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M E N T A L H E A L T H

Correlates of depression in a representative nationwide sample of adolescents (15–19 years) and young adults (20–24 years)

LINNEA M. HAARASILTA, MAURI J. MARTTUNEN, JAAKKO A. KAPRIO, HILLEVI M. ARO *

Background: The authors investigated correlates of depression in a general population sample of adolescents (15–19 years) and young adults (20–24 years). **Methods:** As part of the Finnish Health Care Survey a random sample of 509 adolescents (281 females, 228 males) and 433 young adults (224 females, 209 males) was interviewed in 1996. DSM-III-R major depressive episode (MDE) was assessed by the University of Michigan Composite International Diagnostic Interview Short Form (UM-CIDI SF). **Results:** In multivariable regression analysis, current smoking (odds ratio (OR) 5.54; 95% confidence interval (CI) 1.44, 21.3) and chronic illness (OR 3.77; 95% CI: 1.04, 13.7) associated with MDE among adolescents. Among young adults, drunkenness at least twice a month (OR 4.48; 95% CI: 1.44, 14.0) or once a month (OR 2.79; 95% CI: 1.14, 6.83), not being married nor cohabiting (OR 3.50; 95% CI: 1.35, 9.08) and infrequent physical exercise (OR 4.01; 95% CI: 1.18, 14.0) were related to MDE. Female MDE associated with not being married nor cohabiting (OR 3.56; 95% CI: 1.23, 10.1) and living in southern Finland (OR 2.30; 95% CI: 1.06, 5.02). Drunkenness at least twice a month was related to MDE among males (OR 4.54; 95% CI: 1.27, 16.3). **Conclusions:** Attention should be paid to compromised health and health-related behaviour associating with MDE in youth. Specifically, the association between smoking and major depression in early adolescence should be borne in mind, and drinking habits or frequency of drunkenness should be carefully noted.

Keywords: adolescents, alcohol, chronic illness, depression, physical exercise, smoking

Cigarette smoking or nicotine dependence^{1–4} and alcohol use disorders^{5,6} are associated with major depressive disorder (MDD) in adolescents and young adults. However, current diagnostic criteria for alcohol use disorders may miss young problem users,^{7,8} and the relations between the broader continuum of alcohol use and MDD in youth have been little studied.⁵ Adolescents are usually considered to be in good health, and associations between measures of physical health^{9,10} and MDD have seldom been investigated in non-clinical adolescent populations using structured diagnostic interviews. The aim of our study was to analyse how cigarette smoking, alcohol consumption and certain sociodemographic factors associate with DSM-III-R major depressive episode (MDE) among adolescents (15–19 years) and young adults (20–24 years) in the general population.

METHOD

Subjects and procedure

This study forms part of the Finnish Health Care Survey (FINHCS '96), an epidemiological population-based cross-sectional study designed to monitor the health of the general population and evaluate the use of and need for health services.^{11–13} Professional interviewers trained in the survey conducted the interviews between 5 April and 21 June 1996. The

design was a one-stage cluster sampling in which households formed the clusters. A reference person was first drawn and each member of his or her household thereby identified from the population register. Institutionalized persons were excluded. All subjects were fully informed, and gave formal verbal consent as required by the Personal Data File Act. The participation rate of completed household interviews was 86% (3614 of 4200 households).¹²

The FINHCS '96 sample compares closely with the Finnish population.¹² The basic target population of the present study was non-institutionalized 15–19- and 20–24-year-old inhabitants of Finland in 1996. The participating households included 1357 15–24-year-olds, of whom 49 (3.6%) could not be reached or chose not to participate. Interview data were collected on 792 adolescents (401 males, 391 females) and 516 young adults (272 males, 244 females). Data on absent household members were collected by proxy interviews, but this excluded the diagnostic interview for MDE.

