Who Benefits from Childhood Anemia Interventions? Examining Social Capital and Ethnicity in Kazakhstan

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Iron deficiency anemia (IDA) is a disease caused by poor nutrition, including not consuming foods with iron, and consuming foods and beverages that block iron consumption. IDA is can be avoided through consumption of foods with iron, through taking iron supplements, or through fortifying food supplies such as flour. IDA in children causes severe cognitive and developmental issues years afterwards, including poor recognition memory (Carter et al. 2010), lower mental and motor functioning compared to similarly-aged peers (Lozoff and Wachs 2001; Mason, Rivers and Helwig 2005), growth failure (Passi and Vir 2001; Yalcin et al. 2008), more problems with anxiety and/or depression, and attention deficits, resulting in poorer performance in school and ultimately creating a population which is underdeveloped and underproductive (Passi and Vir 2001).

Anemia is an important global health concern, especially for developing countries where regional variances show high prevalences of anemia, as is the case for adolescent girls in eastern India (99.9%) (Bharati et al. 2009), and children in Palestine (50%) (Odeh 2006). Although economic development may lessen the national prevalence of anemia by 25% over the course of several decades, increases in the level of income in developing countries is not enough to eliminate anemia (Alderman and Linnemayr 2009). Global organizations and national governments have worked together in several countries around the world to implement anti-anemia interventions, with some success (Alaofé et al. 2009; Baizhumanova et al. 2010). In this paper, we are motivated by the question of whether the success of such interventions is equal across all populations, and if not, what factors may influence disparities. We examine anemia in Kazakhstan, a developing nation that has hosted numerous interventions in attempts to lessen anemia among women and children. Drawing from DHS and MICS data from 1995 to 2006, we utilize multinomial logistic regression models to examine (1) trends in the prevalence of IDA over time in Kazakhstan, and (2) the relationship of the presence of anemia to social capital indicators. Kazakhstan is a unique case for this research because anti-anemia interventions during the late 1990s did lessen anemia rates by one-third, although the prevalence is still quite high.

Health and Social Stratification

The importance of health as a key contributor to and result of social stratification is extensively discussed in the literature (Sen 1993; Wilkinson 1996; Williams 1990). Evidence indicates that ethnic and racial stratification combined with economic and social inequality power health differentials in the United States (Williams and Collins 1995), Britain (Acheson et al. 1998), South Africa (Benatar 1997), Brazil (Wood and Lovell 1992), and Russia (Bobak et al. 2000). Within the literature, scholars such as Braveman and Tarimo (2002) call for increasing attention to disparities specifically within developing countries. Access to resources and medical care, accumulated stress and isolation, cultural norms and behavior are all forwarded as potential causal links between disadvantaged social status and health, with considerable agreement on the overall importance of psychosocial factors (Williams 1990).

In terms of child health, issues of racial and ethnic stratification and disparities are particularly critical as young children are embedded within informal networks that define their health context (Mayall 1998). They have little agency in terms of pursuing formal care or selecting health behaviors, and are closely tied to parental (particularly maternal) and household characteristics. Children under the age of three years face severe health risks due both to relatively high sensitivity and to the long term developmental implications of compromised health during this stage in the life course.

Anemia in Sociological Perspective

The occurrence of moderate or severe anemia in children less than three years of age typically reflects poor overall nutritional quality and is associated with long-term developmental delays, attention deficits, and decreased intellectual capacity (Nokes, van den Bosch and Bundy 1998). Additionally, children with low iron levels exhibit a decreased capacity for nutrient absorption, which in a context of poor water quality and high rates of dysentery (as in Kazakhstan) increases the severity of health risks associated with diarrhea. Timely intervention with nutritional supplements can help avoid long-term cognitive effects of childhood anemia, as clinical trials indicate that supplements can improve motor skills and language acquisition among young children, particularly in developing country settings (Stoltzfus et al. 2001).

Typically studied through in public health or pediatrics, anemia is an important topic for sociological exploration, especially as IDA has a higher prevalence in developing rather than developed countries, and within those countries, a higher prevalence exists among disadvantaged groups. Studies from around the globe identify low economic status as the strongest risk factor for childhood anemia (Rokx, Galloway and Brown 2002) and indicate that cultural barriers, such as behaviors, languages, and traditional food reliance often act as a barrier to addressing anemia risk (Cohen 1999). Comparing studies from Turkey, Kazakhstan, Palestine, Brazil, Iran, Serbia, India, Mexico, and Lithuania show three general ideas are important to how anemia is conceptualized and explored as a problem: consumption, knowledge, and capital.

