

Commentary on the effects of gestational hypertension on new-onset diabetes mellitus

National Health Insurance (NHI) was initiated in March 1995 in Taiwan. The Taiwan NHI is a compulsory and unique system, and covers nearly all of Taiwan's residents; 96% in 2000, 98% in 2005 and 99.6% in 2010. Such a high coverage rate makes this system an excellent nationwide representative database for epidemiological research. A population sample of 1 million subjects obtained from the database allows privacy and provides good nationwide representation, except for rare diseases.

A cohort study usually provides more convincing evidence than a case-control study. However, cohort studies can be much more expensive and time-consuming than case-control studies. Taiwan's NHI database has been in place longer than 15 years, sufficient for most retrospective cohort analysis. This design can provide results before a prospective cohort study, and can act as a surrogate if well validated.

It is appropriate to use Taiwan's NHI database for investigating hypertensive disorder in pregnancy (HDP) and new-onset diabetes mellitus¹; both diseases still have important clinical questions that require answers. Gestational hypertension means hypertension after 20 weeks of pregnancy. If combined with proteinuria, patients are said to have pre-eclampsia, and the maternal and fetal risks are much higher. Therefore, blood pressure monitoring has become routine in the field of obstetrics. The complete schedule of pregnancy checkups in Taiwan includes 10 visits without copayment, which includes tests for urine protein/sugar, blood pressure and bodyweight.

Therefore, HDP can be routinely detected in Taiwan.

A validation study of diabetes mellitus was carried out using Taiwan's NHI in 2000². One discharge or at least three outpatient visits within 1 year with the diagnosis of diabetes mellitus (*The International Classification of Diseases*, 9th Revision, Clinical Modification code 250 or A code A181) was approximately 90% accurate for diagnosing diabetes², a rate much higher than the 75% that can be achieved for diagnosis based on one or more outpatient visits within 1 year. However, the article¹ did not address other definitions of diabetes. Therefore, the accuracy of the diagnosis of diabetes mellitus in the present study can be considered between 75 and 90%.

Hyperlipidemia and obesity were also analyzed for their effects on the onset of diabetes mellitus together with HDP, and the investigators provided a detailed table showing the interaction between these two factors and HDP. Bodyweight was routinely measured during pregnancy check-ups. The metabolic syndrome handbook in Taiwan was published by the Bureau of Health Promotion and Diabetes Association of the Republic of China in 2006. There was only limited consensus over the definition of obesity in Taiwan before its publication. No lipid lowering medications have been proved safe in pregnancy, and no recommendations or guidelines exist that suggest screening for hyperlipidemia in pregnancy. Therefore, the rates of hyperlipidemia (approximately 10%; $n = 555$) and obesity (2%; $n = 111$) in the present study might not represent the true prevalence of these diseases in Taiwan.

Insulin resistance has been shown to be associated with gestational hypertension³. After excluding patients with a history of hypertension or diabetes mellitus, those with gestational diabetes mellitus (GDM)

were also excluded from the present study. Therefore, unlike obesity and hyperlipidemia, the effects of interactions between HDP and GDM on the onset of diabetes mellitus cannot be clearly shown. Screening for GDM is not reimbursed by Taiwan's NHI, although it is not expensive. This article is helpful in that it provides persuasive evidence to encourage women with HDP to undergo GDM screening, even in the absence of general GDM screening reimbursement in Taiwan.

Since the beginning of the NHI program in 1995, a health check-up for adults is reimbursed without copayment every 3 years for those aged 40–64 years, and every year for those aged over 65 years. A health check-up for Taiwan's employees should be carried out every 2 years. Therefore, the detection rate of diabetes mellitus is lower for those aged <40 years. In Taiwan, the average age of first pregnancy is 29 years: screening during pregnancy might allow diabetes mellitus to be diagnosed at an earlier and asymptomatic stage.

There are many well-known risk factors for diabetes mellitus, including hypertension, hyperlipidemia, obesity, family history and GDM. To reduce the rate of undiagnosed diabetes mellitus, the Taiwan Diabetes Risk Score (TDRS) was developed to identify people at high risk⁴. The instrument was well validated and can be freely used online (www.diabetes.org.tw). Data for more than 10,000 people were collected during the first year of the tool's availability online. The instrument can also help to identify those at high risk who are aged <40 years, and prompt the checking of blood glucose levels in such people.

With the conclusion from this article and previous studies, the checklist for glucose screening at the peri-pregnancy period is summarized in Table 1. The TDRS⁴ can be checked at the first

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Table 1 | Checklist and candidates recommended for peri-pregnancy glucose screen in Taiwan

Visits for pregnancy	Recommendation	Candidates
First visit	Screen for diabetes mellitus	TDRS* positive (obese, hypertension, family history of diabetes, age) or dyslipidemia
Each visit	Blood pressure and urine protein/sugar	All women
24–28 weeks	Screen for gestational diabetes	All women
Postpartum 6–12 weeks	Screen for diabetes mellitus	Gestational diabetes/hypertension Giant baby (>4 kg birthweight) TDRS* very high risk (>20%) Dyslipidemia

*Taiwan Diabetes Risk Score (TDRS)⁴. Risk category: low (<5%), middle (5–10%), high (10–20%), very high risk (>20%).

pregnancy check-up visit. Screening for diabetes was recommended if there was one or more positive item(s) in the TDRS (obese, hypertension, family history of diabetes, age) or if there was hyperlipidemia. Blood pressure/urine dipstick for sugar or protein at each visit and gestational diabetes screening at 24–28 weeks of pregnancy have been a standard for gynecologists. Pregnant women in the high-risk group for diabetes (gestational diabetes or hypertension, dyslipidemia, giant baby [>4 kg birthweight]) for should be screened at 6–12 weeks postpartum. Furthermore, the very high-risk group in TDRS (diabetes risk >20%) should be screened annually in Taiwan. Therefore, these women should also be rechecked for diabetes mellitus at 6–12 weeks postpartum, as well as at their first pregnancy visit.

Taiwan maintains comprehensive care for patients with diabetes, and the mortality from diabetes decreased approximately 20% from 2000 to 2009⁵. However, there is still room to improve screening and early detection of diabetes. Taiwan's NHI should reevaluate their policies regarding reimbursement for GDM and diabetes mellitus screening during pregnancy, because pregnancy provides an excellent opportunity to detect diabetes mellitus at an early stage, allowing early intervention for young adults with diabetes⁵.

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