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Article

The double burden of malnutrition in Indonesia: Social determinants and geographical variations

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ABSTRACT

The presence of simultaneous under- and over-nutrition has been widely documented in low- and middle-income countries, but global nutritional research has seen only a few large-scale population studies from Indonesia. We investigate the social determinants as well as the geographical variations of under- and over-nutrition in Indonesia using the largest public health study ever conducted in the country, the National Basic Health Research 2007 (N=645,032). Multilevel multinomial logistic regression and quantile regression models are fitted to estimate the association between nutritional status and a number of socio-economic indicators at both the individual and district levels. We find that: (1) education and income reduce the odds of being underweight by 10–30% but at the same time increase those of overweight by 10–40%; (2) independent from the compositional effect of poverty, income inequality is detrimental to population health: a 0.1 increase in the Gini coefficient is associated with an 8–12% increase in the odds of an individual's being both under- and overweight; and (3) the effects that these determinants have upon nutritional status are not necessarily homogeneous along the continuum of body mass index. Equally important, our analysis reveals that there is substantial spatial clustering of areas with elevated risk of under- or over-nutrition across the 17,000-island archipelago. As of 2007, under-nutrition in Indonesia remains a 'disease of poverty', while over-nutrition is one of affluence. The income inequality accompanying Indonesia's economic growth may aggravate the dual burden of under- and over-nutrition. A more equitable economic policy and a policy that improves living standards may be effective for addressing the double burden.

1. Introduction

The simultaneous presence of under- and over-nutrition within populations of developing countries undergoing rapid economic transition has been widely documented (Gillespie & Haddad, 2003; Jehn & Brewis, 2009). The changes in dietary intake patterns and leisure-time activities associated with industrialisation and urbanisation are known to have contributed to an increased prevalence of obesity in numerous countries (Popkin, 1998, 1999); at the same time, the problem of under-nutrition remains undefeated. This dual burden, which may also exist within a single household (Doak, Adair, Bentley, Monteiro, & Popkin, 2005; Lee, Houser, Must, de Fulladolsa, & Bermudez, 2012), is costly for the health as well as the economy of a nation. Under-nutrition impairs cognition (Sandjaja et al., 2013) and physical development (Mani, 2012), reduces economic productivity (Victora et al., 2008), raises the mortality rate, and even induces an intergenerational cycle of malnutrition (Barker, 1997); on the other extreme of the nutritional spectrum, over-nutrition is known to increase the risk of non-communicable diseases, inflate health care costs (Cawley & Meyerhoefer, 2012; Withrow & Alter, 2011), and reduce overall quality of life.

The body of nutritional epidemiology and development economics research suggests that, over and above the biological aspects of age and sex, socio-economic status, along with a number of ecological factors such as urban environment, area-level economic development and income inequality, seems to consistently determine the social distribution of malnutrition (Doak et al., 2005; Ha et al., 2011; Lee et al., 2012; Rahmanian et al., 2014; Roemling & Qaim, 2013; Shafique et al., 2007; Subramanian, Kawachi, & Smith, 2007; Vaezghasemi et al., 2014). Notwithstanding the increasing number of studies in this stream of research, the literature, however, does not yet include sufficient evidence from Indonesia, which is the most populous developing country after China and India. To date, empirical evidence tends to come from South Asia, Africa and Latin America (see for example

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Corsi, Finlay, & Subramanian, 2011 or Jehn & Brewis, 2009). Little is known about the double burden of malnutrition in Indonesia, despite the fact that it is in a state of rapid economic and epidemiologic transition where industrialisation, urbanisation and political decentralisation are met with rising income inequality, widening regional disparities and a diminishing rate of poverty reduction (World Bank, 2014). All existing studies focusing on Indonesia (Doak et al., 2005; Oddo et al., 2012; Roemling & Qaim, 2013; Vaezghasemi et al., 2014; Winkvist, Nurdiati, Stenlund, & Hakimi, 2000) have thus far (1) dealt specifically with the coexistence of under- and over-nutrition within the same households (double burden households), (2) concentrated only on particular population subgroups (women) or small geographical areas (relatively affluent western Indonesia), or (3) failed to account for the influence of macro-level contextual factors. A large-scale population study covering the entire 17,000-island archipelago is, to our knowledge, non-existent as 'there is little awareness of the double burden of malnutrition issues, be it in the government, the public or professional circles' (Shrimpton & Rokx, 2013: 6; see also WHO, 2010).

Exploiting the fact that a large, nationally representative sample has recently become available, this paper aims to investigate the social determinants as well as the geographical variations of under- and over-nutrition among adults aged 15 years and older living in 440 districts in Indonesia. In particular, we are interested in understanding (1) the pattern of association between an individual's socio-economic position and his or her nutritional status; (2) the influence of contextual factors at the district level on one's probability of being under- or overweight; and (3) the geographical distribution of the risk of malnutrition within the archipelago after accounting for the effects of observable socio-demographic determinants. Because understanding *who* gets the diseases and *where* the diseases strike is imperative for tackling the double burden (UNSCN, 2006: 7), insights gained from this analysis are of high relevance for the formulation of evidence- or need-based intervention measures—especially for policy targeting in Indonesia as well as in other parts of the developing world.

