


First Aid Practices for Injured Children in Rural Ghana: A Cluster-Random Population-Based Survey

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Abbreviations:

DALY: disability-adjusted life year
EMS: Emergency Medical Service
LMIC: low- and middle-income countries

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Abstract

Introduction: The majority of injury deaths occur outside health facilities. However, many low- and middle-income countries (LMICs) continue to lack efficient Emergency Medical Services (EMS). Understanding current first aid practices and perceptions among members of the community is vital to strengthening non-EMS, community-based prehospital care.

Study Objective: This study sought to determine caregiver first aid practices and care-seeking behavior for common household child injuries in rural communities in Ghana to inform context-specific interventions to improve prehospital care in LMICs.

Methods: A cluster-randomized, population-based household survey of caregivers of children under five years in a rural sub-district (Amakom) in Ghana was conducted. Caregivers were asked about their practices and care-seeking behaviors should children sustain injuries at home. Common injuries of interest were burns, laceration, choking, and fractures. Multiple responses were permitted and reported practices were categorized as: recommended, low-risk, or potentially harmful to the child. Logistic regression was used to examine the association between caregiver characteristics and first aid practices.

Results: Three hundred and fifty-seven individuals were sampled, representing 5,634 caregivers in Amakom. Mean age was 33 years. Most (79%) were mothers to the children; 68% had only completed basic education. Most caregivers (64%-99%) would employ recommended first aid practices to manage common injuries, such as running cool water over a burn injury or tying a bleeding laceration with a piece of cloth. Nonetheless, seven percent to 56% would also employ practices which were potentially harmful to the child, such as attempting manual removal of a choking object or treating fractures at home without taking the child to a health facility. Reporting only recommended practices ranged from zero percent (burns) to 93% (choking). Reporting only potentially harmful practices ranged from zero percent (burns) to 20% (fractures). Univariate regression analysis did not reveal consistent associations between various caregiver characteristics and the employment of recommended only or potentially harmful only first aid practices.

Conclusions: Caregivers in rural Ghanaian communities reported using some recommended first aid practices for common household injuries in children. However, they also employed many potentially harmful practices. This study highlights the need to increase context-appropriate, community-targeted first aid training programs for rural community populations of LMICs. This is important as the home-based care provided for injured children in these communities might be the only care they receive.

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Introduction

Injury constitutes a major global health problem accounting for eight percent of mortality and ten percent of disability-adjusted life years (DALYs) world-wide.¹ Annually, nearly five million deaths from injuries are recorded, 90% of which occur in low- and middle-income countries (LMICs). Millions more suffer various forms of disabilities from injury. Injury is increasingly a cause of death and disability among LMIC children.² In 2017, unintentional

injury was the cause of 18 deaths per 100,000 Ghanaian children under age 14, resulting in nearly 1,070 DALYs per 100,000.¹ Reducing this burden of pediatric injury necessitates not only prevention strategies, but also improvements in trauma care.

The majority of injury deaths occur outside health facilities. In Kenya, 51% of injury deaths occurred in the prehospital period, while in Ghana, 80% of all injury deaths occurred in the field before the victim could get to the hospital.^{3,4} The importance of prehospital care in reducing out-of-hospital death for the injured is well-established.⁵⁻⁷ However, many LMICs continue to lack efficient Emergency Medical Services (EMS) or ambulance systems.⁸ Ghana's National Ambulance Service (Accra, Ghana) was created in 2004 and currently has presence in every region of the country. However, despite the addition of new ambulances to its fleet, it has yet to consistently provide scene-of-injury response, especially in rural communities. In light of this gap, there is the need to increase provision of emergency care training to first responders and other lay members of the community. Especially at the household level, the initial care provided by household/family members impacts injury outcome, whether this care is first aid provided before medical care is sought for an injured person or whether this is the only care the injured person receives. Understanding current first aid practices and perceptions among members of the community is vital to any initiative to strengthen non-EMS, community-based prehospital care.^{9,10}

Previous work in semi-urban communities in Ghana identified that the majority of caregivers would employ recommended first aid practices for common household child injuries. However, for these same injuries, a large proportion of caregivers would also employ potentially harmful practices.⁹ The effect of community of residence on first aid practices in LMICs has not been well-studied. Thus, this study sought to ascertain caregiver first aid practices and care-seeking behavior for common household child injuries in rural communities in Ghana to inform effective, context-specific interventions to improve prehospital care in LMICs.

