

WELFARE, MATERNAL EMPLOYMENT AND ON-TIME CHILD IMMUNIZATION RATES

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Final Report

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## I. Introduction

### A. Nature of the research problem

Under the old Healthy People 2010, the target for the proportion of young children who received all vaccines recommended for universal administration (4 diphtheria, tetanus, pertussis; 3 polio; 1 measles, mumps, rubella; 3 *haemophilus influenza* type b; 3 hepatitis B – 4:3:1:3:3) was 80%.<sup>1</sup> This target was achieved by 2008, but there still remain considerable differences in immunization rates among race/ethnicity and income groups. Children whose mothers were on welfare after the reform of 1996 and were required to work are a subgroup who might have substantial deficits in vaccination coverage. Despite concerns about how welfare reform would affect health of the low-income children in general and immunization rates in particular, how welfare reform and its work-related provisions affect child immunization rates has not been systematically examined.

### B. Purpose, scope, and methods of the investigation

The overall aim of this project was to utilize rich data from a longitudinal study of children's health and healthcare utilization to examine how maternal work and welfare status were associated with immunization status for low-income young children in Illinois whose families were in transition from welfare to work. The Illinois Family Study: Child Well Being (IFS-CWB) project collected detailed data on a representative sample of families on welfare in 1998 in Illinois, including children's health status and healthcare utilization for well-child as well as sick visits through four waves of annual surveys (2001 – 2004). Along with administrative data on welfare receipt status, data on detailed immunization records, maternal employment, Medicaid insurance coverage, family income, and living arrangements are available in this data set. This study had two objectives.

The first was to describe the effect of work and welfare status on child immunization rates by comparing immunization rates of children in families in transition from welfare to work with immunization rates of all US children from the National Immunization Survey. The main objective here is to compare immunization rates by mother's work and welfare status and with the national average.

The second objective was to examine factors associated with on-time immunization of children in families in transition from welfare to work. Specifically, we examined how welfare receipt status, Medicaid enrollment and/or disenrollment, maternal employment, and other access to care factors affected immunization rates. Three hypotheses were tested that included:

**Hypothesis 1:** Welfare receipt is associated with higher on-time immunization rates.

**Hypothesis 2:** Maternal work is associated with lower on-time immunization rates.

**Hypothesis 3:** Medicaid coverage is associated with higher on-time immunization rates.

### C. Nature of the findings

We found that the children in families that received welfare assistance had slightly lower rates of on-time immunization rates than children in Chicago public schools at 36 months (56% vs. 59%). Our data suggest that welfare receipt was associated with higher on-time immunizations but that maternal work was not, independently of each other. When children in our study cohort were further stratified by welfare receipt and maternal work statuses, maternal work was associated with significantly lower likelihood of on-time immunization when families

were receiving welfare but with a significantly higher likelihood when families were not receiving welfare.

## **II. Review of the Literature**

Immunization protects not only children but also their families and communities from outbreaks of serious diseases. Pockets of the population are still lagging behind in child immunization rates and pose threats to public health. Special outreach programs including the use of immunization registry,<sup>2</sup> door-to-door canvass of urban housing development neighborhoods,<sup>3</sup> and outreach initiatives of local governments<sup>4</sup> were all found effective in increasing immunization coverage for hard-to-reach subpopulations. But lack of health care workers and other barriers limit the effectiveness of these programs with the gaps in immunization coverage among racial/ethnic groups still persisting. The overall immunization rates, an aggregate statistic, appear to mask an even bigger problem: that is, delay in immunization. Dominguez et al.<sup>5</sup> recently showed “striking” delay in immunization; on-time immunization rates for Chicago public school children were 31% at 7 months of age, 32% at 19 months, and 59% at 36 months. Black children had the lowest on-time rates at all ages <4 years. By school entry, all race/ethnicity groups achieved 70% or higher completion rates, suggesting that the delay resulted in late “catch-up” vaccinations, most likely to meet immunization requirements for school entry, which in turn means unprotected time for the children and more provider errors in vaccine administration.<sup>5,6</sup> More recently, Luman et al. found that US children were undervaccinated a mean of 172 days for all vaccines in the first two years of life and that severe delay was significantly higher for black non-Hispanics and for children whose mothers did not finish high school.<sup>7</sup>

Welfare reform dramatically changed the way how medical care in general is accessed and utilized by children in low-income families. In 1996, the U.S. Congress enacted the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA), replacing the key U.S. social welfare entitlement program, Aid to Families with Dependent Children (AFDC), with a new program, Temporary Assistance for Needy Families (TANF). The changes included work requirements, cash assistance benefit reduction, and time limits for enrollment. Many of the mothers affected by TANF – popularly known as “welfare reform” – had young, preschool-aged children. While AFDC provided cash welfare assistance for mothers with young children in the household and did not permit receipt of additional income through employment, welfare reform required mothers of families receiving TANF to work or to participate in a job training program.