Internationally, research examining consumption has found higher rates of anemia among those who are not eating iron-rich foods, consume foods or drinks which block iron absorption (Baizhumanova et al. 2010; Djokic et al. 2010; Mason, Rivers and Helwig 2005; Ramzi et al. 2011; Turnbull et al. 2006), or on the other side of the coin are skipping meals or cutting portion sizes down (Djokic et al. 2010; Skalicki et al. 2006). Several researchers have investigated the level of knowledge people have surrounding anemia, its causes, and iron levels in various foods, assuming that the more knowledge one has about what causes anemia the less likely one would be to have anemia or children with anemia, although some results show a prevalence of anemia even when people understand anemia and its causes (Baizhumanova et al. 2010). In these cases, researchers point to cultural norms about food which dictate what people should consume which overrides their knowledge of how anemia develops.

The third area of investigation in research on anemia is capital. This refers to whether nutritionally appropriate foods are available within a particular region or even to a household (sometimes referred to as food insecurity), the socioeconomic status of families which may impact their ability to afford foods or treatment for anemia, and parental educational levels (Baizhumanova et al. 2010; Bharati et al. 2009; Pasricha et al. 2010; Skalicki et al. 2006). Interestingly, past research has found that although general national income level is inversely associated with anemia prevalence, individual family socioeconomic status (SES) is not significantly associated with the presence of anemia. In some cases, studies have found slightly higher rates of anemia among higher SES groups, although the differences were not statistically significant. In contrast with the importance researchers place on level of knowledge about anemia, past research has failed to show a significant relationship between the education level of parents and whether their child or children have anemia (Akramipour, Rezaei and Rahimi 2008). Again, researchers believe that cultural norms and mores have a stronger influence in the lives of people than their knowledge of the disease.

Health Related Issues in Kazakhstan

Since its independence in 1991, health indicators in Kazakhstan have fluctuated but indicate an overall worsening. Between 1991 and 2003, estimated life expectancy for men declined 3.3 years from 61.49 to 58.61 while projected infant mortality rates increased nearly 15% from 51.2 to 58.7 (Census 2003). Increases in suicide, accidental and trauma deaths along with rising cancer rates contribute to the health decline in Kazakhstan (Buckley 1998). Child health decreased substantially across the 1990s, with rising rates of birth abnormalities, declines in survival until age five, and increased morbidity due to infectious and parasitic diseases (WHO 1999). Adults and children suffered due to the inherited weaknesses of the Soviet-style health care program, a shortage of general practice medical personnel, and widespread funding difficulties in the area of public health (Klugman, Schieber and Heleniak 1996). Much of the health decline has been attributed to widespread poverty in the country. World Bank surveys indicated 30% of the urban and 39% of the rural population was in poverty in 1996 (UNESCAP 2003). Although Kazakhstan enjoys a higher standard of living and average income than other Central Asian states, persistent poverty and indicators of growing wealth inequity are cause for alarm.

Available evidence points to a wide and growing gap between urban and rural residents in Kazakhstan. As elsewhere in the Soviet Union, Kazakhstani villages received precious little infrastructure development before 1991 and displayed consistent health disadvantages throughout the mid-1990s (Buckley 1998). Rural areas experienced higher prevalence of unemployment, poverty, and low educational attainment. Health reform initiatives in the 1990s, seeking to “rationalize” health care provision by allotting it more efficiently throughout the country, closed many rural medical care centers, decreasing the already low access to health care and information for rural residents (McKee, Healy and Falkington 2002). The rural health disadvantage contributes to health differentials between the two largest ethnic groups in Kazakhstan, the Russians (who are concentrated in urban areas) and Kazakhs (who reside primarily in rural locales).

