Lives Saved Tool Technical Note
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Technical note on average length of hospital stay among preterm or low birth weight infants

Introduction

One in ten babies are born prematurely across the world, which accounts for nearly 15 million live births per year (1). Of these 15 million preterm infants, nearly 80 % are born in Asia and Sub-Sahara Africa (1). Given that preterm birth is the leading cause of death among under-five children (2), an effective and affordable approach to prevent and provide care for preterm infants is urgently needed.

On the World Prematurity Day November 17th, 2022, the World Health Organization (WHO) launched new recommendations for care of the preterm or low birth weight (LBW) infants (3). This is 4th update since 2011, 2013, and 2015. The new guideline includes 11 strong (4 new, 6 updated) and 14 conditional (5 new, 9 updated) recommendations. To continuously support our users' strategic planning, evaluation, and advocacy about maternal and child health, the LiST team is aiming to estimate the financial cost of these interventions recommended by the WHO. As a part of this project, we explored the average length of hospital stay among preterm or LBW infants based on available peer-reviewed articles and gray literatures.

Methods

Peer-reviewed articles

We conducted a scoping review of articles published in PubMed since inception to December 2022. The literature search was carried out on 14th December 2022 using queries covering four key words: "preterm", "low birth weight", "cost of hospitalization" and "length of hospital stays" (Table 1). An article was included if it's an original article, population of interest was preterm or LBW infants, and outcome was the length of hospital stay (LOS). Review articles were screened for citation searching but were not included in the final review. An article was excluded if it was clinical trial, letter, commentary, or editorial, or if not written in English. The title and abstract screening, full literature review, and data extraction was done by a single reviewer. Extracted data was discussed and interpreted by the entire LiST team.

Table 1: Queries and number of articles identified in PubMed

Keyword	Queries	# articles identified
a. Preterm birth	"Premature Birth" [mesh] OR "Premature Birth" [tw] OR "Infant, premature" [mesh] OR "infant, premature" [tw] OR "preterm" [tw] OR "pre-term" [tw] "premature" [tw] OR "prematurely" [tw]	118,370
b. Low birth weight	"Infant, Low Birth Weight" [mesh] OR "Infant, Low Birth Weight" [tw] OR "low birth weight*"[tw] OR "low-birth-weight*"[tw]	53,598
c. Length of hospital stay	"Length of Stay" [mesh] OR "length of stay*" [tw] OR "length of hospital stay*" [tw] OR "hospital stay*" OR "stay length*" [tw] OR "hospital stay*" [tw] OR "stay*, hospital"[tw]	210,808
d. Cost of hospitalization	"Hospital Costs" [mesh] OR "hospital cost*" [tw] OR "hospitalization cost*" [tw] OR "cost of hospitalization*" [tw] OR "cost*"[tw]	859,455
a AND b AND c AND d		417

Gray literatures

On 14th December 2022, using the same four key words, inclusion and exclusion criteria, data extraction, and review process, gray literatures appeared in the first 50 items in the google were assessed for eligibility.

Results

Our initial search of peer-reviewed articles in PubMed yielded a total of 417 records. Title and abstract screening found 18 articles potentially eligible. Full literature review led to 11 articles qualified for final review. Of the first 50 items identified with the Google search, we found one gray literature qualified for final review. Therefore, a total of 12 articles were included in final review.

Settings

All included articles were published in 2000 and thereafter. In terms of the location, most of the articles were from North America (n=8), followed by from South America (n=2) (Table 2). No articles from Africa or from lower-middle and low-income countries were identified.