Welfare reform and its work requirements have profound and unanticipated effects on child health. Between 1996 and 1998, the number of families receiving TANF decreased by 28% nationally and 15% in Illinois, while over 6% of the families were disenrolled from Medicaid nationally and 11% in Illinois.<sup>8</sup> While the transition from welfare to work did not materially improve economic situations of these families, considerable number of families lost Medicaid when they left welfare. But only a small proportion of children from these families enrolled in the State Children’s Health Insurance Program (SCHIP).<sup>9,10</sup> As a result, a year or more after leaving welfare, 49% of women and 30% of children were uninsured.<sup>11</sup> Even though children in these families could obtain immunizations free of charge, other factors such as their mother’s lack of insurance coverage or the lack of usual source of care significantly affected immunization rates of these children.<sup>12</sup>

Along with the increase in the proportion of uninsured children, welfare reform's work requirement for TANF benefits made mothers often unable to take their children to health care facilities for needed medical care.<sup>10</sup>

In summary, welfare reform had affected a large number of families who were transitioning from welfare to work and, during this transition, children were often uninsured and undervaccinated. This transition is still occurring in poor families, especially in immigrant families and racial/ethnic minority families that traditionally constituted hard-to-reach pockets of the population for child immunization.

When welfare reform was first proposed and was publicly debated, many people anticipated that it would negatively affect children's health and that its effects would be most profound for poor immigrant families.<sup>13-15</sup> Regarding child immunization rates, the National Vaccine Advisory Committee within the Center for Disease Control and Prevention passed a resolution in 1995 that the Secretary of Health and Human Services "consider requesting all relevant federal agencies involved with welfare reform to monitor the possible impact of these reforms on the immunization status of children and adults, to coordinate planning and development of welfare reform activities with respect to this issue, and to provide joint guidance to appropriate State agencies on vaccine coverage for such welfare reform proposals." Despite these initial concerns, no study so far has systematically evaluated how welfare reform and its other provisions have affected child immunization rates. This study is the first to do so.

TANF has been recertified annually since 2002 and was finally approved until 2010 in 2006. TANF is coming up for recertification in 2010 and this study provides policy-makers with new information about factors that affect immunization rates among children in low-income families, including whether some policy options such as medical waivers for mothers of children with special needs, chronic conditions, disability, or other medical needs or altering maternal work requirements can help increase on-time immunization rates of these children.

### **III. Study Design and Methods**

#### **A. Study design**

This study is a retrospective cohort study using a cohort of children enrolled in the Illinois Family Study: Child Well-Being study.

#### **B. Population studied**

The study population includes all children in families that were enrolled in the TANF in the state of Illinois in September – November, 1998.

#### **C. Sample selection**

The IFS sample is a stratified, randomly selected sample of 1,899 TANF grantees from the Illinois TANF caseloads in the fall of 1998. Half of the sample members resided in Cook County (Chicago and suburbs) and the other half resided in one of eight "downstate" counties representing mid-size urban, small urban and rural areas. Sample members were randomly selected from within each regional stratum. Taken together, the counties targeted for the IFS represented approximately three-quarters of the state's TANF population in 1998. Comparisons between IFS study counties and non-included counties using U.S. Census data produced further evidence that the included county sites were representative of the state at large, in terms of its TANF population.<sup>16</sup> IFS sample members were interviewed annually beginning in late 1999/early 2000 and for three subsequent years (i.e., 2001, 2002, 2003). The initial response rate

for the IFS was 72%. This rate is comparable to the response rates of several other large-scale survey studies involving TANF or low-income populations.<sup>17</sup> Retention rates in the sample in subsequent years averaged 90%.

The **IFS-CWB sample** is a sub-sample of the IFS consisting of 583, of whom we actually interviewed 554 families. IFS respondents whose youngest child in the household was 3 years old or younger at the time of the respondent's Year 1 IFS interview. This sub-sample captured all IFS families with an infant or toddler as of the Year 2 IFS interview, and therefore represents a slightly younger population of TANF recipients with younger families.

Eighty-seven percent (513 participants) of the IFS-CWB sample consented to the review of their child's medical charts. Eighteen children had incomplete medical charts (3.5%) and were excluded from the study cohort. Children whose primary caregivers were not mothers ( $n = 10$ ), and for whom no vaccination records were available ( $n = 28$ ) were excluded. The final study cohort included 457 children.

