Clinical effectiveness and safety of 1,600 g as a standard weaning weight for transferring premature infants to an open crib: systematic review and meta-analysis

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Background: There is controversy about the ideal weight to transfer a premature infant from an incubator to a crib. Most randomized controlled trial (RCT) studies use 1,600 g as the initial weaning weight, and there were differences in outcome indicators and results between studies. Therefore, this meta-analysis validated whether 1,600 g can be a suitable weaning weight standard and evaluated its clinical effectiveness in providing healthcare professionals with a reference value for relevant decision-making.

Methods: Articles were obtained by searching the PubMed, MEDLINE, Web of Science, Cochrane Central Register of Controlled Trials (CENTRAL), Embase, CNKI and Wanfang databases for literature published until October 2023. RCTs on the body weight of premature infant transferred from incubators to cots were included. Primary outcomes were growth velocity, episodes of low temperature (temperature <36.5 ℃) and length of stay (LOS). The number of infants returned to incubators, postmenstrual age (PMA), hospital readmission and weight at discharge were secondary outcomes. We used the bias risk assessment tool in the Cochrane Manual of Systematic Reviews 5.1.0 to evaluate efficacy.

Results: We included four RCTs involving a total of 653 preterm infants. Growth rate was significantly higher in the lower weight group compared with higher weight group from incubator weaning to discharge home [3 studies, mean difference (MD) 0.9; 95% confidence interval (CI): 0.75 to 1.04]. Three studies report there was no statistically significant difference in LOS (MD: −2.71; 95% CI: −10.04, 4.61). Two studies report there was no statistically significant difference in proportion of infants having low temperature during 72 hours post-transfer (risk ratio: 0.6; 95% CI: 0.36 to 1.01). Additionally, the PMA at discharge, weight at discharge, the number of premature infants returned to the incubator and hospital readmission in the two groups also showed no difference (P>0.05).

Conclusions: The optimal weight for transferring premature infants from an incubator to an open crib is 1,600 g, without adverse clinical outcomes. This can increase weight gain velocity during hospitalization.

Keywords: Premature infants; incubator; open crib; weight; weaning

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Introduction

Preterm birth refers to the delivery of a baby before 37 weeks of gestation and the average preterm birth rate worldwide is 10% (1). In neonatal intensive care unit (NICU), the incubator provides a womb-like environment for premature infants, with its calibrated high humidity helping to reduce their insensible water loss and maintain electrolyte balance, thus reducing the degree of physiological weight loss (2). The ability to maintain a stable temperature in premature infants after being released from the incubator is one of the key criteria for discharge from the NICU (3). In addition, getting out of the incubator can be an important condition for premature babies to have early contact with their parents and carry out family-integrated care (FICare). Studies have shown that early contact and FICare can improve the neurobehavioral development of premature infants and improve their long-term neurodevelopment (4,5).

However, there is controversy over when to transfer premature infants from the incubator to an open crib. Currently, there are significant differences in the standards for weaning premature infants out of incubators among various NICUs, and most of these are based on clinical experience without sufficient evidence-based support (6). It is commonly considered that the weight range for preterm infants transferred from an incubator to a crib is around 1,700–1,800 g (7). Delayed the transfer from incubators may result in longer hospital stays, increased hospital costs, higher risk of infection, and anxiety in the infants' family (8,9). Studies have shown that early transfer of premature infants from incubators to cribs can lead to weight gain, shortened time to full oral feeding, and shorter hospital stays (10-12). However, premature transfer may also lead to cold stress and increased energy expenditure (11), which can increase length of stay (LOS).

Currently, there is limited research on which weight when preterm infants are transferred from incubators to cribs, and most studies are retrospective or observational with significant differences in weight ranges. In randomized controlled trials (RCTs) (11,13-15), weight comparisons mainly focus on 1,600–1,700 and 1,800–1,900 g. Although relevant systematic reviews have discussed weight comparisons when preterm infants are transferred from incubators to cribs (16), the Cochrane review needs updating to include the latest, more extensive RCTs, and an optimal weight range is not specified. Razak (17) integrated various literature types and suggested that premature infants weaned from the incubator when they were ≥1,600 g without complications. However, fewer articles and indicators were included in this meta-analysis.

Therefore, this study includes the latest literature and comprehensively analyzes relevant indicators to validate whether 1,600 g can serve as a suitable weaning weight standard for transfer of preterm infants from incubators to cribs, in order to provide healthcare professionals with a reference for relevant decision-making. We present this article in accordance with the PRISMA reporting checklist (available at https://pm.amegroups.com/article/view/10.21037/pm-23-41/rc).

