Neonatal Outcomes of Very Preterm or Very Low Birth Weight Triplets

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OBJECTIVES: To compare the neonatal outcomes of very preterm triplets with those of matched singletons using a large international cohort.

METHODS: A retrospective matched-cohort study of preterm triplets and singletons born between 2007 and 2013 in the International Network for Evaluation of Outcomes in neonates database countries and matched by gestational age, sex, and country of birth was conducted. The primary outcome was a composite of mortality or severe neonatal morbidity (severe neurologic injury, treated retinopathy of prematurity, and bronchopulmonary dysplasia). Unadjusted and adjusted odds ratios with 95% confidence intervals (CIs) were calculated for model 1 (maternal hypertension and birth weight z score) and model 2 (variables in model 1, antenatal steroids, and mode of birth). Models were fitted with generalizing estimating equations and random effects modeling to account for clustering.

RESULTS: A total of 6079 triplets of 24 to 32 weeks’ gestation or 500 to 1499 g birth weight and 18232 matched singletons were included. There was no difference in the primary outcome between triplets and singletons (23.4% vs 24.0%, adjusted odds ratio: 0.91, 95% CI: 0.83–1.01 for model 1 and 1.00, 95% CI: 0.90–1.11 for model 2). Rates of severe neonatal morbidities did not differ significantly between triplets and singletons. The results were also similar for a subsample of the cohort (1648 triplets and 4944 matched singletons) born at 24 to 28 weeks’ gestation.

CONCLUSIONS: No significant differences were identified in mortality or major neonatal morbidities between triplets who were very low birth weight or very preterm and matched singletons.

WHAT'S KNOWN ON THIS SUBJECT: Multiple-gestation pregnancies are associated with preterm birth and very preterm birth. Neonatal outcomes of triplets have been reported to be similar to singletons or worse than singletons.

WHAT THIS STUDY ADDS: In a large multinational study, we identified that triplets who were very low birth weight or very preterm had similar mortality and morbidity when compared with gestational-age and sex-matched singletons.
For a number of years, the prevalence of triplet pregnancies increased, possibly because of an increase in the use of treatments to induce multiple ovulation and other assisted reproductive techniques.1–3 However, in recent years, the number of triplet pregnancies steadily decreased in many high-income countries because of the adoption of single-embryo transfer4–5 or potential implantation of 1 or 2 fertilized embryos. Multiple-gestation pregnancies are associated with preterm birth.6,7 More than 90% of multiples are born preterm compared with 6% to 10% of singletons,8,9 and very preterm birth is especially high for pregnancies with triplets and higher-order multiples when compared with singleton pregnancies.9 In turn, preterm birth is associated with complications that have individual, family, societal, and financial implications.10,11

In previous work, researchers evaluated outcomes of triplets6,12–15 and reported higher risks of mortality,2 respiratory distress syndrome,3,7,8,12 retinopathy of prematurity (ROP),3,16 and intraventricular hemorrhage (IVH)3 in triplets who were very preterm than in singletons. However, authors of other studies reported no difference in outcomes between triplets and singletons.17 A majority of the previous studies are old and only included small sample sizes of triplets who were very or extremely preterm born before modern neonatology was introduced. In addition, most were single-center or regional studies lacking population-based data, and some were not able to adjust for potential confounders.17 In 1 contemporary and large network-based multicenter study from Europe, researchers reported preterm and survival rates for multiples but did not selectively address the outcomes for triplets.2

The International Network for Evaluation of Outcomes (iNEO) in neonates is a multicountry collaboration with the goals of evaluating variations in outcomes of neonates who are preterm and very low birth weight across countries and learning from each other to identify and implement interventions that can improve neonatal outcomes for each participating country.18 Our objective for this study was to compare survival and neonatal morbidity among very low birth weight, preterm triplets born at <33 weeks’ gestation to that of matched singletons by using the large international iNEO cohort.

METHODS

Study Design and Population

We conducted a retrospective matched-cohort study that included triplets and matched singletons identified from the iNEO cohort as born alive between 240 and 326 weeks’ gestation or with 500 to 1499 g birth weight and who were admitted for neonatal intensive care between 2007 and 2013. For generalization purposes, we included triplets irrespective of whether only 1, 2, or all 3 triplets were available in the data set. Neonates with a major congenital anomaly were excluded. For the matched cohort, 3 singletons were matched to each triplet neonate by gestational age (in weeks), sex, and country of birth. We matched for these variables because these are the most important covariates that are usually different in comparison of triplets and singletons and can influence outcomes significantly.

