Brief Report

Preferences and Practices: Use of Neonatal Resuscitation Devices in Low-Resource Settings

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Summary

Background: Birth asphyxia, when a baby does not breathe at birth, is estimated to account for 23% of the approximately four million neonatal deaths that occur annually. Correct use of neonatal resuscitators is critical to lower neonatal mortality rates due to birth asphyxia.
Methods: In order to understand the context of use of resuscitators including use scenarios, training, device readiness and design features and preferences, PATH conducted an anonymous web-based survey among neonatal health experts. Twenty-eight percent (22/80) of experts completed the survey.
Results: In general, the bag and mask devices were used by more practitioners and in more places than the tube and mask design; the tube and mask device was not well known. Features of the bag and mask device that mattered most were ease of use, mask size and device function.
Features of the tube and mask device that mattered most were ease of use and availability. Device readiness at delivery and use of devices after long periods of inactivity were also concerns.
Conclusions: There was a clear preference for the bag and mask device over the tube and mask device due to its ease of use. Programmatic implications include the need to improve health workers' confidence in the ability of the device to be cleaned and to remain in safe working order over time. These issues should be reviewed during periodic refresher training courses.

Introduction

Birth asphyxia is estimated to account for 23% of the approximately four million neonatal deaths that occur annually worldwide [1]. The goal of this research was to gather information about the use of neonatal resuscitators at all levels of health care in low-resource settings in order to inform decisions about product design and increase use of the technology throughout the health system.

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Methods

We conducted an anonymous opinion survey of neonatal experts about the context of use of the two most customary resuscitator designs: bag and mask, and tube/mouth and mask. Experts were identified through participant lists of recent global meetings on neonatal health, personal networks and referrals from colleagues. The final list of potential respondents was a well-rounded group of experts with experience working at tertiary, secondary and primary levels of care with various educational backgrounds and professional and country experiences. Topics covered included resuscitator use scenarios, device availability, readiness and features of both design types. An electronic survey, following the principles outlined in Dillman [2], was used to collect data from February through June 2005. We achieved a response rate of 28% (22/80). Two reminder e-mail messages were sent to non-respondents.

Results

Respondent characteristics
Approximately one-half (10/19) of respondents conduct the majority of their work in subSaharan Africa, 21% (4/19) in South and Southeast Asia, 11% (2/19)

TABLE 1

Frequency of use of neonatal resuscitator devices in developing countries, as observed by respondents

Respondents	Never number (%)	Rarely (less than 1 time/year) number (%)	Somewhat common (1–3 times/year) number (%)	Common (at least 1 time/quarter) number (%)	Very common (at least 1 time/month) number (%)
Medical doctors in tertiary care facility	0	0	2/21 (10)	2/21 (10)	17/21 (81)
Nurses in tertiary care facility	0	1/21 (5)	2/21 (10)	4/21 (19)	14/21 (67)
Medical doctors in secondary care facility	0	1/20 (5)	1/20 (5)	8/20 (40)	10/20 (50)
Nurses in secondary care facility	1/20 (5)	3/20 (15)	1/20 (5)	6/20 (30)	9/20 (45)
Midwives in secondary care facility	2/18 (11)	1/18 (6)	2/18 (11)	4/18 (22)	9/18 (50)
Traditional birth attendants (TBAs) in secondary care facility	12/14 (86)	2/14 (14)	0	0	0
Medical doctors in primary care facility	4/17 (24)	6/17 (35)	1/17 (6)	1/17 (6)	5/17 (29)
Nurses in primary care facility	5/18 (28)	4/18 (22)	3/18 (17)	0	6/18 (33)
Midwives in primary care facility	5/18 (28)	2/18 (11)	3/18 (17)	3/18 (17)	5/18 (28)
TBAs in primary care facility	13/15 (87)	1/15 (7)	0	0	1/15 (7)
Midwives at home birth	7/15 (47)	2/15 (13)	4/15 (27)	1/15 (7)	1/15 (7)
TBAs at home birth	12/17 (71)	3/17 (18)	1/17 (6)	1/17 (6)	0

TABLE 2

Neonatal resuscitators currently in use by health workers attending births in developing countries