Highlight box

Key findings

- It is feasible and safe for preterm infants in medically stable to be transferred from incubator to open cribs when body weight is 1,600 g without adverse clinical outcomes, which can increase weight gain velocity during hospitalization.

What is known and what is new?

- The timing of weaning from the incubator of premature infants is important. However, the weight range of weaning is largely based on clinicians' professional experience and varies widely among neonatal units.
- This meta-analysis included randomized controlled trials (RCTs) and chose 1,600 g as the weaning weight standard for transferring preterm infants from incubators to cribs to provide healthcare professionals with a reference for relevant decision-making.

What is the implication, and what should change now?

- In clinical practice, premature infants with stable conditions can be transferred from the incubator to an open crib when their body weight reaches 1,600 g.
- The number and sample size of relevant RCTs are limited. Future research will carry out multi-center RCTs with more comprehensive indicators and lower research weight.

Methods

Study selection

Literature inclusion criteria: (I) the study design includes RCTs. The languages were Chinese or English; (II) the subjects were preterm infants whose gestation weeks <37 weeks in NICU; (III) intervention measures: transferring of preterm infants from an incubator to an open cot at a lower body weight compared with higher body weight. "Lower" is defined as transfer reaching 1,600–1,700 g, and "higher" is defined as transfer reaching 1,700 g or more; (IV) the outcome indicators included weight gain from incubator weaning to discharge home (g/kg/day), LOS (length of hospital stay days from randomisation to discharge), episodes of low temperature (axillary temperature <36.5 ℃), postmenstrual age at discharge (weeks), weight at discharge (g), the number of premature infants returned to incubator and hospital readmission in lower weight group and higher weight group.

Literature exclusion criteria: (I) literature with repeated publication, data missing or outcome indicators not mentioned; (II) literature without original data obtained by contacting the original author; (III) literature in languages other than Chinese and English.

Search strategy

We searched PubMed, MEDLINE, Embase, Web of Science, Cochrane Central Register of Controlled Trials (CENTRAL), Wanfang, and CNKI databases from establishing the database to October 2023. The search strategy was performed using the medical subject headings (MeSH) and keywords, which included four groups: (I) "Neonate" or "Newborn*" or "Infant" or "Low-birth-weight Infant" or "Low birth weight" or "Premature " or "Very low birth weight" or "Preemie*" or "Premie*"; (II) "Incubator*" or "Incubators, infant"; (III) "Infant equipment" or "baby equipment" or "cot" or "cot-nurs*" or "crib*" or "equipment, infant" or "Isolette" or "Heated water-filled mattress"; (IV) "Weaning" or "transfer*" or "discontinue". We used the Boolean operator "AND" combination with four group terms in every database to search. Manual search was also conducted as a complementary method by reviewing the reference lists and prospective citation search for all retrieved studies.

Data extraction

The data was extracted by two researchers independently. The studies that did not accord with the inclusion criteria were excluded. In addition, researchers read the full text and included only the articles that met the above criteria. When extraction results were inconsistent, consultation with a third researcher was pursued. Extraction content includes: (I) general information: author's name, and publication time; (II) research characteristics: demographic characteristics, research types; (III) results: outcome indexes and results data.

Bias risk assessment

Two researchers assessed the risk of bias in the included studies using the bias risk assessment tool in the Cochrane Manual of Systematic Evaluation 5.1.0. This assessment contents include: (I) the generation of random sequence; (II) allocation hiding; (III) blinding of the study object or the intervention implementer; (IV) blinding of the result evaluators; (V) data integrity; (VI) selective reporting; (VII) other offset. Each criterion was evaluated with "low risk bias, high risk bias, or unclear".

Statistical analysis

A meta-analysis was performed using RevMan 5.4 software. Weighted mean difference (WMD) and 95% confidence interval (CI) were used to combine the effect values of the continuous indicators using the inverse variance analysis method. We presented results as a summary risk ratio with 95% CIs for dichotomous data using the Mantel-Haenszel analysis method. The I^2 and Chi^2 statistics were used to test for heterogeneities. If $P \leq 0.1$, $I^2 > 50\%$, indicating significant heterogeneity, we used the random-effects model; if $P > 0.1$, $I^2 \leq 50\%$, we used the fixed-effect model for analysis. Forest plot showing the results of pooled effect value and heterogeneity. In addition, some relevant original studies did not directly provide the mean and standard deviation (SD) of the sample. This study used median, range, and sample size to estimate the mean and SD (18). For example, if $n>25$, median ≈ mean and $15<n\leq 70$, SD ≈R/4; $n>70$, SD ≈R/6, R refer to range.