## D. Instruments used

### D.1. Medical Records and Medicaid Claims Data

Detailed information about a child's medical care utilization during the past year was collected at each survey and used to contact providers to obtain all medical charts for the target child. The medical records for all hospitalization and outpatient visits were abstracted, using a standardized tool, into a computerized database that included information on all vaccinations. Completeness of each child's medical record was estimated. To supplement the medical record data, Medicaid enrollment and claims data for IFS-CWB children who had ever been enrolled in Medicaid between 1995 and 2006 were obtained from the Illinois Department of Human Services.

### D.2. Child-Vaccine Records and Timeliness of Vaccination

For each child, dates of all administered vaccines were abstracted from the medical records and from the Medicaid claims database. There were 18 recommended vaccines for the ages of the children included in the study, including three doses of hepatitis B (HepB), five doses of diphtheria/tetanus/pertussis or diphtheria/tetanus/acellular pertussis (DTaP), four doses of Haemophilus influenza type b (Hib), four doses of inactivated polio (PV), and two doses of measles/mumps/rubella (MMR).

Timeliness of administration for each vaccine dose was determined based on the *window* of time in the recommended schedule approved by the Advisory Committee on Immunization Practices (ACIP) and the American Academy of Pediatrics (AAP).<sup>18</sup> The minimum acceptable age for each vaccine in the guideline was used as the beginning date of the *window*.<sup>7,18</sup> The end date for a routine administration in the guideline was used as the end date of the *window*. The dates in months or years were converted to age in days using an algorithm that produced the widest possible *window*, in part to be consistent with previous research and, in part, to make the definition of on-time administration as lenient as possible.<sup>19</sup> Any vaccine dose administered during the *window* was defined as "on time." Table 1 shows the *window* for each vaccine dose used to determine ACIP/AAP guideline compliant administration of childhood vaccinations.

Doses recommended before implementation of TANF ( $n = 472$ ) and after the study period ( $n = 681$ ) were excluded. For the 3<sup>rd</sup> dose of Hib, the algorithm proposed in Luman et al. (2002)<sup>20</sup> was used to identify children who followed the 3-dose or 4-dose schedule. The 6-month dose for children following the 3-dose schedule was then excluded ( $n = 112$ ).

### D.3. Receipt of Welfare Cash Assistance and Maternal Employment

Maternal work status was obtained from the Illinois Department of Employment Security Unemployment Insurance database for 1995 – 2004. Enrollment and receipt of welfare cash assistance from AFDC and TANF was obtained from the Illinois Department of Human Services registries. For each window, the number of days that the family and child received welfare cash assistance and the number of days worked by the mother were determined. A child whose family received welfare for 50% or more days during a window was classified as receiving welfare cash assistance. Almost 90% of families classified as receiving cash assistance by this cutoff received assistance for 85% or more days during the recommended windows for all vaccine doses.

Likewise, a mother who worked 50% or more days during a window was classified as working.

### D.4. Covariates

Child and maternal characteristics were obtained from the first IFS survey. These included child sex, race/ethnicity, birth weight, mothers' age at child's birth and highest educational attainment, number of children born before the target child, and the county of residence (Cook versus Downstate). Downstate counties include cities of East St. Louis and Peoria, and rural counties surrounding Peoria.<sup>21</sup>

Child's usual place of care, marital status of mother, and family member available for child care were gathered from the most recent IFS-CWB survey to each vaccine window. Medicaid eligibility was determined from the Illinois Medicaid enrollment data. A child was considered eligible if he/she was Medicaid-enrolled or in a 90-day retroactive eligible period for at least 50% of the days during a recommended vaccine dose window.

The response to “usual place to go for routine care such as a physical exam, well-baby check, or shot or when he/she is sick” was used to determine the usual source of care. A child was considered to have another adult available for care when responses to “who provided the most child care for [the target child] when you were unable to be with him/her” included any of the following: other biological parent, step-parent or respondent’s spouse/partner, grandparent or great-grand parent, or other relative.

## E. Statistical techniques employed

The key outcome is on-time administration of each vaccine dose. A child-vaccine dataset was constructed that included up to 18 vaccines for each child. Covariates were observed at baseline and during each recommended vaccine dose window. Random-intercept logistic regression was used to adjust for autocorrelation between vaccine doses. Sampling weights were applied at the child level to adjust for oversampling in Downstate counties and non-response, and to derive estimates reflecting the welfare population in 1998 in Illinois from which the IFS sample was originally derived.<sup>22</sup>

Sensitivity analyses were conducted to examine how different cutoffs defining welfare receipt and maternal work statuses might have affected study results. Sensitivity analyses were also conducted using an alternative definition of the on-time window, based on ACIP recommended windows for “routine” administration.