Resuscitators	Tertiary care facility number (%)	Secondary care facility number (%)	Primary care facility number (%)	In the home number (%)
Bag and mask	19/21 (90)	20/21 (95)	13/21 (62)	4/21 (19)
Tube and mask	4/11 (36)	2/11 (18)	6/11 (55)	5/11 (45)
Other	3/8 (38)	2/8 (25)	7/8 (88)	5/8 (63)

in North America/Europe and 11% (2/19) work globally. Seventy-four percent (14/19) of respondents currently work as medical doctors, 11% (2/19) as nurses and 16% (3/19) as midwives. No information is available about non-respondents due to the anonymous nature of the survey.

Scenarios of use
Eighteen out of twenty-one (86%) respondents reported that they had used a neonatal resuscitator device in a developing country. Respondents reported that the most common scenario of use (at least once a month) occurred with medical doctors in tertiary facilities (81%) (Table 1). In contrast, scenarios reported as never observed by respondents were use by traditional birth attendants (TBA) in primary care facilities (87%), followed by TBA use in secondary care facilities (86%) and during home births (71%).

Device availability
Bag and mask devices were cited much more frequently than tube and mask as the type of resuscitator currently being used by health workers attending births, especially at higher levels of care (Table 2). When no resuscitator device was available,

mouth-to-mouth resuscitation with a gauze barrier was used most commonly.

Device preference
Ease of use was the feature that mattered most to those who had experience using either kind of device. Size of the mask and overall device function were noted as key features by respondents who had experience using bag and mask devices, and availability was noted as a key feature by respondents with experience using tube and mask devices.

Respondents reported a clear preference for the bag and mask device over the tube and mask device, (Table 3) due to its ease of use. The tube and mask design was preferred for its simplicity and portability. The tube and mask device was cited as difficult to use because it requires the user to constantly bend forward and blow 30–40 times per minute, the infant is not visible during resuscitation, and it is difficult to tell if the pressure being used is appropriate.

Device readiness, ease of cleaning and storage
Forty-two percent (8/19) of respondents said that a resuscitation device was ready and available for all deliveries, while 16% (3/19) said it was ready only

TABLE 3

Questions and answers on survey regarding bag and mask versus tube and mask

Questions	Bag and mask number (%)	Tube and mask number (%)
Number of respondents with experience using the device.	20/21[a] (95)	4/19[b] (21)
How many newborns have you effectively resuscitated with each device?		
None	0	1/4 (25)
1–4 newborns	0	2/4 (50)
5–20 newborns	3/19 (16)	0
21 or more newborns	13/19 (68)	0
Other	4/19 (21)	1/4 (25)[c]
How many newborns have you seen other health care workers resuscitate effectively with each device?		
None	0	1/4 (25)
1–4 newborns	0	1/4 (25)
5–20 newborns	2/19 (11)	1/4 (25)
21 or more newborns	13/19 (68)	0
Other	4/19 (21)	1/4 (25)
Overall is the device easy to use for newborn resuscitation?		
Yes	20/20 (100)	2/4 (50)
Is the device easy to assemble and disassemble for cleaning without written instructions?		
Yes	14/18 (78)	3/3 (100)
What features make it easy to use?		
Clear instructions/easy to read	10/19 (53)	2/4 (50)
Pictures for non-literate populations	8/19 (42)	3/4 (75)
Few parts to assemble	15/19 (79)	4/4 (100)
Easy to clean	11/19 (58)	2/4 (50)
Other	4/19 (21)	2/4 (50)
What features make it difficult to use?		
Instructions are difficult to read	5/14 (36)	1/4 (25)
No instructions for non-literate populations	6/14 (43)	1/4 (25)
Too many parts to assemble	6/14 (43)	0
Difficult to clean	8/14 (57)	0
Tiring to use for more than a few minutes	5/14 (36)	3/4 (75)
Other	2/14 (14)	3/4 (75)
Is it easy to train someone how to use this device?		
Yes	17/19 (90)	3/4 (75)
Is the face mask provided usually the appropriate size for most newborns?		
Yes	9/19 (47)	2/4 (50)
Is the device easy to clean?		
Yes	12/18 (67)	3/3 (100)
After cleaning the device are you confident that any/all bacteria and microbes have been removed and that it has not been damaged due to the cleaning process?		
Yes	7/18 (39)	1/3 (33)
Is the device easy to store?		
Yes	18/18 (100)	3/3 (100)
How long are these devices able to remain in good working condition?		
Less than 1 year	3/17 (18)	0
1–5 years	12/17 (71)	4/4 (100)
More than 5 years	2/17 (12)	0
Is the device easily accessible/easy to find when needed?		
Yes	14/17 (82)	3/3 (100)
Do you have confidence that after long periods of non-use, a previously used, cleaned, and stored device will work adequately?		
Yes	11/18 (61)	2/3 (67)
Do you have confidence that after long periods of non-use, a previously used, cleaned and stored device is safe during use?		
Yes	10/18 (56)	3/3 (100)
In your opinion, can health workers use the device easily and safely, without any refresher training, after long periods of non-use?		
Yes	7/17 (41)	1/2 (50)

