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## Exploring the potential of triage and task-shifting in preventive child health care

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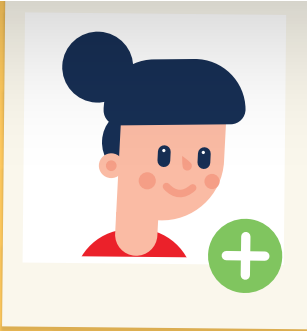
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Janine Bezem



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## **PROEFSCHRIFT**

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**Colophon**

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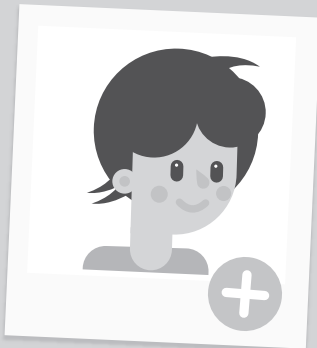
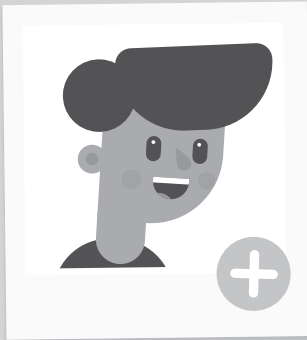
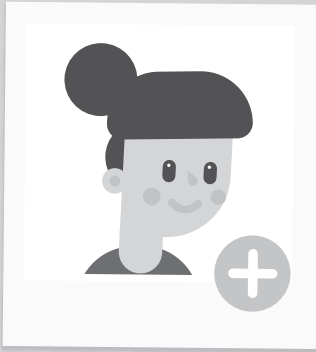


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## Introduction and aims of this thesis



1

## **Preventive Child Health Care**

The aim of Preventive Child Health Care (PCH) is to monitor growth and development in children, and to detect health problems and risk factors early, principally using a routine screening programme for all children [1,2]. It is essential to detect health problems so that early treatment can be given and illness and severe health problems can be prevented later [3-7].

The PCH system in the Netherlands is based on the Dutch Public Health Act (WPG), which requires municipal authorities to ensure that all children have access to PCH [8,9]. PCH care is paid for through government funding, which means that access is independent of insurance status. Specially trained community PCH professionals (physicians, nurses and assistants) provide vaccinations and preventive health care for all children from birth to 18 years of age [10]. A pre-defined age schedule is used to deliver preventive health assessments and the attendance rates are between 85% and 99% depending on the age group [11,12]. Traditionally, all children receive about seventeen routine health assessments: thirteen in the first four years (in well-child care) and four between the ages of 4 and 18 years (in school health services) [10]. Standardised screening procedures are used to identify a wide range of disorders such as visual and hearing impairment, psychosocial problems, motor dysfunction and overweight. In addition to the usual items (vision, hearing, growth), particular attention has been paid to mental health and lifestyle issues in the last decade. When risk factors are identified during the routine assessments, PCH physicians and nurses decide whether there is any need for advice, additional assessments by PCH, or referral to external services such as a general practitioner or specialised care.

Despite the benefits of a basic package of routine assessments for all children, many PCH services in both the Netherlands and many other countries are evaluating the organisation of their system. Given the health care and economic challenges, 80% of all European countries have developed a reform of PCH in the last five years [1]. PCH services need to be better tailored to adult-driven diseases such as mental health disorders and lifestyle-related problems but uneven access to care and shortfalls in programme quality also need to be addressed [13-18]. Economic challenges such as reduced budgets, the inefficient use of professionals and workforce shortages mean that the system of preventive health care also needs to be more efficient [19]. In addition, greater flexibility is required in the delivery of the PCH programme so that

it is tailored to apparent inequities in health between subgroups of children and the different care needs of children that arise as a result. Timely and appropriate care should be available for all children at risk [20]. Furthermore, in the Netherlands, children aged 4 to 18 years are assessed only four times during their time at school and no health problems are found at those times in the majority of children. This raises the question of how PCH should be re-organised to tailor care to the development of individual children.

There is also debate about whether the assessments must always be conducted by a physician or a nurse. Furthermore, is it possible to make more efficient use of the risk factors known to school professionals in children they meet daily in order to improve the early detection of health problems by PCH?

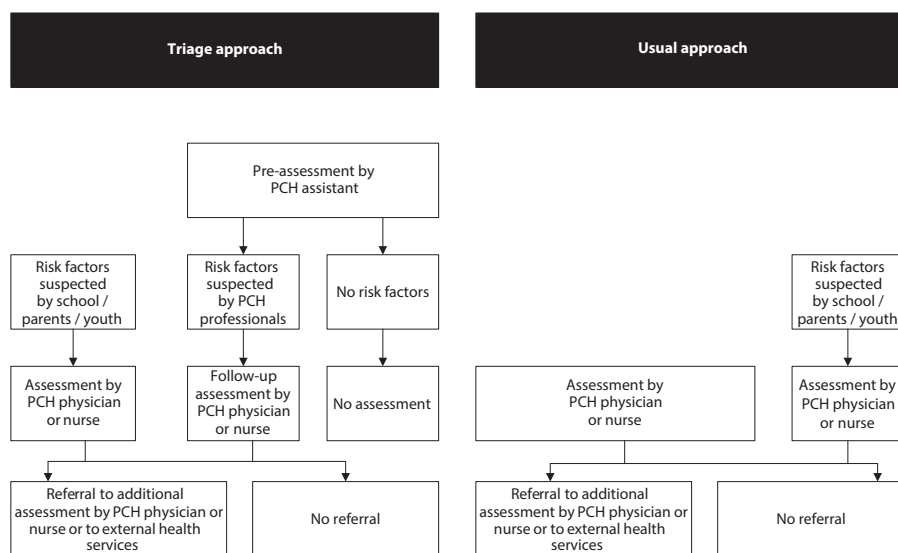
### **A triage approach and the approach as usual**

In light of the need to reform the PCH system to provide a more efficient preventive service based on children's care needs, we investigated the possibilities of a novel approach organising routine assessments. The options for organising PCH on different lines are: reducing the frequency of routine assessments, task-shifting between the disciplines and different assessment methods such as face-to-face assessments, telephone assessments or contact using digital channels. To ensure that the Dutch PCH remains strong in terms of a low threshold and the wide coverage necessary for the early identification of health problems, we decided to investigate the integration of the principles of triage and task-shifting in the PCH system. Triage can be defined as the process of determining the need for an intervention, the level of urgency and the likely response to the intervention [21]. Task-shifting can be defined as the delegation of existing tasks to current or new professionals with less and/or more specific training.

Although triage and task-shifting among health care professionals have primarily been introduced in primary health care and emergency health care services, the integration of these principles in the PCH system may have several advantages such as: the optimal use of the skills and expertise of health care professionals; a reduction in the workload of physicians and nurses; improved accessibility of health care and greater patient satisfaction [22-29].

A novel PCH approach to routine assessments was developed based on task-shifting from PCH physicians and nurses to PCH assistants for children aged 4 to 18 years [30]. In the usual PCH approach, all children are assessed by a PCH

physician or a nurse, sometimes with support from a PCH assistant. In the two-step procedure in the triage approach, children are first assessed by a PCH assistant who follows a strict pre-assessment protocol. The pre-assessment of the children is conducted on the basis of questionnaires completed by parents and school professionals and face-to-face screening. The PCH assistant refers only children with suspected health concerns to a follow-up assessment by a PCH physician or nurse. The triage procedure therefore includes both a pre-assessment and a possible follow-up assessment. The nature and complexity of the suspected health problems determines whether follow-up assessment by a physician or a nurse is needed: physicians attend to medical and developmental disorders; nurses usually attend to psychosocial problems and lifestyle issues. The follow-up assessment by the PCH physician or nurse, like the routine assessment in the usual approach, determines the need for referral to additional PCH assessment or to an external health service. Furthermore, PCH professionals can assess children in the triage and the usual approach at the request of, for example, parents, school professionals and adolescents. The assessment procedures in the two approaches are shown in the following figure.



The aim of the triage approach is to organise the early identification of health problems as part of the routine health programme for all children more effectively and efficiently [31]. We hypothesised that the efficient involvement

of PCH professionals and a reduction in health care costs for routine assessments would create more opportunities to provide additional PCH care for children with specific health care needs. We believed that more time would therefore be available for additional PCH assessments, not only at times other than those in the pre-defined schedule but also at the request of school professionals, parents and adolescents.

### **Study of the triage approach**

ZonMw granted funding for a pilot study with retrospective data and a more comprehensive prospective cohort study to investigate the triage approach. This study was carried out by TNO in cooperation with the Leiden University Medical Center and six PCH departments of Regional Health Services. The Medical Ethics Committee of Leiden University Medical Centre approved the study.

A separate study using digital questionnaires was conducted in 2012 to investigate school professionals' perceptions of access to school health services when a triage approach is in place.

Research looking at the daily practice of PCH is important to improve the quality and efficiency of preventive health care for children.

### **Outline of the thesis**

The aim of this thesis is to establish a picture of access to PCH, detection rates and the delivery of care when a triage approach is used by PCH, and looks at the possible cost implications by comparison with routine assessments.

The findings could result in recommendations for efficient and flexible PCH services in order to optimise customised care for children with specific health care needs.

This led to the following research questions:

- What are the attendance rates for routine PCH assessments and the delivery of care in terms of rates of referral for the triage approach, as compared with the usual approach?
- How does the triage approach perform by comparison with the usual approach in terms of identifying overweight, visual disorders, and psychosocial problems?
- What is the impact of triage on additional PCH care and referral rates to external health services when triage is used as opposed to the usual approach?

- What are the costs of conducting routine health assessments by PCH with a triage approach and with the usual approach?
- What is the impact on school professionals' perception of access to PCH in terms of the approachability and appropriateness of PCH support when the triage approach is used rather than the usual approach?

In **Chapter 2** we explore the help-seeking process in a triage approach to PCH. We also discuss a retrospective pilot study in which data about routine assessments were used to investigate accessibility (in terms of attendance rates) and the delivery of extra care (in terms of referral rates to either additional PCH care or to external services) under the triage approach by comparison with the usual approach.

In **Chapter 3** we present the results of a prospective cohort study in which the detection by the triage approach of overweight, visual disorders, and psychosocial problems was compared with the results with the usual PCH approach. We also assessed the severity of the health problems in the subgroups of children with the detected health problems.

**Chapter 4** describes a prospective observational cohort study comparing the delivery of extra care for children with health care needs in the triage approach and the usual approach. We investigated referral rates to extra care, by PCH or by external services, and rates of PCH assessments at the request of parties such as parents and school professionals.

In **Chapter 5** we describe the direct costs of conducting PCH assessments with the triage and usual approach using a bottom-up micro-costing approach. PCH professionals registered time spent on assessments, including time related to non-attendance for assessments, the referral of children and administration.

**Chapter 6** describes how professionals in primary schools perceive access to school health services (SHS) under a triage approach by comparison with the usual approach. School professionals completed digital questionnaires about contact frequency, the approachability of SHS and the appropriateness of support from SHS.

Finally, in **Chapter 7**, we discuss our findings and the implications for preventive child health care and further research.



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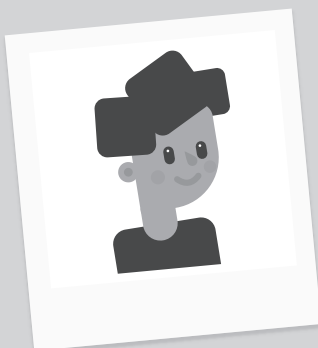
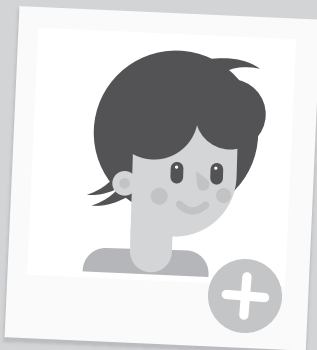
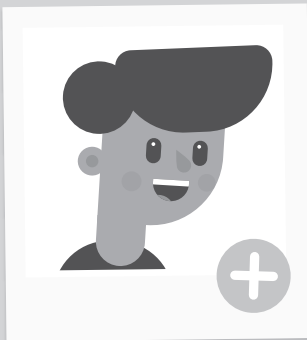
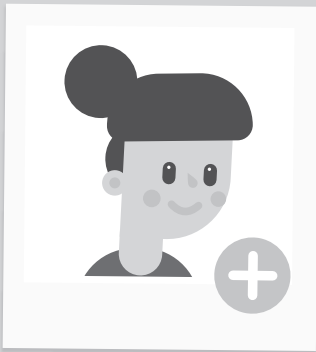
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**A novel triage approach  
of child preventive  
health assessment:  
an observational study  
of routine registry-data**



2

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## ABSTRACT

### *Background*

The coverage of preventive health assessments for children is pivotal to the system of preventive health screening. A novel method of triage was introduced in the Preventive Youth Health Care (PYHC) system in the Netherlands with an associated shift of tasks of professionals. Doctor's assistants carried out pre-assessments to identify children in need of follow-up assessment, whereas in the traditional approach all children would have been screened by a doctor or nurse. The accessibility and care delivery of this new PYHC system was studied.

### *Methods*

The new triage approach was compared to the traditional approach in 780 children undergoing PYHC assessment with the use of an observational retrospective study design. Outcomes were attendance of assessment appointments (accessibility of care) and referral of children to either extra PYHC assessment or external specialized care (delivery of preventive care). PYHC registry data were analysed. In two regions of the Netherlands, 390 children five to six years of age were randomly selected from the PYHC registries according to the socio-economic strata of the schools they attended.

### *Results*

When the triage and traditional approaches to PYHC were compared, we found similar attendance rates for assessment appointments, namely about 90%. As expected, 100% of the children in the traditional group were assessed by a PYHC doctor but 46% of the children in the triage group were. Significantly fewer children were referred for extra PYHC assessment or for treatment by an external specialized care giver when a triage as opposed to the traditional assessment approach was used (19.6% vs. 45.9%).

### *Conclusions*

The novel triage approach for preventive health assessment shows equal accessibility, but a different delivery of preventive care. A beneficial effect of the adoption of the triage approach is the opportunity to provide more attention from doctors and nurses to children at risk of health problems. However, lower referral rates of the triage approach may be explained by an under-

identification of children with health problems. Further research is needed to document the health outcomes and the possible reduction of health care costs with a triage approach compared to traditional PYHC care.

## BACKGROUND

A preventive health care programme for children and young people can be found in most countries, with major attention being paid to immunization, systematic screening for asymptomatic children and the detection of disorders [1, 2]. Structural reforms of the health care systems in many countries today and increased attention to such health problems as mental health disorders and lifestyle issues are calling for changes to the system of preventive health care for children as well [3,4]. Preventive Youth Health Care (PYHC) services must be better aligned with current health priorities but must also address uneven access to care, inadequate programme quality and workforce shortages [5].

To meet these current health care needs of society, a novel approach has recently been developed for the provision of PYHC for children 4 to 18 years in the Netherlands. This approach is based on triage and a shifting of the tasks among health care professionals. Triage can be defined as the process of determining clinical need, the likely response to intervention and the degree of urgency for such intervention [6]. The shifting of tasks can be defined as the delegation of existing tasks to current or new professionals who have less and/or more specific (i.e., tailored) training. Although triage and a shifting of the tasks of health care professionals have so far been introduced primarily in primary health care and emergency health care services, the integration of these principles in the PYHC system may have several promising advantages. These are: optimal use of the skills and expertise of health care professionals; reduced workloads of doctors and nurses; improved accessibility of health care and greater patient satisfaction [7-9]. To meet these current health care needs of society, a novel approach has recently been developed for the provision of PYHC for children in the Netherlands. This approach is based on triage and a shifting of the tasks among health care professionals.

The PYHC system of the Netherlands is unique. It has been offering routine preventive public health care to all Dutch children from birth to 18 years of age for more than a hundred years. Access is free of charge and thus independent of insurance status. The Dutch PYHC has been aimed at monitoring the growth and development of children and at prevention of health problems in children. The system has been set up for preventive and screening services for asymptomatic children, including the provision of the national vaccination programme. A standard call-up scheme is utilized for this purpose. Data of



children to be invited for an assessment are provided by municipal registries (0 to 3 years) or by schools (4 to 18 years). Traditionally, all children receive about 17 routine health assessments, 13 in the period from birth to three years (i.e. well baby clinics) and three times for the age group four to 18 years (i.e. school health services). These assessments consist of a general physical examination including standardized screening procedures with regard to specific health related topics, and an interview with parents or with older children themselves concerning the child's physical, developmental and psychosocial health. When problems are detected, PYHC doctors and nurses decide whether there is any need for advice, extra assessments by PYHC, or referral to specialized care. The specially trained community health-care doctors, nurses and doctor's assistants (henceforth: PYHC professionals) work separately from specialized clinical caregivers such as paediatricians or other clinical health professionals. PYHC professionals keep records on the routine health assessments in a registry system. The attendance rates for routine assessment are typically very high (i.e., more than 85% on average) [10, 11]. The majority of children who are seen for such PYHC assessment show no health problems at the time.

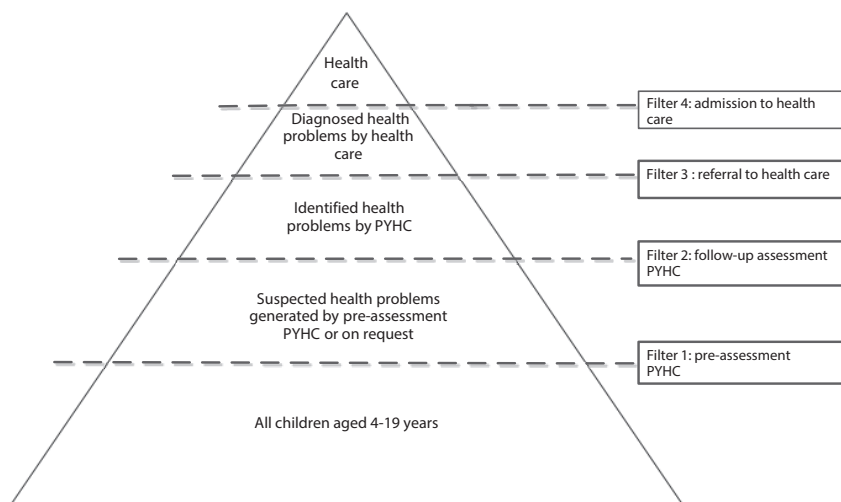
This raises the question of what frequency of routine PYHC assessment is most suitable and whether this must always be conducted by a doctor or a nurse. Some PYHC organizations in the Netherlands have introduced a triage approach to make the procedure for detecting children with health problems or at risk for health problems more efficient.

A two-step procedure has been adopted for children 4 to 18 years of age in the Netherlands. In contrast to traditional PYHC, not all children are assessed by a doctor or a nurse in this new triage approach. Rather, children are seen by a doctor's assistant who follows a strict pre-assessment protocol and refers only children with suspected health care needs for follow-up assessment by a PYHC doctor or nurse. Both pre-assessment and follow-up assessment are part of the triage health assessment procedure.

This possibly creates time for PYHC doctors and nurses to devote their attention to children who need extra care, such as children with mental health and lifestyle related problems. More time in that case will be available for assessment of children on request of parents, teachers, professionals and children themselves.

For a health screening programme it is essential that it is accessible for the population of children. Further, it should be assured that children are

referred to the appropriate services according to their needs [12]. In this article, we report the results of a pilot study of the accessibility of PYHC assessment and delivery of preventive care by organisations that adopted the newly developed triage approach for PYHC in the Netherlands. As can be seen from figure 1, the triage approach with PYHC pre-assessment by a specially trained assistant introduces an earlier filter to more intensive levels of health care [13, 14]. This can possibly affect the access to PYHC assessment services by the public and delivery of PYHC care [15-19]. We therefore addressed the following research questions. What are the attendance (i.e. utilization) rates for routine PYHC assessment when a triage as opposed to traditional approach is used? What are the rates of referral (i.e. delivery of care) when a triage as opposed to traditional approach is used?



**Figure 1.** *Help-seeking process within triage approach to PYHC (adapted from Goldberg and Huxley, 1980, 1992)*

The present pilot study was conducted to provide preliminary answers to these questions and is preparatory for future inquiries into the equity of service delivery and consequences for health outcomes of a triage approach to PYHC. We hypothesized the following. 1) With regard to attendance rates for routine PYHC assessment appointments, the triage and traditional approaches could be expected to produce equal results. This would indicate equal access to care. 2) With regard to the delivery of preventive care we hypothesized that triage may lead to fewer routine PYHC assessments by doctors as opposed to the

traditional approach, as well as fewer indications for extra PYHC assessments and referrals to external specialized care givers.

## METHODS

### *Study sample*

Attendance to PYHC assessment appointments and delivery of preventive care for two populations of children from separate geographic areas of the Netherlands were analysed. In a retrospective research design, we compared data from a total of 780 children. Random samples of 390 children aged five to six years were selected from the registries of two PYHC services in two geographically distinct regions, one using a triage approach and one using a traditional approach. Routine health assessments are being conducted by PYHC organizations in Dutch primary schools at two age groups namely five to six years and ten to eleven years which made access to registry data of a large number of children possible. We focused in this pilot study on the youngest age group of five to six years, for whom the detection of developmental problems is essential.

We selected a random sample of five to six year olds from the population of children who were invited for a pre-assessment (triage PYHC) or assessment (traditional PYHC). For each PYHC service, 390 children were selected from socio-economic strata of the schools being attended: 130 children from low SES schools, 130 from middle SES schools and 130 from high SES schools. The selection took place in a random way: the registers of the sample were ordered by day of birth and SES of school. Next, the first child out of five was selected. The socio-economic status of the schools was determined on the basis of national census statistics. Similar age and gender distributions were obtained for the triage PYHC assessment group (390 children from 78 schools) as for the traditional PYHC assessment group (390 children from 30 schools). The study sample was drawn from children undergoing assessment during a four month period in 2008.

*Triage approach versus traditional approach*

Pre-assessment of the children in the triage PYHC service was carried out by doctor's assistants on the basis of the following information: PYHC records; questionnaires completed by school teachers and parents; and face-to-face screening. Routine assessments of the traditional approach versus the triage approach differ in certain aspects (see figure 2).

Traditional approach	Triage approach
<b>1. All Children</b> Assessment by PYHC doctor or nurse: <ul style="list-style-type: none"> <li>- Parental questionnaire including motor problems, cleanliness, chronic disease and SDQ for psychosocial problems</li> <li>- Teacher questionnaire</li> <li>- Face-to-face health screening including vision, hearing, weight/length</li> <li>- Tailored physical or psychosocial examination and advice</li> </ul>	<b>1a. All Children</b> Pre-assessment by doctor's assistant: <ul style="list-style-type: none"> <li>- Parental questionnaire including motor problems, cleanliness, chronic disease and SDQ for psychosocial problems</li> <li>- Teacher questionnaire</li> <li>- Face-to-face health screening including vision, hearing, weight/length</li> </ul> <b>1b. Children with suspected health problems (follow up)</b> <ul style="list-style-type: none"> <li>- Tailored physical or psychosocial examination and advice by PYHC doctor or nurse.</li> </ul>

**Figure 2.** Routine assessments: traditional approach versus triage approach

The questionnaires covered a wide range of topics such as motor problems, cleanliness and chronic disease. The questionnaires included the Strength and Difficulties Questionnaire (SDQ) for parents in order to screen for psychosocial problems on the part of the child [20]. The assistants followed strict protocols to determine if follow-up PYHC assessment by the doctor or nurse was necessary. The nature and complexity of the suspected health problems determined whether follow-up assessment by a doctor or a nurse was needed: doctors attended to medical and developmental disorders; mostly nurses attended to psychosocial problems and lifestyle issues. During follow-up assessment by the PYHC doctor or nurse, the need for extra PYHC assessment or referral to an external service - a specialized care giver e.g., family doctor or social worker - was determined. The task of referral of children is assumed to be a vital part of the care delivered by PYHC.

Pre-assessment by the assistants was conducted in the schools in the absence of parents but with parental consent. Follow-up assessment by the doctor or nurse occurred in the presence of the child's parent.

The children assessed by the traditional PYHC services were all examined by the PYHC doctor in the presence of the child's parent. The doctors in the traditional

group also had the following at their disposal: PYHC records and questionnaires completed by the teachers and parents prior to the consultation (see figure 2). Those children with suspected problems were referred for extra assessment, which — just as in the triage approach — could be provided by the PYHC doctors or nurses themselves, or to an external service.

#### *Data collection*

Data on PYHC assessment appointment attendance rates (i.e. accessibility of PYHC services) and the referral rates for extra PYHC assessment or to external specialized care givers (i.e. delivery of preventive care) were collected from the PYHC records. The extra PYHC assessment or external specialized care are called hereafter 'extra care'.

Referral rates were determined for the following health indicators: psychosocial problems, visual disorders and overweightness. These health indicators were chosen because standard rules for screening for these health issues were available for both triage and traditional approaches to PYHC assessment. The psychosocial problems included behavioural and emotional problems on the part of the child, social interaction problems and/or child abuse. The identification of such psychosocial problems was based on the assessment made by the PYHC professional and the child's SDQ scores [21]. Visual disorders, including amblyopia and impaired vision, were determined using a visual acuity test (i.e. the Snellen chart with SD scores based on the Dutch general population) [22]. Problems of overweightness were determined using the body mass index. The child's Body Mass Index (BMI) was derived from the PYHC records of routine health assessments. The thresholds used by the international obesity task force were adopted as the BMI cut-off points for overweightness and obesity [23]. SD scores for BMI were based on the Dutch general population [24].

Four of the 780 children had to be excluded because their data were incomplete. This left the data for a sample of 776 children to be analysed (390 traditional approach and 386 triage approach).

#### *Statistical analyses*

First, we assessed differences in background characteristics between the two approaches using the chi-square test and t-test.

Next we compared the percentages of the children showing up for the assessment sessions in the traditional condition (usually assessment by a doctor) and the triage condition (pre-assessment by a doctor's assistant and possibly follow-up assessment by a PYHC doctor or nurse) using the Chi-square test. We also compared the percentages of children referred for extra care for the two conditions.

Referral rates for care were calculated for total problems, psychosocial problems, visual disorders and overweightness. We tested differences in referral rates for total problems for the two groups using four separate logistic regression analyses with referral to extra care (total, psychosocial-, visual-disorder, overweightness) as the outcome variables and the group and significant background characteristics (Table 1) as the independent variables (SPSS 22.0 for Windows, SPSS Inc., Chicago, IL).

## RESULTS

Table 1 presents the background characteristics of the children participating in the study. The study groups did not differ significantly in terms of gender and socio-economic status, but the mean age of the children differed between the two approaches, 5.7 years for the traditional approach and 6.3 years for the triage approach.

**Table 1.** Characteristics of triage of 4-19 years old children: type of assessment, level of professional, presence of parents and assessment target

Type of assessment	Level of professional	Age of children	Presence of parents	Target of assessment
Pre-assessment	assistant	5-6 years	No	Growth, motor problems, vision, hearing
		10-11 years	No	Growth, vision, hearing, social development
		13-14 years	No	Growth, vision, hearing, lifestyle
Follow-up assessment or assessment upon request <sup>a</sup>	doctor	4-19 years	Yes (4-12 years) No (13-19 years)	Medical subjects, psychiatric disorders, school absenteeism, child abuse
	nurse	4-19 years	Yes(4-12 years) No (13-19 years)	Overweight, lifestyle, upbringing

<sup>a</sup> Upon request of parents, teachers or police

The appointment attendance of the traditional assessment has been compared with the appointment attendance of pre-assessment and follow-up assessment of the triage approach. Our results show no significant different appointment attendance rates for the two approaches to PYHC.

As can be seen from table 2, 351 of the sample of 390 children (90.0%) who were invited for an assessment in the traditional group, actually attended this assessment. In the triage group 372 of the sample of 386 children (96.4%) attended a pre-assessment by a doctor's assistant and 143 of the sample of 163 children (87.7 %) who were referred to a follow-up assessment by the doctor or nurse indeed attended this assessment.

