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Knowledge and use of prevention measures related to dengue in northern Thailand

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Summary

OBJECTIVE To determine the frequency and determinants of knowledge of dengue infection in three sites in northern Thailand, and to compare prevention measures of people with and without knowledge of dengue.

METHODS In May 2001 we conducted an epidemiological survey among 1650 persons living in three areas in northern Thailand. Knowledge of dengue and the use of prevention measures were measured by means of a structured questionnaire. Differences in knowledge of dengue and the use of prevention measures between risk groups were calculated by chi-square test. Logistic regression was used to identify determinants of knowledge.

RESULTS Of the 1650 persons, 67% had knowledge of dengue. Fever (81%) and rash (77%) were the most frequently mentioned symptoms. Persons with knowledge of dengue reported a significantly higher use of prevention measures than persons without knowledge of dengue. In multivariate analyses, knowledge of dengue significantly differed by age, sex, occupation and site ($P < 0.05$). Younger people knew more about dengue than older persons: adjusted odds ratio (aOR) of 6.75 [95% confidence interval (CI): 4.32–10.6] for the 15–29 age group compared with people aged 60 and older. In comparison with farmers (reference group), knowledge of dengue was significantly higher among students (aOR: 10.6, 95% CI: 4.27–26.4), but lower among housewives or unemployed persons (aOR: 0.44, 95% CI: 0.31–0.64).

CONCLUSION The overall knowledge of dengue was high, but housewives, unemployed and old persons had relatively little knowledge of dengue. Therefore, these groups may need special attention in future dengue education programmes. Persons with knowledge of the disease more frequently reported the use of preventive measures, indicating the value of education programmes as a tool in dengue prevention.

keywords dengue, knowledge, prevention, practice, Thailand

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Introduction

Since the first epidemic in 1958 in Thailand, there has been a global upward trend in the incidence of dengue infections. Population growth, rural–urban migration, inadequacy of basic urban infrastructure and exponential growth of consumerism are responsible for conditions that are highly favourable for viral transmission by the main mosquito vector, *Aedes aegypti* (WHO 1997). Today, in several Asian countries dengue haemorrhagic fever is a leading cause of paediatric hospitalization and death. In Thailand, periodic outbreaks of dengue have been reported throughout the country, with a large outbreak in 1987 causing more than 1000 deaths (Ministry of Public Health, Division of Epidemiology 1989) and another in 1998 causing 424 deaths (Ministry of Public Health, Department of Communicable Disease Control 2000).

The great heterogeneity in the incidence of dengue observed over time and space reflects the complexity of risk factors involved in disease transmission. Dengue used to be confined to large cities in Thailand, but recent incidence rates were higher in rural than urban areas (Chareonsook

et al. 1999). One possible reason for change in the incidence of dengue, as well as other vector-borne diseases, over time and place, is change in land use. In Thailand, for example, great areas of forest are cleared to cultivate cash crops, and in some suburban areas rice fields have been converted to housing projects. A possible reason for a decrease in the incidence of dengue may be people's awareness of the disease, which changed because of the presence of prevention programmes. In 1999 a large prevention and control programme for dengue was introduced in Thailand, the King's Project (Ministry of Public Health, Ministry of Public Health, Department of Communicable Disease Control 2000). In this project people were informed through education, posters, cassettes, videos and television advertisements. The aim was to increase people's knowledge of the disease and as a consequence to change their risk behaviour. Although knowledge often increases through prevention programmes, it is well known that changing risk behaviour remains difficult to establish.

Most infections occur during the rainy season from May to October. As there is no dengue vaccine available to date, the focus is on control activities such as vector elimination: insecticide spraying to prevent and interrupt outbreaks is performed by local health workers and community participation is used to eliminate breeding places. Community participation has resulted in various degrees of success in disease prevention. It seems difficult to motivate people for continuous participation in larval control activities (Wangroongsarb 1997). Thus, despite the large effort made on control activities, transmission of dengue still occurs.

As part of a multidisciplinary project called RISKMODEL, which aims to investigate the relationship between changes in land use and the occurrence of malaria and dengue in northern Thailand, a large epidemiological survey on dengue is ongoing. The aim of this epidemiological survey is to determine risk factors for dengue infection among inhabitants of three different study sites in northern Thailand where changes in land use took place over the last 10 years. One of these potential risk factors may be ignorance of dengue. To gain insight into this knowledge at the start of our project, we determined the commonness and determinants of knowledge, and compared the practice of prevention measures between people with and without knowledge of the disease.

