, Michael & Rutter, M. (1993). Developing Minds: Challenge and Continuity Across the Life Span (pp. 1–416). New York, NY: Basic Books.

Sampson, R. J. & Laub, J. H. (1997). Life-Course Theory of Cumulative Disadvantage and the Stability of Delinquency. In T. P. Thornberry, *Developmental Theories of Crime and Delinquency* (pp. 1–29). Piscataway, NJ: Transaction Publishers.

Schafer, M. H., Ferraro, K. F. & Mustillo, S. A. (2011). Children of Misfortune: Early Adversity and Cumulative Inequality in Perceived Life Trajectories. American Journal of Sociology, 116, 1053–1091.

Shonkoff, J. P., Richter, L., van der Gaag, J. & Bhutta, Z. A. (2012). An Integrated Scientific Framework for Child Survival and Early Childhood Development. Pediatrics, 129, 1–15.

Shonkoff, J., Boyce, W. T. & McEwen, B. (2009). Neuroscience, molecular biology, and the childhood roots of health disparities. Journal of American Medical Association, 301, 2252.

Singer, J. D. & Willet, J. B. (1993). It's About Time: Using Discrete-Time Survival Analysis to Study Duration and the Timing of Events. Journal of Educational Statistics, 18, 155–195.

Tilbury, C. (2009). The over-representation of indigenous children in the Australian child welfare system. International Journal of Social Welfare, 18, 57–64.

Tilbury, C. & Thoburn, J. (2009). Using racial disproportionality and disparity indicators to measure child welfare outcomes. Children and Youth Services Review, 31, 1101–1106.

Todd, P. E., & Wolpin, K. I. (2007). The Production of Cognitive Achievement in Children: Home, School, and Racial Test Score Gaps. *Journal of Human Capital*, *1*(1), 91–136.

Walker, S. P., Wachs, T. D., Black, M. M., Nelson, C. A., Huffman, S. L., Baker-Henningham, H., et al. (2011). Inequality in Early Childhood: Risk and Protective Factors for Early Child Development. *Lancet*, *378*, 1325–1338.

Wilensky, G. R. & Satcher, D. (2009). Don't Forget About the Social Determinants of Health. Health Affairs, 28, w194–w198.

Wright, K. A., Kim, B., Chassin, L., Losoya, S. H. & Piquero, A. R. (2014). Ecological context, concentrated disadvantage, and youth reoffending: identifying the social mechanisms in a sample of serious adolescent offenders. Journal of Youth and Adolescence, 43, 1781–1799.

Wulczyn, F. (2008). Child Well-Being and Human Capital (pp. 1–12). Chicago: Chapin Hall Center for Children at the University of Chicago.

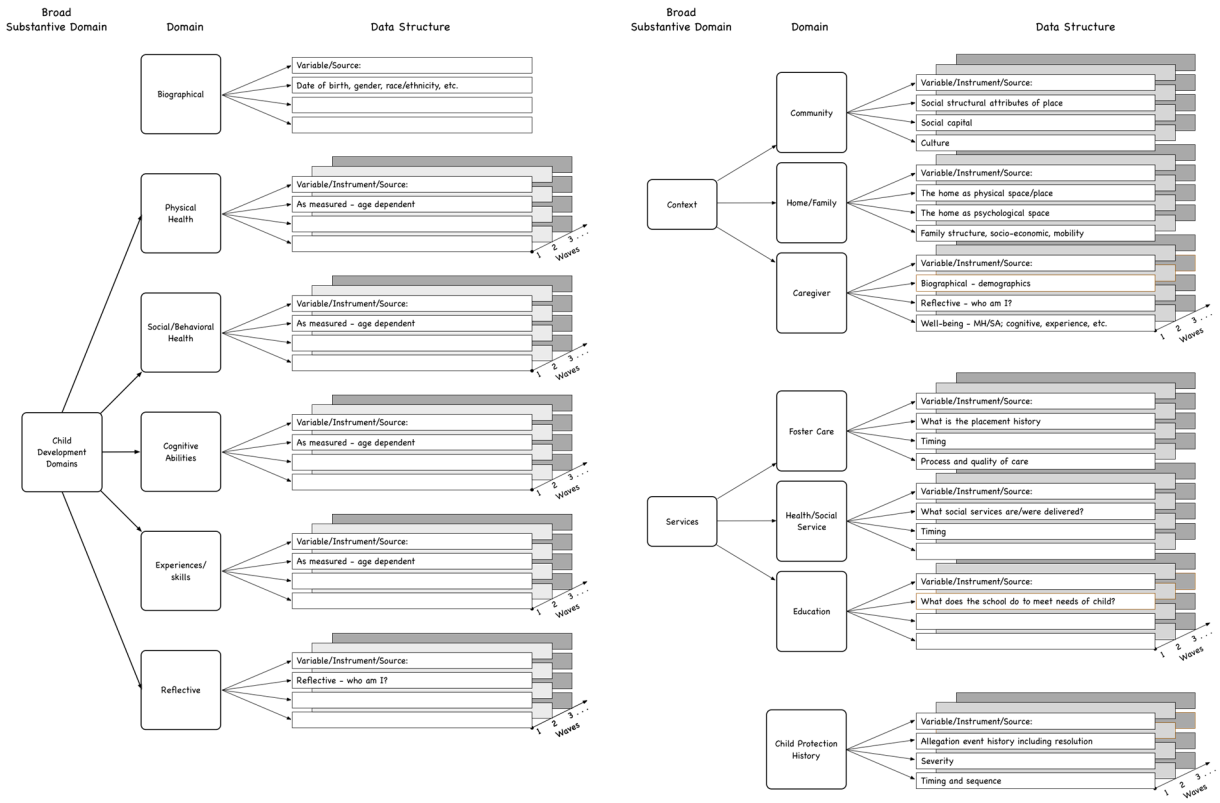
Wulczyn, F. & Feldman, S. (2018). The Scale up of Linked Multilevel Interventions: Impact on Placement Stability and Reunification. In A. Shlonsky & R. Mildon, Implementation Science (pp. 1–23). Berlin.

Wulczyn, F., Barth, R., Yuan, Y.-Y., Harden, B. J. & Landsverk, J. (2005). Beyond Common Sense: Child Welfare, Child Well-being, and the Evidence for Policy Reform. Aldine Transaction.

Wulczyn, F. H. & Chen, L. (2018). *Placement Changes Among Children in the POCLS Survey Cohort* (pp. 1–19). Sydney, NSW, AU.: Family and Community Services.

Appendix The POCLS data structure

To realise the full potential of the POCLS data, researchers will have to exploit the structure of the data within a longitudinal analytic framework. Because the data collection waves represent discrete times, the longitudinal model best suited to the analysis is the discrete time model presented above. Appendix Figure 1 below shows how the data collection in Figure 4.5 spreads across each of the waves. Symbolically, the waves are portrayed from front to back. To maintain their conceptual clarity, the meaning of individual variables as the life course progresses has to be retained if the instruments are not identical. The visual in Appendix Figure 1 is meant to provide a physical representation of the data structure so that data elements can be added to the model in the proper temporal order.



Appendix Figure 1 The POCLS data structure, domains and variables

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