Results

Search results of literature

A total of 186 studies were found in the initial search. After reading the titles and abstracts, 169 articles were deleted that they did not meet the inclusion criteria. After reading the full text, 13 studies were excluded, and four studies were finally included (11,13-15). *Figure 1* shows the literature screening process.

Characteristics of studies

Four studies were included with 653 patients, including 328 patients at weights between 1,600 and 1,700 g and 325

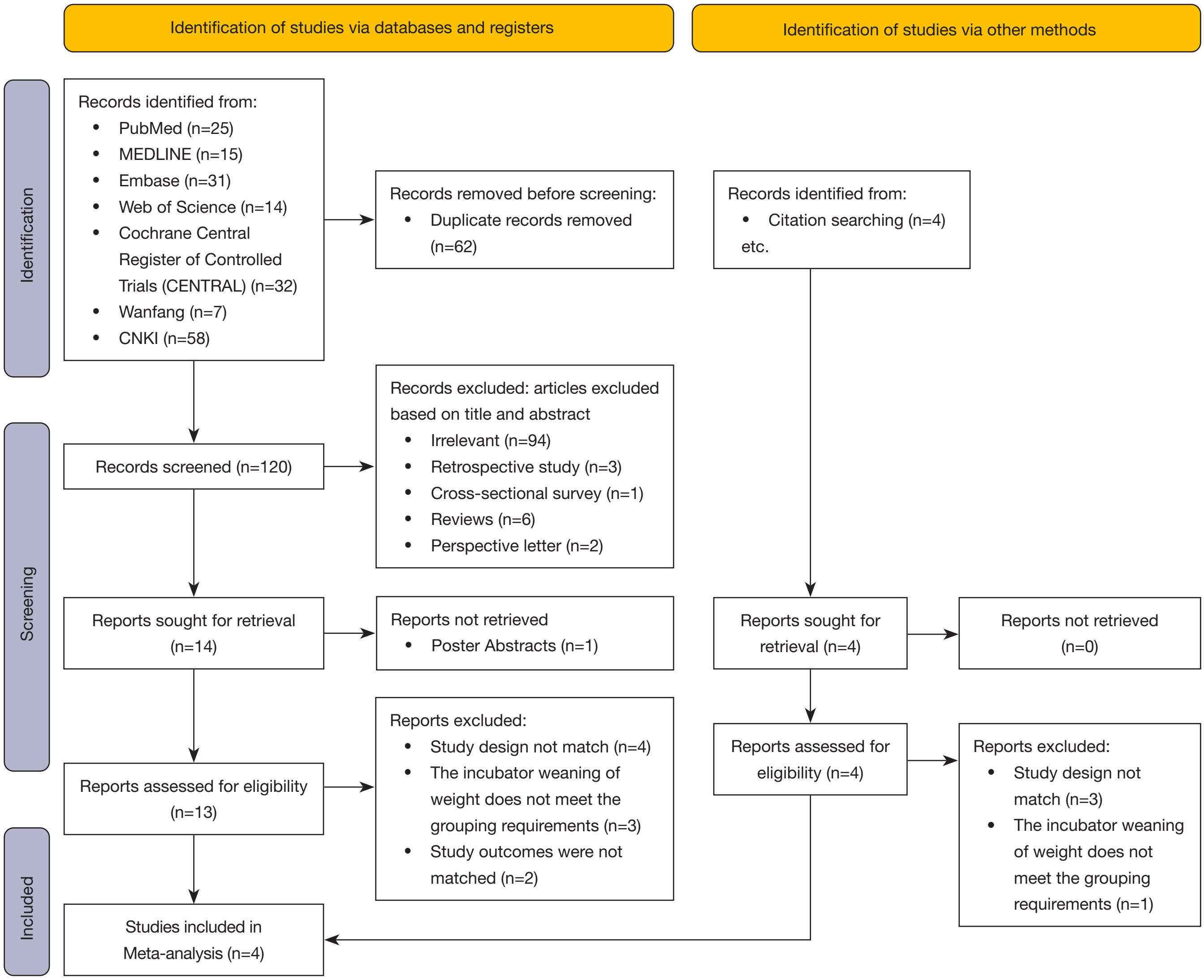

Figure 1 Literature screening flow chart flow chart.

patients at weights between 1,800 and 1,900 g. The essential features of the included studies are shown in *Table 1*.