Methods

Study design

RISKMODEL is a research project which aims to investigate the relationship between changes in land use and the occurrence of malaria and dengue in northern Thailand. In this project, entomologists, geographers and epidemiologists collaborate closely. The main objective of the epidemiological part of this multidisciplinary project is to investigate (changes in) incidence and risk factors of two vector-borne diseases, malaria and dengue, in relation to changes in land use. For the prospective dengue study, three study sites with changes in land cover were selected. The main change observed in Ban Pa Nai, a rural area in Chiang Mai province, is a shift from one to two rice harvests a year facilitated by the building of a dam in 1996. Mae Hia is situated in the suburbs of Chiang Mai. Following land speculation, large areas of former rice fields were converted to housing projects or reverted to wasteland because of the Asian financial crisis of 1997. Ban Pang is a rural site in Lamphun province. Surrounding a narrow irrigated valley, large areas on the hill-slope have been cleared for planting longan trees (fruit used as cash crop). All study villages had a history of dengue outbreak.

Before the start of the study, permission and collaboration of the head of the public health centre and/or head of the village were obtained. The questionnaire was tested before the start of the study. The interviewers received an interview training of 1 day. The study was conducted at weekends to increase the possibility of meeting people at home. The staff comprised 10 interview teams each consisting of two interviewers from vector-borne disease units and one local public health volunteer. Each team was responsible for a number of households in the village. A supervising team visited each interview team during their work to check their performance and questionnaires were checked for inconsistencies. When correction was deemed necessary, the interview team visited the study participant, the same day, again to gather the missing information.

Study population

All inhabitants of a study site were asked to participate in the study. In total, 1928 persons were included since May 2001. They will be followed for three consecutive years, twice a year, in May and September (before and at the end of the 'dengue season'). Written informed consent was given (those who could not write gave a fingerprint). Persons were asked about their knowledge of dengue, the use of preventive measures, movement history and other risk factors by means of a structured questionnaire. Knowledge of dengue was measured by asking questions related to disease symptoms, mode of disease transmission, breeding places of mosquitoes and preventive measures. All questions related to knowledge were open questions. Questions related to knowledge were asked before the questions concerning preventive measures to avoid bias.

The prevention measures were mentioned one-by-one to investigate practices. The interviewer checked the availability of mosquito nets when counting potential breeding places of mosquitoes in and around the house.

Statistical analyses

The commonness of knowledge was measured during the first survey in May 2001. Differences between the three study sites concerning knowledge of dengue and differences in the use of prevention measures between persons with and without knowledge of dengue were calculated by chi-square test and a *P*-value of 0.05 was considered as statistically significant. Logistic regression was used to identify determinants of knowledge of dengue. Determinants significantly associated ($P < 0.05$) with knowledge of dengue in univariate analyses were selected for multivariate analyses, using a forward procedure. In multivariate analyses, we tested statistically significant ($P < 0.05$) interactions between determinants in the final model and confounding.

Results

In total, 1928 persons participated in the study. The participation rate was 78% (541 of 694 inhabitants) in Ban Pa Nai, 25% (703 of 2839) in Mae Hia and 82% (684 of 837) in Ban Pang. The age distribution of the total and the study population did not differ for Ban Pa Nai and Ban Pang, but the study population of Mae Hia was older than the total population of Mae Hia.

Of the 1928 individuals included in the dengue study, 1650 (86%) were aged 14 years or older. All were asked questions related to knowledge of dengue. Overall, more females than males took part in the study and sex distribution was different among the three study sites as well as the age and profession distribution (Table 1). In Ban Pang, more young persons were included (24%) than in Mae Hia and Ban Pa Nai (18% and 14%, respectively). In Ban Pang and Ban Pa Nai, 57% and 43% of the interviewed population were farmers, whereas this was only 2% of the study population in Mae Hia. Overall, 67% had knowledge of dengue and no significant difference between sites was observed ($P = 0.24$).