Data Source and Definitions

Data were obtained from 11 high-income countries by 10 independent neonatal networks that contribute deidentified individual patient data to the iNEO. The iNEO data set includes individual patient data on over 140 000 very preterm neonates with very low birth weight born between 2007 and 2013. The participating countries and networks include Australia and New Zealand Neonatal Network (ANZNN), Canadian Neonatal Network (CNN), Finnish Medical Birth Register (FinMBR), Israel Neonatal Network (INN), Neonatal Research Network Japan (NRNJ), Spanish Neonatal Network (SEN1500), Swedish Neonatal Quality Register (SNQ), Swiss Neonatal Network (SwissNeoNet), TIN Toscano online network (Tuscan NN), and the UK Neonatal Collaborative (UKNC). A common set of variables and data definitions were predetermined.19 The iNEO participants have slightly different methods of data collection, which have been previously described.19 Gestational age was reported on the basis of date of in vitro fertilization, early prenatal ultrasound, last menstrual period, or physical examination of the neonates at birth, in that order. Receipt of antenatal steroids was defined as any administration (regardless of drug, timing, or dose) of corticosteroids before birth. Maternal hypertension was defined according to local national guidelines.20 Birth weight z score for each neonate was calculated by using country-specific birth weight standards as described previously.21 The research ethics boards of the participating networks approved data collection methods and analyses. Analyses for the current project were approved by the iNEO steering committee.
Outcome Measures

The primary outcome was a composite of mortality or any of the 3 severe neonatal morbidities. Mortality was defined as death before discharge from the hospital. Severe neonatal morbidity was defined as severe neurologic injury, treated ROP, or bronchopulmonary dysplasia (BPD). Severe neurologic injury was defined as grade 3 or grade 4 IVH with ventricular dilatation or parenchymal injury (including periventricular leukomalacia) with or without IVH. Treated ROP included laser surgery or receipt of intraocular injections of antivascular endothelial growth factor agents. BPD was defined as oxygen requirement at 36 weeks’ postmenstrual age or at discharge, if earlier. Secondary outcomes were analyses of the individual components of the composite outcome.

Statistical Analysis

To verify matching criteria and identify potential covariates, perinatal demographics for the triplet and singleton neonates were summarized and compared by using either a Pearson χ² test for categorical values or a Mann–Whitney U test for continuous variables. Triplets were analyzed as individuals, and analysis was conducted by assuming clustering of outcomes within a triplet set. Primary and secondary outcomes were compared by using unadjusted and adjusted analyses and odds ratios (ORs) with 95% confidence intervals (CIs) computed. Two models for adjustment were employed: (1) nonmodifiable covariates (potential confounders) of maternal hypertension and birth weight z score and (2) variables in model 1, maternal hypertension and birth weight, in addition to cesarean birth and receipt of antenatal steroids (potential mediators that are affected by variations in practices). Models were fitted by using generalizing estimating equations and random effects modeling to account for clustering of triplet outcomes. Because our data set included some incomplete sets of triplets, we analyzed whether outcomes varied between triplet births represented by 1, 2, or all 3 triplets in subgroups. In addition, we made a comparison with an adjusted model (same as above) that was derived for the analysis of outcomes when only 1 neonate from each triplet set was included, versus 2 or all 3 neonates. The possibility that growth-restricted infants were included because of the gestational age or birth weight criteria led us to conduct a subgroup analysis of neonates born between 24⁴ and 28⁶ weeks’ gestational age and sensitivity analyses using only complete sets of triplets. Statistical analysis was conducted by using SAS version 9.2 (SAS Institute, Inc, Cary, NC) and R version 2.2 (R Project, Vienna, Austria). Statistical significance was attributed to \( P < .05 \).

RESULTS

A total of 6079 triplets and 18 232 matched singletons were included in this study. A detailed description of the numbers of neonates included, excluded, and matched from each country is provided in Table 1. We could not identify 5 matching singletons (1 in Finland and 4 in Spain) with our specified
As a proportion of total neonates, Tuscany and Israel had higher rates of triplets than other countries. Selected maternal and neonatal characteristics are shown for triplets and singletons in Table 2. The rates of maternal hypertension, birth outside tertiary center, Apgar score of <7 at 5 minutes, mean birth weight, and mean birth weight z score were all lower in triplets than singletons, whereas rates of cesarean birth and receipt of antenatal steroids were higher in triplets than singletons.

