

**Table 7: Survival Rates over Time for Aim 2 Adjusted Model**

Variable	6 Months		12 Months		18 Months	
	%	95% CI	%	95% CI	%	95% CI
<b>Reference baseline</b> <sup>a</sup>	86.5	80.5-93.0	69.1	59.0-81.0	52.4	40.2-68.4
<b>Depo injections over time</b>	97.7	96.0-99.4	94.3	90.4-98.3	90.2	83.8-97.0
<b>Maintenance method</b>	91.4	86.5-96.7	79.6	70.0-90.4	67.1	54.0-83.4
<b>Barrier method</b>	77.1	64.7-92.1	51.5	34.0-78.0	31.4	15.5-63.7
<b>LARC method</b>	84.9	71.8-100	65.8	43.5-99.7	48.2	23.5-98.9
<b>Unplanned index pregnancy</b>	92.6	89.7-95.5	82.1	77.1-87.4	70.8	70.2-82.4
<b>Physical abuse during pregnancy</b> <sup>b</sup>						
<b>Postpartum depression score</b>						
<b>0</b>	60.5	33.6-100	27.7	6.3-100	10.6	0.8-100
<b>6</b> <sup>c</sup>	82.0	74.1-90.6	60.1	48.1-75.3	41.2	28.2-60.1
<b>Age at entry</b> <sup>d</sup>						
<b>14</b>	80.8	71.4-91.4	58.0	43.7-77.1	38.6	23.7-62.9
<b>18</b>	84.2	77.1-91.9	64.4	53.0-78.3	46.4	33.3-64.5
<b>25</b>	88.8	83.4-94.6	73.9	64.0-85.2	58.9	46.4-74.8
<b>30</b>	91.3	86.1-96.9	79.3	69.0-91.1	66.7	52.6-84.4

<sup>a</sup> All dichotomous variables set to 0, all continuous variables set to their mean (postpartum depression score = 1.77, age = 21.9).

<sup>b</sup> Measured at the given levels of postpartum depression score

<sup>c</sup> 90% quantile in the final sample

<sup>d</sup> Values chosen arbitrarily

## Discussion and Conclusion

### 6.1 Depo Injection at Discharge and Depo Injections over Time

When receiving Depo injections over time, 90.2% (98% *CI*: 83.8-97.0) of clients had not conceived again at 18 months. For Aim 2, the most protective factor was continuing the Depo injections over time. Disregarding the time-varying effects of receiving a Depo injection at discharge, about 76.3% (95% *CI*: 66.7-87.4) of clients who received the Depo injection at discharge had not conceived again by 18 months. For Aim 1, adjusting for the time-varying effect of Depo injection at discharge indicated that the Depo injection at discharge had an increasingly protective effect across time. This does not reflect a time-varying effect of Depo at

discharge itself, which is biologically effective for three months. Instead, it may suggest a relationship between receiving the Depo injection at discharge and the continued use of the Depo injection or other highly effective contraceptive methods over time, which is the focus of the Aim 2 analysis. The drastically large HR at time zero occurs from the logarithmic transformation of time for the interaction. The large HR in the earlier months, therefore, may reflect the client's behavior with contraception soon after she received the Depo injection at discharge. The time-varying effect suggests that, for the first nine months, a client who received the Depo injection at discharge may not have kept immediate and consistent use of a contraceptive method after her Depo injection expired, hence experiencing a RRP. On the other hand, clients who retained a contraceptive method beyond nine months after receiving the Depo injection at discharge likely experienced a longer IPI or no RRP at all. Aim 2 showed that sustained use of the Depo injection is protective against RRP. Fitting Depo injection at discharge into Model 2 showed that it may not affect overall Depo use, but that it may matter indirectly, signifying that continued use of contraception method is an important outcome for future research. The hypothesis that receiving the Depo injection at discharge provides a protective factor against short IPIs holds true, but the results suggest underlying behavioral factors in clients who experience an IPI of less than nine months for which the hypothesis is rejected. The second hypothesis that receiving the Depo injection over time holds true, as would be expected for a client who consistently adheres to the proper usage.

## **6.2 Long-Acting Reversible Contraceptives**

In the Aim 2 analysis, LARC had the largest effect, although it was not statistically significant. The time-varying effect of LARC becomes less and less negative, likely reflecting that as long as the client is on a LARC, they are protected. Biologically, being on a LARC

renders the chance of conception to be essentially zero, unless the LARC is removed and discontinued. Thus, the increasing hazard ratio over time must reflect the client's use of the LARC. The standard error for the effect of LARC is large, which is likely due to the low rate of use in the sample and the resulting sampling error.