Child well-being generally, and susceptibility to anemia specifically, are known to vary by the health status of the mother and by health practices such as breastfeeding. Previous research has pointed to breastfeeding as an indirect indicator of commitment to intensive childcare, generating an additional benefit in addition to the documental nutritional advantages (Engle, Castle and Menon 1996). Poor maternal health, such as moderate or severe anemia, can indicate short birth intervals or reflect poor household diet. Investigations using DHS data from the mid-1990s indicate that maternal anemia status served as a power predictor of child anemia across Uzbekistan, the Kyrgyz Republic, and Kazakhstan. In Kazakhstan maternal anemia was also significantly predictive of low weight for age among children under three (Buckley 2003).

Reforms in Kazakhstan's Health Care Program

The provision of social services generally and of health care is particular changes dramatically during the 1990s in Kazakhstan, reflecting numerous national and international initiatives (Klugman, Schieber and Heleniak 1996; McKee, Healy and Falkington 2002). Maternal and child health emerged as a central policy concern in early 1990s, while the late 1990s witness concerted international efforts to curb childhood anemia across the Central Asia republics and Kazakhstan (often referred to as CARK) (Gleason and Sharmanov 2002).

In 1995 and 1996, agencies of the United Nations and non-governmental organizations funded through the United States Agency for International Development join efforts with the Kazakh government to address anemia and child nutrition in the CARK region. Initiatives include nutritional supplementation of wheat in the Kyrgyz Republic, iron and folate supplementation in southern regions of Kazakstan in 1997, expanded educational efforts targeted at mothers across the region in 1998, and the provision of supplement tablets in select oblasts (administrative districts) in 1999 (Gleason and Sharmanov 2002). Throughout the 1996-2006 period, the well-respected Kazakhstan Academy of Nutrition collected support from the Asian Development Bank, the World Bank, UNICEF and other organizations for a variety of projects to combat childhood anemia. Educated women, who are particularly receptive to mass media educational campaigns, benefit from the educational aspects of such international programs, which continue and expand throughout the 1999-2002 period (Rokx, Galloway and Brown 2002). In 2003, regional campaigns to increase anemia awareness preceded efforts at wheat flour fortification the following year to enhance iron intake (Baizhumanova et al. 2010). The success of this program prompted UNICEF to support a national roll out in 2011. Continued efforts to combat childhood anemia in the country are critical as the initial declines between 1996 and 1999 (from 69.5% to 36.3% for children under five), were erased by assessments in 2008 (47.7%) (Salkhanova 2010).

Social Change in Kazakhstan: Ethnic and Language Variations

A variety of external interventions have resulted in marked population shocks over the history of Kazakhstan, altering the ethnic and linguistic composition of the population. During the early 18th century, Tsarist decrees encouraged the settlement of Russian speaking Cossacks in the region. The emancipation of serfs in the following century generated a sizable inflow of freed Slav peasants, who were granted plots for cultivation. Stalinist collectivization processes were particularly brutal in Kazakhstan, leading to mass starvation and famine concentrated among rural ethnic Kazakhs. Soon after, forced deportations of

Germans, Chechens, Tatars and Koreans to Kazakhstan took place. During the Khurshchev period, the Virgin Lands campaign encouraged the large scale in-migration of ethnic Russians (and other Slavs) into the northern Kazakhstan steppe, taking the process of *Sovietization* to a massive scale. At the time of the last Soviet census, ethnic Kazakhs accounted for only 40% of the republic's total population, and Kazakh language use was relatively rare outside of rural regions. Russian was the language of mass media, higher education, government, and economic activity, and ethnic Russians enjoyed higher levels of education, urban residence, and professional status (Chinn and Kaiser 1996; Peyrouse 2007).

Soon after independence in 1991 a program of *Kazakhification* began, led by President Nazerbayev, an ethnic Kazakh. New regulations elevating Kazakh language as the state language, requiring public sector employees to demonstrate Kazakh language skills, and instituting proficiency tests for University graduates were adopted. Kazakh-language education rose from use in only 30.2% schools in 1988 to 56% by 2004 (Fierman 2006). While Russian maintained status as an official language, the growing political and economic control held by ethnic Kazakhs hindered opportunities for other ethnic groups such as Russian (Peyrouse 2007). Large scale out-migration of ethnic Russians peaked in the mid-1990s. By the time of the 1999 census, ethnic Kazakhs comprised 53.4% of the country's population, and among citizens between the ages of 25 and 29, ethnic Kazakhs were more likely to have a completed higher education than ethnic Russians in Kazakhstan (14.7% versus 13.9%) (SoK 2000).