Methods

Study Population

Ghana is a lower middle-income country with a population of over 29 million, approximately 45% of whom live in rural communities.¹¹ Many rural communities are close to more populated areas with some health resources (eg, health promotion initiatives, organized prehospital care services, and referral hospitals); however, these communities have markedly lower penetrance of health initiatives and poorer access to health care services. As in other LMICs, rural communities in Ghana that are close to more populated areas are often inhabited by populations mostly engaged in agriculture or pastoralism or practice subsistence activities.

Using a four percent injury prevalence reported among children under five years in rural Pakistan,¹² a 95% confidence level, 10% margin of error, and a design effect of two, a sample size of 738 was calculated.¹³

Survey Design

A cluster-randomized, population-based household survey was conducted to examine household child injuries as well as first aid practices and health care-seeking behaviors of caregivers when a child sustained an injury at home in rural communities close to large metropolises. Firstly, one rural district (Bosomtwe) out of six bordering the Kumasi metropolis in Ghana was selected by computer random sampling (Strata 1). Secondly, one of

Bosomtwe's three sub-districts, which were similar in socioeconomic status and demographics, was randomly selected (Amakom; Strata 2).¹⁴ Thirdly, six of 11 community clusters in Amakom were randomly selected (Strata 3). Each dwelling within each community was exhaustively sampled. Dwellings were often occupied by multiple households. However, only households with a child under five years were eligible for the survey. Households with no child under five years were excluded. One eligible household within each dwelling was randomly selected (Strata 4). The sample represented the 18,988 population of Amakom, 3,779 of whom were children under five years and 14,032 were under 18 years.¹⁴

The primary caregiver of a child under five within selected households was interviewed with a previously validated structured questionnaire about first aid practices and care-seeking behaviors should a child sustain an injury at home. The questionnaire included specific questions adapted from the Integrated Management of Childhood Illness tool and has been previously used in Ghana.^{9,15} It considered injuries from burns, lacerations, fractures, and choking. These injuries were among the most commonly reported household child injuries (Gyedu A; unpublished data). Multiple responses were permitted. In consultation between study team members and a panel of consultants, including a plastic surgeon, an ear-nose-throat surgeon, and an orthopedic surgeon, reported practices were grouped into those that were recommended, low-risk, or potentially harmful (Table 1). The survey was administered by local enumerators in Twi, the predominant language spoken in the study area. Enumerators collected demographic and household characteristics on ownership of consumable goods and physical characteristics of the household. These were used to create a wealth index using principal component analysis, whose scores were divided into quintiles, the first quintile representing the poorest households of the distribution.

All survey respondents consented to be studied. The Kwame Nkrumah University of Science and Technology (Kumasi, Ghana) Committee for Human Research, Publications, and Ethics approved the study (Protocol number: CHRPE/AP/589/17).

Data Analysis

Analyses utilized survey sampling weights, adjusted for clustering by community (Strata 3) and household (Strata 4). All analyses were done using survey weights in STATA version 14 (StataCorp; College Station, Texas USA). Data were expressed as descriptive statistics. Univariate logistic regression was used to examine the association between caregiver characteristics and first aid practices for common injuries. Two sets of caregiver practices were considered as outcome variables: recommended only practices (ie, caregivers who indicated that they would use only recommended practices for a given injury type) and potentially harmful only practices (ie, caregivers who indicated that they would use only potentially harmful practices for a given injury type). Variables of interest included caregiver education, employment status, household socioeconomic status, the number of children the caregiver took care of, caregiver relationship to the child, caregiver experience with household child injury, and whether they had previously received first aid training. Caregiver education was dichotomized as "no formal education" and "any level of formal education." The number of children the caregiver took care of and household socioeconomic status were considered as continuous variables.