To address the first objective, the comparison of the immunization rates between our study population and the national average based on the National Immunization Survey (NIS) was made by first obtaining immunization coverage rates for US children from the NIS for years 1999 – 2002, a period when most of the immunizations for the IFS-CWB children were recommended. The immunization coverage estimates reported from the NIS are rates of being

up-to-date with respect to the recommended number of doses of all recommended vaccines and were measured every year for those children aged between 19 - 35 months. From our sample data, we also selected those children whose birth dates match the birth date criteria used by NIS for each survey year and compared the UTD immunization rates. Descriptive data on immunization coverage rates are provided in Table 5.

#### IV. Detailed Findings

The study sample included 6,961 vaccine doses, after all exclusion criteria were applied for 457 children in the study cohort. Baseline child and maternal characteristics are reported in Table 2. The study cohort consisted of more girls than boys (55.9 versus 44.1%), was overwhelmingly non-Hispanic black (79.4%) and resided in Cook county (90.1%). Ten percent of the children were born to teen-aged mothers and 13% to mothers who were older than 35 years at the time of the child's birth. Twelve percent of the children were first born and 58% were born to families with  $\geq 2$  older siblings.

Table 2 also shows on-time vaccination rates for all 18 vaccine doses by child and maternal characteristics. After applying sampling and non-response weights, we found that 55.9% of all vaccine doses were administered on time. Unadjusted on-time rates were significantly different by mothers' educational attainment and the number of children born before the target child. Children of Hispanic ethnicity had the highest on-time rates (67%), followed by non-Hispanic black children (55%). Children of other race/ethnicity (53%) and non-Hispanic white children (52%) had on-time rates that were almost 15% lower than Hispanic children.

Table 3 shows data pertaining to the recommended vaccine dose windows. Sixty-eight percent of all doses were recommended during windows when families were receiving welfare and 62% of doses were recommended when mothers were not working. When welfare receipt and maternal work were combined, almost half of all recommended doses were during windows when families were receiving welfare and mothers not working. Fifty-two percent were recommended during windows when children were eligible for Medicaid. Slightly more than half of all vaccine doses were recommended during windows when mothers identified public health clinics as the usual place of care for their children. Unadjusted on-time rates were 5% higher if a family was receiving welfare than not (52.8% versus 57.4%) but there was no difference by maternal work status (55.6% versus 56.4%).

When controlling for baseline and time-varying covariates in multivariable analyses, children in families receiving welfare assistance were 42% more likely to receive vaccinations on time compared to children in families not receiving welfare ( $OR = 1.42$ ; 95% CI, 1.21 – 1.68), independent of maternal work. But maternal work was not significantly associated with on-time vaccination ( $OR = 0.97$ ; 95% CI, 0.81 – 1.15) after adjusting for welfare status and other covariates (data not shown).

When interaction terms between welfare and maternal work were included in the models, maternal work and on-time vaccination were significantly associated (Table 4). Each model was estimated twice with different omitted categories for the combined welfare and maternal work status ("No TANF-No Work" in the first model and "TANF-No Work" in the second). The first model shows that maternal work was associated with a 68% higher likelihood of on-time vaccination ( $OR = 1.68$ ; 95% CI, 1.27 – 2.22) among children in families not receiving welfare during the recommended windows, but was associated with a 27% lower likelihood ( $OR = 0.73$ ; 95% CI, 0.59 – 0.90) among children in families receiving welfare. Overall, children in families

in the “TANF-No Work” group had the highest and those in the “No TANF-No Work” group had the lowest odds of on-time administration.

Results from all vaccine doses recommended before 36 months and during the first year of life were consistent with those from the full sample (Table 4). Comparing across the three models, effects of maternal work during periods when families received welfare was stronger for vaccines recommended within one year of life ( $OR = 0.55$ ; 95% CI, 0.36 – 0.83) than for all vaccines combined ( $OR = 0.73$ ; 95% CI, 0.59 – 0.90).

Vaccination rates for the IFS-CWB children lagged behind the national average as well as the average for children in the city of Chicago, where most of welfare families in Illinois reside. Table 5 shows up-to-date (UTD) immunization rates for children in our study (displayed as ‘CWB’) are much lower than the national, state, and Chicago coverage rates. For example, the UTD rates for the overall 4:3:1:3:3 series for Chicago children were 66.4% in 1999, 60.6% in 2000, 65.1% in 2001 and 69.1% in 2002, while the rates of the same vaccination series for CWB children were 59.6%, 63.8%, 60.7% and 51.6% respectively in the corresponding years. Except for 2000 when the immunization rates for the 4:3:1:3:3 series from National Immunization Survey was unusually low compared to other years, the CWB children show significantly lower UTD immunization rates than the Chicago children. When the rates for each vaccine are analyzed separately, the differences are smaller for certain vaccines than others. In 1999, the UTD rates for Chicago children were 86.4% for one or more doses of measles-mumps-rubella vaccine, which is quite similar to 86.1% UTD rates for the CWB children. However, the UTD rates for three or more doses of Hepatitis B for the same year show almost 6% difference between the children in the city of Chicago and CWB study.

