



## Reducing intrusive traumatic memories after emergency caesarean section: A proof-of-principle randomized controlled study



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### ABSTRACT

Preventative psychological interventions to aid women after traumatic childbirth are needed. This proof-of-principle randomized controlled study evaluated whether the number of intrusive traumatic memories mothers experience after emergency caesarean section (ECS) could be reduced by a brief cognitive intervention. 56 women after ECS were randomized to one of two parallel groups in a 1:1 ratio: intervention (usual care plus cognitive task procedure) or control (usual care). The intervention group engaged in a visuospatial task (computer-game 'Tetris' via a handheld gaming device) for 15 min within six hours following their ECS. The primary outcome was the number of intrusive traumatic memories related to the ECS recorded in a diary for the week post-ECS. As predicted, compared with controls, the intervention group reported fewer intrusive traumatic memories ( $M = 4.77$ ,  $SD = 10.71$  vs.  $M = 9.22$ ,  $SD = 10.69$ ,  $d = 0.647$  [95% CI: 0.106, 1.182]) over 1 week (intention-to-treat analyses, primary outcome). There was a trend towards reduced acute stress re-experiencing symptoms ( $d = 0.503$  [95% CI: -0.032, 1.033]) after 1 week (intention-to-treat analyses). Times series analysis on daily intrusions data confirmed the predicted difference between groups. 72% of women rated the intervention "rather" to "extremely" acceptable. This represents a first step in the development of an early (and potentially universal) intervention to prevent postnatal posttraumatic stress symptoms that may benefit both mother and child.

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Operative delivery by emergency caesarean section (ECS) is indicated in cases of risk to maternal and/or fetal life, therefore qualifying as a psychologically traumatic event for the mother (American Psychiatric Association, 2013). Even when the baby is

delivered safely, by one month post-ECS approximately 39% of mothers have developed postnatal posttraumatic stress disorder (PTSD) (Soderquist, Wijma, & Wijma, 2002). Posttraumatic stress disorder consists of four symptom clusters: re-experiencing (including intrusive traumatic memories of the event), avoidance, hyperarousal, and negative cognitions and mood (American Psychiatric Association, 2013).

Recurrent and distressing traumatic intrusive memories consist of involuntary, sensory (predominantly visual) mental images which intrude the mind unbidden, their content often overlapping with the most distressing moments of the traumatic event

*Abbreviations:* ECS, emergency caesarean section; PTSD, posttraumatic stress disorder; ASD, acute stress disorder; ASDS, Acute Stress Disorder Scale; HADS, Hospital Anxiety and Depression Scale; PDS, Posttraumatic Diagnostic Scale.

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(American Psychiatric Association, 2013; Grey, Holmes, & Brewin, 2001). After ECS, examples of traumatic intrusive memories include a mental image springing to mind of the screen of the fetal heart rate monitor indicating 'Stop' or seeing the face of the doctor announcing that the patient immediately needs an ECS.

Intrusive traumatic memories are the core clinical feature of both acute stress disorder (ASD) and PTSD (American Psychiatric Association, 2013; Brewin & Holmes, 2003). As a precursor of PTSD (which is diagnosable from 1-month post-trauma), women may experience ASD symptoms such as intrusive traumatic memories in the first four weeks after ECS (Harvey & Bryant, 2000). Indeed, traumatic intrusions and other ASD symptoms in the first 10 days in a sample of patients presenting to a hospital emergency department following motor vehicle accidents, terrorist attacks, or work accidents have been found to predict chronic PTSD (Galatzer-Levy, Karstoft, Statnikov, & Shalev, 2014). Thus, reducing intrusions in the acute period may be beneficial not only in its own right for reducing distress, but for reducing later PTSD. While the prevalence rate of ASD following ECS is unknown, it is likely to be substantially higher than that after childbirth generally (5.6%) (Creedy, Shochet, & Horsfall, 2000). Critically, targeting early symptoms is useful in its own right for mother and child, and may ultimately help prevent later PTSD (McKenzie-McHarg et al., 2015).

Early symptoms soon after childbirth (such as being "haunted by" intrusive images of the traumatic birth (Fenech & Thomson, 2014)) are highly distressing for women. Traumatic intrusive images may be associated with sleep problems and dysfunctional coping mechanisms, such as non-initiation or early cessation of breastfeeding in order to avoid those images often triggered by close contact with their baby (Beck & Watson, 2008; Fenech & Thomson, 2014). There is mounting evidence that later postnatal PTSD symptoms can negatively affect the attachment relationship between the baby and the mother, increase parenting stress, and compromise the baby's subsequent development (Fenech & Thomson, 2014; McDonald, Slade, Spiby, & Iles, 2011; Parfitt & Ayers, 2009; Parfitt, Pike, & Ayers, 2014). Postnatal PTSD also negatively influences future reproductive choices, can lead to fear of childbirth (tokophobia), sexual problems, avoidance of medical care (King, McKenzie-McHarg, & Horsch, 2017; Morland et al., 2007), and increases the risk of maternal stress and negative birth outcomes during a subsequent pregnancy (Seng et al., 2001). Postnatal PTSD significantly contributes to the costs of perinatal mental health problems, estimated at £8.1 billion per year in the UK alone (Bauer, Parsonage, Knapp, Lemmi, & Adelaja, 2014).