	Recommended Practice	Low-Risk Practice	Potentially Harmful Practice
Burn Injury	Applying cool water	Applying antibiotic powder, gentian violet, salty or soapy water	Applying any of oil, egg albumen, petroleum jelly, kerosene, or traditional medicine
	Taking child to a health facility		Taking the child to a prayer camp
			Doing nothing
Choking on Small Object	Hitting the child's back		Heeding advice of a neighbor
	Taking child to a health facility		Attempting manual removal of the object
			Giving the child plenty of water, okra, palm oil, or banana in an attempt to "push it down"
Laceration	Tying laceration with a piece of cloth	Applying cold liquid	Doing nothing
	Taking the child to a health facility	Applying salt	Heeding advice of a neighbor
		Applying gentian violet or methylated spirit	Applying sand
Fractures	Immediately taking child to a health facility	Applying powdered charcoal, ground cassava	Applying traditional medicine
		Initially treat child within the household, then take them to a health facility	Taking the child to a prayer camp
			Doing nothing
			Heeding advice of a neighbor
			Applying powdered charcoal, ground cassava
			Treating child within the household only
			Taking the child to a bone healer
			Heeding the advice of a neighbor

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Table 1. Caregiver-Reported First Aid Practices for Common Household Child Injuries

Results

Caregivers

Three hundred and fifty-seven individuals were sampled, representing 5,634 caregivers in the Amakom sub-district. Their mean age was 33 years. They were mostly mothers to the children (79%), had only completed basic education (68%), and engaged in non-salaried jobs (69%). Sixty-seven percent of caregivers took care of up to three children. Under one-half of them (49%) had experienced a household child injury and only seven percent had previously received first aid training (Table 2).

First Aid Practices

Most caregivers (64%-99%) would employ recommended first aid practices for managing common injuries, depending on the mechanism. These included: applying cool water on a burn injury, tying a laceration with a piece of cloth, hitting the child's back to expel a choking small object, or immediately taking the child to a hospital if there was a fracture. Nonetheless, many caregivers (7%-56%) would also employ practices which were potentially harmful to the child. Such strategies included: applying kerosene or oil on a burn, attempting manual removal of a choking object, applying powdered charcoal to a laceration, or treating fractures at home without taking the child to a health facility. The most commonly reported potentially harmful practices included: application of traditional medicine to a cut/laceration (59% of respondents), taking a child with a fracture to a bone-setter (43% of respondents), and applying petroleum jelly (22% of respondents) or traditional medicine (11% of respondents) on a burn injury.

No caregiver reported that they would employ only a recommended practice should a child sustain a burn injury at home. Additionally, none of them reported that they would employ only a potentially harmful practice for a burn injury. However, 37%-93% of caregivers reported that they would engage in only a recommended practice for laceration, fractures, and choking. Although very few of them would engage in only potentially harmful practices for choking and laceration (1% and 6%, respectively), 20% would engage in only potentially harmful practices for fractures (Table 3).

Risk Factors for Engaging in Only Recommended or Only Potentially Harmful Practices

Univariate associations between caregiver characteristics and recommended only first aid practices were examined, as well as potentially harmful only first aid practices (Table 4). Given the few significant associations noted in univariate analysis, multivariable analyses were not explored. Female caregivers were more likely to employ only recommended first aid practices when a child sustains a laceration (odds ratio [OR] = 3.4; 95% CI, 1.4-8.6) compared to males. Fathers would employ only recommended practices when a child chokes on a small object. However, they were associated with decreased odds of only recommended practices for lacerations (OR = 0.2; 95% CI, 0.04-0.5) compared to mothers.

Salaried workers identified only recommended practices for fractures or for episodes of choking. Caregivers who were engaged in non-salaried work showed a trend towards employing only potentially harmful practices for lacerations

