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Effects of Gestational Weight Gain on Pregnancy Outcomes According to Siriraj Recommendations in Thai Obese Women

Mareena Binraheem, M.D.,*,
Sitchuphong Noothong, M.D.,*,
Warangkana Kolaka, M.D.,*.

** Department of Obstetrics and Gynecology, Hatyai Hospital, Hatyai, Songkhla 90110, Thailand*

ABSTRACT

Objectives: To evaluate the effect of gestational weight gain on maternal and fetal outcomes according to Siriraj recommendations in Thai obese women.

Materials and Methods: This was a retrospective cohort study of obese Thai women with term-singleton pregnancy. We used The Regional Office for Western Pacific Region of WHO (WPRO) BMI criteria for Asians to define obesity. Data was collected from 1 January 2014 to 31 December 2015. Three hundred and eighty patients were included into this study, 235 patients were in obese class I (BMI 25-29.9 kg/m^2) and 145 patients were in obese class II (BMI >30 kg/m^2). Statistical analyses of adverse maternal and neonatal outcomes between excessive gestational weight gain (GWG) and normal GWG, based on Siriraj recommendations, were assessed.

Results: When compare with normal GWG group, excessive GWG in obese class I and obese class II had greater risk of adverse neonatal outcomes including large for gestational age (LGA), macrosomia and higher birth weight, with statistical significance. Excessive GWG in obese class I and obese class II also had statistically-significant higher risk of adverse maternal outcomes, including severe preeclampsia, postpartum hemorrhage (PPH), cephalopelvic disproportion (CPD) and increased rate of cesarean delivery.

Conclusion: Obese Thai women with term-singleton pregnancy should have GWG according to Siriraj recommendations. Excessive GWG women were associated with increased risk of LGA, macrosomia and higher birth weight. Adverse maternal outcomes were also greater including preeclampsia, PPH, CPD and increased rate of cesarean section.

Keywords: gestational weight gain, obesity, pregnancy outcomes, Siriraj recommendations

Correspondence to: *Sitchuphong Noothong, M.D., Department of Obstetrics and Gynecology, Hatyai Hospital, Hatyai, Songkhla 90110, Thailand, Tel. 66817666263, E-mail: sitchupom@hotmail.com*

ผลของน้ำหนักที่เพิ่มขึ้นระหว่างตั้งครรภ์ตามคำแนะนำของโรงพยาบาลศิริราชต่อผลลัพธ์ของการตั้งครรภ์ในหญิงไทยที่มีภาวะอ้วน

มารีนา บินระหีม, ศิชฌุพงศ์ หนูทอง, วรางคณา โกละกะ

บทคัดย่อ

วัตถุประสงค์: *เพื่อศึกษาผลของน้ำหนักที่เพิ่มขึ้นระหว่างตั้งครรภ์ตามคำแนะนำของโรงพยาบาลศิริราชต่อผลลัพธ์ของการตั้งครรภ์ในหญิงไทยที่ภาวะอ้วน*

วัสดุและวิธีการ: *เป็นการศึกษาเชิงวิเคราะห์แบบตามรุ่นย้อนหลัง ในสตรีครรภ์เดี่ยวที่ตั้งครรภ์ครบกำหนดและมีภาวะอ้วนตามเกณฑ์ของ The Regional Office for Western Pacific Region of WHO (WPRO) BMI criteria for Asians ที่มาฝากครรภ์ ณ โรงพยาบาลหาดใหญ่ รวบรวมข้อมูลจากเวชระเบียน ตั้งแต่ 1 มกราคม 2557 ถึง 31 ธันวาคม 2558 จำนวน 380 คน ประกอบด้วย กลุ่ม obese class I 235 คน (BMI 25-29.9 kg/m^2) และ กลุ่ม obese class II 145 คน (BMI >30 kg/m^2) ภาวะแทรกซ้อนของการตั้งครรภ์ในมารดาและทารกแรกเกิด ในสตรีครรภ์เดี่ยวที่ตั้งครรภ์ครบกำหนดและมีภาวะอ้วนที่น้ำหนักขึ้นตามเกณฑ์และเกินเกณฑ์ตามคำแนะนำของโรงพยาบาลศิริราชจะถูกนำมาวิเคราะห์ทางสถิติ*