The findings show that there are significant deficits in immunization coverage for children in low-income families in Illinois in all vaccines both examined separately and combined.

## **V. Discussion and Interpretation of Findings**

This study shows that welfare receipt was associated with higher on-time vaccinations but that maternal work was not, independently of each other. When the two were interacted, maternal work was associated with significantly lower likelihood of on-time vaccination when families were receiving welfare but with a significantly higher likelihood when families were not receiving welfare.

This is the first study to identify unfavorable consequences of TANF implementation on childhood vaccination rates. The divergent nature of the association between maternal work and vaccination in relation to welfare receipt is a notable finding. A review of 15 prior studies on maternal employment and childhood vaccination in OECD countries concluded that maternal employment was not associated with children’s vaccination rates.<sup>23</sup> Two recent studies examining US data on children in low-income families suggest that maternal employment may have negative effects on children’s health. Using the IFS-CWB data, Slack et al.<sup>24</sup> showed that proxy-reported health status for children of mothers who did not receive welfare was better if their mothers did not work than if they did. Gennetian et al. examined children’s health status from a survey of welfare-to-work program participants in three cities across the US and reported that maternal employment was modestly associated with lower child health status.<sup>25</sup> Both studies showed negative effects of maternal work on children’s health status. In contrast, our study found a positive association of maternal work and on-time vaccination when mothers no longer

received welfare (not consistent with either) but a negative association when mothers were still receiving welfare (consistent with Gennetian et al.).

One explanation for the negative effect of maternal work in families receiving welfare may be related to the nature of low income mothers' work. There is evidence that many of these mothers had hourly wage work, were not paid for time off for child health visits, and lacked flexibility in their work schedule.<sup>8,10,25-28</sup> We posit that such work conditions may have limited mothers' willingness to take time off from work for recommended well-child care health visits and timely vaccinations.

Of particular concern are the significantly lower rates of on-time vaccinations when families were no longer receiving welfare and the mothers were not working ("No TANF-No Work"). A previous study suggests that most unemployed mothers still needed welfare assistance when they were forced off welfare either due to time limits or sanctions.<sup>27</sup> These families experienced substantially decreased economic status,<sup>29</sup> greater food insecurity,<sup>30-32</sup> and higher odds of being hospitalized.<sup>30</sup> Even though TANF enrollment was not required for Medicaid eligibility, most of these mothers were not covered by Medicaid<sup>21,22</sup> and had reduced access to healthcare for their children.<sup>13-15</sup> More importantly, mothers who did not receive welfare were more likely than those receiving welfare to have health conditions that prevented them from working<sup>25,27</sup> which may have also contributed to fewer healthcare visits for their children and lower vaccination rates.

### **A. Conclusions to be drawn from findings**

Our results show that welfare receipt overall was associated with increased on-time vaccination but maternal employment among welfare recipients was associated with decreased on-time vaccination. This study provides highly relevant information about a subpopulation of children at significant risk for delayed vaccinations. These are children affected by TANF policies. The three policy changes we recommended will contribute significantly to reaching the Healthy People 2020 childhood vaccination goal.

### **B. Explanation of study limitations**

This study has several limitations. First, proximate linking was used to merge survey data with child-vaccine records. The first IFS and IFS-CWB surveys were conducted in 1999 and 2000, respectively, and survey data may lag by up to two years for vaccine doses recommended in 1997. Second, arbitrary cutoffs were used to classify a family as receiving welfare or a mother as working (50% for both). Sensitivity analyses using 40% and 60% cutoffs showed no significant change in results (available on request). Third, very conservative windows for defining on-time vaccination were used. A sensitivity analysis based on windows for "routine" administration was also consistent with the results.

### **C. Comparison with findings of other studies**

This is the first study to examine the role of welfare receipt and maternal work on childhood vaccination rates. A previous study by Dominguez et al.<sup>5</sup> reported a 59% on-time vaccination rate for Chicago public school children at 36 months of age. In comparison, this study shows that only 56% of all vaccine doses (with three doses being recommended between

ages 4 and 6 years) were administered on time. Despite differences between the studies in vaccine doses examined and in the methods used to identify vaccination timeliness, the Dominguez et al. study provides a point of reference in interpreting these data. IFS-CWB children had about a 3% lower on-time rate than Chicago public school children who achieved 87% up-to-date rates by school entry for all vaccines required under Illinois law.

