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ORIGINAL ARTICLE

Do we get the message through? Difficulties in the prevention of abusive head trauma

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Abstract

Many programs aim to prevent abusive head trauma throughout the USA, Europe, and in many other regions of the world. Most of these programs inform mothers shortly after delivery about the dangers of abusive head trauma. Effectiveness of these programs usually is measured by the increase of knowledge on abusive head trauma. Recent research showed, however that for effective primary prevention, a much broader approach might be necessary. But so far, there is no data that reports the knowledge on key messages on abusive head trauma in the general public as a baseline. We conducted a representative population-based survey on abusive head trauma knowledge in Germany. Whereas the dangers are generally well known, a majority might be ambivalent towards the recommendation to leave a crying infant alone for a few minutes when the caregiver becomes too stressed or frustrated. Furthermore, a majority prefers being informed on abusive head trauma *before* birth.

Conclusion: Future preventive programs should focus on educating adolescents (potential baby sitters) and young adults when they do not yet have children of their own.

What is known:
- *Most programs for primary prevention of abusive head trauma (AHT) focus on mothers shortly after delivery*
- *There are no analyses so far of the quality of education programs in the general public, as educating mothers might not be sufficient to reduce incidence rates*

What is new:
- *Our study is the first population-based survey to measure the knowledge on AHT in a representative population sample and to provide the data base for targeted prevention programs.*
- *The introduction of broader prevention programs might be necessary.*

Keywords Child abuse · Shaken baby syndrome · Prevention · Abusive head trauma · Maltreatment

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Abbreviations

AHT	Abusive head trauma
NZFH	Nationales Zentrum Frühe Hilfen (national centre for early interventions, Germany)
SBS	Shaken baby syndrome
SD	Standard deviation

Background

Abusive head trauma (AHT) is one of the most severe forms of child physical abuse. It often occurs when an infant is shaken violently with or without impact on a hard surface [11] and is associated with high mortality [18, 23]. Survivors often suffer from long-term impairment [16]. Incidence rates remain high at 16–33/100,000 children under the age of 24 months in the USA. For Germany, the German Society of Pediatric Surgery roughly estimates 100–200 cases per year [13], the resulting incidence rate is approximately 7.3–14.6/100,000 children under the age of 24 months [20]. AHT thus poses a great burden to affected children, their families, and also to economies [19].

Various authors report an association between AHT and infant crying. Incidence rates of AHT are highest in infants at the age of 9–12 weeks. At this age, most infants also have periods of inconsolable crying of up to 6 h per day [4, 14]. Furthermore, it is known from confessions of perpetrators of AHT that they got frustrated by the infant's crying [2].

As Dias et al. stated, AHT basically is a promising target for primary prevention. The group at risk is clearly defined (young infants) and almost all infants and their parents have contact to healthcare professionals around the time of birth [9]. Consequently, some preventive programs were followed by a decrease in AHT incidence [3, 9] while other studies could show an increase in parental knowledge on AHT, but no decrease in incidence rates [10, 26].

Therefore, according to recommendations by the World Health Organization [22], preventive programs should convey two key messages: (1) that AHT can lead to severe brain damage or death and (2) that it was preferable letting an infant cry and leaving the room for a few minutes. Interestingly, no program does give a specific amount of time. Parents are advised to "walk away" and "it's ok to let a baby cry" [8] or "get away from the crying for a while and calm down" and return frequently to check on their babies [17; 18]. Most studies report that their main target group have been mothers in maternity wards or shortly after discharge [5, 8, 24] while Dias and colleagues developed a program that systematically enrolls fathers and father figures [9, 10]. When evaluated, most programs show modest increase in knowledge on AHT shortly after participation [5, 8, 12]. Mann and coworkers asked similar questions to mothers in maternity wards who have not been informed about AHT before by healthcare professionals. Over 90% of the participants knew that AHT can cause severe brain damage or death [17].

In Germany, a nationwide preventive strategy called Alliance Against Shaken Baby Syndrome (Bündnis gegen Schütteltrauma) is being put forward by the German National Centre for Early Intervention (Nationales Zentrum Frühe Hilfen, NZFH).The program is financed by the Federal Ministry of Family Affairs, Senior Citizens, Women, and Youth and includes similar messages. Professionals, who are in contact with parents of infants are provided with leaflets and a short video [1, 7].

It is known from previous research that mothers are only one possible group of AHT perpetrators [21, 25]. Therefore, it is important to include all possible caregivers of infants in education programs, such as non-related father figures, babysitters, and grandparents [9, 15]. Nevertheless, to the best of our knowledge, there has never been an analysis assessing how the two key messages of AHT information campaigns are understood in a broad audience. To better understand the needs of information on AHT in a general public and to create a data base for future evaluation of nationwide prevention programs, we assessed how effectively the two key messages about AHT have been conveyed so far in a population-based sample of the German population.