Of the 1650 persons aged 14 years or over, 1144 reported to know the disease dengue. However, 36 of them could not mention any of the acknowledged symptoms, resulting in 1108 persons (67%) with knowledge of dengue. Of these, 98% knew that dengue is transmitted via mosquitoes and 74% mentioned that dengue vectors bite during daytime. Among the persons with knowledge of dengue, fever and rash/bleeding were most frequently mentioned as disease symptoms, by 81% and 77%, respectively (Table 2). Fever

Table 1 Characteristics of the 1650 persons older than 14 years in the three villages of the dengue study

	Ban Pa Nai *n* (%)	Mae Hia *n* (%)	Ban Pang *n* (%)	Total *n* (%)	*P*-value
Total	461 (28)	608 (37)	581 (35)	1650 (100)	
Sex					
Male	209 (45)	245 (40)	293 (50)	747 (45)	
Female	252 (55)	363 (60)	288 (50)	903 (55)	0.002
Age (years)					
15–29	65 (14)	112 (18)	139 (24)	316 (19)	
30–44	155 (33)	161 (27)	210 (36)	526 (32)	
45–59	132 (29)	184 (30)	137 (24)	453 (27)	
>59	109 (24)	151 (25)	95 (16)	355 (22)	<0.001
Profession					
Farmer	262 (57)	13 (2)	252 (43)	527 (32)	
Trader	27 (6)	111 (18)	30 (5)	168 (10)	
Housewife/unemployed	91 (20)	224 (38)	74 (13)	389 (23)	
Student	31 (7)	45 (7)	47 (8)	123 (8)	
Employee	43 (9)	170 (28)	103 (18)	316 (19)	
Others	7 (1)	45 (7)	75 (13)	127 (8)	<0.001
Knowledge of dengue*					
Yes	314 (68)	419 (69)	375 (65)	1108 (67)	
No	147 (32)	189 (31)	206 (35)	542 (33)	0.24

* People with knowledge of dengue could mention at least one symptom of the disease dengue.

Table 2 Knowledge of dengue symptoms, mosquito breeding places and prevention measures of 1108 persons older than 14 years of age and knowledge of the disease dengue

	Ban Pa Nai *n* (%)	Mae Hia *n* (%)	Ban Pang *n* (%)	Total *n* (%)	*P*-value
Total	314 (28)	419 (38)	375 (34)	1108 (100)	
Disease symptoms					
Fever	245 (78)	366 (87)	290 (77)	901 (81)	<0.001
Headache	176 (56)	154 (37)	204 (54)	534 (48)	<0.001
Rash/bleeding	252 (80)	324 (77)	275 (73)	851 (77)	0.10
Muscular pain	60 (19)	60 (14)	71 (19)	191 (17)	0.13
Nausea/vomiting	81 (28)	92 (22)	92 (25)	265 (24)	0.46
Breeding places					
Water jars	252 (80)	283 (68)	298 (80)	833 (75)	<0.001
House drains	168 (54)	338 (81)	242 (65)	748 (68)	<0.001
Ant traps	195 (62)	171 (41)	127 (34)	493 (45)	<0.001
Cement baths	122 (39)	139 (33)	138 (37)	399 (36)	0.26
Flower pots/vases	191 (61)	144 (34)	66 (18)	401 (36)	<0.001
Prevention measures					
Temephos	260 (83)	255 (61)	329 (88)	844 (76)	<0.001
Covering containers	141 (45)	163 (39)	140 (37)	444 (40)	0.11
Mosquito nets	213 (68)	211 (50)	296 (79)	720 (65)	<0.001
Disposal	197 (63)	265 (63)	210 (56)	672 (61)	0.08
Spraying	98 (31)	120 (29)	97 (26)	315 (28)	0.30
Repellent	56 (18)	115 (27)	99 (26)	270 (24)	0.01
Changing stored water	163 (52)	181 (43)	185 (49)	529 (48)	0.05
Others	48 (15)	108 (26)	64 (17)	220 (20)	<0.001

was more often mentioned in the suburban site Mae Hia, whereas a headache was more often mentioned in the two rural sites ($P < 0.001$). About 14% mentioned one symptom, 43% two symptoms and 43% had knowledge of three symptoms or more. Muscular pain was the least frequently mentioned disease symptom, only by 17%. Water jars (75%) and house drains (68%) were the most frequently mentioned breeding places of mosquitoes. However, percentages significantly differed between sites ($P < 0.001$). Use of the larvicide temephos (76%) and mosquito nets (65%) were the best known preventive measures, especially in rural sites. Furthermore, disposal of discarded containers was mentioned by 61% of the study participants as a measure to prevent dengue infection.

