Chapter 9.

Summary
Acute abdominal pain is the third most important reason for children under 15 years to be admitted to emergency departments, and is associated with high costs and decreased quality of life. There are various causes of acute abdominal pain in children, and it is important to quickly differentiate between life-threatening and non-life-threatening diseases. Acute appendicitis and constipation are two common causes of acute abdominal pain in children who are admitted to the emergency department. The goal of this thesis was to broaden our knowledge on the diagnostic process and treatment of acute appendicitis and constipation in these children.

To refine the diagnostic process of acute appendicitis in children, it is important to evaluate factors that can influence this process. In Chapter 2 we describe the results of our study on the influence of BMI on the diagnostic process and treatment of acute appendicitis. We have found that having underweight is a risk factor for the misdiagnosis of acute appendicitis in children. In addition, both underweight and obesity increase the risk on poor treatment outcome after an appendectomy, since they are associated with a high complication rates and prolonged hospital stay. Finally, we recommend to use a laparoscopic appendectomy instead of an open appendectomy for obese children, because this surgical technique is associated with better treatment outcome in these children.

In Chapter 3 we aimed to refine our knowledge on the etiology of acute appendicitis, by investigating if cytomegalovirus (CMV) and human herpes virus 6 (HHV-6) are associated with acute appendicitis in immunocompetent children. None of the children with or without appendicitis had CMV DNA in their blood or appendix, which indicates that acute appendicitis was not associated with an active CMV infection in our study population. However a possible relation cannot be ruled out due to a low CMV seroprevalence resulting in a small sample size. Furthermore, HHV-6 DNA was detected in the appendices of both children with and without appendicitis, indicating that HHV-6 does not seem to play a role in the development of acute appendicitis, or at least not in all cases.

In Chapter 5 we discuss current problems at different stages of the diagnostic process of constipation. We found that many constipated children do not
Summary

recognize their defecation disorder as a problem. This leads, in combination with a taboo on talking about defecation, to a low percentage of constipated children that seek help for their problems. It is therefore important to provide more education to children and their caregivers on correct toilet postures, bowel habits, and defecation disorders to improve the recognition and remedy the existing taboo. Moreover, merely questioning children about defecation pattern is not sufficient to diagnose or exclude constipation, considering that the majority of constipated children have normal stool frequencies and consistencies. Thus, medical specialists should interview children who are suspected of constipation more extensively.

In Chapter 7 we present a new screening method for constipation: the Groningen (Pediatric) Defecation and Fecal Continence questionnaire, which is a feasible tool to not only screen for defecation disorders, but also to determine causative factors due to its extensive range of questions. Importantly, the questionnaire has both a pediatric and adult version which consist of the same questions and validated scores. This provides medical specialists or general practitioners the possibility follow up patients during the transition from childhood to adult life.

In Chapter 4 we propose an alternative approach for confirming or excluding constipation in children with acute abdominal pain, namely treating them with laxatives and/or enemas. We hypothesize that a relatively high percentage of children with acute abdominal pain who have not been diagnosed during the first consultation are constipated, and therefore using laxatives and enemas would lead to quick reduction of pain (with the exception of therapy-resistant constipation). In addition, such pain reduction would provide more certainty that constipation was indeed the cause of the abdominal pain. However, this hypothesis has yet to be proven in a future study.

Finally, due to problems with the diagnostic process of constipation in children, there are also problems with providing the treatment. Especially, since it is often assumed that children outgrow defecation disorders after the transition to adulthood. However, we have demonstrated in Chapter 6 that the prevalence rates and the occurrence of associated symptoms of constipation were
not lower in young adults than in children. Therefore, we recommend to treat every child with constipation as early as possible.

**In conclusion,** with this thesis we aimed to broaden our knowledge on the diagnostic process and treatment of acute appendicitis and constipation in children. In the first part of this thesis we have demonstrated new risk factors for the diagnosis and treatment of acute appendicitis, and made recommendations to adjust for these factors in practice. In addition, we have further explored the etiology of acute appendicitis to see if we could find new treatment targets. In the second part of this thesis we have explored several factors that influence the diagnosis of constipation. Furthermore, we have presented two methods that may in the future contribute to refine the diagnostic process of constipation at the emergency department. Finally, we recommend to treat constipation as early as possible in children, since young adults do not have lower prevalence rates of constipation or fewer associated symptoms.