Children in the Radiology Department
-a study of anxiety, pain, distress and verbal interaction

Berit Björkman

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“Everything that we see is a shadow cast by that which we do not see”

Martin Luther King Jr.
Abstract

This dissertation focuses on children’s experiences of going through an acute radiographic examination due to a suspected fracture. The findings from interviews with children aged 3-15 years showed anxiety, pain and distress to be a concern in conjunction with an examination (Paper I). These initial findings entailed empirical studies being undertaken in order to further study children’s pain and distress in conjunction with an examination (Paper II) as well as children’s anxiety, pain and distress related to the perception of care in the peri-radiographic process (Paper III). Finally, the verbal interaction between the child and radiographer during the examination was studied (Paper IV).

The research was conducted through qualitative, quantitative and mixed method studies. The data collection methods comprised interviews (Paper I), children’s self-reports (Papers II and III), drawings (Paper III), questionnaire (Paper III) and video recordings (Papers I, II and IV). Altogether, 142 children (3-15 years) and 20 female radiographers participated in the studies.

Children aged 5-15 years were observed and they completed self-reports on pain and distress. The children were also provided with an opportunity to express their perceptions of the peri-radiographic process and to make a drawing that was analysed with regard to their level of anxiety. Finally, the verbal interaction between the child and radiographer during the examination was analysed.

Qualitative content analysis was used to analyse the interviews and the written comments in the questionnaire (Papers I and III). The Child Drawing: Hospital Manual (CD:H) was used when analysing the children’s drawings (Paper III), and the Roter Interaction Analysis System (RIAS) was used when analysing the verbal interaction derived from the video recordings (Paper IV). Non-parametric statistics were applied when analysing the quantitative data (Papers II, III and IV).
The findings showed that children aged 5-15 years reported pain on the Coloured Analogue Scale (CAS) and distress on the Facial Affective Scale (FAS) above levels at which treatment or further intervention is recommended. These findings corresponded to the observed pain behaviour measured on the Face, Legs, Activity, Cry and Consolability Scale (FLACC) and anxiety expressed through drawings (CD:H). The children's perception of the care being provided in the peri-radiographic process, was not related to the experience of anxiety, pain and distress however. The children were confident in the radiographers, who they perceived to be skilled in the task and sensitive to their needs. These findings are supported by the analysis of the verbal interaction (RIAS), which showed that the radiographer adjusted the communication when balancing the task-focused and socio-emotional interaction according to the child’s age.

The findings point to the conclusion that children going through an acute radiographic examination should be assessed regarding the anxiety, pain and distress they experience. This is a prerequisite for the radiographer to provide care according to the child’s ability and preferences when interacting with children in the peri-radiographic process.

Keywords: Children, radiography, experiences, anxiety, pain, distress, verbal interaction, examination
Original papers

This thesis is based on the following papers, which are referred to by their Roman numerals in the text.

Paper I
10.1016/j.radi.2011.10.003

Paper II
10.1016/j.radi.2012.02.002

Paper III

Paper IV
http://dx.doi.org/10.1016/j.pedn.2013.03.007

The articles have been reprinted with the kind permission of the respective journals.
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*Berit Björkman*
## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>CAS</td>
<td>Coloured Analogue Scale</td>
</tr>
<tr>
<td>CD:H</td>
<td>Child Drawing: Hospital</td>
</tr>
<tr>
<td>FAS</td>
<td>Facial Affective Scale</td>
</tr>
<tr>
<td>FLACC</td>
<td>Face, Legs, Activity, Cry and Consolability</td>
</tr>
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<td>IASP</td>
<td>International Association for the Study of Pain</td>
</tr>
<tr>
<td>NOBAB</td>
<td>Nordisk Standard för barn och ungdomar inom hälso- och sjukvård</td>
</tr>
<tr>
<td>RIAS</td>
<td>Roter Interaction Analysis System</td>
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<td>UNCRC</td>
<td>United Nations Convention on the Rights of the Child</td>
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Introduction

Children entering a hospital after being exposed to a physical injury, may experience pain, anxiety and distress. For children who are seen for a suspected fracture, the visit to hospital usually also entails the need for a radiographic examination. This may be a time of intensified emotions, as the context and procedure may be unknown and perhaps imply additional pain.