Table 2: Summary of included articles

First author, year	Country	Country income- level[#]	Data source	Population	Sample size	Average LOS (days)
Rios, 2021	Canada	High	National database	Preterm	27,742	Not available
McLaurin, 2019	US	High	Multi-state database	Preterm survived to discharge	325,834	Not available
Zainal 2019	Malaysia	Upper middle	Medical record in hospital (n=2)	Preterm	93	13 (late) 24.5 (moderate) 51.5 (very) 88.0 (extremely)
Ogata 2016	Brazil	Upper middle	Medical record in hospital (n=1)	Preterm with GA 26-37 week	211	21
Ergen 2015	Turkey	Upper middle	Medical record in hospital (n=1)	Preterm	211	13.6
Desgualdo 2011	Brazil	Upper middle	Medical record in hospital (n=2)	Preterm	156	21
Knowlessar 2011*	US	High	National sample survey	Preterm or LBW	321,900 (preterm) 231,900 (LBW)	14.3 (preterm) 17.7(LBW)
Lim 2019	Canada	High	National database	Preterm or SGA	13,005	10.0
Barradas 2009**	US	High	National sample survey	Preterm or LBW	193,000 (Medicaid) 169,600 (commercial)	12.8 (Medicaid) 11.9 (commercial)

					17,000 (uninsured)	7.2 (uninsured)
Russel 2017	US	High	National sample survey	Preterm or LBW	384,200	12.9
Ringborg 2006	Sweden	High	National database	Preterm	7646	Not available
St John 2000	US	High	Medical record in hospital (n=2)	Preterm	958	Not available

LOS: Length of Hospital Stay, GA: Gestational Age, LBW: Low Birth Weight, SGA: Small for Gestational Age

Based on the World Bank country classifications by income level: 2022-2023 (4)

*Average LOS was provided separately for preterm (n=321,900) and LBW (n=231,900 infants

**Average LOS was provided by payer types: Medicaid (n=193,000), commercial insurance (n=169,600) and uninsured (n=17,000)

Data source

Seven (U.S. [n=4], Canada [n=2], Sweden [n=1]) used national or multi-state level data, while the remaining five (Brazil [n-=2], Malaysia [n=1], Turkey [n=1], U.S. [n=1]) used subnational level data, such as medical records from one or two tertiary level hospitals (5–9).

Average length of hospital stay

Of the seven nation-wide studies, four described the average LOS of overall preterm or LBW infants included in the study. This included three studies based on the U.S. Nationwide Inpatient Sample (NIS) Survey(10–12), and one based on the Canadian Institute for Health Information (CITI) nation-wide survey (13). One study from a tertiary-level hospital in Brazil also provided the average LOS of overall preterm infants (6). The remaining three described only the LOS of preterm or LBW infants by gestational age at birth, thus the overall LOS was not identified (14–16).

The estimated average LOS ($\pm$ SD) based on the six populations in the above-mentioned four study (Knowlessar 2011 [preterm], Knowlessar 2011 [LBW], Lim 2019, Barradas 2009 [Medicaid], Barradas 2009 [commercial], Barradas 2009 [uninsured], and Russel 2017) were 12.4 ± 3.3 days.

Discussion

With scoping review of peer-reviewed articles and google search of gray literatures, we found only four nation-wide studies providing the average LOS of preterm or LBW infants. All of them were from high-income countries, mostly from North America. No studies from lower-middle-income or low-come countries were identified. Although we found several studies from upper-middle income countries, all of them were conducted at the subnational level, thus not readily generalizable.

The average of the average LOS in selected four nation-wide studies were 12.6 days, which will be used as a default value in the LiST software. However, this value has to be used with caveat by those who are fully aware of the following limitations: data extracted was only from high-income counties – predominantly from North American region, only one database (i.e., PubMed) was used, review of articles was done by a single reviewer, and the average LOS provided here is an average of average LOS, but not that based on meta-analysis. We highly encourage using local data if available.

Our study also highlighted hat data on health care cost for preterm or LBW infants, including length of hospital stay is quite limited, particularly in low-income settings. Even in high-income countries, some national-level data were available only upon purchase. Because cost-effectiveness is a crucial element for

a stronger health system in any country, data availability on this topic should be addressed and improved across the globe.

In summary, our scoping review identified a total of 12 records including 11 peer-reviewed articles and one gray literature, of which four nationwide study from the U.S. or Canada provided the average LOS of overall preterm or LBW infants. The estimated average LOS was 12.4±3.3days, which will be used as a default value in the LiST software. However, this value has to be used by our users with caveat, and the LiST team encourages using local values if available.

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