Depressive Symptoms and Carotid Artery Intima Media Thickness In Police Officers

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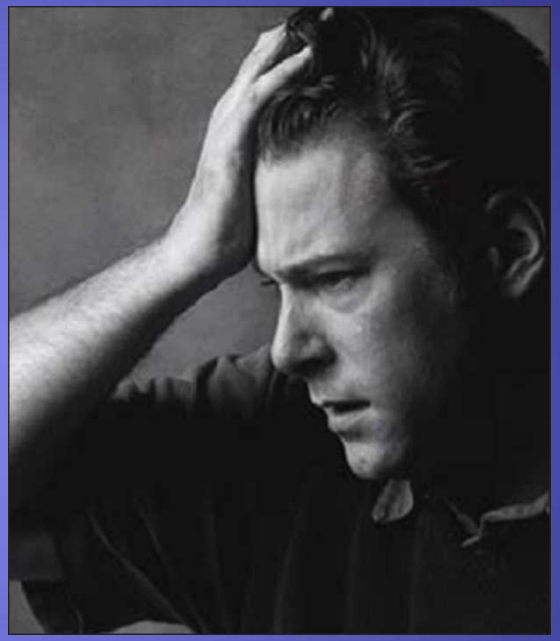
BCOPS

The Buffalo Cardio-Metabolic Occupational Police Stress study

A five year investigation of police stress, shift work, cardiovascular disease, and metabolic disorders conducted at the University at Buffalo, State University of NY in collaboration with NIOSH.

Police work is considered a stressful occupation which not only involves danger and traumatic event exposure, but also organizational stressors such as lack of support, punishment centered executive philosophies, and excessive paperwork..

Such exposure can lead to behaviors and patterns associated with chronic stress. Sustained or chronic stress may lead to elevated hormones such as cortisol and reduced serotonin and other neurotransmitters in the brain, including dopamine, which has been linked to depression.

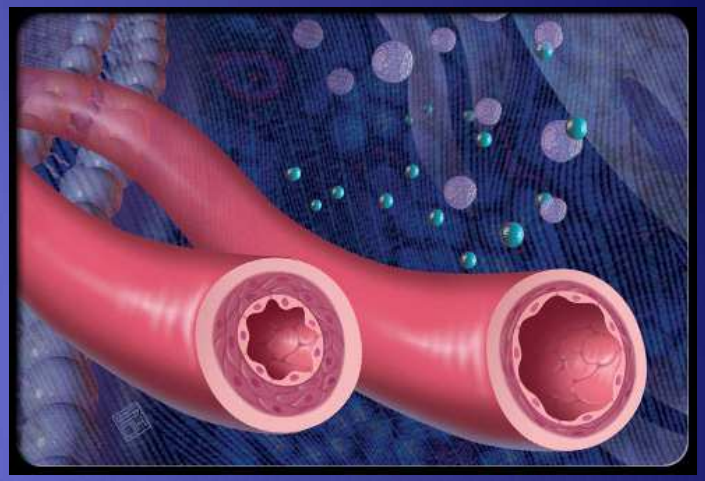


Depression has also been associated with biological outcomes which exacerbate the risk of CVD, including hyperactivity within the hypothalamic- pituitary-adrenal axis, diminished heart rate variability, and ventricular instability.

Due to occupational exposure and increased risk for stress and depression, police officers may be at higher risk for CVD.

Hartley et al (2011) found that the number of Metabolic Syndrome components increased significantly across categories of depressive symptoms for male officers (p-trend=0.003).

For each 5-unit increase in the depression score, odds for having hypertriglyceridemia increased by 47.6%, 51.8% for having hypertension, and 56.7% for having glucose intolerance.



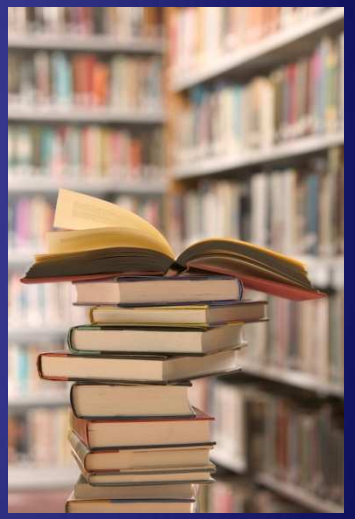
In the present study, we tested the hypothesis that depressive symptoms in police officers are associated with carotid artery intima-media thickness (CIMT) after adjustment for traditional CVD risk factors.