Working as a clinical radiographer, I often reflected on the care provided in the interaction with the patient during the peri-radiographic process. I remember thinking that interacting with children can be particularly challenging. How do children experience being examined in the rather technological context of a radiology department? How can the radiographer interact with the child in a way that provides child-centred care at the same time as satisfactory quality of the diagnostic material? How can the radiographer meet the needs of children of various ages and developmental stages when they may be anxious, distressed and in pain?

When searching for answers in the literature, I found this an area scarcely investigated and described.

This dissertation takes the child’s perspective when studying children’s experiences of undergoing an acute radiographic examination after being physically injured. It takes the child’s perspective as well as a child perspective when studying anxiety, pain and distress and children’s perceptions of care in the peri-radiographic process. Finally, the dissertation takes into account the parent and radiographer when studying the triadic verbal interaction during examination.
Background

Children in health care

Of the total population in Sweden, 20% are children under the age of 18, and 21% of patients seen in health care settings for an acute condition due to an injury are children (Socialstyrelsen, 2011). The age of a child is defined by the United Nations Convention on the Rights of the Child (UNCRC) as between 0 and 18 years (United Nations, 1989).

For a child, going to hospital may imply a variety of feelings due to a number of factors, such as the environment often being experienced as new and unknown (Runeson, Mårtenson, & Enskär, 2007). Children's views on hospital have been shown to be both positive and negative. For some children, hospital is a place where they expect to receive help and recover when ill or injured. For other children, hospital is a threatening place associated with feelings of anxiety due to a fear of the unknown (Coyne & Kirwan, 2012).

This may be especially applicable to children seen in a radiology department (Chesson, Good, & Hart, 2002), where a suspected fracture is the most common reason for a child being submitted for a radiographic examination (Johnston, Bourmaki, Gagnon, Pepler, & Bourgault, 2005). Before the age of 15 years, two-thirds (64%) of boys and almost half (39%) of girls are expected to suffer an injury requiring a radiographic examination (Drendel, Lyon, Bergholte, & Kim, 2006).

Children’s rights

The Health- and Medical Services Act (SFS 1982:763) prescribes, that the care provided to patients should, at all times, be of good quality and meet its needs for confidence. The information provided should also be adjusted to each patient, in an effort to facilitate for the patient to be involved in his or her own health care procedure.

Children are not specifically mentioned in the Health- and Medical Services Act, but according to the United Nations, children in need of
healthcare have the right to express their opinions and to have these taken into consideration in situations affecting them (Article 12) (United Nations, 1989). The Nordic Charter for Children and Youth in Health and Hospital Care (NOBAB) is a standard specially designed to safeguard children’s rights in health care and can be seen as guidance when applying child-centred care. The NOBAB standard emphasizes the child’s - and the parents’ - right to receive information regarding illness, treatment and care in an understandable way (Article V). Health care professionals caring for sick children also need to possess adequate knowledge and competence to meet each child’s physical and psychological needs (Article VII). The child should also at all times be met with respect and integrity (Article X) (NOBAB, 2014).

Nevertheless, previous research shows, that children’s rights in health care are not always applied (Runeson, Hallstrom, Elander, & Hermeren, 2002), which may be due to a difference sometimes seen between considering what is best for the child in the health care situation, and at the same time, taking into account the child’s rights (Söderbäck, Coyne, & Harder, 2011).

A child(s) perspective

Research issues related to children’s health and wellbeing have previously mostly been answered by others than the children themselves. Conducting research with children is different from conducting research with adults in that children have different experiences and understandings of the world and also communicate in different ways (Kirk, 2007). However, it has been considered important to give children the opportunity to participate in research focusing on their own experiences of those issues (Nilsson et al., 2013).

The perspectives taken in health care and research, however, differ between a child perspective and the child’s perspective, both of which focus on children. Taking a child perspective implies, that the adult takes into account what is considered best for the child in the health care situations. The adult tries to understand the child’s perception, experiences and wishes. This viewpoint is based on the adult’s own experiences, knowledge and value. Within research, a child perspective could, for example, involve the use of measurements to rate the child’s behaviour. The child’s perspective, on the other hand, signifies that the
child is provided with an opportunity to express his or her own perceptions, desires and understanding of the world (Nilsson, et al., 2013; Sommer, Pramling Samuelsson, & Hundeide, 2011).

