

# Baby Box Distributions: Public Health Benefit or Concern?

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An increasing number of countries, including Canada, the United Kingdom, and South Asia, are distributing baby boxes (ie, cardboard boxes for infants to sleep in during naps and at nighttime that are patterned from a baby box distributed in Finland) as part of initiatives to reduce the incidence of sleep-related infant death.<sup>1,2</sup> Beginning in 2017, distribution initiatives in the United States included statewide and citywide efforts. Continuing initiatives in 4 states (Alabama, New Jersey, Ohio, and Texas) plan the distribution of 705 000 baby boxes.<sup>2</sup> Some communities are distributing baby boxes to mothers of infants at risk for sudden unexplained infant death syndrome; others are distributing baby boxes to all new mothers.<sup>3,4</sup>

Reducing the high number of sleep-related infant deaths in the United States (3700 deaths in 2015, or approximately 90 deaths per 100 000 live births)<sup>5</sup> is the primary motivation for distributing baby boxes.<sup>6</sup> However, empirical evidence documenting the effectiveness of a cardboard baby box either as a safe sleep space or a means of decreasing sleep-related infant deaths is absent from the literature.<sup>7,8</sup> This absence of scientific evidence of the safety and effectiveness of the baby box for reducing sleep-related infant deaths raises 2 questions: “What is driving distribution?” and “What are the potential concerns?”

## Current Use and Concerns

A common justification for distributing cardboard baby boxes is an inaccurate interpretation that baby box distribution in Finland drove changes in rates of infant deaths during sleep.<sup>7</sup> It is accurate that the Social Insurance Institution of Finland, Kela, distributed baby boxes beginning in the 1930s.<sup>9</sup> Distribution was part of a health initiative focused on reducing rates of sudden infant death syndrome and increasing birth rates in Finland by increasing the number of women seeking prenatal care.<sup>9,10</sup> Receiving a baby box required engagement in a specified number of prenatal visits.<sup>10</sup> The incentive for completing prenatal care was receipt of the baby box, which was filled with baby-related

materials. A spokesperson for Kela indicated that this health care initiative, which aimed to increase prenatal care and included antipoverty actions, drove improvements in infants’ outcomes.<sup>10</sup> The importance of emphasizing antipoverty programs and new directions for health policy, rather than a reliance on baby box distribution, is evident globally in both research and public health campaigns.<sup>2,11</sup>

## Safety of Use

Cardboard baby boxes do not meet the definition of a bassinet or crib. Thus, baby boxes are not subject to standard US safety certifications (eg, certification by the Consumer Product Safety Commission). Part of certification is the reporting of adverse events with certified products. Because accidents or deaths related to use of the cardboard baby box would not be reported through this central resource, it would be difficult for families or agencies to monitor the safety of using cardboard baby boxes for infant sleep.<sup>12</sup>

The safety of the baby box for infant sleep raises other pressing concerns, particularly concerns related to the ventilation of baby boxes, the box as an impediment to breastfeeding, the integrity of cardboard as an infant sleep space, baby box placement, and the likelihood that baby boxes will be used for infant sleep. No scientific studies address

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these issues.<sup>1,6</sup> We address these concerns and related potential risks.

### **Ventilation**

The height of the sides of the most commonly distributed cardboard baby boxes is approximately 10 inches.<sup>13</sup> This height and the impermeability of cardboard raise concerns about the quality of air available to infants.<sup>1,6</sup> It is not known whether ventilation is sufficient to avoid infants' rebreathing of expired breath. One concern is that rebreathing expired air can result in potentially higher concentrations of carbon dioxide in the baby box, which can pose an increased risk of sleep-related death.<sup>6,14</sup> A second concern related to ventilation is whether poor ventilation places infants at risk of overheating. Empirical evidence associates overheating with an increased risk of infant suffocation during sleep.<sup>1</sup> Without empirical evidence of safety, adequate ventilation remains a concern. Of note, an empirical study found that in-bed bassinets, which are smaller than baby boxes, have lower sides, have mesh or aerated walls, provide adequate ventilation, and maintain infants' oxygen saturation and thermal environment during sleep.<sup>15,16</sup>

### **Impediment to Breastfeeding**

The height of the cardboard box walls<sup>13</sup> and the impermeability of the cardboard sides raise concerns about mothers' breastfeeding.<sup>6,14</sup> Unlike other in-bed devices, which have lower and often softer sides (ie, approximately 6 inches),<sup>17,18</sup> baby boxes prohibit mothers from easily breastfeeding their infant.<sup>15</sup> Breastfeeding is an important protective factor against infant death during sleep. Thus, balancing the use of baby boxes with the risk of reducing the likelihood of breastfeeding is a concern.

