

## Psychiatric Comorbidity in Korean Children and Adolescents with Attention-Deficit Hyperactivity Disorder: Psychopathology According to Subtype

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It is well-known that more than 50% of attention-deficit hyperactivity disorder (ADHD) cases also have comorbid psychiatric disorders. We evaluated the comorbid psychopathology of Korean children and adolescents with ADHD using a standardized diagnostic instrument. The Korean Kiddie-Schedule for Affective Disorders and Schizophrenia-Parent and Lifetime Version (K-SADS-PL-K) was administered and completed in 105 patients who had been referred to the outpatient and inpatient clinics at the Samsung Medical Center from March 2004 to May 2005. All of the cases were diagnosed as ADHD according to DSM-IV criteria. We analyzed their clinical characteristics and psychiatric comorbidities, and assessed the correlation of any comorbidity with gender, age and ADHD subtype. Among our 105 participants, 70 (66.7%) subjects were diagnosed with combined-type ADHD, 22 (21.0%) were the predominantly inattentive type, only 1 (1.0%) was determined to have the predominantly hyperactive-impulsive type of ADHD, and 12 (11.4%) were classified as not otherwise specified (NOS) ADHD. Eighty (76.2%) subjects had at least one comorbid disorder such as oppositional defiant disorder ( $n = 53$ , 50.5%), anxiety disorders ( $n = 35$ , 33.3%) and affective disorders ( $n = 15$ , 14.3%). Our patients ranged in age from five to 16 years. Among the factors including gender, age, and ADHD subtype, ADHD subtype was the only one significant to comorbidity in our study. The results of this study suggest that psychiatric comorbidity in Korean children with ADHD is similar to the results of previous studies in western countries. Out of all the ADHD subtypes, the com-

bined-type group had a significantly higher ratio of comorbid disorders and psychopathologies.

**Key Words:** Attention-deficit hyperactivity disorder, comorbidity, Kiddie-Schedule for Affective Disorder and Schizophrenia-Parent and Lifetime Version-Korean Version, psychopathology

### INTRODUCTION

Attention-deficit hyperactivity disorder (ADHD) is a common problem in children; it is diagnosed in about 30 to 50% of patients who are referred to child psychiatric clinics.<sup>1</sup> The prevalence of ADHD has been reported to be from 1.7 to 16% according to our study's background,<sup>2</sup> and it was also found to be 3 to 5% among school-aged children based on DSM-IV criteria.<sup>3</sup>

It is well known that more than 50% of patients with ADHD have comorbid psychiatric comorbid disorders.<sup>4,5</sup> A review of the literature suggests that about 30 to 40% of children with ADHD have oppositional-defiant disorder,<sup>6-9</sup> 30 to 50% have a conduct disorder,<sup>4</sup> nine to 38% have depressive disorders,<sup>10</sup> and 25% have anxiety disorders.<sup>11</sup> Although the issue is still debated, the comorbid rate of bipolar disorders has been considered to be lower than that of other disorders.<sup>12-14</sup> Learning disorders, which have been regarded as common comorbid conditions in patients diagnosed with ADHD, account for nine to 30% of ADHD patients, as noted in prior studies.<sup>4,10,15</sup> However, the definition of a learning disorder can differ from study to study so that it is difficult to integrate the

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results of previous reports.

There is increasing evidence that comorbid disorders affect the manifestation and severity of symptoms, long-term prognosis and treatment response in patients diagnosed with the ADHD.<sup>16</sup> For example, when a conduct disorder is comorbid with ADHD, this makes ADHD symptoms more severe and patients exhibit more aggression, anxiety and failure of peer relationships.<sup>17-19</sup> Comorbid disorders such as conduct disorders, affective disorders and anxiety disorders are predictive factors that affect the chronic course of ADHD.<sup>20</sup> Other authors have reported that the presence of anxiety disorders is associated with a poor response of ADHD symptoms to psychostimulant medication.<sup>10,21,22</sup> However, recent studies have not confirmed this effect of comorbid anxiety disorders.<sup>23,24</sup>

In Korea, there have been many studies on ADHD. In regard to comorbidity, there are several studies on the correlations between ADHD and disruptive disorders,<sup>25,26</sup> between ADHD and depressive disorders,<sup>27</sup> and between ADHD and learning disorders.<sup>28</sup> However, there are few comprehensive studies investigating the overall comorbidity of ADHD using a well-known systemic interview.