CIMT progression rates have been associated with risk factors such as diabetes, smoking, hypercholesterolemia, and hypertension

METHODS

- Between June 2004 and October 2009, 464 police officers in a mid-sized urban police department were examined at the University Clinic.

- The final sample included 412 officers with complete data (305 men and 107 women)
- who were currently employed
- had complete information for CIMT
- had completed the Center for Epidemiologic Studies *Depression* (*CES-D)* Scale.

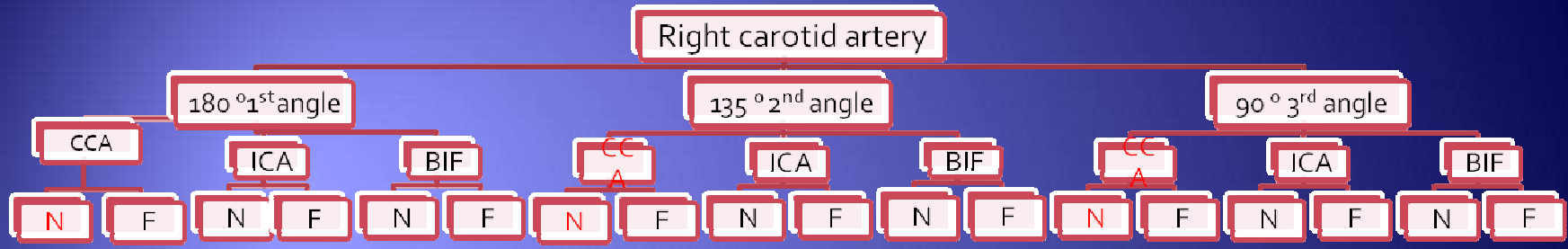


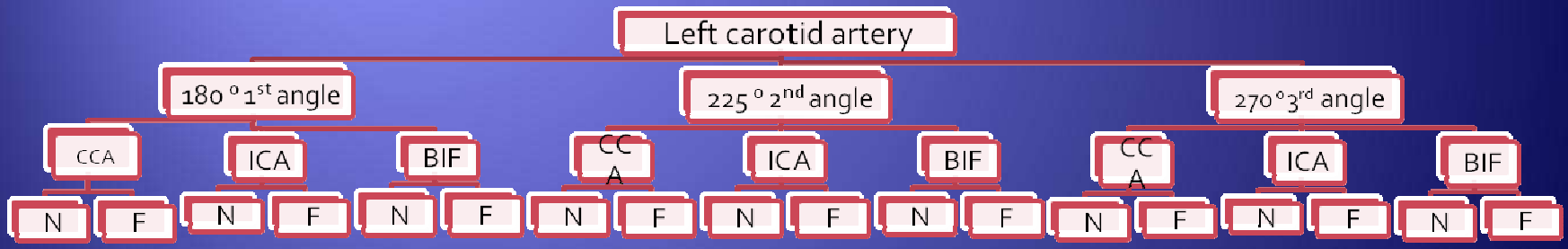
- Prior to any clinic examinations the officers reviewed and signed informed consent forms. The Institutional Review Board at the University at Buffalo and the National Institute for Occupational Safety and Health (NIOSH) approved the study.

Assessment of Carotid Intima Media Thickness: (CIMT)

Certified sonographers used a standardized ultrasound protocol that was adopted from the Center for Medical Ultrasound at Wake Forest University. High resolution B-mode carotid ultrasonography was performed using a 7.5- to 10-MHz transducer and a Biosound Esaote (AU5) ultrasound machine.