The proxy interviews done on 283 adolescents (35.7%) and 83 young adults (16.1%) ($\chi^2_{df=1}=62.4, p<0.001$) were more frequent in males than females among both adolescents ($n=173$; 43.1% vs. $n=110$; 28.1%, $\chi^2_{df=1}=19.4, p<0.001$) and young adults ($n=63$; 23.2% vs. $n=20$; 7.8%, $\chi^2_{df=1}=21.9, p<0.001$). No other statistically significant differences in sociodemographics were found. Thus, the final sample including diagnostic data on MDE consisted of 509 adolescents (281 females, 228 males) and 433 young adults (224 females, 209 males). The majority of the subjects had completed elementary school (59.1%) or reported ongoing basic education (21.4%). Education after elementary school comprised high school (10.6%), vocational school (6.3%) or other schooling (2.6%).¹³ The study population was representative of the general population of corresponding age groups.¹³

Measures: diagnostic interview for MDE

The data were collected by the Computer Assisted Personal Interview technique. The University of Michigan Composite

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International Diagnostic Interview Short-Form (UM-CIDI SF)¹⁴ was used to generate a probability diagnosis of DSM-III-R MDE during the preceding 12 month period. UM-CIDI SF is a modification of the Composite International Diagnostic Interview (CIDI), a structured diagnostic interview with reportedly good reliability and validity designed for use in general population surveys.^{15,16} To produce UM-CIDI SF a subsample of CIDI respondents in the NCS was studied and the items for an optimal algorithm to reproduce full CIDI diagnoses thereby selected.¹⁴ Assessment of psychomotor disturbance is not included in the SF algorithm and the total number of diagnostic symptoms possible to endorse is eight. According to the diagnostic algorithm of the UM-CIDI SF the diagnosis of MDE is determined by the presence of depressed mood or anhedonia for at least two weeks and most times of day, plus at least two additional symptoms of depression.^{13,14} The data on SF scales suggest that the CIDI diagnostic classification can be reproduced with moderate to excellent accuracy using the MDE Short-Form, as indicated by sensitivity of 89.6, specificity of 93.9 and overall classification accuracy of 93.2%.¹⁴ Results from an external study comparing the accuracy of the UM-CIDI-SF to a semistructured clinical interview in a sample of young adults show satisfactory specificity.¹⁷

Measures: independent variables

The FINHCS '96 survey included items related to general health and health behaviour, which have been associated with depression in the literature. Sociodemographic data collected included gender, age, region of residence (southern Finland / elsewhere), urbanicity (urban / semi-urban or rural municipality), employment status (working or studying / unemployed, not in school) and marital status (married or cohabiting / not married nor cohabiting).

All interviewees were asked how often (once a day/ once a week/ 2–3 times a month/ once a month/ never) they drank alcohol and how often (once a week/ 2–3 times a month/ once a month/ never) they became drunk. A categorical variable of 'frequency of drunkenness' (at least twice a month/ once a month or less/ never drunk) was formed. Lifetime and current smoking and number of cigarettes smoked daily was recorded and dichotomized (currently smokes more than 10 cigarettes per day/ others).

Self-report data on chronic medical conditions lasting at least three months and diagnosed by a physician were collected. Specific illness categories included e.g. asthma, respiratory allergies, other allergies, neurological, metabolic, and musculoskeletal disorders. An aggregated measure of 'chronic illness' was formed (none/ one/ two or more chronic medical conditions diagnosed by a physician). Physical exercise lasting at least 30 minutes (daily/ twice a week to twice a month/ once a month or less often) was recorded. Body mass index (BMI) was calculated from self-reported height (m to the closest cm) and weight (kg) as wt/ht^2 .

Statistical procedures

To adjust for differential participation rates, the respondents were post-stratified by age, sex and region of residence, and then weighted to correspond to the distribution of the Finnish population.^{12,13} Logistic regression analyses by STATA software¹⁸ using survey estimation methods taking into account the aforementioned weighting and household sampling were applied to analyse correlates of MDE. Age- and sex-adjusted analyses for each independent variable were performed separately for each age group and gender. The set of independent variables significant in these analyses (i.e. odds ratios (OR) with a lower 95% confidence limit >1) was then selected for multivariable logistic regression analyses. This fixed model was carried out by age group and gender.

RESULTS

Correlates of MDE: age- and sex-adjusted analyses

When adjusted for age and sex, current smoking, having two or more chronic medical conditions and being unemployed or not attending school correlated with MDE in adolescents. Among young adults drunkenness at least twice a month or once a month, infrequent physical exercise, chronic illness, not being married or cohabiting and living in southern Finland were associated with MDE. Drunkenness at least twice a month was significantly associated with MDE among males, while female depression was related to drunkenness once a month, living in southern Finland and not being married nor cohabiting. Neither educational level, urbanicity nor BMI significantly associated with MDE in any age- and sex-adjusted analyses (table 1).