Inheriting an understanding of the child's perspective in health care implies that the child is involved in research (Pelander, Leino-Kilpi, & Katajisto, 2009). However, the way children are involved in research should depend on the problem under study as well as the context in which the research is being carried out and the participating children's cognitive and experiential capacity (Nilsson, et al., 2013). Rather than simply seeing research with children as being different from research with adults, it has been suggested as a continuum dependent on the previously mentioned factors (Punch, 2002). At the same time, it is important to consider using research methods based on children's preferred ways of communication (Barker & Weller, 2003).

Cognitive development

Children are not small adults but growing human beings under development, which implies going through varying developmental stages (Piaget & Inhelder, 1969). It therefore follows, that children should not be treated the same way as adults are. This is especially true when interacting with children during the peri-radiographic process, when they may behave differently from adults (Mathers, Anderson, & McDonald, 2011).

Piaget's theory of cognitive development can form the basis of an understanding of the child's cognitive and emotional development across the childhood period (Piaget & Inhelder, 1969). The sensorimotoric stage (approximate age 0-2 years) is characterized, during the very first months, by the child living solely in the immediate, experienced world. Soon, however, the bodily movement patterns, which are expressions of understanding and thoughts, are replaced with patterns of behaviour. However, the sensorimotoric period of life is characterized by the child's egocentric perspective of seeing the world with the self at the centre. Children in the pre-operational stage (approximate age 3-6 years) often think of what they see, meaning that their reasoning is influenced by their immediate perception of the present situation, believing that the way they see things corresponds to reality. The concrete operational stage (approximate age 7-11 years) is
referred to as a stage in which the child has a more developed ability to take other persons’ perspectives as well as to reason logically. This ability is further developed in the formal operational stage (approximate age from 12 years) when adolescents are capable of abstract and logical thinking as well as distancing themselves from the present situation (Piaget, 1929).

Developing and moving from one stage to another occurs over time, however, and may differ from one child to another. Nevertheless, age is an important factor in relation to children’s understanding and the most frequent used proxy to define differences regarding these matters (McGrath et al., 2008).

Piaget’s theory of cognitive development has dominated previous research regarding children’s understanding of health and illness across childhood (Hansdottir & Malcarne, 1998; Redpath & Rogers, 1984; Simeonson, Buckley, & Monson, 1979). Recent research, however, points to children’s development being more complex and as also relating to cultural and social factors as experienced earlier in life (Doverborg & Pramling Samuelsson, 2000; Havnesköld & Risholm Mothander, 2009).

To approach children of different ages and developmental stages requires a perspective in which health care professionals are sensitive and attentive in order to understand children in general and the individual child’s preferences and motivation in the health care situation in particular (Söderbäck, et al., 2011).

The diagnostic radiology context

A radiology department is characterized as a high-technological environment. This particular environment is a result of the implementation of digital systems and the advanced equipment used to serve patients in a variety of examinations and interventions (Fridell, Aspelin, Edgren, Lindsköld, & Lundberg, 2009). The most recent report from the Swedish Radiation Safety Authority (SSM) showed that 5.4 million radiological examinations were performed annually in Sweden. Of these, 7% involved children aged 0-15 years (SSI Rapport 2008:03).

A child who is in a condition that requires a radiographic examination may experience a variety of feelings, e.g. pain (Chesson, et al., 2002), but
in general, children’s needs are only taken into account to some extent in this environment. Most radiology departments are not specially designed to meet the needs of a variety of developmental stages (Mathers, et al., 2011).

Nevertheless, when operating within an ethical and legal framework, a number of issues need to be taken into consideration when examining children of all ages, e.g. psychological, safety, social and integrity needs (Harvey-Lloyd, 2013). The development of radiographic practice focuses not only on the technology but also on the human capital of the radiographer as a decisive factor in the radiographic procedure (Murphy, 2006). At the same time, a child-centred approach is an important aspect in that the child may feel comfortable in the context (Söderbäck, 2010).