Carotid Intima Media Thickness Ultrasound Measurement

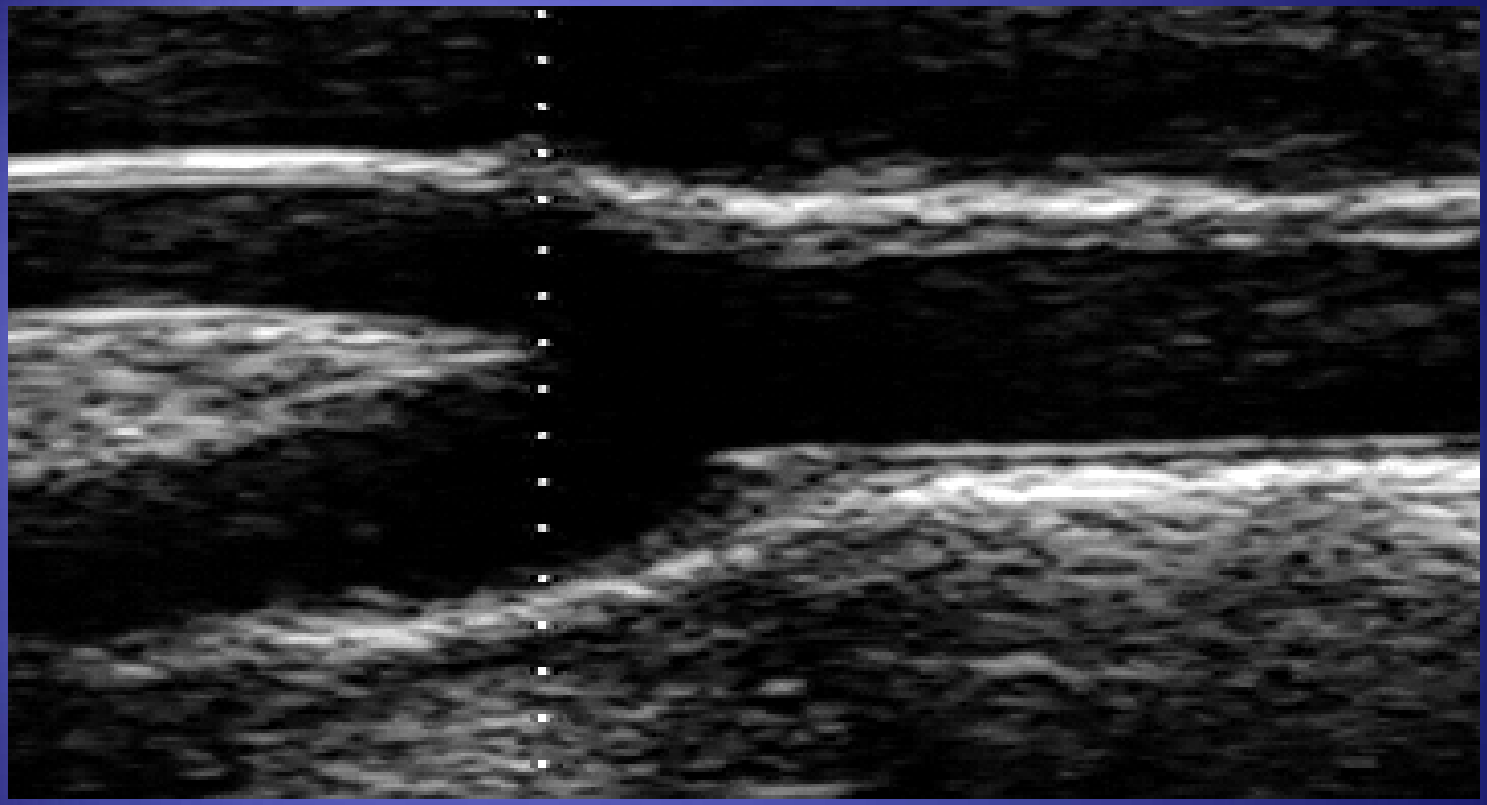




Abbreviation: A1, first angle; A2, second angle; A3, third angle; BIF, bifurcation; CCA, common carotid artery; ICA, internal carotid artery; IMT, intima-media thickness; F, far wall; N, near wall; L, left side; R, right side.

0.109- conversion value- pixels to millimeters on computer

36 measures total



B-mode ultrasound image of the carotid artery, taken at the optimal angle of interrogation (showing the CCA, bifurcation, ICA segments). The "dotted" vertical line demarcates the tip of the flow divider into the external and internal carotid branches.

The acceptable differences between any two ultrasound readers did not exceed <0.03 mm for the MMCCA and <0.05 mm for the MMXIMT. A phantom scan, using a tissue equivalent phantom, was performed every two weeks to ensure accurate calibration of the ultrasound machine and transducers

Assessment of depressive symptoms

Depressive symptoms were measured using the Center for Epidemiological Studies Depression (CES-D) scale. The CES-D is a short scale that was designed to measure symptoms of depression in the general population.