Correlates of MDE: multivariable analyses

Table 2 shows the results of the multivariable logistic regression analyses on the correlates of MDE in the study population. Among adolescents, currently smoking more than 10 cigarettes daily and having chronic medical conditions retained their significance in the multivariable analysis. Among young adults, drunkenness once a month or less, drunkenness at least twice a month, not being married nor cohabiting and lack of physical exercise associated with MDE. MDE in females was linked with not being married nor cohabiting and living in southern Finland. Drunkenness at least twice a month was the sole correlate for MDE among males.

The interactions between cigarette smoking ($p=0.013$) as well as having two or more chronic medical conditions ($p=0.003$) and age were significant. The two-way interactions between gender and other independent variables did not reach statistical significance.

Age differences in the associations between substance use and MDE

To further investigate the age differences in the pattern of substance use associating with MDE, we performed analyses in which the respondents were divided by age into three developmentally different age groups: adolescents (15–17 years), older adolescents (18–21 years) and young adults (22–24 years). Sex-adjusted logistic regression analyses including current smoking and frequency of drunkenness were then performed separately for each age group (table 3). The association of current smoking with MDE among the youngest respondents became more evident. The interaction between three – category age and current smoking – was significant ($p=0.022$) (table 3). The strongest association between frequency of drinking to drunkenness and MDE was seen in the age group of 18–21-year-olds (OR 4.56; 95% CI: 1.25, 16.6) but the interaction between age and drunkenness was not statistically significant (table 3).

DISCUSSION

Substance use: drunkenness and cigarette smoking

Frequency of drunkenness associated with a history of MDE in the past year while frequency of alcohol consumption *per se* did not. Previous research has suggested frequency of drunkenness to be a valid indicator of problem drinking among young adults.¹⁹ Other simple measures such as frequency and number of drinks consumed are closely related to diagnostic alcohol abuse and dependence.^{20,21} Previously, when drinking behaviour and problems related to alcohol have been viewed as a continuum, increasing alcohol use has been linked with increasing lifetime occurrence of depressive disorders.⁵ Our results suggest that frequent drunkenness is an indicator of potentially harmful drinking related to adolescent depression, and that the correlation strengthens as the frequency of intoxication increases.

The association between drunkenness and MDE peaked in late adolescence and young adulthood while the correlation of MDE with cigarette smoking was especially evident among the

Table 1 Weighted prevalences of the independent variables, by age group, gender and MDE status and results (odds ratio (OR) and 95% confidence interval [95% CI]) of the age- and sex-adjusted logistic regression analyses among the Finnish Health Care Survey (FINHCS '96) respondents (N=942)