**Table 2.** Attendance rates for traditional versus triage approaches to preventive youth health (PYH) care assessment

	Traditional approach	Triage approach	
	Assessment by doctor	Pre-assessment by assistant	Follow-up assessment by doctor or nurse
Calls for Examination	N=390	N=386 <sup>a</sup>	N=163
Attendance	90.0%	96.4%	87.7%

<sup>a</sup> Four children were excluded from analyses due to incomplete data

All of the children in the traditional group received routine PYHC assessment by a doctor while only 46% of the children in the triage group required PYHC assessment by a doctor or a nurse. Next, the percentages of children referred

for extra care were compared (see table 3). A significant difference was found: 45.9% for the traditional group were referred to extra care as compared to 19.6% for the triage group (OR=3.9, 95%-C.I. (2.7-5.8)).

The percentages of children referred to extra care also differed significantly for the health indicators visual disorder and overweightness between the traditional versus triage group. For possible visual impairments, 8.3% of the children in the traditional group were referred to extra care, compared to 3.2% of the children in the triage group (OR=3.0, 95%-C.I. 1.5-6.1), after 9.7% had seen a PYHC doctor or nurse for follow-up assessment. For possible problems of overweightness, 12.3% of the children in the traditional group were referred to extra care, compared to 5.4% in the triage group (OR=3.6, 95%-C.I. 1.9-6.7), after 8.1% had seen a PYHC doctor or nurse for follow-up assessment. No difference was found for the health indicator 'psychosocial problems'. For suspected psychosocial problems, 8.0% of the children in the traditional group were referred for extra PYHC or external care compared to 5.1% of the children in the triage group (OR=1.1, 95%-C.I. 0.7-3.0), after 15.9% in this group had seen a PYHC doctor or nurse for follow-up assessment.

**Table 3.** *Referral rates of the traditional versus triage approaches to preventive youth health (PYH) care*

	<b>Traditional approach N=351<sup>a</sup></b>	<b>Triage approach N=372<sup>a</sup></b>	
	Assessment by doctor	Pre-assessment by assistant	Follow-up assessment by doctor or nurse
Referral to	Extra PYH assessment or to external health services	Follow-up assessment by doctor or nurse	Extra PYH assessment or to external health services
Total	45.9%	46.0%	19.6%
Psychosocial problem <sup>b</sup>	8.0%	15.9%	5.1%
Visual disorder <sup>b</sup>	8.3%	9.7%	3.2%
Overweight <sup>b</sup>	12.3%	8.1%	5.4%

<sup>a</sup> The number of assessments in Table 3 is not similar to the number of children mentioned in Table 4 due to missing data for some of the children.

<sup>b</sup> Examples of measured health indicators for referral to extra care

The two approaches also differed in terms of the proportions of children who were referred to extra care by PYHC and those who were referred to specialized care outside of PYHC.

In the traditional approach 39.9% of 351 children were referred to extra care by PYHC, versus 14.8% of 372 children who received triage approach (OR=4.5, 95%-C.I. 3.0-6.7). 12.5% of 351 children in the traditional approach versus 5.1%



of 372 children in the triage approach were referred to specialized care (OR=2.4, 95%-C.I. 1.3-4.7).

## DISCUSSION

In this study, a novel method of triage for the public health assessment of children combined with a shifting of the tasks of Preventive Youth Health Care (PYHC) professionals was explored. We compared the attendance rates for the PYHC assessment appointments in groups using a triage approach versus a traditional approach. PYHC appointment attendance rates were taken to be indicators of the accessibility of PYHC. We also examined the referral rates for extra PYHC assessment or external specialized care, called 'extra care', as indicators of delivery of preventive care, assuming that referral is a vital part of the care delivered by PYHC.

The type of approach, i.e. a triage or traditional approach did not affect the accessibility of the routine PYHC assessment. The appointment attendance rates for PYHC assessment, which are traditionally quite high, continued to be high also for the triage approach to assessment. The attendance rate of the pre-assessment appointments were probably high because the parents were not required to be present.

Major differences in the referral rates for extra care were detected when the traditional approach was compared to the triage approach: lower referral rates for extra care were found for the triage approach relative to the traditional approach. The different referral rates for extra care can most likely be attributed to the different processes used to identify health problems in the two approaches.

In the traditional assessment approach, all children are assessed by a PYHC doctor or nurse. In the two-step, triage approach to assessment, all children are pre-assessed by a doctor's assistant and only those in need of follow-up (i.e., with health problems or at risk for health problems) are referred for assessment by a PYHC doctor or nurse. It is possible that this two-step approach provides an additional barrier to access to care. Children with health problems may be under-identified (false negatives, i.e. incorrectly classified as healthy) and therefore not referred for extra care. Another explanation for the lower referral rates is that in the second step in the triage assessment process, the PYHC doctor or nurse can provide more tailored advice, recommendations and

reassurance, which can remove the need for further referral to extra care. It is, of course, also possible that spontaneous remission occurs during the period between pre-assessment by the doctor's assistant and follow-up by the PYHC doctor or nurse and that this reduces referral for extra care in the triage group in particular. We did not measure the care which may have been sought during the period between pre-assessment and follow-up assessment, although this could also account for the significantly lower rate of referral for extra care in the triage group compared to the traditional group.

Finally, the different referral rates found for extra care in the two groups might lie in earlier identification of health problems in the triage group as the triage approach to assessment allows for more responding to requests and questions from parents, teachers and the children themselves and may therefore nip more problems in the bud than a traditional approach to assessment.

When we compared the referral rates for extra care for psycho-social problems, visual disorders and overweightness in our study to the actual prevalence rates for these problems among five to six year olds in the Netherlands, the triage referral rates resembled the actual prevalence rates of 6% for psychosocial problems and 2 to 4% for visual disorders [8,25]. The traditional-group referral rate of 12% for extra care for overweightness was higher than the triage-group referral rate of 5%, but approached the actual prevalence rate of 15% among 5 and 6 year olds in the Netherlands [26, 27]. The referral rates for both the triage and the traditional groups in the present study represent health problems which have been newly identified by the PYHC service while the actual prevalence rates include problems which are already known. This means that PYHC referral rates for extra care may be lower than prevalence rates. More detailed and large-scale research on PYHC assessment practices and approaches is needed to gain insight in the identification of care needs and subsequent referrals.

### *Strengths and weaknesses of the present study*

A strength of the present study is that we were able to carefully compare the traditional and triage approaches by matching the groups with regard to the spread of socio-economic backgrounds (i.e., equal numbers of low, middle and high SES children in each group). We included a homogenous group of children within the age range of 5 to 6 years and controlled for differences

in age distribution between the two study groups. Another strength is that we analysed assessment for a limited number of health problems for which standard screening guidelines have been established. Both of the approaches studied here thus used similar screening methods, which limited the possibility of observation bias

A possible limitation of this study is the lack of insight into the numbers of children correctly and incorrectly identified with a problem in the triage versus traditional approaches to routine PYHC assessment. In this pilot work, we did not monitor the results of the referrals for extra care, and we therefore do not know if children were incorrectly referred for a health problem or potential health problem. For that matter, we do not know if children with actual health problems were mistakenly missed. Another possible limitation is the use of a retrospective research design. Marked differences in the identification and/or reporting of health problems by PYHC professionals cannot be ruled out and may have influenced our results. A last limitation is the inclusion of only two PYHC organisations in this study. A larger sample of organisations could add to the robustness of the data set and validity of the outcomes presented.

*Implications for preventive youth health care and directions for future research*

This study provided a preliminary indication for the triage approach to have introduced a shift of tasks among PYHC professionals without sacrificing accessibility of PYHC assessment (i.e. attendance rates).

The shifting of tasks with the introduction of pre-assessment by doctor's assistants and fewer referrals to extra care of PYHC resulted in a less time consuming PYHC assessment procedure. This triage procedure enables PYHC doctors and nurses to devote more attention to children with special health care needs, often related to social inequities, mental health and lifestyle related problems.

Time can be given for other consultations than the routine assessments, such as on request of parents, youths themselves or school staff. In this study we did not investigate the PYHC consultations at the request of schools, parents or children themselves.

The shift of tasks to PYHC doctor's assistants within a triage approach to assessment, calls for new competencies on the part of these PYHC professionals and may result in the loss of generalized knowledge and expertise on the part of PYHC doctors and nurses when not all children are seen by them. Training of PYHC professionals is thus needed to maximize their diagnostic skills [28, 29]. Considerable attention has been paid to the training of all PYHC professionals working with a triage approach to routine PYHC assessment, but research is needed to determine the actual quality of detection using such an approach. A criterion for determining the quality of detection could be the diagnosis of problems by professionals from an external organisation. This would allow us to determine the accuracy of referral for extra care (i.e. justified or not justified) and the quality of a triage approach to routine PYHC assessment in general. Examination of the outcomes of referrals for extra assessment by PYHC professionals or external specialized care givers can give us insight into the extent of compliance with such referral. It also can provide insight into the equity of care distribution to the children who are in need of health care.

Research across a greater age range and greater number of PYHC organisations using nevertheless uniform protocols and standard registration procedures to reduce the possibility of observation bias, is needed. Research is also needed to document the satisfaction of the children, young people, their parents and their teachers with a triage approach to routine PYHC assessment and the resulting care. Moreover, research into the effects of the new triage approach on the long-term need for care is advised.

Finally, research into the costs of the new triage approach compared to routine PYHC assessment reported on here must be undertaken, particularly with respect to the traditional PYHC assessment approach.

## CONCLUSIONS

The present results show that a triage approach compared to routine PYHC assessment maintains the accessibility of assessments. The use of doctors and nurses for routine assessments has been reduced through a shift of assessment tasks among the PYHC professionals. The delivery of preventive care to children, including referral to external services has changed in the new approach. The triage approach for PYHC assessment may create opportunities for greater attention from doctors and nurses to children who are at risk and to children with clear health needs. The triage approach for routine PYHC assessment and its contribution to efforts in reducing the need for specialized health care among children and into adulthood needs further validation.

### **List of abbreviations**

BMI	Body Mass Index
SDQ	Strength and Difficulties Questionnaires
SES	Social Economic Status
PYHC	Preventive Youth Health Care

### **Conflict of interest**

The authors declare that they have no conflict of interest.

This study was approved by the internal TNO Review Board and is in accordance with the Dutch act on Medical Research Involving Human Subjects. Medical ethical approval was not required for this study.

### **Authors' contributions**

JB had the original idea, contributed to the development of the triage protocols, acquisition and interpretation of data and drafting of this manuscript.

MT contributed to the conception and design, analysis and interpretation of data. She was involved in revising the manuscript.

PK contributed to the conception and design, analysis and interpretation of data and drafting of the manuscript. He supervised the execution of the study.

SB contributed to the revision of the intellectual content of this paper.

Finally, all authors read and approved the final manuscript.

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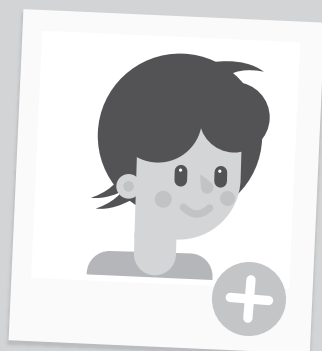
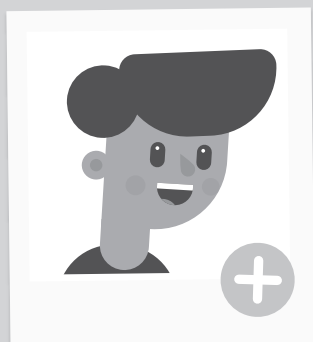
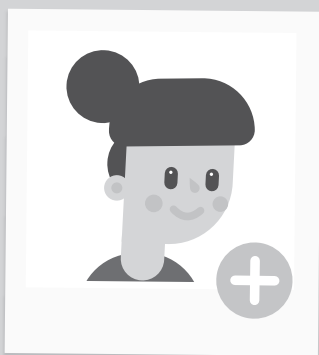
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## A novel triage approach to identifying health concerns



3

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## ABSTRACT

### *Background*

We investigated the detection of health problems in Preventive Child Healthcare (PCH) by a novel triage approach for routine health assessments. In the triage approach, all children were preassessed by a physician's assistant, and only those in need of follow-up were assessed by a PCH physician or nurse. In the traditional approach, all children were assessed by a PCH physician or nurse.

### *Methods*

A prospective cohort design was used with data on routine assessments of 1897 children aged 5 to 6, and 10 to 11 years. Primary outcomes were the detection of overweight, visual disorders and psychosocial problems, with the type of approach (traditional vs triage) as the independent variable. To assess the severity of health problems, BMI, Snellen, Strengths and Difficulties Questionnaire, and Child Behavior Checklist, scores were compared for both approaches in subgroups of children with overweight, visual disorders or psychosocial problems.

### *Results*

No significant differences were found between the approaches in terms of the detection of incident cases of overweight, visual disorders and psychosocial problems. Significantly higher Strengths and Difficulties Questionnaire scores were found in the subgroup with psychosocial problems when the triage approach was used. Marginal differences between the approaches were found for severity of overweight in the subgroup of overweight children.

### *Conclusions*

A novel triage approach to PCH resulting in less involvement of physicians and nurses in routine assessments appears to detect health problems as effectively as the traditional approach in place.

More research is needed to determine the long-term outcomes of the 2 approaches.

**What's Known on This Subject**

Scientific evidence is available about health and economic effects of screening activities in preventive child health. Efficient use of the skills of physicians and nurses using triage may help to improve the accessibility of health services and quality of care.

**What This Study Adds**

A novel triage approach to preventive child health care resulting in less involvement of physicians and nurses in routine assessments appears to achieve levels of health problem detection that are comparable with the traditional approach in which all children are assessed regularly.

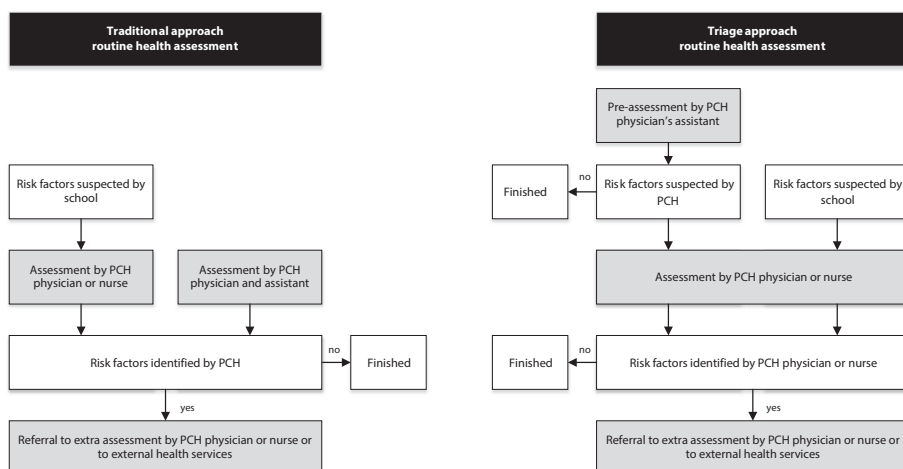
**INTRODUCTION**

Preventive services that screen health and monitor child growth and development contribute significantly to the early detection of physical and mental health problems in children [1,2]. Sufficient evidence exists that screening for amblyopia, monitoring of psychosocial problems and growth in children of elementary school age, enhance health and social well-being [3-7]. However, awareness is growing that preventive services for children must be conducted more cost-efficiently and better alignment with current health system issues, such as improved use of physician and nurse competences, evolving health priorities, inequities in health, and uneven access to preventive care [8-11].

Many countries have preventive child health care (PCH) programs for universal routine child health assessments, and vaccination programmes. The Netherlands has a free PCH program for all children aged 0 to 18 years, including ~17 routine health assessments. They are examined for a wide range of disorders such as congenital disorders, visual and hearing impairment, psychosocial problems, motor dysfunction, and overweight. The attendance rate of the routine programme is > 90% [12]. The PCH assessments are conducted by specialized community physicians or nurses ("PCH professionals"). When problems are identified by PCH professionals, they decide whether to refer for extra assessments by PCH or to external specialised care.

The Dutch system of health assessments is currently being debated, despite its proven merits [5-13]. A criticism is that routine assessments at isolated points in time provide only snapshots of the dynamic process of development and growth, especially during school age. Moreover, the issue of responsibility for the detection of health problems in children has been discussed: does this reside entirely with PCH professionals, or is it a responsibility that should be shared with parents or, for example, teachers?

In response to this criticism, a novel approach has been developed for routine health assessments for children aged 4 to 18 years based on triage and shifting of tasks among PCH professionals. A triage assessment procedure allows physicians and nurses to focus more on children with special health care needs often linked to social inequity, mental health, and lifestyle-related problems [14,15]. Furthermore, the workload of physicians for routine health assessments can be reduced, improving the accessibility and quality of care [14,15]. A 2-step triage procedure has been introduced in the Netherlands to identify more efficiently children with potential health problems. (see Fig. 1). Children are first seen by a physician's assistant who follows a strict preassessment protocol. The assistant refers only children with suspected health care needs to a follow-up assessment by a PCH physician or nurse. Both pre-assessment and follow-up assessment are part of the triage procedure.



**Figure 1.** The delivery of care by routine health assessments: the traditional approach and the triage approach compared.

A pilot study of the triage approach [16] found no change in accessibility of PCH, but significantly fewer children were referred for extra PCH assessment or for treatment by an external specialist than in a traditional approach. Further research was needed to compare the quality of care delivered by the triage approach to traditional PCH.

This article describes a study of the implications of the triage approach for routine child health assessments. The research question addressed was as follows: How does the triage approach perform compared with the traditional PCH approach in terms of identifying overweight, visual disorders and psychosocial problems?

## METHODS

A prospective observational cohort design was used to study PCH levels of health-problem detection. The Medical Ethics Committee of Leiden University Medical Centre approved this study.

### *Study sample*

We obtained our sample from a population of elementary school children attending PCH services in 4 distinct urban and nonurban areas in the Netherlands. Two services used the triage approach, and 2 services the traditional approach. The study group was randomly selected from schools stratified for socio-economic status (low, middle and high status) and urban or rural area. All children eligible for routine assessment and aged 5 to 6, or 10 to 11 years were then selected and routine health assessments were organised at the selected schools. A sample of 986 children (21 schools) went through the traditional approach, and a sample of 1008 children (20 schools) went through the triage approach.

### *Data collection*

Data were obtained from routinely registered digital PCH records. Additional data for new cases detected by PCH were registered in their records for the following health problems: overweight, visual disorders and psychosocial problems. These health indicators were chosen because identification procedures for these items are known to be valid [12,13]. The assessment procedures were described in uniform protocols for all PCH services covered by this study and

the PCH professionals participating were informed about these protocols. For the sake of completeness, a random sample of the data set from the PCH records was checked manually. The quality of data relating to health outcomes was checked by comparing them with information from other registered data fields and open answers about the children's health status. Children in the study sample underwent assessments from January to April 2012. Data relating to children requiring follow-up assessment were included until December 2012.

### *Procedures*

The traditional health assessments were conducted with parents present. Triage preassessments were conducted in the absence of parents, but they were asked to provide consent for the triage screening. Before the screening or the routine health assessment took place, parents filled out a general questionnaire about the health of their child and the Strengths and Difficulties Questionnaire (SDQ) questionnaire to measure psychosocial problems [18]. We used the Child Behaviour Checklist (CBCL) as a gold standard to assess whether PCH professionals failed to identify children with psychosocial problems. The CBCL is a validated questionnaire that measures behavioural and emotional problems [19,12]. Random samples of 300 parents for each approach were asked to fill out the CBCL, which was sent with the standard invitations. The completed CBCL questionnaires were returned to the PCH in a sealed envelope and directly forwarded to the research institute. In addition, parents of children identified with psychosocial problems by the PCH physician or nurse were asked to fill out a CBCL.

The following child and family sociodemographic variables were recorded by the PCH professionals: gender of the child (boy/girl) and age. The socio-economic status of the children was extracted from national census statistics and established on the basis of postal codes for their home addresses and on the basis of education, income and employment status of inhabitants of that area. Finally, the results of the assessments of height and weight, visual screening and psychosocial health status were recorded by the PCH professionals.

### *Outcomes*

Primary outcomes in this study were the incidence of overweight, visual and psychosocial problems. Overweight was determined by measuring height and weight, and classified using the child's Body Mass Index (BMI) according to



international standards, [22,23] in combination with the observations of the PCH professional. Visual disorders were determined using a visual acuity test (the Snellen chart with SD scores based on the Dutch general population) and an assessment of strabismus [13]. A visual disorder was classified as a problem (yes/no) if PCH professionals concluded that vision was insufficient on the basis of the tests.

Psychosocial problems included child behavioural and emotional problems, social interaction problems and/or child abuse. The identification of these psychosocial problems was based on the child's elevated SDQ total problem score or elevated SDQ impact scores [18], or on the response to the following question asked by the professional: "Are there additional child signs or signs expressed by others indicating a psychosocial problem?". SDQ cutoffs were calculated on the basis of the cutoffs used in PCH. The group of children identified with psychosocial problems by both methods were compared with the group of children with returned CBCL questionnaires. CBCL cutoffs were based on a large-scale Dutch sample using the 90<sup>th</sup> percentile for age and gender [24]. Children who had received or were receiving treatment were not classified as incident cases for any of the problems.

#### *Statistical analyses*

First, we used chi-square testing to assess differences between the background characteristics of children going through the 2 approaches. Next, we used logistic regression analysis to compare attendance rates of children attending the traditional PCH assessments, and triage preassessments and follow-up assessments, to analyze the response to both PCH approaches. Third, a comparison of the incidence rates for overweight, visual, and psychosocial problems between the 2 approaches was made using multilevel logistic regression analysis. We performed these analyses with identified problem by PCH (yes vs no) as outcome variable (overweight, visual disorder and psychosocial problem) and approach as predictor. In all analyses, we adjusted for socio-economic status. Multilevel analyses were conducted because the assessments of children were stratified by health care professional [25]. For all regression analyses, we studied the interaction effects of the children's age with type of approach on the outcome measures. Fourth, to study the severity of health problems found in both approaches, the BMI, Snellen and SDQ and CBCL

scores were studied in the subgroups of children identified with overweight, visual disorders or psychosocial problems using the chi-square test or Fisher's exact test. Finally, we compared the proportion of false-negative cases of psychosocial problems on the basis of the CBCL score of both approaches using chi-square test. Effects were statistically significant at a  $P < .05$  (2-sided). SPSS Statistics was used to analyze the data (SPSS 22.0 for Windows, SPSS Inc., Chicago, IL).

## RESULTS

### *Response and study sample*

The response for the routine assessments was the same in the triage and traditional approaches (Figure 2). The rate of attendance for the assessments in the traditional approach was 93.6%.

For triage, 96.6% of the children attended the preassessment, and 89.4% of the referred children attended a follow-up assessment by a physician or nurse (Figure 2).

The response to the CBCL questionnaire was higher from the parents in the triage approach compared to the traditional approach: 85.5% and 70.8%, respectively, in the random subsample who received the questionnaire, and 50.3% and 32.0%, respectively, in the subsample of children identified with psychosocial problems by PCH.

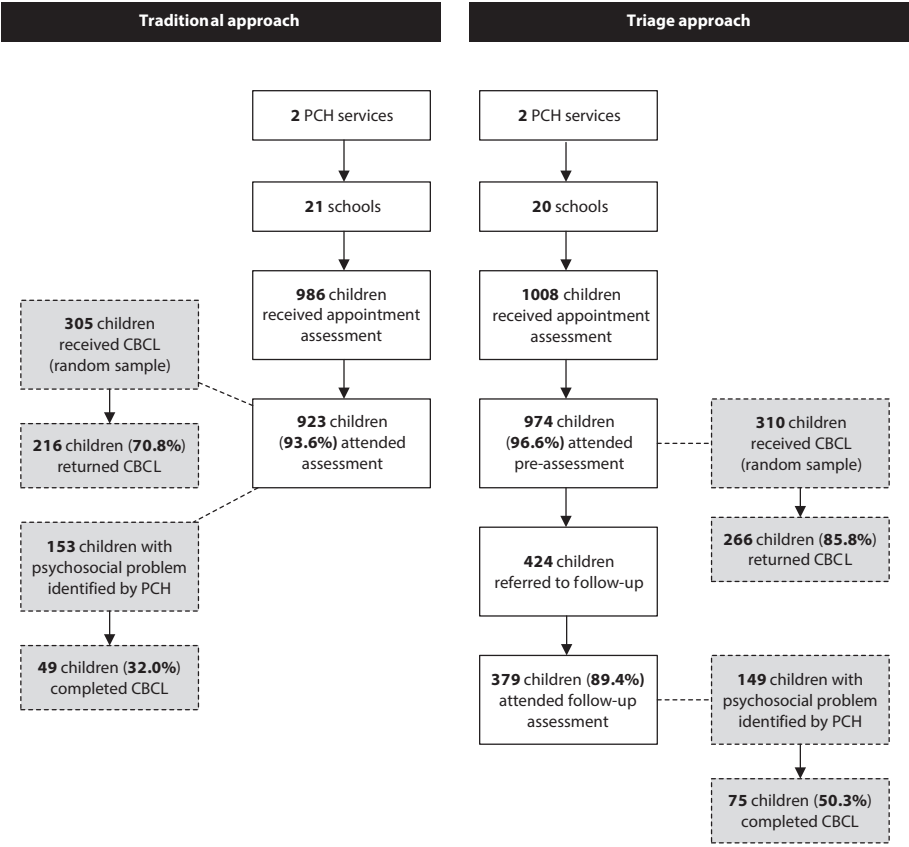


Figure 2. Response flow chart showing traditional and triage approach.

We found no differences in age or gender of the children in the triage and traditional approaches. However, there was a difference in the socio-economic status of the children (Table 1): the triage sample included more children of a low socio-economic status.

**Table 1.** Characteristics of children assessed by traditional and triage approach.

	<b>Traditional approach (N=923), N(%)</b>	<b>Triage approach (N=974), N(%)</b>
Gender		
Boy	455 (49.3)	485 (49.8)
Girl	468 (50.7)	489 (50.2)
Age (years)		
≤8	468 (51.8)	480 (49.3)
≥9	436 (48.2)	494 (50.7)
Socio-economie status (SES)*		
Low	342 (37.1)	415 (42.9)
Middle	372 (40.4)	304 (31.4)
High	207 (22.5)	249 (25.7)

\*  $P < 0.001$ *Incidence of identified problems by PCH versus approach*

We did not find differences between the 2 approaches for the incidence of overweight, visual disorders and psychosocial problems (Table 2). Because routine PCH assessments were carried out in the age groups 5 to 6 and 10 to 11 years, interaction effects of the PCH approach with children's age on the incidence of overweight, psychosocial and visual problems were studied. No such interaction effects were found. In other words: age had no influence on the relation between PCH approach and incidence of identified problems.

**Table 2.** PCH physician or nurse in the traditional approach and the second step of the triage approach / Rates of detection of incident cases of overweight, visual disorder and psychosocial problems in the traditional and triage approaches to preventive child healthcare assessment.

	<b>Traditional approach (N=923)</b>	<b>Triage approach (N=974)</b>			
	<b>Assessment by PCH physician or nurse, N( %)</b>	<b>Pre-assessment by PCH physician's assistant, N( %)</b>	<b>Follow-up assessment by PCH physician or nurse, N( %)</b>	<b>Odds Ratio<sup>^</sup></b>	<b>95%CI</b>
Overweight	85 (9.2)	153 (15.7)	70 (7.2)	0.8	0.4 -1.3
Visual disorder	25 (2.7)	55 (5.5)	21 (2.2)	0.9	0.6 -1.4
Psychosocial problem	153 (16.6)	172 (17.7)	149 (15.3)	0.9	0.6 -1.2

<sup>^</sup> Multilevel logistic regression analyses with health problems as the outcome variable, the approach (traditional assessment or follow-up triage assessment) as the independent variable, and socio-economie status as co-variate

We found a marginal difference in numbers of children with elevated BMI scores in the triage and traditional approaches. The subgroup of children identified with overweight in the triage approach included more children with a BMI indicating severe obesity than the traditional approach, which found more children with a BMI indicating overweight.

We also found a statistically significant difference in the subgroup of children with psychosocial problems identified by PCH. More children identified with psychosocial problems in the triage approach had an elevated SDQ score than children in the traditional approach.