	Unweighted		Weighted	
	Percent	Freq (n = 357)	Percent	95% CI
Caregiver				
Age, Mean (SD), years	35 (SD = 13)		33	31 - 35
Female	88	315	92	89 - 94
Relationship to Child				
Mother	76	272	79	73 - 84
Father	9	32	6	4 - 9
Other ^a	15	53	15	11 - 21
Education				
None	21	75	24	18 - 31
Basic	70	249	68	61 - 74
Senior High and Above	9	33	8	5 - 12
Employment Status				
Household/Unemployed	25	91	30	23 - 38
Non-Salaried Worker	73	262	69	61 - 76
Salaried Worker	1	3	1	0.3 - 5
Missing	0.3	1		
No. of Children Under Care of Caregiver				
1	25	88	26	20 - 34
2	25	88	26	20 - 34
3	20	71	21	15 - 27
4	15	53	13	9 - 18
≥ 5	16	57	14	11 - 18
Previous HCI Experience				
Yes	56	199	49	42 - 56
Previous First Aid Training				
Yes	9	33	7	5 - 12
Socioeconomic Status Level				
1 (Lowest)	19	69	22	17 - 28
2	19	68	21	15 - 29
3	19	68	20	15 - 28
4	19	68	18	13 - 24
5 (Highest)	19	68	18	13 - 24
Missing	4	16		

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Table 2. Caregiver characteristics
Abbreviation: HCI, household child injury.

^a Grandparent, older sibling, or aunt.

(OR = 2.8; 95% CI, 0.9-8.6) or fractures (OR = 2.1; 95% CI, 0.9-5.1) compared to unemployed caregivers.

The odds of recommended first aid practices for common injuries did not show any association with socioeconomic status, previous first aid training, or education level. However, higher socioeconomic status was associated with decreased odds of engaging in only potentially harmful practices for laceration injury (OR = 0.6; 95% CI, 0.4-0.96). Caregiver education, on the other hand, was associated with increased odds of engaging in only potentially harmful practices for laceration injury (OR = 4.2; 95% CI, 1.4-12.3) compared to no education.

Prior experience with a household child injury was associated with reduced odds of engaging in only recommended practices for laceration, fracture, or choking. For fractures in particular, prior experience with a household child injury was associated with increased odds of employing only potentially harmful practices as first aid (OR = 5.1; 95% CI, 2.1-9.7).

Increased number of children the caregiver took care of reduced the odds of a caregiver engaging in only recommended first aid practices for laceration (OR = 0.6; 95% CI, 0.5-0.7) and fractures (OR = 0.7; 95% CI, 0.6-0.9). For fractures, it was associated with increased odds of employing only potentially harmful practices (OR = 1.2; 95% CI, 1.01-1.5).

Discussion

The majority of injury-related deaths occur in the prehospital phase.¹⁶ Recent improvements in emergency care in LMICs have largely focused on in-hospital care; however, the overall impact of emergency care can be realized only when in-hospital care is augmented by an effective prehospital care system.¹⁷ The Ghana National Ambulance Service, despite recent improvements, is yet to fulfill its potential of providing adequate prehospital care for the injured from within the community. In this void, initial care is provided

	Unweighted		Weighted	
	Percent	Freq (n = 357)	Percent	95% CI
Burn				
Recommended	80	321	92	89 - 95
Low Risk	100	357	100	-
Potentially Harmful	41	146	40	33 - 47
Recommended Only	0	0	0	-
Potentially Harmful Only	0	0	0	-
Laceration				
Recommended	87	312	90	85 - 93
Low Risk	16	57	14	10 - 19
Potentially Harmful	63	224	56	48 - 63
Recommended Only	28	99	37	30 - 45
Potentially Harmful Only	8	30	6	4 - 10
Fractures				
Recommended	60	213	64	58 - 70
Low Risk	17	59	19	14 - 26
Potentially Harmful	45	161	38	32 - 44
Recommended Only	45	161	50	43 - 56
Potentially Harmful Only	25	92	20	16 - 24
Choking				
Recommended	98	351	99	96 - 99
Low Risk	-	-	-	-
Potentially Harmful	8	29	7	5 - 11
Recommended Only	92	328	93	89 - 95
Potentially Harmful Only	2	6	1	0.5 - 4

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Table 3. Caregiver-Reported Injury Management for Common Household Child Injury

Note: Multiple responses were permitted for each category. Hence, percent for “recommended,” “low risk,” and “potentially harmful” in each category can add to more than 100%.

by lay members of the public whose ability to institute appropriate first aid practices for the injured could reduce death and disability from injury.¹⁸ However, literature on caregiver first aid practices and care-seeking behaviors for household child injuries in LMICs is limited. Previous work reported that most caregivers in semi-urban communities of Ghana would employ both recommended and potentially harmful first aid practices for the same types of household child injury. In light of that, this study sought to determine practices of caregivers in rural communities in Ghana to ascertain how community of residence affected prehospital care for injured children.