2. Methods

2.1. Data

The data are drawn from the Riset Kesehatan Dasar (National Basic Health Research; henceforth 'Riskesdas') 2007. Managed by the Ministry of Health of the Republic of Indonesia, Riskesdas is the largest public health research initiative ever carried out in the country. The repeated cross-sectional study includes 987,205 individuals from 258,366 households residing in all 440 districts and is thus representative of the Indonesian population (Kemenkes, 2008). Its size and geographical coverage clearly distinguish Riskesdas from the Indonesia Family Life Survey (IFLS) dataset (30,000 individuals living in 260 districts) that was analysed in some earlier studies (Doak et al., 2005; Roemling & Qaim, 2013). Hence, in addition to the benefit of additional statistical power, Riskesdas also offers the opportunity for researchers to extend their inferences to the deprived and usually neglected islands of the archipelago (Sulawesi, Maluku, Halmahera, Nusa Tenggara and Papua). Informed consent was obtained prior to interview and participants' confidentiality was strictly protected. Further details regarding ethical and sampling procedures are available through Kemenkes (2008).

Included in the sample of this study are adults aged 15 and older. After excluding pregnant women and individuals of extreme height (less than 100 cm or more than 200 cm) or weight (less than 25 kg or more than 200 kg), the final sample size was 645,032 individuals. This corresponds to approximately 97% of all adults who participated in the Riskesdas 2007 study.

2.2. Variables

The dependent variable is adult nutritional status as indicated by body mass index (BMI). BMI is calculated by dividing an individual's weight (in kilograms) by his or her squared height (in metres); following the standard adopted by the government of Indonesia (Kemenkes, 2008), the individual is then classified as 'underweight' ($BMI < 18.5$), 'normal' ($18.5 \leq BMI < 25$), 'overweight' ($25 \leq BMI < 27$), or 'obese' ($BMI \geq 27$). However, for the sake of computational feasibility as well as ease of understanding, we collapse the last two categories (see also Gurrici, Hartriyanti, Hautvast, and Deurenberg (1998) and WHO Expert Consultation (2004) for discussions regarding BMI cut-off points for obesity in the Indonesian context). Both the categorical representation of nutritional status and the continuous measure of BMI are used in the following statistical analysis.

The individual-level socio-economic explanatory variables of interest are education (indicator variables for primary education or less, secondary school, high school and college or more), employment status (dummy indicators for those who are not employed or in school) and per capita household expenditure (PCE) serving as a proxy for individual income. In Indonesia, as in many parts of developing world, the individual income measure is usually not available (reliable) due to the high prevalence of both self- and seasonal employment (60–70% in Indonesia; Nazara, 2010). The literature (Deaton & Zaidi, 2002; Howe et al., 2012) suggests that PCE is capable of delivering a good approximation for permanent income due to its insensitivity to intermittent income shock that is inherent in informal economy. Both the logarithmic and the quintile representations of PCE are used in the analysis.

At the district level, we include continuous measures of income inequality, level of economic development (median PCE in million Indonesian rupiah) and index of deprivation. Income inequality is measured using the Gini index on a scale of 0–1 and was derived from the PCE measure available in Survei Sosial Ekonomi Nasional (National Socio-economic Survey) 2007 dataset using the method described by Milanovic (1997). Subsequently, to aid with interpretation, this Gini index is multiplied by a factor of 10 before being used in any statistical modelling exercises. The deprivation index was calculated from the Potensi Desa (Village Census) 2008 dataset, covering all 75,410 villages across the archipelago. Factor loadings, proportion of shared variance as well as other statistics obtained during the derivation of the index are shown in Table 1. It is noteworthy, at this point, that the inclusion of measures of area-level economic development and facility deprivation alongside the income inequality variable allows researchers to separate the contextual effect of income inequality from the compositional effect of poverty (Subramanian & Kawachi, 2004).

In the statistical models described next, we also control for survey respondent age group (15–24, 25–34, 35–44, 45–54, 55–64, or 65+), sex (dummy variable for female survey respondents),

Table 1
Exploratory factor analysis of district deprivation index.

Proportion of village without	Factor loading	Summary statistics	
Communication facilities	0.86	Explained variance	88%
Electricity	0.81	Cronbach's α	0.82
Street lighting	0.76	Eigenvalue	3.58
Healthcare facilities	0.75	KMO	0.80
TV signal coverage	0.73	*N*	454
Education facilities	0.65		
Entertainment facilities	0.30		