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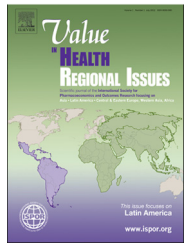

Cost Effectiveness of a Community-Delivered Consultation to Improve Infant Sleep Problems and Maternal Well-Being

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ABSTRACT

Objectives: To evaluate the cost effectiveness of a community-delivered consultation aimed at improving infant sleep and maternal well-being. **Methods:** A decision-analytic model was developed that compared the costs and benefits of an infant sleep consultation with usual care. The effectiveness of the consultation was based on clinical evidence, and improvements in maternal quality of life were estimated by mapping the Edinburgh Postnatal Depression Scale scores to published utility scores. Cost effectiveness was calculated as the incremental cost per quality-adjusted life-year gained (QALY). **Results:** The statistically significant improvements in mean Edinburgh Postnatal Depression Scale scores at 4- and 16-month follow-ups were used to estimate the benefit in terms of QALYs. The modeled results demonstrated that the infant sleep consultation is low-cost (A$ 436), more effective in terms of QALYs gained (0.017), and cost-effective. The estimated incremental cost-effectiveness ratio was A$ 4031/QALY gained. The main drivers of the model were the use of early parenting centers and nurse training costs. **Conclusions:** Community-based nurse-delivered infant sleep consultations aid infant sleep, improve maternal quality of life, and are cost-effective compared with usual care and lead to improvements in quality of life through a reduction in postnatal depression.

Keywords: cost effectiveness, depression, infant, maternal-child health centers, postpartum, sleep disorder.

Introduction

Infant sleep problems are common, with 17% [1] to 46% [2] of Australian parents reporting problems in the first year postpartum. The most common causes of infant sleep problems are behavioral sleep disorders, such as frequent night waking and difficulty settling to sleep, which may be caused by sleep associations (e.g., rocking, milk, or dummy) [3]. Less common causes are medical problems such as obstructive sleep apnea [3].

Infant sleep problems have adverse impact on maternal physical and mental well-being [1,2]. Postnatal depression, a significant problem in mothers, can be exacerbated by infant sleep problems. In Australia, postnatal depression affects about 16% of mothers [4], and mothers with clinically significant depression symptoms are often reluctant to accept their diagnosis or seek care [5]. Untreated maternal depression can have consequences for both the mother and the baby, including a woman's overall well-being, family's functioning, and the child's development [6].

In addition to the health burden, infant sleep problems are directly associated with an increase in health care resource use [7] and indirectly through the treatment of postnatal depression [8]. Existing services for women seeking advice on infant sleep problems include general practitioner (GP) visits, nurse consultations, pediatrician visits, and parenting centers (including day visits, residential stays, and home visits). In Australia, these services may be federally funded (Medicare), state-funded, or privately funded (via private health insurance or out-of-pocket expenses). An analysis of the Longitudinal Study of Australian Children demonstrated that cases of infants with persistent sleep problems are associated with higher Medicare costs [7]. Therefore, reducing persistent sleep problems represents an opportunity to leverage existing community health care services and reduce health care costs.

Three Australian studies have attempted to evaluate the effectiveness of community-delivered behavioral infant sleep interventions. These include the nurse-delivered Infant Sleep Study (ISS) cluster randomized controlled trial (RCT) [5], a pediatrician-delivered RCT [9], and a before and after study delivered by a single GP or a registered nurse [10]. These studies found that short-term consultations significantly reduced infant sleep problems and improved maternal mental health. Internationally, other RCTs have reported reduced prevalence of depression symptoms in mothers and/or improved maternal and infant

Conflicts of interest: The authors declare that they have no conflicts of interest.

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health outcomes [11–15]. Two of these studies were delivered via the Internet and focused on the establishment of a bath and bedtime routine [11,12] and two delivered information without a specific behavior component [14,15]. Rickert and Johnson [13] included a behavioral consultation; nevertheless, the only outcome reported was the number of awakening episodes.

Only one economic evaluation of a preventative infant sleep problem consultation was identified [16]. This study claimed that a behavioral and educational consultation was cost-effective when compared with usual care (from a UK National Health Service perspective). The reported outcome of this study was "cost per interruption-free night gained," which makes it difficult to assess true value for money [17]. To date, there has been no cost-effective analysis of consultations designed to treat infant sleep problems in Australia.

The aim of this study was to conduct an economic evaluation of an infant sleep consultation in the Australian context. In addition to estimating the cost per interruption-free night gained, this study estimates the incremental cost per quality-adjusted life-years (QALYs) gained, which enables comparison with other health care interventions and is therefore a more appropriate measure of value for money. This study is also the first study to map changes in the Edinburgh Postnatal Depression Scale (EPDS) to derive utility estimates. We also discuss the pertinent policy implications relating to the different funding mechanisms of health services in Australia.