Interventions are urgently needed to prevent the development of postnatal post-traumatic stress and acute posttraumatic stress reactions as their precursor. Given in ECS that there is both a known traumatic cause, and a substantial rate of subsequent mental health impairment, it is critical both for mother and child that interventions are developed. However, to date, we lack evidence-based interventions for women after traumatic childbirth (Bastos, Furuta, Small, McKenzie-McHarg, & Bick, 2015), particularly those targeting early symptoms of posttraumatic stress that could improve longer term outcomes (McKenzie-McHarg et al., 2015). Here we investigate a new preventative intervention to reduce intrusive memories of the traumatic event, taking an innovative hypothesis-driven approach (Holmes, Craske, & Graybiel, 2014) informed by cognitive science of emotional memory and using technology (computer game play) rather than a therapist.

Our hypothesis is to reduce the frequency of recurrence of traumatic memories (e.g. the upsetting intrusive visual memories of the heart rate monitor/doctor's face in the patient examples given earlier) via a "cognitive therapeutic vaccine" informed by cognitive science (Holmes, James, Kilford, & Deepro, 2010;

Poland, Murray, & Bonilla-Guerrero, 2002). This approach is informed by a number of insights: First, intrusive memories of trauma comprise sensory-perceptual mental images with visuo-spatial components (Brewin, 2014; Holmes, Grey, & Young, 2005). They are proposed to occur due to excessive perceptual (sensory) processing during a trauma (Brewin & Holmes, 2003; Brewin, 2014; Ehlers & Clark, 2000; Holmes & Bourne, 2008) resulting in sensory-based (predominantly visual) images of the trauma that intrude into the mind spontaneously. Second, cognitive psychology research suggests that we can disrupt visual aspects of (traumatic) memory that underpin intrusions by actively engaging in visuo-spatial tasks, since these compete for resources with the brain's sensory-perceptual resources (Andrade, Kavanagh, & Baddeley, 1997; Baddeley & Andrade, 2000; Kavanagh, Freese, Andrade, & May 2001). Numerous types of visuospatial tasks could be used – here we use Tetris game-play in translating laboratory work to the clinic.

Third, neuroscience research on the formation of memory and its consolidation suggests that memories are malleable (i.e. not yet stabilised) from the onset event until approximately 6 h after initial encoding (McGaugh, 2000; Nader, Schafe, & LeDoux, 2000; Walker, Brakefield, Hobson, & Stickgold, 2003). This early time frame post-trauma presents a window of opportunity during which to disrupt the consolidation of visual (emotional) memory – here with a visuo-spatial task. Selectively disrupting the visual aspects of trauma memory during its consolidation is predicted to render the memory less 'overly perceptual' and thus less intrusive.

Fourth, our cognitive behavioural formulation about trauma memory suggests that it is only discrete points within the memory (and not others) – i.e. 'hotspots' – that later become intrusive memories (Grey & Holmes, 2008; Grey, Young, & Holmes, 2002; Holmes et al., 2005) (see also (Bourne, Mackay, & Holmes, 2013; Clark et al., 2014)). Thus we suggest that one does not need to engage in the competing task for the full duration of the original trauma, but rather adequately compete for resources with the consolidation of these (briefer) hotspot moments selectively, intrusions of which patients typically begin to re-experience even soon after the event. Laboratory studies indicate that participants should engage in the competing task uninterrupted for approximately 10–20 min (Holmes, James, Coode-Bate, & Deepro, 2009; Holmes et al., 2010; James et al., 2015). Given that the women were still receiving care in the hospital at the time of the intervention, the hospital context provided an *in vivo* cue for the trauma memory hotspots of the ECS.

In summary, actively engaging in a visuospatial cognitive task for c.15 min up to 6 h after a traumatic event is predicted to reduce the occurrence of subsequent intrusive memories of the trauma via competing with sensory aspects of the trauma memory before it has been fully consolidated. Indeed, lab-based experiments with healthy volunteers have demonstrated that engaging in the computer game Tetris, a game which taxes visuospatial functions (Green & Bavelier, 2003), up to 4 h following exposure to traumatic film material can significantly reduce the later number of intrusive memories (Holmes et al., 2009, 2010). The requirement for the task to compete specifically for visuospatial resources (as opposed to merely providing distraction) has been indicated by findings that non-visuospatial tasks (e.g. a verbal computer game) do not reduce, and in some instances may even increase, the occurrence of intrusive memories (Holmes et al., 2010). We note that in addition to Tetris, other absorbing visuospatial tasks would also be predicted to be beneficial.

Women hospitalised following an ECS are an ideal population for testing the potential clinical application of this cognitive science paradigm in reducing intrusive memories of their traumatic

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