

Short Communication

Anaemia prevalence over time in Indonesia: estimates from the 1997, 2000, and 2008 Indonesia Family Life Surveys

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Objective: To summarize anaemia prevalence data for children, women, and men using data from the second, third and fourth waves of the Indonesia Family Life Surveys (IFLS), which were conducted in 1997/8, 2000, and 2007/8, respectively. **Methods:** Anaemia prevalence was determined for children 0 to 5 years, 5 to 12 years, 12 to 15 years, non-pregnant women at least 15 years, pregnant women at least 15 years, and men at least 15 years, based on haemoglobin adjusted for altitude and smoking status. **Results:** Compared with 1997/8 estimates, anaemia prevalence estimates were lower in 2007/8 for all groups, with the greatest relative decline occurring in children 5 to 12 years (25.4%). Trend analysis found anaemia significantly declined over the survey years for all groups ($\chi^2 p=0.005$ for pregnant women, $\chi^2 p<0.001$ for all other groups). **Conclusions:** IFLS anaemia estimates for different population groups decreased between 1997/8 and 2007/8 and were consistent with estimates from Southeast Asia, and with other studies conducted in Indonesia. While the prevalence of anaemia consistently decreased in all groups, anaemia remains a moderate public health problem for children 0 to 5 years, children 5 to 12 years, and non-pregnant and pregnant women.

Key Words: anaemia, haemoglobin, Indonesia, IFLS, Southeast Asia

INTRODUCTION

Because anaemia is an important public health problem, it is often measured over time among children, adolescent, and adult populations.^{1,2} In adults, anaemia can cause weakness and fatigue, resulting in decreased productivity in the manual labour sector and decreased work capacity.^{3,4} In addition, there is evidence that anaemia-related cognitive defects are directly linked with lower future earnings.^{4,5} A recent systematic analysis of global anaemia estimated that, in East and Southeast Asia between 1995 and 2011, anaemia prevalence decreased from 29% to 25%, 29% to 21%, and 34% to 25%, in children less than 5 years, non-pregnant women, and pregnant women, respectively.² Of all global regions, East and Southeast Asia tended to show strongest improvements in anaemia, thus it is important to monitor anaemia prevalence among Southeastern Asian countries to better understand the changing burden of anaemia over time.

While anaemia prevalence has been estimated previously for different Indonesian population groups, anaemia trends have not been published. For example, in the RISKESDAS (National Basic Health Research Survey by the National Institute of Health Research and Development, Ministry of Health) conducted in 2013, the prevalence of anaemia was estimated in children 0 up to 15 years, pregnant women, non-pregnant women, and men.⁶

In the Indonesian South East Asian Nutrition Survey (SEANUTS) conducted in 2011, the prevalence of anaemia among children 6 months to 12 years was estimated.⁷

The goal of this communication was to summarize anaemia trends for children, women, and men in Indonesia using longitudinal data.

MATERIALS AND METHODS

The Indonesia Family Life Survey (IFLS) is an on-going longitudinal survey conducted by the RAND Corporation that follows about 7,200 families in Indonesia.⁸ The survey is representative of about 83% of the Indonesian population and consists of over 30,000 individuals who lived in 13 of the 27 Indonesian provinces at the start of the survey. The first wave of surveys, IFLS1, was conducted in 1993/4.⁹

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The successive survey waves (IFLS2-4), were conducted in 1997/8, 2000, and 2007/8, respectively, and covered 94%, 95% and 94% of the original IFLS1 families, respectively.⁹⁻¹¹ Data from the IFLS are publicly available upon registration with RAND. The three most recent waves measured haemoglobin, and were used to determine and compare anaemia prevalence in Indonesia for each of the corresponding survey years.

Anaemia prevalence was determined in the IFLS for children 0 to 5 years, 5 to 12 years, 12 to 15 years, non-pregnant women at least 15 years, pregnant women at least 15 years, and men at least 15 years, based on adjusted haemoglobin measurements. Each survey wave of the IFLS consistently measured haemoglobin using capillary blood and a HemoCue analyzer.⁹⁻¹¹ The following haemoglobin cut-offs were used to define anaemia, in accordance with the WHO: 11.0 g/dL for children <5 years; 11.5 g/dL for children 5-<12 years; 12.0 g/dL for children 12-<15 years; 12.0 g/dL for non-pregnant women ≥15 years; 11.0 g/dL for pregnant women ≥15 years, and 13.0 g/dL for men ≥15 years.¹²

Individuals' haemoglobin levels were adjusted based on altitude (men, women, and children) and smoking status (men and women) as described by Sullivan et al.¹³ Individuals with adjusted haemoglobin concentrations lower than the cut-offs were defined as being anaemic. Smoking adjustments were made based on the number of cigarettes smoked per day, which was determined using the appropriate IFLS survey books, as previously performed.¹⁴ Altitude was determined using Google Earth using the household location (sub district) that was recorded during data collection.¹⁴

Sex and age were also determined using the appropriate survey books.¹⁴ Pregnancy status was determined by cross-checking respondent answers between survey books. The answers between books usually agreed, but if a discrepancy existed the values were set to missing, and were excluded from the analysis. If questions regarding preg-

nancy status were not answered, then women were assumed to be non-pregnant.