Assessment of CVD covariates

CVD risk components were based on cut points established by the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III), the American Heart Association and the National Heart, Lung, and Blood Institute, National Institutes of Health…

Large Waist Size	**For men: 40 inches or larger** **For women: 35 inches or larger**
Cholesterol: High Triglycerides	Either 150 mg/dL or higher or Using a cholesterol medicine
Cholesterol: Low Good Cholesterol (HDL)	Either For men: Less than 40 mg/dL For women: Less than 50 mg/dL or Using a cholesterol medicine
High Blood Pressure	Either Having blood pressure of 135/85 mm Hg or greater or Using a high blood pressure medicine
Blood Sugar: High Fasting Glucose Level	100 mg/dL or higher

- Participants were weighed and height was measured without shoes. Body mass index (BMI) was calculated as weight (in kilograms) divided by height (in meters) squared.
- Blood was collected from officers who had fasted for at least 12 hours the previous night.
- Blood parameters were measured by standard laboratory techniques on the Beckman Coulter LX20 clinical chemistry analyzer and included a blood lipid panel for HDL and triglycerides, and chemistry panels for glucose.
- Officers were given self and interviewer administered questionnaires to provide information on demographic characteristics, lifestyle behaviors, and medical history

Statistical Analysis

- Simple descriptive measures were calculated for all variables.

- Associations for all covariates with CES-D scores and CIMT were examined using the chi-square test of independence and Analysis of Variance (ANOVA).

- ANOVA and Analysis of Covariance (ANCOVA) were utilized to examine the mean values of CCA IMT and MMXIMT across quintiles of depressive symptoms. Depressive symptoms were categorized into quintiles in order to present mean values of the dependent variables which facilitate interpretation of the results.

- The p-values for linear trends were obtained from linear regression models utilizing the continuous forms of both dependent and independent variables.

- Effect modification was assessed for antidepressant medication use, BMI, smoking status, alcohol consumption status, physical activity status, history of hypertension and diabetes, race, gender, and sleep duration.

- The potential confounders were age, gender, race/ethnicity, educational level, cigarette smoking status, alcohol intake, BMI, HDL cholesterol, LDL cholesterol, triglycerides, glucose, and antidepressant medication use. All analyses were conducted in SAS version 9.2.

RESULTS

Table 1. Demographic and lifestyle characteristics by gender, BCOPS study.

Characteristics	Men (n=305)		Women (n=107)	
	N	Mean (SD)	N	Mean (SD)
Age (years)	305	41.1 (7.4)	107	40.7 (6.1)
Police service (years)	302	14.9 (7.7)	107	13.5 (6.8)
Depressive symptoms (CES-D score)	305	7.4 (6.6)	107	8.7 (8.2)
CCA IMT (mm)	305	0.626 (0.105)	107	0.587 (0.078)
MMXIMT (mm)	305	0.801 (0.150)	107	0.729 (0.102)
		%		%
Ethnicity				
European-American	237	78.2	78	72.9
African-American	53	17.5	29	27.1
Hispanic-American	13	4.3	0	0
Antidepressant medication use	19	6.3	12	11.2
Hypertension	80	26.2	18	16.8
Diabetes	10	3.3	1	0.9

Hypertension was defined as taking any medication for high blood pressure or SBP ≥140 or DBP ≥90.
Diabetes was defined as taking any medication for diabetes or fasting serum glucose ≥126.
BMI = body mass index; BP = blood pressure.
CIMT = Carotid intima-media thickness; CES-D = Center for Epidemiologic Studies Depression scale.

- The mean age of all officers was approximately 41.0 years. The age ranges for men and women were 21 - 66 and 26 – 53 years, respectively.
- Female officers had slightly higher CES-D scores than male officers.
- In contrast, male officers had slightly higher mean common IMT and maximum IMT values than women.
- The majority of officers were Caucasian.
- Male officers had a higher prevalence of hypertension and diabetes compared to female officers.

Table 2. Gender-adjusted associations of selected characteristics by quintiles of CES-D score, BCOPS study.