Methods

Survey

Between November 2017 and February 2018, a survey in a representative sample of the German population of 14 years and older was conducted. A random route approach was chosen to assure representativeness in selecting participants. The households of every third residence in randomly selected streets were invited to participate. To select participants in multi-person households, a Kish-selection-grid was applied. For inclusion, sufficient German language skills and at least 14 years of age were needed. Of the 5160 initially contacted households, 2531 persons completed the survey. The main reason for non-participation were refusal by the selected household to identify the person of target (16.5%), refusal of the target person to participate (15.8%), and failure to contact anyone in the residence after four attempts (14.4%). Participants were informed about the study and informed consent was obtained. In the case of minors, participants gave informed assent with informed consent being provided by their caregivers. Responses were anonymized. First, sociodemographic data was obtained by interview. Participants then completed a questionnaire and sealed them in an envelope. The completed questionnaire was then linked to the sociodemographic data but did not contain any data to identify the participant.

The study was conducted in accordance with the Declaration of Helsinki and fulfilled the ethical guidelines of the International Code of Marketing and Social Research Practice of the International Chamber of Commerce and of the European Society of Opinion and Marketing Research. The study was approved by the Ethics Committee of the Medical Department of the University of Leipzig.

Measures

Sociodemographic questions covered among others are age, gender, education, occupation, marital status, number of persons under 18 years in the household, and number of own children.

Awareness of AHT was assessed by the question "Have you ever heard of shaken baby syndrome"? The common term in Germany is "Schütteltrauma," i.e., "shaking trauma;" thus, in the questionnaire, AHT was referred to by "shaking" or "Schütteltraumasyndrom" ("shaken baby syndrome").

Only participants who stated that they had heard of AHT before were included in the further analyses unless otherwise stated.

Sources of information about AHT were assessed by asking "How did you learn about Shaken Baby Syndrome?". Possible answers were grouped to "medical professionals," "media and news," and "friends and colleagues".

To assess whether the key messages of AHT education have been understood, we asked two questions: "How long is it ok to let an infant cry?" The participants could answer "not at all," "up to 5 min," "up to 15 min," "up to 30 min," or "longer." We grouped the answers in "never," "up to 5 min," and "longer than 5 min" as the most common advice to parents is to leave the infant for "a few minutes", and to our understanding, this would be most consistent with up to 5 min. To minimize social desirability bias, this question was asked first after general demographic questions, without reference to AHT. The second question was: "What do you think could result from shaken baby syndrome?" Four possible results could be answered with "yes" or "no." Those were "severe brain damage," "developmental anomalies," "coma," or "death."

Finally, participants were asked for the ideal timing to inform about AHT with answers being "before birth," "in the hospital," "after discharge."

Table 1 Sample characteristics

	Total ($n = 2531$)	Female ($n = 1401$, 55.4%)	Male ($n = 1130$, 44.6%)
Age, M (SD)	48.6 (18.0)	48.7 (18.0)	48.4 (18.1)
Living with a partner	1351 (53.4)	734 (52.4)	617 (54.6)
Subjects with own children *N* (%)	1586 (62.7)	949 (67.7)	637 (56.4)
German citizenship	2429 (96.0)	1359 (97.0)	1070 (94.7)
Educational achievement *N* (%)			
Left school before graduation	56 (2.2)	40 (2.9)	16 (1.4)
School graduation	2169 (85.7)	1222 (87.2)	947 (83.8)
University degree	233 (9.2)	103 (7.4)	130 (11.5)
Attending school	65 (2.6)	33 (2.4)	32 (2.8)
Occupational status			
Full-time	1067 (42.4)	429 (30.8)	638 (56.8)
Part-time	285 (11.3)	260 (18.7)	25 (2.2)
< 15 h/week	83 (3.3)	71 (51.1)	(12 (1.1)
Federal volunteer service/parental leave	26 (1.0)	23 (1.7)	3 (0.3)
Unemployed	125 (5.0)	68 (4.9)	57 (5.1)
Retiree	640 (25.4)	350 (25.1)	290 (25.8)
Homemaker	79 (3.1)	76 (5.5)	3 (0.3)
In training	62 (2.5)	36 (2.6)	26 (2.3)
Student	149 (5.9)	80 (5.7)	69 (6.1)
Heard of AHT before			
Yes	1503 (59.4)	951 (67.9)	552 (48.8)
No	1015 (40.1)	445 (31.8)	570 (50.4)

Characteristics of the population representative sample, presented as mean (M) and standard deviation (SD) for age and number of subjects (%) for other characteristics

Participants

Two thousand five hundred thirty-one participants completed the questionnaire. 55.4% ($n = 1401$) of the participants were female. Participants were on average 48.6 years old, age range was 14 to 93 years. The sample was representative for the German population in regard to age and gender. Relevant sample characteristics are presented in Table 1.

