

Long-term impacts of sulfur mustard exposure on mental health, quality of life, and lung function

Akademisk avhandling

Som för avläggande av medicine doktorsexamen vid Sahlgrenska akademien, Göteborgs universitet kommer att offentligen försvaras i Hälsovetarbacken hus 2, Hörsal 2118, den 22:e september, klockan 13.00

av

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Avhandlingen baseras på följande delarbeten

- I. **Moradi Faraidoun**, Söderberg Mia, Moradi Fazil, Daka Bledar, Olin Anna-Carin, and Mona Lärstad: Health perspectives among Halabja's civilian survivors of sulfur mustard exposure with respiratory symptoms—a qualitative study. *PLoS ONE*. 2019;14(6)
- II. **Moradi Faraidoun**, Moradi Fazil, Söderberg Mia, Daka Bledar, Olin Anna-Carin, and Mona Lärstad: Gendered lived experiences of marriage and family following exposure to chemical warfare agents: content analysis of qualitative interviews with survivors in Halabja, Kurdistan-Iraq. *BMJ Open*. 2020;10(10)
- III. **Moradi Faraidoun**, Moradi Fazil, Li Ying, Olin Anna-Carin, and Daka Bledar: The impact of sulfur mustard on quality of life and mental health in Kurdish survivors in Sweden, thirty years after exposure. *Health and quality of life outcomes* 2022;20(1):1–10
- IV. **Moradi Faraidoun**, Kjellberg Sanna, Li Ying, Daka Bledar, and Olin Anna-Carin: Respiratory function 34 years after sulfur mustard exposure in survivors in Sweden. Submitted.

**SAHLGRENSKA AKADEMIN
INSTITUTIONEN FÖR MEDICIN**



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Abstract

Sulfur mustard is a highly harmful blistering chemical warfare agent with an alkylation ability that can affect multiple organs (skin, eyes and lungs) in the short and long term. Sulfur mustard's long-term biopsychosocial effects have not been sufficiently studied. This thesis aims to explore and describe such effects on individuals exposed to sulfur mustard and compare them with unexposed individuals in Sweden and Kurdistan-Iraq.

For Studies I and II, individuals exposed to sulfur mustard in Halabja, Kurdistan-Iraq were interviewed in 2016. For Studies III and IV, exposed individuals originally from Kurdistan but now living in Sweden were recruited and compared with unexposed Kurdish-Swedish individuals. In Study III, the Montgomery and Asberg Depression Rating Scale was used to collect mental health data, while the quality of life was evaluated using the RAND Short Form Health Survey 36-Item. In Study IV, impulse oscillometry, multiple breath washout, and the diffusing capacity of the lungs for carbon monoxide were used to evaluate lung function.

Systematic text condensation was deployed to analyze the interviews in Study I, while the content analysis approach was employed in Study II. For Studies III and IV, group comparisons were carried out using the Mann-Whitney U-test, independent t-test, or Fisher's exact test, depending on the type of variables.

The narrative findings in Study I showed that individuals exposed to sulfur mustard had poor access to sustainable healthcare in Kurdistan-Iraq. They were stigmatized and socially abandoned because of the label "Chemically exposed survivor". The narrative findings indicated development of "Chemical contamination anxiety" which caused fear and insecurity and limited their ability to start a family and be active in social and professional life. The gender-related effects of exposure in Study II showed that women experienced more psychosocial effects while men were worried about post-exposure complications e.g., disabilities and death.

Study III showed that individuals exposed to sulfur mustard had significantly poorer quality of life and more moderate depressive symptoms than those not exposed. Study IV revealed that individuals exposed to sulfur mustard had markedly worse small airways function than unexposed participants.

Overall, this thesis with its mixed-method approach showed an association between sulfur mustard exposure and significant long-term worse physical and mental symptoms, impaired quality of life, and lower lung function among individuals exposed to sulfur mustard than those unexposed. The thesis emphasizes the importance of a biopsychosocial model to address this group of patients' unique needs.

Keywords: Chemical Warfare Agent, Sulfur Mustard, Halabja, Quality of life, Mental health, Small airways dysfunction