The absence of a useful evaluation instrument may be the main difficulty in these studies of comorbidity. During the past 35 years, a variety of efforts have devoted resources to develop accurate, objective and replicable diagnostic tools that can be used in the clinic as well as for research. In Korea, however, the tools available for clinical and research evaluations have been limited. Therefore, the standardization of the Kiddie-Schedule for Affective Disorders and Schizophrenia-Present and Lifetime Version (K-SADS-PL) by Kim et al. in 2004<sup>29</sup> made available a reliable and valid diagnostic instrument. This tool has been used extensively and internationally. The availability of this instrument for clinical and academic activities in child and adolescent psychiatry in Korea provides a useful method for rigorous psychiatric evaluations.

In this study, we evaluated the comorbid psychopathology of school-age children and adolescents diagnosed with ADHD using the K-SADS-PL-K, and we compared our findings with

previous results. We also compared the differences of comorbid disorders and psychopathology according to ADHD subtype.

## MATERIALS AND METHODS

Subjects recruited for the study were 105 children and adolescents who were referred to the outpatient and inpatient clinics of the Samsung Medical Center from March 2004 to May 2005. These children were diagnosed as having ADHD according to the DSM-IV criteria. All participants completed a comprehensive and standardized psychological evaluation battery at our hospital. Mentally handicapped patients were excluded from the study, and blood tests were performed to rule out other medical diseases. We also obtained a careful history and an EEG (if needed) to rule out any seizure disorders. We obtained institutional review board (IRB) approval from the Samsung Medical Center to review, analyze and report these findings.

The researchers consisted of six well-trained child and adolescent psychiatrists who were employed by the Samsung Medical Center. All investigators received a one-hour lecture as training in the use of the Kiddie-Schedule for Affective Disorders and Schizophrenia-Present and Lifetime Version-Korean Version (K-SADS-PL-K). Each investigator evaluated a sample patient on videotape, and then intensive discussions followed for more than five hours to determine a consensus as to the proper diagnosis.

K-SADS-PL-K interviews were performed with all subjects and their parents. K-SADS-PL-K is a semi-structured interview that is carried out by clinically-experienced evaluators. In Korea, Kim et al. examined the validity and reliability of the K-SADS-PL-K when used for Korean children. They found a significant correlation between the K-SADS-PL-K and the Korean Child Behavior Checklist (K-CBCL), a commonly-used standardized test in Korea. In order to examine the subjects' psychopathology, the Korean Personality Inventory for Children (KPI-C)<sup>30</sup> and the Korean Version of the Child Behavior Checklist (K-CBCL)<sup>31</sup> were also used.

## Statistics

SPSS-PC (Windows version 12.0) was used for all statistical analyses. A chi-square test and a one-way analysis of variance (ANOVA) (with Tukey and Scheffe's post hoc test) were used to evaluate the data. All tests were two-tailed, and  $p$  values  $< 0.05$  were considered significant.

## RESULTS

Demographic characteristics are shown in Table 1. Subjects were between the ages of five and 16 years, and the mean age ( $\pm$ SD) was  $9.70 \pm 2.48$  years. There were 79 (75.2%) elementary school students, and the majority ( $n = 95$ , 90.5%) were male. The mean total IQ, verbal IQ and performance IQ ( $\pm$ SD) were  $105.0 \pm 14.8$ ,  $104.8 \pm 14.9$ , and  $103.8 \pm 16.1$ , respectively.

ADHD subtypes are shown in Table 1.

According to the DSM-IV criteria, four subtypes of ADHD have been classified. There were 70 (66.7%) subjects who were diagnosed with the combined type of ADHD, 22 (21.0%) were the predominantly inattentive type, only one (1.0%) was found to be of the predominantly hyperactive-impulsive type, while 12 (11.4%) were diagnosed as having ADHD with not otherwise specified (NOS) type.

There was no significant correlation between gender and ADHD subtype, and there was no

significant difference between mean age and the different subtypes.

Patterns of psychiatric comorbidity associated with ADHD shown in Table 2 and Fig. 1.