Bias risk of included studies

Four included studies (11,13-15) were randomized controlled trials, and two studies (14,15) mentioned the use of opaque envelopes for distribution hiding. None of the studies mentioned the use of participant and implementer blindness, but outcome measurements were not affected (based on outcome evaluators are not involved in caring for premature infants and only record objective outcome indicators). None of the studies reported the research results selectively and no other bias was found. The literature risk of bias is shown in *Figure 2*.

Outcomes

Weight gain from incubator weaning to discharge home

Three studies (11,13,15) reported weight gain from incubator weaning to discharge home, and there was no significant heterogeneity among the studies: (Chi^2=2.56, df=2, P=0.28, I^2=22%); therefore, we chose the fixed-effect model. The results showed an effect value of WMD =0.90 (95% CI: 0.75, 1.04), and the weight growth rate of lower weight group from incubator weaning to discharge home

Table 1 The basic characteristics of included four studies

Author, year	Setting	Study group and sample size	Inclusion and exclusion criteria	Weaning procedure	Meta-analysis outcome indicators
Heimler *et al.*, 1981 (15)	The Medical College of Wisconsin and Milwaukee county medical complex, USA	14 premature infants; group A (infant weaned to an open crib between 1,600–1,700 g) =6 and group B (infant weaned to an open crib between 1,800–1,900 g) =8	Inclusion criteria: growing premature infants; had reached a weight of 1,400 g; oral intake of at least 100 kcal/kg/day; free of cardiopulmonary or infectious disease Exclusion criteria: none reported	Infants are nursed in single walled incubators. Incubator air temperature kept between 30 and 32 ℃ and room temperature between 25 and 27℃. Infants were fed outside the incubator after they reached a weight of 1,500 g. Each infant was dressed in a single shirt, diaper, cap and booties throughout the study. Following transfer at either 1,600–1,700 or 1,800–1,900 g, infants were covered with four blankets. All other aspects of care are managed in the same way for all infants	• Weight gain from incubator weaning to discharge home
Zecca *et al.*, 2010 (13)	Neonatal sub-intensive unit, Italy	94 premature infants; the early transition group (1,600–1,680 g) =47; the standard transition group (1,800–1,890 g) =47	Inclusion criteria: weight ≥1,600 g at enrollment, medically stable condition (normal temperature, no apnea, and no sepsis), no phototherapy requirement, and stable or increasing weight at 48 hours Exclusion criteria: infants with major congenital abnormalities at birth and infants who required respiratory support (continuous positive airway pressure or oxygen therapy) at the time	The nursery is kept at a temperature of 24 ℃ and a relative humidity of 40%. At transition, infants in both groups were dressed in a woollen hat, booties, two vests and a cotton wrap. Feeding of up to 150 mL/kg/day. Axillary temperature measured hourly until two consecutive readings of ≥36.5 ℃; then every 3 hours up to 72 hours post-transfer	• Weight gain from incubator weaning to discharge home • Length of stay • Proportion of low temperature during 72 hours post-transfer • Postmenstrual age at discharge • Weight at discharge • The number of infants returned to incubator • Readmission rate
New *et al.*, 2012 (14)	One tertiary and two regional neonatal units, Australia	182 preterm infants; intervention group (open cot at 1,600 g) = 90 and control group (open cot at 1,800 g) =92	Inclusion criteria: preterm infants born less than 1,600 g; postnatal age of at least 48 hours, medical stability (no oxygen requirement, no significant apnoea or bradycardia), no phototherapy requirement and enteral feed intake of at least 60 mL/kg/day Exclusion criteria: infants required ventilation or continuous positive airways pressure within the last 48 hours or had a major congenital abnormality	Each unit used central temperature control systems to maintain temperatures at 24–26 ℃ with relative humidity ≤55%. On transfer, infants were dressed in a singlet, a cotton full-length jumpsuit, a woollen hat and wrapped in a flannelette sheet and a cotton blanket. A quilt was placed over the infant's bedclothes. Post-transfer axillary temperatures were measured at 1 hour, 3 hours, then every 3 hours until 72 hours, and thereafter a minimum of three times a day until discharge	• Length of stay • Proportion of low temperature during 72 hours post-transfer • Postmenstrual age at discharge • Weight at discharge • The number of infants returned to incubator
Shankaran *et al.*, 2019 (11)	17 clinical centres in Eunice Kennedy Shriver National Institute of Child Health and Human Development Neonatal Research Network	366 preterm infants; transfer to open cot at lower weight 1,600 g =185; transfer to open cot at a higher weight of 1,800 g =178	Inclusion criteria: (I) moderately preterm infants ($29^{0/7}$–$33^{6/7}$ weeks gestational age) and <1,600 g at birth; (II) weight <1,540 g at screening; (III) age ≥48 hours; and (IV) in an incubator Exclusion criteria: infants had phototherapy for hyperbilirubinemia, respiratory support (>2 L/minute of oxygen therapy or positive pressure support), treatment for hypotension, multiple episodes of apnea (>5 episodes per hour), a major congenital anomaly, or designation for transfer to a referral hospital while in an incubator	Infants were dressed in a single layer of clothing, cap, and booties and two layers of cotton blankets or a sleep sack. The incubator humidification was discontinued. The incubator temperature was decreased by 1.0 to 1.5 ℃ every 24 hours until 28.0 ℃ and the infant's axillary temperature was maintained at 36.5–37.4 ℃ (97.7–99.3 ℉). The infant was transferred to a crib once the axillary temperature was stable for 8–12 hours in a 28.0 ℃ incubator. In the crib, infants were covered with two layers of blankets or a sleep sack and a hat. Temperature was monitored in both groups every 3–4 hours for the first 24 hours after weaning to the crib	• Weight gain from incubator weaning to discharge home • Length of stay • Postmenstrual age at discharge • The number of infants returned to incubator • Readmission rate

