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# Large Variety of Medical Specialties Involved in Management of Pediatric Minor Traumatic Head Injury in the Netherlands

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## Background

It is estimated that every year about 12 000 children younger than 18 years of age are seen at an emergency department (ED) in the Netherlands with minor traumatic head injuries (MTHI).[1] In the Netherlands, the national MTHI guidelines, published in 2010, decide whether or not to make a cranial computed tomography (CT) scan in children with MTHI.[1] Briefly, based on the best available evidence at that time combined with personal experience, the expert committee concluded that it was safe and practical to distinguish 3 age categories.[1] The age categories were classified as under the age of 2, between 2 and 5 years, and 6 years or more. In addition, per age category, various major and minor criteria were defined for obtaining a CT scan, which were primarily based on 2 pediatric studies, and added into a flowchart.[2,3]

It was expected that implementation of guidelines resulted in a more uniform management of pediatric MTHI and, as a result, decreased the number of CT scans in children with MTHI. However, a retrospective control study showed the opposite.[4] Also, a recent prospective multicenter study among 1002 children in the northwest region of the Netherlands showed a high CT rate of 44%.[5] This high CT use cannot be explained by increase of patient severity or increase rates of clinically important traumatic brain injuries.[4,6,7] Several factors may contribute to CT scan increase. First, adherence to the Dutch MTHI guidelines is low.[8] Second, the large amount of criteria in the guidelines and the fact that they could be interpreted in a number of ways resulted in large inter-hospital variations in the management of MTHI.[9] Third, variations in obtaining CT scans also depend on the primarily responsible medical specialty in the ED.[10] However, to date, it is unknown which medical specialties in the Netherlands are primarily responsible for the management of pediatric MTHI. In contrast to other countries, the EDs in the Netherlands are staffed by various medical specialties and not solely by pediatric emergency physicians. Furthermore, since the guidelines define 3 different age categories, it may be that even within one hospital different specialties are involved.

The objective of this national survey study was to determine which specialties are primarily responsible for the management of children with MTHI at the ED in the Netherlands. This may help understand differences in management of pediatric MTHI.

## Methods

### *Study Setting*

We selected all the 82 Dutch hospitals, 8 university hospitals, and 74 general hospitals, with a 24-hour, 7 days a week open ED. Pediatric MTHI patients are being admitted to the ED by ambulance, after referral by a general practitioner, or self-referrals. In every case, depending on age category, a medical specialist is primarily responsible for the diagnosis and management of pediatric MTHI. In case of severe or moderate pediatric MTHI, patients are referred to a University Hospital or Level 1 Trauma Center.

MTHI in the Dutch guidelines was defined as trauma to the head, except for superficial trauma of the face.[11] By definition, this was caused by a direct trauma to the head or an acceleration-deceleration trauma to the head.[12] To diagnose an MTHI, 3 criteria were applied. First, the patient needed a Glasgow Coma Scale score of 13 to 15 at the first examination in the ED. Second, their

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maximum duration of posttraumatic loss of consciousness was limited to 30 minutes. Third, the maximum duration of post-traumatic amnesia was 24 hours.[13]

### Study Design

The pediatrician on call in these hospitals was contacted by telephone by the investigator (LW). The pediatrician was asked which specialty (pediatrics, neurology, emergency medicine, surgery, or other) was primarily responsible per age category for the management of children with MTHI according to the Dutch guidelines at their hospital. No information was collected from individual medical specialists involved in the management of pediatric MTHI regarding in clinical practice.

### Ethical Approval and Informed Consent

The scientific Review Committee of Tergooi Hospitals reviewed the application of ethical approval for this study and concluded that formal ethics approval was not required (correspondence kv/16.009).

## Results

The contacted pediatrician of all 82 Dutch hospitals, 8 university hospitals, and 74 general hospitals, with a 24-hour, 7 days a week open ED, responded to our survey.

In 7 of the 8 university hospitals, the neurologist, predominantly the pediatric neurologist, was responsible for the care of children with MTHI in all age categories. Only in 1 university hospital was a pediatrician responsible for the care in children younger than 2 years. In contrast, in the general hospitals, we observed that children younger than 2 years were predominantly seen by the pediatrician (74%) and children 6 years and older by the neurologist (52%).

In 47 of the 82 hospitals, 1 specialty was responsible for all age categories (Table 1). These specialties were pediatrics (n = 23), neurology (n = 21), emergency medicine (n = 1), and surgery (n = 2). In 7 hospitals, 2 specialties were responsible, namely, pediatrics and/or neurology (n = 5) or pediatrics and/or surgery (n = 2). In 5 hospitals, 1 specialty was responsible for all ages, namely, pediatric (n = 4) or neurology (n = 1); however, this was combined with another specialty depending on age. In the remaining 23 hospitals, different specialties were involved depending on age (Table 1). Overall, children younger than 2 years were predominantly seen by the pediatrician and children 6 years and older by the neurologist. We also observed that 1 specialty was responsible for 2 age categories, primarily pediatrics (n = 7) for age categories under 2 years and between 2 and 5 years and neurology (n = 15) between 2 and 5 years and 6 years and older. Remarkably, in 5 hospitals, the age limits within an age category were divided in under the age of 1 and 1 year and older, consequently 2 specialties were responsible within 1 age category.