Except for 25 (23.8%) subjects who had no comorbid disorders, 80 (76.2%) subjects had at least one comorbid disorder. The most common comorbid disorder was oppositional defiant disorder ( $n = 50$ , 47.6%), while anxiety disorders ( $n = 35$ , 33.3%) were the second most common comorbid diagnosis. Affective disorders ( $n = 15$ , 14.3%) were the third most common comorbid disorder, and the remaining disorders were identified as either tic or elimination disorders.

Among the ADHD subtypes, the combined type group showed a significantly higher ratio of comorbid disruptive disorders than the predominantly inattentive subgroup or the NOS subgroup ( $p =$

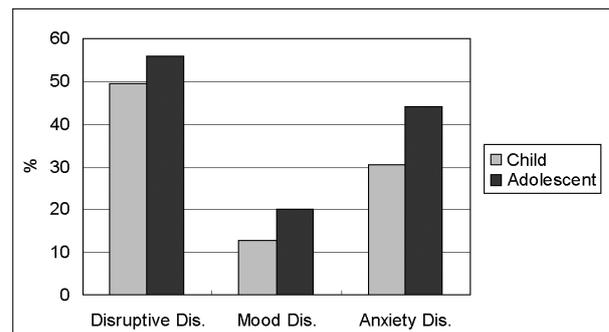


Fig. 1. Psychiatric comorbidity in school-age (aged 6-11) and adolescent (aged 12-16) ADHD subjects. Dis, Disorder.

Table 1. Demographic Characteristics of Each Subtype Group of ADHD ( $n = 105$ )

	ADHD-C $n = 70$ (66.7%)	ADHD-I $n = 22$ (21.0%)	ADHD-H $n = 1$ (1.0%)	ADHD-NOS $n = 12$ (11.4%)	TOTAL $n = 105$ (100%)
Gender					
Male ( $n = 95$ )	65 (68.4%)	18 (18.9%)	1 (1.1%)	11 (11.6%)	95 (90.5%)
Female ( $n = 10$ )	5 (50.0%)	4 (40.0%)	0 (0.0%)	1 (10.0%)	10 (9.5%)
Age (yr, mean $\pm$ SD)	$9.71 \pm 2.50$	$9.79 \pm 2.63$	7.96	$9.60 \pm 2.36$	$9.70 \pm 2.48$
Preschool-age (5-6 yrs)	1 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (1%)
School-age (7-11 yrs)	54 (68.4%)	16 (20.3%)	1 (1.3%)	85 (10.1%)	79 (75.2%)
Adolescent (12-16 yrs)	15 (60.0%)	6 (24.0%)	0 (0.0%)	4 (16.0%)	25 (23.8%)

SD, standard deviation; ADHD-C, ADHD-combined type; ADHD-I, ADHD-predominantly inattentive type; ADHD-H, ADHD-predominantly hyperactive-impulsive type; ADHD-NOS, ADHD-not-otherwise specified.

**Table 2.** Psychiatric Comorbidity in Children with ADHD (n = 105)

	ADHD-C (n = 70)	ADHD-I (n = 22)	ADHD-H (n = 1)	ADHD-NOS (n = 12)	p <sup>†</sup> (Comparison)
Non-comorbid ADHD	12 (17.1%)	9 (40.9%)	1 (100.0%)	3 (25.0%)	
Disruptive disorders (n = 54, 51.4%)	44 (62.9%)	6 (27.3%)	-	4 (33.3%)	.010* (a>b, c)
Conduct (n = 4, 3.8%)	4	-	-	-	
Oppositional defiant (n = 50, 47.6%)	40	6	-	4	
Mood disorders (n = 15, 14.3%)	11 (15.7%)	2 (9.1%)	-	2 (16.7%)	.844
Major depressive (n = 11, 10.5%)	7	2	-	2	
Adjustment (n = 1, 1.0%)	1	-	-	-	
Dysthymic (n = 2, 1.9%)	2	-	-	-	
Depressive NOS (n = 1, 1.0%)	1	-	-	-	
Anxiety disorders (n = 35, 33.3%)	22 (31.4%)	7 (31.8%)	-	6 (50.0%)	.544
Separation anxiety (n = 25, 23.8%)	17	5	-	3	
Agoraphobia (n = 2, 1.9%)	2	-	-	-	
Social phobia (n = 13, 12.4%)	6	6	-	1	
Specific phobia (n = 8, 7.6%)	6	1	-	1	
General anxiety (n = 4, 3.8%)	2	-	-	2	
Obsessive compulsive (n = 1, 1.0%)	1	-	-	-	
Tic disorders (n = 14, 13.3%)	12 (17.1%)	2 (9.1%)	-	4 (33.3%)	
Transient (n = 6, 5.7%)	6	-	-	-	
Chronic (n = 8, 7.6%)	5	2	-	1	
Tourette's (n = 4, 3.8%)	1	-	-	3	
Elimination disorders (n = 14, 13.3%)	10 (14.3%)	4 (18.2%)	-	-	
Enuresis (n = 14, 13.3%)	10	4	-	-	
Encopresis (n = 2, 1.9%)		2	-	-	