ผลการวิจัย: *สตรีครรภ์เดี่ยวที่ตั้งครรภ์ครบกำหนดและมีภาวะอ้วนร่วมกับน้ำหนักขึ้นเกินเกณฑ์ของโรงพยาบาลศิริราช ทั้งกลุ่ม obese class I และ obese class II มีความเสี่ยงที่จะมีทารกตัวโตกว่าอายุครรภ์ น้ำหนักแรกเกิดมากกว่า 4,000 กรัม รวมทั้งมีน้ำหนักแรกเกิดมากกว่ากลุ่มที่น้ำหนักขึ้นตามคำแนะนำของโรงพยาบาลศิริราชอย่างมีนัยสำคัญทางสถิติ สำหรับในมารดาการมีน้ำหนักขึ้นมากกว่าคำแนะนำของโรงพยาบาลศิริราชเพิ่มความเสี่ยงต่อภาวะครรภ์เป็นพิษชนิดรุนแรง ภาวะตกเลือดหลังคลอด การผิดสัดส่วนระหว่างศีรษะทารกกับกระดูกเชิงกราน และเพิ่มอัตราการผ่าตัดคลอด อย่างมีนัยสำคัญทางสถิติ โดยความเสี่ยงจะเพิ่มมากขึ้นในกลุ่ม obese class II*

สรุป: *หญิงที่มีภาวะอ้วนและมีน้ำหนักขึ้นเกินเกณฑ์ตามคำแนะนำของโรงพยาบาลศิริราชจะเพิ่มความเสี่ยงที่จะมีทารกตัวโตกว่าอายุครรภ์ และน้ำหนักแรกเกิดมากกว่า 4,000 กรัม รวมทั้งเพิ่มความเสี่ยงต่อภาวะครรภ์เป็นพิษ ภาวะตกเลือดหลังคลอด การผิดสัดส่วนระหว่างศีรษะทารกกับกระดูกเชิงกราน และเพิ่มอัตราการผ่าตัดคลอด*

คำสำคัญ: *น้ำหนักระหว่างตั้งครรภ์, อ้วน, ผลลัพธ์ของการตั้งครรภ์, คำแนะนำโรงพยาบาลศิริราช*

Introduction

Obesity has become a major health problem worldwide. Developing countries are experiencing increased rate of obesity. World Health Organization (WHO) reported that more than 400 million adults were obese[1], similar to Thailand situation. Thailand National Health Examination Survey reported a significant increase in the prevalence of overweight and obesity, from 25% in 1991 to 48% in 2004 in a sample of Thai adults aged 35–59 years[2].

Obesity can lead to serious diseases and adverse health conditions such as cardiovascular disease, dyslipidemia, diabetes mellitus, cerebrovascular disease and hypertension[3]. Obese women who get pregnant may predispose to serious adverse pregnancy outcomes, increased morbidity and mortality rates.

Obese pregnant women may predispose to obstetric complications. Neonatal complications include neonatal large for gestational age (LGA), macrosomia and birth asphyxia. Influence of various factors on the fetal overgrowth were studied such as maternal obesity, gestational diabetes mellitus (GDM), maternal excessive gestational weight gain (GWG), previous neonatal LGA, and ethnicity[4]. Fetal overgrowth increases risks of shoulder dystocia, genital tract lacerations, emergency cesarean delivery and uterine atony. Other adverse maternal complications include the greater requirement of insulin for patients with diabetes, emergency cesarean section, preeclampsia, gestational hypertension, increased placental weight, shoulder dystocia, post-term pregnancy, postpartum hemorrhage (PPH), puerperal infection and prolonged length of hospital stay[5,6]. Moreover, the greater hospital's resources are used according to increased pregnancy complications.

Because body size of Asian women were smaller than Western women, the Regional office for Western Pacific Region of WHO (WPRO) proposed BMI criteria for Asians[7], obesity was defined as BMI more than or equal to 25 kg/m^2, which suitable for Thai women. Obesity was further classified into 2 subgroups, obese class I (BMI: 25-29.9 kg/m^2) and obese class II (BMI more than or equal to 30 kg/m^2).