The radiographer

A registered radiographer (röntgensjuksköterska) working in Sweden is in a unique position in that he or she is responsible for both patient care and the technical equipment when performing accurate radiographic examinations, while also taking into consideration radiation and safety aspects (Andersson, Fridlund, Elgán, & Axelsson, 2008). The main subject of study for a radiographer is radiography, which has a multidisciplinary base, including knowledge of caring, medicine, physics and technology. The radiographer performs examinations as documentation for diagnoses and treatment, taking into consideration each patient’s care needs (Örnberg & Andersson, 2011).

It is inherent in the radiographer profession to operate in unison with human rights and according to the individual’s right to life. The radiographer also respects the individual’s right to autonomy and protects the patient’s integrity and dignity in an attempt to relieve discomfort and pain during the peri-radiographic process. The radiographer has a responsibility to provide the patient with adequate information regarding examination and treatment (Swedish Society of Radiographers, 2008).

It is a challenge, however, for the radiographer to achieve a balance between the tasks comprising an examination situation. The long-term goal, which is for the radiographer to accomplish a high-quality
diagnostic image, and the short-term goal, of obtaining a good caring approach and interaction with the patient, are necessary components when performing the examination (Reeves & Decker, 2012).

Most radiographers may not have undergone specialist training in paediatrics, however, and may have only little experience of examining children (Mathers, et al., 2011). For most radiographers who work in general hospitals, the interaction during radiographic procedures with children of various developmental stages will also only be on an occasional basis (Rigney & Davis, 2004). Nonetheless, it is vital that the health care professionals who interact with children in various procedures and examinations possess knowledge regarding children’s development in general and each child in particular. A child-centred approach implies that such knowledge is a prerequisite to convey confidence when caring for children in hospital (Sommer, et al., 2011).

**Caring in the peri-radiographic process**

Nursing, as first described by Florence Nightingale, focused on health and indicated a holistic view, putting the person in the best position to maintain and restore health (Parker & Smith, 2010). In the literature, caring has been viewed from a variety of perspectives, but it can be seen as a central concept of nursing (McCance, McKenna, & Boore, 1997). A study by Lundgren and Berg (2011) showed that the general public’s perception of receiving care is a mix of conceptions. On the one hand, participants expressed expectations of support and access to good care whenever needed, while, on the other, a fear of presumed powerlessness in situations when they were in need of care. Consequently, the service of nursing implies caring for the person exposed to actual or potential health deviations (Swanson, 1991), incorporating a range of skills, e.g. professional, personal, scientific, ethical, cognitive, effective, technical and administrative (McCance, McKenna, & Boore, 1999). For radiographers, competence in these areas is necessary when interacting with patients in various radiographic procedures (Halldorsdottir, 2008; Lundgren & Berg, 2011).

In the rather technological context of a radiology department, the radiographer is in a unique position due to being responsible for the patient during the peri-radiographic process, meaning the entire stay in the radiology department (Örnberg & Andersson, 2011). The care
perceived within this framework is vital to the outcome of the examination as well as to the child’s perception of the procedure. Swanson’s Theory of Caring can be applied in an attempt to understand the situation, as it has meaning to the child and makes the procedure run smoothly, helping the child not to harbour negative feelings. The theory was empirically derived from research in perinatal contexts, but postulated to be generalizable beyond those contexts to be applied also to other contexts and professions in health care (Swanson, 1993). The theory contains five areas for consideration (Table 1).

Table 1: Overview of Swanson’s Theory of Caring (Swanson, 1991).