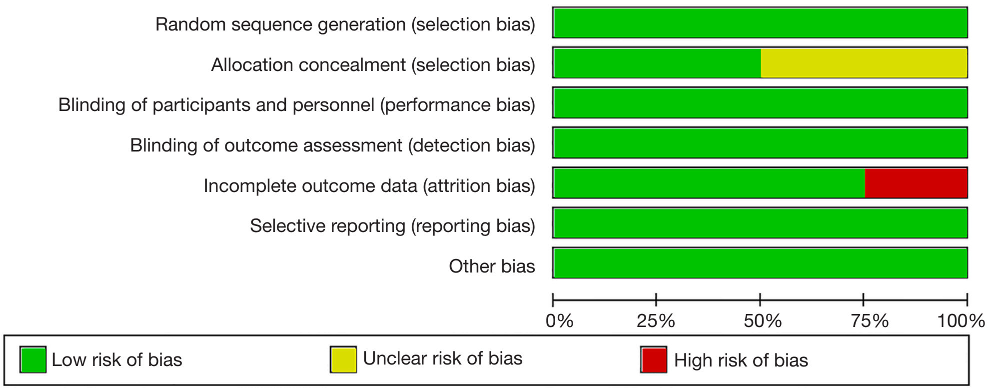

Figure 2 Bias risk figure of included literature.

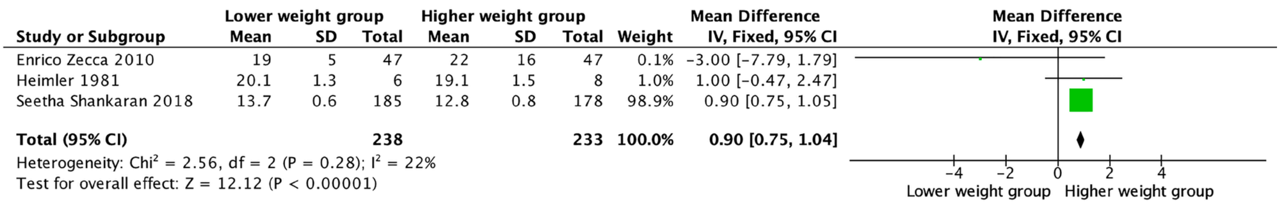

Figure 3 Forest plot for weight gain from incubator weaning to discharge home. SD, standard deviation; CI, confidence interval.