## Discussion

This study demonstrated that the management of pediatric MTHI shows a large diversity among EDs in the Netherlands. We observed that both pediatricians and neurologists were primarily responsible for the care of children with MTHI admitted to the ED in the Netherlands. This varied, however, by hospital type and age category. In only 47 of the 82 (57%) hospitals, 1 specialty was responsible for all age categories, whereas in the remaining hospitals, 2 or more specialties were responsible, either for all or for different age categories.

We believe that this diversity in involved medical specialties affect the management of pediatric MTHI, in particular the use of CT scans. First, in our recent multicenter study, we evaluated guidelines adherence and CT use in pediatric MTHI among 1002 children in the northwest region of the Netherlands.[5] We observed that guideline adherence was significantly higher among pediatricians (71%) and emergency physicians (73%), whereas neurologist adherence was lowest at 52%. Strict adherence to the guidelines, however, resulted in overuse of CT scans. Also, a recent retrospective multicenter cohort study in the southwest region of the Netherlands reported that the Dutch national guidelines were followed correctly in approximately 49% of the children with an MTHI.[8] Thus the variation to guidelines adherence by the various involved specialties causes variability of CT use.[9,10] Second, the guidelines define, per age category, various major and minor criteria, for obtaining a CT scan. Interpretation and applicability of the major criteria for obtaining a CT scan may differ between involved specialties. For example, obtaining patient's history, performing physical examination, and interpretation in MTHI due to child abuse may differ between a surgeon, a pediatrician, or pediatric neurologist. Also, training in pediatric neurological examination differs between specialties. For example, in contrast to neurologists in training who have an obligatory 3 months of pediatric neurology training, pediatricians in training only rarely spend time in a pediatric neurology department. We did not examine in this survey if the diversity of involved specialties may cause difficulty in interpretation and applicability of the major criteria for obtaining a CT scan. However, in our previous survey, we observed that the large number of criteria results in a low adherence to the guidelines.[9] The results of this

**Table 1.** Specialties Involved per Hospital (n = 82) According to Age Categories for Children With MTHI.

| All Age Categories (n = 59) | | Different Age Categories (n = 23) | | | |
|---|---|---|---|---|---|
| One single specialism (n = 47) | All ages | One specialism per age category (n = 18) | 0-2 years | 2-5 years | ≥6 years |
| - Pediatrics | 23 | - Pediatrics | 17 | 7 | 0 |
| - Neurology | 21 | - Neurology | 1 | 11 | 17 |
| - Emergency medicine | 1 | - Emergency medicine | 0 | 0 | 1 |
| - Surgery | 2 | - Surgery | 0 | 0 | 0 |
| One specialism combined depending on age with another specialism (n = 5) | All ages | Two specialisms for 1 age category (n = 5) | 0-2 years | 2-5 years | ≥6 years |
| - Pediatrics and neurology ≥2 years | 1 | - Pediatrics <1 year and neurology ≥1 year | 5 | n/a | n/a |
| - Pediatrics and neurology ≥6 years | 3 | | | | |
| - Neurology and pediatrics ≥2 years | 1 | | | | |
| Two specialisms (n = 7) | All ages | | | | |
| - Pediatrics and/or neurology | 5 | | | | |
| - Pediatrics and/or surgery | 2 | | | | |

Abbreviation: MTHI, minor traumatic head injuries.

survey and our previous studies clearly show a large variation in management of pediatric MTHI across hospitals in the Netherlands. Future studies are necessary to determine how the different involved medical specialties interpret the major and minor criteria for obtaining a CT scan. This may serve to adapt the guidelines. Eventually, the goal is to achieve a more uniform management of pediatric MTHI in the Netherlands and, consequently, safely decrease the number of CT scans.

In general, studies have indicated that both subjective and objective clinical variables in children with blunt head trauma can be assessed by different observers with acceptable agreement.[14] However, these studies were performed in the United States and did not specifically define which specialties other than the ED physicians were involved. Hence, it remains to be elucidated if this is also true among different specialties as in our study.

Clinicians tend to rely more on their clinical experience rather than strictly follow guidelines to obtain a CT scan.[9] For example, we and others found that in the Netherlands physicians prefer to admit children with an MTHI to hospital instead of carrying out a CT, despite the current recommendations of the Dutch national guidelines.[5,8] Only a few studies have addressed the accuracy of clinical judgement on identifying traumatic brain injury. Daymont et al reported that ED physician estimates of probability of any brain injury in children were collectively accurate for children with low and moderate degrees of predicted risk, whereas risk was underestimated in infants.[15] On the other hand, a decision rule trended toward greater sensitivity than clinician judgment by ED physicians for identifying children with traumatic brain injury on CT but was less specific.[16] It has been shown, however, that substantial variation exists between specialties in reported hospitalization practices of neurologically normal children with blunt head trauma and traumatic CT findings.[17]

In conclusion, our study shows a large diversity among EDs in the Netherlands in the management of pediatric MTHI. To overcome this, we advocate that after implementation of guidelines, local provider feedback, self-assessment, and evaluation are necessary to improve the quality of care of children with MTHI. This may help understand differences in management between various involved specialties.

## Author Contributions

NN and FBP contributed to conceptualization of idea. NN and LW contributed to data collection. All authors contributed to writing of this article.

## Declaration of Conflicting Interests

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