Methods

Systematic Review

A systematic literature review of community-delivered infant sleep consultations was undertaken. The search was conducted in Embase, PubMed (incorporating MEDLINE), CINAHL, The Cochrane Library, and the Centre for Reviews and Dissemination (York) databases from inception to October 16, 2014. The search was limited to the English language with no restriction on time.

The search terms included baby, babi*, sleep disorders, infant*, sleep problem*, sleep disorder* infant* sleep intervention* or behavioral infant sleep intervention* or behavioural infant sleep intervention* or behavioral modification program* or behavioural modification program, maternal-child health centers, community sample or community survey, or community-delivered or community-based (both UK and American English). The text words for the consultation were combined using "OR." Medical Subject Headings terms were searched separately, and the final results for each group were narrowed down using "AND."

Included articles were RCTs or systematic reviews, comparing the effectiveness of a behavioral infant sleep intervention and a suitable comparator in the management of infant sleep problems. The population of interest was mothers and infants (aged 0–12 months), and limited to postnatal interventions. Required details included program information, such as intensity, frequency, and who delivered it.

A total of 547 records were identified through the database search, with 524 articles screened on the basis of title and abstract (37 duplicates removed and 7 articles identified through other sources) (see Fig. 1). The title and abstract review excluded 456 articles, with 61 articles included for the full-text review. A total of 38 studies were excluded, leaving 23 studies included in the qualitative synthesis, 7 systematic literature reviews [18–24], 10 unique prevention interventions [16,25–33], and 7 unique treatment interventions [5,9,11–15].

Of the seven treatment studies identified, only two studies fulfilled the study inclusion criteria, the ISS [5] and the study by Hiscock and Wake [9,34]. The treatment studies estimated the effectiveness of a range of interventions, which differed in terms of the behavioral approach and its communication to the parent.

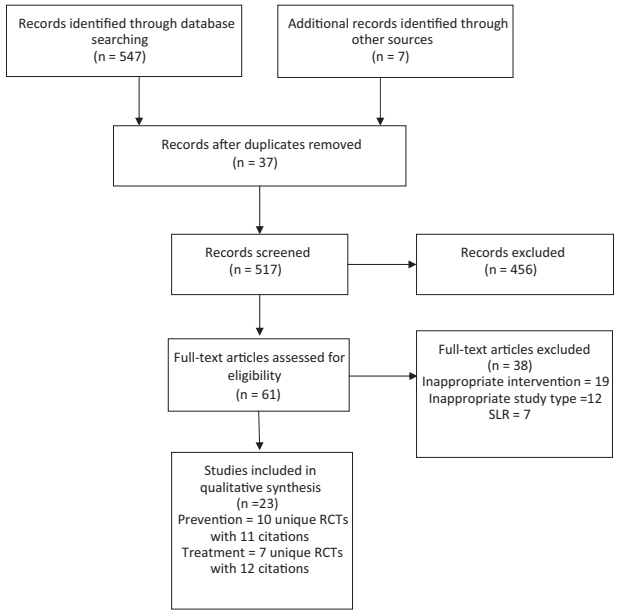

Fig. 1 – PRISMA flow diagram for systematic literature review of community-delivered infant sleep consultations. RCT, randomized controlled trial; SLR, systematic literature review; *Source*: Adapted from Moher et al. [48]. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

The Infant Sleep Study

The ISS was a community-delivered cluster RCT that assessed outcomes of maternal reports of infant sleep and maternal well-being and examined the delivery of this consultation within an existing health service in Australia. The trial included 49 Maternal and Child Health (MCH) centers (clusters) in Melbourne with 328 mothers (consultation group = 174, control group = 154) [5]. The intervention consisted of face-to-face consultations with MCH nurses, which on average equated to 1.52 visits of 25 minutes duration, for the mothers who received the consultation (n = 100). These consultations were delivered at an infant's visit at age 8 months (1 of 10 free visits) and the nurses provided mothers with individualized sleep management plans and information handouts about sleep patterns, sleep problems, managing overnight feedings, and the use of dummies (pacifiers) [9]. Mothers were offered to choose between two behavioral interventions ("controlled crying" or "camping out") and bedtime routines.

In the controlled crying approach, parents were instructed to respond to their infant's crying by increasing the time intervals to allow the child to learn to self-settle [5,9]. In the camping out approach, the parent sat with the child as they learnt to independently fall asleep [5,9]. The effectiveness of the ISS estimated maternal well-being using the mean change in the EPDS score, measured when the infant was aged 10 and 12 months [5] and at age 2 years [34]. Further details of the trial are described elsewhere [5,34–37]. The Department of Education and Early Childhood Development (DEECD) has since trained all Victorian MCH nurses in the program [38].

The study of Hiscock and Wake [9] was an RCT of 156 mothers (78 each in the consultation and control groups) with an intervention similar to that in the ISS, but differing in the inclusion of