To ensure data quality, a few exclusions were made based on implausible information (e.g., pregnant males), or if responses were available to questions that should not have been asked (e.g., childhood smoking, childhood pregnancy). Three pregnant women under 15 years (2 from IFLS3, 1 from IFLS4), 5 pregnant males (all from IFLS3), and 4 smokers under 15 years (all from IFLS3) were excluded for these reasons. Additionally, 1 child under 5 years and 1 non-pregnant woman were excluded from IFLS3 because they had a haemoglobin concentration of 99.9 g/dL, which was implausible and may have resulted from incorrect data coding. No other exclusions were made.

No identifying information of human subjects was used, thus this study was exempt from Institutional Review Board review.

RESULTS

The proportion of anaemia in each of the groups along with the corresponding mean adjusted haemoglobin values are displayed in Table 1. Compared with 1997 estimates, anaemia prevalence estimates were lower in 2008 for all groups, with the greatest relative decline occurring in children 5-<12 years (25.4%) (Table 1). In children 0 to 5 years, 12 to 15 years, and non-pregnant and pregnant women the highest prevalence of anaemia was observed in 2000. However, chi square trend analysis found anaemia prevalence declined significantly in all groups over the survey years ($p=0.005$ for pregnant women, $p<0.0001$ for all other groups).

DISCUSSION

From 1997 to 2008, the prevalence of anaemia consistently declined among Indonesian children, adolescents, women and men assessed in the Indonesia Family Life Surveys (IFLS). To our knowledge, this is the first trend

Table 1. Anaemia prevalence and adjusted haemoglobin (Hb) concentrations of children, women, and men that were measured during the years of the second, third, and fourth waves of the Indonesia Family Life Surveys (IFLS).

Group	Year [†]	Sample size	Anaemia (%)	Mean adjusted Hb±SD [‡] (g/dL)
Children 0-<5 y	1997/8	1,867	46.0	10.9±1.4
	2000	2,346	54.6	10.7±1.5
	2007/8	2,963	31.4	11.4±1.4
Children 5-<12 y	1997	4,308	46.0	11.9±1.4
	2000	4,887	36.4	11.8±1.3
	2008	5,570	20.6	12.3±1.4
Children 12-<15 y	1997	2,221	27.5	12.7±1.4
	2000	2,159	28.2	12.6±1.3
	2008	2,172	15.8	13.3±1.4
Women ≥15 y (non-pregnant)	1997	10,168	36.0	12.3±1.6
	2000	12,935	38.8	12.2±1.5
	2008	14,704	26.6	12.6±1.6
Women ≥15 y (pregnant)	1997	277	45.1	12.0±1.5
	2000	520	46.5	12.1±1.5
	2008	563	37.3	12.4±2.1
Men ≥15 y	1997	8,592	29.0	13.8±1.8
	2000	11,873	22.8	14.0±1.8
	2008	13,730	15.4	14.5±1.9

[†]IFLS2 conducted in 1997/8, IFLS3 conducted in 2000, IFLS4 conducted in 2007/2008.

[‡]Adjusted for altitude based on district using Google Earth and for smoking status based on number of cigarettes smoked per day as described¹³; SD: standard deviation.

assessment of anaemia prevalence for different Indonesian population groups.

The IFLS data are consistent with other studies that have documented anaemia in Indonesia or Southeast Asia. For example, the decline in anaemia observed among non-pregnant women between 1997 and 2008 in the IFLS (9.4%) is consistent with the decline in non-pregnant women estimated between 1995 and 2011 in Southeast Asia (8%).² The anaemia decline among pregnant women during those times is also consistent between the IFLS (7.8%) and estimates for Southeast Asia (9%). However, the anaemia decline among children less than 5 years during these time periods was much greater in the IFLS (14.6%) compared with estimates for Southeast Asia (4%).

Prior studies conducted in Indonesia also observed consistent results. For example, the SEANUTS study conducted in 2011 estimated anaemia in children 6 months to 12 years to be between 17.6% (urban) and 18.5% (rural), which is fairly consistent with the 2008 estimate for this same group according to the IFLS (20.6%).⁷ The RISKESDAS national health survey, which was conducted in 2013, produced similar estimates to comparable age groups for the 2007/8 IFLS: anaemia prevalence of non-pregnant women was estimated to be 22.7% (versus 26.6% from IFLS); anaemia prevalence of pregnant women was estimated to be 37.1% (versus 37.3% from IFLS); anaemia prevalence of men was estimated to be 16.6% (versus 15.4% from IFLS), and anaemia prevalence of children 0 to 5 years was estimated to be 28.1% (versus 31.1% from IFLS).⁶

Despite important declines in the prevalence of anaemia in all population groups per the IFLS, anaemia remains a public health problem in Indonesia. Based on 2007/8 IFLS data, anaemia would be classified by WHO as a moderate public health problem for children 0-5 years, children 5-12 years, and for non-pregnant and pregnant women ≥15 years, as the prevalence ranged from 20.0-39.9%.¹

From this first ever trend analysis of anaemia in different population groups in Indonesia, we conclude that there has been a reduction in the prevalence of anaemia from 1997 to 2008 in all age and sex groups studied. Despite this progress, anaemia remains a moderate public health problem in children <12 years and in non-pregnant and pregnant women ≥15 years.