Statistical analyses

All analyses were conducted using SPSS version 21. Descriptive analyses were performed for prevalence rates. Comparisons were conducted using Chi^2 tests.

Results

A correct response to the sequelae of AHT was noted as choosing all four possibilities "severe brain damage," "developmental anomalies," "coma," or "death." We chose this rather conservative approach, as the answers might have been somewhat suggestive and we wanted to measure the knowledge the participants had from AHT education where all four potential harmful sequelae should be addressed. According to this approach, 83.6% gave the right answer. All participants on the other hand agreed to at least one possible result of AHT: 100% answered "yes" at least to one of the four possibilities. From all participants who have heard of AHT before, 97.5% knew that shaking can cause severe brain injury. The rates of participants who agreed that coma, developmental problems, or death can result from AHT, were lower at 91.2%, 91.5%, and 90.8%, respectively. Gender or whether the subjects had children of their own did not affect their tendency to answer this question. Young age was associated with knowing less on the dangers of AHT as were an academic degree and still attending school (Table 2).

Fifty three percent of the participants who had heard of AHT before answered that it was not ok to leave a crying infant alone at all. Only 35.0% answered they would accept to leave a crying infant for up to 5 min, what we considered consistent with the message of the preventive programs. 11.1% would leave a crying infant for longer than 5 min. Strikingly, answers of subjects who had *not* heard of AHT before did not differ from those who had heard of AHT: in both groups, 53% would not leave a crying infant at all. In the group that had heard of AHT before, 35% would leave a crying infant for up to 5 min; in the group that had not heard of AHT, it were 32%, but the difference did not reach significance. Women were more likely to not leave a crying infant

Table 2 Dangers of shaking

	Severe brain injury	Developmental problems	Coma	Death
Heard of AHT ($n = 1503$)	97.5 (1465)	91.5 (1375)	91.2 (1371)	90.8 (1365)
Subjects with children	97.5 (1026)	92.2 (970)	91.8 (966)	92.2 (970)
Subjects without children	97.3 (436)	89.7 (402)	89.7 (402)	87.5 (392)
Chi^2	1.07	3.27	2.88	9.48**
Gender				
Male	97.6 (539)	90.7 (501)	92.5 (511)	90.7 (501)
Female	97.3 (926)	91.9 (874)	90.4 (860)	90.8 (864)
Chi^2	1.62	0.77	2.17	0.11
Age				
< 25 years	95.3 (102)	90.6 (97)	84.1 (90)	82.2 (88)
25–40 years	97.9 (377)	92.9 (358)	91.6 (353)	90.1 (347)
41–55 years	99.0 (421)	93.8 (399)	93.1 (396)	93.8 (399)
> 56 years	96.4 (565)	88.9 (521)	90.7 (532)	90.6 (531)
Chi^2	14.02*	14.59*	15.85*	24.53***
Educational level				
Left school before graduation	95.6 (22)	95.6 (22)	95.6 (22)	95.6 (22)
School graduation	98.0 (1287)	92.4 (1214)	91.7 (1205)	91.4 (1201)
Academic degree	94.6 (142)	84.0 (126)	88.6 (133)	86.6 (130)
Attending school	82.3 (14)	76.4 (13)	64.7 (11)	70.5 (12)
Chi^2	28.17**	19.20**	19.45**	20.06**

"What do you think could result from shaken baby syndrome" with possible answers being "severe brain damage," "developmental problems," coma," or "death." Presented are subjects that answered "yes" to each possibility. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Table 3 Acceptance for letting an infant cry

	Never	Up to 5 min	Longer than 5 min
Heard of AHT			
Yes ($n = 1503$)	53.0 (797)	35.0 (526)	11.1 (167)
No ($n = 1015$)	52.8 (536)	32.2 (327)	13.2 (134)
Chi^2	4.999		
Subjects with children	53.8 (562)	35.0 (365)	11.2 (117)
Subjects without children	52.4 (232)	36.3 (161)	11.3 (50)
Chi^2	0.294		
Gender			
Male	47.8 (261)	36.8 (201)	15.4 (84)
Female	56.8 (536)	34.4 (325)	8.8 (83)
Chi^2	19.182***		
Age			
< 25 years	50.0 (53)	39.6 (42)	10.4 (11)
25–40 years	54.9 (209)	36.0 (137)	9.2 (35)
41–55 years	51.4 (218)	36.3 (154)	12.3 (52)
> 56 years	54.7 (317)	33.3 (193)	11.9 (69)
Chi^2	4.391		
Educational level			
Left school before graduation	52.2 (12)	26.1 (6)	21.7 (5)
School graduation	53.2 (690)	35.3 (458)	11.5 (149)
Academic degree	58.5 (85)	32.7 (48)	8.8 (13)
Attending school	41.2 (7)	58.8 (10)	0.0 (0)
Chi^2	9.695		