We also assessed whether, on the basis of their CBCL scores, children with psychosocial problems were missed by PCH professionals (in other words, whether there were false-negatives). On the basis of their CBCL score, 2 children in the traditional group and 1 child in the triage group were not identified as having a psychosocial problem by the PCH physician or nurse.

**Table 3.** *The association between the preventive child healthcare approach and the BMI, Snellen, SDQ and CBCL scores in subgroups of children with overweight, visual disorder or psychosocial problems as identified by the physician or nurse#*

	Traditional approach, N (%)	Triage approach, N (%)
Identified overweight by PCH	85 (100)	70 (100)
BMI overweight	65 (78)	50 (71)
BMI obese	14 (17)	20 (29)*
Identified visual disorder by PCH	25 (100)	21 (100)
Insufficient Snellen score	18 (75)	17 (90)
Identified psycho social problem by PCH	153 (100)	149 (100)
Elevated CBCL	6(12)	17 (23)
Elevated SDQ	88 (58)	124 (83)**

\*  $P = 0.05$

\*\*  $P < 0.001$

# Missing data (BMI N=2; visual disorder N=3; SDQ N=0; CBCL N=178, due to non-response of the CBCL in the subsample of children identified with a psychosocial problem, see figure 2.)

## DISCUSSION

This study aimed to investigate the detection of health problems in PCH with a new triage approach in routine health assessments for children aged 5 to 6, and 10 to 11 years.

We found no difference in the detection rates for incident cases of overweight, visual and psychosocial problems between the triage approach and the traditional approach. The study found a marginal difference between the 2 approaches in the BMI scores in subgroups of children identified with overweight or obesity by PCH. In the triage approach the subgroup of children identified with overweight included more children with a BMI indicating obesity, while the traditional approach included more children with a BMI indicating less severe overweight. Significantly higher SDQ scores were found in the subgroup of cases with identified psychosocial problems when the triage approach was used compared to the traditional approach.

These results can be explained by differences in the assessment procedures used in the two approaches[16]. Triage preassessments are conducted in the absence of parents, whereas the traditional health assessments are conducted with parents present. Literature claims that the early detection of health problems is more accurate when parents are present [24,26], but this study did not find a difference in identification rates between the 2 approaches.

The detection of children with higher scores on BMI obesity and SDQ by PCH with the triage approach, may be the result of the inclusion of more children with a lower socio-economic status in the triage group facing these health problems. The higher proportion of children with elevated scores can also be explained by the different organization of assessments of children of the 2 approaches, where all children with elevated BMI and SDQ scores during the triage pre-assessment are referred to follow-up by a physician or nurse for further diagnostic assessment [17].

### *Strengths and weaknesses of the present study*

A strength of this study is that the 2 approaches were studied by comparing random samples of schools stratified by socio-economic status. We included a homogeneous group of children with regard to gender and age range and controlled for differences in socio-economic status. Moreover, the sample

in the current study was selected from the general Dutch population from urban and rural areas, making generalisation of the findings to other PCH organisations possible. Another strength is that we analyzed the incidence rates of a limited number of health problems for which commonly used standard screening guidelines exist. All 4 PCH services implementing triage and traditional approaches in this study used these guidelines, reducing the possibility of identification and reporting bias. We used the CBCL as a reference for the accuracy of identification of psychosocial problems in the 2 approaches because it is known to be a valid and well-adapted measure for psychosocial problems [19-21].

There are some methodological limitations that may have affected our results. The outcomes of the triage approach may be affected by a difference in the extent of the implementation of the innovative triage approach in the 2 triage PCH services. The 2 traditional PCH services had already been working with the traditional approach for a long time. Because it takes time to establish uniformity and adequate skills levels among all professionals working with the triage approach, the comparability with the traditional approach may have been affected. Another limitation is that the differences in detected severe problems between the triage and traditional group could not be confirmed by further diagnostic assessments. Finally, the small group size of the parents who returned CBCL questionnaires and the lower response in the traditional PCH group may also be a limitation. Prevalence of elevated CBCL may be underestimated in this response group.

#### *Implications for practice and directions for future research*

Economic circumstances and changing health demands urge to develop new ways of delivering care. The triage approach with task-shifting may be a promising way to achieve efficiency gains for routine assessments. In that case, more time will be available for physicians and nurses to focus on children with special healthcare needs that are often linked to social inequity, mental health, and lifestyle-related problems [14,15].

The differences in severity with respect to BMI and SDQ raises the question from a preventive public health perspective whether it is better to detect all children as early as possible or to select the more severe problems with a more

efficient approach. An advantage of the triage approach may be that parents with children with more severe problems are more willing to accept referral to extra care if necessary, with more promising results of further treatment. On the other hand, advice can be given to parents of children with less severe problems when all children are being assessed.

Research is needed to assess the accuracy of detection using the triage approach. An examination of the outcomes of referrals for extra assessment by PCH professionals or external specialized care providers could provide a picture of the accuracy of health-problem detection. More validated tools are needed with respect to the detection of health problems other than those included in this study. Availability of such tools enables the assessment of the generalizability of the triage approach in general. Research is also needed into the effects of triage in age groups other than those included in our study. On the basis of differences in salaries of the various professionals, we expect that the triage approach will lead to cost savings compared to the traditional approach (~10-20%); however, further research is required to document a possible reduction in healthcare costs when using a triage approach and task-shifting compared to the traditional approach.

## CONCLUSION

Our study indicates that a novel triage approach to preventive child health assessment with less use of physicians and nurses appears to be as successful in detecting health problems in children as the traditional approach in which all children are regularly assessed. However, more research is needed to determine the long-term outcomes of the identification procedures for both approaches.

### **Contributors' Statements**

Janine Bezem: drs. J. Bezem developed the triage approach, and contributed to the development of the triage protocols, acquisition and interpretation of data, and the drafting of the initial manuscript.

Meinou H.C. Theunissen: dr. M. Theunissen contributed to the design of the data collection instruments, carried out the analyses and interpretation of data, and reviewed the manuscript.



Mascha Kamphuis: dr. M. Kamphuis coordinated and supervised data collection, and critically reviewed the manuscript.

Mattijs E. Numans: Prof. dr. M.E. Numans contributed to the intellectual content and revision of this paper, and critically reviewed the manuscript

Simone E. Buitendijk: Prof. dr. S. Buitendijk contributed to the revision of the intellectual content of this paper, and critically reviewed the manuscript.

Paul L. Kocken: dr. P. Kocken was responsible for the concept and design, the analysis and interpretation of data, and the review and revision of the manuscript.

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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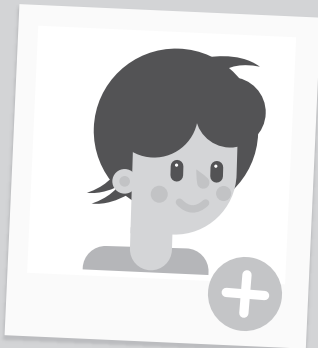
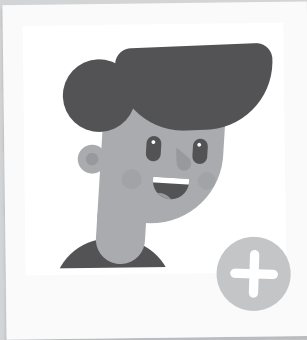
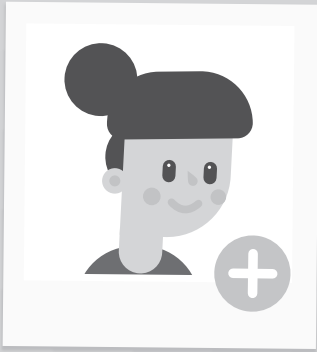
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**Triage in Preventive Child  
Health care:  
a prospective cohort study  
of care use and referral  
rates for children at risk**



4

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## ABSTRACT

### *Objectives*

A novel triage approach to routine assessments was introduced to improve the efficiency of Preventive Child Health care (PCH): PCH assistants carried out pre-assessments of all children and sent the children with suspected health problems to follow-up assessments conducted by a physician or nurse. This two-step approach differed from the usual approach, in which physicians or nurses assessed all children. This study was aimed to examine the impact of triage and task-shifting on care for children at risk identified by PCH or parents and schools.

### *Design, participants*

An observational prospective cohort design was used, with an analysis of the basic registration data from the preventive health assessments for 1897 children aged 5 to 6, and 10 to 11, years from a sample of 41 schools stratified by socio-economic status, region of PCH service and urbanisation.

### *Setting*

A comparison was made between two PCH services in the Netherlands that used the triage approach and two PCH services that provided the usual approach.

### *Main outcome measures*

The primary outcome measures were the referral rates to either additional PCH assessments or external services. The secondary outcome measures were the rates of PCH assessments requested by, for example, parents and schools.

### *Results*

Overall, a higher referral rate to additional PCH assessments was found for the triage approach than for the usual approach (OR 1.3, 95%-C.I. 1.0-1.6), mainly in the age group of 5 to 6 years (OR 1.9, 95%-C.I. 1.3-2.7). We found a lower rate of referral to external services in the triage approach (OR 0.4, 95%-C.I. 0.3-0.7) and a higher referral rate to PCH assessments on request (OR= 4.6, 95%-C.I. 3.0-7.0).

### *Conclusions*

The triage approach provides extra opportunities to deliver PCH assessments and PCH assessments on request for children at risk. Further research is needed into the cost benefits of the triage approach.

### *Keywords*

Triage. Task-shifting. Health service supply and distribution. Primary care. Prevention. School health services. Children. Screening.

## ARTICLE SUMMARY

### **Strengths and limitations of this study**

- The inclusion of four PCH services from urban and rural areas, improving the external validity of the study.
- The inclusion of a random sample of schools stratified by socio-economic status, region of PCH service and urbanisation.
- We selected groups of children that were homogeneous in terms of gender and age, and controlled in the analyses for differences in socio-economic status.
- We were not able to monitor the outcome of the referrals to additional PCH assessments or to external services because we were not allowed to analyse the individual details of the children in the absence of informed consent.

## BACKGROUND

Changes in the prevalence of disorders such as mental health problems, the need to prevent violence, increases in lifestyle-related problems and apparent health inequities between subgroups of children all mean that improvements are needed in the system of community preventive services for children [1-6]. These preventive services face several challenges, such as accessibility to care, programme quality and the efficient use of professionals [7,8]. Changes and improvements to health care systems could be accomplished by introducing triage and the shifting of tasks between health care professionals. Task-shifting is defined as the delegation of existing tasks to current or new professionals who have less and/or more specific training[9]. Triage and task-shifting may result in the more optimal use of the skills and expertise of health care professionals, reduce workloads for physicians and nurses, and therefore improve the quality of care and result in greater patient satisfaction [9,10]. Research in primary care shows that shifting tasks from physicians to nurses dealing with chronic disorders results in more additional assessments by nurses after the initial visit of the patient and that the number of referrals to secondary care is similar for nurses and physicians. Nevertheless, this type of task-shifting has a clearly positive impact on patient satisfaction [11-14].

Preventive Child Health care (PCH) services in several countries provide vaccinations and routine assessments using a pre-defined age schedule (see Figure 1 for a glossary of terms used for PCH care). The aim is to monitor child growth and development and to prevent child health problems [8,15]. In the Dutch PCH programmes, all children receive 17 unsolicited routine assessments: 13 in the first 3 years of life (in well-child clinics) and 4 in the age group 4 to 18 years (in school health services).

The routine assessments consist of standardised screening procedures targeting several health-related topics. Specially trained community-based physicians, nurses and assistants ('PCH professionals') work separately from specialised clinical care-providers such as paediatricians or other clinical health professionals. In the usual approach in PCH, all children are initially assessed by a PCH physician or nurse, who will sometimes receive support from PCH assistants who have been trained at the secondary vocational level that focuses specifically on medical issues. The Dutch PCH services are free of charge and



Routine assessment:	A health assessment routinely conducted by PCH services accessible for all Dutch children and provided unsolicited and free of charge, using a pre-defined schedule of invitations to the assessments from birth till the age of 18.
Usual approach of routine assessments:	The "traditional" way of routine assessments provided to all children by a PCH physician and PCH assistant, or by a PCH nurse who is sometimes supported by a PCH assistant.
Triage approach of routine assessments:	A two-step assessment approach of routine assessments, in which all children are preselected by a PCH assistant for a follow-up assessment. In case of suspected health problems the routine assessment also includes a follow-up assessment by a PCH physician or nurse.
Pre-assessment:	First step in the triage approach conducted by a PCH assistant accessible for all children to select children with suspected health problems.
Follow-up assessment:	Second-step in the triage approach by a PCH physician or nurse to children with suspected health problems who are referred after a pre-assessment by the PCH assistant.
Assessment on request:	Assessment at the request of parties such as parents or school professionals who suspect risk factors with regard to the health of the child. These assessments are conducted by a PCH physician or nurse and are not part of the routine assessment schedule. In both usual and triage approach, assessments on request are possible.
Additional PCH assessment:	An additional assessment of a child identified with health problems, conducted by a PCH physician or nurse, resulting from a routine assessment or an assessment on request.
External service:	A general practitioner, specialist or other care provider, to which children identified with health problems have been referred as a result of a routine assessment, additional PCH assessment, or assessment on request by PCH.
Extra care:	An additional PCH assessment or care by an external service directed to children identified with health problems.

**Figure 1.** Glossary of the assessments stages and care provided by the usual and triage approaches in Preventive Child Health Care (PCH).

attendance rates can be more than 85% [16,17]. When problems are identified, PCH physicians and nurses decide whether there is any need for advice, additional assessments by PCH, or referral to external services such as a general practitioner or a specialist. The referral to the services appropriate to the needs of the children is an essential component of the health screening programmes delivered by PCH [18].

The PCH programme needs to be more flexible and demand-driven than in the current pre-defined schedule, in which there are only four assessments during a school career, in order to respond to the changing care needs of the children. PCH assessments traditionally provide snapshots of the dynamic process of development and growth of children at isolated points in time, even though most children will have no problems at those times. PCH needs to improve its

accessibility, be more available for children and parents throughout the school period, and offer care when it is needed.

To achieve a more flexible provision of care, a two-step triage approach was developed for children aged 4 to 18 years involving triage and the shifting of tasks from PCH physicians and nurses to PCH assistants [19]. In the triage approach, children are pre-assessed by a PCH assistant using a strict protocol which includes the completion of questionnaires by parents and teachers, and face-to-face screening (that covers areas such as growth, hearing and vision). Only children with suspected health concerns are selected by the PCH assistant for follow-up assessment by a PCH physician or nurse. The triage approach could reduce the involvement of physicians and nurses in routine assessments, and therefore release resources that can be used for PCH assessments for children at risk. When children are referred for follow-up assessment, the nature and complexity of the suspected health problems determines whether that assessment should be conducted by a physician or a nurse: physicians attend to medical and developmental disorders and nurses attend mostly to psychosocial problems and lifestyle issues. Pre-assessments at schools by PCH assistants are conducted in the absence of parents but with parental consent. Follow-up assessments by a physician or nurse take place in the presence of a parent in order to allow for interaction with the PCH professional about the potential health concerns detected by the PCH assistant. In both the usual and the triage approaches, children in whom health concerns have been identified in the routine assessments may be referred to extra care, in other words additional PCH assessments or external services appropriate to the children's specific needs. In both approaches, children may be assessed at the request of, for example, parents or school professionals (we will refer to these assessments as 'PCH assessments on request'). PCH assessments on request are intended for children from age groups other than those pre-defined for the routine assessments in order to reach all children in need of care. A pilot study of the triage approach that compared appointment attendance and referral rates in the triage and the usual approach was conducted before the present study. We found that attendance levels were the same, and that the referral rate to additional PCH assessments or external services was lower, in the triage approach than in the usual approach [19]. Another study showed that routine assessments in a triage approach detect health concerns as effectively as the usual approach[20]. Our study of the costs of the routine assessments in the

two approaches showed that the triage approach resulted in a cost reduction of about one-third for the age group of 5 to 6 years and a minimal cost reduction for the age group of 10 to 11 years [21]. The present study examined the impact of triage and task-shifting on care for children at risk who were identified by PCH or by external parties such as parents and schools. It addresses the following research questions:

- What are the rates of referral to additional PCH assessments and external services resulting from routine assessments in the triage approach as compared with the usual PCH approach?
- What are the rates of PCH assessments on request, including the referral rates resulting from these assessments, when a triage approach is used rather than the usual approach?

## METHODS

An observational prospective cohort design was used to study the research questions.

### **Study sample**

The study was conducted with routine and administrative data from four PCH services active in four separate regions in the Netherlands. Two services used the triage approach and two services the usual approach. Each PCH service covers a population of around 125,000 children from birth to the age of 18 years. A sample of primary schools stratified for socio-economic status (low, middle and high status), region of the PCH service, and urban or rural area was randomly selected from these four services. To obtain sufficient and equal numbers of children for both study groups (in other words, the triage and usual approach), 20 schools that used the triage approach were matched with 21 schools that used the usual approach. The socio-economic status of the schools was determined using national census statistics. Routine assessments were conducted by PCH services in Dutch primary schools for two age groups: 5 to 6 years, and 10 to 11 years. To study the referral rates to additional PCH assessments and external services, the study included all the children aged 5 to 6 and 10 to 11 years from the selected schools who were offered a routine assessment. A sample of 1008 children who received the triage approach was compared with a sample of 986 children who received the usual approach. In the usual approach, all children aged 5 to 6 years are assessed by a physician and children aged 10 to 11 years are assessed by a nurse. When medical problems are suspected, nurses must refer the child for an additional PCH assessment by a physician. In the triage approach, all children are pre-assessed by a PCH assistant and follow-up assessments are conducted by PCH physicians and nurses. In addition to routine PCH assessments, we also investigated PCH assessments on request. To study the referral rates to PCH assessments on request, we followed all children attending the schools selected for this study for a maximum of 12 months (the reference population). This resulted in a sample of 4050 children in the schools where the triage approach was used and 4611 children in the schools where the usual approach was adopted. Since there were no vital changes or interventions in health care, and all the data were fully anonymised and coded, and since the data did not include medical details that could be linked to individuals before inclusion in this study on a population level, no informed consent was needed.

### **Data collection**

Study data were registered in digital PCH records during the study period. In addition, data were registered for the PCH assessments on request. The

assessment procedures were described in uniform protocols for all PCH services covered by this study and the participating PCH professionals were informed about these protocols. For the sake of completeness, we compared a random sample from the analysis data file with the data in the PCH records. Children in the study sample who received triage pre-assessments or assessments as usual were included from January to April 2012. Data relating to children requiring triage follow-up assessment and PCH assessments on request were included and the children were followed until December 2012.

## Procedures

When weight problems, visual disorders and/or psychosocial problems were identified by PCH physicians and nurses, the children were referred to additional PCH assessments or external services. We chose these three health indicators because the relevant procedures are established and known to be valid [17,22]. Children were referred for these indications after the follow-up assessment in the triage approach, and after the routine assessment in the usual approach. When school professionals or parents suspected the presence of risk factors in children, they were allowed to request an assessment by PCH for further identification. After problems were identified by a PCH physician or nurse, these children could also be referred for additional PCH assessments or to external services (Figure 2).

PCH professionals registered and coded socio-demographic variables in digital PCH records that included gender and age, weight, visual and psychosocial health status, and referrals to additional PCH assessments and to external services. The socio-economic status of the children was established using national census statistics and on the basis of postal codes for their home addresses using education, income and employment status of the local population [23].

Weight, visual and psychosocial health status were assessed and recorded in the digital PCH records as usual. Problems with weight (both overweight and underweight) were determined using the body mass index and assessment by the professional. The thresholds used by the international obesity task force were adopted as the BMI cut-off points for overweight and obesity [24]. Standard deviation (SD) scores for BMI were based on the Dutch general population [25]. Visual disorders, including amblyopia and impaired vision, were determined using a visual acuity test: the Snellen chart with SD scores based on the Dutch

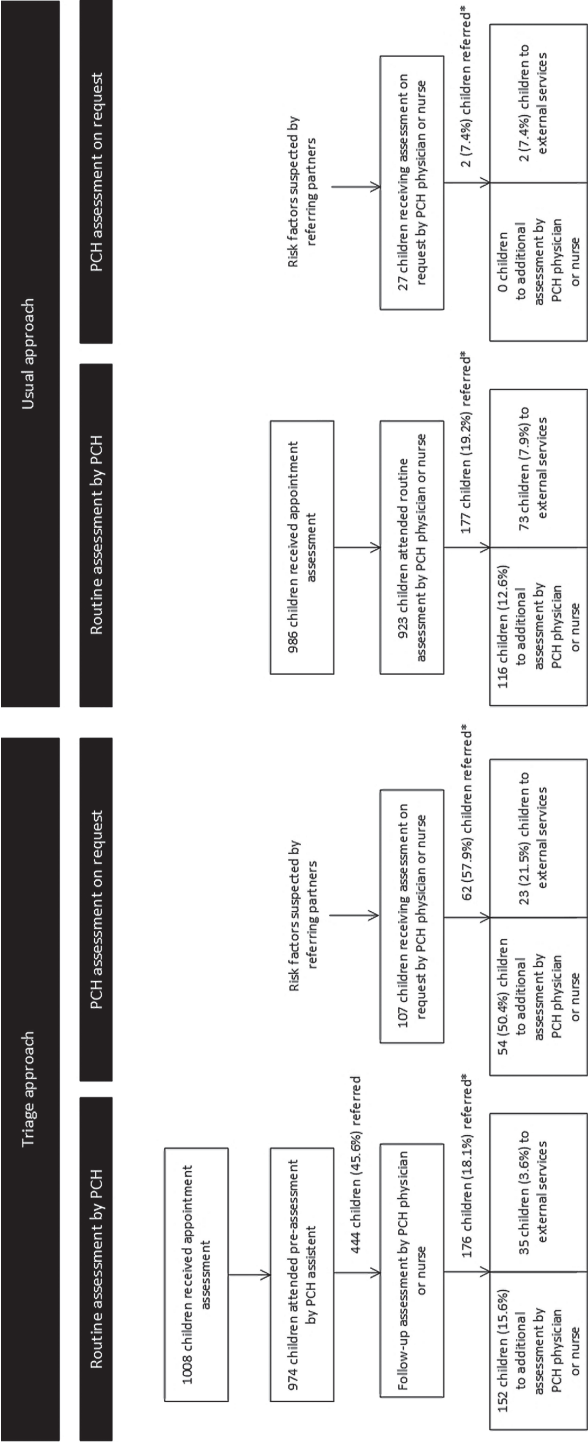


Figure 2. Flowchart for the PCH routine assessment and assessment on request in the triage and usual approaches

\* some children were referred to both additional PCH assessment and external services.

general population [22]. Psychosocial problems included child behaviour and emotional problems, social interaction problems and child abuse. The identification of these psychosocial problems was based on the assessment made by the PCH professional, and it also included the child's scores on the Strengths and Difficulties Questionnaire [26,27].

All referrals to additional PCH assessments or to external services were registered and coded by the PCH professionals.

Finally, records were kept of whether requests for PCH assessments were made by parents, school professionals or professionals in well-child care. The referrals to additional PCH assessments and to external services subsequent to these assessments were also registered.

### **Study outcomes**

The primary outcomes of this study were the rates of referral to additional PCH assessment and to external services as a result of the routine assessments. The secondary outcomes were the rates of PCH assessments on request, and rates of referral to additional PCH assessment and to external services resulting from these assessments.

### **Statistical analyses**

Our first step was to look at differences in background characteristics such as gender, age and socio-economic status between the two cohorts using chi-square tests. Secondly, we studied the rates of referral to follow-up assessments in the triage approach. We also made separate analyses of the referral rates to additional PCH assessment and external services, and the sum of referrals to additional PCH assessments and to external services. We tested differences in rates of referral between the two approaches using three separate logistic regression analyses with the outcome variables 'referral to additional PCH assessment', 'referral to external services' and 'sum of referrals to additional PCH assessments and external services'. Adjusted Odd Ratios (OR) were calculated in all logistic regression analyses. We adjusted for socio-economic status. Missing data were excluded from the regression analyses. These analyses were repeated for the subgroups of children referred for weight problems, visual disorders and psychosocial problems.

Because routine PCH assessments were conducted in the age groups of 5 to 6 and 10 to 11 years, the interaction effects of child age and the type of approach

(in other words, the triage and usual approaches) on the outcome measures were studied. When we found interaction effects associated with child age, the analyses were repeated separately for the age groups of 5 to 6 and 10 to 11 years. Thirdly, we compared the rates of PCH assessments on request in the two approaches using Fisher's exact test. In these analyses, the total sample of children of the schools participating in this study was used as the reference population. We also assessed whether children were referred by different parties (school, parents, well-child care, other) in the two approaches. Furthermore, we assessed the differences between the two approaches in the rates of referral for the group of children who received a PCH assessment on request. Due to the small number of children referred to PCH assessment on request in the usual approach, it was not possible to adjust for background characteristics. We therefore used Chi-square and Fisher's exact tests (categories were tested separately). In these analyses, the sample of the group of children who received a PCH assessment on request was used as the reference population. Effects were considered to be statistically significant when the p-value was  $\leq 0.05$  (2-sided). SPSS Statistics was used to analyse the data (SPSS 22.0 for Windows, SPSS Inc., Chicago, IL).



## RESULTS

### *Study sample*

To study the rates of referral to additional PCH assessments and external services, we compared a sample of 1008 children who were eligible for a pre-assessment in the triage approach with a sample of 986 children who were eligible for an assessment in the usual approach (Figure 2). To investigate the rates of PCH assessments on request a sample of 4050 children in the schools where the triage approach was used was compared with a sample of 4611 children in the schools where the usual approach was adopted.

We found no differences in the ages or genders of the children receiving routine assessments in the triage and usual approaches. However, the socio-economic

**Table 1.** Characteristics of children assessed using the triage and usual approaches to PCH

Characteristics	Triage approach n (%)	Usual approach n (%)	p-value
<b>Children receiving routine assessment*</b>	N=974	N=923	
Gender			
Boy	485 (49.8)	455 (49.3)	0.83
Girl	489 (50.2)	468 (50.7)	
Age (years)			
≤8	480 (49.3)	468 (51.8)	0.28
≥9	494 (50.7)	436 (48.2)	
Socio-economic status			
Low	415 (42.9)	342 (37.1)	<0.01
Middle	304 (31.4)	372 (40.4)	
High	249 (25.7)	207 (22.5)	
<b>Children receiving assessment on request**</b>	N=107	N=27	
Gender			
Boy	67 (62.6)	10 (40.0)	0.04
Girl	40 (37.4)	15 (60.0)	
Age (years)			
≤8	78 (72.9)	21 (77.8)	0.61
≥9	29 (27.1)	6 (22.2)	
Socio-economic status			
Low	68 (65.4)	17 (70.8)	0.61
Middle	22 (21.2)	2 (8.3)	
High	14 (13.5)	5 (20.8)	

\* Missing data (triage approach: socio-economic status n=6; usual approach: age n=19, socio-economic status n=2).

\*\* Missing data (triage approach: socio-economic status n=3; usual approach: gender n=2, socio-economic status n=3).

status of the children did differ: the triage sample included more children with a lower socio-economic status (Table 1). No differences were found in the ages or socio-economic status of the group of children receiving PCH assessments on request. There was a gender difference in the group of children receiving assessments on request: more boys received an assessment on request in the triage approach than in the usual approach (Table 1).

### **Referral to additional PCH assessments or to external services**

The percentage of children referred from pre-assessment to a follow-up assessment in the first step of the triage approach was 45.6% (444 of 974).

We did not find any difference between the rates of referral for the total group of children referred to extra care (in other words, the children referred to additional PCH assessments and/or to external services) in the two approaches: 176 of 974 children (18.1%) in the triage group were referred to extra care after the follow-up assessments, and 177 of 923 children (19.2%) were referred from the usual approach (OR=0.9, 95%-C.I. (0.7-1.1)) (Figure 2, Table 2). A closer look at these rates indicates that there was a higher referral rate to additional PCH assessments (OR 1.3, 95%-C.I. 1.0-1.6) and a lower referral rate to external services in the triage approach than in the usual approach (OR 0.4, 95%-C.I. 0.3-0.7).