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AUTHOR DISCLOSURES

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REFERENCES

1. De Benoist B, McLean E, Egli I, Cogswell M, editors. Worldwide prevalence of anaemia 1998–2005: WHO global database on anaemia. Geneva: World Health Organization; 2008. [cited 2015/7/22]; Available from: http://whqlibdoc.who.int/publications/2008/9789241596657_eng.pdf.
2. Stevens GA, Finucane MM, De-Regil LM, Paciorek CJ, Flaxman SR, Branca F, Peña-Rosas JP, Bhutta ZA, Ezzati M. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995–2011: a systematic analysis of population-representative data. Lancet Glob Health. 2013;1:e16-25. doi: 10.1016/S2214-109X(13)70001-9.
3. Haas JD, Brownlie T. Iron deficiency and reduced work capacity: a critical review of the research to determine a causal relationship. J Nutr. 2001;131:S676-S90.
4. Basta SS, Soekirman, Karyadi D, Scrimshaw NS. Iron deficiency anemia and the productivity of adult males in Indonesia. Am J Clin Nutr. 1979;32:916-25.
5. Galal OM, Neumann CG, Hulett J. Proceedings of the international workshop on articulating the impact of nutritional deficits on the education for all agenda. Food Nutr Bull. 2005;26:S127-S287.
6. National Institute of Health Research and Development. Report of national baseline health research (RISKESDAS). Jakarta: Ministry of Health; 2013. (In Indonesian).
7. Sandjaja S, Budiman B, Harahap H, Ernawati F, Soekatri M, Widodo Y et al. Food consumption and nutritional and biochemical status of 0–5–12-year-old Indonesian children: the SEANUTS study. Br J Nutr. 2013;110:S11-S20.
8. Frankenberg E, Karoly L. The 1993 Indonesia family life survey: overview and field report. Santa Monica (CA): RAND; 1995.
9. Frankenberg E, Thomas D. The Indonesia family life survey (IFLS): study design and results from waves 1 and 2. Santa Monica (CA): RAND; 2000.
10. Strauss J, Beegle K, Sikoki B, Dwiyanto A, Herawati Y, Witoelar F. The third wave of the Indonesia family life survey (IFLS): overview and field report. Santa Monica (CA): RAND; 2004.
11. Strauss J, Witoelar F, Sikoki B, Wattie AM. The fourth wave of the Indonesia family life survey (IFLS4): overview and field report. Santa Monica (CA): RAND; 2009.
12. World Health Organization. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. Geneva: World Health Organization, Vitamin and Mineral Nutrition Information System; 2011.
13. Sullivan KM, Mei Z, Grummer-Strawn L, Parvanta I. Haemoglobin adjustments to define anaemia. Trop Med Int Health. 2008;13:1267-71. doi: 10.1111/j.1365-3156.2008.02143.x.
14. Kendrick KL. Analysis of the family life surveys in Indonesia: the contribution of wheat flour fortification to improving anemia [master's thesis]. Atlanta (GA): Emory University; 2013.

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印尼歷年貧血盛行率：1997、2000 及 2008 年印尼家庭生活調查估計

目的：本研究整理從 1997/8、2000 及 2007/8 年執行的第二次、第三次及第四次的印尼家庭生活調查 (IFLS) 獲得的兒童、女性及男性的貧血盛行率。**方法：**貧血盛行率為評估 0-5 歲、5-12 歲、12-15 歲的兒童，至少 15 歲以上的非懷孕及懷孕婦女以及至少 15 歲以上的男性，以調整家戶所在地的海拔高度及抽菸狀況的血紅蛋白作為評量標準。**結果：**與 1997/8 年的估計值相比，2007/8 年所有族群的貧血盛行率估計值均較低，其中在 5-12 歲兒童有最大的相對降幅 (25.4%)。趨勢分析發現全部族群的貧血顯著的隨著調查年份而降低 (懷孕婦女 $X^2 p=0.005$ ，所有其他組別 $X^2 p<0.001$)。**結論：**從 1997/8 到 2007/8 年，不同族群的 IFLS 貧血估計值與東南亞及其他印尼研究結果一致。儘管所有族群的貧血盛行率均降低，貧血依然是 0-5 歲幼兒、5-12 歲兒童及非懷孕及懷孕婦女中等的公共衛生問題。

關鍵字：貧血、血紅蛋白、印尼、IFLS、東南亞