Variable	15–19 years		20–24 years		Females		Males	
	MDE–	MDE+	MDE–	MDE+	MDE–	MDE+	MDE–	MDE+
	N=482	N=27	N=392	N=41	N=464	N=41	N=410	N=27
	%	%	%	%	%	%	%	%
		OR [95% CI]		OR [95% CI]		OR [95% CI]		OR [95% CI]
Sociodemographics								
Females (%)	54.1	62.1	50.9	58.4	–	–	–	–
		1.38 [0.62–3.07]		1.36 [0.71–2.62]				
Age (mean, [95% CI])	–	–	–	–	19.1 [18.9–19.4]	20.0 [19.2–20.8]	19.5 [19.2–19.8]	20.1 [19.1–21.1]
					1.12 [1.01–1.25]		1.08 [0.94–1.24]	
Living in southern Finland (%)	58.7	70.7	62.1	80.8	57.3	78.6	63.5	74.2
		1.71 [0.74–3.99]		2.69 [1.19–6.04]		2.79 [1.30–5.98]		1.65 [0.69–3.98]
Urbanicity (%)	49.6	59.8	65.7	75.6	58.0	71.2	55.6	66.7
		1.49 [0.69–3.24]		1.61 [0.76–3.39]		1.68 [0.82–3.41]		1.52 [0.67–3.44]
Not married nor cohabiting (%)	96.4	96.5	64.4	85.9	77.3	88.5	87.2	92.5
		1.13 [0.14–8.87]		3.73 [1.49–9.37]		4.06 [1.42–11.6]		2.63 [0.57–12.0]
Unemployed, not in school (%)	3.4	11.4	17.8	24.4	7.9	17.4	12.0	21.3
		4.27 [1.18–15.5]		1.50 [0.69–3.25]		2.05 [0.81–5.17]		1.90 [0.72–5.03]
Substance use								
Current smoking (%)	6.0	27.0	17.6	16.7	5.5	14.7	17.6	29.9
		6.40 [2.39–17.1]		1.04 [0.43–2.53]		2.61 [0.93–7.28]		1.82 [0.71–4.65]
Drunkenness never (reference category)	59.0	41.5	36.0	18.8	54.4	31.6	42.4	22.0
Drunkenness >0, ≤ x1/month (%)	38.2	51.3	51.6	61.7	42.0	61.4	46.7	51.9
		1.96 [0.87–4.40]		2.47 [1.06–5.77]		2.26 [1.11–4.61]		2.18 [0.72–6.60]
Drunkenness ≥ x2/month (%)	2.9	7.2	11.4	19.5	3.7	6.9	10.1	26.0
		3.99 [0.78–20.7]		3.95 [1.34–11.7]		2.75 [0.69–11.0]		4.95 [1.37–17.9]
Physical health								
No chronic illness (reference category)	76.7	59.9	79.0	70.7	77.3	66.2	78.1	66.8
One chronic illness (%)	18.4	25.5	14.9	29.3	17.3	26.6	16.4	29.5
		1.81 [0.72–4.57]		2.13 [1.01–4.51]		1.77 [0.83–3.77]		2.22 [0.90–5.46]
≥2 chronic diseases (%)	5.0	14.5	6.0	0	5.4	7.2	5.5	3.7
		3.86 [1.17–12.8]		–		1.43 [0.37–5.48]		0.82 [0.10–6.63]
Exercise < x1/month or never (%)	7.1	11.1	8.8	16.9	7.0	9.7	8.8	22.0
		1.48 [0.37–2.12]		3.92 [1.13–13.6]		2.56 [0.67–9.77]		2.34 [0.74–7.38]
Exercise < daily, ≥ x1/month (%)	64.6	59.6	68.1	71.1	67.9	76.4	64.3	51.8
		0.88 [0.37–2.12]		1.98 [0.74–5.29]		0.88 [0.32–2.05]		0.81 [0.32–2.05]
Exercise daily (reference category)	28.2	29.2	22.9	11.6	25.1	13.9	26.7	26.2
Body mass index (BMI) (mean, [95% CI])	21.0 [20.8–21.3]	20.8 [19.8–21.9]	22.4 [21.4–23.3]	22.8 [22.5–23.2]	21.4 [21.1–21.7]	21.7 [20.1–22.6]	22.3 [22.0–22.6]	22.0 [20.8–23.1]
		0.98 [0.86–1.12]		0.97 [0.87–1.07]		1.01 [0.92–1.10]		0.97 [0.77–1.07]

Correlates of adolescent depression

Table 2 Correlates of MDE by age and gender in multivariable logistic regression analyses^a