ADHD-C, ADHD-combined type; ADHD-I, ADHD-predominantly inattentive type; ADHD-H, ADHD-predominantly hyperactive-impulsive type; ADHD-NOS, ADHD-not otherwise specified.

\* $p < 0.05$ .

<sup>†</sup>ANOVA (Tukey's post hoc test).

0.010). In addition, the combined type exhibited a significantly higher overall comorbidity than the predominantly inattentive type group ( $p = 0.038$ ).

There were no significant differences observed for overall and major psychiatric comorbidity in either school-age children or adolescents with ADHD (Fig. 1). Gender had no significant effect on the overall comorbidity in children with ADHD.

K-CBCL and KPI-C results are shown in Table 3 and Table 4.

In keeping with the results of the K-CBCL (Table 3), the combined-type subjects had significantly more 'attention problems,' 'aggressive behavior' and 'externalizing problems' than the predominantly inattentive type subjects. The scores of children with 'social problems' and 'attention problems' in the combined-type group

**Table 3.** Results of K-CBCL

	ADHD-C (n = 53)	ADHD-I (n = 16)	ADHD-NOS (n = 11)	F <sub>2,77</sub>	P <sup>†</sup>	Comparison <sup>§</sup>
Withdrawn	57.43 (9.97)	57.63 (14.38)	58.00 (8.25)	.01	.987	
Somatic complaints	52.25 (9.84)	53.88 (15.48)	53.09 (8.79)	.14	.868	
Anxious/Depressed	56.51 (10.74)	53.81 (11.43)	57.64 (6.45)	.55	.582	
Social problems	65.28 (9.98)	60.63 (9.95)	57.55 (18.19)	2.66	.076	
Thought problems	54.60 (13.57)	54.38 (10.12)	54.55 (9.50)	.00	1.00	
Attention problems	65.25 (7.18)	59.75 (6.14)	59.73 (9.86)	4.88	.010 <sup>†</sup>	a>b
Delinquent behavior	56.83 (10.50)	51.25 (11.36)	56.18 (10.66)	1.69	.191	
Aggressive behavior	61.74 (10.75)	53.38 (12.64)	58.00 (15.02)	3.21	.046 <sup>*</sup>	a>b
Internalizing problems	56.75 (9.15)	53.69 (11.77)	57.91 (9.34)	.85	.432	
Externalizing problems	61.17 (10.31)	53.06 (12.88)	58.00 (13.45)	3.23	.045 <sup>*</sup>	a>b
Total behavior problems	61.62 (8.00)	57.63 (9.51)	58.18 (9.16)	1.79	.174	

ADHD-C, ADHD-combined type; ADHD-I, ADHD-predominantly inattentive type; ADHD-H, ADHD-predominantly hyperactive-impulsive type; ADHD-NOS, ADHD-not otherwise specified; K-CBCL, Korean child behavior checklist.

\* $p < 0.05$ , <sup>†</sup> $p < 0.01$ , <sup>‡</sup>ANOVA, <sup>§</sup>Sheffe' post hoc test.

exceeded 65T. As in the results of the K-PIC (Table 4), the combined-type subjects showed significantly more HPR (hyperactivity) and AUT (autism: social withdrawal) than the predominantly inattentive-type subjects. The NOS-type subjects had a higher level of VDL (verbal development) than the combined and the predominantly inattentive-type subjects. The HPR of the combined-type group exceeded a score of 65T.

