A Review of

Maternal anxiety versus depressive disorders: specific relations to infants' crying, feeding and sleeping problems

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1. Introduction

Giving birth to a baby is not always a happy thing to mothers. In fact, statistics shows that each year 80% of mothers who give birth suffer from emotional disruption. 10% to 20% of those new mothers are clinically diagnosed to have postpartum depression (Postpartum Progress Inc.). It worsen the situation when 49% of the mothers who suffer from postpartum depression did not seek helps from doctors or psychiatrists. Moreover, 38% of the mothers who have depression disorder during pregnancy wanted to commit suicide (Royal College of Psychiatrists). Mother's mental health has profound impacts on their children even during pregnancy period. Early detection of mother's mental disorders will help to improve children's health condition. The research that we discussed in this review aims to find the relations between mother's mental condition and infant's regulation problems. The following sections include a summary of the research, a simulation of its calculation, reflections on its contributions and limitations, and some recommendations on the future studies and applications.

2. Summary of the Paper

2.1 Research Question

The paper being discussed is co-authored by J. Petzoldt, H. U. Wittchen, F. Einsle and J. Martini from Technische Universität Dresden, Dresden, Germany. It studies the relationship of maternal anxiety and/or depressive disorder with infants' excessive crying, feeding and sleeping problems. Specifically, 3 questions were investigated.

1) What is the occurrence pattern of excessive crying, feeding and sleeping problems in infants of mothers with and without anxiety and/or depressive disorders?
2) Will maternal anxiety and/or depressive disorders prior to, during and after pregnancy predict later excessive crying, feeding and sleeping problems in infants?
3) Is there any difference in infants of primiparous and multiparous mothers?

2.2 Method

The analysis is based on the Maternal Anxiety in Relation to Infant Development (MARI) Study, a longitudinal research that is conducted on 286 dyads of mothers and their infants from early pregnancy until 16 months postpartum. Composite International Diagnostic Interview for Women (CIDI-V) is used to assess the maternal anxiety and depressive disorders. Mothers are grouped into the 4 groups (Figure 1) and regular assessments were carried out in the early pregnant phase, during pregnancy and after delivery. Questionnaire and interviews (Baby-DIPS) were used to assess infants' regulation problems. To further investigate anxiety and depressive disorders from their comorbid presentation, the research also studied the 286 mothers in another way of grouping (Figure 2).

Group	Description
No AD	No anxiety or depressive disorder
Pure A	Pure anxiety disorder
Pure D	Pure depressive disorder
Comorbid AD	Comorbid anxiety and depressive disorder

Figure 1. Groups of mothers

Group	Description
No anxiety disorder	No anxiety disorder
Any anxiety disorder	Comorbid anxiety and depressive disorder, Pure anxiety disorder
No depressive disorder	No depressive disorder
Any depressive disorder	Comorbid anxiety and depressive disorder, Pure depressive disorder

Figure 2. Another grouping of mothers

2.3 Results and Discussion

1) *What is the occurrence pattern of excessive crying, feeding and sleeping problems in infants of mothers with and without anxiety and/or depressive disorders?*

The result shows that excessive crying was significantly related to feeding problems (p-value < 0.001), and feeding problems were significantly associated with sleeping problems (p-value = 0.021). Additional research on other sociodemographic factors shows that infants' regulation problems are not associated with most of the factors. However, younger (p-value = 0.004) and lower educated (p-value = 0.035) mothers were more likely to have excessively crying babies. Moreover, lower infant weight often predicts later feeding problems (p-value = 0.035).

2) *Will maternal anxiety and/or depressive disorders prior to, during and after pregnancy predict later excessive crying, feeding and sleeping problems in infants?*

   The results show a strong co-relationship between mother's mental health conditions and infant regulation problems. Generally, anxiety disorder predicts infant's crying and feeding problems. Infant's sleeping problem is significantly associated with depressive disorder. More specifically, excessive crying is significantly associated with pure anxiety disorder prior to and during pregnancy. Feeding problem was significantly associated with comorbid anxiety and depressive disorders prior to, during and after pregnancy. Sleeping problem was significantly associated with any Depressive disorders prior to, during and after pregnancy.

