Association between Depressive Symptoms, Metabolic Risk Factors, and Cognitive Impairment:

Results from a Community Study in Quebec, Canada

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Introduction

Metabolic risk factors and depression have both been associated with cognitive impairment in the elderly. Despite frequent comorbidity, it remains unclear whether the combination of the two conditions has an additive effect on cognitive impairment. Moreover, there is limited knowledge about their combined effect on the cognitive function of middle-aged adults (40-69 years old).

Objective: To investigate a potential association between depression and metabolic risk factors on cognitive function in a middle-aged population.

Methods

Figure 1. Selection process of the EMHS participants from the CARTaGENE study

Of the **18,000 adults** that participated in CARTaGENE, **2,525 without diabetes** at baseline and information on depressive symptoms and metabolic risk factors were selected for the EMHS study (2016).

The same participant group that had complete information on the cognitive function tests were used for the current study.

A stratification approach contingent on the presence of depressive symptoms and metabolic dysregulation was used to recruit participants from four groups, presence of:

- neither condition - reference group
- metabolic risk factors only
- depressive symptoms only
- comorbid - both conditions

The scores of each group on three cognitive domains, **Fluid Intelligence (FI)**, **Reaction Time (RT)** and **Visual Memory (VM)** were compared.

The Four Participant Groups

Figure 2. The four condition groups which were compared using the overall cognitive score that is composed of three cognitive measures

- Depression** – PHQ-9
Depressive symptoms = score 6 ≤

Metabolic Risk Factors

Metabolic syndrome = ≥ 3 factors
➢ measured on site (physical & biochemical/ hematological measures)

Cognitive Function

- “Fluid Intelligence”**
12 Questions – higher score means better cognitive function (0-13)
- “Reaction Time: Snap”**
Time is measured in milliseconds
➢ Higher score reflects poorer cognitive function.
- “Pairs Matching”**
Shown 6 cards with different symbols for 3 seconds & asked to memorize the positions of as many cards as possible
➢ Higher number of tries indicates poorer cognitive function.

- The **G-factor score** was computed through the combination of the three standardised cognitive scores and adjusted for age and education
- Linear and logistic regression were conducted for the analysis. In the logistic regression model, individuals in the lower quartile of the age and education adjusted g-score (25%) were classified as having poorer cognitive function, while everyone else was categorized as having good cognitive function.

Results

Table 1 Results from Linear Regression Model with Overall Cognitive Score as the Dependent Variable and the Four Groups as in the Independent Variables

Group	Base model ^a			Fully Adjusted ^b			Linear Trend (+ve)
	Beta Coefficient	95% CI	P Value	Beta Coefficient	95% CI	P Value	
Metabolic Risk Factors only	.05	-.06 .16	.37	.03	-.08 .15	.63	Sig. Groups: 1.Both 2. Depression 3. Metabolic 4. Healthy
Depression only	-.29	-.41 -.17	.00	-.30	-.42 -.18	.00	
Depression & Metabolic Risk Factors	-.33	-.46 -.19	.00	-.36	-.50 -.23	.00	

Beta values reflect the difference vs. healthy controls. CI, confidence interval.

^aAdjusted for age and education.

^bAdjusted for age, education, sex, smoking status, physical activity, language, and ethnicity.

Figure 3. CI, confidence interval. Results of the logistic regression model; the odds of reduced cognitive function in the three conditions groups as compared to the healthy group (non-adjusted for age and sex).

- Synergistic Effect: Interaction Contrast Ratio (ICR) = 0.619**

Discussion

STRENGTHS

- Large sample
- Representative of the Quebec population
- Consistent and reliable measures, similar to those used in large population studies such as the UK Biobank Study

LIMITATIONS

- Cross-sectional design; therefore cannot determine cause and effect
- Snapshot timing may not be representative
- Only three cognitive domains were examined
- Depressive symptoms were assessed but not clinical depression
- Diabetes patients were excluded
- Missing or invalid data points

Conclusion

Comorbidity of **depression** and **metabolic risk factors** is associated with the **poorest cognitive performance** in all three cognitive function domains. The results of our study also show that the co-occurrence of depression and metabolic risk factors might have more than an additive effect on cognitive function.