To investigate whether increased knowledge resulted in more frequent use of preventive measures, differences in use were compared between persons with and without knowledge of dengue (Figure 1). Overall, persons with knowledge reported to use all asked preventive measures more frequently than persons without knowledge, except for mosquito nets. However, at least 60% of the persons without knowledge of dengue reported the use of preventive measures such as the use of temephos, covering of containers, disposal of discarded containers and changing of stored water. As in Mae Hia, 67% of the houses had screened windows, other preventive measures were less often used than in Ban Pang and Ban Pa Nai ($P < 0.01$) (data not shown).

Table 3 shows determinants for knowledge of dengue infection. In univariate analyses, age and profession were significantly related with knowledge of dengue and both determinants remained statistically significant in multivariate analyses. In univariate analyses, knowledge of dengue did not significantly differ by sex and site. However, in multivariate analyses, after adjustment for the other factors, age and sex appeared significantly related to knowledge of dengue, which decreased with age; younger persons had better knowledge of dengue than older ones [adjusted odds ratio, aOR: 6.75 (95% confidence interval, CI: 4.32–10.6) for persons of 15–29 years of age compared with persons of 60 years and older]. In comparison with farmers, knowledge of dengue was significantly higher among students (aOR: 10.6, 95% CI: 4.27–26.4), whereas housewives or unemployed persons (mainly men) had significantly less knowledge of dengue (aOR: 0.44, 95% CI: 0.31–0.64). Housewives and unemployed persons were