3) *Is there any difference in infants of primiparous and multiparous mothers?*

   The results show a significant difference in infants of primiparous mothers and multiparous mothers. For first-time mothers, excessive crying and feeding problems were found to be more frequently associated with anxiety disorder. However, this association was not significant in experienced mothers. On the other hand, the association between depressive disorder and infant's sleeping problem was proved to be significant for both primiparous and multiparous mothers.

3. Possible Explanations

In regarding the three infant's regulation problems discussed in the research, some possible explanations are mentioned. As for excessive crying, multiparous mother are usually more confident in handling the situation as they have more experience in taking care of infants after delivering. For the first-time mothers with younger age and lower-educated level, they intend to have anxious misinterpretation of new and even frightening situation with the baby, thus results in more intrusive, inconsistent, or overinvolved behaviors in taking care of babies. As a result, the infants' crying problem can be intensified.

For infant feeding problems associating with infant birth weight, one possible explanation is that first-time mothers are likely to worry about insufficient food intake of baby especially when their babies have lower birth weight. They are also likely to be less confident in their own parenting competencies.

During the investigation of sleeping problem, mothers who have a history of depressive disorders may be vulnerable to sleep disturbances and lack of the knowledge on appropriate bedtime routines to ensure enough sleep-wake regulation for infants.

4. Contributions and Strengths

This research is the very first longitudinal study that studied two maternal mental health disorders: anxiety and depression, and their relations to all three early regulation problems of infants, namely, excessive crying, feeding, and sleeping problems, in the phases of prior to, during and after pregnancy. There are some previous studies in this area that have analyzed the relationship and association between maternal mental health disorders and regulations problems, but most of them did not clearly distinguish the differences between two disorders, or examine specifically about how each mental disorder is related to individual problem among three aspects of infants' regulation problems.

As a result, the study illustrated the significant relationship between mother's mental health and infants' regulation problems. It applies standardized interview for target mothers, which is known as Composite International Diagnostic Interview for Woman (CIDI-V). According to the original paper, it is a well-established and modified version of the World Health Organization CIDI, which comprises good psychometric properties that provides comprehensive assessment for maternal mental health problems. The CIDI allows the fully standardized symptom and syndrome assessment, and has reliability and validity world widely. Compare with self-report questionnaires as a traditional method applying in other studies, the interview ensures the accuracy of the identification as well as the discrimination of both disorders condition.

As for the assessment of infant regulatory problems, the study used a reliable diagnostic instrument named Baby-DIPS that includes three different standards for evaluating three problems. The excessive crying is based on the Wessel's rule of three, and feeding problem together with sleeping problem are assessed by DSM criteria and the diagnostic guidelines of the German Society of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy. Criteria are quantified into questions format in the assessment, detailed examples of situation are also given to better identify the corresponding problem.

In addition, the research applies regional epidemiological sampling. In contrast with data derived from clinical studies, the research represents a larger variety of mothers with broader background, thus helps to generate more generalizable results to the community.

5. Challenges and Limitations

Although the established diagnostic approaches were used in assessing infant regulation problem, more research is needed to confirm the preliminary evidence to ensure the clinical validity of the applied diagnostic criteria of Baby-DIPS. Also, early regulation problems were only assessed through maternal report, whose accuracy might be influenced by mother's perception of infant regulatory behaviors. For example, if mother

has prior depressive or anxiety disorders during the time frame to be assessed, the report could be biased as the mother's mental status is unstable to may reflect the wrong perception for their babies' behaviors.

Another limitation is that data may not be representative for unmarried women with low educational level or women who are excluded by the criteria of MARI Study. The challenge here is that the research has geographical and regional limitation and constraints. Women in a particular district may not be presenting the general characteristics of women. In addition, multiparous mothers and preterm infants were slightly underrepresented in the study due to the exclusion criteria, as the multiple or high-risk pregnancies were all excluded.