<table>
<thead>
<tr>
<th>Area</th>
<th>Meaning</th>
<th>Implying</th>
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<tbody>
<tr>
<td>Knowing</td>
<td>Striving to understand an event as it has meaning in life to the other</td>
<td>Avoiding assumptions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Centring on the one cared for</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Assessing thoroughly</td>
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<td></td>
<td></td>
<td>Seeking cues</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engaging the self of both</td>
</tr>
<tr>
<td>Being with</td>
<td>Being emotionally present for the other</td>
<td>Being there</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conveying ability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sharing feelings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not-burdening</td>
</tr>
<tr>
<td>Doing for</td>
<td>Doing for the other what he or she would do for the self if it were at all possible</td>
<td>Comforting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Anticipating</td>
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<tr>
<td></td>
<td></td>
<td>Performing competently</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Protecting</td>
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<tr>
<td></td>
<td></td>
<td>Preserving dignity</td>
</tr>
<tr>
<td>Enabling</td>
<td>Facilitating the other’s passage through life transactions and unfamiliar events</td>
<td>Informing/explaining</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Supporting/allowing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Focusing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Generating alternatives</td>
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<tr>
<td></td>
<td></td>
<td>Giving feedback</td>
</tr>
<tr>
<td>Maintaining belief</td>
<td>Sustaining faith in the other’s capacity to get through an event or transition and face the future with meaning</td>
<td>Believing in/holding in esteem</td>
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<tr>
<td></td>
<td></td>
<td>Maintaining a hope-filled attitude</td>
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<tr>
<td></td>
<td></td>
<td>Offering realistic optimism</td>
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<tr>
<td></td>
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<td>“Going the distance”</td>
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Care of another person should be based on a fundamental belief in his or her capacity to get through the process at hand and to face the future with meaning.
Knowing implies that the radiographer strives to understand an event, e.g. the radiographic procedure, as it has meaning to the child being examined and cared for, and avoids a priori assumption about the meaning of the specific event. Being with means being emotionally present for the one being cared for and available to share feelings, taking into consideration the child’s emotional status, such as experiences of anxiety and distress. Doing for comprises comforting, anticipation and protection when caring for the person in need and implies treating the child with integrity and respect when helping him or her to feel as much at ease as possible during the peri-radiographic process. Enabling embraces the radiographer to help facilitate the passage for the child cared for through unfamiliar events such as, for example, a radiographic examination. Intertwined with these, when the radiographer operates within these areas, maintaining belief in the child cared for should become evident in the peri-radiographic process. This may imply assisting the child to maintain or regain meaning during the process (Swanson, 1991), which may involve a variety of feelings and emotions for the child.

Anxiety

Anxiety is a subjective experience referring to a sense of unease and dread (Berde & Wolfe, 2003) associated with a child undergoing stress, and it influences the child’s ability to cope with a stressful situation (Edwinson Månsson, 1992). Children may experience anxiety when they are ill, injured and in hospital (Pao & Bosk, 2011), or exposed to situations of which they have no previous experience (Wennström, 2011). Expressions of anxiety may include crying, and feeling tense, worried and fearful (Pao & Bosk, 2011). Anxiety of the unknown, in association with pain anticipation, is often experienced by children undergoing health care procedures (Coyne, 2006a; Ortiz, López-Zarco, & Arreola-Bautista, 2012; Runeson, 2002) and may be exaggerated if the child has been exposed to previous unpleasant and painful procedures (Rocha, Marche, & von Baeyer, 2009). The reverse liaison has also been theorized, suggesting that anxiety may increase the experience of pain as a result of descending nerve impulses from the brain, such as emotions, beliefs and thoughts, influencing the ascending pain signals from the tissue damage (Cohen, 2008).
Pain

Pain is subjective and perceived individually as learned through experiences related to injury in early life. According to the International Association for the study of Pain (IASP), pain is defined as “an unpleasant experience associated with actual or potential tissue damage, or described in terms of such damage” (International Association for the Study of Pain, IASP, 1979).

Acute pain, e.g. procedure-related pain, is interpreted by the body as a threat, which leads to a number of physiological reactions such as an increase in pulse, blood pressure, breathing, sweating and muscle activity. Moreover, pain can lead to anxiety and distress which can intensify the experience of the original pain (Molin, Norrbrink, Lundeberg, Lund, & Lundeberg, 2010). Hence, children’s experience of pain is recognized as a rather complex stressor, which may have consequences for pain-related behaviour during the procedure as well as perceptions later in life (Kortesluoma, Nikkonen, & Serlo, 2008).