Excessive GWG can lead to adverse obstetric complications, such as preeclampsia, GDM and increased cesarean section rate[8]. However excessive GWG is one of the preventable causes, especially in obese woman. In 2009 The Institute of Medicine (IOM) published the recommendations for pregnancy weight gain[9]. Overweight patients should have GWG about 7-11 kg and obese patients (all classes) should have GWG about 7-9 kg. Based on the updated IOM recommendations, less than half of the Thai pregnant women gained optimal weight according to these recommendations[10].

In 2014, the most recent recommendations for GWG in Thai population, Siriraj recommendations for GWG were published. Optimal GWG for obese class I was 6-14 kg and 4-8 kg for obese class II[10]. However, there were few studies about pregnancy outcomes of obese pregnant women who have GWG followed Siriraj recommendations. This study was performed to evaluate the effect of gestational weight gain on maternal and fetal outcomes according to Siriraj recommendations in Thai obese women.

Materials and Methods

This study was retrospective cohort design, performed at Hatyai Hospital, Songkhla, Thailand. After obtaining approval from Institutional Review Board (protocol number : 64/2559), electronic hospital database and medical record were reviewed (from 1 January 2014 to 31 December 2015). The cohort study for binary data formula was used for sample size calculation. Prepregnant-obese Thai women with singleton pregnancy were included. All patients must attend the antenatal care clinic from the first trimester of pregnancy. Obesity was defined as BMI more than or equal to 25 kg/m^2 according to WPRO criteria for Asians. Participants who were diagnosed prepregnancy

medical conditions were excluded (such as hypertension, diabetes mellitus, thyroid diseases, autoimmune diseases, heart diseases, respiratory diseases, renal diseases etc.). Because GDM may affect neonatal birthweight[11], patients with this condition were also excluded from the study. A two-step approach was used for diagnosed GDM in our institute. The test was performed at first prenatal visit for high risk patients or those at 24-28 weeks. All included participants had to deliver at 37-42 completed weeks. Patients were categorized into two groups according to prepregnancy BMI (obese class I and obese class II). Optimal and excessive GWG in each group followed Siriraj recommendations.

Maternal and neonatal outcomes were evaluated. The following variables were defined as (a) LGA: a birth weight more than or equal to 90th percentile for age, based on birthweight of neonates for gestational age (GA) from the study of The King Chulalongkorn Memorial Hospital[12] (b) Neonatal macrosomia: a birth weight was at least 4 kg (c) Neonatal hypoglycemia: blood glucose <40 mg/dL after delivery. (d) Birth asphyxia: APGAR score less than or equal to 7 points at 1 and 5 minutes after delivery. (e) PPH: blood loss was at least 500 mL after third stage of labor in vaginal delivery and at least 1,000 mL in cesarean delivery. (f) cephalopelvic disproportion (CPD): obstructed labor resulting from disparity between the fetal head size and maternal pelvis followed by WHO partograph based on diagnostic criteria[13] (g) Failed induction of labor: defined as failure to generate regular (e.g. every 3 minutes) contractions and cervical change after at least 24 hours of oxytocin administration, with artificial membranes rupture if feasible[14].

Data were analyzed using the STATA version 13.0. Continuous data was analyzed with Mann-Whitney U Test. Categorical data was analyzed with Chi-Squared and Fisher's Exact test. Results were expressed as the relative risk (RR) with 95% confidence interval (CI). Statistical significance was considered when p value < 0.05.

Results

Three hundred and eighty singleton obese pregnant women were included (Obese class I: 235, Obese class II: 145). The patients were categorized into two subgroups, excessive and optimal GWG. In obese class I group, median total GWG in excessive and optimal GWG patients were 15.5 kg (IQR:14.53, 17.35) and 8 kg (IQR:7, 10), respectively ($p < 0.01$). Likewise, obese class II group, median total GWG in excessive GWG patients was 11 kg (IQR:10, 13.20) while median optimal GWG patients was 6.55 kg (IQR:5, 7.70). P value of this difference was less than 0.01. Baseline characteristics of class I and II obese patients were shown in Table 1.

When compared excessive GWG with optimal GWG group: neonatal LGA, macrosomia and birth weight were statistically significant difference in both obese class I and II patients. In obese class I group, median neonatal birthweight in excessive and optimal GWG patients were 3,290 g (IQR: 3,050, 3,690) and 3,177 g (IQR: 2,915, 3415), respectively. This difference was statistical significance ($p < 0.01$). Likewise, obese class II group, median birth weight in excessive GWG patients was 3,436 g (IQR: 3,030, 3,815) while median optimal GWG patients was 3,060 g (IQR: 2,820, 3,310). Considered in obese class I and II, other neonatal outcomes including hypoglycemia, birth asphyxia, and neonatal intensive care unit (NICU) admission were similar between excessive GWG and optimal GWG group. Detailed information about neonatal complications was presented in Table 2.