Data & Methodology

Data for the present analyses are obtained from the Kazakhstan Demographic and Health Surveys (DHS) for the years 1995 and 1999. We plan to expand these analyses in two important directions for our final conference paper. First, we will include findings concerning child and maternal health from the Kazakh MICS III survey. While MICS does not include a full blood test and anemia assessment, several indicators of overall well-being, the presence of treated salt in the household, and anemia diagnosis will enable an extended longitudinal assessment. Secondly, we will further specify our outcome variables, shifting form the bivariate logistical regressions presented here, to a multinomial logistic model comparing mild and severe/moderate anemia, with those children not indicating anemia as the control group. Our preliminary analyses with this approach further specify the relative risks associated with language, ethnicity, rural residence, household wealth and education. As we are continuing to specify these models, we present out simplified bivariate results in this preliminary conference version.

The 1995 and 1999 Kazakh DHS data are comprised of a nationally representative probability sample of female residents of Kazakhstan between the ages of 15-49. In 1995, respondents were chosen from five sampling districts in Kazakhstan, each comprised of various numbers of mostly contiguous oblasts. The five resulting sampling districts represented the following geographic areas: Almaty City, South Region, West Region, Central Region, and North and East Region. Steps were taken to ensure that each district was equally represented in the sampling process, and that adequate numbers of respondents were selected from both rural and urban areas (with the exception of Almaty City, which is exclusively urban). In 1995 a total sample of 3,771 women, 3,658 were tested for anemia, along with 739 of their children age 36 months and younger. Testing was conducted in the field by drawing blood from a finger using a Tenderfeet lancet, and hemoglobin levels were then read less than a minute later from a battery operated portable photometer (Sharmanov, 1996: 136).

Certain methodological modifications were made to the Kazakhstan Demographic and Health Survey in 1999 (see Sherman et al., 1999: 152). Included among these modifications is the implementation of a sub-sample of the KDHS nationally representative sample obtained exclusively to test for the prevalence of anemia. This sub-sample is comprised of every second household used in the larger KDHS nationally representative sample. Secondly, the maximum age of children tested for anemia is increased from three years of age to five years. These two methodological alterations resulted in a smaller sample of 2,216 women aged 15-49 and 574 children aged 5 and under who were tested for anemia. In order to maintain analytical homogeneity, children over the age of 3 years are omitted from our analyses. This reduction, coupled with declining fertility in the period and incomplete interviews, reduced the sample of children in 1999 to 305.

We provide separate analyses for each DHS year, testing the estimated odds of child under the age 3 suffering from moderate or severe anemia, defined using the World Health Organization standard of 9.9 g/dl or less. A logistic regression procedure is used to determine the odds of a child respondent met this criterion (=1), in reference to child respondents possessing hemoglobin levels 10.0 g/dl or greater (=0).

Guided by the literature cited above, we employ three additive models, grouped in the following manner: socio-demographic covariates, indirect economic indicators, and the health status and practices of the mother. Socio-demographic variables include a control for those children tested between the ages of 12 and 24 months (=1) and those children between the ages of 24 and 36 months (=1), with children under one year of age as the reference category. To assess the importance of ethnicity and language, variables are created to capture the separate risks associated with being ethnic Kazakh and Russian speaking, as well as ethnic Kazakh and Kazakh speaking, we create separate variables for Kazakh women who communicated with their DHS interviewer in Kazak, or in Russian. We use "language of interview in Kazakh" as a means to more precisely measure the possible disadvantages faced by the titular ethnic group, and the extent to which language policies have diminished risks associated with the official state language (Kazakh).[i] We test the risk associated with rural residence to determine the extent to which measures designed to curb anemia in children are available to those living outside of urban areas. In addition, we measure any risk associated with being a female child. The final socio-demographic measure we include is a control for the presence of one or more children under age 5 in the home, to examine the potential health ramifications resulting from young children competing for household resources.