In the Western World, pain is the most frequent reason for seeking health care. Children are seen more often than adults, for acute conditions (Socialstyrelsen, 2011). Musculoskeletal injuries are one of the most common painful conditions seen in paediatric emergency settings (Ali, Drendel, Kircher, & Beno, 2010). It is in the first 48 hours following the injury that the child experiences the worst pain (Drendel, et al., 2006), and it is also the time frame within which the child is most often seen for an examination in the radiology department, which may cause further pain (Reeves & Decker, 2012). However, children should be spared experiencing pain whenever it can be avoided (NOBAB).

Distress

A number of potentially painful procedures in the health care, e.g. radiographic examination, can involve considerable distress for the child, which may give rise to a variety of negative emotional and behavioural consequences (Duff, Gaskell, Jacobs, & Houghton, 2012). The unpleasantness that may be experienced in conjunction with a painful procedure has been studied and described in previous research as distress (Nilsson, Kokinsky, Nilsson, Sidenvall, & Enskär, 2009; Page et al., 2012). However, distress is a complex phenomenon that has been
used as an umbrella term to embrace all the negative reactions a child may experience in conjunction with acute medical procedures (Cohen, Blount, Cohen, & Johnson, 2004).

More specifically, distress has been described as a composition of anxiety and pain in which the two factors are combined in a behaviourally indistinguishable way (Berde & Wolfe, 2003) that is also the viewpoint in this thesis. Within research, however, it is recommended to distinguish between anxiety, pain and distress when assessing them using a variety of measurement tools. Due to the subjective nature of these factors, the use of self-reporting is therefore warranted (Cohen, et al., 2004).

Verbal interaction

When the patient is anxious and distressed, communication during the peri-radiographic process is of utmost importance (Törnqvist, 2010) and essential to the compliance and the outcome of the procedure (Fossum & Arborelius, 2004). Adapted communication is a prerequisite for obtaining an optimum examination in general, and in particular when interacting with patients in a radiology department where diagnostic images of adequate quality have to be taken (Booth & Manning, 2006).

The meeting in the radiology department is often characterized as a short encounter with the patient and, thus, the radiographer’s communication skills are of vital importance to successfully manage the patient interaction with the outcome of the procedure resulting in high-quality images and good patient care (Reeves & Decker, 2012).

When interacting with children in health care situations, this may at times be a triad including a parent or close relative, which at times can be a complex situation, especially considering that children have the right to be heard and to have their views taken into consideration (Hemingway & Redsell, 2011).

However, interaction with children in health care procedures should include information regarding the procedure at hand adjusted to each child and presented in an age-appropriate way (Söderbäck, et al., 2011). It is important that the health care professionals communicate in a
child-friendly way, e.g. no use of medical jargon, complicated words or long sentences (Coyne & Kirwan, 2012). The communication, including information about the examination, should be simple, honest and reassuring, and be performed in a way adapted to each child’s level of understanding and cognitive development (Edwinson Månsson, 1992).

**Rationale**

The research that has been conducted in the context of a radiology department, studying children’s experiences of the peri-radiographic process in general and the radiographic procedure in particular, is rather sparse (Chesson, et al., 2002; Törnqvist, 2010). The interaction between the patient and radiographer is often characterized by short encounters, implying that the radiographer should have good professional and communication skills (Reeves & Decker, 2012). Furthermore, a registered radiographer meeting patients throughout the lifecycle may find it particularly challenging to interact with children during radiographic examinations due to the fact that little is required regarding this matter in the Swedish national curriculum to become a radiographer (SFS 1993:100). In addition, most radiographers work in general hospitals, seeing children of various ages only occasionally and, hence, may be less familiar with such examination situations (Rigney & Davis, 2004).

Presumably, the reason for not always feeling comfortable in the interaction may be due to a lack of knowledge and experience, as most radiographers are not specifically trained in paediatrics in general or in caring for children of various developmental stages. However, most examinations proceed smoothly without indications of any major concerns, but the contrary may also be the case, as children seen in a radiology department may be in pain and also experience anxiety and distress, which may obstruct the procedure. Firstly, it is difficult to perform any medical procedure with an anxious and distressed child and secondly, the radiographic examination usually requires the child to be relaxed and still in order to obtain satisfactory image quality. In
addition, negative experiences with regard to health care situations may lead to negative expectations of similar events in health care settings in the future (Cohen et al., 2001).