Independent variable	15–19 years	20–24 years	Females	Males
	N=509	N=433	N=505	N=437
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age (continuous)	1.10 (0.82–1.50)	0.98 (0.76–1.26)	1.14 (1.00–1.30)	1.05 (0.88–1.25)
Sex				
Male	1.00	1.00	–	–
Female	2.10 (0.81–5.44)	1.93 (0.93–4.02)	–	–
Region of residence				
Other regions	1.00	1.00	1.00	1.00
Southern Finland	1.52 (0.65–3.53)	2.12 (0.92–4.89)	2.30 (1.06–5.02)	1.50 (0.60–3.75)
Marital status				
Married or cohabiting	1.00	1.00	1.00	1.00
Not married nor cohabiting	4.16 (0.27–65.0)	3.50 (1.35–9.08)	3.56 (1.26–10.1)	3.39 (0.68–16.8)
Working status				
Studying or working	1.00	1.00	1.00	1.00
Unemployed, not in school	1.59 (0.30–8.49)	1.31 (0.58–2.99)	1.69 (0.64–4.46)	1.52 (0.52–4.44)
Smoking				
Never, former, occasional	1.00	1.00	1.00	1.00
Current, >10 cigarettes/d	5.54 (1.44–21.3)	0.75 (0.29–1.95)	2.17 (0.65–7.27)	1.04 (0.36–2.96)
Frequency of drunkenness				
Never	1.00	1.00	1.00	1.00
>0, ≤ x1/month	1.56 (0.54–3.61)	2.79 (1.14–6.83)	2.02 (0.97–4.22)	1.97 (0.67–5.74)
≥ x2/month	1.58 (0.31–8.05)	4.48 (1.44–14.0)	2.01 (0.55–7.40)	4.54 (1.27–16.3)
Chronic illness				
No	1.00	1.00	1.00	1.00
One	1.68 (0.63–4.47)	2.25 (0.98–5.13)	1.44 (0.62–3.36)	2.21 (0.84–5.81)
Two or more	3.77 (1.04–13.7)	–	1.12 (0.27–4.62)	0.83 (0.10–7.05)
Frequency of physical exercise				
Daily	1.00	1.00	1.00	1.00
< daily, > x1/month	0.74 (0.29–1.87)	1.71 (0.64–4.59)	1.57 (0.62–3.99)	0.94 (0.37–2.40)
≤ x1/month or never	0.86 (0.18–4.18)	4.01 (1.18–14.0)	1.93 (0.50–7.43)	2.36 (0.69–8.10)

a: Six respondents had missing data on alcohol use or physical exercise and were included in respective reference categories.
OR: odds ratio, 95% CI: 95% confidence interval

Table 3 Smoking and frequency of drunkenness as correlates for MDE in logistic regression analyses by three age groups (adolescents, late adolescents and young adults)^a

	15–17 years	18–21 years	22–24 years	Interaction with age p value
	OR (95% CI) n=280	OR (95% CI) n=408	OR (95% CI) N=254	
Gender				
Male	1.00	1.00	1.00	
Female	1.17 (0.36–3.83)	1.81 (0.80–4.06)	1.67 (0.67–4.18)	
Smoking				
Never, former, occasional	1.00	1.00	1.00	
Current, >10 cigarettes/d	15.4 (2.20–109)	1.14 (0.42–3.15)	1.32 (0.41–3.11)	0.022
Drunkenness				
Never	1.00	1.00	1.00	
>0, ≤ x1/month	2.07 (0.58–7.31)	3.04 (1.20–7.74)	1.20 (0.41–3.53)	0.395
≥ x2/month	–	4.56 (1.25–16.6)	3.14 (0.79–12.4)	0.801

a: Five respondents had missing data on alcohol use and were placed in respective reference categories.
OR: odds ratio, 95% CI: 95% confidence interval

youngest respondents. This suggests developmental differences in how substance use is related to MDE. Moreover, the availability of legal substances may modulate the effect since 18 years is the legal drinking age in Finland, whereas cigarettes could be bought at the age of 16 in 1996. Our results accord with studies concluding that the relationships between cigarette smoking or nicotine dependence and MDD are established early in life.^{3,4} Some evidence supports the hypothesis of common vulnerability between major depression and nicotine dependence^{1,3,22} but contradictory evidence also exists²³ and more research is needed to reveal the underlying mechanisms.

The association between frequency of drunkenness and MDE appeared stronger among males than females although the difference was not supported by a significant interaction analysis. It is possible that not controlling for other psychiatric disorders affected the strength of the associations as other disorders (e.g. conduct and attention deficit disorders) could also be associated with similar patterns of substance use or health behaviour. As males drink more often and more per occasion, the results may reflect gender-related differences in quantity and frequency of alcohol use that our measures did not assess. Consistent data exist on gender differences in the prevalence estimates of MDE and alcohol use disorders but only minor gender differences in the association of MDE and heavy drinking have been reported.^{5,24,25} Reportedly, alcohol use disorders in young people are as likely to precede depression as to follow it,^{5,26,27} suggesting that there may be different mechanisms involved in different types of comorbidity.