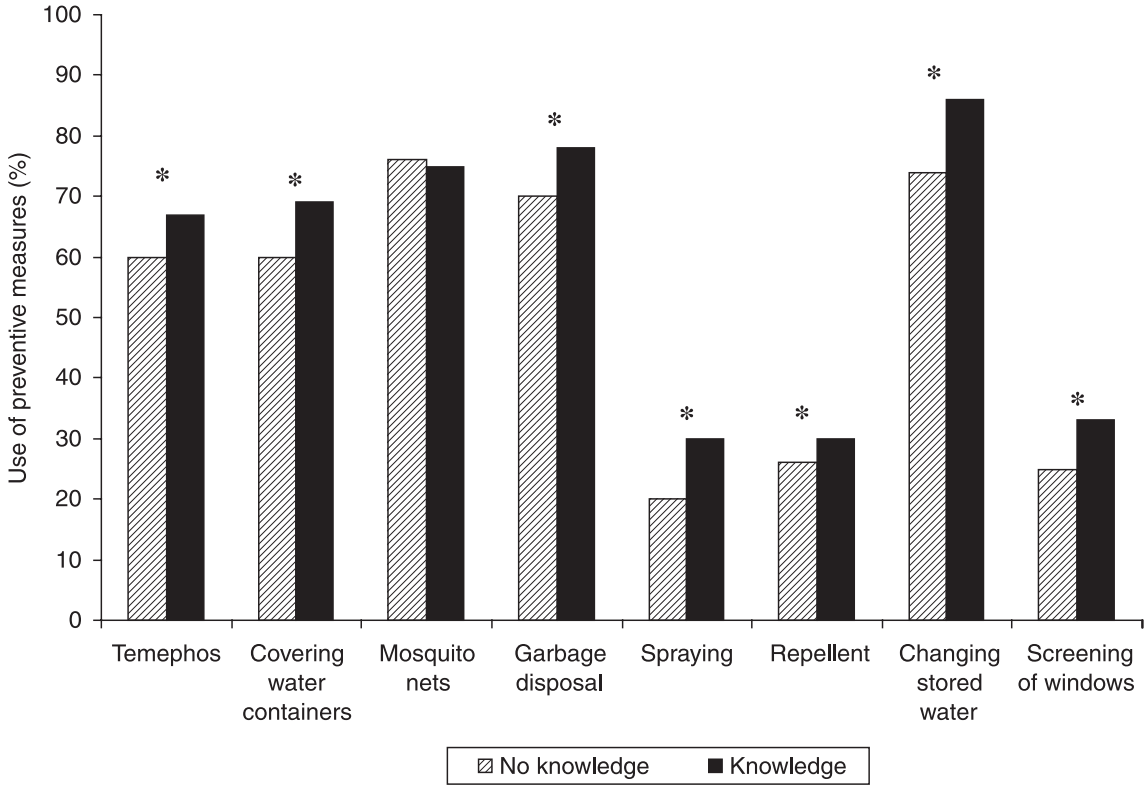

Figure 1 Differences in the use of preventive measures between persons with ($n = 1108$) and without ($n = 542$) knowledge of dengue (*indicates $P < 0.05$).

combined in the statistical analyses because ORs were comparable. Women had better knowledge of dengue than men (aOR: 1.31, 95% CI: 1.03–1.67). People in Chiang Mai province had better knowledge of dengue than inhabitants of Ban Pang, a site in Lamphun province: aOR of 1.88 (95% CI: 1.39–2.55) for Mae Hia and an aOR of 1.48 (95% CI: 1.11–1.99) for Ban Pa Nai. In the final multivariate model, a significant interaction existed between age and site ($P < 0.05$). Decreasing knowledge with age was less pronounced in Ban Pang, whereas persons in Mae Hia between 30 and 44 years of age and between 15 and 29 years of age had a comparable knowledge. Restricting the risk factor analysis to one person per household did not substantially change the results.

Discussion

In the three research sites in Chiang Mai and Lamphun provinces, Thailand, 67% of the study population had knowledge of the disease dengue. This percentage was lower than that in a survey conducted in Tak province in 1990 in which more than 90% of the interviewed women knew that dengue was transmitted via *Aedes* mosquitoes (Swaddiwudhipong *et al.* 1992b). In our study old persons had significantly less knowledge of the disease than young persons. In Thailand, dengue prevention programmes try to reach all villagers and there are special programmes for schoolchildren. The lack of knowledge in old persons could be an indication that they are not reached by prevention programmes. As old people are less mobile they could have a higher risk to become infected, as the majority of dengue infections occur in and around the house (Strickman *et al.* 2000). Other groups with a relatively low knowledge of dengue were housewives and unemployed persons. Like old persons, they tend to stay at home more often and therefore could run a higher risk of infection. Therefore, future programmes should incorporate the elderly as well as housewives and unemployed persons as a special target group for prevention.

Knowledge of dengue was better in the suburban site, Mae Hia, than in the two rural sites Ban Pa Nai and Ban Pang. This result is comparable with the results of a study in India after a dengue outbreak (Gupta *et al.* 1999). Dengue infection was first found mainly in urban areas, but

Table 3 Logistic regression to identify determinants for knowledge of dengue in three villages in northern Thailand

	n	Per cent with knowledge	Unadjusted		Adjusted	
			OR*	95% CI*	OR*	95% CI*
Sex						
Male	747	66	1.0		1.0	
Female	903	68	1.11	0.91–1.37	1.31	1.03–1.67
			$P = 0.31$		$P = 0.03$	
Age (years)						
>59	355	35	1.0		1.0	
45–59	453	69	4.21	3.13–5.66	3.24	2.35–4.46
30–44	526	76	5.79	4.31–7.78	4.69	3.36–6.54
15–29	316	86	11.5	7.82–16.9	6.75	4.32–10.6
			$P < 0.0001$		$P < 0.0001$	
Profession						
Farmer	527	69	1.0		1.0	
Trader	168	81	1.92	1.25–2.94	1.43	0.89–2.30
Housewife/ unemployed	389	46	0.38	0.29–0.50	0.44	0.31–0.64
Student	123	96	10.6	4.27–26.4	4.59	1.71–12.3
Employee	316	71	1.10	0.81–1.49	0.74	0.52–1.05
Others†	127	71	1.10	0.72–1.68	0.83	0.52–1.32
			$P < 0.0001$		$P < 0.0001$	
Site						
Ban Pang	581	65	1.0		1.0	
Mae Hia	608	69	1.22	0.96–1.55	1.88	1.39–2.55
Ban Pa Nai	461	68	1.17	0.91–1.52	1.48	1.11–1.99
			$P = 0.24$		$P < 0.0001$	

* OR = odds ratio; 95% CI = 95% confidence interval.
† Others include monks, nuns, labour, forest workers and government employees.

recently the incidence of dengue infection in Thailand was higher in rural than in urban areas (Chareonsook *et al.* 1999). The expansion of dengue infection in rural areas may be explained by increased mobility of the rural population. Other explanations for the higher incidence in rural areas could be a lack of knowledge and the dependence on water storage during the dry season. However, in our three study sites, tap water was available. To increase knowledge, prevention programmes should now include rural areas as well.