Maternal outcomes of obese class I and II were shown in Table 3. Statistically significant higher rate of severe preeclampsia, PPH and cesarean section were presented in excessive GWG when compared with optimal GWG group. CPD was the most common indication for cesarean section in both obese class I and II patients. There were significant higher rate of CPD in excessive GWG group in both obese class I and II patients. Detailed information about maternal outcomes was presented in Table 3.

Table 1. Maternal characteristics of obese class I and obese class II patients.

Characteristics	Obese class I (n=235)			Obese class II (n=145)		
	Excessive GWG (n=105)	Optimal GWG (n=130)	p value	Excessive GWG (n=75)	Optimal GWG (n=70)	p value
Age			0.08[a]			0.32[a]
< 20 years	17 (16.19%)	16 (12.31%)		9 (12.00%)	4 (5.71%)	
20-34 years	79 (75.24%)	90 (69.23%)		57 (76.00%)	54 (77.14%)	
≥ 35 years	9 (8.57%)	24 (18.46%)		9 (12.00%)	12 (17.15%)	
Parity			0.19[a]			0.09[a]
Primiparous	35 (33.33%)	33 (25.54%)		23 (30.67%)	13 (18.57%)	
Multiparous	70 (66.67%)	97 (74.46%)		52 (69.33%)	57 (81.43%)	
GA at first ANC (weeks) median (IQR)	9 (7, 11)	10 (8, 12)	0.33[b]	9 (7, 12)	10 (8, 12)	0.35[b]
Prepregnancy BMI median (IQR)	27.80 (27.50, 28)	27.8 (27.50, 28.19)	0.98[b]	32 (31, 34)	32 (30.43, 34.22)	0.42[b]
GA at delivery (weeks)			0.74[a]			0.49[a]
Early term (37-38^{+6})	39 (37.14%)	47 (36.15%)		29 (38.67%)	29 (41.43%)	
Full term (39-40^{+6})	57 (54.29%)	75 (57.69%)		39 (52%)	38 (54.29%)	
Late term (41-41^{+6})	9 (8.57%)	8 (6.16%)		7 (9.33%)	3 (4.28%)	

[a] Chi-squared, [b] Mann-Whitney U Test

Table 2. Neonatal complications between excessive GWG and optimal GWG.

Outcomes	Obese class I (n=235)				Obese class II (n=145)			
	Excessive GWG (n=105)	Optimal GWG (n=130)	RR (95% CI)	p value	Excessive GWG (n=75)	Optimal GWG (n=70)	RR (95% CI)	p value
Neonatal LGA	46 (43.81%)	28 (21.54%)	2.03 (1.37-3.01)	< 0.01[a]	41 (54.67%)	12 (17.14%)	3.19 (1.83-5.55)	< 0.01[a]
Macrosomia	8 (7.62%)	2 (1.54%)	4.95 (1.07-22.83)	0.05[b]	10 (13.33%)	1 (1.43%)	9.33 (1.22-71.04)	0.01[b]
Hypoglycemia	3 (2.86%)	1 (0.77%)	3.71 (0.39-35.19)	0.33[b]	5 (6.67%)	3 (4.29%)	1.56 (0.39-6.27)	0.72[b]
Birth asphyxia	2 (1.90%)	2 (1.54%)	1.24 (0.18-8.64)	1.00[b]	4 (5.33%)	2 (2.86%)	1.87 (0.35-9.88)	0.68[b]
NICU admission	2 (1.90%)	1 (0.77%)	2.48 (0.23-26.93)	0.59[b]	3 (4.00%)	2 (2.86%)	1.40 (0.24-8.13)	1.00[b]

[a] Chi-squared, [b] Fisher's exact test

Table 3. Maternal complication between excessive GWG and optimal GWG.