*Weight problems.* The percentage of children referred to extra care was different in the group of children found to have a weight problem. In the triage group, 44 of 974 children (4.5%) were referred to extra care for a weight problem after 150 of 974 (15.4%) had been referred to a follow-up assessment by a PCH physician or nurse. In the usual group, 48 of 923 children (5.2%) were referred to extra care. The lower referral rate by triage PCH for a weight problem was particularly striking in the referrals to external services: 3 of 974 children (0.3%), as opposed to 13 of 923 (1.4%) in the usual PCH group (OR=0.2, 95%-C.I. 0.1-0.7).

*Psychosocial problems.* We found no difference between the triage and usual groups in the percentage of children with psychosocial problems who were referred to extra care. However, we found a difference in the percentage of referrals to external services: 1.2% of children (12 of 974) in the triage group were referred to external services; the rate of referral was 2.5% (23 of 923) in the usual group (OR=0.5, 95%-C.I. 0.2-1.0).

*Visual problems.* No differences were found between the referral rates to extra care in the triage and usual approaches for the health indicator 'visual disorder'.

Interaction effects were found for child age. In the age group of 5 to 6 years, no differences were found between the two approaches in the total referral rates for extra care (including additional PCH assessments and external services). When looking closer at the type of extra care to which children were referred, we found a higher referral rate to additional PCH assessments in the age group of 5 to 6 years when the triage approach was used (OR=1.9, 95%-C.I. 1.3-2.7). In the age group of 10 to 11 years, a lower referral rate was found to extra care in the triage group (including additional PCH assessments and external services) than in the usual group (OR=0.6, 95%-C.I. 0.4-0.9). This effect was found for additional PCH assessments in particular (OR=0.5, 95%-C.I. 0.3-1.0). In the age group of 10 to 11 years, a lower referral rate was found to extra care for weight problems (OR=0.6, 95%-C.I. 0.3-1.0) and for psychosocial problems (OR=0.5, 95%-C.I. 0.3-0.8) when the triage approach was used. When looking closer at the type of extra care, we found a higher referral rate to additional PCH assessments for psychosocial problems in the age group of 5 to 6 years when the triage approach was used (OR=2.2, 95%-C.I. 1.0-4.5).

**Table 2.** Association between referral to additional PCH assessment or to external services and the PCH approach (triage versus usual care)

	Triage approach N=974		Usual approach N=923		Odds ratio^	95% CI	p-value
	Referral after pre-assessment by PCH assistant	Referral after receiving a follow-up assessment from a PCH physician or nurse	Referral after assessment by PCH physician or nurse	n (%)			
<b>All referrals</b>							
Children referred to follow-up assessment	444 (45.6)	-	-	-	-	-	
Children referred to additional PCH assessment and/or external services	-	176 (18.1)~	177 (19.2)	0.9	0.7-1.1	0.42	
additional PCH assessment	-	152 (15.6)	116 (12.6)	1.3	1.0-1.6	0.09	
external services	-	35 (3.6)	73 (7.9)	0.4	0.3-0.7	<0.01	
<b>Indication for referral: weight problem</b>							
Children referred to follow-up assessment	150 (15.4)	-	-	-	-		
Children referred to additional PCH assessment and/or external services	-	44 (4.5)	48 (5.2)	0.8	0.5-1.3	0.36	
additional PCH assessment	-	43 (4.4)	38 (4.1)	1.0	0.7-1.6	0.89	
external services	-	3 (0.3)	13 (1.4)	0.2	0.1-0.7	0.01	
<b>Indication for referral: visual disorder</b>							
Children referred to follow-up assessment	47 (4.8)	-	-	-	-		
Children referred to additional PCH assessment and/or external services	-	16 (1.6)	22 (2.4)	0.7	0.3-1.3	0.25	
additional PCH assessment	-	10 (1.0)	10 (1.1)	1.0	0.4-2.4	0.94	
external services	-	8 (0.8)	14 (1.5)	0.5	0.2-1.3	0.15	

Table 2. Continued

	Triage approach N=974		Usual approach N=923		Odds ratio^	95% CI	p-value
	Referral after pre-assessment by PCH assistant	Referral after receiving a follow-up assessment from a PCH physician or nurse	Referral after assessment by PCH physician or nurse				
	n (%)	n (%)	n (%)				
<b>Indication for referral: psychosocial problem</b>							
Children referred to follow-up assessment	152 (15.6)	-	-		-	-	
Children referred to additional PCH assessment and/or external services	-	48 (4.9)	57 (6.2)	0.8	0.5-1.1	0.17	
additional PCH assessment	-	38 (3.9)	36 (3.9)	0.9	0.6-1.5	0.82	
external services	-	12 (1.2)	23 (2.5)	0.5	0.2-1.0	0.05	

^ Logistic regression analyses with referral by PCH as the outcome variable, the approach (triage follow-up assessment or usual assessment) as the independent

<sup>^</sup> Logistic regression analyses with referral by PCH as the outcome variable, the approach (triage follow-up assessment or usual assessment) as the independent variable, and socio-economic status as co-variate

~ Some children were referred to both additional PCH assessment and external services.

### PCH assessments on request

We found a higher rate of PCH assessments on request in the triage approach than in the usual approach ( $p < 0.01$ ) (Table 3). In particular, a higher rate was found for PCH assessments at the request of school professionals and of well-child care for the triage approach than in the usual approach. Furthermore, we found differences between the two approaches for the referral rates to additional PCH assessments pursuant to the PCH assessments on request. Half of the children seen on request were referred to additional PCH assessments and one out of five to external services in the triage approach. No children in the usual approach were referred to additional PCH assessments and 2 of 27 children (7.4%) were referred to external services.

**Table 3.** Association between PCH approach (triage versus usual care) and children receiving PCH assessments on request and referral of these children to additional PCH assessments or to external services

	Triage approach	Usual approach	p-value
	n (%)	n (%)	
	N=4050#	N=4611#	
Children receiving PCH assessment on request	107 (2.6)	27 (0.6)**	<0.01
	N=107	N=27	
Referring parties~			
School	18 (16.8)	0 (0.0) *	0.02
Parents	18 (16.8)	5 (18.5)	0.78
Well-child care	33 (30.8)	0 (0.0) **	0.01
Other	1 (0.9)	1 (3.7)	0.36
Unknown	37 (34.6)	21 (77.8) **	<0.01
Referral to additional PCH assessment and/or external services	62 (57.9)	2 (7.4) **	<0.01
additional PCH assessment	54 (50.5))	0 (0.0) **	<0.01
external services	23 (21.5)	2 (7.4)	0.09

# All children (4-12 years) at the schools included

^ Chi-square test / Fisher's exact test

~ The five categories were tested separately. For example, the school as the referring party was tested relative to all categories as a reference to analyse differences between the triage and usual approaches.

## DISCUSSION

The present study examined the impact of triage and task-shifting on care for children at risk identified by PCH or by external parties such as parents and schools. We compared the rates of referral to additional PCH assessments and external services after the identification of health concerns pursuant to routine assessments with either the triage approach or the usual approach. We did not find any differences between the total sum of referral rates to additional PCH assessments and external services in the two approaches. However, the referral rate to additional PCH assessments was higher in children aged 5 to 6 years and lower in children aged 10 to 11 years in the triage approach. Overall, the referral rates to external services resulting from the routine assessments were lower when triage was used rather than the usual approach. The differences between the referral rates could be attributed to the different processes used to identify health problems in the two approaches. In the two-step triage approach, children requiring follow-up (in other words, children with suspected health problems) are assessed twice. After the pre-assessment by the PCH assistant, the PCH physician or nurse and the parents need to focus only on the suspected health problems. In this follow-up assessment, more time may be available to provide advice, recommendations and reassurance. This could possibly reduce the need for referral to external services. Because the routine assessments in the usual approach are intended to cover all the different screening items, little time is available for a further investigation of the problems identified. This could explain why the referral rate to external services is higher in the usual approach than in the triage approach. In particular, the lower referral rates in the triage approach to external services for weight problems and psychosocial problems as indicators of health problems could be explained by the positive fact that more time is available to investigate the problems during the follow-up assessment. Children with visual problems are usually referred directly to external services in both approaches and this could explain the equal referral rates to external services for these problems. The lower referral rate to external services in the triage approach may also be explained by the fact that problems – minor psychosocial problems, for example – are resolved in the period between the pre-assessment and the follow-up assessment. On the other hand, parents may seek care in the period between the

pre-assessment and the follow-up assessment and this may reduce the referral rates to external services in the triage approach.

In addition, the discipline conducting the assessment may also explain the differences found between the two approaches. The aim of task-shifting and pre-assessment by PCH assistants is to save time in order to allow for additional PCH assessments by physicians and nurses so that more attention can be paid to the care needs of children at risk. And indeed, we found a higher referral rate to additional PCH assessments for the age group of 5 to 6 years when the triage approach was used. However, in the age group of 10 to 11 years, we found a lower referral rate to additional PCH assessments in the triage approach. This could possibly be explained by the fact that all children aged 10 to 11 years are assessed by a nurse in the usual approach and children aged 5 to 6 years are assessed by a physician. When medical problems are suspected, nurses must refer the child for an additional PCH assessment by a physician. This leads to extra referrals to additional PCH assessments. However, in the triage approach, the PCH assistant preselects the children with suspected medical problems and refers them immediately for a follow-up assessment by a PCH physician. This is routine in the triage approach and does not qualify as an additional PCH assessment. Furthermore, it is also possible that there are more additional assessments with PCH nurses than with PCH physicians and that this leads to a higher referral rate to additional PCH assessments for the age group of 10 to 11 years in the usual approach.

A pilot study with the triage approach showed that referral rates to additional PCH assessments or to external services were lower than in the usual approach [19]. This has been confirmed in our study looking at referral to external services. Our results relating to referral rates to additional PCH assessments associated with the shifting of tasks from PCH physicians and nurses to PCH assistants for the age group of 10 to 11 years are in line with studies of task-shifting in primary care, which found more additional assessments when nurses took over tasks from physicians, even though the number of referrals did not change [12,13]. We examined the results of the PCH assessments on request. The triage approach was developed to reduce the cost of routine assessments and release resources to conduct PCH assessments on request for children with specific health-care needs. Higher rates were found for PCH assessments on request in the triage approach. The referrals for these children came from school professionals in particular. Differences in PCH assessments on request between the triage and



usual approach may be attributed to the fact that the triage approach results in a greater awareness among school professionals of the abilities of physicians and nurses to assess children on request. This explanation is in line with the findings of our earlier study of school professionals, who responded that PCH services with the triage approach contribute more to support for children with specific needs than the usual approach [28]. However, we did not study the reasons for referral to PCH assessments on request. A possible reason for the introduction of the triage approach could be to improve the cost-benefit ratio for PCH. An earlier study of the costs of the routine assessments showed that the triage approach resulted in a cost reduction. However, we did not study the costs of onward referrals and of the PCH assessments on request.

Finally, the outcomes of the triage approach in PCH as measured in this study may have been affected by its relatively recent introduction by comparison with the usual approach. It can reasonably be expected that the triage approach will have a stronger impact on the number of PCH assessments on request when this approach has been in place for a longer period of time. It takes time to establish a relationship with parties such as school professionals.

### **Strengths and limitations of the study**

The strengths of this study are that it is a 'real-life' observational comparison that included four PCH regional services and random samples of schools stratified by socio-economic status and urbanity. We were able to use data from a homogeneous group of children with regard to gender and age range, and we controlled for differences in socio-economic status. The sample in the current study was selected from the general Dutch population from urban and rural areas, making generalisation of the findings to other PCH organisations possible. Although the power conditions to study the referral rates on request were not met in the analyses, the differences between the approaches were large enough to find significant associations. All four PCH services in this study used the same guidelines and registration procedures, reducing the possibility of identification and reporting bias. A limitation is that we were not allowed to use and analyse the individual details of the children referred to additional PCH assessments or to external services given the absence of informed consent.

### **Implications for practice**

Economic circumstances and changing health demands require the development of new ways of delivering care. More efficiency and flexibility in the delivery of the PCH programme are needed to address challenges such as reduced budgets, workforce shortages, the growing need for optimal use of expertise of professionals, and the wish to provide customised care. Other PCH services in the Netherlands have introduced more flexible PCH care delivery, with task-shifting [29]. The aim of the triage approach is to deliver more customised care in response to health issues that arise in the life cycle of children. The triage approach has the potential to deliver a basic package of care for all children while preserving the strengths of the preventive health service: a low threshold and the wide reach necessary for the early identification of health problems. In earlier studies we found that access to PCH and the detection of health problems were comparable with the usual approach. In this study we found that physicians and nurses working with a triage approach delivered extra PCH care in terms of additional PCH assessments for the age group of 5 to 6 years and a higher rate of PCH assessments at the request of parents, school professionals or professionals in well-child care targeting children with specific needs. Our study provides further insight into the possibilities of a more flexible and demand-driven delivery of preventive health services for children.

### **Future research**

Further research is needed to assess the satisfaction of the children, young people and their parents with a triage approach to routine PCH assessment and the resulting care. Research is also needed to determine the actual quality of detection and referrals using a triage approach. This would allow us to determine the accuracy of referral to extra care (in other words, to determine whether a referral is justified or not) and to enhance our understanding of the equity of care distribution to the children needing health care. Further research is needed into the outcomes of referral to extra care. Moreover, we studied only the costs of the routine assessments, but research will also be needed into the costs of onward referrals to extra care and the costs of PCH assessments on request. So further research is needed to determine whether the triage approach is actually cost-effective. Moreover, research is required to determine the impact of the triage approach on the long-term need for care.

## CONCLUSIONS

The triage approach provides extra opportunities to deliver PCH assessments and PCH assessments on request for children at risk. In the triage approach, fewer children are referred to external services than in the usual approach in the case of the routine assessments. More research is needed into the outcomes of referral to extra care and into the cost benefits of the triage approach.

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### **Ethical approval**

The Medical Ethics Committee of Leiden University Medical Centre approved this study (reference P11.161/NV/nv).

### **Availability of data**

Anonymised data can be provided by TNO to researchers on request.

### **List of abbreviations**

BMI      Body Mass Index

PCH      Preventive Child Health care

### **Competing interests**

The authors declare they have no competing interests.

### **Authors' contributions**

JB had the original idea, contributed to the development of the triage protocols, acquisition and interpretation of data and drafting of this article.

MN contributed to the revision of the drafts and the intellectual content of this article.

SB contributed to the revision of the drafts and the intellectual content of this article.

MK contributed to data collection, and to the analysis and interpretation of the data. She was involved in revising the article.

MT contributed to the conception and design, analysis and interpretation of data. She was involved in revising the article.

PK contributed to the conception and design, analysis and interpretation of data and drafting of the article. He supervised the execution of the study.

Finally, all authors read and approved the final article.

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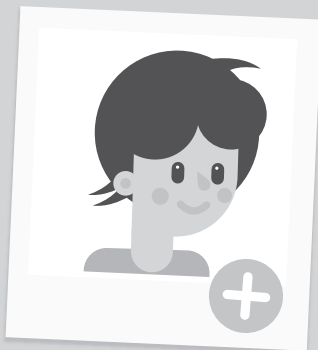
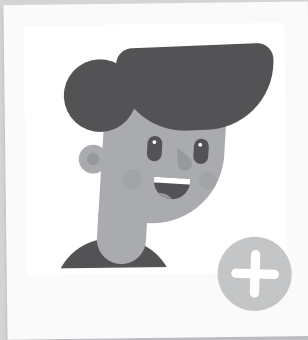
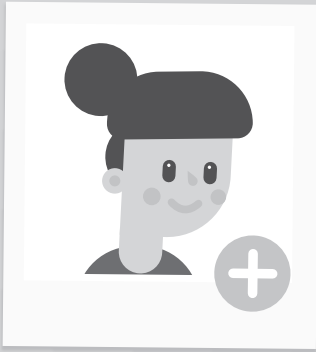
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Preventive child health care  
at elementary school age:  
the costs of routine assessments  
with a triage approach



5

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## ABSTRACT

### *Background*

Triage in Preventive Child Health Care (PCH) assessments could further the efficient use of human resources and budgets and therefore make extra care possible for children with specific needs. We assessed the costs of routine PCH assessments with and without triage for children aged 5/6 years and 10/11 years. In a triage approach, PCH assistants conduct pre-assessments to identify children requiring follow-up assessments by a physician or nurse. In the usual approach, all children are assessed by a physician and an assistant (children aged 5/6 years) or a nurse (children aged 10/11 years).

### *Methods*

All the direct costs of conducting routine PCH assessments with the triage and usual approach were assessed using a bottom-up micro-costing approach. In four PCH services in the Netherlands, two using triage and two the usual approach, professionals completed questionnaires about time spent on assessments, including time related to non-attendance at assessments, the referral of children and administration.

### *Results*

The projected costs for PCH professionals working on PCH assessments amounted to €5.2 million per cohort of 100,000 children aged 5/6 years in the triage approach, and €7.6 million in the usual approach. The projected costs in both approaches for children aged 10/11 years were about €4 million per 100,000 children.

### *Conclusion*

The triage approach to PCH resulted in a projected cost reduction of about one-third, compared with usual practice, for routine assessments by physicians of children aged 5/6 years. There are minimal cost savings in the group of children aged 10/11 years when nurses are involved and so other considerations such as workforce shortages would be required to justify a change to a triage approach. Further research is needed to investigate the differences in costs of care after the completion of the routine assessments.

## BACKGROUND

There is a growing realisation that health services for children, including preventive health services, should be managed efficiently. The delivery of preventive child health assessments needs to be more efficient because of organisational challenges in terms of limited financial resources, staff shortages and the high workloads of physicians and nurses, and the need to use workforce competences better [1]. Moreover, changing the organisation of preventive child health care (PCH) will create opportunities to spend more time on current health issues such as mental health problems, preventing violence, lifestyle-related problems and inequities in child health [1-4]. Changing the workforce skill mix by using triage and shifting tasks of health professionals, in particular in primary and emergency health care services, could be a way of delivering cost-conscious health services without negatively affecting the quality of health care [5-8]. However, there is a lack of research looking at the costs of changing the skill mix in primary care, including PCH, and of role changes involving workers other than physicians and nurses [9-11]. Research shows that shifting tasks from physicians to nurses in primary care has a positive impact on patient satisfaction [9,12]. Research into the efficiency of shifting tasks from physicians to nurses shows that nurses spend more time on assessments and return consultations [13,14]. However, given their lower salaries, this could still result in a reduction in the costs of provided care. The current study used assessment duration and the hourly wages for the different disciplines to investigate costs.

Many countries provide preventive child health care services for vaccinations and a pre-defined schedule of assessments for the early detection of health problems in children [4]. These services are often performed by nurses. In the Dutch PCH programme, all children may undergo seventeen routine assessments between birth and 18 years of age: thirteen in the first four years of life (in well-child clinics), and four between the ages of 4 and 18 years (in school health services). These assessments are conducted by PCH physicians and nurses until the age of 6 years and by PCH nurses for the older age groups. When PCH physicians and nurses identify problems, they decide whether to refer children for additional assessments by the PCH, or to external services [15]. Rising health care costs have challenged the Dutch PCH to find innovative

organisational models for the efficient delivery of preventive health services. In the approach as usual, all children aged 5 to 6 years are assessed by a PCH physician with support from an assistant. There are two possibilities for children aged 10 to 11 years: in one PCH service the children are assessed by a nurse and in the other the nurse receives support from a PCH assistant. These assessments are conducted, in the case of younger children, in the presence of parents. As the benefits of triage and task-shifting are known in other sectors in health care, we investigated whether these can also be found in preventive health care [5-8]. A new two-step procedure was developed for children aged 4 to 18 years involving triage and the shifting of tasks from PCH physicians and nurses to PCH medical assistants [15]. Children are first assessed by a PCH assistant who receives training at the vocational education level that focuses specifically on medical issues. The pre-assessment of the children is conducted using a strict protocol and includes the completion of questionnaires by parents and school teachers, and a face-to-face screening (that includes, for example, screening of growth, hearing and vision). Only children who have missed the pre-assessment and children with suspected health care needs are referred for follow-up assessment by a PCH physician or nurse.

The nature and complexity of the health problems determine which professional is needed for follow-up assessment: follow-up assessments for medical and developmental disorders are performed by physicians, while follow-up assessments for psychosocial problems and lifestyle issues are mostly performed by nurses. The pre-assessment by the PCH assistants takes place at schools in the absence of parents but with parental consent. Follow-up assessments by a physician or nurse are conducted in the presence of the children's parents. The triage approach leads to less involvement of physicians and nurses in the routine assessments, creating time for them to provide additional consultations tailored to children's specific health needs.

Other studies examining the triage approach to child health assessments showed that the attendance levels with this approach matched those for the usual approach and that it seemed to detect health problems as effectively as the usual approach [15-17]. Significantly fewer children were referred for additional assessment by PCH or for treatment to external health services in the triage approach [15]. Further research is needed to compare the efficiency of care delivered by the triage approach with usual practice [16]. The aim of this study was to compare the costs of conducting preventive child health

assessments with a triage approach and the usual approach. We limited this study to the costs for the system of routine PCH assessments.

## METHODS

PCH services in the Netherlands offer routine health assessments for children in elementary schools from two age groups, namely 5/6 and 10/11 years. A bottom-up micro-costing approach was used to analyse the costs of the triage and usual approaches at these ages. The measure used was the salary costs for the PCH professionals who conducted the preventive assessments. We distinguished between these salaries and the costs associated with the time taken by parents to attend the assessments of their children, two elements which together make up the costs for society [18]. Other costs such as the costs of consumables, rent and utilities were not included as these are expected to be comparable for both approaches.

### Data collection

PCH physicians, nurses and assistants recorded the time they spent on conducting the assessments (face-to-face (FtF) and non-FtF, in terms of contact by email or telephone), on referring children and on administration. If children failed to attend the appointments, the professionals estimated the time taken to complete the non-attendance protocol and the lost time that could not be spent on other productive professional activities. In the case of care as usual, each physician and each nurse recorded the time needed to conduct FtF assessments using a stopwatch for ten of their children per age group (5/6 and 10/11 years), and each assistant timed 20 children per age group. In the triage approach, each assistant recorded the time duration of 20 FtF assessments using a stopwatch. A total of 518 triage assessments and 529 assessments with usual care were timed by PCH professionals. In the triage approach, physicians and nurses conduct follow-up assessments of specific problems such as behaviour, hearing or weight problems. Because most problems targeted by follow-up assessments are too rare to be measured repeatedly, respondents were asked not to use a stopwatch but to estimate the average time needed for both FtF and non-FtF assessments of these specific problems on the basis of their experience with multiple previous cases [18].

PCH professionals completed questionnaires about time spent on assessments that covered time recorded using a stopwatch and estimated time. Time records were obtained from 32 physicians (18 triage, 14 usual approach), 31 nurses (16 triage, 15 usual approach) and 22 assistants (13 triage, 9 usual approach). In addition, for usual care as well as triage, all PCH assistants asked four parents in each age group how much time the parents needed to travel to and from the assessment, including waiting time.

The measurements with a stopwatch were first averaged for each individual professional, and these mean outcomes per professional were then averaged for all the professionals in the same discipline. The estimates of average time needed to assess specific problems were averaged for the professionals in the same discipline. The time taken by parents was calculated by averaging the responses from the parents.

Data collection took place in the last quarter of 2012.

To study the costs of routine health assessments we used data from a larger study of the effects of the triage approach which was performed in two PCH services using the triage approach and two PCH services with similar demographic characteristics which used the usual approach [16]. Each PCH service covers a population of around 125,000 children annually aged between 0 and 18 years. We selected a sample of 1008 children (from 20 schools) assessed using the triage approach and a sample of 986 children (from 21 schools) assessed with the usual approach. The samples were randomly selected from elementary schools which were stratified for socio-economic status (low, middle and high status) and the urban or rural area selected.

### **Cost per assessment**

The average time spent on the assessments and the salaries for each discipline was used to calculate the costs of the assessment [19]. Costs were indexed from 2011 to 2013 using the Dutch Consumer Price Index [20]. The costs per hour were €104 for physicians, €62 for nurses and €49 for assistants. The time spent by parents on attending the assessment, travelling and waiting were valued at an hourly rate of €13.60 on the basis of the cost of replacing household care (price level 2013) [18].

## ANALYSES

To compare the costs of the triage and usual approach, we calculated the projected costs for a theoretical cohort of 100,000 children. Attendance rates for the pre-assessments and follow-up assessments and the referral rate to follow-up assessments in the triage approach — and the attendance and referral rates for assessments in the usual approach — (see Fig 1 and 2) were measured as part of the larger study of the effects of the triage approach using a study cohort of 1897 children [16]. We used these rates to determine the numbers of the different types of assessments needed for a theoretical cohort of 100,000 children. By multiplying the numbers of the different types of assessments by the costs, we obtained the total projected costs for both approaches. The total projected costs of parental attendance were calculated on the basis of the number of assessments in combination with the average time needed by parents to accompany their child.

Sensitivity analyses were performed to assess whether the cost calculations were sensitive to uncertainty in our assumptions and estimates. We used the socio-economic status of the schools (extracted from national census statistics established on the basis of the postal code for the school address) to determine the effect that socio-economic status had on the results. In the primary analysis, we assumed that there was no difference in socio-economic status. To determine whether this assumption was justified, cost calculations were also made for both socio-economic status groups (low and medium/high). Another sensitivity analysis was conducted of the time estimates for follow-up assessments in the triage approach. A few PCH professionals estimated that a large amount of time would be required on average for some specific problems. In this sensitivity analysis, we examined the impact on total costs when we used maximum amounts of time for follow-up assessments: 60 minutes for FtF, 30 minutes for non-FtF and 30 minutes for administration. When professionals thought more time was needed, those estimates were disregarded ('missing' result).