Besides, the drop-out rate in young mother is higher than overall drop-out rate during the whole period of investigation. However, it is usually challenging for researchers to keep track of the mothers' status during long period of time. Some possible solutions could focus on reducing the interval between interviews with the mothers or updating the contact information of mothers more frequently throughout the research period. Furthermore, there are 20 unreached mother after 16 postpartum for the interview of sleeping problem, and the research replaces the missing information with conservative assumption that particular regulation problem is not presented at the assessment point of time. Hence, the problem of infant may be underestimated in this situation.

There are some other limitations that were not mentioned in the paper, which are believed to have certain levels of impact on the results as well. First of all, the selected groups of mothers are categorized by marriage status, education level, employment status, and number of times giving deliver. However, many factors may contribute to the problem of maternal psychopathology. It may lack control over other variables that may also have influence on women's mental condition. According the research from Tavistock Centre for Couple Relationships, the intimate relationship quality and women's mental disorders are highly correlated. In the same time, the quality of the parental couple relationship also has an impact on the emotional and behavioral problems in infants and children. In the

study, it does not control or eliminate the influence of intimate relationship quality for both mothers' disorders and infants' regulation problems. Likewise, problems such as financial stability and nature of occupation may also have influence to the mental disorders and infant problems, but the study may lack of control in these influential variables.

Secondly, the study lacks the in-depth discussion of the relationship between mother's mental disorders and infant regulation problems. Although the research shows the strong correlation between maternal disorders and infant health problems, it does not indicate clearly about if the link is single-direction or bi-direction. The evidence from the results does not acknowledge if the mental health disorders are merely the cause of infant regulation problems or can also be considered as a consequence of infant's problems.

6. Future Study

Based on our analysis on limitation and challenges, we come up with some suggestions in the future study in this area. Firstly, a future investigation could focus on identifying the impact direction in the relationship. Research such as whether infant regulation problems worsen the situation of maternal disorders can be carried out to illustrate if the relationship has two-way impact.

Secondly, quantitative research could be further explored to define the extent and gradient of the impact for the relationship. Additionally, future study could consider a more general target that includes more characteristics such as women with wider age range and women who are high-risk pregnancies.

7. Application

Although the research mainly focuses on local community, the research methodology can be reutilized and applied to national and global extent.

Moreover, during the investigation of the cause of infant's health problems in future analysis and clinical study, mothers' mental health records should also be took into consideration as the research has clearly indicated the strong association between maternal mental disorders with infant regulation problem.

Besides, the study gives more insights about the association between early mental disorders prior to pregnancy with later infant regulation problems, thus promotes the specific and early targeted intervention for expectant mothers with prior anxiety or depressive disorder during their perinatal care period.

8. Simulation

We have replicated two experimental plots with R via simulation and also use data provided in the experiment or via simulation.

We firstly used simulation to plot the co-occurrences of excessive crying, feeding and sleeping problems. We categorized 8 situations, namely, no regulation problem, excessive crying only (E), sleeping problem only (S), feeding problem only (F), E&S (E together with problem S), E&F, S&F, E&S&F. We assume each sample will fall into one of these 8 situations and we simulate by generating multinomially distributed random number vectors and compute multinomial probabilities base on the original result. We plot the result by using bubble plot (Figure 1). The original and simulation results are as follow:

Original result

No regulation problem	**E**	**S**	**F**	**E&S**	**E&F**	**S&F**	**E&S&F**
0.552	0.028	0.053	0.245	0.003	0.053	0.049	0.017

Simulation result

No regulation problem	**E**	**S**	**F**	**E&S**	**E&F**	**S&F**	**E&S&F**
0.5597	0.0280	0.0537	0.2492	0.0029	0.0544	0.0504	0.0017

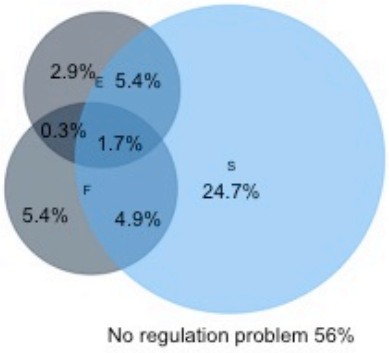

Figure 3

Besides, we used fisher test to simulate the results in Table 4 of the original report (Figure 4). We used the numbers in the "No" and "Yes" column to calculate the odds ratio, confidence interval and p-value in R (Figure 5).