These data suggest that most caregivers in rural communities in Ghana would also employ a recommended first aid practice for common household child injuries. Additionally for these same injuries, they would also engage in potentially harmful practices, such as applying traditional medicine on a burn, attempting manual removal or giving the child palm oil or okra to attempt “pushing down” a choking object, applying powdered charcoal or sand to a laceration, and taking the child to a bone healer in the case of a fracture. It was only for burn injury that no caregiver identified only potentially harmful first aid practices. There were no consistent associations, across common injury types, between various caregiver characteristics and the odds of employing only recommended or only potentially harmful practices.

Caregiver education was associated with increased odds of employing only potentially harmful practices for lacerations. Although the reason for this observation was not known, it was

noted that 68% of the caregivers had only completed basic education and only eight percent had completed any higher education. The apparent homogeneity of the rural population with regards to education may thus contribute to this finding. A study on first aid knowledge of burn injury among high-risk workers, most (98%) of whom had completed only 12th grade of education, showed that only 29.5% achieved the desirable score of 75%.¹⁹ Caregivers who engaged in salaried work appeared to consistently employ recommended only practices as opposed to only potentially harmful practices for common injuries. This finding may not be generalizable as only one percent of the caregivers engaged in salaried work.

Previous experience with household child injury was associated with reduced odds of employing only recommended practices for common injuries and actually associated with increased odds of engaging in only potentially harmful practices for fractures. Fracture had the highest percentage of caregivers (20%) who would employ only a potentially harmful first aid practice. Patronage of traditional medical services, especially bone-setters, is widespread in Ghana and other LMICs due to ready availability within communities, apparently low direct cost to patients, and a deep cultural acceptance for their services within the society.²⁰⁻²³ Patrons who have had any form of acceptable results from previous experiences with traditional medicine might try the service again when they need it. Conversely, individuals who did not initially receive formal health care for injuries such as a fractured bone may experience substantial delays and associated morbidity and disability when formal care is finally sought.⁹

	Recommended Only			Potentially Harmful Only		
	Laceration	Fracture	Choking	Laceration	Fracture	Choking
Caregiver Age						
Age (years)	0.97 (0.94 - 0.99)	0.99 (0.97 - 1.01)	1.03 (0.99 - 1.06)	1.01 (0.98 - 1.05)	1.0 (0.98 - 1.02)	0.94 (0.89 - 0.99)
Caregiver Gender						
Male (ref)						
Female	3.4 (1.4 - 8.6)	1.2 (0.6 - 2.5)	0.5 (0.1 - 4.0)	1.0 (0.3 - 3.4)	0.6 (0.3 - 1.3)	†
Relationship to Child						
Mother (ref)						
Father	0.2 (0.04 - 0.5)	0.8 (0.3 - 1.8)	#	1.2 (0.3 - 4.9)	1.4 (0.5 - 3.4)	‡
Other ^a	0.8 (0.4 - 1.7)	1.5 (0.7 - 3.3)	1.8 (0.4 - 8.2)	1.9 (0.4 - 9.2)	0.5 (0.2 - 1.2)	‡
Education						
No (ref)						
Yes ^b	0.7 (0.3 - 1.6)	0.9 (0.4 - 1.8)	0.8 (0.3 - 2.2)	4.2 (1.4 - 12.3)	1.6 (0.8 - 3.2)	†
Employment Status						
Unemployed (ref)						
Non-Salaried Worker	0.8 (0.3 - 1.8)	0.6 (0.3 - 1.3)	0.3 (0.1 - 0.97)	<i>2.8</i> (0.9 - 8.6)	<i>2.1</i> (0.9 - 5.1)	0.6 (0.1 - 3.9)
Salaried Worker	4.5 (0.3 - 62.0)	#	#	‡	‡	‡
Previous HCI Experience						
No (ref)						
Yes	0.5 (0.3 - 0.9)	0.4 (0.3 - 0.8)	0.4 (0.1 - 0.97)	2.6 (0.7 - 10.1)	5.1 (2.7 - 9.7)	14.3 (1.6 - 131.5)
Previous First Aid Training						
No (ref)						
Yes	0.4 (0.9 - 1.6)	2.1 (0.7 - 6.7)	3.1 (0.7 - 14.4)	3.9 (0.7 - 22.8)	0.7 (0.2 - 1.8)	‡
Socioeconomic Status^c	0.9 (0.7 - 1.1)	1.0 (0.8 - 1.2)	1.0 (0.7 - 1.4)	0.6 (0.4 - 0.96)	0.9 (0.7 - 1.1)	1.2 (0.7 - 2.1)
No. of Children Under Care of Caregiver	0.6 (0.5 - 0.7)	0.7 (0.6 - 0.9)	0.9 (0.7 - 1.2)	1.1 (0.9 - 1.4)	1.2 (1.01 - 1.5)	1.0 (0.4 - 2.1)