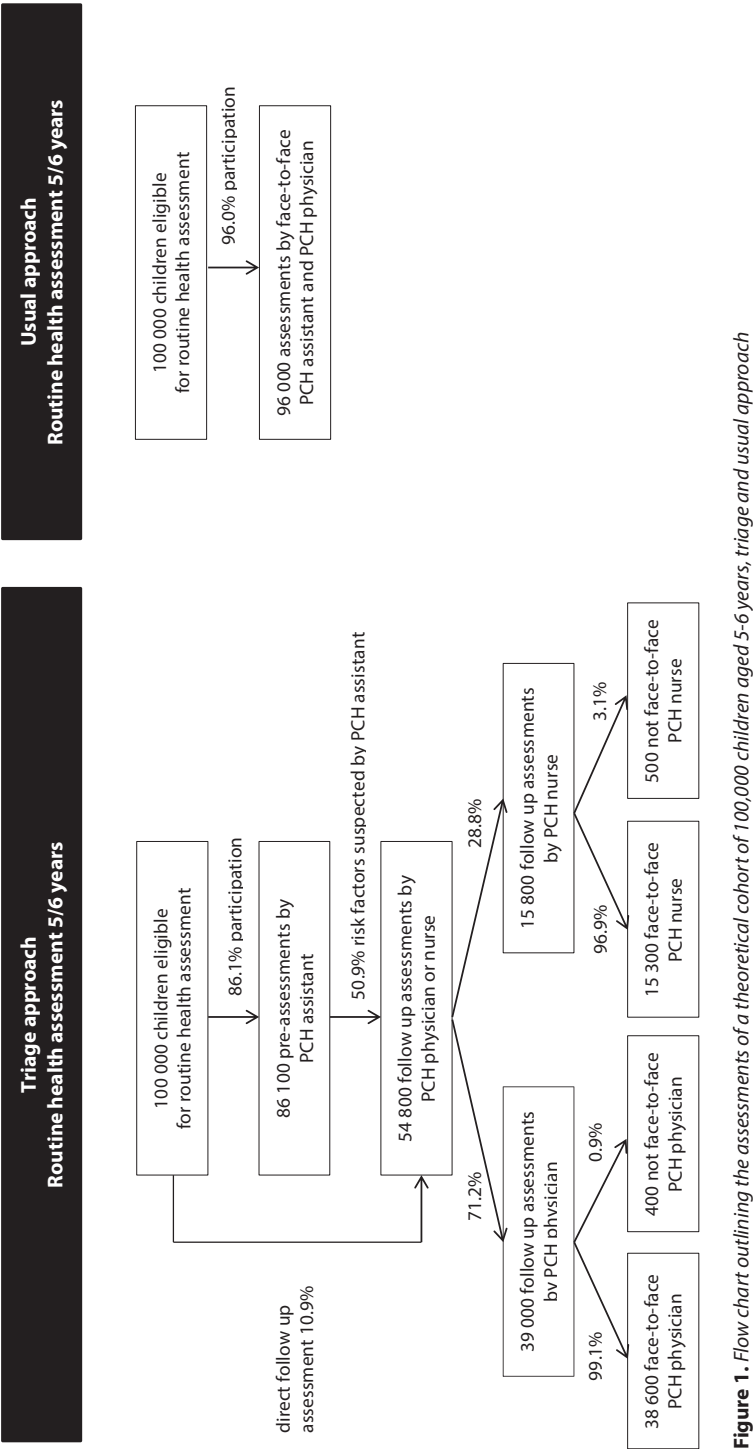
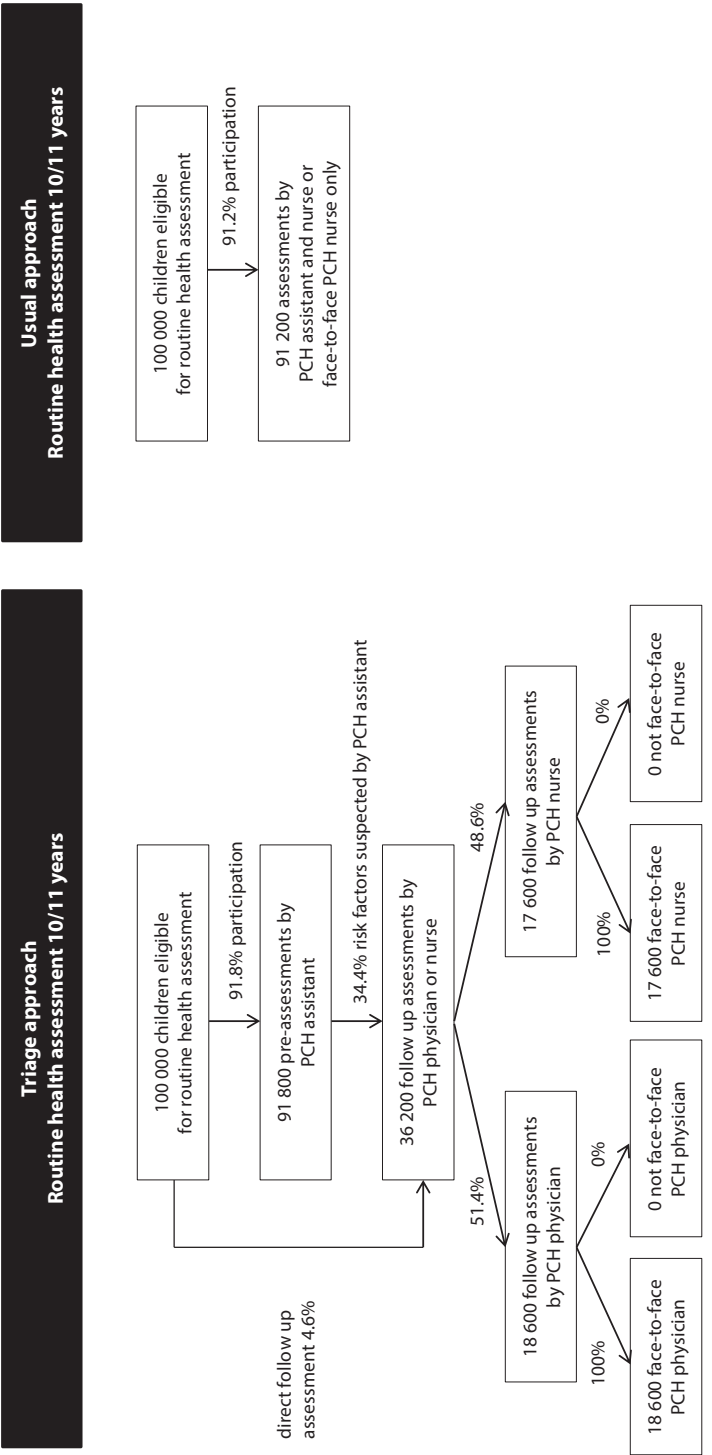


Figure 1. Flow chart outlining the assessments of a theoretical cohort of 100,000 children aged 5-6 years, triage and usual approach





**Figure 2.** Flow chart outlining the assessments of a theoretical cohort of 100,000 children assessed aged 10-11 years, triage and usual approach.

**Table 1.** Costs (2013 €) associated with the time spent by PCH professionals on preventive assessments of child health in the triage approach and the usual approach for children aged 5/6 years on the basis of a theoretical cohort of 100,000 children per year

	Triage approach (N=100,000)			Usual approach (N=100,000)		
	Pre-assessment by PCH assistant	Follow-up assessment by PCH physician	Follow-up assessment by PCH nurse	Total	Assessment by PCH assistant	Assessment by PCH physician
Number of children attending assessment						
Face-to-face (N)	86 100 <sup>1</sup>	38 600 <sup>2</sup>	15 300 <sup>2</sup>		96 000 <sup>3</sup>	96 000 <sup>3</sup>
Not face-to-face (N)	-	400 <sup>2</sup>	500 <sup>2</sup>		-	-
Mean time spent by professionals on assessment per child (min)	25.6	specified in Table 3 specified in Table 3			25.4	28.5 / 33.1 <sup>4</sup>
Total time spent by professionals on assessments (hrs)	36 600	20 900	9 500	67 100	40 700	46 900
Costs of conducting assessments (euro)	1 800 000	2 173 000	588 000	4 561 000	1 998 000	4 869 000
Number of non-attended assessments (N) <sup>5</sup>	23 300	31 600	12 800		24 400	24 400
Mean time related to non-attendance per child (min) <sup>6</sup>	5.8	14.1	19.5		7.8	13.0
Total time related to non-attendance (hrs)	2 300	3 700	2 100	8 000	3 200	5 300
Costs non-attendance (euro)	111 000	384 000	128 000	623 000	155 000	549 000
Total costs of conducting assessments including non-attendance (euro)				5 184 000		7 572 000

<sup>1</sup> On the basis of an attendance rate of 86.1%. Some of the 100,000 children receive a follow-up assessment directly without a pre-assessment.

<sup>2</sup> On the basis of the number of children attending pre-assessment (86,100), the percentage of children referred to a follow-up assessment, (50.9%) and the percentage of children receiving a follow-up assessment without pre-assessment (10.9%). In the follow-up assessment, 71.2% of the children were seen by the PCH physician and 28.8% by the PCH nurse.

<sup>3</sup> On the basis of an attendance rate of 96.0%.

<sup>4</sup> 28.5 minutes if no referral to additional assessment by PCH or external health services was needed; 33.1 minutes if a referral to additional assessment was necessary.

<sup>5</sup> More than one non-attendance per child is possible.

<sup>6</sup> Time to conduct non-attendance protocol and lost time for professionals.

**Table 2.** Costs (2013 €) associated with the time spent by PCH professionals on preventive assessments of child health in the triage approach and the usual approach for children aged 10/11 years on the basis of a cohort of 100,000 children per year

	Triage approach (N=100,000)				Usual approach <sup>1</sup>		
	Pre-assessment by PCH assistant	Follow-up assessment by PCH physician	Follow-up assessment by PCH nurse	Total	Assessment by PCH assistant and nurse (N=100,000)		Assessment by PCH nurse (N=100,000)
					Assessment by PCH assistant	Assessment by PCH nurse	
Number of children attending assessment							
Face-to-face (N)	91 800 <sup>2</sup>	18 600 <sup>3</sup>	17 600 <sup>3</sup>		91 200 <sup>4</sup>	91 200 <sup>4</sup>	91 200 <sup>4</sup>
Not face-to-face (N)	-	0 <sup>3</sup>	0 <sup>3</sup>		-	-	-
Mean time spent by professionals on assessment per child (min)	22.1	specified in Table 3	specified in Table 3		10.3	27.7 / 40.6 <sup>5</sup>	36.2 / 43.5 <sup>6</sup>
Total time spent by professionals on assessments (hrs)	33 900	11 300	10 400	55 500	15 600	46 400	57 500
Costs of conducting assessments (euro)	1 664 000	1 171 000	642 000	3 477 000	767 000	2 869 000	3 555 000
Number of non-attended assessments (N) <sup>7</sup>	15 400	10 200	9 600		36 100	36 100	36 100
Mean time related to non-attendance per child (hrs) <sup>8</sup>	5.8	14.1	19.5		7.8	14.3	14.8
Total time related to non-attendance (hrs)	1 500	2 400	3 100	7 000	4 700	8 600	8 900

Table 2. Continued

	Triage approach (N=100,000)				Usual approach <sup>1</sup>		
	Pre-assessment by PCH assistant	Follow-up assessment by PCH physician	Follow-up assessment by PCH nurse	Total	Assessment by PCH assistant and nurse (N=100,000)		Assessment by PCH nurse (N=100,000)
					Assessment by PCH assistant	Assessment by PCH nurse	
Costs non-attendance (euro)	73 000	248 000	194 000	515 000	230 000	533 000	763 000
Total costs of conducting assessments including non-attendance (euro)				3 992 000			4 399 000
							550 000
							4 105 000

<sup>1</sup> Two different methods can be distinguished for the usual approach: a combined assessment by a PCH nurse and an assistant, and an assessment by a PCH nurse only.

<sup>2</sup> On the basis of an attendance rate of 91.8%. Some of the 100,000 children received a follow-up assessment directly without a pre-assessment.

<sup>3</sup> On the basis of the number of children attending pre-assessment (=91 800), the percentage of children referred to a follow-up assessment (34.4%) and the percentage of children receiving a follow-up assessment without pre-assessment (4.6%). In the follow-up assessment 51.4% of the children were assessed by the PCH physician and 48.6% by the PCH nurse. All children were assessed face-to-face.

<sup>4</sup> On the basis of an attendance rate of 91.2%.

<sup>5</sup> 27.7 minutes if no referral to additional assessment by PCH or external health services was needed; 40.6 minutes if a referral to additional assessment was necessary.

<sup>6</sup> 36.2 minutes if no referral to additional assessment by PCH or external health services was needed; 43.5 minutes if a referral to additional assessment was necessary.

<sup>7</sup> More than one non-attendance per child is possible.

<sup>8</sup> Time to conduct non- attendance protocol and lost time for professional

In a theoretical cohort of 100,000 children, the time spent by professionals on assessments of children aged 5/6 years was 67,100 hours in the triage approach and 87,600 in the usual approach (Table 1). In a theoretical cohort of 100,000 children aged 10/11 years, the total time spent on assessments was 55,500 hours in the triage approach, 62,000 hours in the usual approach if assessments were performed by both the assistant and nurse and 57,500 hours if the assessment was conducted by a nurse alone (see Table 2). A valuation was made of the time spent by the different professionals on the basis of their hourly rates. That valuation resulted in total projected costs (excluding non-attendance) of €4,561,000 in the triage approach and €6,867,000 in the usual approach for children aged 5/6 years. The projected costs were lower for children aged 10/11 years: €3,477,000 in the triage approach, €3,636,000 in the usual approach if assessments are performed by both a nurse and an assistant and €3,555,000 if the assessment is performed by a nurse alone.

The time and costs associated with non-attendance (the time needed to implement the non-attendance protocol and lost time for professionals) are shown in Tables 1 and 2. The projected costs per 100,000 children associated with non-attendance in the triage approach vary from €515,000 to €623,000 depending on the age group. In the usual approach, the costs vary from €550,000 to €763,000.

The time needed to conduct follow-up assessments in the triage approach and the extra time needed to refer children to additional assessments by PCH or to external services was estimated by physicians and nurses (see Table 3). The time spent on follow-up assessments targeting specific problems of children in the triage approach, as estimated by the physician, was between 19.4 minutes for vision problems to 85.3 minutes for child abuse in face-to-face contacts. In the case of face-to-face follow-up assessments performed by a nurse, the estimated time ranged from 10.5 minutes for musculoskeletal reasons to 73.4 minutes for child abuse (see Table 3).

The total projected costs of assessments by PHC professionals (including non-attendance) are €5,184,000 per theoretical cohort of 100,000 children aged 5/6 years in the triage approach, and €7,572,000 in the usual approach. In children aged 10/11 years, the triage approach costs €3,992,000, and the usual approach costs €4,399,000 if the assessments are performed by both a nurse and an assistant and €4,105,000 if the assessment is performed by a nurse alone. The different professionals involved, and the costs of the deployment for the routine

assessments of the two approaches, including the costs of non-attendance, are shown in Figure 3. The difference is presented for the two age groups.

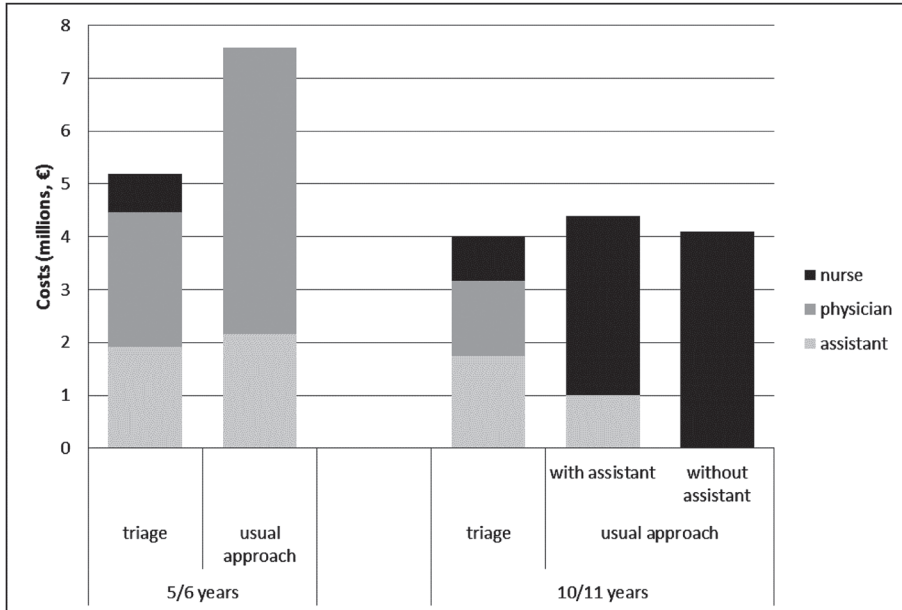
**Table 3.** Average estimated time spent by professionals on follow-up assessments in the triage approach (minutes)

	Triage approach					
	Follow-up assessment by PCH physician			Follow-up assessment by PCH nurse		
	Face-to-face <sup>1</sup>	Not face-to-face <sup>2</sup>	Extra time for referring <sup>3</sup>	Face-to-face <sup>1</sup>	Not face-to-face <sup>2</sup>	Extra time for referring <sup>3</sup>
Musculoskeletal	20.1	9.0	6.8	10.5	3.7	7.5
Cognitive development	37.2	18.9	22.0	22.8	17.5	13.8
Weight	22.9	12.7	7.2	24.0	19.4	12.9
School problems	40.8	22.1	21.7	36.3	28.7	25.8
Child abuse	85.3	32.9	32.2	73.4	36.1	41.7
Lifestyle	27.9	17.3	11.2	26.1	20.8	15.0
Length	19.6	11.1	8.6	18.0	10.0	15.0
Motor development	28.5	11.8	8.1	14.3	8.3	-
Eyesight	19.4	10.1	6.4	12.7	7.3	5.3
Hearing	20.5	9.8	7.4	10.7	7.3	4.0
Psychosocial development	47.1	24.4	30.8	36.5	29.1	29.5
Speech and language development	25.2	11.3	8.9	13.4	9.3	4.7
Truancy	58.5	23.9	24.6	26.3	20.0	15.0
Cleanliness	28.6	15.7	9.2	28.9	22.9	11.3
Not otherwise specified	26.3	6.4	9.7	23.5	14.6	6.5

<sup>1</sup> Time needed for 'Face-to-face follow-up assessment' includes time for preparation, consultation and reporting results.

<sup>2</sup> Time needed for 'Non-face-to-face follow-up assessment', in terms of contact by email or telephone, includes time for preparation, unanswered calls, discussions and reporting results.

<sup>3</sup> Time needed for referral to additional assessments by PCH, or to external services.



**Figure 3.** Projected costs (2013 €) of the deployment of professionals for routine health assessments of children aged 5/6 and 10/11 years, triage and usual approaches.

The projected costs of parental attendance at assessments, including waiting and travelling time, are shown in Table 4. The projected costs of the triage approach, in which parents only accompany their child if there is a follow-up assessment, are €428,000 for children aged 5/6 years; these costs amount to €1,434,000 in the usual approach. In the case of parents of children aged 10/11 years, the costs are €297,000 in the triage approach and €1,027,000 and €971,000 in the usual approach depending on whether or not the nurse receives support from a PCH assistant.

**Table 4.** *Projected costs (2013 €) associated with the time required for parental attendance at the assessments of their children aged 5/6 and 10/11 years on the basis of a theoretical cohort of 100,000 children per year*

	<b>Triage approach</b>	<b>Usual approach</b>	
	<b>Pre-assessment by PCH assistant and assessment by PCH physician or nurse (N=100,000)</b>	<b>Assessment by PCH assistant and physician/nurse<sup>2</sup> (N=100,000)</b>	<b>Assessment by PCH nurse (N=100,000)</b>
Total time associated with parental attendance <sup>1</sup> (hrs)			
Children aged 5/6 years	31 500	105 400	-
Children aged 10/11 years	21 800	75 500	71 400
Costs of parental attendance (euro)			
Children aged 5/6 years	428 000	1 434 000	-
Children aged 10/11 years	297 000	1 027 000	971 000

<sup>1</sup> On the basis of the number of children attending assessment (see Table 1 and 2), the time per assessment (see Table 1, 2 and Additional file 1), a mean travelling time of 8.1 minutes (one way) and a mean waiting time of 2.9 minutes.

<sup>2</sup> 5/6 years: PCH assistant and physician; 10/11 years: PCH assistant and nurse.

The sensitivity analysis in which we made a distinction between children with a low socio-economic status and children with a medium or high socio-economic status, and the sensitivity analysis in which we placed an upper limit on the time needed for a follow-up assessment in the triage approach led to only marginal differences (€0.30-€2.03 per child) in the results presented and did not affect the conclusions with regard to the comparison of the triage and usual approaches.

## DISCUSSION

This paper describes a comparison of the costs of routine assessments in preventive child health care (PCH) in a triage approach and an approach-as-usual. We found a cost reduction of about one-third for assessments of children aged 5/6 years when the triage approach was used rather than the usual approach. A minimal cost reduction was found in the group of children aged 10/11 years. This difference in the cost reduction for the two age groups can be explained by the time spent by physicians and nurses on assessments for the two age groups (see Fig. 3).

In the triage approach for children aged 5/6 years, the cost reduction is attributable to the lower level of physician involvement in the assessment of



children in combination with the same level of deployment of PCH assistants with relatively low salary costs by comparison with the usual approach. The cost reduction for children aged 10/11 years can be attributed to the costs required for pre-assessments by PCH assistants in the triage approach (which are lower than the costs of assessments by a nurse in the usual approach). However, this reduction in costs was almost offset by the higher costs of the follow-up assessments by physicians or nurses in the triage approach. Furthermore, we found a reduction in the projected costs of parental attendance at assessments with the triage approach that is attributable to the absence of parents at pre-assessments in the triage approach. This finding applies to both age groups.

#### *Strengths and weaknesses of the current study*

A strength of our study is that we asked a large sample of PCH professionals working with both approaches to measure the main components of the assessments precisely with a stopwatch because this improves the internal validity of the results. This was not done in the follow-up assessments looking at potential health or psychosocial problems as part of the triage procedure because the majority of the problems were too rare to be measured repeatedly. To assess the duration of these problem-specific assessments, the respondents were asked to estimate the mean time spent on the specific assessments (see Table 3). The direction of the possible bias caused by these estimates is not clear. Another strength is that we conducted sensitivity analyses to assess the possible effect of the socio-economic status of the children and the maximum time spent on the follow-up assessments and that we found that the marginal differences did not affect the conclusions with regard to the comparison of the triage and usual approaches. Another strength is that the four PCH services in this study used the same protocolled screening and registration methods, reducing the possibility of reporting bias. A limitation is that the outcomes of the triage approach may have been affected by a difference in the duration of the use of the triage and usual approaches. The triage approach was introduced a few years ago, whereas the PCH services in the approach-as-usual group had been working with this approach for a long time. It can reasonably be expected that triage will have a larger impact on cost efficiency when the triage approach has been in place for a longer period of time. We limited this study to the use of human resources and efficiency, but we have not measured the costs of safeguarding the quality of care in terms of the training and supervision of professionals.

*Implications for practice and directions for future research*

Health system issues — in terms of increasing pressures on limited resources and shortages of physicians and nurses — require the development of new organisational models for health care delivery. The outcomes of this study suggest that a triage approach may be a promising way of improving efficiency in countries with systems of preventive child care services delivered by physicians, who are mostly active for the younger age group in well-baby clinics. On the other hand, our study showed that minimal costs savings are obtained with a triage approach for preventive child care services delivered by nurses.

Other arguments may also be relevant for the use of the triage approach, such as improvements in the use of the competences of professionals and workforce shortages. Since PCH assessments are typically straightforward and consist to a large extent of routine protocolled screening activities conducted by dedicated PCH professionals, it is reasonable to argue that the organisation of PCH can be changed by optimising the workforce skill mix. The impact on health outcomes resulting from task-shifting depends on the complexity of tasks, degree of autonomy, and level of education and competences of the professionals involved [21, 22]. Investments in training and supervision for the various professionals are therefore necessary to safeguard the quality of care when introducing a triage approach [12]. PCH assistants are typically less expensive to train and to employ than physicians and nurses. However, in the triage approach, PCH assistants need more training and supervision because they take on some of the tasks of the physicians and they work independently. As well as cutting costs, the shifting of tasks from PCH physicians and nurses to assistants is intended to give physicians and nurses more time to provide additional PCH assessments tailored to children's specific health needs and to respond to requests from parents, school professionals or young people themselves. Another benefit of the triage approach is the reduction in time needed by parents to accompany their children to assessments as they do not attend the pre-assessments in the triage approach. On the other hand, the absence of parents during the assessments may result in less involvement with the PCH professionals.

This study was confined to an analysis of the costs of conducting PCH routine assessments. We did not report on the costs arising after the identification of health concerns by PCH during assessments, an example being the costs

of health care involving medical specialists. Further research is needed to investigate the differences between the additional costs of referrals to additional assessment by PCH or to external services in the two approaches. It will be useful to learn more about which children are missed in the two approaches and the long-term health outcomes to further determine the cost-effectiveness of the implementation of the triage approach for preventive assessments of child health. Finally, we did not examine the quality of care, including parent satisfaction, in the two approaches.

## CONCLUSIONS

The triage approach to PCH resulted in a projected cost reduction of about one-third, compared with usual practice, for routine assessments by physicians of children aged 5/6 years. There are minimal cost savings in the group of children aged 10/11 years when nurses are involved and so other considerations such as workforce shortages would be required to justify a change to a triage approach. Further research is needed to investigate the differences in costs of care after the completion of the routine assessments.

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### Author Contributions

Drs. J. Bezem developed the triage approach and contributed to the development of the triage protocols, the acquisition and interpretation of data, and the drafting of the initial manuscript.

Dr. M. Elske van den Akker-van Marle was responsible for the concept and design of the study and the data collection instruments, she carried out the initial analyses and interpretation of data, and she contributed to the drafting of the manuscript.

Dr. C.P.B. van der Ploeg contributed to the design of the data collection instruments, coordinated and supervised data collection, and contributed to the drafting of the manuscript.

Professor M.E. Numans contributed to the intellectual content and revision of this paper, and critically reviewed the manuscript.

Professor S.E. Buitendijk contributed to the revision of the intellectual content of this paper, and critically reviewed the manuscript.

Dr. P. Kocken contributed to the concept and design of the study, the analysis and interpretation of data, and the review and revision of the manuscript.

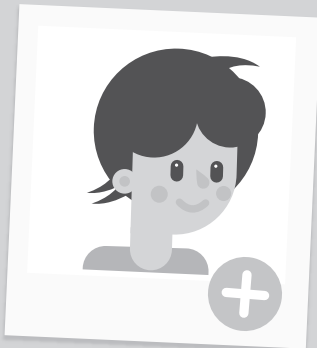
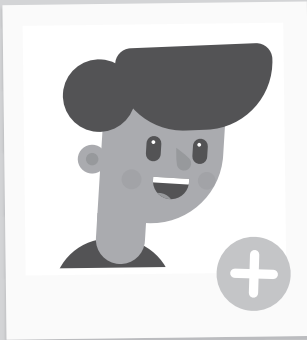
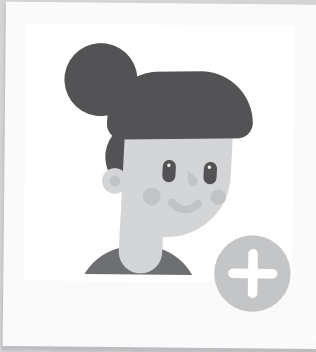
All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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Improving access to school  
health services as perceived  
by school professionals



6

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*Submitted*

## ABSTRACT

### *Background*

The organisation of health assessments by preventive health services focusing on children's health and educational performance needs to be improved due to evolving health priorities such as mental health problems, reduced budgets and shortages of physicians and nurses. We studied the impact on the school professionals' perception of access to school health services (SHS) when a triage approach was used for population-based health assessments in primary schools. The triage approach involves pre-assessments by SHS assistants, with only those children in need of follow-up being assessed by a physician or nurse. The triage approach was compared with the usual approach in which all children are assessed by physicians and nurses.

### *Methods*

We conducted a cross-sectional study, comparing school professionals' perceptions of the triage and the usual approach to SHS. The randomly selected school professionals completed digital questionnaires about contact frequency, the approachability of SHS and the appropriateness of support from SHS. School care coordinators and teachers were invited to participate in the study, resulting in a response of 444 (35.7%) professionals from schools working with the triage approach and 320 (44.6%) professionals working with the usual approach.

### *Results*

Respondents from schools using the triage approach had more contacts with SHS and were more satisfied with the appropriateness of support from SHS than respondents in the approach-as-usual group. No significant differences were found between the two groups in terms of the perceived approachability of SHS.

### *Conclusions*

School professionals were more positive about access to SHS when a triage approach to routine assessments was in place than when the usual approach was used. Countries with similar population-based SHS systems could benefit from a triage approach which gives physicians and nurses more opportunities to attend schools for consultations and assessments of children on demand.



## BACKGROUND

Cognitive performance and educational achievements in children benefit from good health and health-related behaviours [1,2]. The integration of preventive health services in the education system helps to detect health problems in school children and furthers early interventions intended to improve health and, therefore, cognitive outcomes [3-7]. Health services available in schools (School Health Services, SHS) include prevention, early detection and intervention in the area of school children's physical, social and - increasingly - mental health [3,4].

Research shows that equal access to SHS and SHS quality need to be improved for all groups of children. Furthermore, SHS should be tailored to health priorities such as overweight and mental health [4,8,9]. Health system issues relating to staff shortages in SHS, high workloads and inadequate demarcation of the position and responsibilities of SHS in educational institutions need to be addressed [4,10].

These health system issues have challenged SHS to find innovative models which allow an efficient delivery of health services to school age children. In the Netherlands, community-based SHS professionals usually visit schools a few times a year to carry out routine assessments based on a pre-defined age schedule in which children between the ages of four and eighteen receive four routine health assessments from SHS physicians and nurses, sometimes supported by SHS assistants.

Physicians conduct the assessment in the youngest age group. Nurses conduct the assessments for older age groups, an approach that is also common in many other countries. The SHS delivers services free of charge. Interdisciplinary collaboration between professionals in the health-care and educational systems is organised in both approaches in multi-disciplinary school-based networks based on shared competencies, roles and responsibilities.

A novel approach was developed to conduct the routine health assessments based on triage and task-shifting among SHS professionals [11]. In this two-step triage procedure, pre-assessments were delegated to SHS assistants who had received specific training. Only children in need of follow-up were assessed by a SHS physician or nurse, which led to less involvement of physicians and nurses in the routine assessments. This created time for physicians and nurses to visit schools regularly and provide additional consultations that were tailored

to children's specific needs in response to requests from school professionals, parents and children themselves.