Unadjusted and adjusted comparisons of outcomes between triplets and singletons are reported in Table 3. There were no differences in outcomes between triplets and singletons, except that the OR for mortality was lower in triplets when adjusted for nonmodifiable covariates (model 1) but not when adjusted for modifiable covariates (model 2).

### Table 2 Maternal and Neonatal Characteristics of Triplets and Matched Singletons

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Triplet Neonates, N = 6079&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Singleton Neonates, N = 18232</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal hypertension, n (%)</td>
<td>627 (11.3)</td>
<td>4110 (24.6)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Birth outside tertiary centers, n (%)</td>
<td>152 (3.2)</td>
<td>1433 (10.2)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Any antenatal steroids received, n (%)</td>
<td>5282 (89.2)</td>
<td>13583 (77.4)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Cesarean birth, n (%)</td>
<td>5616 (95.1)</td>
<td>11771 (66.2)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Boys (%)</td>
<td>2840 (48.4)</td>
<td>8815 (48.4)</td>
<td>n/a</td>
</tr>
<tr>
<td>Apgar score &lt;7 at 5 min, n (%)</td>
<td>484 (10.4)</td>
<td>2383 (17.2)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>GA of entire cohort in wk, mean (SD)</td>
<td>28.7 (2.5)</td>
<td>28.7 (2.5)</td>
<td>n/a</td>
</tr>
<tr>
<td>Birth wt in g, mean (SD)</td>
<td>1238 (333)</td>
<td>1291 (395)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Birth wt z score, mean (SD)</td>
<td>−0.53 (0.92)</td>
<td>−0.34 (1.11)</td>
<td>&lt;.01</td>
</tr>
</tbody>
</table>

GA, gestational age; N, number in group; n, number in category; n/a, not applicable.

<sup>a</sup> These triplets came from 2899 pregnancies.

### Table 3 Primary Composite and Secondary Outcomes in Triplets and Singleton Births

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Triplet Neonates, N = 6079</th>
<th>Singleton Neonates, N = 18232</th>
<th>Unadjusted OR (95% CI)</th>
<th>Adjusted OR&lt;sup&gt;a&lt;/sup&gt; (95% CI)</th>
<th>Adjusted OR&lt;sup&gt;b&lt;/sup&gt; (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composite outcome&lt;sup&gt;c&lt;/sup&gt;, n (%)</td>
<td>1305 (23.4)</td>
<td>3941 (24.0)</td>
<td>0.97 (0.89–1.06)</td>
<td>0.91 (0.83–1.01)</td>
<td>1.00 (0.90–1.11)</td>
</tr>
<tr>
<td>Mortality before discharge, n (%)</td>
<td>360 (5.9)</td>
<td>1138 (6.2)</td>
<td>0.95 (0.81–1.10)</td>
<td>0.83 (0.70–0.98)</td>
<td>1.08 (0.90–1.30)</td>
</tr>
<tr>
<td>Severe neurologic injury, n (%)</td>
<td>343 (6.2)</td>
<td>1094 (6.7)</td>
<td>0.92 (0.80–1.07)</td>
<td>0.91 (0.78–1.06)</td>
<td>1.12 (0.94–1.33)</td>
</tr>
<tr>
<td>Treated ROP, n (%)</td>
<td>181 (3.0)</td>
<td>522 (2.9)</td>
<td>1.04 (0.85–1.28)</td>
<td>0.99 (0.80–1.22)</td>
<td>1.05 (0.85–1.32)</td>
</tr>
<tr>
<td>BPD, n (%)</td>
<td>717 (12.7)</td>
<td>2130 (12.6)</td>
<td>1.01 (0.90–1.13)</td>
<td>0.97 (0.86–1.09)</td>
<td>0.94 (0.83–1.07)</td>
</tr>
</tbody>
</table>

N, number in group; n, number in category.

<sup>a</sup> Adjusted for maternal hypertension and birth wt z score.

<sup>b</sup> Adjusted for maternal hypertension, cesarean birth, antenatal steroid administration, and birth wt z score.