(continued)

TABLE 3
Continued

Questions	Bag and mask number (%)	Tube and mask number (%)
Which features matter most to you when forming your overall opinion about the device?	Bag: 10/18 (56)	Tube: 3/4 (75)
	Mask: 12/18 (67)	Mouthpiece: 2/4 (50)
	Valve: 7/18 (39)	Mask: 2/4 (50)
	Other: 3/18 (17)	Valve: 2/4 (50)
In general, which device do you prefer?	17/19 (90)	0

Note: Because not all those surveyed answered each question, the percentages and number of respondents indicated are not consistent from question to question. Percentages are based on the number of respondents answering each question.
[a]One respondent skipped this question while 21 respondents answered this question. One noted he/she had not used this device before and thus was not allowed to answer any further questions related to the bag and mask device in this section. The denominators indicate the number of people who responded to that question. Respondents were allowed to skip questions in this section. If a respondent skipped the question, his/her responses were excluded from the analysis and subtracted from the denominator of total respondents for that question.
[b]Three respondents skipped this question while 19 respondents answered this question. Fifteen respondents noted they had not used this device before and thus were not allowed to answer any further questions related to the tube and mask device in this section. The denominators indicate the number of people who responded to that question. Respondents were allowed to skip questions in this section. If a respondent skipped a question, his/her responses were excluded from the analysis and subtracted from the denominator of total respondents for that question.
[c]Answers included 'hundreds' and '30 years experience with thousands of infants'.

when a complication was anticipated. Most respondents reported that device accessibility depended heavily on where it was stored.

Respondents considered the bag and mask device difficult to clean due to difficulty in accessing the inner part of the device. One respondent noted that it was difficult to properly clean the tube of the tube and mask design and that the design allows some residue to remain inside the tube, even after cleaning.

After long periods of non-use, previously used, cleaned and stored devices may not be entirely ready for use. The majority of respondents recommended checking and even cleaning the device if it had not been used for long periods of time. The need for frequent refresher trainings was stressed to ensure safe and effective use of either device.

Discussion

This study was not designed to be representative and is therefore subject to self-selection bias. It also included a limited number of practitioners with experience using the tube and mask design.

This investigation, however, yielded important information regarding practices related to device use in low-resource settings and the positive and negative aspects of device designs. In general, bag and mask devices were used by more practitioners and in more places than the tube and mask design. This is consistent with the relatively limited literature that documents the use of tube and mask designs in low-resource settings [3, 4].

Although laboratory testing of various resuscitator designs has been conducted in a limited fashion [5–7], these findings represent the first time that device-specific information about preferences and practices has been reported. Strengthening the supply of neonatal services has been identified as an essential ingredient to systematic global scale-up of neonatal care [8]. Strengthening supply requires a detailed understanding of preferences and practices related to specific equipment being used. This study offers information that is useful not only to product development teams but also to program planners who are interested in addressing some of the equipment issues related to the provision of neonatal care in low-resource settings. Programmatic implications include the need to improve health workers' confidence in the ability of the device to be cleaned and to remain in safe working order over time. These issues should be reviewed during periodic refresher training courses.

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