"How long is it ok to let an infant cry?" The answers were grouped in "never," "up to 5 min", and "longer than 5 min" ***$p < 0.001$

alone at all (57%); men showed a tendency to leave crying infants alone longer (48% for not at all, 37% for up to 5 min and 15% for longer). Age, education, and having own children did not affect these results (see Table 3).

The source of information on AHT did not make a significant difference to the attitude of letting an infant cry, see Table 4. In particular, subjects who have been informed on AHT by healthcare professionals did not show a higher acceptance to taking a break from a crying infant.

If asked when education about AHT should take place, 85.0% answered they would prefer education before birth. 79.8% and 61.7% considered it appropriate to inform parents in the hospital or after discharge (see Fig. 1).

Discussion

Due to the devastating consequences of AHT, primary prevention is a major public health issue. In order to provide a basis for the development of targeted prevention campaigns, we assessed how effectively key messages about AHT are conveyed in the general public.

First of all, we show that it is not sufficient to gather data on AHT knowledge from mothers, as the knowledge on the issue was worst in young participants and those still attending school. The latter being of particular relevance as adolescents have to be taken into account as potential babysitters. To understand and address individual needs in AHT education of

Table 4 Sources of information and attitude towards letting an infant cry

	Healthcare professionals ($n = 392$)	News/media ($n = 1252$)	Friends/colleagues ($n = 403$)
Never	26.0 (207)	83.7 (667)	25.7 (205)
Up to 5 min	26.8 (667)	84.8 (446)	28.1 (148)
Longer than 5 min	26.3 (205)	83.2 (139)	29.9 (50)
Chi^2	0.114	0.375	1.735

"How did you learn about AHT?" Answers were provided; subjects had to choose "yes" or "no." The answers were grouped in "yes" for "healthcare professionals," "news/media," and "friends/colleagues" respectively

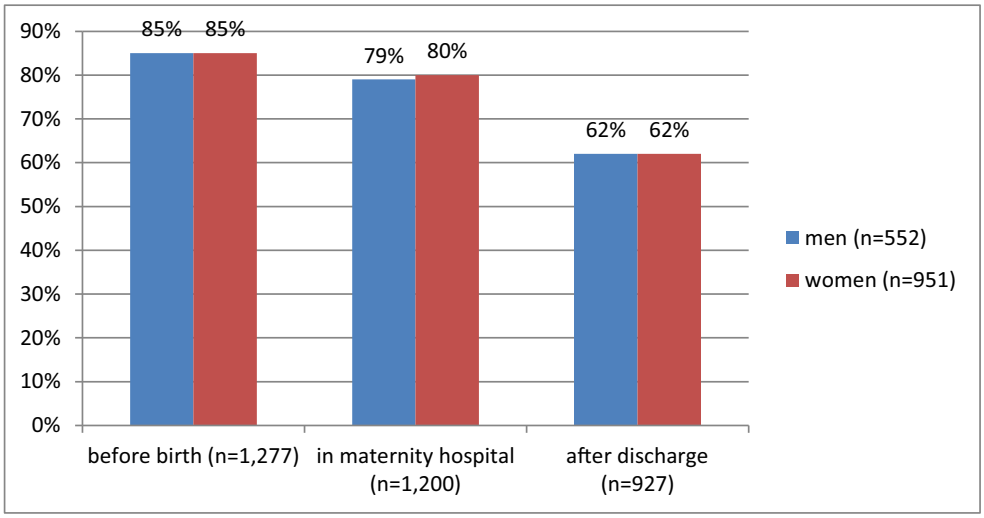

Fig. 1. Best timing for education programs. "What do you consider the best timing for AHT education?". All participants who heard of AHT before, ($n = 1503$), presented as percentages (n). Multiple answers were allowed

each relevant group, differentiated studies are necessary. After all, all of the participants considered at least one of the four possible sequelae of AHT as a possible outcome but only about 80% answered correctly and chose all four possible answers. Our data from subjects with children are consistent to previous studies on AHT knowledge in mothers [17].