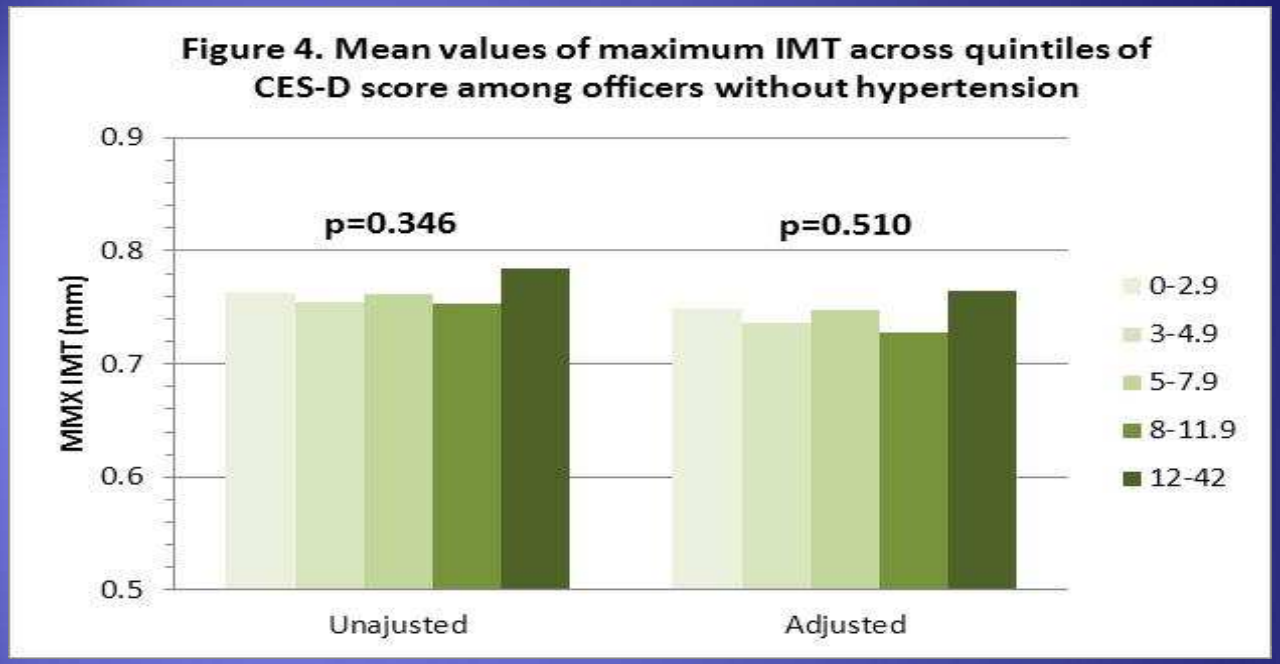
	Quintiles of CES-D score					
	0-2.9 (n=88)	3-4.9 (n=74)	5-7.9 (n=80)	8-11.9 (n=80)	12-42 (n=90)	P
Age (years)	40.5 ± 8.1	40.8 ± 6.3	41.4 ± 7.5	41.3 ± 6.6	40.8 ± 7.0	0.833
Police service (years)	14.0 ± 8.0	14.2 ± 6.4	15.9 ± 8.1	14.3 ± 7.7	14.4 ± 6.9	0.999
Race/Ethnicity (%)						
European-American	83.0	63.0	77.5	74.7	83.3	0.029
African-American	17.0	31.5	21.3	20.3	12.2	
Hispanic-American	0	5.5	1.3	5.0	4.4	
Antidepressant medication	5.7	5.5	5.0	2.5	17.8	0.004
Hypertension (%)	25.0	24.3	26.3	21.3	22.2	0.944
Diabetes (%)	2.3	4.1	5.0	0	2.2	0.306

Results are means ± Standard deviations or percentages.
BMI = body mass index; BP = blood pressure.
HDL = high density lipoprotein; LDL = low density lipoprotein.
The p-values for continuous variables are from linear regression models.
The p-values for the categorical variables are from the chi-square tests.

- **Neither age nor years of police service were significantly associated with depressive symptoms.**

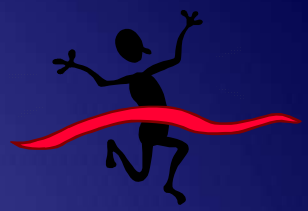
- **Race/ethnicity was significantly associated with depressive symptoms.**

We then stratified by traditional CVD risk factors to reveal whether any of these risk factors might modify the association between depressive symptoms and CIMT. No significant differences were noted in the associations between depressive symptoms and CIMT after stratification with one exception: *hypertension*.



- We assessed the association between depressive symptoms and *maximum IMT* among officers who were free of hypertension.
- After adjustment for the same covariates, the association between depressive symptoms and *maximum IMT* was not statistically significant

CONCLUSIONS



- This result indicated that depressive symptoms may be independently associated with CIMT, yet only among participants free of hypertension and only the common IMT.

- One advantage is that information on mean common CIMT can generally be obtained easily in protocols assessing mean maximum CIMT, but not the other way around.

- As seen in this study, classic risk factors such as hypertension may mask the association between depression and CIMT and must be included in any analysis.

- Additionally, recent work on depression and hypertension has provided evidence of increased sympathetic activity and increased blood pressure reactivity. These studies suggest that depression may have an effect on the cardiovascular system that could lead to the development of hypertension and possible future CVD.