We include three additional indirect economic indicators in Model 2. The first of these is a control for respondents not married at the time of the interview. Second, we control for mother's age by creating a dummy control for those women over the age of 30 years, and a control for women with "higher" education. While these indicators rely on maternal status primarily, and are indirect in nature, precise income variables are unavailable in this data set for Kazakhstan.[ii]

Finally, to examine the effects of maternal health on moderate and severe anemia in young children, Model 3 introduces two measures. The first assesses the potentially protective effect of current breastfeeding. Secondly, we control for the presence of moderate and severe anemia in the mother. Women with hemoglobin levels of 9.9 g/dl or less were coded as 1, while those who had hemoglobin levels of 10 g/dl or greater are the reference group. These maternal health traits are likely to subject young children to additional health problems early in life, thereby increasing the risks of morbidity and mortality.

Descriptive statistics for the included covariates in the investigation are presented in Table One. The markedly lower sample size in 1999 do raise some concerns regarding the comparability of the models, but the prevalence rates of the covariates indicates an acceptable number of observations within each category. Generally, the distributions among the categories investigated here remain stable between 1995 and 1999, however the 1999 sample appears to be slightly more Russian speaking and urban. Additionally, breast feeding prevalence declines by 12%. Due to the small sub-sample we examine in these analyses, we have elected to not employ the overall study weights. The weights were intended to enhance the representative nature of the sample of women 15 to 49 in Kazakhstan, and may not assist in improving the representative characteristics of our sample of children less than three years of age. In the analyses, we will focus on the comparative patterns exhibited between the two time points within the observed samples.

Results

Results predicting the odds of moderate and severe anemia in children under the age of 3 are presented in Table 1. Consistent with previous literature, our comparison of socio-demographic correlates in Model One for both 1995 and 1999 indicates that children between the ages of 12 and 24 months are at significant risk for moderate or severe anemia. Relative to children under one year of age, one year olds faced 85% increased odds for moderate or severe anemia in 1995, and the relative risk increased significantly in 1999. While the smaller sample size in 1999 casts questions on the strength of the comparison, the finding indicates increasing risk concentration in this age group as overall rates decline. For children between 24 and 36 months (2 years of age), anemia risk relative to infants was not significant at high rates of prevalence (1995), but at low rates of prevalence (1999) 2 year olds faced 2.69 times higher risk for moderate or severe anemia compared to infants less than one year of age. In terms of ethnicity, Kazakh mothers faced significantly increased risks of having moderately or severely anemic children, regardless of language, with Russian speaking Kazakhs at a slightly elevated risk in 1995 but Kazakh speaking Kazakhs facing higher relative risk in 1999. Neither sex of the child or other children under the age of 5 in the household was significant as anemia risk factors, an issue we will explore further in the final version with more recent MICS III data.

Model 2 introduces three indirect economic indicators to the socio-demographic factors discussed above. Unwed mothers, those aged 30 years or older, and in women in possession of higher educational attainment were not more likely than the reference categories to have moderately or severely anemic children. The modest increase in the pseudo R^2 between Model 1 and Model 2 for both DHS years underscores the weak effect of these variables. The inclusion of indirect economic indicators does not considerably alter the significance patterns or coefficient size for variables relating to the age of child. Additionally in Model Two for both time periods, ethnic Kazakhs continued to face higher relative risk for moderate and sever anemia, with Russian speaking Kazakhs exhibiting slightly higher risk levels than Kazakh speaking Kazakhs, reversing the linguistic effect seen in Model 1 between 1995 and 1999.

In addition to the covariates examined in Models 1 and 2, Model 3 examines the effect of maternal health practices and status on estimating the odds of moderate or severe anemia in children less than 3 years. Our health practice measure is a dummy variable for those women currently breastfeeding, as several past studies note the positive health effect of breast-feeding for child health. We find no support in our models to suggest that breastfeeding influences the anemia risk for young children. Current anemia status of the mother however exerts a profound effect upon the anemia status of their young children, but this effect disappears between 1995 and 1999. In 1995, the odds of moderate or severe anemia in children of women with hemoglobin levels measured at 9.9 g/dl or less were 80% greater than children of non-anemic mothers. In 1999, mother's anemia was no longer a significant predictor. Socio-demographic variables continued to exert a significant effect for the full model in 1995 and 1999. With the inclusion of other risk factors, one year olds (12 to 24 months) continued to exhibit a markedly higher risk for severe to moderate anemia than infants. The extreme value of the odds ratio is linked to the small sample size for 1999, but the findings are consistent with those for the larger sample size in 1995.