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Table 4. Caregiver Factors Associated with Employment of Recommended and Potentially Harmful First Aid Practices for Common Injury Types: Univariate Analysis

Note: Odds ratio in bold denote those with $P < .05$; Odds ratio in italics denote those with $P = .05 - .10$.

Abbreviation: HCI, household child injury.

^a Grandparent, older sibling, or aunt.

^b Any level of education.

^c Socioeconomic status (wealth quintiles) considered as a continuous variable.

† No member of the reference group would engage in a potentially harmful practice only for the particular injury type.

‡ None would engage in a potentially harmful practice only for the particular injury type.

They would all engage in only recommended practices for the particular injury type.

These findings highlight the need for more community-based educational campaigns to raise awareness and knowledge among caregivers of children and other rural community members about recommended first aid practices for common injuries. Traditional

bone-setters could also be a target for training in order to reduce the potentially harmful effects of their practice. A study in Nigeria reported the willingness of traditional bone-setters to undergo some formal training to improve their knowledge and skills.²³ Areas of

training identified included appropriate patient selection, splinting techniques, and institution of a referral system.

Apart from instances of choking, where none of the respondents with previous first aid training would employ only potentially harmful first aid strategies, the study did not find any association between first aid training and caregiver practices. First-aid training, particularly recent training, has been found to be associated with higher perceived first-aid skills and increased expected and actual employment of those skills.^{24,25} Very few of the study population (less than 10%) had received first aid training. This study did not ask about the type of first aid training caregivers had received. While provision of first aid training to lay members of the community is beneficial and recommended,⁷ training must be tailored to specific common injuries to enable caregivers to consistently provide recommended practices across most common injury types. This is more important as the home management provided for children in these rural communities might be the only care they receive when injured.^{26,27}

Limitations

This study has some limitations that need to be acknowledged. Firstly, the study is based on self-reported data and the accuracy of responses provided by caregivers could not be independently confirmed. Secondly, caregivers may have provided socially-desirable responses. Thirdly, caregivers were relatively similar with regards to gender, educational status, and socioeconomic level. This relative lack of variation in these important factors may have limited the ability to examine associations between caregiver characteristics and first aid practices. Finally, the number of caregivers who met the inclusion criteria were less than the a priori calculated sample size, which could

have influenced the associations between caregiver characteristics and employment of recommended and potentially harmful first aid practices for common injury types. Despite these limitations, these data allow the drawing of some conclusions regarding the types of first aid practices that caregivers in rural Ghanaian communities provide when children sustain injuries at home.

Conclusions

Caregivers in rural Ghanaian communities would employ both recommended and potentially harmful first aid practices for common household child injuries. As LMICs work towards improving their prehospital care systems, this study highlights the need to increase context-appropriate, community-targeted first aid training programs, with emphasis on seeking early formal medical care, that allow for continuous evaluation to improve the knowledge of individuals living in rural communities. This is important as the home-based care provided for injured children in these communities might be the only care they receive.

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Authors Contributions

Study concept and design: AG, EO, and PD. Acquisition, analysis, or interpretation of data: AG, BS, PD, and CM. Drafting of the manuscript: all authors. Critical revision of the manuscript for important intellectual content: all authors. Administrative, technical, or material support: all authors.

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