



Short Communication

Infant mortality rates based on two registration criteria for live births: A comparison of Taiwan with 26 European countries

Fu-Wen Liang ^a, Min Chen ^b, Mei-Hwan Wu ^c, Hung-Chi Lue ^d,
Tung-liang Chiang ^e, Tsung-Hsueh Lu ^{f,*}



^a Department of Public Health, College of Health Sciences, Kaohsiung Medical University, Kaohsiung, Taiwan

^b Department of Census, Director-General of Budget, Executive Yuan, Taipei, Taiwan

^c Department of Pediatrics, National Taiwan University Hospital, Taipei, Taiwan

^d Child Health Alliance Taiwan, Taipei, Taiwan

^e Institute of Health Policy and Management, College of Public Health, National Taiwan University, Taipei, Taiwan

^f NCKU Research Center for Health Data and Department of Public Health, College of Medicine, National Cheng Kung University, Tainan, Taiwan

Received Oct 11, 2017; received in revised form Apr 20, 2018; accepted Jun 21, 2018
Available online 27 June 2018

1. Introduction

Rankings of infant mortality rates (IMRs) are the most commonly cited international comparisons of health status^{1,2}; however, because of international variation in registration criteria for live births, the comparability of IMRs across countries is compromised.^{3,4} Many countries (including Taiwan) have identified a live birth as any product of conception that shows signs of life at birth. However, some countries, such as France and the Netherlands, have adopted threshold criteria of 22 weeks

of completed gestation or a birth weight cutoff of no less than 500 g.^{3,4} To control potential variations in birth registration across countries, Euro-Peristat project used these same criteria for live births (minimum 22 weeks gestation or 500-g birth weight) to calculate the corrected IMRs for each participating country in 2004 and 2010.² In this study, we examined the differences in rankings of 2010 IMRs of Taiwan and 26 European countries between traditional and threshold registration criteria for live births.

2. Materials and methods

Data of traditional IMRs for 2010 of 26 European countries and Taiwan according to traditional registration criteria for live births were extracted from the World Health Organization⁵ and the Office of Statistics, Ministry of Health and

* Corresponding author. Department of Public Health, College of Medicine, National Cheng Kung University, No 1, Dah Hsueh Road, East District, Tainan, 701, Taiwan.
E-mail address: robertlu@mail.ncku.edu.tw (T.-H. Lu).

Welfare, Taiwan.⁶ Data of IMRs for 2010 of 26 European countries based on threshold criteria of 22 weeks of completed gestation or a birth weight cutoff of 500 g were obtained from the European Perinatal Health Report 2010, the latest available data using threshold criteria.² The IMR of Taiwan based on the same threshold for 2010 was calculated by linking the Taiwan Birth Notification dataset (the gestational age and birth weight were recorded) from the Health Promotion Administration with the Mortality dataset from the Office of Statistics at the Ministry of Health and Welfare. In addition, the mortality rate ratios (RR) and 95% confidence intervals (95% CI) were calculated using Taiwan as the reference in order to assess the differences in the mortality rates and statistical significance between Taiwan and the other countries.⁴

3. Results

Of 26 European countries examined, 9 countries used the threshold criteria (Table 1). Among 18 countries (including Taiwan) using signs of life at birth (traditional) criteria, 11 countries exhibited threshold IMRs lower than the traditional IMRs. The traditional IMR of Taiwan was 4.2 (deaths per 1000 live births) and decreased to 3.9 based on the

threshold criteria. However, the rank (20th) of Taiwan did not change between the two criteria. The rank increased prominently for Denmark (from 13th to 8th), Switzerland (from 18th to 12th), and Austria (from 19th to 13th). Conversely, the rank decreased drastically for Spain (from 10th to 17th) and Germany (from 14th to 18th). In addition to the changes in rankings, the number of countries with IMR significantly lower than that of Taiwan was different using the two criteria. Only 12 countries had IMRs statistically significantly lower than that of Taiwan under the threshold criteria whereas 15 countries with significantly lower traditional IMRs.

4. Discussion

The findings of this study indicate that most of the countries defining live birth as any product of conception showing signs of life at birth would have lower corrected IMRs based on the thresholds of 22 weeks of gestation or 500-g birth weight, because many stillbirths and extremely low birth-weight babies were likely excluded when calculating threshold IMRs. Several studies have shown the possible effects of the proportion of extremely low birth-weight babies on IMRs between countries.^{3,6}

Table 1 Ranks of 2010 infant mortality rates (IMR) [deaths per 1000 live births] of Taiwan and 26 European countries based on two criteria.*