Controlling for maternal health practices diminished the observed risk for 2 year olds, and ethnic Kazakhs continued to exhibit a significantly higher risk for childhood anemia in the full model in 1995 and 1999. In 1995 children of ethnic Kazakh mothers speaking Russian faced a 229% higher risk for severe or moderate anemia in reference to non-Kazakhs (primarily ethnic Russians), while children of Kazakh-speaking ethnic Kazakhs faced a 187% higher risk. In 1999, the risk for children of ethnic Kazakhs speaking Kazakh language increased. In 1999 children in this group faced a 314% higher risk of anemia in comparison to non-Kazakhs.

Surprisingly, these preliminary analyses indicate that the status of women is not a major determinant in predicting the health of their children. Neither maternal education nor maternal age was important mediating factors in determining the anemia status of young children. The inclusion of maternal health status and practices, in Model 3, is only significant in 1995, when children of anemic mothers were 80% more likely to be anemic in comparison to children of non-anemic mothers. At lower levels of prevalence (1999), maternal health and breastfeeding practices are not significant risk factors. In the final form of the paper, we will expand our investigation of health practices to include treating young children with tea, a culturally common practice among both ethnic Kazakhs and to a lesser extent, Russians. Tea is known to hinder iron absorption, and may provide a functional behavioral mechanism capable of clarifying the importance of ethnicity.

Table 1: Descriptive Statistics for Included Covariates, Kazakhstan DHS, 1995 and 1999

Covariates		**1995** (n = 739)			**1999** (n = 305)	
	Mean	**S.D.**	**Range**	**Mean**	**S.D.**	**Range**
Child 12-24 Months	.363	.481	0-1	.346	.476	0-1
Child 24-36 Months	.328	.470	0-1	.361	.481	0-1
Kazak Ethnicity/Language	.461	.499	0-1	.417	.493	0-1
Kazak Ethnicity/Russian Lang.	.206	.404	0-1	.263	.441	0-1
Rural Resident	.615	.487	0-1	.539	.499	0-1
Female Child	.512	.500	0-1	.498	.500	0-1
Other Child Under Age 5	.475	.500	0-1	.417	.493	0-1
Unmarried Repsondents	.083	.276	0-1	.095	.294	0-1
Respondents Over Age 30	.326	.469	0-1	.377	.485	0-1
Respondent w/ Higher Education	.171	.377	0-1	.175	.381	0-1
Rs Currently Breastfeeding	.468	.499	0-1	.343	.475	0-1
Mothers With Anemia	.155	.362	0-1	.125	.331	0-1

Table 2: Estimated Odds Ratios Predicting Moderate or Severe Anemia in Children Under Age 3 in Kazakhstan, 1995 and 1999

	1995	1999	1995	1999	1995	1999
Socio-Demographic Covariates:						
12-24 Months (=1)	1.85***	9.60***	1.86***	11.18***	1.98***	11.01***
24-36 Months (=1) (reference = less than one year)	1.04	3.69**	1.08	3.92**	1.17	3.73
Kazak Ethnicity/Language (=1)	3.04***	4.30***	3.21***	4.01***	2.87***	4.14***
Kazak Ethnicity/Russian Language (=1)	3.41***	4.04**	3.72***	4.41**	3.29***	4.02**
Rural Resident (=1)	1.53	1.96	1.42	1.96	1.40	1.83
Female Child (=1)	.69	.71	.71	.75	.70	.78
Other Child Under Age 5 (=1)	.86	.63	.84	.56	.81	.55
Indirect Economic Indicators:						
Respondent Not Married (=1)			1.15	.69	1.15	.67
Respondent Over Age 30 (=1)			.76	2.23	.75	2.27
Respondent has Higher Education (=1)			.66	.28	.68	.28
Maternal Health Practice/Status:						
Currently Breastfeeding (=1)					1.14	.92
Mother Anemic (=1)					1.80***	1.96
Sample Size:	739	305	739	305	739	305
Psuedo R2	.078	.180	.084	.217	.092	.225

***p less than/equal to .001
**p less than/equal to .01

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[i] Language of Interview us used to indicate language preference rather than the answer to the question “What is your mother tongue,” as the later question may be answered based on ethnic identity rather than linguistic facility.

[ii] Detailed income information is not gathered in the standard DHS protocol, and included measures, such as employment, are difficult to assess among the mothers of young children who are likely to be on child leave.