#### **D. Possible application of findings to actual MCH health care delivery situations**

This study has several policy implications. Our results suggest that providing welfare cash assistance for children in low-income families can increase on-time vaccination rates overall by 43%. For mothers receiving welfare, an additional 30% increase in on-time vaccination rates might be achievable by waiving work requirements. Illinois currently does not require mothers with children in their first year of life to work for welfare eligibility, but welfare receipt during that time is still counted toward TANF time limit (5 years). Since most of the recommended vaccine doses are concentrated during the first year of life, excluding children's first year of life from the TANF time limit for their families can further improve timely vaccination rates.

Additionally, children in families that are no longer receiving welfare and whose mothers are not working are especially vulnerable for missing timely vaccinations. Targeted interventions for this group of children may include the use of an immunization registry,<sup>2</sup> door-to-door canvassing of urban housing development neighborhoods,<sup>3</sup> and outreach initiatives of local governments.<sup>4</sup> As part of these outreach programs, a concerted effort by state agencies responsible for welfare, unemployment, and health may be necessary to identify these children.

Future TANF legislation should therefore consider mandating that states (1) exclude the one-year work exemption period from the welfare receipt time limit; (2) create a carve-out rule for families no longer receiving welfare and with mothers who are not working, permitting them to be TANF-eligible at least for the first 12 months of their child's life; and (3) intervene with families at the time of removal from welfare when mothers are not working to assure that the child is connected with appropriate vaccination outreach programs. Such targeted TANF policies may be a cost-effective way of improving on-time vaccination rates for all US children.

#### **E. Policy Implications**

Relevant policy implications are included in the previous section (Section D).

#### **F. Suggestions for further research**

First, our study is focused on the specific population in Illinois and its results showed how the effects of maternal work on immunization rates vary by the welfare receipt status in Illinois. Similar data from states other than Illinois may be needed to better understand whether and how different states implemented TANF's maternal work provision and its sanctions and how they affect childhood immunization rates for the children in low-income families. This is important, because there are differences in how TANF policies have been implemented between states.

Secondly, we have found that the UTD immunization rates of our study population are much lower than the national and state level immunization coverage rates. To better understand

the implication of the lower immunization rates of our study population, we should use the national and state level the immunization rates that are stratified by income level and welfare receipt status, and then compare the rates. The comparison will provide more useful information about our study population and the impact of welfare policy change on childhood health care.

## **VI. List of products**

No published papers yet.

Two manuscripts were written. One (Vaccination) was submitted to a peer-reviewed journal for consideration of publication. The other one (Well-Child Care) will be submitted shortly.

Sohn MW, Yoo J, Oh EH, Amsden LB, Holl JL. Welfare, Maternal Work, And On-Time Childhood Vaccination Rates.

Holl JL, Oh EH, Yoo J, Amsden LB, Sohn MW. Well-Child Care Utilization for Low-Income Children on Welfare.

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## Appendix

Table 1: ACIP/AAP recommended windows for childhood vaccinations and age in days used to determine timeliness of vaccine administration

Vaccine Doses	Recommended Age for Routine Administration	Minimum Acceptable Age <sup>*</sup>	Age When Delay Count Initiated, days <sup>†</sup>	Age in days used to determine on-time vaccination <sup>‡</sup>	
				From	To
HepB1	0 - 2 months	0	93	0	92
HepB2	1 - 2 months	4 weeks	154	28	153
HepB3	6 - 18 months	24 weeks	580	42	579
DTaP1	2 months	6 weeks	93	42	92
DTaP2	4 months	10 weeks	154	70	153
DTaP3	6 months	14 weeks	215	98	214
DTaP4	15 - 18 months	12 months	580	364	579
DTaP5	4.6 years	4 years	2191	1461	2190
HIB1	2 months	6 weeks	93	42	92
HIB2	4 months	10 weeks	154	70	153
HIB3	6 months	14 weeks	215	98	214
HIB4	12 - 15 months	12 months	489	364	487
PV1	2 months	6 weeks	93	42	92
PV2	4 months	10 weeks	154	70	153
PV3	6 - 18 months	14 weeks	580	98	579
PV4	4 - 6 years	4 years	2191	1461	2190
MMR1	12 - 15 months	12 months	489	364	487
MMR2	4 - 6 years	13 months	2191	395	2190

\* From Table 1 in Center for Disease Control and Prevention (2006).<sup>18</sup>

† From Table 1 in Luman et al. (2005).<sup>7</sup>

‡ For each dose, “from” days were minimum acceptable age in days and “to” days were age in days when delay count initiated minus 1.