	Excessive crying			Feeding problem			Sleeping problem		
	No (*n* = 257) *n* (row%)	Yes (*n* = 29) *n* (row%)	*OR (95% CI)*	No (*n* = 182) *n* (row%)	Yes (*n* = 104) *n* (row%)	*OR (95% CI)*	No (*n* = 251) *n* (row%)	Yes (*n* = 35) *n* (row%)	*OR (95% CI)*
Prior to pregnancy									
No AD (reference) (*n* = 100)	92 (92.0)	8 (8.0)	—	73 (73.0)	27 (27.0)	—	91 (91.0)	9 (9.0)	—
Pure D (*n* = 46)	45 (97.8)	1 (2.2)	0.26 (0.03–2.11)	33 (71.7)	13 (28.3)	1.07 (0.49–2.32)	42 (91.3)	4 (8.7)	0.96 (0.28–3.31)
Pure A (*n* = 79)	67 (84.8)	12 (15.2)	2.06 (0.80-5.32)	47 (59.5)	32 (40.5)	1.84 (0.98–3.46)	72 (91.1)	7 (8.9)	0.98 (0.35–2.77)
Comorbid AD (*n* = 61)	53 (86.9)	8 (13.1)	1.74 (0.62–4.89)	29 (47.5)	32 (52.5)	**2.98 (1.53–5.82)**	46 (75.4)	15 (24.6)	**3.30 (1.34–8.10)**
Prior to and during pregnancy*									
No AD (reference) (*n* = 91)	85 (93.4)	6 (6.6)	—	67 (73.6)	24 (26.4)	—	82 (90.1)	9 (9.9)	—
Pure D (*n* = 42)	41 (97.6)	1 (2.4)	0.35 (0.04–2.96)	30 (71.4)	12 (28.6)	1.12 (0.49–2.52)	38 (90.5)	4 (9.5)	0.96 (0.28–3.31)
Pure A (*n* = 84)	70 (83.3)	14 (16.7)	**2.83 (1.03–7.76)**	50 (59.5)	34 (40.5)	**1.90 (1.00–3.59)**	77 (91.7)	7 (8.3)	0.83 (0.29–2.33)
Comorbid AD (*n* = 69)	61 (88.4)	8 (11.6)	1.86 (0.61–5.63)	35 (50.7)	34 (49.3)	**2.71 (1.40–5.26)**	54 (78.3)	15 (21.7)	**2.53 (1.03–6.19)**
Prior to, during and after pregnancy*									
No AD (reference) (*n* = 83)	77 (92.8)	6 (7.2)	—	62 (74.7)	21 (25.3)	—	74 (89.2)	9 (10.8)	—
Pure D (*n* = 33)	33 (100)	0 (0.0)	Omitted[#]	26 (78.8)	7 (21.2)	0.79 (0.30–2.10)	31 (93.9)	2 (6.1)	0.53 (0.11–2.60)
Pure A (*n* = 84)	75 (89.3)	9 (10.7)	1.54 (0.52–4.54)	52 (61.9)	32 (38.1)	1.82 (0.94–3.52)	79 (94.1)	5 (5.9)	0.52 (0.17–1.62)
Comorbid AD (*n* = 86)	72 (83.7)	14 (16.3)	2.50 (0.91–6.84)	42 (48.8)	44 (51.2)	**3.09 (1.61–5.93)**	67 (77.9)	19 (22.1)	2.33 (0.99–5.51)

Abbreviation: *n*, number; row%, row percentage; OR, odds ratio; 95%CI, 95% confidence interval; No AD, no anxiety nor depressive disorder; Pure D, pure depressive disorder; Pure A, pure anxiety disorder; Comorbid AD, comorbid anxiety and depressive disorder. Bold characters display statistically significant associations on the 5% level.

*Note that the participants were reallocated to the appropriate group whenever they reported incident anxiety and/or depressive disorders during and after pregnancy.

[#] Variable was omitted due to empty cell.