Outcomes	Obese class I (n=235)				Obese class II (n=145)			
	Excessive GWG (n=105)	Optimal GWG (n=130)	RR (95% CI)	p value	Excessive GWG (n=75)	Optimal GWG (n=70)	RR (95% CI)	p value
Severe preeclampsia	14 (13.33%)	5 (3.85%)	3.47 (1.29-9.31)	0.01[a]	15 (20.00%)	3 (4.29%)	4.67 (1.41-15.43)	0.01[b]
Genital tract lacerations	5 (4.76%)	3 (2.31%)	2.06 (0.51-8.44)	0.47[b]	4 (5.33%)	1 (1.43%)	3.73 (0.43-32.60)	0.39[b]
Operative vaginal delivery	3 (2.86%)	5 (3.85%)	0.74 (0.18-3.03)	0.74[b]	4 (5.33%)	2 (2.86%)	1.87 (0.35-9.88)	0.68[b]
PPH	9 (8.57%)	2 (1.54%)	5.57 (1.23-25.23)	0.01[b]	9 (12.00%)	1 (1.43%)	8.4 (1.09-64.61)	0.02[b,*]
Cesarean section	36 (34.28%)	14 (10.77%)	3.18 (1.82-5.58)	< 0.01[a]	33 (44.00%)	9 (12.87%)	3.42 (1.77-6.63)	< 0.01[a]
CPD	17 (16.19%)	6 (4.61%)	3.51 (1.43-8.58)	< 0.01[a]	12 (16.00%)	3 (4.29%)	3.73 (1.10-12.68)	0.03[b]
Fetal distress	6 (5.71%)	4 (3.08%)	1.85 (0.54-6.41)	0.35[b]	6 (8.00%)	2 (2.86%)	2.8 (0.59-13.41)	0.28[b]
Failed induction of labour	6 (5.71%)	2 (1.54%)	3.71 (0.77-18.02)	0.14[b]	9 (12.00%)	2 (2.86%)	4.2 (0.94-18.77)	0.06[b]
Previous cesarean section	3 (2.86%)	1 (0.77%)	3.71 (0.39-35.19)	0.33[b]	2 (2.67%)	1 (1.43%)	1.87 (0.17-20.13)	1.00[b]
Others	4 (3.81%)	1 (0.77%)	4.95 (0.56-43.64)	0.18[b]	4 (5.33%)	1 (1.43%)	3.73 (0.42-32.60)	0.37[b]

[a] Chi-squared, [b] Fisher's exact test

Discussion

Neonatal birth weight in excessive GWG group was higher than optimal GWG group with statistical significance in both obese class I and obese class II. The rates of following neonatal complications including neonatal LGA and macrosomia were significant higher in women with excessive GWG, too. Excessive GWG was not only affected the neonatal birth weight, but also affected several maternal outcomes. In this study, there were significant increased incidence of severe preeclampsia, PPH, cesarean section rate, and emergency obstetric conditions due to CPD.

These outcomes were similar to previous studies. Neonatal LGA were associated with fetal and maternal risk[15-17]. Fetal risk included birth trauma, e.g., shoulder dystocia, brachial plexus injury and death[18]. Interestingly, no shoulder dystocia was found in the present study. However, the rate of shoulder dystocia may be affected from difference decision making of the obstetrician in performing cesarean section. Maternal risk for neonatal LGA included genital tract lacerations, prolonged labor, uterine atony and increased cesarean section rate[19]. The risk that mentioned above was related to increased incidence of life threatening complications and hospital expenses, especially PPH.

At two hours after delivery, there was no statistically significant difference in the incidence of

neonatal hypoglycemia between two groups in obese class I and obese class II. This finding was different from the study of Stotland et al., which reported significant higher incidence of neonatal hypoglycemia in excessive GWG group[20]. The incidence of neonatal hypoglycemia might be affected from subclinical insulin resistance mentioned in Stotland's study. However, early breast feeding policy in our institute might prevent hypoglycemia in neonates. Other adverse neonatal outcomes such as birth asphyxia and NICU admission rate were not statistically significant difference between two groups.