Table 2: Child and maternal characteristics of the study sample and on-time vaccination rates  
(Sample N = 457)\*

Characteristics	Weighted percent	Weighted on-time rate
All children	100.0%	55.9%
Child's sex		
Boy	44.1%	57.7%
Girl	55.9%	54.6%
Race/ethnicity		
NH Black	79.4%	54.7%
Hispanic	11.5%	66.8%
NH White	6.9%	52.3%
Other	2.2%	53.0%
Child's Birthweight		
<2,500 g	14.9%	56.0%
≥ 2,500 g	85.1%	55.6%
Mother's Age at Child's Birth <sup>†</sup>		
< 20 years	10.0%	54.1%
20 - 35 years	80.3%	57.8%
> 35 years	9.7%	42.1%
Mother's education <sup>†</sup>		
< High School	40.8%	51.0%
High School or GED Completed	41.4%	60.9%
Some college or higher	17.8%	54.6%
County of residence		
Cook	90.0%	55.7%
Downstate	10.0%	57.8%
Children born before target child		
0	12.1%	64.3%
1	29.8%	59.3%
2 or more	58.1%	52.3%

\* NH = Non-Hispanic; GED = Graduate Equivalency Diploma.

<sup>†</sup> A weighted Pearson chi-square test of independence between the characteristic and average on-time vaccination rates significant at p < 0.05.

Table 3: Child-Vaccine Level Characteristics during the Recommended Vaccination Window  
(Sample N = 6,929)\*

Child-Vaccine Characteristics	Weighted percent	Weighted on-time rate
All vaccine doses	100.0%	55.9%
TANF Receipt Status		
No TANF	32.2%	52.8%
TANF	67.8%	57.4%
Mother's Work Status		
No Work	62.0%	55.6%
Work	38.0%	56.4%
TANF and Mother's Work Status <sup>†</sup>		
No TANF & No Work	15.1%	44.6%
No TANF & Work	17.2%	60.0%
TANF & No Work	47.0%	59.1%
TANF & Work	20.8%	53.5%
Medicaid Coverage <sup>†</sup>		
Not covered	48.5%	53.6%
Covered	51.5%	58.1%
Usual Place of Care		
Hospital-based Clinic	31.6%	56.7%
Physician's Office	15.2%	61.0%
Public Health Clinic	50.6%	54.5%
No Usual Place or Unknown	2.6%	44.4%
Marital Status of Mother		
Not Married	85.5%	55.6%
Married	14.5%	57.6%
Family Member Available for Child Care <sup>†</sup>		
No	25.5%	50.0%
Yes	74.6%	58.3%

\* TANF = Temporary Assistance for Needy Families; ER = emergency room.

<sup>†</sup> A weighted Pearson chi-square test of independence between the characteristic and average on-time vaccination rates significant at p < 0.05.

Table 4: Adjusted Odds Ratios for TANF and maternal employment and their 95% confidence intervals

Models	Odds Ratio (95% Confidence Interval)*			
	NO TANF		TANF	
	No Work	Work	No Work	Work
All Vaccines (N = 6,961)	Ref.	1.68 (1.27 - 2.22)	2.12 (1.69 - 2.66)	1.55 (1.18 - 2.02)
	0.47 (0.38 - 0.59)	0.79 (0.63 - 0.99)	Ref.	0.73 (0.59 - 0.90)
Vaccines recommended within one year (N = 4,073)	Ref.	1.41 (0.72 - 2.75)	4.02 (2.34 - 6.90)	2.20 (1.21 - 3.99)
	0.25 (0.15 - 0.43)	0.35 (0.20 - 0.62)	Ref.	0.55 (0.36 - 0.83)
All vaccines recommended before age 36 months (N = 5,959)	Ref.	1.32 (0.92 - 1.90)	2.43 (1.81 - 3.25)	1.66 (1.18 - 2.33)
	0.41 (0.31 - 0.55)	0.55 (0.41 - 0.73)	Ref.	0.68 (0.54 - 0.87)

\* TANF = Temporary Assistance for Needy Families. Each row represents adjusted odds ratios from the same model estimated twice with the omitted category being the “NO TANF and No Work” group in the first and the “TANF and No Work” group in the second. The models were adjusted for child’s sex, child’s race, child’s Medicaid enrollment status during the window, birth order, birth weight, maternal age at child’s birth, maternal education at the first IFS survey, marital status of the mother, availability of a family member (parent, grandparent, sibling, or relative) at home for child care, county of residence (Cook vs. Downstate), and usual place of care (hospital-based clinic, physician’s office, public health clinic, and not available).