## DISCUSSION

The results of this study suggest that the psychiatric comorbid rate of children and adolescents with the diagnosed ADHD in Korea is consistent with previous studies reported in western coun-

tries. In the group studied, 80 of 105 subjects (76.2%) had at least one comorbid disorder. This rate is analogous to the results of other studies using the K-SADS-PL,<sup>32</sup> and is similar to the higher rate of identification of the results of studies using different instruments.<sup>6-9</sup> This slightly higher rate may be related to the fact that the K-SADS-PL-K instrument is a comprehensive measure of a variety of pathological conditions from both the past and the present. The clinical group has been reported as showing a higher comorbidity than the general population.<sup>16</sup> This result may be due in part to the fact that the patients with more severe symptoms or functional disturbances are more likely to visit a hospital. All subjects in this study were under treatment at a university hospital.

**Table 4.** Results of KPI-C

	ADHD-C (n = 49)	ADHD-I (n = 15)	ADHD-NOS (n = 11)	F2,72	p <sup>†</sup>	Comparison <sup>§</sup>
ERS	57.80 (11.28)	56.93 (11.34)	55.09 (11.09)	.52	.597	
VDL	57.92 (12.69)	57.33 (13.55)	44.73	4.57	.014*	a,b>c
PDL	55.00 (14.26)	56.13 (17.55)	47.55 (11.80)	1.34	.269	
ANX	51.00 (10.66)	48.47 (13.82)	53.55 (7.53)	.69	.506	
DEP	57.80 (11.28)	56.93 (11.34)	55.09 (11.09)	.27	.768	
SOM	49.00 (11.04)	47.60 (9.91)	51.82 (12.98)	.47	.629	
DLQ	61.39 (10.73)	59.36 (12.08)	59.36 (10.29)	1.97	.148	
HPR	67.98 (10.44)	58.80 (12.18)	60.64 (10.52)	5.22	.008 <sup>†</sup>	a>b
FAM	55.88 (12.70)	49.87 (11.62)	54.82 (13.46)	1.31	.276	
SOC	54.96 (8.13)	54.13 (10.47)	53.64 (7.97)	.13	.875	
PSY	52.39 (16.28)	44.27 (13.26)	43.45 (14.88)	2.53	.087	
AUT	64.00 (13.59)	53.93 (12.89)	54.20 (11.03)	4.74	.012*	a>b

ADHD-C, ADHD-combined type; ADHD-I, ADHD-predominantly inattentive type; ADHD-H, ADHD-predominantly hyperactive-impulsive type; ADHD-NOS, ADHD-not otherwise specified; KPI-C, Korean personality inventory for children; ERS, ego-resilience scale; VDL, verbal development scale; PDL, performance development scale; ANX, anxiety scale; DEP, depression scale; SOM, somatic concern scale; DLQ, delinquency scale; HPR, hyperactivity scale; FAM, family relations scale; SOC, social skills scale; PSY, psychosis scale; AUT, autism scale.

\*p<0.05, <sup>†</sup>p<0.01.

<sup>†</sup>ANOVA, <sup>§</sup>Sheffe' post hoc test.

Our findings suggest that the pattern of comorbid disorders in Korean children with ADHD is similar to results reported by previous studies. Oppositional defiant disorder was the most common comorbid condition identified. This finding is in agreement with other recent reports.<sup>32,33</sup> The comorbid rate of anxiety disorders was also consistent with the findings of previous reports.<sup>10,11</sup>

However, our findings showed that the comorbid rate of patients diagnosed with a conduct disorder was significantly lower in this study

(3.8%) compared to previous studies (30 to 50%).<sup>4</sup> We suggest that the proportion of adolescent patients who were at risk for conduct disorders was lower than that found in other studies. In the MTA study,<sup>9</sup> the comorbid rate of a conduct disorder of ADHD groups in school-age children was lower than in other studies. However, the relatively high socioeconomic status (SES) and good parental support that was observed in the participating families may have influenced this result. Further studies controlling for the effects of SES

and other family factors are needed. It would be desirable to test whether SES has an influence on the comorbidity of patients diagnosed with ADHD who also have oppositional defiant disorders, affective disorders, anxiety disorders, and other possible disorders.