<sup>c</sup> Composite outcome was defined as mortality or any of three major morbidities including severe neurologic injury, treated ROP, or BPD.

### Table 4 Outcomes Among Triplets Based on Number of Triplets Included in Database

<table>
<thead>
<tr>
<th>Characteristics and Outcomes</th>
<th>One Triplet Only, N = 995</th>
<th>Two Triplets, N = 1256</th>
<th>All 3 Triplets, N = 3828</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristics</td>
<td></td>
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</tr>
<tr>
<td>Maternal hypertension, n (%)</td>
<td>82 (9.5)</td>
<td>141 (12.3)</td>
<td>404 (11.4)</td>
<td>.14</td>
</tr>
<tr>
<td>Birth outside tertiary centers, n (%)</td>
<td>47 (5.8)</td>
<td>45 (4.3)</td>
<td>60 (2.1)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Antenatal steroids received, n (%)</td>
<td>788 (80.7)</td>
<td>1081 (89.1)</td>
<td>3433 (91.5)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Cesarean birth, n (%)</td>
<td>872 (90.3)</td>
<td>1125 (91.8)</td>
<td>3619 (97.4)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>GA of entire cohort in wk, mean (SD)</td>
<td>30.8 (3.0)</td>
<td>29.6 (2.7)</td>
<td>29.4 (2.2)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Male sex, n (%)</td>
<td>469 (47.1)</td>
<td>611 (48.7)</td>
<td>1880 (48.6)</td>
<td>.70</td>
</tr>
<tr>
<td>Birth wt in g, mean (SD)</td>
<td>1239 (289)</td>
<td>1218 (332)</td>
<td>1244 (337)</td>
<td>.06</td>
</tr>
<tr>
<td>Birth wt z score, mean (SD)</td>
<td>−0.38 (1.78)</td>
<td>−0.57 (0.98)</td>
<td>−1.08 (1.05)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Apgar score &lt;7 at 5 min, n (%)</td>
<td>60 (7.6)</td>
<td>90 (8.7)</td>
<td>334 (11.9)</td>
<td>&lt;.01</td>
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</tbody>
</table>

Outcomes

<table>
<thead>
<tr>
<th>Characteristics and Outcomes</th>
<th>One Triplet Only, N = 995</th>
<th>Two Triplets, N = 1256</th>
<th>All 3 Triplets, N = 3828</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composite outcome&lt;sup&gt;a&lt;/sup&gt;, n (%)</td>
<td>196 (22.0)</td>
<td>285 (24.3)</td>
<td>824 (23.5)</td>
<td>.46</td>
</tr>
<tr>
<td>Mortality before discharge, n (%)</td>
<td>76 (7.7)</td>
<td>72 (5.7)</td>
<td>212 (5.5)</td>
<td>.04</td>
</tr>
<tr>
<td>Severe neurologic injury, n (%)</td>
<td>47 (5.3)</td>
<td>74 (6.4)</td>
<td>222 (6.4)</td>
<td>.49</td>
</tr>
<tr>
<td>Treated ROP, n (%)</td>
<td>28 (2.8)</td>
<td>42 (3.4)</td>
<td>111 (2.9)</td>
<td>.69</td>
</tr>
<tr>
<td>BPD, n (%)</td>
<td>9 (11.0)</td>
<td>161 (13.8)</td>
<td>465 (13.0)</td>
<td>.04</td>
</tr>
</tbody>
</table>

GA, gestational age; N, number in group; n, number in category.

<sup>a</sup> Composite outcome was defined as mortality or any of three major morbidities including severe neurologic injury, treated ROP, or BPD.

SHAH et al 2004
When the outcomes were compared on the basis of whether 1, 2, or all 3 triplets were included in the data set, the unadjusted mortality was higher when only 1 of the triplets was included in data set than when 2 or 3 triplets were included. Comparison of baseline characteristics revealed that when only 1 triplet was included in the data set, the rate of birth outside of tertiary centers, mean gestational age (by ~1.5 weeks), and mean birth weight z score were higher, whereas the rates of antenatal steroids and cesarean births were lower than when 2 or 3 triplets were included. The rate of BPD was lower when only 1 triplet was included than when 2 or 3 triplets were included. The results of individual analyses were also consistent with overall results (Supplemental Table 8).