Because obesity and excessive GWG were characterized by insulin resistance, causing inflammation and endothelial activation, excessive GWG in obese pregnant women was associated with preeclampsia. The volume of extracellular fluid, manifest as edema, is usually much greater than that in normal pregnant women. The mechanism responsible for pathological fluid retention is thought to be endothelial injury[21]. Thus this may increased incidence of preeclampsia in excessive GWG. This hypothesis was supported by the increased rate of preeclampsia in obese pregnant women. It increases from 1.4% in women with normal prepregnancy BMI to 2.5% in those with BMI 25-29.9 kg/m^2 and 4.7% in those with BMI greater than or equal to 30 kg/m^2 [22]. Moreover, Swank et al reported higher frequencies of preeclampsia in excessive GWG patients with statistical significance[23], as same as findings from our study. Cesarean section rate was related to excessive GWG and obesity. The most common obstetric indication for cesarean section was CPD. One reason was obese pregnant women tend to increased thickness of pelvic soft tissue, resulting in a narrow birth canal[24]. In addition, obese pregnant women were susceptible to have LGA that could not easily passed birth canal.

Moreover, cesarean section also increased risk of infections, damage of adjacent organs and bleeding from uterine atony and laceration. At the same time, cesarean section was associated with complications from regional and general anesthesia. Incidence of other adverse maternal outcomes such as genital tract lacerations and operative vaginal delivery were not significant difference between two groups.

PPH was a one of significant associated factor, regardless of route of deliveries. It had highest relative risk in both obese class I and II comparing with other factors. PPH was multifactorial causes, the results might be confounded by increased cesarean section rate, and obstetric injuries from large fetus. However, avoid excessive GWG brought to decrease risk of PPH, a life-threatening condition.

IOM recommendations on GWG were appropriate for western population. In 2014, Siriraj recommendations were published and applied for Asian pregnant women, especially Thai population. There were few studies about pregnancy outcomes according to Siriraj recommendations. We followed GWG of obese pregnant women based on this guideline and pregnancy complications were evaluated.

In Thailand, the impact of prepregnancy BMI for obese pregnant has not been well studied. Several studies demonstrated that body size of Thai population was smaller than western population, so BMI greater than or equal to 25 kg/m^2 was appropriate cut-off point for obesity in Thai population. The study of Pongchaiyakul et al supported this cut-off point because percentage of body fat in Thai population at BMI greater or equal to 25 kg/m^2 were not different from obese Caucasian populations[25].

The Siriraj recommendations for GWG are applicable to obese Asian women because their body sizes were similar to pregnant Thai women. Moreover, Siriraj recommendations for GWG are effective as IOM recommendations, supported by the present study results. The authors compared adverse maternal outcomes between the patients whom GWG according to Siriraj recommendations and IOM recommendations were archived, the results were equivalent. From the reasons that mentioned above, pregnant Thai women should have GWG be in line with Siriraj recommendations.

Obesity and excessive GWG were preventable. Ida et al., reported that appropriate nutritional care,

advice and body weight follow-up not only controlled GWG but also significantly reduced emergency cesarean section rate and postpartum weight retention[26]. Weight control and nutritional care during pregnancy were beneficial for obese pregnant women. Multidisciplinary teams can use this result for counseling obese women about preconception planning, diet, and physical activities for prevent intrapartum and postpartum complications. The present study collected clinical data based on Thai population. The results can be used as reference outcomes for obese Asian pregnant women which body size were proportionate to obese Thai pregnant women.

Siriraj recommendations and IOM guidelines yielded similar pregnancy outcomes, including neonatal and maternal outcomes. The proportion of subjects who gained optimal weight according with Siriraj recommendations and IOM recommendations was 60% and 40%, respectively. Similar to Siriraj recommendations, this study not only showed high cesarean section rate, incidence of severe preeclampsia and low operative vaginal deliveries, but also displayed high incidence of LGA. Following Siriraj recommendations, bad outcomes seem to be decreased. It could be implied that these recommendations are suitable for Thai obese women.

Retrospective design was a limitation of this study. This observational study was not addressing the long-term neonatal and maternal outcomes. Future study may be performed to explore long-term complications of excessive GWG.

Conclusion

obese Thai women with term-singleton pregnancy who was diagnosed excessive GWG according to Siriraj recommendations were associated with increased risk of neonatal LGA, macrosomia and higher birth weight. Adverse maternal outcomes were also greater including severe preeclampsia, CPD, cesarean section rate and PPH. Siriraj recommendations for GWG is applicable to obese Thai pregnant women, including obese Asian pregnant women.

Potential conflicts of interest

The authors declare no conflict of interest.

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