Figure 4. Original results in Table 4

Our result as follow:

	Excessive Crying				*Feeding Problem*				*Sleeping Problem*		
	No	*Yes*			*No*	*Yes*			*No*	*Yes*	
	(n = 257)	*(n = 29)*	*OR (95% CI)*		*(n = 182)*	*(n = 104)*	*OR (95% CI)*		*(n = 251)*	*(n=35)*	*OR (95% CI)*
Prior to pregnancy											
No AD	92	8	-		73	27	-		91	9	-
Pure D	45	1	0.26		33	13	1.06		42	4	0.96
Pure A	67	12	2.05		47	32	1.83		72	7	0.98
Comorbid AD	53	8	1.73		29	32	**2.96**		46	15	**3.27**
Prior to and during pregnancy											
No AD	85	6	-		67	24	-		82	9	-
Pure D	41	1	0.35		30	12	1.12		38	4	0.96
Pure A	70	14	**2.82**		50	34	**1.89**		77	7	0.83
Comorbid AD	61	8	1.85		35	34	**2.69**		54	15	**2.52**
Prior to, during and after pregnancy											
No AD	77	6	-		62	21	-		74	9	-
Pure D	33	0	Omitted		26	7	0.80		31	2	0.53
Pure A	75	9	1.54		52	32	1.81		79	5	0.52
Comorbid AD	72	14	2.48		42	44	**3.07**		67	19	2.32

Figure 5. Simulation result

Abbreviation: n, number; OR, odds ratio; 95%CI, 95% confidence interval; No AD, no anxiety nor depressive disorder; Pure D, pure depressive disorder; Pure A, pure anxiety disorder; Comorbid AD,

comorbid anxiety and depressive disorder. Bold characters display statistically significant associations on the 5% level.
Note that the participants were reallocated to the appropriate group whenever they reported incident anxiety and/or depressive disorders during and after pregnancy.
Variable was omitted due to empty cell.

References

Petzoldt, Wittchen, Einsle and Martini (2015). Maternal anxiety versus depressive disorders: specific relations to infants' crying, feeding and sleeping problems. Institute of Clinical Psychology and Psychotherapy, Technische Universität Dresden, Dresden, Germany. 2015 John Wiley & Sons Ltd, Child: care, health and development, 42, 2, 231–245.

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Appendix A. R code and Simulated Results

```
#1: No regulation problem: 55.2%
#2: Excessive crying only (E): 2.8%
#3: Sleeping problem only (S): 5.3%
#4: Feeding problem only (F): 24.5%
#5: E&S: 0.3%
#6: E&F: 5.3%
#7: S&F: 4.9%
#8: E&S&F: 1.7%

n.sample = 100000
simulation = sample(1:8,
                    size = n.sample,
                    replace = TRUE,
                    prob = c(0.552, 0.028, 0.053, 0.245, 0.003, 0.053, 0.049, 0.0017))
result = table(simulation)/n.sample

#Simulation Result
> result
simulation
      1       2       3       4       5       6       7       8
0.55973 0.02798 0.05368 0.24920 0.00294 0.05436 0.05040 0.00171
```

Figure 6. Simulation Code

```
circle.1 = sum(result[c(2, 5, 6, 8)])*100
circle.2 = sum(result[c(3, 5, 7, 8)])*100
circle.3 = sum(result[c(4, 6, 7, 8)])*100

library(ggplot2)
x = c(0.0358, 0.0345 ,0.05)
y = c(0.00135, 0.0009, 0.001)
size = c(circle.1, circle.2, circle.3)
label=c("E","F","S")
data = data.frame(x, y ,size)

ggplot(data = data,
       aes(x = x, y = y, size = size, label = label), guide = FALSE) +
  geom_jitter(aes(size = size, colour = size, alpha=.02))+ scale_size_area(max_size =
78)+
  scale_x_continuous(limits=c(0,0.1))+
  scale_y_continuous(limits=c(0,0.0025))+
  annotate("text", x = 0.033, y=0.0014, label = "2.9%")+
  annotate("text", x = 0.04, y=0.00136, label = "5.4%")+
  annotate("text", x = 0.038, y=0.0011, label = "1.7%")+
  annotate("text", x = 0.03, y=0.0008, label = "5.4%")+
  annotate("text", x = 0.04, y=0.00078, label = "4.9%")+
  annotate("text", x = 0.032, y=0.00115, label = "0.3%")+
  annotate("text", x = 0.05, y=0.0009, label = "24.7%")+
  annotate("text", x = 0.05, y=0.0003, label = "No regulation problem 56%")+
  geom_text(size=2.5)+ theme(axis.line=element_blank(),axis.text.x=element_blank(),
                             axis.text.y=element_blank(),axis.ticks=element_blank(),
                             axis.title.x=element_blank(),
                             axis.title.y=element_blank(),legend.position="none",

panel.background=element_blank(),panel.border=element_blank(),panel.grid.major=element_
blank(),
panel.grid.minor=element_blank(),plot.background=element_blank())
```