DISCUSSION

In this large, multicenter, international matched-cohort study of triplet outcomes, we identified that there was no significant difference in the composite outcome of mortality or major morbidities or any individual morbidities between triplets who were very low birth weight or very preterm and matched singletons. The results were similar in a cohort of triplets who were extremely low gestational age compared with singletons. The composite outcome and mortality were higher when only 1 of the triplets was included compared with the inclusion of 2 or 3 triplets.

The strengths of our study are that it is a large multicenter, multicountry cohort specifically including only triplets. With the adaptation of single-embryo transfer and reduction of triplets to twins or singletons at earlier gestation, high-income countries have noted a steady decline in triplet births. The opportunity to study >6000 triplets in high-income countries is so exceptionally rare that our results will be an extremely valuable reference for obstetricians and neonatologists. In addition, we employed a matched-cohort design instead of comparing all remaining singletons to the triplet sets, and we made extensive and appropriate statistical adjustments. To avoid influences on outcomes due to differences in resuscitation practices at lower gestational age (22 and 23 weeks), we used a cohort of >24 weeks.

However, we must acknowledge the limitations of our study. We do not have data as to whether the triplets were conceived spontaneously, after ovarian stimulation therapy, or using assisted reproductive technologies. We also do not have data on chorionicity or zygosity of the triplets. Furthermore, we do not have complete information regarding the reasons for preterm birth, which are

<table>
<thead>
<tr>
<th>TABLE 5 Comparison of Outcomes Based on Number of Triplets Available in Data Set</th>
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<tbody>
<tr>
<td>Outcomes</td>
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<tr>
<td>Composite outcome</td>
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<tr>
<td>Mortality before discharge</td>
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* Adjusted for maternal hypertension and birth wt z score.
* Adjusted for maternal hypertension, cesarean birth, antenatal steroid administration, and birth wt z score.
* Composite outcome was defined as mortality or any of three major morbidities including severe neurologic injury, treated ROP, or BPD.
* The comparison of 1 vs 3 meant the comparison of outcomes between a triplet set including only 1 infant versus those including 3 infants.
possibly different between singletons and triplets. It is more likely that the singletons were born after pregnancy complications such as maternal hypertensive disorders, infection, or abruption, whereas in triplets, acute pregnancy complications were less likely as was reflected in an increased rate of antenatal steroids and centralization of the triplet deliveries. We also acknowledge that we are missing ~30% of neonates from this analysis because only 1 or 2 neonates from those triplet sets were included in our data set. The loss of triplet infants may have occurred at lower gestations due to still birth or intrapartum or delivery room deaths. We observed higher odds of composite outcome and death if only 1 triplet was included in the data set, which suggests that we may be including single triplets from both gestational extremes, surviving triplets of lower gestational age, and small-for-gestation triplets of higher gestational age, who are at increased risk of adverse outcomes. However, our sensitivity analyses included only complete sets of triplets, and it did not differ much from the original results.

There were baseline differences between the triplets and singletons, with triplet pregnancies having higher rates of births at tertiary centers, receipt of antenatal steroids, and cesarean deliveries as well as lower rates of maternal hypertension and neonatal Apgar scores <7 at 5 minutes than with singletons. These differences are not unexpected and are reflective of the differences between the reasons for preterm births in singletons and multiple pregnancies. For example, it is likely that triplet pregnancies were cared for and delivered at tertiary-level centers and had time to receive antenatal steroids. We identified some differences between triplets and singletons on the basis of the predictors adjusted for in the analyses; however, for all practical purposes, the results revealed no differences between the outcomes of triplets and singletons matched for gestational age, sex, and country of birth.

In our cohort, complete sets of triplets tended to have reduced odds of the composite outcome of mortality or major morbidity; however, the statistical association was unstable for variables included in the model. There was higher mortality and lower odds for BPD when only 1 triplet of the set was available for inclusion analyses compared with when all triplets were included. There were some unfavorable characteristics when only 1 triplet was included in the data set, such as a higher outborn rate and a lower rate of antenatal steroids than when 2 or 3 triplets were included. It is possible that in some instances only 1 triplet was transferred to a tertiary center and that the neonate was small for gestational age because the mean gestational age was ~1.5 weeks higher, whereas the mean birth weight was not different. However, this is speculative; therefore, we conducted sensitivity analyses including only complete sets of triplets.