Triage and the shifting of tasks between health-care professionals have been used primarily in primary health care and emergency health-care services worldwide. Research shows that triage and task-shifting have several benefits: the optimal use of the skills and expertise of health-care professionals, reduced workloads for physicians and nurses, improved access to health care and greater patient satisfaction [12-15]. A pilot study examining the triage approach in SHS showed equal attendance levels of about 90% for health assessments in a comparison of the triage and usual approaches. Fewer children were referred for extra assessment by SHS or for treatment by external health services in the triage approach [11]. Another study showed that routine health assessments in a triage approach seemed to detect health problems as effectively as the usual approach [16].

The aim of this study was to explore how school professionals in primary schools experience access to population-based SHS systems when a triage approach is used for routine health assessments.

We compared these perceptions with those of school professionals working with the usual SHS approach. In this study, school professionals are primary school teachers and care coordinators. The latter are teachers who also support children with specific needs.

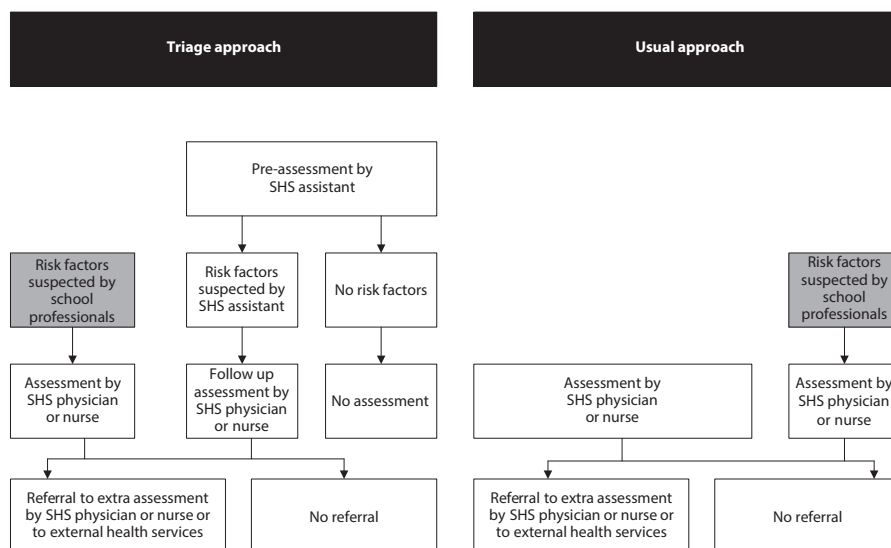
We studied the views of school professionals about access to SHS because we know accessibility affects health service utilisation, consumer satisfaction and the quality of care [17-20]. Accessibility factors relating to health services include approachability, acceptability, availability, affordability and appropriateness of care [19]. The triage system specifically targeted the improvement of two aspects of access to preventive health services: approachability and the appropriateness of care. 'Approachability' refers to consumers' ability to gain access to the service and to identify the existence of some form of service, and the terms also refers to the fact that a service can be reached, and the fact that it has an impact on health. 'Appropriateness' of care relates to the adequacy of the health services provided and this is linked to the willingness to use the services [19]. Acceptability, availability and affordability are less relevant for preventive services like SHS, which should be offered to whole populations of children proactively. This manuscript addresses the following research question: what is the impact on the school professionals' perception of the approachability and

appropriateness of SHS support for primary-school children when the triage approach is used rather than the usual approach?

## METHODS

We conducted a cross-sectional survey of access to SHS as perceived by school professionals (in other words, as stated above, primary school teachers and care coordinators). We compared school professionals who had worked with the triage approach in SHS and those who had worked with the usual approach.

In the triage approach, SHS assistants follow a strict pre-assessment protocol to preselect children. The pre-assessment of the children is carried out based on: SHS records, questionnaires completed by school teachers and parents, and face-to-face screening. The assistants prioritise referral to SHS for children with suspected health-care needs. The next step is a follow-up assessment by a physician or nurse. Pre-assessment and follow-up assessments are part of the triage assessment procedure (see Figure 1). In the usual approach to routine assessments, a physician or nurse assesses all children. In the triage and usual approaches, school professionals can refer children with suspected risk factors for an assessment by a SHS physician or nurse.



**Figure 1.** Proces of routine health assessment by school Health Services (SHS); triage and usual approach.

### Participants

Four distinct urban and non-urban areas in the Netherlands participated in the study. An urban and a non-urban area were selected for the triage and the usual approaches. One triage SHS had recently introduced the triage approach and the other SHS had done so five years before the study began. The two SHS in the approach-as-usual group had been working with this approach for a long time.

A two-step procedure was completed to select the study population. In the first step, 600 primary schools from the four geographical SHS regions were selected at random. In the second step, the school care coordinators and teachers in four school years (Kindergarten and school years 1, 4 and 6 (US system): children aged 5, 6, 9 and 12 years respectively) were selected from every school for inclusion in the study (1249 employees for the triage approach and 729 for the usual approach). Schools specifically for children with special needs, school professionals who had worked for less than six months at the school, and professionals other than teachers or care coordinators were excluded from the study. To ensure adequate power in the data analysis, we adopted a predefined significance level of 5% and statistical power of 80%. With a total population of about 1400 schools (in other words, all schools in the four SHS regions that were eligible for participation in the study), the minimum sample size was 300

schools. Assuming a school response rate of 50%, a sample of 600 schools was enough to ensure adequate power.

### *Data collection*

Data were obtained using a digital questionnaire sent by e-mail. Firstly, professionals at schools known to the SHS were approached to obtain the e-mail addresses of the respondents. In the triage group, e-mail addresses for most of the school care coordinators were available to the SHS. In the approach-as-usual group, we contacted school heads to obtain the e-mail addresses of the respondents.

To maximise the response rate, a pre-notification letter was sent by e-mail to the school board and two reminders were sent to non-respondents [21]. The questionnaires were sent and returned in June and July 2012. Additional information about topics in terms of involvement in school networks or school size was collected through online searches.

The questionnaire items were based on the Consumer Quality Index [22,23]. The concepts in this index were translated for use in this study. The questionnaire was developed with an expert group of SHS professionals. The questionnaire was pre-tested in a group of six school care coordinators. This resulted in only small changes in the wording of sentences and word selection.

This is a general accepted procedure when questionnaires tailored to the study group are not available.

Three scales were established to measure school professionals' perceptions of access to SHS: two scales for approachability and one for the appropriateness of SHS support (see Table 1; for a full overview of the questions and the scales, see Additional file 1). The two scales for approachability were: a five-item scale 'SHS approachability for contact and feedback' and a two-item scale 'SHS approachability for support for health issues'. In addition, a three-item scale 'appropriateness of SHS support for children with specific needs' was established. The answer categories used five-point Likert scales for the statements (ranging from 'strongly disagree' to 'strongly agree') or four-point Likert scales for the questions (ranging from 'never' to 'always'). A question about the number of contacts between the school and SHS professionals was added to measure the contact frequency between the school and SHS in the previous six months. The answer categories were 0, 1-2, 3-4, 5-6 and >6 times.

The demographic and descriptive data relating to schools and school professionals were collected using the questionnaire and online searches of the schools' characteristics, including the involvement of SHS in school-based networks, school size, municipality size, position of the school professional (teacher or school care coordinator), and number of years working at the current school. The socio-economic status of the school population was determined on the basis of the postal codes of the schools and was based on education, income and employment status of the inhabitants of the school area.

### *Data analysis*

We used descriptive analyses and chi-square tests to assess differences between the background characteristics of schools and school professionals in either the triage group or the approach-as-usual group.

Scales were constructed using multiple steps. At first, we converted the answer categories of the ordinal variables into quantified (continuous numeric) variables for all subsequent analyses using categorical principal component analysis (for further details, see [24]). Secondly, the quantified variables were clustered into scales using a principal component analysis. The discriminant validity of the scales was tested using the eigenvalues of the factors and the associated scree plot. According to the Guttman-Kaiser criterion, factors with an eigenvalue greater than one were retained. Thirdly, drawing on research [19,20] and the principal component analysis, we constructed three scales: 'SHS approachability for contact and feedback', 'SHS approachability for support for health issues' and 'appropriateness of SHS support for children with specific needs' (see Table 1). The reliability of the scales was analysed using Cronbach's alpha coefficients or Pearson's correlation coefficients.

Our next step was to analyse the differences between school professionals' perceptions of access to SHS in the triage and approach-as-usual conditions using multilevel regression analysis with contact frequency, the approachability of SHS and the appropriateness of support as outcome variables and the approach (triage or usual approach) and differences between background characteristics as the independent variables. A multilevel regression analysis was required because of the lack of independence between school professionals in individual schools [25,26]. The size of the differences between the triage approach and

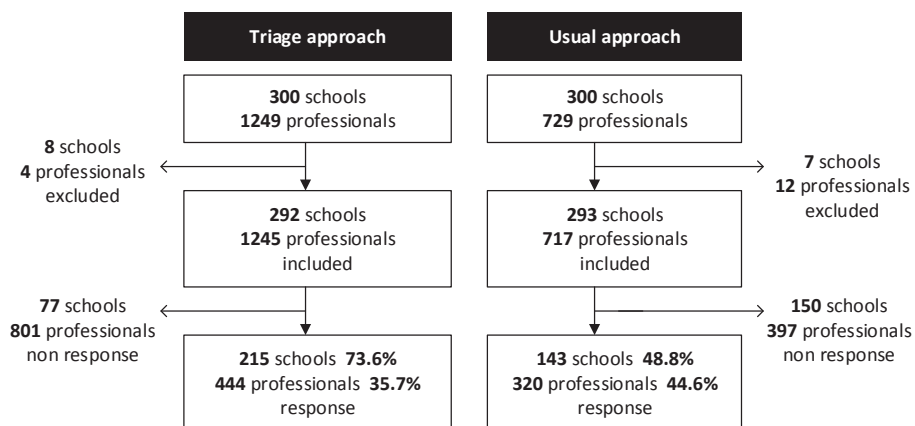
**Table 1.** Questionnaire item/scales measuring how school professionals perceive access to school health services (SHS)

Item	Number of questions	Cronbach's alpha ( $\alpha$ ) or Pearson correlation ( $r$ )	Example of questions, answer categories and score range
Contact frequency between school and SHS	1	-	How often did you have contact with SHS professionals in the last six months in addition to the regular assessments? 0 times (1) more than six times (5) (5 categories)
Scales			
SHS approachability for contact and feedback	5	$\alpha = 0.79$	Can you reach SHS professionals when you need them? never (1) always (4) (5 categories including not applicable)
SHS approachability for support for health issues	2	$r = 0.64$	To what extent do you agree or disagree with the statement: I contact SHS when I have concerns about a pupil's health: strongly disagree (1) strongly agree (5) (6 categories including no opinion)
Appropriateness of support provided by SHS for children with specific needs	3	$\alpha = 0.74$	To what extent do you agree or disagree with the statement: SHS ensures children with specific needs are referred to proper care in time: strongly disagree (1) strongly agree (5) (6 categories including no opinion)

usual approach was given using standardised regression coefficients with 95% confidence intervals. SPSS Statistics was used to analyse the data (SPSS 21.0 for Windows, SPSS Inc., Chicago, IL).

## RESULTS

Figure 2 shows the questionnaire responses for the triage and usual approach. Data relating to four school professionals and eight schools in the triage group, and twelve school professionals and seven schools in the usual approach group, had to be excluded due to non-conformity with our inclusion criteria or because the professionals could not be reached due to an incorrect e-mail address.



**Figure 2.** Response flow diagram; triage and usual approach.

The response rate was 73.3% for the schools in the triage group and 48.8% for the schools in the approach-as-usual group. The response from the professionals was 35.7% in the triage group and 48.6% in the approach-as-usual group (see Figure 2). The most frequently stated reason for not participating in the study was a lack of time.

Our data showed a difference between the schools using the two approaches in terms of the municipality size (Table 2). Schools in the triage group were situated less often in municipalities with fewer than 40,000 residents than schools in the approach-as-usual group. No other differences were found between the triage and approach-as-usual group in terms of the background characteristics of schools such as the participation of SHS in school-based networks, the socio-economic status of the school population or school size.

Our study showed a difference in contact frequency and school professionals' perceptions of the appropriateness of SHS support between the two study groups (triage and usual approach) (Table 3). The school professionals in the triage group reported significantly more contact with SHS professionals than professionals in the approach-as-usual group. In addition, we found differences in perception with respect to the appropriateness of support provided by SHS professionals. More school professionals in the triage group than in the approach-as-usual group thought the support provided by SHS for children with specific needs was appropriate. The main difference between the schools relates to the scale item 'SHS makes an important contribution to the detection



**Table 2.** *Characteristics of schools and respondents; triage and usual approach*

	<b>Triage approach</b>	<b>Usual approach</b>	<b>Total group</b>
	N (%)	N (%)	N (%)
<b>School characteristics</b>	<b>N=215</b>	<b>N=143</b>	<b>N=358</b>
Schools with SHS participating in interdisciplinary network			
No	28 (16.9)	20 (16.4)	48 (16.7)
Yes	138 (83.1)	102 (83.6)	240 (83.3)
Missing	49	21	70
Socio-economic status of the school population			
Low	77 (36.0)	49 (34.8)	126 (35.5)
Middle	90 (42.1)	60 (42.6)	150 (42.3)
High	47 (22.0)	32 (22.7)	79 (22.3)
Missing	1	2	3
School size			
≤ 200 pupils	104 (56.5)	73 (58.9)	177 (57.5)
> 200 pupils	80 (43.5)	51 (41.1)	131 (42.5)
Missing	31	19	50
Municipality size*			
≤ 40,000 residents	97 (45.3)	87 (61.7)	184 (51.8)
> 40,000 residents	117 (54.7)	54 (38.3)	171 (48.2)
Missing	1	2	3
<b>Respondent characteristics</b>	<b>N=444</b>	<b>N=320</b>	<b>N=764</b>
Position school professional			
School care coordinator	134 (30.2)	81 (25.3)	215 (28.1)
Teacher	310 (69.8)	239 (74.7)	549 (71.9)
Number of years working at the current school			
½ - 1	23 (5.2)	16 (5.0)	39 (5.1)
1-5	105 (23.6)	72 (22.5)	177 (23.2)
5-10	91 (20.5)	48 (15.0)	139 (18.2)
≥10	225 (50.7)	184 (57.5)	409 (53.5)

\*p&lt; 0.01

of problems'. The values of the standardised betas in Table 3 reflect the strength of the measured relationship. The association between the SHS approach and the frequency of contact between the school and SHS is stronger than the association with the appropriateness of support provided for children with specific needs.

No impact was found on the perceived approachability of SHS evidenced by the response from school professionals on the scales 'SHS approachability for contact and feedback' and 'SHS approachability for support for health issues' in the comparison of the triage group with the approach-as-usual group.

**Table 3.** School professionals' perceptions about access to school health services (SHS); triage and usual approach

	Triage approach N=444	Usual approach N=320	
	Mean (SD) <sup>1</sup>	Mean (SD) <sup>1</sup>	$\beta$ (95% CI) <sup>2</sup>
<b>Item</b>			
Contact frequency between school and SHS <sup>3</sup>	1.71 (0.99)	1.41 (0.74)	0.26 (0.13 - 0.39)*
<b>Scales<sup>4</sup></b>			
SHS approachability for contact and feedback	-0.02 (0.73)	0.02 (0.74)	-0.02 (-0.14 - 0.10)
SHS approachability for support for health issues	0.00 (0.86)	0.00 (0.97)	0.00 (-0.14 - 0.14)
Appropriateness of provided SHS support of children with specific needs	0.05 (0.81)	-0.07 (0.80)	0.13 (0.01 - 0.20)**

SD= Standard Deviation;  $\beta$ = standardized regression coefficient; CI= Confidence Interval.

\*  $p < 0.001$ ; \*\*  $p < 0.05$

<sup>1</sup> Crude mean values.

<sup>2</sup> Multilevel regression analyses with the scales and contact frequency as outcome variables and the approach (triage and usual) and municipality size as independent variables. Standardized regression coefficient ( $\beta$ ) and confidence interval (CI).

<sup>3</sup> The contact frequency was measured on a five-point scale with answer categories 0, 1-2, 3-4, 5-6 and >6 times (coded 1 to 5).

<sup>4</sup> All categorical variables of the scales were converted to quantified (i.e. continuous numeric) variables with a mean of 0 (using categorical principal component analysis). A higher value means more satisfaction for the scale described.

## DISCUSSION

The aim of this study was to explore how school professionals in primary schools experience working with a triage approach to the routine assessments conducted by school health services (SHS) and to make a comparison with school professionals who were offered the usual SHS approach. An difference was found between the two groups in the perceived appropriateness of support from SHS and the contact frequency between school and SHS professionals. These differences may be linked to the differences between the two approaches. In both approaches, SHS professionals visit schools both using a predefined schedule and when necessary. A triage assessment procedure creates time for physicians and nurses to visit schools regularly to conduct additional assessments of children with specific needs when asked to do so by school professionals, parents and children themselves. The procedure also creates more possibilities to cooperate in school-based networks. The triage approach contributes to

the sharing of information between school and health professionals about children with specific needs and the early detection of health problems, and this may explain the positive evaluation of the appropriateness of SHS support. On the other hand, it is possible that children are missed in the assessments by assistants in the triage approach, and parents are less involved in the first step of the triage procedure. However, school professionals are in contact with almost every child daily, making it possible to identify children with health-related problems. Other studies show that the efficiency and responsiveness of the health care system are known to be linked to the approachability and expertise of health-care professionals [12,27,28]. The perceived approachability of SHS will not have changed because dedicated professionals are active in the Dutch SHS system in both approaches.

#### *Strengths and limitations*

A strength of our study is that we sent questionnaires to a random sample of schools. Respondents completed the digital questionnaires anonymously and this may have improved the reliability of the results. The background characteristics of the study groups were similar, except for the municipality sizes, which we corrected for in the analyses.

A methodological limitation is the low response rates, although this is not uncommon in surveys of both schools and professionals in those schools. The results may have been positively affected by the higher response rates from schools and school professionals who were positive about access to SHS. We expect schools and school professionals who are satisfied with either approach or who have had more contact with SHS professionals to be more willing to participate in the study. This would imply an overestimation of the findings for our outcome measures, appropriateness of care and contact frequency.

A difference in the response rates was found between the schools. We found that more schools located in relatively larger municipalities in the triage group responded than schools in those municipalities in the approach-as-usual group. Although we corrected for this in the analyses, the higher scores for appropriateness and contact frequency may suffer from bias due to the more frequent and severe health problems in children living in a more urban area, leading to more SHS activities. On the other hand, there were no differences between the schools in terms of socio-economic status.

Because this is an important factor for the health status of children and the

correlation with urbanisation, we expect that differences in levels of urbanisation to have a minor effect in schools using the triage and usual approaches.

We were not able to analyse differences between the characteristics of schools or professionals in the response and non-response groups because the background characteristics of the non-response group were not available.

Another possible cause of bias is that the outcomes of the triage approach may have been affected by the fact that the triage approach had not been in place for as long as the usual approach. The professionals using the triage approach have less experience with this novel method, and this could lead to contact frequency and the appropriateness of care being underestimated. Triage can reasonably be expected to have a stronger impact on appropriateness of care and possibly on approachability when it has been in place for a longer period of time.

Finally, we used a self-report questionnaire based on an existing instrument to measure school professionals' perceptions of approachability and the appropriateness of support from SHS. Further questionnaire development and research into the validity of the questionnaire are recommended.

#### *Implications for school health services*

SHS systems are available in many countries, and they are often delivered by nurses. The efficiency and quality of these SHS systems need to be optimised to improve children's health and development and to tailor SHS to school systems [4,10]. A change in the organisational model of SHS is needed for the efficient use of resources available in the system and to solve the problem of a shortage of SHS physicians and nurses. Most countries with a high level of staffing have introduced reforms in the last five years, including triage and task-shifting [4]. The benefits of task-shifting are already widely known in health care. We studied the impact of introducing triage and task-shifting to SHS because there has not yet been enough research in this field of health care. Our study showed that the use of a triage approach by SHS could be advisable in countries with similar population-based SHS systems involving routine assessments conducted by physicians and nurses. The involvement of assistants in the routine assessments could improve the efficiency of SHS. A triage approach used by population-based SHS systems could create opportunities for nurses and physicians to increase the contact frequency with schools to deliver care on demand and to enhance the collaboration and relationship between school and health professionals. This

improved collaboration between schools and health professionals is expected to contribute to the early detection of health-related school problems and to benefit children with specific needs.

#### *Implications for research*

An examination of more objective outcome measures such as lower school absenteeism for the support provided by schools and SHS professionals for children with specific needs is advised to enhance our understanding of the benefits of investment in collaboration between the two systems.

Further research is also recommended into the position and responsibilities of SHS and school professionals with a view to improving collaboration between the two systems to improve children's health and well-being. Parents' experiences with the triage approach represent another area requiring study.

## **CONCLUSIONS**

School professionals had more contacts with SHS professionals and were more positive about the appropriateness of support from SHS when a triage approach to routine assessments was in place than when the usual approach was used. Countries with similar population-based SHS systems could benefit from a triage approach which gives physicians and nurses more opportunities to attend schools for consultations and assessments of children on demand.

#### **List of abbreviations used**

SHS: School Health Services

#### **Declarations**

##### *Ethics approval and consent*

Medical ethical approval was not required for this study according to the Dutch Medical Research Involving Human Subjects Act.

Participants completed the digital questionnaires anonymously. They gave consent to participate in the study when they completed the questionnaire.

#### **Consent for publication**

Not applicable.

### **Availability of data and material**

Data can be provided by the corresponding author to researchers on request.

### **Competing interests**

The authors declare they have no competing interests.

### **Funding**

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### **Authors' contributions**

JB developed the triage approach, contributed to the development of the triage protocols, contributed to the conception and design of the study, the acquisition and interpretation of data, and the drafting of this manuscript.

DH contributed to the conception and design of the study, carried out the analysis and interpretation of the data, and revised the manuscript.

RR contributed to the intellectual content and revision of this paper, and critically reviewed the manuscript.

SB contributed to the intellectual content and revision of this paper, and critically reviewed the manuscript.

MN contributed to the intellectual content and revision of this paper, and critically reviewed the manuscript.

PK contributed to the conception and design, the analysis and interpretation of the data, and the review and revision of the manuscript.

Finally, all authors read and approved the final manuscript.

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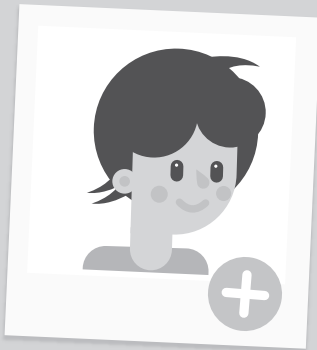
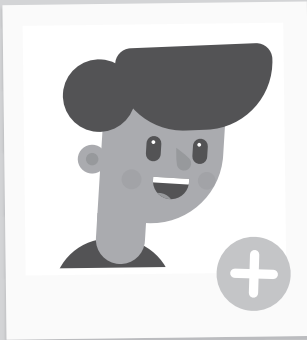
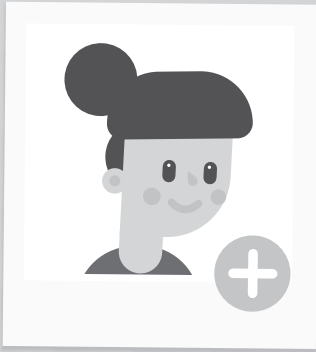
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## General discussion



7

### **Preventive Child Health care in the Netherlands**

Preventive child health care (PCH) services monitor the growth and development of children in order to detect physical and mental health problems in the early stages [1,2]. There is adequate evidence that screening for amblyopia and the monitoring of psychosocial problems and growth in children improve health and social well-being [3-7]. The PCH system in the Netherlands is unique in that it has provided an important, highly accessible, well-known preventive service for over a hundred years, principally using a routine assessment programme open to all children between birth and 18 years old [8-10]. It is also the only primary care system in the country that adopts a broad socio-medical approach to longitudinal monitoring of health and development and it outperforms other Dutch care systems in that it sees more than 90% of all the children in the country [11,12] with an associated budget which is small by comparison with that for curative care [13]. Nevertheless, the system cannot afford to rest on its laurels. Despite the strengths of the Dutch PCH – the wide reach and its prominent position in primary care for the prevention of problems in children – challenges must be addressed in order to improve the social relevance of the system, which will have to adapt to economic, social and health care developments. There has, for example, been an increasing policy focus on prevention and early intervention, in particular in response to economic factors such as the need to reduce demand for more expensive specialised care. In addition, attendance at PCH assessments is no longer unquestioned by all parents and children and a frequent criticism is that PCH is not tailored to the care needs of parents and their children. Furthermore, greater flexibility is required in the delivery of the PCH programme so that it addresses apparent inequities in child health and the different care needs of children that arise as a result.

In response to the challenge of changing the routines in PCH and in line with the need for more attention for children at risk, the Gelderland Midden Regional Health Service developed a novel approach to organising preventive routine assessments for children of school age: the introduction of triage and task-shifting between PCH professionals [14]. Several PCH services have followed this example in the past period and others have made other changes to how routine assessments are organised. However, research was needed to validate the assumptions underlying the development of the triage approach. In this thesis we present a series of papers looking at the first results of our study of

the triage approach. Given our scientific data, our preliminary expectation is that triage and task-shifting could improve the delivery of PCH assessments for children with specific needs. However, no firm conclusions can be drawn yet because of a number of limitations affecting our study. Assuming that our initial results can be substantiated in further research, the triage approach can be expected to produce the results described below.

### **Main findings of our research**

This thesis shows a with usual care comparable access to preventive basic care in the triage approach that we developed and investigated. Also the detection rate of the three health problems studied (overweight, and visual and psychosocial problems) were comparable, however the severity of the weight and psychosocial problems detected differed [15]. The efficient deployment of PCH professionals using triage and task-shifting reduced the costs of routine assessments in the age group 5 to 6 years. There are minimal cost savings in the group of children aged 10 to 11 years [16]. The associated release of manpower and funding can create more opportunities for the delivery of care to children and their families with specific health care needs. In our study PCH physicians and nurses provide more demand-driven care at the request of parents and others such as schools, and therefore this will add to an early detection of health problems. Access to the system and the efficacy of the PCH system are important: assessments must have a wide reach and include the most vulnerable children and their families, even when there is no manifest demand for care. The socio-economic status of children receiving PCH assessments on request was lower and these children were referred more often to extra care than children receiving the routine PCH assessments in both approaches [17]. School professionals using the triage approach said that they had more contact with PCH professionals and they were more positive about the appropriateness of support from PCH than school professionals who were offered the usual approach [18]. The structural presence of PCH physicians and nurses in schools, which is part of the triage approach and necessary to assess children on demand, improved access to PCH and furthered collaboration with school professionals.

We used a prospective cohort design in which we compared a group of children who received the triage approach with a group of children who were seen with

the usual approach. The comparison study group has been matched on gender and age range and we controlled for differences in socio-economic status. We used a pragmatic study design that made research in the daily practice of PCH possible. In the ideal study design children we may have carried out a randomised study in which children are offered either the triage approach or the usual approach. In practice, this was not possible because triage was already being implemented in PCH services. Alternatively, a study-design in which both a pre-assessment and the usual routine assessment are compared in one child would be time-consuming and prohibitively costly because extra trained staff is needed to independently carry out the assessments. Also this design would have been too burdensome for children and parents.

This study has some limitations. It lacks information about the test characteristics for triage. This study design did not allow us to follow children over time in the way that would have been required to learn more about the long-term health outcomes of both approaches. It would be useful to know more about the children with health problems that were not detected by the two approaches. We are in particular interested in the false negative cases in the triage group who were offered a pre-assessment by the PCH assistant but not referred to a follow-up assessment from a physician or nurse. Ideally, we would have a clearer picture of the outcomes of the referrals to additional PCH assessments and to external caregivers in order to know more about potential false positive cases. This would however require a more long-term follow-up of the children.

The generalisation of the results for the triage approach is of particular interest for other nations with similar population-based PCH systems. It depends on the characteristics of health care systems in other countries, such as how PCH is organised, financing, the structure of health care and cultural norms [19].