Figure 7. Bubble graph plot

Excessive crying Prior to	Excessive crying Prior to and During	Excessive crying After
cryingPrior1 <- data.frame(No=c(92,45),Yes=c(8,1))	cryingDuring1 <- data.frame(No=c(85,41),Yes=c(6,1))	
rownames(cryingPrior1) <- c("NoAD", "PureD")	rownames(cryingDuring1) <- c("NoAD", "PureD")	
fisher.test(cryingPrior1)	fisher.test(cryingDuring1)	
cryingPrior2 <- data.frame(No=c(92,67),Yes=c(8,12))	cryingDuring2 <- data.frame(No=c(85,70),Yes=c(6,14))	cryingAfter2 <- data.frame(No=c(77,75),Yes=c(6,9))
rownames(cryingPrior2) <- c("NoAD", "PureA")	rownames(cryingDuring2) <- c("NoAD", "PureA")	rownames(cryingAfter2) <- c("NoAD", "PureA")
fisher.test(cryingPrior2)	fisher.test(cryingDuring2)	fisher.test(cryingAfter2)
cryingPrior3 <- data.frame(No=c(92,53),Yes=c(8,8))	cryingDuring3 <- data.frame(No=c(85,61),Yes=c(6,8))	cryingAfter3 <- data.frame(No=c(77,72),Yes=c(6,14))
rownames(cryingPrior3) <- c("NoAD", "ComorbidAD")	rownames(cryingDuring3) <- c("NoAD", "ComorbidAD")	rownames(cryingAfter3) <- c("NoAD", "ComorbidAD")
fisher.test(cryingPrior3)	fisher.test(cryingDuring3)	fisher.test(cryingAfter3)

Feeding Prior to	Feeding Prior to and During	Feeding After
feedingPrior1 <- data.frame(No=c(73,33),Yes=c(27,13))	feedingDuring1 <- data.frame(No=c(67,30),Yes=c(24,12))	feedingWholePeriod <- data.frame(No=c(62,26),Yes=c(21,7))
rownames(feedingPrior1) <- c("NoAD", "PureD")	rownames(feedingDuring1) <- c("NoAD", "PureD")	rownames(feedingWholePeriod) <- c("NoAD", "PureD")
fisher.test(feedingPrior1)	fisher.test(feedingDuring1)	fisher.test(feedingWholePeriod)
feedingPrior2 <- data.frame(No=c(73,47),Yes=c(27,32))	feedingDuring2 <- data.frame(No=c(67,50),Yes=c(24,34))	feedingWholePeriod <-data.frame(No=c(62,52),Yes=c(21,32))
rownames(feedingPrior2) <- c("NoAD", "PureA")	rownames(feedingDuring2) <- c("NoAD", "PureA")	rownames(feedingWholePeriod) <- c("NoAD", "PureA")
fisher.test(feedingPrior2)	fisher.test(feedingDuring2)	fisher.test(feedingWholePeriod)
feedingPrior3 <- data.frame(No=c(73,29),Yes=c(27,32))	feedingDuring3 <- data.frame(No=c(67,35),Yes=c(24,34))	feedingWholePeriod <- data.frame(No=c(62,42),Yes=c(21,44))
rownames(feedingPrior3) <- c("NoAD", "ComorbidAD")	rownames(feedingDuring3) <- c("NoAD", "ComorbidAD")	rownames(feedingWholePeriod) <- c("NoAD", "ComorbidAD")
fisher.test(feedingPrior3)	fisher.test(feedingDuring3)	fisher.test(feedingWholePeriod)

