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LETTER TO THE EDITOR

Reply to critical comments on the article 'Increased risk of developing psychiatric disorders in children with attention deficit and hyperactivity disorder (ADHD) receiving sensory integration therapy: a population-based cohort study'

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Lai et al. present comments on our article, entitled "Increased risk of developing psychiatric disorders in children with attention deficit and hyperactivity disorder (ADHD) receiving sensory integration therapy: a population-based cohort study" [1]. They propose that our study failed to address the effectiveness of sensory integration (SI) therapy for children with ADHD. They challenge our study design, although they fail to indicate that SI therapy is not currently in the clinical practice guidelines from the American Academy of Pediatrics for the treatment of ADHD. To date, there is still no clear indication of how often or with what dosage a child with ADHD should receive SI therapy to demonstrate the treatment effectiveness.

Methylphenidate (MPH) therapy and psychosocial interventions are the management approaches adopted by clinical practice guidelines to improve ADHD symptoms, such as inattention, hyperactivity, or impulsivity [2, 3]. Although MPH therapy is not recommended for children under 7 years of age as the first-line treatment, research evidence has suggested that multi-model management strategies (including parent or teacher behavioral training, or social skills training) are more suitable for younger children with ADHD [2–4]. Evidence on the effectiveness of SI is limited due to small study samples [5], lack of a clear definition of SI intervention dosage [6], poor compliance or premature termination of the intervention [5, 7], heterogeneous sample, or inappropriate selection on outcome measures [8]. Using the large pediatric data set of Taiwan, our study found that, among children with ADHD recorded as receiving SI therapy, 77.8% received no ADHD medications and 56.5% received no psychosocial interventions. These observations suggest that parents may choose SI for their children with ADHD, but do not seek evidence-based multi-model management. From our findings, and as acknowledged in the manuscript, we are unable to infer a causal association between SI and psychiatric disorder. Additional studies are needed to evaluate the effectiveness of SI therapy.

Some parents of children with ADHD are more likely to prefer alternative treatments (such as SI) than guideline-indicated management approaches provided by child and

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Table 1 Incidence and hazard ratio of psychiatric disorder by SI frequency for ADHD children in the SI cohort compared to a propensity score matched non-SI cohort

Variables	ADHD child			Hazard ratio (95% CI)	
	Event	PY	Rate	Crude	Adjusted[¤]
Non-SI	368	11,955	30.8	Ref.	Ref.
SI, frequency					
1 prescription	152	2938	51.7	1.68 (1.39–2.03)***	1.67 (1.38–2.03)***
2–3 prescriptions	91	2067	44	1.45 (1.16–1.83)**	1.42 (1.12–1.78)**
> 3 prescriptions	234	6606	35.4	1.14 (0.96–1.34)	1.15 (0.97–1.35)

PY person-years, *Rate* incidence rate (per 1000 person-years), *CI* confidence interval

[¤]Multivariate Cox model controlling for age, gender, comorbidities, psychosocial interventions, and drug used. Comorbidity included cerebral palsy, autism, hearing loss, delay development, or mental retardation

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

adolescent psychiatrists due to the social stigma associated with mental illness [9]. These parents are generally unaware of treatment using both psychosocial intervention and medication as a normal practice to prevent subsequent psychiatric disorders [1], instead of relying on only SI [5].

Lai et al. suspect that index dates for the non-SI cohort were defined differently from the SI cohort in our study resulting in an underestimation of the risk of psychiatric disorder for the non-SI cohort. In fact, distributions of all covariates between our study cohorts were similar, because the two cohorts were established frequency-matched by propensity score, with similar inclusion and exclusion criteria. Children with psychiatric disorder at baseline were excluded from both cohorts. Therefore, we feel that it is unlikely that the risk was underestimated in the non-SI cohort.

In regard to the effect of SI 'dosage', we performed an additional data analysis also using the insurance claims data of Taiwan from 1996 to 2013 to evaluate whether the psychiatric disorder risk varies by the frequency of SI therapy for ADHD children under 18 years of age. The table shows that the hazard ratio of developing psychiatric disorder reduces with the frequency of SI therapy for ADHD children, suggesting that more frequent SI may be helpful (Table 1).

In response to the comments by Lai et al.: to conduct a time-dependent analysis, a clearer guideline is needed for the duration of exposure to SI that demonstrates its efficacy. Unfortunately, such information is not available. Our data analysis, therefore, adopted the 'intention to treat' design based on the initial treatment assignment [10].

In conclusion, we agree that these results might further influence the decision-making in insurance policies or clinical guidelines. We would like to emphasize that our results suggest that therapy combining psychosocial interventions and pharmacotherapy may be more helpful than SI therapy alone, only medication, or only psychosocial intervention. Parents or caregivers who seek SI for their children deserve psychoeducation on multi-model management. Further studies are still needed to evaluate how variations in treatment affect outcomes in the care of ADHD children.

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Compliance with ethical standards

Conflict of interest Authors declare no financial or personal conflict of interest with a third party, whose interest would influence the article's contents.

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