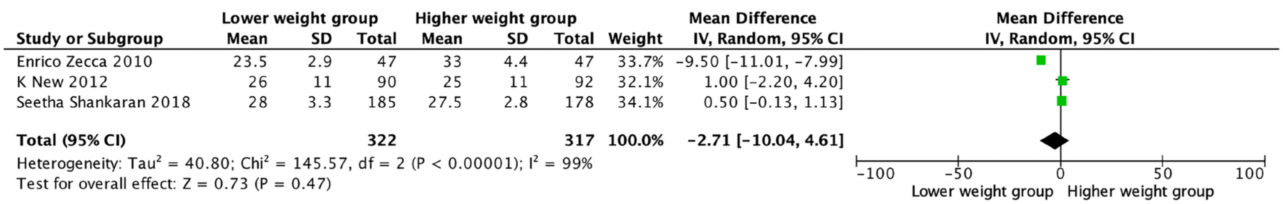

Figure 4 Forest plot for length of stay. SD, standard deviation; CI, confidence interval.

was significantly higher (*Figure 3*).

LOS

LOS was reported in three studies (11,13,14), and the heterogeneity among the studies was high (Chi^2=145.57, df=2, P<0.00001, I^2=99%). Therefore, we used the random-effects model showed an effect value of MD =−2.71 (95% CI: −10.04, 4.61), and the difference was not statistically significant (P=0.47) (*Figure 4*).

Proportion of low temperature during 72 hours post-transfer

Two studies (13,14) reported that proportion of infants having at least one episode of low temperature during 72 hours post-transfer, and there was no significant heterogeneity between studies: Chi^2=0.68, df=1. P=0.41, I^2=0%); therefore, we used fixed-effect model. The result showed no significant difference (P=0.05) in an effect value of pooled risk ratio =0.60 (95% CI: 0.36, 1.01) (*Figure 5*).

Postmenstrual age at discharge

Postmenstrual age at discharge in three studies (11,13,14) had high heterogeneity (Chi^2=30.08, df=2, P<0.00001, I^2=93%). Therefore, the random effects model was used. The result showed an effect value of WMD =−0.45 (95% CI: −1.41, 0.50). The difference was not statistically significant (P=0.35) (*Figure 6*).

Study or Subgroup	Lower weight group Events	Lower weight group Total	Higher weight group Events	Higher weight group Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Enrico Zecca 2010	4	47	4	47	12.6%	1.00 [0.27, 3.76]
K New 2012	15	90	28	92	87.4%	0.55 [0.31, 0.95]
Total (95% CI)		**137**		**139**	**100.0%**	**0.60 [0.36, 1.01]**
Total events	19		32			
Heterogeneity: $Chi^2 = 0.68$, df = 1 (P = 0.41); $I^2 = 0\%$						
Test for overall effect: Z = 1.93 (P = 0.05)						

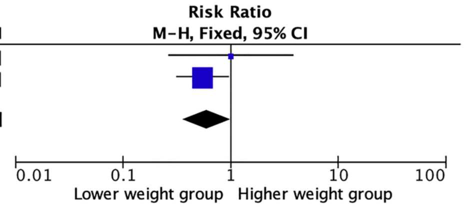

Figure 5 Forest plot for proportion of low temperature during 72 hours post-transfer. CI, confidence interval.

Study or Subgroup	Lower weight group Mean	SD	Total	Higher weight group Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Enrico Zecca 2010	35.6	1.5	47	37	1.1	47	32.8%	−1.40 [−1.93, −0.87]
K New 2012	37.8	2	90	37.9	2.6	92	30.9%	−0.10 [−0.77, 0.57]
Seetha Shankaran 2018	37.1	0.4	185	37	0.4	178	36.3%	0.10 [0.02, 0.18]
Total (95% CI)			**322**			**317**	**100.0%**	**−0.45 [−1.41, 0.50]**
Heterogeneity: $Tau^2 = 0.65$; $Chi^2 = 30.08$, df = 2 (P < 0.00001); $I^2 = 93\%$								
Test for overall effect: Z = 0.93 (P = 0.35)								

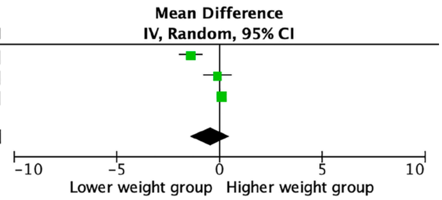

Figure 6 Forest plot for postmenstrual age at discharge. SD, standard deviation; CI, confidence interval.