Sleeping Prior to	Sleeping Prior to and During	Sleeping After
sleepingPrior <- data.frame(No=c(91,42),Yes=c(9,4))	sleepingPrior_During <- data.frame(No=c(82,38),Yes=c(9,4))	sleepingWholePeriod <- data.frame(No=c(74,31),Yes=c(9,2))
rownames(sleepingPrior) <- c("NoAD", "PureD")	rownames(sleepingPrior_During) <- c("NoAD","PureD")	rownames(sleepingWholePeriod) <- c("NoAD","PureD")
fisher.test(sleepingPrior)	fisher.test(sleepingPrior_During)	fisher.test(sleepingWholePeriod)
sleepingPrior <- data.frame(No=c(91,72),Yes=c(9,7))	sleepingPrior_During <- data.frame(No=c(82,77),Yes=c(9,7))	sleepingWholePeriod <- data.frame(No=c(74,79),Yes=c(9,5))
rownames(sleepingPrior) <- c("NoAD", "PureA")	rownames(sleepingPrior_During) <- c("NoAD","PureA")	rownames(sleepingWholePeriod) <- c("NoAD","PureA")
fisher.test(sleepingPrior)	fisher.test(sleepingPrior_During)	fisher.test(sleepingWholePeriod)
sleepingPrior <- data.frame(No=c(91,46),Yes=c(9,15))	sleepingPrior_During <- data.frame(No=c(82,54),Yes=c(9,15))	sleepingWholePeriod <- data.frame(No=c(74,67),Yes=c(9,19))
rownames(sleepingPrior) <- c("NoAD", "comorbidAD")	rownames(sleepingPrior_During) <- c("NoAD","ComorbicAD")	rownames(sleepingWholePeriod) <- c("NoAD","comorbidAD")
fisher.test(sleepingPrior)	fisher.test(sleepingPrior_During)	fisher.test(sleepingWholePeriod)

Figure 8. R code for Fisher test

	Pure D	Pure A	Comorbid AD
Crying	data: cryingPrior1	data: cryingPrior2	data: cryingPrior3
	p-value = 0.2732	p-value = 0.1548	p-value = 0.2942
	alternative hypothesis: true odds ratio is not equal to 1	alternative hypothesis: true odds ratio is not equal to 1	alternative hypothesis: true odds ratio is not equal to 1
	95 percent confidence interval:	95 percent confidence interval:	95 percent confidence interval:
	0.005640339 2.019541830	0.7246521 6.1299364	0.5317082 5.6313478
	sample estimates:	sample estimates:	sample estimates:
	odds ratio	odds ratio	odds ratio
	0.2573433	2.051302	1.729574
	Pure D	**Pure A**	**Comorbid AD**
	data: cryingDuring1	data: cryingDuring2	data: cryingDuring3
	p-value = 0.4315	p-value = 0.05526	p-value = 0.3975
	alternative hypothesis: true odds ratio is not equal to 1	alternative hypothesis: true odds ratio is not equal to 1	alternative hypothesis: true odds ratio is not equal to 1
	95 percent confidence interval:	95 percent confidence interval:	95 percent confidence interval:
	0.007340088 3.012632897	0.9555848 9.4281080	0.5321092 6.8259265
	sample estimates:	sample estimates:	sample estimates:
	odds ratio	odds ratio	odds ratio
	0.3477436	2.816875	1.850564
	Pure D	**Pure A**	**Comorbid AD**
		data: cryingAfter2	data: cryingAfter3
		p-value = 0.5898	p-value = 0.09477
		alternative hypothesis: true odds ratio is not equal to 1	alternative hypothesis: true odds ratio is not equal to 1
		95 percent confidence interval:	95 percent confidence interval:
		0.4619629 5.5168054	0.8403563 8.3229144
		sample estimates:	sample estimates:
		odds ratio	odds ratio
		1.536047	2.482359