However, the answers how long a crying infant could be left alone were much more diverse. Consistently, about half of our participants answered that it was not ok to let an infant cry at all. Only a third was prepared to take a break from a crying infant for up to 5 min, what we consider consistent with the messages of the prevention programs. Interestingly, the only predictor for letting an infant cry for up to 5 min was correlated with being male. But men were likely to let an infant cry for longer in general. This might not be due to a higher awareness of AHT messages, but due to a more casual attitude towards a crying infant.

Subjects who have been informed on AHT by healthcare professionals did not show a higher acceptance towards taking a break from a crying infant. This suggests that education by healthcare professionals so far is not more effective than other means of information. Therefore, programs for primary prevention must firstly train professionals before the professionals educate potential caregivers. This is supported by the fact, that the most effective prevention programs trained nurses to educate parents on AHT [3, 9]. It is also part of the "Period of PURPLE Crying," one of the most common programs that help professionals in educating caregivers about infant crying [6, 26].

A large majority of participants consider it appropriate to educate about AHT before delivery. In mothers alone, this effect is even larger, as shown by Mann and coworkers [17]. We did not ask our participants for a particular period before birth. This results might indicate that information on AHT is desired as early as possible, supporting the idea of adding AHT education to high school curricula.

Our data suggest that the dangers of AHT are common knowledge in those who have heard of AHT before, independent from the source of information. Only young age and ongoing scholar education were associated with strikingly low knowledge on the danger of AHT even though every participant recognized at least one dangerous result of AHT.

Nevertheless, the key message that it is preferable to let an infant cry for a few minutes instead of using force that might result in AHT is not being delivered successfully in the present. Moreover, and more disturbingly, healthcare professionals do not seem to be more efficient than other sources of information in order to inform about these messages. Why the two key messages are being understood so differently should be subject to further research. One possible reason might be that the duration, how long a person would leave his or her crying infant depends on a person's attitude much rather than on knowledge. Therefore, information on AHT might not be sufficient but trainings and courses might be necessary for an effective primary prevention of AHT.

Limitations

As participants were asked how long it would be ok to let an infant cry without reference to AHT, there might be a social desirability bias. Potentially, with a reference to AHT, more subjects could have answered that leaving a crying infant alone for a few minutes would be acceptable. Nevertheless, we aimed to analyze the attitude towards leaving a crying infant alone in general and tried to avoid bias of hinting the subjects towards AHT. To further minimize social desirability bias, the survey was designed to administer anonymous questionnaires rather than interviewing the subjects.

In addition, by suggesting possible answers for the dangers of AHT, we might have overestimated the knowledge on the dangers of AHT. But lower knowledge on the dangers of AHT would rather support the findings of our study than contradict

them. As our results for the possible sequelae "severe brain injury" and "death" were very similar to the findings of a previous smaller study [8], we believe that this did not affect our findings relevantly.

Sufficient language and reading skills were necessary to complete the survey. We thus do not have data on subjects who do not speak German, or are illiterate. To include at least the first group, multilingual questionnaires would be preferable.

Conclusion

To deliver effective programs for the primary prevention of AHT, it is paramount to include all possible caregivers of infants. Furthermore, programs must take into account that it might be hard, especially for mothers, to accept leaving their crying infant alone for a short period of time to compose themselves. Against the background of a majority of the participants considering courses as the most effective way of education, safe parenting classes should be introduced in senior years of every type of school. Thus, the broadest target audience, including future parents, biologically unrelated father figures, and babysitters could be reached. Multilingual media and face-to-face education should be used to reach as many potential caregivers as possible. For evaluation of future programs, the percentage of subjects from all relevant subgroups should be taken into account. Qualitative interviews could add more insight in the information demand of different subgroups.

Authors' Contributions OB contributed to the conception and design of the study, data analysis, interpretation of findings, and drafting the article.

AW and VC contributed to the data processing and interpretation.

EB, PLP, JMF contributed to study conception, design, data collection, and critical revision of the results.

All authors revised the manuscript and finally approved the version submitted.

Compliance with ethical standards

The study was conducted in accordance with the Declaration of Helsinki and fulfilled the ethical guidelines of the International Code of Marketing and Social Research Practice of the International Chamber of Commerce and of the European Society of Opinion and Marketing Research. The study was approved by the Ethics Committee of the Medical Department of the University of Leipzig. No. 132/18-EK of April 3rd, 2018.

Conflict of interest The authors declare that they have no conflict of interest.

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Informed consent Participants were informed about the study and informed consent was obtained. In the case of minors, participants gave informed assent with informed consent being provided by their caregivers. Responses were anonymized.

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