### **The impact of a triage approach on Dutch PCH**

This study produced some arguments that support the consideration of implementing a triage approach in PCH.

#### *Impact on accessibility*

Appointment attendance rates were not adversely affected by the triage approach. This is an important result because it shows that access to PCH, a proven merit of the Dutch PCH system, was maintained.

We think a routine preventive programme should promote equity and access to assessments for the entire target population in order to reduce uneven access to care and to detect health problems in all children as early as possible.

*Impact on detection and on the delivery of care*

An important finding of our study was that the detection rates of the three health problems studied were comparable between the triage and the usual approaches. However, we found a marginal difference between the two approaches in the severity of the weight and psychosocial problems in subgroups of children identified with these problems by PCH. In the triage approach, children are first assessed by a PCH assistant who determines which children are referred for a follow-up assessment by a PCH physician or nurse. Since PCH assessments are typically straightforward and consist to a large extent of routine protocolled screening activities, it can be argued that pre-selection by PCH assistants could be a reasonable alternative to normal practice in terms of detecting health problems. However, it may be argued that triage by highly qualified professionals, such as physicians and nurses could improve the detection of health problems, although this was not confirmed by the current results of our study keeping in mind that we have no data about false negative cases.

The possibility that the triage approach could result in greater flexibility in the delivery of care for children at risk is important: case-finding should be an ongoing process and not only by a predefined schedule. In the usual approach, PCH professionals visit elementary schools only a few times a year to assess the children at the pre-determined ages (5 to 6, and 10 to 11 years). Routine PCH assessments at isolated points in time provide only snapshots of the dynamic process of development and growth. No problems will be seen in most children at these times. The PCH programme should respond, as they arise, to the care needs of children associated with health issues and stressful life events such as divorce or unemployment, which are more often suspected by school professionals who are in daily contact with parents and their children. In the triage approach, physicians and nurses are less involved in the routine assessments, and this indeed appears to result in more opportunities to look at children with specific care needs: more children were assessed by PCH at the request of parents, well-child care professionals and, in particular, school professionals than in the usual approach, and this favours the early detection

of health problems. It is reasonable to suggest that the increase in PCH assessments on request in the triage approach can be attributed to the fact that the triage approach makes school professionals more aware that physicians and nurses can assess children on request several times in a year and at ages other than those used in the pre-defined scheme for routine assessments. This hypothesis would seem to confirm the thinking among school professionals that the triage approach delivers more appropriate support for children with specific needs than the usual approach [18].

#### *Efficient use of resources*

A balance must be struck between the cost of case-finding on the one hand, and expanding care delivery to optimise child health on the other. We found that the triage approach resulted in a cost reduction of one third in the age group of 5 to 6 years and a minimal cost reduction in the age group of 10 to 11 years. Routine PCH assessments with triage and task-shifting could cut back on the physician and nurse workload at this stage, and result in assistants being more involved, freeing up more time for physicians and nurses to assess children at risk. In broad terms, we found that physicians were less involved in the routine assessments with the age group of 5 to 6 years, and that nurses were less involved with the age group of 10 to 11 years, when the triage approach was used. This is an important result given the increasing shortage of PCH physicians and nurses in the Netherlands. Triage and task-shifting aims to deliver appropriate care to vulnerable children while maintaining the routine assessments for all children.

#### **Implications for PCH services in the Netherlands**

Changes in thinking about priorities in care and recent legislation affecting local policies require the transformation of the youth health care system. The decentralisation of policy development for the youth system managed by municipal authorities was initiated with the aim of improving the prevention of health problems and cutting the costs of specialised care [20]. The thinking is that municipal authorities will then have more opportunities to deliver the appropriate care for the needs of their citizens.

The effectiveness, strengths and social relevance of PCH depend on addressing a number of challenges, to which we now turn.



*Maintaining access to PCH and a wide reach*

We have already mentioned the importance of access to PCH, and the need to use resources more efficiently. From a public health point of view it is important to maintain the low threshold, and wide coverage, of PCH in order to ensure the early identification of health problems, to promote the health of all children, and to provide a safety net for the most vulnerable groups of children and their families.

In the usual approach parents are always asked to be present at routine assessments of children aged 5 to 6 years but the policies of health services vary in this respect for children aged 10 to 11 years. In the triage approach parents are not present at pre-assessments at schools. However, in the triage approach parents are asked to fill out questionnaires about the health of their child and to give consent for the assessment. The parents are also given the option in the questionnaire to state whether they wish to attend the pre-assessment, but almost no parents avail themselves of this opportunity. Parents are expected to be present at follow-up assessments by physicians or nurses. A survey of parents using the triage approach showed that, although they were willing to be present at the assessment, parents appreciated not having to take time to do so, and that they had the opportunity to attend any follow-up assessment by a physician or nurse [21]. However, as a consequence, parents who do not require follow-up assessment have no face-to face contact with PCH physicians or nurses in the triage approach, and this could reduce the involvement of parents and their children. Another consequence may be that it is not possible to deliver personal health education for all parents and their children. Furthermore, there are parents who are not capable of completing questionnaires, and therefore of granting consent for the pre-assessment. In these cases, there is no pre-assessment, and these parents are invited to be present at the assessment by a physician or nurse.

PCH services face the important challenge of reaching the largest number of children possible, and particularly vulnerable groups of children. To maintain the current high attendance rate, we advise PCH services to adopt a more active role in communicating the aims of PCH services, and to encourage parents and adolescents to complete questionnaires and attend routine PCH assessments. Questionnaires should also give parents the idea that they are welcome to ask for advice or an appointment with the physician or nurse. Digital options to

make or reschedule appointments are also important tools that can further attendance by parents and adolescents. To reach vulnerable or care-averse families and their children, PCH services should consider organising more outreach assessments, and home visits in particular, when parents and children do not attend the PCH assessments.

*Tailoring the delivery of PCH care to the requirements of parents and children*

There is an increasing emphasis on empowering parents so that they are more involved in care for the health and development of their children. This implies a greater focus by preventive services on positive parenting. However, unsolicited assessments, advice and support from PCH professionals are no longer accepted by all parents, who also find it less natural to turn to PCH because it does not always address their needs or the needs of their children. Some parents prefer to discuss behaviour problems with school or youth care professionals and medical problems with the GP. Nevertheless, other parents are unable to take responsibility for the health and development of their children and still others do not attend the PCH assessments.

To maintain the wide reach of the PCH system, PCH has to be a relevant partner that responds to needs and demands of parents and children. To make the system more relevant for parents, we advise more personalised assessments in consultation with, or in response to requests from, parents or adolescents. PCH has to be visible and easy to reach for parents and adolescents with requests for voluntary help by PCH. A shift is therefore required from supply-oriented care: PCH professionals need to establish a dialogue with parents and adolescents with the aim of customising the care they provide. PCH has started to develop instruments to facilitate the dialogue with parents, such as Starting Together ( "Samen Starten") and Joint Assessment of Care Requirements ("Gezamenlijk Inschatten Zorgbehoeften") to improve engagement with parents [22,23]. More generally, PCH should be looking at the development of more customer-driven and innovative service delivery in co-creation with parents and adolescents.

We have emphasised the importance of making PCH more flexible to be able to address the needs of children and their parents. The description of the activities of the PCH in the Dutch National Professional Framework (LPK,

Landelijk Professioneel Kader) provides enough openings for more flexibility of PCH care [24,25].

In addition to a triage approach of the routine assessments we advise the introduction of flexibility in the PCH assessments in order to respond to the varied care demands of children and parents. Greater flexibility is needed in terms of frequency of the assessments and of the assessment methods, such as group consultations, telephone assessments or contact through digital channels. Assessments should be arranged at the times and places that are most convenient for parents and children. Digital options such as videos may be helpful tools for the delivery and promotion of health care support on demand, not only in general but also in the periods between routine assessments.

#### *Improving the efficient use of resources*

We have already discussed the importance of using resources efficiently. Triage and task-shifting appear to have a positive impact on the use of budgets and human resources, and it is therefore possible that, within the constraints of the budget and skills mix available for routine PCH services, extra care can be provided for children with specific needs.

The Convention on the Rights of the Child asserts that every child has the same right to the highest attainable level of health [26]. However, there are remarkable differences in the health status of children. Apparent inequities in the health of subgroups of children are often linked to social inequity [27]. These considerations are important here since it has been found that freeing up resources for the health needs of the most disadvantaged makes primary care less costly for individuals and more cost-effective for society [28]. It is therefore reasonable to make an appraisal, from a preventive public health perspective, of the added value of universal prevention and positive parenting for all children by comparison with an increased focus on children at risk with the aim of reducing health inequalities between children. The results of our study of the triage approach show that it is possible to maintain routine assessments for all children while paying more attention to children at risk. However, more research into its effectiveness is needed.

We advise PCH services to engage in discussions with municipal authorities about the focus of their services in order to improve the efficiency and quality of PCH care. Policy needs to be developed targeting the optimal balance

between the aim of promoting the health of all children and the need for tailored PCH care for children and families at risk. The human resources and budgets available determine how much attention can be paid to these two areas [13]. PCH services must claim the resources saved by triage and task-shifting to provide extra care for children at risk. At the Gelderland Midden Regional Health Service, this has resulted in increases in the funds earmarked to address the health needs of vulnerable children.

*Ensuring that PCH services respond to developments in the youth health care system*

National priorities in health care and recent changes in legislation relating to the youth, educational and health care system require adaption of PCH services [20,29]. Following the recent introduction of new legislation relating to the education system (known as Passend Onderwijs) more complicated health problems are increasingly being referred by school professionals for assessment by PCH professionals from the Gelderland Midden Regional Health Service, possibly due to the fact that school and other health care professionals appreciate the broad social-medical scope of PCH professionals. Because the detection and referral of problems, and in particular psychosocial and parenting problems, are not the exclusive domain of PCH professionals, the coordination of health care and collaboration in networks of organisations targeting similar groups of children are important to detect these problems early and to provide parents and children with more efficient and effective support. Our findings for the triage approach suggest that it will encourage the ongoing formation of networks of this kind, and the position of PCH in them: school professionals using the triage approach appreciated the appropriateness of support from PCH and had more contacts with PCH. Furthermore, in the triage approach, PCH professionals visit schools frequently to assess children, both at their own initiative and at the request of school professionals [18].

We advise PCH services to create enough time for PCH professionals to collaborate with professionals from the school system and from the youth health care and primary care system, with the aim of improving joint commitment to early detection, and referral to specialised care if necessary. PCH professionals have a lot of information and knowledge about child growth and development. We advise intensive cooperation between the PCH professionals in school-based and other networks involving children in order to further the

exchange of information about children with health-related school problems and provide them with the care they need to complete their school careers successfully. PCH should be a community facility with a structural presence in schools or other public facilities to maintain accessibility and to encourage collaboration with parties such as school professionals and professionals from the youth health care and primary care system.

We also advise PCH physicians to connect with medical health care professionals such as GPs and medical professionals in youth health care with the aim of delivering more coordinated care.

#### *Implementation of a triage approach*

Implementing a novel triage approach with task-shifting in a PCH service requires approval from managers and the Health Care Inspectorate. The Health Care Inspectorate requires the number of routine assessments to be maintained but accepts flexibility in terms of which professional conducts the assessments [30]. Managers and municipal authorities who are responsible for PCH delivery and budgets have to be involved at an early stage. It is important to explain to municipal funding authorities that the aim of a triage approach is to improve the quality of PCH services and preventive care for children and not to cut costs. Throughout the process of implementation, PCH professionals, parents and other stakeholders should to be involved and kept informed about the new PCH approach and the consequences for PCH care delivery.

We advise making it clear to managers and municipal authorities that time and funding are required to implement a new organisational model, while keeping PCH services in place. A quality-based development of a novel approach implies the close involvement of PCH professionals, as well as the bottom-up development of new protocols and guidelines. Funds and time must be earmarked for professionals so that they can evaluate the care delivered and in order to allow for the further development of the novel approach. Communications with all parties is an area that requires a lot of attention. Finally, we recommend the simultaneous involvement of support departments such as logistics and ICT in order to ensure that implementation is a success.

#### *Investment in the development of PCH professionals when a triage approach is used*

A better-targeted use of professionals' competencies and knowledge is an important pre-condition for the successful introduction of a triage approach with

task-shifting. Tasks must be performed by the most appropriate professionals, and not necessarily the professionals who have done the work in the past. The skill mix should also be optimal, and this depends on the complexity of the tasks, the level of autonomy, and the education and competences of the professionals involved [31,32]. PCH assessments are typically straightforward and consist mainly of routine screening activities by PCH professionals for, in general, healthy children. The Gelderland Midden Regional Health Service has found that PCH can be re-organised if the skill mix of the professionals concerned is optimised. In the triage approach, PCH assistants assess children independently and they take over some of the screening tasks of the physicians or nurses. PCH physicians and nurses working with the triage approach assess only the children with suspected risk factors. Not only can this new approach result in career opportunities and skills development for the professionals involved, it may also be a solution to the increasing shortage of PCH physicians and nurses.

We advise PCH services to invest in training for professionals and supervision to safeguard the quality of care when a triage approach is introduced since the process involves changes in task demarcation for PCH professionals. The Gelderland Midden Regional Health Service has determined the skill levels for all the tasks involved in the delivery of PCH and organised in-service training for assistants from PCH physicians and nurses. Physicians and nurses need to acquire the knowledge and skills required for demand-driven personalised care and also to maintain their levels of knowledge about healthy children. Cooperation and coordination between the different PCH disciplines are also needed because physicians and nurses have to transfer tasks to PCH assistants. This implies not only PCH-specific skills, but also general professional competences. Furthermore, PCH plays a role in public health services generally as a source of relevant aggregated information about the health status of children that is needed to advise municipal authorities and schools. PCH physicians and nurses must therefore be able to make a contribution in this area, and particularly in terms of providing relevant information to give policy-makers a better understanding of the health needs of their citizens. We advise PCH services adopting a triage approach to look at these competences during recruitment procedures and to invest in the training and time that PCH professionals need to perform these tasks.

*Investment in monitoring and quality assurance by PCH*

PCH services must study day-to-day practice to improve their quality and efficiency. Our study of the triage approach provides information about innovations in the organisation of routine assessments and enhances our understanding of approaches to monitoring growth and development in children. We have found that PCH services can conduct research in collaboration with research institutions and that physicians and nurses are interested in applied research looking at their day-to-day practice. The involvement of PCH professionals in research improves the relevance of the outcomes of research for day-to-day practice and the further dissemination of the results to further the ongoing professionalization of PCH.

Our experiences show that PCH services can contribute to applied research. Firstly, the full commitment of PCH services is needed to engage in research. Secondly, if data are used from PCH records, PCH professionals, ICT professionals and professionals managing logistics have to be involved bottom-up in all phases of the research to advise researchers about what is feasible. Thirdly, considerable attention should be paid to instructions about procedures and registration in order to obtain reliable data. And finally, the deployment of PCH and other professionals needs to be fully financed so that they can contribute to data collection and be involved in research [33].

**Directions for further research**

We have conducted pioneering research to explore new ways of organising the routine assessments implemented by PCH. The initial results produced by our study appear to indicate that more efficient and personalised care delivery for children of school age is possible with a triage approach. The results are encouraging but our study suffers from a number of limitations. Additional research is needed in the areas covered by this thesis to further substantiate our results. To begin with, more needs to be known about the actual quality of the detection of health problems and referrals to extra care using a triage approach by comparison with the usual approach. An examination of the outcomes of referrals to additional assessments by PCH professionals or external specialised care-givers could be a useful source of information about the accuracy of health-problem detection. To determine the numbers of children who have been missed in either of the two approaches or who have been assessed mistakenly as having a health problem – the false negative and

false positive cases – we need a long-term study with a large cohort of children and appropriate criterion instruments (“gold standards”).

We have analysed three health problems for which commonly used standard screening guidelines exist. However because there are no gold standards in PCH for health issues such as lifestyle problems, parenting problems and child abuse, studying the sensitivity and specificity of the triage approach represents a challenge.

The results of this study are relevant for preventive child health care in the elementary school age group. More research is also needed into the effects of the triage approach in well-child care (from birth to four years of age) and in secondary schools to allow for the generalisation of the effects of the triage approach.

Surveys of satisfaction among parents and adolescents with the care delivered by the two approaches are also needed, as is investigation of the satisfaction of the different PCH professionals with the two approaches.

Longitudinal research into the impact of the triage approach on the long-term need for care would be advisable to enhance our understanding of the equity of care distribution to the children needing health care and the optimal balance between preventive care for all children and extra care for children at risk. It will also be interesting to establish the impact of the triage approach when it has been implemented over a longer period of time. Moreover, further research is needed to learn more about the cost efficiency of both approaches. Longitudinal research is needed to investigate the costs of referrals to additional assessment by PCH or to external services and, in that way, to determine the cost-effectiveness of the implementation of the triage approach. Further investigation is also recommended of the factors that affect access to PCH professionals. A study of determinants such as the needs of school, youth and health care professionals, and collaboration between the PCH and school systems, as well as factors in the social and political environment of PCH, may teach us more about how to improve children’s health and well-being.

At the time of our study, most PCH services organised routine assessments in the same way. In future research, it will be very difficult to compare PCH approaches with usual care because most PCH services have already made their organisations more flexible and adapted to challenges in society. Follow-up research by TNO, Dutch Child Health Knowledge Centre (NCJ) and four PCH



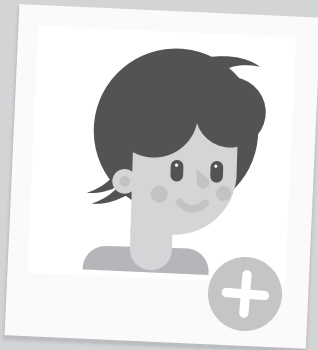
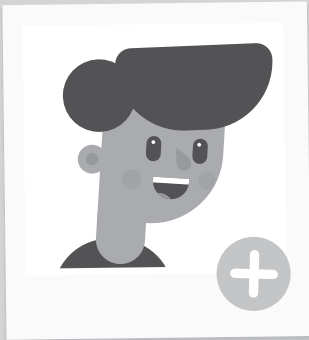
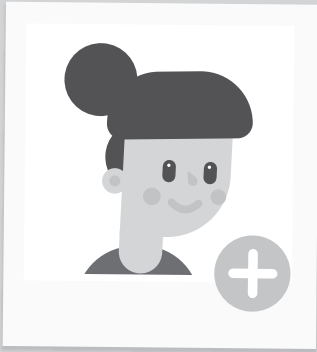
services has now been initiated to compare the impact of different approaches on the flexible delivery of PCH. It will compare the long-term effects on the detection of health problems and referral to care associated with different approaches to the flexible delivery of PCH services involving different skill mixes among PCH professionals and substitutes of face-to-face contacts, such as e-consultations.

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## Summary



In **Chapter 1**, the relevance and challenges of the Preventive Child Health care (PCH) system, and the developed triage approach are described.

The aim of PCH is to deliver preventive services for all children and therefore to detect health problems early and monitor child growth and development longitudinally. Despite the benefits of the Dutch PCH system, which includes a basic package of routine assessments for all children in the country, many PCH services are thinking about ways to reform the organisation of the routine assessments. Greater flexibility is required in the delivery of the PCH programme so that it is tailored to apparent health inequities between subgroups of children and the different care needs that arise as a result. Economic challenges such as reduced budgets, the inefficient use of professionals and workforce shortages mean that the system of preventive health care also needs to be more efficient. In the light of these challenges, we developed a novel approach to the organisation of routine assessments by PCH, involving triage and the shifting of tasks among PCH professionals. We hypothesised that the efficient deployment of PCH professionals and a reduction in the costs of routine assessments would create more opportunities to provide additional PCH care for children with specific health-care needs. Our thinking was that more time would be made available for additional PCH assessments at times other than those pre-defined for routine assessments, and for additional assessments in response to requests from teachers, parents and adolescents.

This thesis addresses several issues relating to access to PCH, detection rates and the delivery of care when a triage approach is used by PCH, and looks at the possible cost implications by comparison with routine assessments.

### **Access to PCH**

It is essential for health screening programmes to be accessible for all children, and this is a proven merit of the basic package delivered by Dutch PCH. In **Chapter 2** we explore the parental help-seeking process in a triage approach to PCH. In a retrospective pilot study based on the data from routine assessments of 390 children aged 5 to 6 years, we investigated access to PCH. We compared the attendance rates for PCH assessment appointments in groups in which the triage approach or the usual approach were used, assuming that attendance rates were indicators of the accessibility of PCH. The attendance rates for pre-assessments and follow-up assessments in the triage approach were compared with the attendance rate for the usual assessment. Our results showed similar

appointment attendance rates for the two approaches. In the triage approach, 96.4% of the children attended the pre-assessment, and 87.7% of the referred children attended a follow-up assessment by a physician or nurse. The rate of attendance for the assessments in the usual approach was 90.0%.

We found similar results in the more comprehensive study described in **Chapter 3** using a prospective observational cohort design. In the triage approach, 96.6% of the children attended pre-assessments, and 89.4% of the referred children attended a follow-up assessment by a physician or nurse. The rate of attendance for the assessments in the usual approach was 93.6%. As expected, all the children in the usual group received a routine PCH assessment by a physician or nurse while only 46% of the children in the triage group required PCH assessment by a physician or a nurse.

In conclusion, access to PCH seems to remain unchanged using a triage approach in a comparison with the usual approach.

### **Detection by PCH**

In **Chapter 3**, we present the results of a prospective cohort study in which detection by the triage approach of overweight, visual disorders, and psychosocial problems was compared with the results of the usual PCH approach. We also assessed the severity of the health problems in subgroups of children with the detected health problems. We used data from the routine assessments of 1897 children aged 5 to 6 and 10 to 11 years.

We found no difference between the triage approach and the usual approach in the detection rates for incident cases of overweight, visual and psychosocial problems. However, we found a marginal difference between the two approaches in the BMI scores in subgroups of children identified with overweight or obesity by PCH. In the triage approach the subgroup of children identified with overweight included more children with a BMI indicating obesity, while the usual approach included more children with a BMI indicating less severe overweight. Significantly higher SDQ scores were found in the subgroup of cases with identified psychosocial problems when the triage approach was used than when the usual approach was adopted.

### **Delivery of extra care for children with specific needs**

When problems are identified by PCH professionals, they decide whether to refer to extra care in the form of additional assessments by PCH, or to external

specialised care. We need to know more about the delivery of extra care in the triage approach, in which PCH professionals are involved differently in routine assessments. In **Chapter 4**, we describe the delivery of extra care targeting children with specific health-care needs in the triage approach and the usual approach in the context of the prospective cohort study. We investigated referral rates to extra care, in other words additional PCH assessments or to external services pursuant to the routine assessments. We did not find any differences between the two approaches for the total group of children referred to extra care. However, more children aged 5 to 6 years and fewer children aged 10 to 11 years were referred to additional PCH assessments in the triage approach. Overall, fewer children were referred to external services in the triage approach than in the usual approach. This can be explained by the fact that in the triage and usual approach the children are assessed by different disciplines leading to other follow-up trajectories. Different processes are used to identify health problems in both approaches. Further, time available to provide advice, recommendations and reassurance may differ, affecting the referral to external services.

In addition, we examined the results of the PCH assessments requested by parties such as parents, school professionals and professionals of well-child care with the aim of devoting more attention to children at risk. More PCH assessments at the request of these parties were found when the triage approach was used ( $p < 0.01$ ). The children were referred by school professionals in particular. It could be hypothesised that differences in the rates for PCH assessments on request between the triage and usual approach are due to the fact that the triage approach results in more awareness among school professionals that physicians and nurses can assess children on request several times in a year. Furthermore, we found differences between the two approaches for the referral rates to additional PCH assessments pursuant to the PCH assessments on request. In the triage approach, half of the children seen on request were referred to additional PCH assessments and one out of five to external services. In the usual approach, no children were referred to additional PCH assessments and 2 of 27 children (7.4%) were referred to external services.

### **Costs of delivering routine assessments**

Triage and task-shifting among PCH professionals could facilitate the resolution of organisational challenges in terms of the efficient use of budgets



and the workforce, allowing for extra care to be given to children with specific needs. In **Chapter 5**, we describe our study of the direct costs of PCH routine assessments by PCH professionals in the triage and usual approaches using a bottom-up micro-costing design. PCH professionals registered time spent on assessments, including time related to non-attendance at assessments, the referral of children and administration. The triage approach to PCH resulted in a projected cost reduction of about one-third by comparison with usual practice for routine assessments of children aged 5 to 6 years by physicians. Minimal cost savings were found in the group of children aged 10 to 11 years when nurses are involved.

The projected costs for PCH professionals working on PCH assessments amounted to €5.2 million per cohort of 100,000 children aged 5/6 years in the triage approach, and €7.6 million in the usual approach. The projected costs in both approaches for children aged 10/11 years were about €4 million per 100,000 children. In the triage approach for children aged 5/6 years, the cost reduction is attributable to the lower level of physician involvement in the assessment of children in combination with the same level of deployment of PCH assistants with relatively low salary costs by comparison with the usual approach. The cost reduction for children aged 10/11 years can be attributed to the costs required for pre-assessments by PCH assistants in the triage approach (which are lower than the costs of assessments by a nurse in the usual approach). However, this reduction in costs was almost offset by the higher costs of the follow-up assessments by physicians or nurses in the triage approach.

We found a reduction in the costs of parental attendance at assessments with the triage approach that is attributable to the absence of parents at pre-assessments in the triage approach. This finding applies to both age groups.

### **School professionals' perception of access to PCH**

Cognitive performance and educational achievements in children benefit from good health and health-related behaviours. The collaboration between preventive health services and the education system helps to detect health problems in school children and furthers early interventions intended to improve health and, therefore, cognitive outcomes. In **Chapter 6** we explore the views of school professionals in elementary schools about working with a triage approach to the routine assessments conducted by PCH and we make a comparison with school professionals who were offered the usual

PCH approach. We conducted a cross-sectional study comparing school professionals' perceptions of the triage and the usual approaches to PCH. The randomly selected school professionals completed digital questionnaires about contact frequency, the approachability of PCH and the appropriateness of support from PCH. School care coordinators and teachers were invited to participate in the study, resulting in a response of 444 (35.7%) professionals from schools working with the triage approach and 320 (44.6%) professionals working with the usual approach.

We found a difference between the two approaches in terms of the perceived appropriateness of support from PCH and the contact frequency between schools and PCH professionals. School professionals using the triage approach had more contacts with PCH and were more satisfied with the appropriateness of support from PCH than respondents in the usual approach group. No impact was found on the perceived approachability of PCH.

Finally, in **Chapter 7**, the main results of this thesis, implications for PCH services and further research developments are discussed.

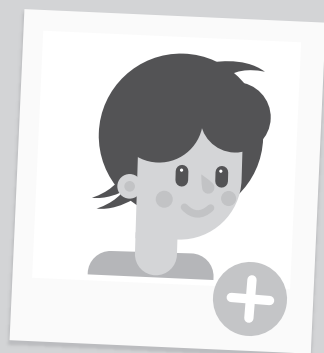
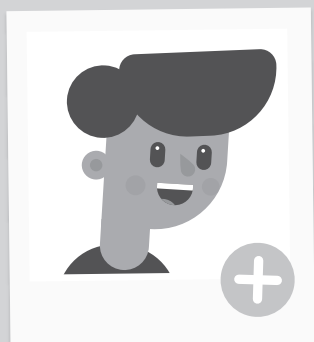
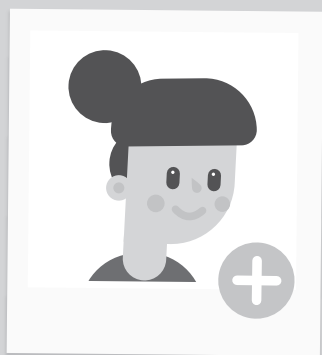
To improve the effectiveness, strengths and social relevance of PCH, it is important to maintain access to PCH and the wide reach of the system. The delivery of PCH care will also have to be tailored to the requirements of parents and children. In addition, it is important that PCH services respond to developments in the youth and health care system. In the triage approach, access to preventive basic care, and the detection of the health problems studied, were comparable with the usual approach. The efficient deployment of PCH professionals using triage and task-shifting reduced the costs and involvement of PCH physicians and nurses in routine assessments, particularly in the youngest age group (5 to 6 years). The associated release of workforce and budgets may create more opportunities for the delivery of care to children and their families with specific health-care needs. In our study, in the triage approach PCH physicians and nurses provided more demand-driven care at the request of parents and others such as school professionals.

