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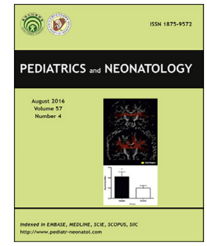

Original Article

Trends in birth weight-specific and -adjusted infant mortality rates in Taiwan between 2004 and 2011

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Key Words
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very low birth weight

Background: A yearly increase in the proportion of very low birth weight (VLBW) live births has resulted in the slowdown of decreasing trends in crude infant mortality rates (IMRs). In this study, we examined the trends in birth weight-specific as well as birth weight-adjusted IMRs in Taiwan.
Methods: We linked three nationwide datasets, namely the National Birth Reporting Database, National Birth Certification Registry, and National Death Certification Registry databases, to calculate the IMRs according to the birth weight category. Trend tests and mortality rate ratios in the periods 2010—2011 and 2004—2005 were used to examine the extent of reduction in birth weight-specific and birth weight-adjusted IMRs.
Results: The proportion of VLBW (<1500 g) infants among live births increased from 0.78% in 2004—2005 to 0.89% in 2010—2011, thus exhibiting a 15% increase. The extents of the decreases in birth weight-specific IMRs in the 500—999, 1000—1499, 1500—1999, 2000—2499, and 2500—2999 g birth weight categories were 15%, 33%, 43%, 30%, and 28%, respectively, from 2004—2005 to 2010—2011. The reduction in IMR in each birth weight category was larger than the reduction in the crude IMR (13%). By contrast, the IMR in the <500 g birth weight category

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exhibited a 56% increase during the study period. The IMRs were calculated by excluding all live births with a birth weight of <500 g. The birth weight-adjusted IMRs, which were calculated using a standard birth weight distribution structure for adjustment, exhibited similar extent reductions.

Conclusion: In countries with an increasing proportion of VLBW live births, birth weight-specific or -adjusted IMRs are more appropriate than other indices for accurately assessing the real extent of reduction in IMRs.

1. Introduction

Infant mortality rate (IMR) has long been used to represent countries' socioeconomic and health status. An international comparative study revealed that the IMR of Taiwan ranked eleventh among 26 high-income countries. However, Taiwan had a relatively high proportion of live births with birth weight <500 g (3.8 per 10,000 live births), ranking after the United States (16.9), Canada (10.8), England and Wales (6.1), Hungary (6.1), Germany (4.8), and Scotland (4.2).[1] Studies have reported that a slowdown of reduction in crude IMRs has been observed in many countries mainly because of an increase in the proportion of very low birth weight (VLBW) and preterm births.[2–4] According to Taiwan official published data, the decreasing trends in crude IMR leveled off since 2008 and the proportion of live births with birth weight <1500 g increased persistently from 2004 to 2015 (Fig. 1).[5,6]

The increase of proportion of VLBW has resulted from older maternal age and the increased use of artificial reproduction technologies, which lead to an increase in the percentage of twins or higher-order multiple births.[7–9] To avoid artifact effects of changes in the proportion of VLBW and preterm births, examining the trends in IMRs according to birth weight categories is recommended for an accurate assessment of the effectiveness of various healthcare interventions.[2–4]

However, presenting yearly IMRs for various birth weight categories and communicating with the public and stakeholders of public health policy is extremely complex. Hence, adjusted IMRs are required. One adjustment method is the exclusion of live births weighing <500 or <1000 g.[2,3,10] An alternative method is to calculate birth weight-adjusted IMRs using a standard birth weight distribution structure similar to the direct adjustment method used to calculate the age-adjusted mortality rate. In this study, we examined trends in birth weight-specific and birth weight- and age-adjusted IMRs in Taiwan between 2004 and 2011.

2. Methods

2.1. Data sources

Every resident of Taiwan is assigned a unique identification (ID) number. We used these ID numbers to link three nationwide population datasets, namely the National Birth Reporting Database (NBRD, 2004–2011), National Birth Certification Registry (NBCR, 2004–2011), and National Death Certificate Registry (NDCR, 2004–2012). The NBRD was established in 1995 and has been published online since 2004. The Health Promotion Administration has released only 2004–2011 birth reporting data for research. A brief introduction of each dataset and linkage method has been reported previously.[11]

In this study, we used the birth weight information of newborn infants recorded in the NBRD because this information was reported by healthcare providers; hence, these records are more accurate than those of the parents of the newborn infants. However, the ID numbers of the infants were not available in NBRD dataset. Hence, we used the mothers' ID numbers recorded in the NBRD dataset as the key to link the NBCR dataset for obtaining the ID numbers of the newborn infants. We then used the ID number of the infants as a link to the NDCR dataset to identify infant deaths.

To facilitate linkage of various government administrative datasets, the Center for Health and Welfare Data Analysis and Application was established by the Department of Statistics, Ministry of Health and Welfare, Taiwan.[12] To protect patient identity and privacy, the linkage analyses were conducted in an isolated, restricted-access room, and all ID numbers were scrambled. Only aggregated statistical tables were released for research after careful inspection by the center staff to ensure that the results did not reveal any personal information. The study design was approved by the Institutional Review Board of National Cheng Kung University Hospital (B-ER-102-120-t).

2.2. Statistical analysis

The linked dataset formed a birth cohort with follow-up information to identify deaths in the first year after birth. We calculated neonatal (0–27 days) and postneonatal (28–364 days) mortality rates as well as the IMRs by birth weight category. The first method of calculating birth weight-adjusted IMRs excluded live births with birth weights of <500 g or <1000 g. The second method of calculating birth weight-adjusted IMRs used a standard birth weight distribution to calculate birth weight-specific and -adjusted IMRs of each year. Standard birth weight distribution was defined as the distribution of the sum of live births between 2004 and 2011 according to birth weight grouping. We first calculated the birth weight-specific

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