Rash/bleeding was mentioned as a disease symptom by 77% of knowledgeable study population. Rash/bleeding is a specific symptom of dengue infection and not common in other febrile illnesses (WHO 1997) indicating that the majority of people can distinguish dengue infection from the other diseases. By contrast, the use of mosquito nets was frequently mentioned as a prevention measure by persons with and without knowledge of dengue, while this measure is not effective for dengue infection as *Aedes* mosquitoes bite mainly during daytime (WHO 1997). This suggests that preventive measures of other vector-borne diseases, which are transmitted by night biting vectors, are mixed with those of dengue infection. However, for small children who sleep during the day, a mosquito net is an important preventive measure for dengue infection.

In a Thai study which surveyed *Aedes* larvae, standard water jars counted for the majority of infested containers (Kittayapong & Strickman 1993). In our study, water jars and house drains were the most frequently mentioned breeding places, which indicates that our study population knew the most important breeding places. Prevention measures which can easily be taken by household members such as covering containers, disposal of discarded containers and changing stored water were mentioned by 40%, 61% and 48%, respectively, of the persons with knowledge of dengue. More importantly, when the knowledgeable group was asked about the use of these prevention measures, 69%, 78% and 86%, respectively, reported using them. In general, the reported use of prevention measures was higher than the reported knowledge of preventive measures except for the use of the larvicide temephos. The use of prevention measures was reported by the interviewee and could not be checked in daily life. Only the reported use of mosquito nets could be compared with the availability of mosquito nets in the house, because the interviewer counted the number of

mosquito nets. In total, 78% of the study population had mosquito nets in their house, which corresponds with the reported mosquito net use of 75%. Based on this, we assumed that also other prevention measures were fairly reported.

Prevention programmes are effective in increasing knowledge of dengue and practice of preventive measures (Lloyd *et al.* 1992; Swaddiwudhipong *et al.* 1992a; Leontsini *et al.* 1993; Gupta *et al.* 1999). However, increased knowledge does not always lead to changes in practice (Rosenbaum *et al.* 1995; Degallier *et al.* 2000). For example, because of water shortage during parts of the year, people tend to collect water in containers although piped water is available (Strickman *et al.* 1990). In contrast to intervention studies, which measure the impact of the intervention shortly after its introduction, our study could indirectly measure the long-term effects of education programmes. The last major education programme, the King's Project, had ended 5 months before our project started. The use of preventive measures was higher in persons with than in persons without knowledge of dengue. This indicates that knowledge of the disease increased the use of preventive measures in our three study sites in northern Thailand. However, the reported use of preventive measures by persons without knowledge of dengue was on average only 4–10% lower and thus also high. These figures could either accurately represent the actual practice or partly be the result of socially desirable answers. It may be possible that ignorant persons knew prevention measures against mosquito bites, but were unable to connect them with the disease dengue. Not all inhabitants of study sites were participating in the present study. However, no differences in age were found between the study and total population in two of the three sites. For these sites we assume that the study population is representative for the study site. In Mae Hia, the study population was older than the general population. This implies that the percentage of persons with knowledge of dengue in Mae Hia is probably even higher.

In conclusion, the majority of the study population had knowledge of dengue. However, from our results we conclude that some groups need special attention in future health education programmes, i.e. housewives, unemployed and old persons. These people, together with small children, may form high-risk groups for dengue infection because of their tendency to stay at home during daytime. Persons with knowledge of the disease more frequently reported the use of preventive measures in this study, indicating that education programmes are an important tool in dengue prevention at least as long as an effective vaccine is not present. Whether increased knowledge and use of prevention measures really decrease the risk of dengue infection will be subject of future investigations.

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