### **Cardboard Integrity**

No empirical studies have examined the probability of keeping the cardboard base of the baby box dry and sanitary.<sup>19</sup> Common occurrences during infant sleep (eg, spitting up, loose diapers) make it unlikely that the cardboard base will remain dry. This potential for the cardboard to become wet leads to concerns about whether a cardboard baby box can maintain its structural integrity and, if so, for how long and under what conditions.<sup>1,6</sup> Because one purported benefit of a cardboard baby box is its portability, the structural integrity of the base is a safety consideration. Portability contributes to decisions to distribute cardboard baby boxes to families in need of a sleep space rather than a certified, structurally sound space, such as a self-standing portable crib.<sup>20</sup>

### **Placement**

An additional safety concern is where parents can place a baby box when it contains the infant (either sleeping or otherwise). The most commonly distributed cardboard baby

boxes are generally larger (eg, approximately 27 inches long and 17 inches wide)<sup>13</sup> than other in-bed sleep bassinets such as the SwaddleMe By Your Side sleeper (Summer, Woonsocket, RI) or the Pepi-Pod (Pepi-Pod, Christchurch, New Zealand; eg, approximately 16 inches long and 13 inches wide).<sup>17,18</sup> The size of the cardboard baby box raises concerns about where caregivers can place the baby box for infant sleep.<sup>1</sup> It is unclear where the box should be placed if it is too large to fit in an adult bed. Placing a baby box on a dresser or table raises potential hazards, including the box tipping over or falling. Placing a baby box on the floor introduces risk from pets, other children, or falling objects.<sup>6</sup> Thus, one concern is how various-sized boxes can be used safely.

### **Likelihood of Use**

Baby box distribution initiatives often focus on lower-income and non-Hispanic black mothers because non-Hispanic black infants are more likely to experience a sleep-related death than non-Hispanic white or Hispanic infants.<sup>21</sup> As such, one concern is whether women from this target population view baby boxes as useful or attractive for infant care. If baby boxes are not seen as useful or attractive as a sleep space for infants, the effectiveness of cardboard baby boxes to reduce the risk of sleep-related infant death will be compromised.<sup>22</sup> To our knowledge, the question of parents' perceptions of the baby box and use has been examined in only 1 empirical qualitative study.<sup>23</sup> In that study, women described the usefulness of baby boxes in relation to the affordability of the baby box for those who could not afford a crib. Attractiveness was described as the baby box being decorative or portable.

### **Soliciting Caregivers' Perceptions**

To explore the question of use more directly, we invited caregivers to rate their perceptions of the attractiveness (ie, comfortable or uncomfortable) and usefulness (ie, worthless or valuable) of the baby box. We solicited feedback by using the online crowdsourcing survey tool MTurk,<sup>24</sup> a data collection platform that has been deemed a reliable source for data collection.<sup>25</sup> We collected data in December 2016, as part of a broader project that had received institutional review board approval at the University of North Texas. In total, 550 survey respondents (125 men, 425 women) were requested through MTurk. Potential participants responded to qualifying questions to determine their eligibility for the study (eg, "Has a baby entered your life in the last 5 months or will a baby enter your life in the next 5 months? If yes, will you take a caregiving role?"). We considered data to be usable if a respondent had a valid US internet protocol address, spent a nonzero amount of time on the survey, and answered at least 1 of the first set of questions about perceived safety. Of 1615 total responses, 750 respondents met the eligibility criteria, 549 of whom provided usable data. Of eligible responses

with usable data, 8 pairs of responses had the same internet protocol address, either the sole complete response was used, or one of the responses was selected at random. The final sample contained 541 eligible respondents.