Study or Subgroup	Lower weight group Mean	SD	Total	Higher weight group Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Enrico Zecca 2010	1,842	126	47	2,067	134	47	51.4%	−225.00 [−277.59, −172.41]
K New 2012	2,328	332	90	2,308	325	92	48.6%	20.00 [−75.47, 115.47]
Total (95% CI)			**137**			**139**	**100.0%**	**−105.87 [−345.88, 134.13]**
Heterogeneity: $Tau^2 = 28466.18$; $Chi^2 = 19.41$, df = 1 (P < 0.0001); $I^2 = 95\%$								
Test for overall effect: Z = 0.86 (P = 0.39)								

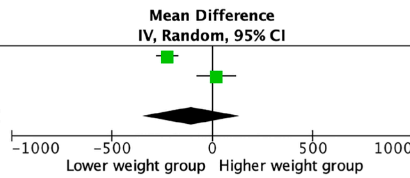

Figure 7 Forest plot for weight at discharge. SD, standard deviation; CI, confidence interval.

Study or Subgroup	Lower weight group Events	Lower weight group Total	Higher weight group Events	Higher weight group Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Enrico Zecca 2010	0	47	0	47		Not estimable
K New 2012	10	90	6	92	42.1%	1.70 [0.65, 4.49]
Seetha Shankaran 2018	12	185	8	178	57.9%	1.44 [0.60, 3.45]
Total (95% CI)		**322**		**317**	**100.0%**	**1.55 [0.81, 2.97]**
Total events	22		14			
Heterogeneity: $Chi^2 = 0.06$, df = 1 (P = 0.80); $I^2 = 0\%$						
Test for overall effect: Z = 1.33 (P = 0.18)						

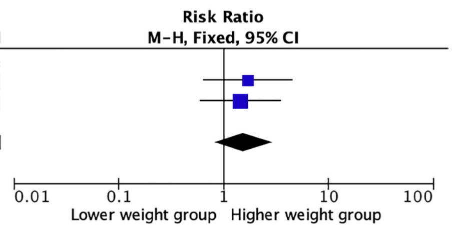

Figure 8 Forest plot for the number of infants returned to incubator. CI, confidence interval.

Weight at discharge

Two studies (13,14) reported weight at discharge, and there was great heterogeneity among the studies (Chi^2=19.41, df=1, P<0.0001, I^2=95%), so the random effects model was used. The result showed an effect value of WMD =−105.87 (95% CI: −345.88, 134.13), and the difference between these studies was not statistically significant (P=0.39) (*Figure 7*).

The number of infants returned to incubator

Three studies (11,13,14) reported that the total of infants returned to incubator after weaning to an open crib; there was no significant heterogeneity between studies (Chi^2=0.06, df=1, P=0.80, I^2=0%) and we used fixed-effect model. The result showed no significant difference (P=0.18) in an effect value of pooled risk ratio =1.55 (95% CI: 0.81, 2.97) (*Figure 8*).

Readmission rate

Two studies (11,13) reported readmission rates had high heterogeneity between these studies (Chi^2=2.40, df=1, P=0.12, I^2=58%). Therefore, we used a random-effect model, and the result showed no statistically significant

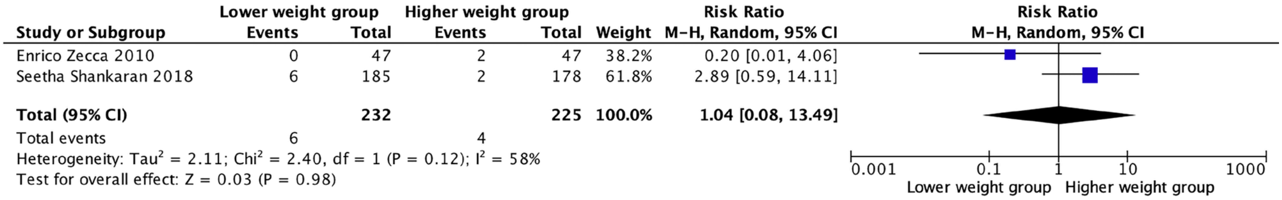

Figure 9 Forest plot for readmission rate. CI, confidence interval.

(P=0.98) in an effect value of pooled risk ratio =1.04 (95% CI: 0.08, 13.49) (*Figure 9*).