The comorbid rate of the affective disorders was found to be low compared to the findings of other studies.<sup>32</sup> One explanation for the lower comorbid rate in Korea could be related to the fact that Korean parents tend to pay more attention to hyperactivity, aggression and impulsive behavior than to emotional difficulties in their children.<sup>34</sup> Because of this, parents may be less likely to report the emotional symptoms of their children. Another consideration is that many Korean children feel guilty about expressing negative emotions, so they are unwilling to verbalize these problems.<sup>35</sup> As a result of these cultural characteristics, some children may express feelings of low self-esteem or emotional discomfort in the face of behavioral problems instead of exhibiting an affective component.

In our study, most ( $n = 11$ ) of the comorbid affective disorders ( $n = 15$ ) were major depressive disorders; no patient was diagnosed with bipolar disorder. This finding is likely due to the well-known observation that bipolar disorders are rarely diagnosed in school-age children.<sup>36,37</sup>

Among anxiety disorders, separation anxiety disorder (23.8%) was the most common diagnosis; agoraphobia/social phobia, specific phobia and generalized anxiety disorder were also diagnosed. Among subjects with anxiety disorders, 60.7% had only one anxiety disorder, 32.1% had two anxiety disorders and 7.1% had three anxiety disorders. The rate of comorbid anxiety disorders was found to be similar compared to the findings of a previous study.<sup>11</sup> Because 39% of ADHD patients with comorbid anxiety disorders had more than two anxiety disorders, clinicians will have to carefully consider the several anxiety disorders in ADHD patients with various symptoms of anxiety.

Among the ADHD subtypes, the combined-type group had a significantly higher ratio of comorbid disruptive disorders. This is consistent with the results of the K-CBCL and KPI-C which found that the combined-type subjects had significantly

higher scores in several subscales than the predominantly inattentive-type subjects. These findings suggest that the ADHD patients of the combined type have a greater variety of problems and more significant behavioral and social problems. Therefore, they may have more comorbid psychiatric (especially disruptive) disorders as a result. However, the NOS-type group had a higher level of VDL, so this group could be regarded as a group with a less severe functional disturbance because a better organized verbal communication ability may result in fewer behavioral problems. As observed in the predominantly inattentive-type group, behavioral problems according to the K-CBCL were not significant. In contrast, the score difference in verbal communication between the predominantly inattentive-type group and the NOS-type group on the KPI-C was considerable. This suggests that even though the behavioral problems in the predominantly inattentive-type group were not severe, subjects in that group have a similar difficulty in organized verbal communication ability as do members of the combined-type group. Even though there have been few studies about the associations between ADHD subtype and CBCL/KPI-C factors, one study reported that the combined type and the predominantly hyperactive-impulsive type had the highest score in HPR on KPI-C.<sup>38</sup>

Child and adolescent psychiatrists believe that mood and anxiety complications associated with the diagnosis of ADHD increase with age.<sup>39</sup> However, the results of this study do not show that comorbidity of mood and anxiety disorders differ between children and adolescents. We did, however, observe a tendency toward a higher comorbid ratio of anxiety disorders in the adolescent group.

Gender also had no significant effect on the comorbidity of ADHD. Because our subjects a low proportion of females compared with males, it was not possible to find any statistical meaning in gender difference.

### Limitations

The main limitation of this study was the relatively low proportion of adolescent subjects compared to previous studies. In addition, the study

was carried out in only one university hospital located in a metropolitan area, and this may not reflect the general Korean child and adolescent population. Another limitation was the inability to diagnose learning disorders because of the limited availability of instruments; these are important comorbid disorders associated with ADHD. Moreover, the ability to generalize our results is also limited because the subjects were from a group of patients which had visited a university hospital for diagnosis and treatment. Studies using out-patient-inpatient study methodologies may be subject to referral bias, which could have inflated the rates of comorbidity in the sample. Thus it is possible that the ADHD patient group that visited our hospital had a higher incidence of psychopathology than the ADHD group in the general population.

### Clinical implications

Despite these limitations, our study has the distinction of being the first comprehensive and systematic study evaluating the comorbidity of child and adolescent ADHD using the K-SADS-PL-K in Korea. The results may be used to further improve clinical management and research in patients with ADHD. Follow-up studies to evaluate the stability of the diagnoses, treatment responses and long-term outcomes are necessary.

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