### Usefulness and Attractiveness

The 541 caregivers who met the inclusion criteria and had usable data rated their perception of the attractiveness and usefulness of the baby box on a scale from 1 (low attractiveness or usefulness) to 100 (high attractiveness or usefulness). Caregivers rated a total of 10 items: 5 measuring the intensity of attraction and 5 measuring the intensity of usefulness. Ratings were based on images of the baby box; 1 image featured a baby and 1 image did not feature a baby. We tabulated descriptive statistics on ratings for the entire sample and by ethnicity, and we examined perceptions of caregivers by whether or not they received public assistance. These ratings can be viewed from the perspective of the expectancy-value theory of planned behavior (ie, considering caregivers' expectancy of a positive outcome with use of the baby box and the value of that outcome).<sup>26</sup>

Caregivers' ratings provided little support for the likelihood of using the baby box. If caregivers' ratings from 1-100 were put in terms of an academic grade, wherein  $\geq 90.0$  was considered an "A," 80.0-89.9 was considered a "B," and so on, the baby box typically earned a "D" (60.0-69.9) or "F" ( $< 60.0$ ). For non-Hispanic black caregivers who received public assistance—a common target for safe infant sleep services—mean ratings of usefulness were  $< 60.0$ . Non-Hispanic black caregivers gave a mean rating of 49 (median, 47) for the usefulness statement, "In my home, this [baby box] would be [responses ranging from worthless to useful]"; a mean rating of 58 (median, 55) for the safety statement, "This [baby box] seems [responses ranging from dangerous to safe]"; and a mean rating of 52 (median, 41) for the attractiveness statement, "Using this [baby box] would be [responses ranging from uncomfortable to comfortable]."

Non-Hispanic white caregivers gave slightly higher ratings for the 3 statements. Non-Hispanic white caregivers gave a mean rating of 61 (median, 65) for the usefulness statement, a mean rating of 59 (median, 59) for the safety statement, and a mean rating of 60 (median, 67) for the attractiveness statement. Thus, the ratings for the 3 statements fell into the "F" range among non-Hispanic black caregivers and the "D" to "F" range among non-Hispanic white caregivers.

These perceptions may preclude caregivers' use of cardboard baby boxes, suggesting that community-wide initiatives, such as those undertaken in the United States and globally, are unlikely to yield their intended result. These findings force the question, "Will caregivers use something that is not perceived as valuable?" The results of this preliminary study suggest that caregivers may not perceive the cardboard baby box as a useful, safe, or attractive sleep space. Results from further exploration of whether

cardboard baby boxes may be useful for caregivers whose infants are at risk of sleep-related death may help inform successful intervention and prevention initiatives. Thus, definitive empirical peer-reviewed research on both attitudes and outcomes is needed.

### Public Health Implications

Without solid empirical accounts of the safety and use of the baby box, broad dissemination of the baby box to help reduce rates of sleep-related infant deaths in the United States is premature. Furthermore, the potential effect of the baby box on parents' engagement in various protective factors, such as breastfeeding, warrants further investigation. Research is needed to examine the baby box's safety and its potential to reduce infants' risk of sleep-related deaths.<sup>27</sup>

Despite the lack of empirical support for the safe use of baby boxes, caregivers are unlikely to question the safety of the baby box as a tool to protect infants during sleep. Caregivers will likely presume that a health product distributed through recognized health organizations is an assurance of product safety. Currently, however, no evidence supports the safety of the baby box, the likelihood that the baby box will positively affect parenting practices, or the creation of safe sleep spaces. Furthermore, the safety of the baby box as a sleep space for infants continues to be questioned by sleep experts. As outlined here, these concerns cross issues of safety and use. For example, one concern is about whether the baby box, which is purported to be a means to reduce infant risk of sleep-related deaths, would actually be used.<sup>1,6</sup> Another concern is whether the cardboard baby box promotes important protective factors for infants during sleep, such as breastfeeding.<sup>6</sup> Other concerns include whether the baby box is practical as a sleep space, whether ventilation is adequate, and whether the cardboard construction is durable enough.<sup>19,27</sup>

Until these concerns are resolved through rigorous research and evaluation, decisions by US public health departments to distribute baby boxes may be premature and should be carefully considered. Attention to factors empirically related to sleep-related infant death may be an important focus in reducing infant risk.<sup>28</sup>

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