Country	Traditional criteria					Threshold criteria				
	Rank	Deaths	IMR	RR	95%CI	Rank	Deaths	IMR	RR	95% CI
Iceland	1	11	2.2	0.53	0.29–0.96	1	11	2.3	0.59	0.32–1.07
Finland	2	138	2.3	0.54	0.44–0.64	2	139	2.3	0.59	0.49–0.70
Slovenia	3	56	2.5	0.60	0.45–0.78	4	56	2.5	0.64	0.48–0.84
Sweden	4	294	2.5	0.61	0.52–0.69	3	278	2.4	0.62	0.53–0.70
Norway	5	157	2.6	0.61	0.51–0.72	9	177	2.8	0.72	0.60–0.84
Portugal	6	260	2.6	0.61	0.52–0.70	5	258	2.5	0.64	0.55–0.74
Czech Republic	7	313	2.7	0.64	0.55–0.72	7	313	2.7	0.69	0.60–0.79
Luxembourg	8	16	2.7	0.65	0.39–1.06	6	16	2.5	0.64	0.39–1.05
Cyprus	9	28	2.9	0.68	0.46–0.99	11	27	3.1	0.79	0.54–1.16
Spain	10	1553	3.2	0.76	0.69–0.83	17	185	3.6	0.92	0.78–1.08
Estonia	11	52	3.3	0.78	0.59–1.03	10	44	2.8	0.72	0.52–0.97
Italy	12	1863	3.3	0.80	0.73–0.86	14	1877	3.4	0.87	0.79–0.95
Denmark	13	217	3.4	0.81	0.69–0.94	8	168	2.7	0.69	0.58–0.82
Germany	14	2322	3.4	0.82	0.74–0.88	18	2322	3.7	0.95	0.86–1.03
France*	15	2821	3.5	0.84	0.77–0.90	15	2785	3.5	0.90	0.82–0.97
Belgium	16	465	3.6	0.85	0.75–0.95	16	470	3.5	0.90	0.79–1.01
Netherlands	17	695	3.8	0.90	0.80–0.99	19	695	3.8	0.97	0.87–1.08
Switzerland	18	307	3.8	0.91	0.79–1.04	12	259	3.2	0.82	0.71–0.94
Austria	19	307	3.9	0.93	0.81–1.06	13	263	3.3	0.85	0.73–0.97
Taiwan	20	705	4.2	1.00	Reference	20	650	3.9	1.00	Reference
UK	21	3504	4.4	1.04	0.96–1.12	21	3086	3.9	1.00	0.91–1.08
Poland	22	2057	5.0	1.19	1.08–1.29	22	2051	5.0	1.28	1.17–1.40
Lithuania	23	153	5.0	1.19	0.99–1.41	23	154	5.0	1.28	1.07–1.52
Hungary	24	481	5.3	1.27	1.12–1.42	24	481	5.3	1.36	1.20–1.52
Latvia	25	110	5.6	1.32	1.08–1.61	26	110	5.7	1.46	1.19–1.78
Malta	26	22	5.6	1.34	0.87–2.05	25	22	5.5	1.41	0.92–2.15
Romania	27	2078	9.8	2.33	2.14–2.53	27	2078	9.8	2.51	2.30–2.74

*Data using traditional criteria were obtained from the World Health Organization,⁵ and data using the threshold criteria of 22 weeks of gestation or 500-g birth weight for live births were obtained from the European Perinatal Health Report.²

We found a large difference between the traditional and threshold IMR of Taiwan. This suggests many stillbirths and extremely low birth-weight babies were likely included in calculations of the traditional IMR of Taiwan. Investigation indicated that despite the slowdown of decreasing trends in crude IMRs in Taiwan, the weight-specific or weight-adjusted IMRs still show steep decreases, which suggest the possible influence of the increasing proportion of live births with extremely low birth weights in Taiwan.⁷ Despite the lower threshold IMR of Taiwan compared with the traditional IMR, the rank remained the same. There were 19 countries with threshold IMRs lower than Taiwan's, yet only 12 countries with IMRs were statistically significantly lower than Taiwan's.

A limitation of this study was that no current data were available. Euro-Peristat is the only project that requires all participating countries to provide IMR data using 22 weeks of completed gestation or a birth weight cutoff of 500 g as criteria, and only 2004 and 2010 data were available. A second limitation was that comparability of IMRs across countries may have been affected by the proportion of live births weighing between 500 and 1500 g. To overcome this limitation, weight-specific or weight-adjusted IMRs should be calculated to ensure accurate comparability.⁷

In conclusion, the international ranks of IMRs changed if threshold criteria for live births were used. Euro-Peristat recommends their member countries use the threshold criteria for live births, and Taiwan should also calculate IMR according to threshold criteria to supplement the traditional IMR in routinely published reports.

Conflicts of interest

The authors have no conflicts of interest relevant to this article.

Acknowledgments

The design of this study has been reviewed by the Institutional Review Board (IRB) of National Cheng Kung University Hospital with IRB Number: B-ER-102-120-t.

References

1. OECD/EU. *Health at a glance: Europe 2016 – State of health in the EU cycle*. Paris: OECD Publishing; 2016. Available at <https://doi.org/10.1787/9789264265592-en>. Accessed August 30, 2017.
2. EURO-PERISTAT Project with SCPE and EUROCAT. The European Perinatal Health Report. Available at <http://www.europeristat.com/reports/european-perinatal-health-report-2010.html>. Accessed December 25, 2017.
3. Joseph KS, Liu S, Rouleau J, Lisonkova S, Hutcheon JA, Sauve R, et al. Influence of definition based versus pragmatic birth registration on international comparisons of perinatal and infant mortality: population based retrospective study. *BMJ* 2012;344:e746.
4. Liang FW, Lu TH, Wu MH, Lue HC, Chiang TL, Huang YL, et al. International ranking of infant mortality rates: Taiwan compared with European countries. *Pediatr Neonatol* 2016;57:326–32.
5. World Health Organization. Health statistics and information systems. *Download the raw data files of the WHO Mortality Database*. Available at http://www.who.int/healthinfo/statistics/mortality_rawdata/en/. Accessed December 13, 2017.
6. Sachs B, Fretts RC, Gardner R, Hellerstein S, Wampler NS, Wise PH. The impact of extreme prematurity and congenital anomalies on the interpretation of international comparisons of infant mortality. *Obstet Gynecol* 1995;85:941–6.
7. Liang FW, Chow HC, Chiou ST, Chen LH, Wu MH, Lue HC, et al. Trends in birth weight-specific and adjusted infant mortality rates in Taiwan between 2004 and 2011. *Pediatr Neonatol* 2018;59:267–73.