We have emphasised the importance of making the PCH programme more flexible to create time for PCH professionals to collaborate with professionals from the school system, and from the youth care and primary care systems, with the aim of improving joint commitment to early detection, and the delivery of more coordinated care. Our findings for the triage approach suggest that it will

encourage the ongoing formation of networks of this kind, and the position of PCH in them: school professionals using the triage approach appreciated the appropriateness of support from PCH and had more contacts with PCH.

In conclusion, triage and task-shifting could help to ensure that appropriate care is delivered to meet the different care needs of parents and their children while maintaining the routine assessments for all children. More research is needed into the outcomes of referral to extra care and into the cost benefits of the triage approach.





## Samenvatting



## **Onderzoek naar de mogelijkheden van triage en taakverschuiving in de Jeugdgezondheidszorg.**

In **Hoofdstuk 1** worden de maatschappelijke relevantie en uitdagingen voor de Jeugdgezondheidszorg (JGZ) beschreven. Verder wordt de ontwikkelde triagemethodiek uitgelegd.

Het doel van de JGZ is om preventieve zorg te bieden aan alle kinderen door vroegtijdig gezondheidsproblemen op te sporen en de groei en ontwikkeling van kinderen longitudinaal te volgen. Ondanks de voordelen van de huidige Nederlandse JGZ, waarbij alle kinderen een basispakket met preventieve basisonderzoeken krijgen aangeboden, oriënteren veel JGZ-organisaties zich op een andere inrichting van het basispakket. Gezondheidsverschillen tussen kinderen en daarmee samenhangende uiteenlopende zorgbehoeften vragen om meer differentiatie in het aanbod van de JGZ. Economische uitdagingen zoals verminderde budgetten vragen een efficiënte inzet van kennis en competenties van professionals. Een toenemend tekort aan jeugdartsen en verpleegkundigen vraagt eveneens om een heroriëntatie op de efficiëntie van de JGZ.

In het licht van deze uitdagingen heeft de GGD Gelderland Midden een triagemethodiek ontwikkeld om de basisonderzoeken voor de 4 tot 18 jarigen anders te organiseren middels taakverschuiving tussen JGZ-professionals. Triage betekent het selecteren van kinderen naar hun zorgbehoefte. In de traditionele werkwijze worden alle kinderen onderzocht door een jeugdarts of jeugdverpleegkundige, soms geassisteerd door een doktersassistente. Bij de triage-methodiek krijgen alle kinderen eerst een vooronderzoek door een doktersassistente. Alleen indien er vermoedens zijn van risicofactoren op het gebied van groei en ontwikkeling worden de kinderen verwezen naar een jeugdarts of jeugdverpleegkundige voor een vervolgonderzoek. De verwachting is dat bij een efficiëntere inzet van de verschillende JGZ-professionals in de basisonderzoeken tijd beschikbaar kan komen om extra zorg te kunnen bieden aan kinderen die meer zorg nodig hebben. Zodoende zou ruimte ontstaan om extra JGZ-onderzoeken uit te voeren, met name voor kinderen die op dat moment niet in aanmerking komen voor een van de basisonderzoeken. Deze kinderen kunnen bijvoorbeeld door de JGZ onderzocht worden op verzoek van derden, zoals scholen, ouders en jongeren zelf. Dit proefschrift beschrijft de toegankelijkheid van de JGZ, de mate van signalering en de geleverde zorg door de JGZ, bij gebruik van de triage-

methodiek. Tevens beschrijft het de kosten van inzet van de JGZ-professionals in de basisonderzoeken bij gebruik van de triage-methodiek in vergelijking tot de traditionele werkwijze. Tot slot zijn de ervaringen beschreven van scholen die JGZ kregen aangeboden middels de triage-methodiek en van scholen waarbij de JGZ via de traditionele werkwijze werd uitgevoerd.

## De toegang tot de JGZ

Het is van essentieel belang dat een screeningsprogramma toegankelijk is voor de totale populatie van kinderen. Dit is een belangrijke verdienste van het huidige Nederlandse JGZ-systeem. In **Hoofdstuk 2** wordt het proces beschreven dat ouders en jongeren moeten doorlopen als er een gezondheidsprobleem wordt geconstateerd bij gebruik van de triage-methodiek.

In een pilot-studie is onder meer onderzocht wat het effect is van triage op de opkomstpercentages bij de basisonderzoeken. In deze studie hebben we de opkomst onderzocht door kindgegevens uit bestaande registraties te analyseren. Er is gebruik gemaakt van de gegevens van de basisonderzoeken van 780 kinderen in de leeftijd van 5 tot 6 jaar. Opkomstpercentages zijn te beschouwen als indicatoren voor de toegang tot de JGZ. De opkomstpercentages bij gebruik van de triage-methodiek, dat wil zeggen van het vooronderzoek door de doktersassistente en het vervolgonderzoek door de jeugdarts of jeugdverpleegkundige, zijn vergeleken met de opkomstpercentages van de basisonderzoeken bij gebruik van de traditionele werkwijze. Wanneer beide werkwijzen worden vergeleken blijkt dat de opkomstpercentages vergelijkbaar zijn. Bij de triage-methodiek verscheen 96,4% van de kinderen bij het vooronderzoek, en 87,7% van de kinderen bij het vervolgonderzoek door een jeugdarts of jeugdverpleegkundige. Bij de traditionele methode is 90,0% van de kinderen verschenen bij de basisonderzoeken.

In de omvangrijkere effect-studie, beschreven in **Hoofdstuk 3**, zijn vergelijkbare resultaten gevonden. In deze effect-studie, die is uitgevoerd met behulp van een prospectief cohortdesign zijn gegevens gebruikt van de basisonderzoeken van 1897 kinderen van 2 leeftijdsgroepen (5 tot 6 en 10 tot 11 jaar). Bij de triage-methodiek is 96,6% van de kinderen verschenen bij het vooronderzoek, en 89,4% van de kinderen bij het vervolgonderzoek door een jeugdarts of jeugdverpleegkundige. De opkomst bij de traditionele methodiek bedroeg 93,6%. Zoals verwacht, zijn met de traditionele methodiek alle

basisonderzoeken uitgevoerd door een jeugdarts of jeugdverpleegkundige, terwijl bij de triage-methodiek 46% van de kinderen is onderzocht door een jeugdarts of een jeugdverpleegkundige.

### **De signalering door de JGZ.**

In **Hoofdstuk 3** presenteren we, als onderdeel van de effect-studie, de resultaten over de signalering van overgewicht, visuele (gezichtsvermogen) stoornissen en psychosociale problemen. Hierbij hebben we de signalering met behulp van de triage-methodiek vergeleken met de resultaten bij gebruik van de traditionele methode. We hebben tevens gekeken naar de ernst van de gezondheidsproblemen in de subgroepen van kinderen op het moment dat deze gezondheidsproblemen door de JGZ waren geconstateerd.

Er zijn geen verschillen gevonden omtrent de incidentiecijfers van overgewicht, visuele stoornissen en psychosociale problemen tussen de triage-methodiek en de traditionele methode. Echter, er is wel een marginaal verschil tussen de twee methodieken gevonden van de BMI-scores in de subgroepen van kinderen die door de JGZ waren geclassificeerd met overgewicht of obesitas. Met de triage-methodiek werden meer kinderen opgespoord met een BMI gelijk aan obesitas in de subgroep van kinderen met overgewicht. Bij de traditionele werkwijze werden meer kinderen met een BMI met minder ernstig overgewicht opgespoord. In vergelijking tot de traditionele werkwijze zijn met de triagewerkwijze significant hogere SDQ scores gevonden in de subgroep van kinderen die geïdentificeerd waren door de JGZ met psychosociale problemen.

### **Extra zorg-aanbod voor kinderen met meer zorgbehoeften.**

Indien JGZ-professionals problemen bij kinderen signaleren, kunnen zij een extra JGZ-onderzoek uitvoeren of het kind verwijzen naar externe zorgverleners, zoals huisartsen of jeugdhulp. Onderzocht is of bij gebruik van de triage-methodiek, waarbij JGZ-professionals een andere rol vervullen in de basisonderzoeken, inderdaad extra zorg door de jeugdartsen en jeugdverpleegkundigen geleverd kan worden. In **Hoofdstuk 4** beschrijven we, als onderdeel van de effect-studie, het extra zorgaanbod voor kinderen met specifieke zorgbehoeften. We hebben de verwijzingspercentages naar extra zorg onderzocht waarbij beide methodieken met elkaar zijn vergeleken. Verwijzing naar extra zorg betekent verwijzing naar extra JGZ-onderzoeken en/of verwijzingen naar externe zorgverleners. De verwijzingspercentages



waren vergelijkbaar voor het totaal van verwijzingen naar extra zorg. Wel blijkt dat met de triage-methodiek meer kinderen in de leeftijdsgroep 5 tot 6 jaar en minder kinderen van 10 tot 11 jaar worden verwezen naar extra onderzoeken door de JGZ. Verder worden bij de triage-methodiek minder kinderen verwezen naar externe hulpverleners. Deze verschillen in verwijzingspercentages zijn te verklaren door de verschillen in de uitvoerende disciplines en het vervolgtraject na signalering tussen beide methodieken.

Daarnaast is onderzocht hoeveel kinderen een onderzoek door de JGZ hebben gekregen op verzoek van derden, zoals ouders, leerkrachten en andere zorgpartners. Dit omdat zij twijfels hebben over de gezondheid en de ontwikkeling van het desbetreffende kind. Er zijn significant meer JGZ-onderzoeken uitgevoerd op verzoek van derden bij gebruik van de triage-methodiek ( $p < 0,01$ ). De kinderen zijn vooral door leerkrachten verwezen naar de JGZ. Mogelijk wordt het verschil tussen beide methodes veroorzaakt doordat leerkrachten beter op de hoogte zijn van wat de JGZ voor hen kan betekenen bij de ondersteuning van zorgleerlingen. Jeugdartsen en jeugdverpleegkundigen zijn bij de triage-methodiek vaker aanwezig op de scholen gedurende het jaar om kinderen te kunnen zien.

Verder vonden we verschillen tussen de twee methodieken betreffende het aantal verwijzingen naar extra JGZ-onderzoeken en naar externe zorgverleners als vervolg op deze onderzoeken op verzoek van derden. Bij de triage-methodiek kreeg de helft van 107 kinderen, die op verzoek van derden door de JGZ zijn onderzocht, aanvullend een extra JGZ-onderzoek en een op de vijf kinderen werd verwezen naar externe zorgverleners. Bij de traditionele methode is geen enkel kind verwezen naar een extra JGZ-onderzoek en 2 van de 27 kinderen zijn verwezen naar externe zorgverleners.

### **Kosten van de JGZ-basisonderzoeken**

Triage en taakverschuiving tussen JGZ-professionals kunnen een rol spelen bij economische uitdagingen. Hierbij kan gedacht worden aan een efficiënt gebruik van budget en inzet van personeel, waardoor middelen beschikbaar komen voor kinderen die meer zorg nodig hebben. In **hoofdstuk 5** zijn de kosten onderzocht van de inzet van JGZ-professionals om de basisonderzoeken uit te voeren door middel van de triage-methodiek en deze te vergelijken met de kosten bij de traditionele methode. De studie is uitgevoerd met behulp van een bottom-up micro-kostenberekening design.

JGZ-professionals registreerden de tijd die zij besteden aan de uitvoering van de basisonderzoeken. Zij registreerden ook de benodigde tijd als kinderen niet verschenen, de benodigde tijd om kinderen te verwijzen en voor de administratieve afhandeling van de onderzoeken. Met de triage-methodiek kan een kostenbesparing worden gerealiseerd van ongeveer een derde bij de uitvoering van het basisonderzoek voor de leeftijdsgroep 5 tot 6 jaar. Er is een minimale kostenbesparing gevonden voor de groep kinderen in de leeftijd van 10 tot 11 jaar.

De kosten voor de inzet van JGZ-professionals, geprojecteerd naar een cohort van 100.000 kinderen van 5 tot 6 jaar, bedroegen € 5,2 miljoen als de triage-methodiek werd ingezet en € 7,6 miljoen bij de traditionele methode. De geprojecteerde kosten voor een cohort van 100.000 kinderen van 10 tot 11 jaar bedroegen bij beide methodieken ongeveer € 4 miljoen.

De kostenvermindering bij gebruik van de triage-methodiek bij 5 tot 6 jarigen wordt veroorzaakt door minder inzet van de jeugdarts bij een nagenoeg gelijkblijvende inzet van de doktersassistente in vergelijking tot de traditionele werkwijze. Bij de leeftijdsgroep 10 tot 11 jarigen worden in de traditionele methode de kinderen onderzocht door een verpleegkundige, soms ondersteund door een doktersassistente. De kostenvermindering bij gebruik van de triage-methodiek door de inzet van de doktersassistente wordt grotendeels teniet gedaan door inzet van de jeugdarts of jeugdverpleegkundige in het vervolgonderzoek.

Door de afwezigheid van ouders bij de vooronderzoeken door de dokters-assistenten worden minder kosten gemaakt door ouders bij de triage-methodiek. Kosten worden veroorzaakt doordat ouders bijvoorbeeld vrij moeten nemen van het werk. Deze bevinding geldt voor beide leeftijdsgroepen.

### **Ervaringen van leerkrachten over de toegankelijkheid en ondersteuning door de JGZ.**

Een goede gezondheid en gezondheidsgedrag hebben een positieve invloed op de cognitieve en educatieve vaardigheden van kinderen. Een goede samenwerking tussen de JGZ en het onderwijssysteem ondersteunt het tijdig opsporen van gezondheidsproblemen bij schoolkinderen en bevordert het inzetten van vroegtijdige interventies om de gezondheid en daarmee de educatieve vaardigheden te verbeteren. In **Hoofdstuk 6** zijn, door middel

van een cross-sectionele studie, de ervaringen onderzocht van scholen in het basisonderwijs over hun samenwerking met de JGZ. Ervaringen van scholen die de triage-methodiek kregen aangeboden zijn vergeleken met ervaringen van scholen waarbij de JGZ werd uitgevoerd door middel van de traditionele methode. De willekeurig geselecteerde scholen hebben digitale vragenlijsten ingevuld over het aantal keren dat zij contact hadden gehad met de JGZ, de ervaren toegankelijkheid van de JGZ en in hoeverre de ondersteuning van de JGZ passend was bij hun hulpvraag. In totaal hebben 444 (respons van 35,7%) professionals van scholen die werkten met de triage-methodiek meegedaan aan het onderzoek en 320 (respons van 44,6%) professionals die de traditionele werkwijze aangeboden hadden gekregen.

Zowel het aantal keren dat scholen contact hadden gehad met de JGZ als de ervaren ondersteuning door de JGZ verschilt tussen beide methodieken. In vergelijking met de traditionele methode hadden scholen die de triage-methodiek kregen aangeboden meer contact gehad met de JGZ. Tevens waren zij positiever over de ondersteuning van de JGZ bij de zorg voor risicokinderen. Scholen geven geen verschillen aan over de toegankelijkheid van de JGZ wanneer beide methoden worden vergeleken.

In **Hoofdstuk 7**, zijn de belangrijkste resultaten, de implicaties voor doorontwikkeling van de JGZ-organisaties en het benodigde vervolg onderzoek besproken.

Om de effectiviteit en de maatschappelijke meerwaarde van de JGZ te verbeteren is het belangrijk om te zorgen dat de toegang tot de JGZ en het grote bereik gehandhaafd blijven. Het zorgaanbod van de JGZ moet beter aansluiten op de zorg behoefte en vragen van ouders en kinderen. Verder is het belangrijk dat JGZ-organisaties met hun aanbod aansluiten op de transformatie in de zorg en op de ontwikkelingen in het lokale sociale domein. Uit deze studie komt naar voren, dat bij gebruik van de triage-methodiek vergelijkbare resultaten worden gevonden voor het bereik van de JGZ en voor de vroeg-signalering van de onderzochte gezondheidsproblemen. Triage en taakverschuiving leiden tot minder inzet van jeugdartsen en verpleegkundigen in het basisonderzoek. Met name voor de leeftijdsgroep 5 tot 6 jarigen verminderen de kosten voor de uitvoering van de basisonderzoeken fors. De daarbij vrijkomende capaciteit van artsen en verpleegkundigen kan ingezet worden voor extra JGZ-zorg voor kinderen en gezinnen die meer zorg nodig

hebben. Het blijkt dat jeugdartsen en jeugdverpleegkundigen, werkende met de triage-methodiek, significant meer onderzoeken uitvoeren op verzoek van derden, zoals leerkrachten en ouders.

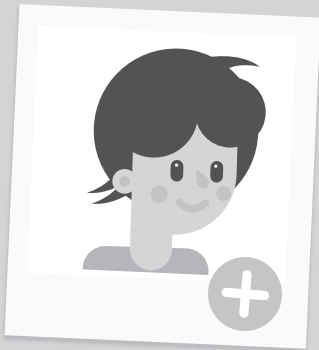
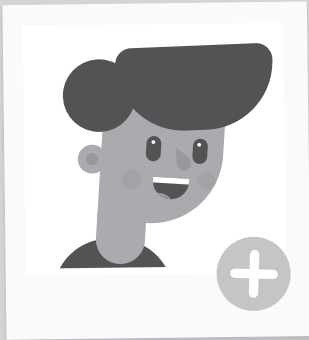
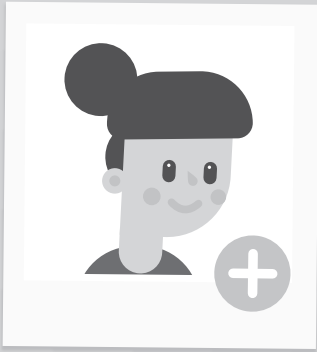
In dit proefschrift is benadrukt dat de JGZ-basisonderzoeken meer op maat en flexibeler uitgevoerd moeten worden. Hierdoor kan ook meer ruimte worden gecreëerd bij jeugdartsen en jeugdverpleegkundigen om samen te kunnen werken met partners, afkomstig uit het onderwijs, de curatieve zorg en het jeugd- en sociale domein met als doel de problemen zo vroeg mogelijk te signaleren en een geïntegreerd zorgaanbod te bieden. De resultaten lijken erop te wijzen dat met gebruik van de triage-methodiek jeugdartsen en jeugdverpleegkundigen meer ruimte hebben om te kunnen participeren in netwerken die betrokken zijn bij zorgvragen over kinderen: scholen hadden vaker contact met de JGZ en vonden de ondersteuning van de JGZ passender bij hun zorgvragen over kinderen.

De bevindingen ondersteunen de voordelen van triage en taakverschuiving. Het blijkt mogelijk om met een efficiënte inzet van middelen alle kinderen het basispakket aan zorg aan te bieden en tevens meer aandacht te geven aan kwetsbare kinderen.

Verder onderzoek is nodig naar de effecten van de verwijzingen naar extra zorg en naar verdere kosteneffectiviteit van beide methodieken.







Dankwoord



Dit proefschrift had hier niet gelegen zonder de medewerking en ondersteuning van velen.

Graag wil ik iedereen bedanken die het voor mij mogelijk hebben gemaakt om dit proefschrift te schrijven.

Op 7 juni 2010 werd in een expertmeeting de evaluatie van de pilot studie naar de triage methodiek gepresenteerd onder voorzitterschap van Simone Buitendijk. Na afloop prikkelde Simone mij om te gaan promoveren op de effectstudie naar de triage methodiek die in voorbereiding was en bood zij aan mijn promotor te worden. Toen ik aangaf de uitdaging aan te gaan sprak zij de voor mij nu historische woorden "dit is een memorabel moment waaraan je later nog terug zal denken". En dat moment is nu aangebroken. Simone bedankt voor je inspiratie en positief kritische scherpe blik.

Een aantal mensen wil ik verder in het bijzonder bedanken:

Mattijs Numans, mijn promotor, die meedacht, bijstuurde en mede het proces tot een goed einde heeft gebracht. Je bleef opbouwend tot het laatst.

Mijn co-promotor Paul Kocken voor het vele, vele werk en de correcties die mij altijd weer aan het denken hebben gezet en die betekenden dat mijn artikelen steeds beter werden. Je bleef kritisch en scherp tot het laatst.

Simone, Mattijs en Paul hebben mij geleerd om wetenschappelijk te denken.

De leden van de beoordelingscommissie voor de tijd en aandacht die zij hebben besteed aan mijn proefschrift.

Mijn overige mede-auteurs die tevens hebben bijgedragen aan het onderzoek: Mascha Kamphuis, Meinou Theunissen, Ria Reis, Debbie Heinen, Elske van den Akker-van Marle en Kitty van der Ploeg.

De deelnemende Jeugdgezondheidszorg organisaties, de ouders, kinderen en leerkrachten. Zonder jullie hadden we de triage methodiek niet kunnen onderzoeken.



Paula van Dommelen voor de statistische ondersteuning bij de analyses.

De gemeente bestuurders in de regio Gelderland-Midden die mij hebben uitgedaagd om een methodiek te ontwikkelen ten behoeve van een meer gedifferentieerd zorgaanbod door de Jeugdgezondheidszorg.

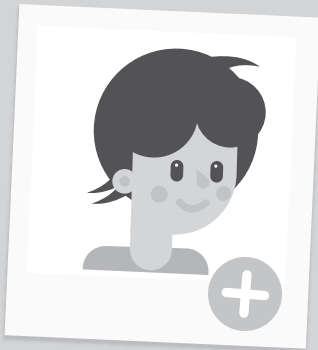
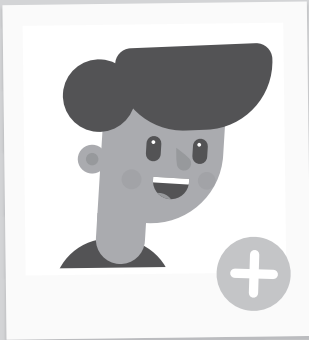
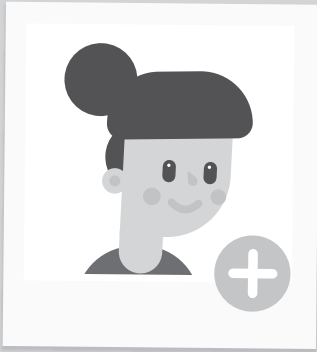
Ype Schat, mijn directeur, voor de mogelijkheden, die ik vanuit de VGGM kreeg om te promoveren. Je stimuleerde mij om het af te ronden voor je pensioen.

Collega's van de VGGM en Eveline Hund, die mijn gedachtengoed over triage en taakherschikking hebben omgezet in praktische werkinstructies en protocollen.

Mijn paranimfen Debbie Heinen en Francine Molenaar voor hun ondersteuning op de achtergrond en mij stimuleerden om door te blijven gaan.

En natuurlijk mijn familie en vrienden. Jan, je hebt met veel steun genoeg moeten nemen met mijn vele uurtjes achter de laptop.





## Curriculum Vitae



Janine Bezem was born on 14 August 1957 in Rotterdam (Netherlands). After completing her secondary education (VWO) at the Alexander Hegius Scholengemeenschap in Deventer in 1975, she studied medicine at Groningen University and received her medical degree in 1983.

During her medical studies, Janine became interested in prevention and Preventive Child Health care (PCH) in particular. She therefore completed a number of housemanships in child health care (preventive and otherwise) including a three-month housemanship in a children's ward in a hospital in London, England. She participated in a research project about Minor Neurological Dysfunction in children supervised by Professor Touwen at Groningen University, where she also taught paediatric psychiatry to students. She started work as a PCH physician ("schoolarts") at the Regional Public Health Service GGD West-Veluwe Vallei in 1984 and, in 1985, she began her training as a public health physician at the University of Nijmegen.

In 2000, after a number of years working as a PCH physician, she was appointed head of the Preventive Child Health Care Department of the Gelderland Midden Regional Health Service (now known as the Gelderland-Midden Health and Safety Region (VGGM)). She completed various management courses at Schouten & Nelissen and trained as a mediator at the Van der Hoeve Negotiation Advisory Board.

From 2007 onwards, she combined her work as a manager with the development and study of the triage approach to increase the quality and efficiency of PCH. As a PCH physician and as head of the PCH department she had already acquired extensive experience with the practical implementation of PCH: the subject of this thesis was born.

Janine was involved intensively in the development and implementation of the triage approach at the GGD Gelderland Midden/VGGM. She was also the leading author of the paper 'Focus on the vulnerable child', which was the basis for the triage approach. After the triage approach was implemented, she wanted to know more about the results of the approach. Working with TNO and two Regional Public Health Services, she was given the opportunity to conduct a pilot study of the triage approach, followed by a more comprehensive study

with TNO, Leiden University Medical Center (LUMC) and four Regional Public Health Services. In September 2011, she was given a post as a research trainee at the TNO Child Health Department and, since 2013, she has been working on this thesis at the LUMC. She has developed and studied a vision about the implementation of triage and task-shifting that has adopted by several PCH services in the Netherlands.

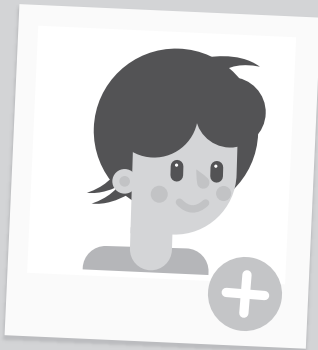
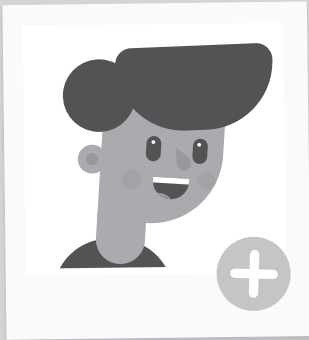
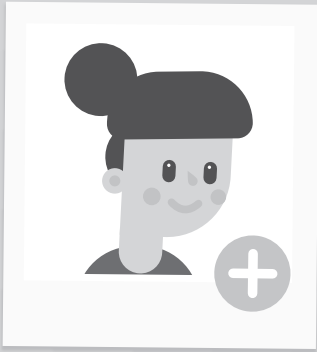
Since 2009, she has been involved in several local, regional and national activities relating to the development of youth care and the development of PCH in particular. Janine participated in a platform called “Jeugdialoog” (Youth Dialogue), an intersectoral collaboration network for the development of the Dutch Youth Care system. She was a member of the “Commissie de Winter, evaluatie van het Basispakket Jeugdgezondheidszorg, VWS” (the De Winter commission for the evaluation of the Basic Package for Preventive Child Health care, Ministry of Health, Welfare and Sport), and went on to be a member of the “begeleidingscommissie uitvoeringsvarianten Basispakket JGZ, NCJ” (monitoring committee for the implementation variants of the JGZ Basic Package).

She has been a member of several ZonMw committees: sub-commissie Interventies, programma Zorg voor Jeugd (the Interventions subcommittee, the Youth Care Programme), “commissie vernieuwing uitvoeringspraktijk Jeugdgezondheidszorg” (the commission for the renovation of implementation practices in Preventive Child Health care) and “werkgroep gemeentelijke pilots vechtscheidingen” (the working group for municipal pilot projects targeting problematic divorce). She has participated in research projects in the field of PCH, in particular about the flexibility of the organisation of PCH.

In addition to her professional activities, Janine is a board member of the “Stichting Jeugdsportfonds Arnhem” (Arnhem Youth Sport Fund).

Janine Bezem lives in Ede and is married to Jan Harms. They have two sons, Robert-Jan and Jorrit, and a daughter, Lisanne.





## List of publications







## List of publications

Bezem J, Theunissen M, Buitendijk SE, Kocken PL.

A novel triage approach of child preventive health assessment: an observational study of routine registry-data

BMC Health Services Research 2014;14:498

Bezem J, Theunissen M, Kamphuis M, Numans ME, Buitendijk SE, Kocken PL.

A novel triage approach to identifying health concerns

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Triage in Preventive Child Health care: a prospective cohort study of care use and referral rates for children at risk

Accepted for publication by BMJ Open 27-09-2017

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Preventive Child Health care at elementary school age: the costs of routine assessments with a triage approach

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