Discussion

Body weight is an important indicator for preterm infants in the incubator being transferred to an open crib. Most randomized controlled trials (11,13-15) used preterm infants weighing 1,600 g as the initial weight for transfer from incubator to crib as the lower birth weight group. However, a few studies have investigated lower weaning weights. For example, a retrospective study (10) used 1,400 g as the weaning weight criterion and found that stable preterm infants can be safely transferred to an open crib at <33 weeks and weight ≤1,400 g. Berger *et al.* (6) conducted a randomized controlled trial comparing weaning weights 1,500 *vs.* 1,600 g and found that weaning preterm infants weighing 1,500 g from an incubator to a warm bassinet was feasible and had no significant deleterious effects on weight gain and resting energy expenditure. This meta-analysis is based on the majority of studies using 1,600 g as the cutoff point for weaning weight and aims to further validate whether 1,600 g can serve as a suitable weaning weight standard for stable preterm infants.

Weight gain is an important indicator which reflects the growth rate and adaptation of newborns to their environment (19). The results of this study demonstrate that preterm infants in the lower weight group had higher growth velocity from incubator weaning to discharge home. New *et al.* (14) showed the average daily weight gain over the first 14 days following transfer to an open cot in the 1,600 g group was 17.07 (±4.5) g/kg/day and in the 1,800 g group was 13.97 (±4.7) g/kg/day (P≤0.001). This finding is consistent with the results of the meta-analysis conducted by New *et al.* (16) and Razak (17). In addition, it is similar to the Rallis *et al.* (10), indicating that lower weight groups (such as ≤1,400 *vs.* >1,400 g) are more favorable for weight gain. Studies by Schneiderman *et al.* (9) have also shown that higher weight out of the incubator will delay the time of oral feeding and reduce the rate of weight gain. This may be attributed to the early transition from the incubator, which promotes mother-infant contact and increases the frequency of breastfeeding (20). However, studies conducted by Lin *et al.* (3) suggest that there is no association between weight gain and calorie intake with the weaning period or early weight-bearing weeks (EWBW), and therefore, it is not related to the incubator weaning process.

The meta-analysis results indicate lower weight transfer to an open crib does not shorten LOS. Reducing the length of hospital stay is an important objective for premature infants, as early discharge has benefits for the family and helps optimize the utilization of medical resources (21-23). Although the retrospective study of Picone *et al.* (24) and Schneiderman *et al.* (9) have shown that the LOS was significantly shorter in the lower weight group than in the higher weight group and Schneiderman *et al.* (9). found in a study of 2,908 infants that for every 100 g increase in average out-of-incubator weight LOS increased by 0.9 days, there is no evidence to date that earlier transition to an open crib is associated with earlier discharge.

Premature infants have weak thermoregulatory abilities and may develop hypothermia when transferred from an incubator to a crib (25). The included randomized controlled trials (11,13-15) all have detailed incubator weaning steps. Once hypothermia occurs in premature infants after being out of the incubator within 72 hours, an additional wrap was added to the infant, and the temperature was checked afterward. If the infant's temperature cannot be maintained ≥36.5 ℃, they will be returned to the incubator. This meta-analysis reported that transferring weight of 1,600 g out of the incubator is safe, which will not increase the proportion of hypothermia, nor will it increase the number of premature infants returning to the incubator due to hypothermia. Multiple studies have consistently shown that there are no adverse effects caused by moving premature infants to a crib (10,17,26). Barone *et al.* showed (12) that 79.2% of 1,600–1,699 g preterm infants in the NICU were successfully transferred from an incubator to an open crib with no significant adverse effects on temperature stability or weight gain and no need for readmission to an incubator.

There are some limitations in our study. Firstly, the number of included studies was limited and noncomparable. Secondly, there were differences in the average birth weight and gestational age of the populations in included studies, leading to heterogeneity in the results. Thirdly, this article did not include a report on publication bias and sensitivity analysis. In addition, this study was not registered, which may cause a small bias. Despite these limitations, we still strictly followed the steps of the systematic review.

Conclusions

Our results indicate that it is feasible and safe for preterm infants in stable condition to be transferred to open cribs when their weight is 1,600 g without adverse clinical outcomes, which can increase weight gain velocity during hospitalization. Future research hopes to conduct more randomized controlled trials and expand the sample size; secondly, detailed records of skin-to-skin contact, breastfeeding, or nutritional intake of premature infants in cribs, e.g., in addition, the outcome indicators included in the study should be comprehensive, the definition of indicators should be clear; increase discharge indicator monitoring, and extend the follow-up time as long as possible to track and register various long-term indicators of premature infants, this includes not only increases in weight, length and head circumference but also measures such as duration of breastfeeding and neurodevelopmental outcomes.

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Footnote

Reporting Checklist: The authors have completed the PRISMA reporting checklist. Available at https://pm.amegroups.com/article/view/10.21037/pm-23-41/rc

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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