Physical health: chronic illness and exercise

The finding of chronic illness relating to MDE in adolescents is consistent with previous research. General population studies using self-report rating scales have found an association between high depressive symptom scores and chronic illness in adolescents.^{28,29} Earlier epidemiological research analysing the association between physical health and structurally diagnosed MDE in youth is scarce. Impairing somatic illness and ill health in young adults³⁰ and adolescents^{9,10} have been linked with MDD.

The correlation of infrequent physical exercise with MDE in young adults is consistent with earlier findings of depressive symptoms independently associating with lack of exercise. Most previous population studies have used self-report rating scales in adult or young adult populations³¹⁻³³ or have not reported results separately for adolescents.³⁴ Low levels of physical exercise may share correlates or risk factors with depression.³¹⁻³³ Many depressive symptoms are likely to reduce physical activity, and may indeed reflect poor physical fitness. Moreover, there is evidence that exercise exerts an antidepressant effect.³⁵

Sociodemographic variables

Although most young people are still unmarried or not cohabiting by the age of 24 in Finnish society, marriage appears to be even more uncommon among those with MDE. The association between MDE and not being married nor cohabiting may indicate lack of social support³⁶ or problems in interpersonal relationships,^{37,38} which both reportedly associate with depression. MDD affects the level of experienced and received social support and low levels of social support can increase the risk of MDD.³⁹ Difficulties in forming a stable relationship in young adulthood may reflect the 'scars' of depression.^{37,40} Young adult females with a history of depression have also been reported to have high rates of early marriage with subsequent marital dissatisfaction in comparison with their non-depressed peers.⁴¹

Living in southern Finland correlated with MDE, which may indicate an uneven distribution of other correlates or latent variables not measured in this survey.^{42,43} Our results may reflect

the high degree of urbanicity in southern Finland, or the lack of social support for young people migrating from other regions of Finland to urban centres for study and work opportunities. Unemployment, previously associated with depressive symptoms in young males,³⁷ did not retain its significance after adjusting for the other independent variables.

Strengths and limitations

Few studies on adolescent psychiatric disorders, including MDE, have been carried out in a highly representative, nationwide sample. The size of our sample, moreover, places it among the largest of epidemiological studies in adolescent depression, although it was still not large enough for some subgroup or interaction analyses of interest. Besides applying a structured diagnostic interview to assess MDE, the study included a variety of items related to physical health and health-related behaviour. These aspects have seldom been combined in epidemiological literature on adolescents and young adults. Additionally, although an ideal way to explore developmental patterns in psychopathology would be a longitudinal design, we were able to investigate developmentally different age groups.

This study has the general limitations of a cross-sectional design: most importantly, causal inferences cannot be made and only correlates can be assessed. In addition, we were unable to assess psychiatric comorbidity in the diagnostic interview, which creates some uncertainty about the strength of the correlations as well as the specificity of the correlates to MDE as opposed to psychiatric disorders in general. Thirdly, we lacked information on any history of earlier depressive episodes or other more rare mood disorders (e.g. bipolar or schizoaffective disorder). Finally, although the procedural validity of CIDI is good, the validity of UM-CIDI SF in general population samples has been studied less.^{14,17} Possible lower sensitivity in comparison with full CIDI may lead to weaker associations. The possibility of non-participants having increased prevalence of psychiatric disorders may have yielded weaker associations among males and adolescents who had comparatively high rates of proxy interviews.

Clinical implications

Observations suggest that the association between MDE and substance use varies by age or developmental phases. The association between smoking and major depression in early adolescence should be borne in mind, and drinking habits or frequency of drunkenness should be carefully noted. Young people are usually considered to be in good health, but the lifestyle and health-related behaviour of a young person with major depression may be compromised in many ways, which may contribute to excess morbidity and mortality later in life. This high-risk group of youngsters, still in the process of forming their health behaviour, is an important target for preventive and treatment interventions. Further, it is likely that other psychiatric disorders besides depression also play a role in the clustering of ill health and compromised health behaviour and these should be carefully assessed, too, to retain a holistic approach on adolescent health and choice of treatment interventions.

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A poster presentation including data from a previously published paper¹³ as well as some of the results presented in this paper was given by Dr Linnea Haarasilta in the congress 'New Commitments for Psychiatrists' (World Psychiatric Association, 30 September - 4 October 2001, Madrid, Spain).

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