### **6.3 Maintenance and Barrier Contraceptive Methods**

Maintenance methods of contraception, such as the OCP, the ring, and the patch, have a small and marginally significant protective factor against RRP. This relationship is much more likely to reflect the client's adherence to the contraceptive method, rather than the effectiveness of the contraceptive methods, themselves. Templemen et al. (2000), likewise, found that the OCP had a significantly lower retention rate and had a significantly greater effect on the chances on RRP than did the Depo injection. Barrier methods of contraception, such as condoms, spermicide, and female condoms, have a small and marginally significant hazardous effect on RRP. This may reflect inconsistency in using condoms during sex or condom breakage.

### **6.4 Psychosocial Factors of RRP**

For Aim 1, the most protective factor from a shorter IPI was found to be a client's unplanned index pregnancy. In both analyses, unplanned index pregnancies predicted a lower hazard rate than pregnancies that were planned. This is in contrast to another study that did not consider postpartum contraceptives, but found that previously unintended pregnancies were highly predictive of a RRP (Gemmill & Lindberg, 2013). It suggests that the clients in this sample who did not plan to get pregnant were more careful to prevent another pregnancy that they likely could not afford.

Physical abuse during and postpartum depression both have a hazardous effect on RRP in the Aim 1 analysis. Interestingly, but not surprisingly, the two variables interacted with each other in the Aim 2 analysis. These findings agree with Patchen et al. (2009) that women with trauma and mental health issues are at higher risk of RRP. The perinatal woman's relationship with the father or a male strongly affects her psychosocial health. Both financial and emotional support are crucial for the mother and the child; lack thereof creates a multitude of challenges for the mother; and, on the other end of the spectrum, abuse is obviously detrimental to the mother's health.

### **6.5 Age as a Predictor of Rapid Repeat Pregnancy**

In contrast with other research findings, the age of the client at her index pregnancy did not have a statistically significant effect on time to RRP in the Aim 1 analysis. The effect itself, although increasingly protective with older clients, was miniscule. Only when adjusting for the time-varying contraceptive method use as well as the interaction of LARC with time did the protective effect of age become statistically significant, but it was still very small in magnitude. This may be due to the age distribution of the final sample, which consists mostly of younger clients (< 23 years old). The restriction of the age range likely prevented the model from detecting the effect that exists in other research.

### **6.6 Conclusion**

As described in the LCHS program strategy, the federal Healthy Start program sets a benchmark goal that, out of the clients who have a repeat pregnancy while enrolled, 70% have an IPI longer than 18 months. Five clients were censored at 24 months, meaning that they experienced a repeat pregnancy, but it was not a RRP as defined for the study. Out of the 107 total repeat pregnancies in the final sample, 21 (19.63%) did not conceive again within 18

months. Out of the total study population that experienced a repeat pregnancy ( $n = 145$ ), including clients who were excluded due to missing covariates, 24 (16.55%) did not conceive again within 18 months. Clearly, far too many women are experiencing repeat pregnancies too soon in their postpartum period, even with increased effort to distribute more postpartum contraception.

The current study has important limitations. It excluded all observations with missing covariates. Several of the t-tests and chi-square tests of association between the excluded sample and the included sample were significant, indicating that the missing observations were not missing completely at random. The final sample included a greater proportion of clients who received postpartum contraceptive methods and used them over a longer period of time. These clients had a more complete assessment, at least with the chosen covariates, and may have had more comprehensive case management and access to contraception. The rate of RRP in the final sample, however, was significantly higher than the rate of RRP in the excluded clients. Nonetheless, the mean IPI of the excluded clients was about two months shorter than that of the final sample. Since the vast majority of clients were censored prior to 24 months postpartum, this may suggest that more clients who had missing covariates dropped services with LCHS before the program could record a RRP for the client. These differences between the final sample and the excluded sample elucidate a strong likelihood of bias in the effect of postpartum contraception that may not be generalizable to the study population. Finally, in calculating the survival rates over time for each covariate, we were not able to capture any interactions with time, as the Cox model cannot estimate survival in the future. Thus, the effects of receiving the Depo injection at discharge in Aim 1 and the effect of receiving a LARC in Aim 2 were not

accurately captured for all lengths of time (6, 12 and 18 months), but rather each variable was assumed (incorrectly) to have proportional hazards in their respective adjusted models.

Critical questions emerged during the analysis that requires future research. Next steps include testing Depo at discharge and other baseline risk factors on predicting continued use or ever-use of the different contraceptive methods to determine that aspect of postpartum contraceptive use, since the issue is in the client's adherence instead of the biological mechanism of the contraceptives. As noted in the literature review, adolescents who received a comprehensive counseling service were less likely to experience an RRP (Barnet et al., 2009; Patchen et al., 2013). LCHS also tracks each counseling and educational service that a client attends. Future research should also take into account the effectiveness of attending the services that are related to family planning and contraceptive use on time to RRP.

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