	Pure D	Pure A	Comorbid AD
Feeding	data: feedingPrior1	data: feedingPrior2	data: feedingPrior3
	p-value = 1	p-value = 0.07776	p-value = 0.001406
	alternative hypothesis: true odds ratio is not equal to 1	alternative hypothesis: true odds ratio is not equal to 1	alternative hypothesis: true odds ratio is not equal to 1
	95 percent confidence interval:	95 percent confidence interval:	95 percent confidence interval:
	0.4454734 2.4612655	0.9346312 3.6291689	1.448422 6.148249
	sample estimates:	sample estimates:	sample estimates:
	odds ratio	odds ratio	odds ratio
	1.064632	1.834445	2.9617
	Pure D	**Pure A**	**Comorbid AD**
	data: feedingDuring1	data: feedingDuring2	data: feedingDuring3
	p-value = 0.8351	p-value = 0.05476	p-value = 0.004553
	alternative hypothesis: true odds ratio is not equal to 1	alternative hypothesis: true odds ratio is not equal to 1	alternative hypothesis: true odds ratio is not equal to 1
	95 percent confidence interval:	95 percent confidence interval:	95 percent confidence interval:
	0.4463869 2.6931632	0.956494 3.786667	1.326442 5.560466
	sample estimates:	sample estimates:	sample estimates:
	odds ratio	odds ratio	odds ratio
	1.115728	1.891311	2.693989
	Pure D	**Pure A**	**Comorbid AD**
	data: feedingWholePeriod	data: feedingWholePeriod	data: feedingWholePeriod
	p-value = 0.8107	p-value = 0.0964	p-value = 0.0008353
	alternative hypothesis: true odds ratio is not equal to 1	alternative hypothesis: true odds ratio is not equal to 1	alternative hypothesis: true odds ratio is not equal to 1
	95 percent confidence interval:	95 percent confidence interval:	95 percent confidence interval:
	0.2540864 2.2546693	0.8914057 3.7344165	1.539687 6.273941
	sample estimates:	sample estimates:	sample estimates:
	odds ratio	odds ratio	odds ratio
	0.7964063	1.810343	3.071511

	Pure D	Pure A	Comorbid AD
Sleeping	data: sleepingPrior	data: sleepingPrior	data: sleepingPrior
	p-value = 1	p-value = 1	p-value = 0.0111
	alternative hypothesis: true odds ratio is not equal to 1	alternative hypothesis: true odds ratio is not equal to 1	alternative hypothesis: true odds ratio is not equal to 1
	95 percent confidence interval:	95 percent confidence interval:	95 percent confidence interval:
	0.2049577 3.6979597	0.2957264 3.1310071	1.232764 9.171333
	sample estimates:	sample estimates:	sample estimates:
	odds ratio	odds ratio	odds ratio
	0.9632089	0.9831172	3.270781
	Pure D	**Pure A**	**Comorbid AD**
	data: sleepingPrior_During	data: sleepingPrior_During	data: sleepingPrior_During
	p-value = 1	p-value = 0.7969	p-value = 0.04541
	alternative hypothesis: true odds ratio is not equal to 1	alternative hypothesis: true odds ratio is not equal to 1	alternative hypothesis: true odds ratio is not equal to 1
	95 percent confidence interval:	95 percent confidence interval:	95 percent confidence interval:
	0.2029545 3.7102507	0.2492214 2.6418052	0.952501 7.020307
	sample estimates:	sample estimates:	sample estimates:
	odds ratio	odds ratio	odds ratio
	0.9593618	0.8291722	2.515815
	Pure D	**Pure A**	**Comorbid AD**
	data: sleepingWholePeriod	data: sleepingWholePeriod	data: sleepingWholePeriod
	p-value = 0.7262	p-value = 0.279	p-value = 0.06259
	alternative hypothesis: true odds ratio is not equal to 1	alternative hypothesis: true odds ratio is not equal to 1	alternative hypothesis: true odds ratio is not equal to 1
	95 percent confidence interval:	95 percent confidence interval:	95 percent confidence interval:
	0.05311419 2.79211918	0.1312477 1.8308458	0.9243975 6.2455659
	sample estimates:	sample estimates:	sample estimates:
	odds ratio	odds ratio	odds ratio
	0.533031	0.5224022	2.320229

Figure 9. Simulated results