Adapted communication with each child is a prerequisite of a successful examination (Booth & Manning, 2006), as is taking into consideration the child’s emotional status, including his or her perception of pain. Nevertheless, an assessment is not routinely performed regarding children’s anxiety, pain and distress. Research investigating the importance of these feelings from the children’s own experiences and the extent to which these factors are valued as serious concerns could therefore form basis for future implications.

Gaining deeper knowledge and understanding of children’s perspectives and experiences is a challenge for research. Hence, knowledge regarding children’s experiences is needed to help health care professionals better understand the children’s world, as a prerequisite for interacting with children in a supportive way through unfamiliar procedures when striving for child-centred care (Kortesluoma, Hentinen, & Nikkonen, 2003).

Evidence-based radiography is seriously needed in the educational curriculum and in clinical practice (Hafslund, et al., 2008) and children’s experiences in conjunction with a radiographic examination may have both theoretical and practical implications. From a practical perspective, research in this regard can be used when generating age-appropriate protocols for interactions with children in the peri-radiographic process. From a theoretical perspective, the research may add to previous research to confirm present theories.
Aim

The overall purpose of this thesis was to study examination situations with children in acute settings in a radiology department after the child had been exposed to a musculoskeletal injury. The specific aims were

- To study children’s experiences of going through an acute radiographic examination and whether they experienced concerns in association with the examination (Papers I and III)

- To study children’s anxiety, pain and distress during an acute radiographic examination and in particular, the way they evaluated these factors in conjunction with the examination (Papers I, II and III) and whether this could be related to the perception of care during the peri-radiographic process (Paper III)

- To study the verbal interaction during an acute radiographic examination (Papers I, III and IV), in particular the nature of the verbal interaction between the child and the radiographer (Paper IV)
Methodological framework

The starting point of the thesis was to inherit new knowledge and understanding from participants examined and cared for in a high-technological context. The complexity of the context and the research questions required a variety of methods to be used when collecting and analysing the data.

Nursing research has traditionally mainly been performed within two broad paradigms, namely, positivistic and naturalistic (Polit & Beck, 2008). As part of this tradition, the radiology department can be seen as a context strongly influenced by the positivistic tradition (Ramlaul, 2010). Within the positivistic paradigm, objectivity is perceived as a goal and the researcher should be as objective as possible. Through mostly quantitative methods the positivistic paradigm implies an attempt to understand the underlying causes of a certain phenomenon (Polit & Beck, 2008).

However, knowledge is derived by looking at the world from a certain perspective, and the version of knowledge is assembled through interactions between people (Burr, 2004), such as for example, the researcher and participants in the studies, and hence, other research traditions may be applied within nursing research. The naturalistic paradigm can be seen as such an alternative. Within the naturalistic paradigm, the research methods are mostly qualitative and context-bound (Lincoln & Guba, 1985). Reality is seen as a construction of the participants in a certain study and their voices and interpretations are crucial to understanding the subject under investigation (Polit & Beck, 2008).

In this thesis, a naturalistic viewpoint has mostly been adopted in an attempt to bring forth both the child’s perspective and a child perspective derived from a variety of research methods and procedures.
Methods

Design

In order to answer the overall aim of the thesis, studies with a number of research questions and a variety of designs were considered necessary.

The purpose of Paper I was to inherit knowledge regarding children’s experiences of going through a radiographic examination, and a qualitative design was considered the best choice (Kazdin, 2003). The results pointed to a need to pay attention to specific factors, and Paper II aimed to study children’s pain and distress. This was best contributed by a quantitative design (Creswell, 2009). Further research was needed in order to clarify this, and the purpose of Paper III was to relate children’s anxiety, pain and distress to the perception of care. A mixed method design was considered a suitable option (Tashakkori & Teddlie, 1998). In order to inherit knowledge regarding the examination situation from an all-embracing perspective, Paper IV aimed to study the verbal interaction between the child and the radiographer, which required a quantitative design (Creswell, 2009).