Table 5. Comparison of vaccination coverage between NIS and CWB children (Children 19-35 months of age)\*

		3+DTP <sup>†</sup>	4+DTP <sup>‡</sup>	3+Polio <sup>§</sup>	1+MMR <sup>  </sup>	3+Hib <sup>¶</sup>	3+HepB <sup>**</sup>	4:3:1:3 <sup>   </sup>	4:3:1:3: <sup>¶¶</sup>
1999	US National (N=22,521)	95.9±0.4***	83.3±0.8	89.6±0.6	91.5±0.6	93.5±0.5	88.1±0.7	78.4±0.9	73.2±0.9
	Illinois (N=564)	95.8±2.0	82.0±3.9	87.9±3.5	91.4±2.8	94.2±2.4	87.6±3.4	77.4±4.2	72.0±4.5
	IL-City of Chicago (N=290)	92.0±4.1	77.1±5.9	87.1±4.7	86.4±5.1	90.8±4.1	85.2±5.0	71.4±6.2	66.4±6.5
	IL-Rest of State	97.4±2.2	84.0±5.0	88.2±4.4	93.4±3.3	95.5±3.0	88.6±4.4	79.8±5.4	74.2±5.8
	CWB (N= 166)	90.96	72.29	83.13	86.14	80.72	78.92	65.06	59.64
2000	US National (N=22,958)	94.1±0.5***	81.7±0.8	89.5±0.6	90.5±0.6	93.4±0.5	90.3±0.6	76.2±0.9	72.8±0.9
	Illinois (N=615)	95.1±1.9	80.8±4.2	88.5±3.1	91.5±2.7	94.0±2.3	88.6±3.1	75.4±4.5	71.2±4.7
	IL-City of Chicago (N=311)	91.7±3.7	73.7±5.9	82.8±5.5	87.2±4.6	90.4±3.9	82.8±5.5	65.1±6.4	60.7±6.4
	IL-Rest of State	96.4±2.2	83.5±5.4	90.8±3.8	93.2±3.3	95.4±2.8	90.9±3.8	79.4±5.8	75.3±6.1
	CWB (N= 221)	90.5	75.57	81	86.43	83.71	81.45	67.87	63.8
2001	US National (N=23,531)	94.3±0.5***	82.1±0.8	89.4±0.7	91.4±0.6	93.0±0.6	88.9±0.7	77.2±0.9	73.7±0.9
	Illinois (N=602)	92.5±2.9	81.2±3.8	85.5±3.6	89.0±3.1	91.9±2.8	88.1±3.1	75.6±4.1	72.7±4.2
	IL-City of Chicago (N=299)	94.1±2.8	76.6±5.6	86.9±4.4	87.4±4.4	88.5±4.2	86.8±4.0	69.0±6.0	65.1±6.2
	IL-Rest of State	91.9±3.8	82.9±4.8	84.9±4.6	89.7±3.9	93.2±3.5	88.5±4.0	78.1±5.2	75.6±5.3
	CWB (N= 239)	87.87	71.13	77.14	84.52	83.26	77.82	64.44	60.67
2002	US National (N=21,410)	94.9±0.6	81.6±0.9	90.2±0.7	91.6±0.7	93.1±0.6	89.9±0.7	77.5±1.0	74.8±1.0
	Illinois (N=562)	96.9±1.6	84.4±4.0	91.8±2.7	94.4±2.2	95.8±1.8	92.5±2.7	79.6±4.3	78.6±4.3
	IL-City of Chicago (N=280)	95.0±3.5	76.8±7.3	85.2±6.8	90.8±4.5	94.4±3.7	86.0±6.8	71.5±7.4	69.1±7.5
	IL-Rest of State	97.6±1.8	87.3±4.7	94.3±2.6	95.8±2.4	96.4±2.1	94.9±2.5	82.6±5.1	82.1±5.2
	CWB (N= 215)	86.05	64.19	74.42	80.47	81.4	73.02	57.67	51.63
All Years	CWB (N=455)	88.57	69.89	78.9	83.74	81.98	77.36	63.08	57.8

\* The immunization coverage estimates reported from the NIS are rates of being up-to-date with respect to the recommended number of doses of all recommended vaccines and were measured every year for those children aged between 19 - 35 months. From our sample data, we also selected those children whose birth dates match the birth date criteria used by NIS for each survey year and compared the UTD immunization rates.

† Three or more doses of any diphtheria and tetanus toxoids and pertussis vaccines including diphtheria and tetanus toxoids, and any acellular pertussis vaccine (DTP/DTaP/DT)

‡ Four or more doses of any diphtheria and tetanus toxoids and pertussis vaccines including diphtheria and tetanus toxoids, and any acellular pertussis vaccine (DTP/DTaP/DT)

§ Three or more doses of any poliovirus vaccine

|| One or more doses of measles-mumps-rubella vaccine; previous reports of vaccination coverage were for measles-containing vaccine (MCV)

¶ Three or more doses of *Haemophilus influenzae* type b (Hib) vaccine

\*\* Three or more doses of hepatitis B vaccine

||| Four or more doses of DTP, three or more doses of poliovirus vaccine, one or more doses of any MCV, and three or more doses of Hib

¶¶ Four or more doses of DTP, three or more doses of poliovirus vaccine, one or more doses of any MCV, three or more doses of Hib, and three or more doses of HepB