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## Original Article

## The brain study: Cognition, quality of life and social functioning following preeclampsia; An observational study <sup>☆</sup>

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## ABSTRACT

**Objectives:** Previously preeclamptic women may express cognitive difficulties, which have largely been unappreciated or attributed to stresses of a complicated pregnancy. This study aimed to explore the scope of perceived neurocognitive and psychosocial problems as well as quality of life following preeclampsia.

**Study design:** Observational study. Through website promotion and e-mail, registrants of the USA-based Preeclampsia Foundation who experienced preeclampsia in the past 20 years were invited to complete a web-based survey. Participants were requested to ask an acquaintance that had a normotensive pregnancy to also complete the survey (controls).

**Main outcome measures:** The Cognitive Failures Questionnaire (CFQ), abbreviated WHO Quality Of Life questionnaire (WHOQOL-BREF), Social Functioning Questionnaire (SFQ) and Breslau Short Screening Scale for DSM-IV Posttraumatic Stress Disorder were used in the survey. Analysis was performed using Mann–Whitney *U* tests and linear regression.

**Results:** 966 cases and 342 controls completed the survey (median age 34, median time since first pregnancy 4 vs. 5 years). Cases scored significantly worse on CFQ (median 35 vs. 27), WHOQOL-BREF domains physical health (15 vs. 17), psychological (13 vs. 15), social relationships (13 vs. 15) and environment (15 vs. 16), and SFQ (8 vs. 7). All  $p < 0.001$ . Multivariable analysis showed an independent significant effect of eclampsia on CFQ and of migraine on all questionnaires and the effect of preeclampsia was still present after adjustment for confounders. Posttraumatic stress symptoms accounted for part of the relationships.

**Conclusions:** Previously preeclamptic women appear to perceive more cognitive and social problems, and report poorer quality of life compared to a group of women with normotensive pregnancies. Research relating to the origin and management of these issues is needed.

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## Introduction

There is growing recognition that preeclampsia is not a transient event. The syndrome is associated with a greater incidence of hypertension, ischemic heart disease or stroke later in life [1]. Mechanisms of the increased risk for cardiovascular disease following a pregnancy complicated with preeclampsia remain unknown but risk factors for atherosclerosis such as chronic hypertension, dyslipidemia, obesity and glucose intolerance are likely to play a role. Formerly eclamptic women report cognitive difficulties related to memory and concentration; small studies have not clearly demonstrated these in preeclampsia [2–7]. At long-term follow-up, formerly eclamptic and preeclamptic women may demonstrate cerebral white matter lesions on MRI [8,9]. The presence of both such lesions and chronic hypertension has been associated with cognitive decline in later life [10–12]. Alternatively, a pregnancy complicated by preeclampsia may be experienced as traumatic, resulting in trauma-related psychopathology such as posttraumatic stress syndrome (PTSD) and depressive symptoms, known to influence cognitive functioning [4,13–16]. It is therefore possible that both biological constitution as well psychosocial factors are responsible for the neurocognitive difficulties reported by formerly preeclamptic women. We sought to determine the actual scope of cognitive problems and the impact of preeclampsia on quality of life and social functioning. Because few small studies so far have focused on cognitive and social functioning after preeclampsia, we aimed to make an inventory of the nature and extent of these issues in a large cohort of formerly preeclamptic women.

## Materials and methods

All registrants of the Preeclampsia Foundation were contacted through the foundation's website ([www.preeclampsia.org](http://www.preeclampsia.org)) and a mass e-mail, explaining the study aims and methodology. The Preeclampsia Foundation is a USA-based non-profit patient advocacy organization established in the year 2000 whose mission is to reduce maternal and infant illness and death due to preeclampsia and other hypertensive disorders of pregnancy, by providing patient support and education, raising public awareness, catalyzing research and improving health care practices. Free registration with the foundation is open to anybody who is interested in preeclampsia, but is mostly sought after by women who experienced the disease. The survey was online between April 29, 2010 and Oct. 4, 2010. At the start of the study, the Preeclampsia Foundation had 8677 registrants. This project was determined to be eligible for a Certificate of Exemption as reviewed by the Human Subjects Review Committee of the University of Washington, Seattle. Participation in the study was anonymous and without a request for any identifying information other than postal zip code and year of birth which were used to identify those women who erroneously filled out the questionnaires more than once. All women were asked to give consent prior to the first survey question.

## Participants

Study participants were asked whether they had experienced any pregnancy-related hypertensive disorder, including preeclampsia (toxemia), HELLP syndrome, or pregnancy-induced hypertension (PIH) during any of their pregnancies. Participation was allowed for women who had their first pregnancy after 1990 and had not been pregnant in the past 3 months. The survey consisted of four web based questionnaires as well as an inquiry about current and past medical history including medication use, age, ethnicity, education level and characteristics of index and subsequent pregnancies (gestational age, birth weight, preeclampsia, HELLP syndrome or eclamptic seizures).

Participants were requested to ask a friend or acquaintance of approximately the same age that had a normotensive pregnancy during the same year of the participant's hypertensive pregnancy to complete the survey as a control subject. Women with current or past neurological conditions or women who lived in a country where English is not the first language were excluded.

## Questionnaires

### *The Cognitive Failures Questionnaire (CFQ)*

The CFQ is a validated questionnaire and contains 25 items scored on a five-point scale. It assesses how often over the past 6 months errors were committed in daily tasks of everyday life. In this study we used 18 of the 25 questions. The answers to 7 questions could not be accessed from the anonymous collection tool. The loss of data weakens the power of the tool but is not expected to create a bias between case and control groups. From the 18 questions we derived a total score ranging from 0 to 72. Higher scores on the CFQ indicate more cognitive failures [17,18].

### *The World Health Organization Quality of Life BREF (WHOQOL-BREF) US version*

The WHOQOL-BREF is a validated abbreviated version of the WHOQOL-100 that contains 100 items developed to assess generic quality of life. The WHOQOL-BREF contains 26 questions in four domains: physical health, psychological, social relationships and environment. Items can be scored on a five-point scale. Higher scores indicate higher quality of life. The mean score of items within each domain is used to calculate the domain score, ranging from four to 20. The first two questions are general questions that do not pertain to one of the domains but are examined separately: question one pertains to overall perception of quality of life and question two pertains to overall perception of health [19].

### *The Social Functioning Questionnaire (SFQ)*

The Social Functioning Questionnaire (SFQ) is a validated questionnaire that contains eight items covering the following domains: work, household tasks, financial matters, family relationships, sexual relationships, social contacts, and spare time activities. Items are scored on a four point-scale, from which a total score can be derived with a range of 0–24 [20]. Higher scores indicate poorer so-

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