Our findings of no differences in the neonatal outcomes of triplets and singletons who were very preterm or very low birth weight are similar to those reported previously. Rodrigues et al24 from Brazil compared neonatal outcomes of 128 triplets and quadruplets with 260 singletons and identified that a majority of outcomes were similar between the groups with 2 exceptions: necrotizing enterocolitis was higher in triplets, and mortality was higher in singletons. Morikawa et al25 reported the outcomes of 320 pregnancies with triplet fetuses that were born after 22 weeks’ gestation in Japan. They reported a perinatal mortality of 25 per 1000 births, which decreased as the number of chorionic membranes increased. In a previous study from the CNN, it was reported that outcomes for triplets improved between 2003 and 2008; however, the sample size was small, and statistical significance was not reached.4 Nasseri and Azhiri26 compared the outcomes of 511 sets of twins, 42 sets of triplets, and 5 sets of quadruplets born in Iran and reported that when matched for gestational age, outcomes were no different for triplets or quadruplets compared with twins. We acknowledge that both the Canadian and Japanese studies included neonates born until 2008; thus, these studies had 2 years of data that may also be included in the current study. However, the data from Iran and Brazil were not a part of the iNEO cohort. Our results of similar findings in individual countries strongly support our overall results of no differences in outcomes. On the other hand, Shinwell et al27 from Israel (comprising a cohort born before the current data for Israel) reported higher odds of mortality in triplet neonates who were very low birth weight (n = 483) compared with twins or singletons from 1995 to 1999 without any difference in neurologic outcome or chronic lung disease. However, results from these recent data from Israel did not reveal any differences (Supplemental Table 8).

The reported results of neurodevelopmental outcomes of triplets are variable. Gnanendran et al28 compared neurodevelopmental outcomes of 1081 singletons and 392 multiples born in Australia and identified no differences (adjusted OR: 1.14; 95% CI: 0.84–1.14). However, twins and triplets were combined in the multiples group. Battin et al6 reported that among surviving triplets who were very low birth weight in New Zealand, 66% were
normal, 32% had mild to moderate disability, and 2% had severe disability. On the other hand, Wadhawan et al29 analyzed outcomes of 8296 singletons, 2164 twins, and 521 triplets or higher-order infants in the United States and reported that the risk of death or neurodevelopmental impairment was higher in triplet and higher-order multiples (adjusted OR: 1.70; 95% CI: 1.29–2.24) compared with singletons; although, it was not different when compared with twins. Once again, triplets were combined with higher-order multiples. Neurodevelopmental outcomes of triplets are important, but a large matched-cohort study would be required to identify whether differences in outcome exist.

Notwithstanding some limitations, our findings are reassuring in showing that the neonatal outcomes of triplets who were very preterm or very low birth weight did not differ from those of singletons of similar gestational age and sex. This may reflect the better care provided during the prenatal, intrapartum, and postpartum periods to triplets. Our findings from a large cohort of neonates can be used to provide reassuring results for families and care providers that although triplets do incur strain to already resource-limited neonatal units, their outcomes are similar to those of singletons.

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A complete list of iNEO investigators can be found in the Supplemental Information.

Dr Shah contributed to the conception and design of the study, drafted and revised the manuscript, had full access to all the data in the study, and takes responsibility for the integrity of the data and the accuracy of the data analysis. Drs Kusuda, Håkansson, Reichman, Lui, Lehtonen, Modì, Darlow, Bassler, and Lee and Mr Adams contributed to the conception and design of the study and critical review of the manuscript; Drs Vento, Rusconi, Norman, Lodha, Helenius, and Isayama and Mr Yang participated in the data analysis and interpretation and critical review of the manuscript; and all authors approved the final manuscript as submitted and are accountable for the data contained therein.

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ABBREVIATIONS

ANZNN: Australia and New Zealand Neonatal Network
BPD: bronchopulmonary dysplasia
CI: confidence interval
CNN: Canadian Neonatal Network
FinMBR: Finnish Medical Birth Register
iNEO: International Network for Evaluation of Outcomes
INN: Israel Neonatal Network
IVH: intraventricular hemorrhage
NRNJ: Neonatal Research Network Japan
OR: odds ratio
ROP: retinopathy of prematurity
SEN1500: Spanish Neonatal Network
SNQ: Swedish Neonatal Quality Register
SwissNeoNet: Swiss Neonatal Network
Tuscan NN: TIN Toscane online network
UKNC: UK Neonatal Collaborative
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