- Behaviors related to stress or depression may also increase the risk for CVD in officers.

- A recent study (Joseph, et al , 2010) found that police officers have increased levels of atherosclerosis compared with a general population sample, which was not fully explained by elevated CVD risk factors; thereby potentially implicating other mechanisms whereby law enforcement work may increase CVD risk.

Officers also die from CVD at earlier ages than the general population (Violanti, etal, 1998). This suggests the possible influence of lifestyle risk factors for those diseases, including psychological stress and depression.

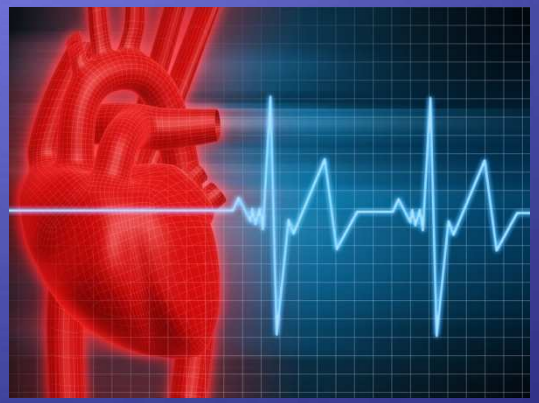
LIMITATIONS

This study is cross sectional and cannot determine the causal direction between depressive symptoms, CIMT and traditional CVD risk factors. Future prospective investigations may help to clarify this issue. Other limitations of this study are the lack of complete recruitment of all members of the police force, residual confounding, and the possibility of selection bias.

- This study has the advantage of being conducted in a controlled clinical setting, where assessment of many CVD risk factors (such as blood pressure or cholesterol) is conducted by trained clinic personnel.

- Data collection for all studies was performed at the same site, using a standardized protocol during similar time frames by the same research team.

These findings suggest that there may be a pathophysiological link between depression and atherosclerosis. Our results do not, however, establish an etiological role of depression in the subclinical development of atherosclerosis in police officers…



Future prospective work is planned with the present police cohort to help clarify such possible causal relationships between depressive symptoms and CVD.

It will also be necessary to examine not only depressive symptoms, but other variables associated with police work such as behavioral lifestyles that may further exacerbate earlier signs of cardiovascular disease.

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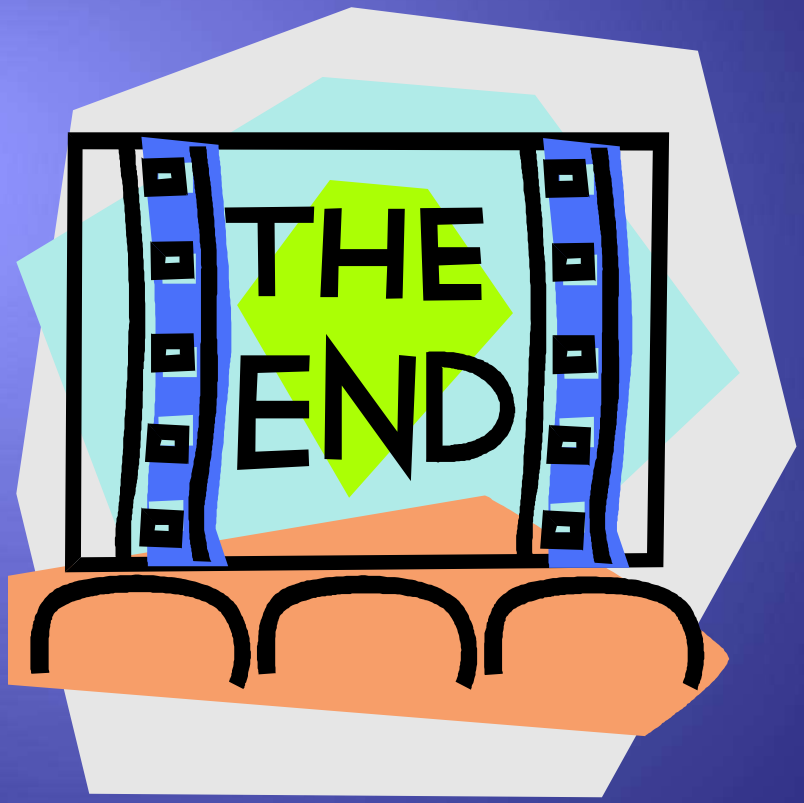
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