An overview of the study design, samples, data collection and analysis methods used in the papers comprising the thesis is presented in Table 2.
Table 2: Overview of the papers in the thesis.

<table>
<thead>
<tr>
<th>Paper</th>
<th>Title</th>
<th>Participants</th>
<th>Design</th>
<th>Method</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Children's experience of going through an acute radiographic examination</td>
<td>32 children*</td>
<td>Qualitative</td>
<td>Interviews</td>
<td>Qualitative content analysis</td>
</tr>
<tr>
<td>II</td>
<td>Children's pain and distress while undergoing an acute radiographic examination</td>
<td>29 children*</td>
<td>Quantitative</td>
<td>Self-reports, Video observations</td>
<td>Descriptive statistics, Spearman's correlation, Chi²-test</td>
</tr>
<tr>
<td>III</td>
<td>Children's anxiety, pain and distress related to the perception of care while undergoing an acute radiographic examination</td>
<td>110 children</td>
<td>Mixed Method</td>
<td>Self-reports, Questionnaire</td>
<td>Quantitative data: CD:H-Manual, Descriptive statistics, Spearman's correlation, Chi²-test, Mann-Whitney U-test, Qualitative data: Qualitative content analysis</td>
</tr>
<tr>
<td>IV</td>
<td>Will it hurt? Verbal interaction between child and radiographer during radiographic examination</td>
<td>32 children*</td>
<td>Quantitative</td>
<td>Video recordings</td>
<td>Roter Interaction Analysis, System, Descriptive statistics, Spearman's correlation, Chi²-test</td>
</tr>
</tbody>
</table>

*Participants drawn from one data collection
Participants and settings

The data collection for Papers I, II and IV was conducted in the context of a radiology department in a county hospital in the south of Sweden. The data were collected consecutively one day a week during four months in the autumn and spring 2009/2010.

The data collection for Paper III was conducted in the context of five radiology departments in Sweden, three of which perform radiographic examinations for adults and children and two situated in a children’s hospital. The data were collected consecutively during four months in the spring of 2012 on days when an appointed radiographer for the task was on duty.

Paper I included 32 children, aged 3-15 years. The inclusion criteria were Swedish-speaking children seen for an acute radiographic examination for a suspected fracture following a musculoskeletal injury of an upper or lower extremity. The exclusion criterion was trauma patients.

Paper II included 29 children, aged 5-15 years. The sample was the same as in study I, with the exception that three children under the age of 5 were excluded as the measurement instruments used in this study had been validated for use with children from 5 years of age.

Paper III included 110 children, aged 5-15 years. The inclusion criteria were Swedish-speaking children seen for an acute radiographic examination for a suspected fracture following an injury of an upper or lower extremity. The exclusion criterion was trauma patients. Seventy participants were seen in a children’s department and 40 in a department for both children and adults.

Paper IV included 32 children, aged 3-15 years and 20 female radiographers with 1-41 years of professional experience in a radiology department. The sample of participating children was the same as in Paper I. The participating radiographers were the ones performing the examinations with the included children.

Demographic data are shown in Table 3.
Table 3: Demographic data of the participants.

<table>
<thead>
<tr>
<th>Category</th>
<th>Papers I and IV</th>
<th>Paper II</th>
<th>Paper III</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Participants</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>32</td>
<td>29</td>
<td>110</td>
</tr>
<tr>
<td>Girls</td>
<td>21 (66%)</td>
<td>19 (66%)</td>
<td>56 (51%)</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-15 years (mean age 9.5)</td>
<td>11 (34%)</td>
<td>10 (34%)</td>
<td>54 (49%)</td>
</tr>
<tr>
<td>5-15 years (mean age 10.0)</td>
<td>56 (43%)</td>
<td>54 (43%)</td>
<td>86 (86%)</td>
</tr>
<tr>
<td><strong>First time visit</strong></td>
<td>10 (31%)</td>
<td>8 (28%)</td>
<td>47 (43%)</td>
</tr>
<tr>
<td><strong>Parent present</strong></td>
<td>21 (66%)</td>
<td>18 (64%)</td>
<td>95 (86%)</td>
</tr>
</tbody>
</table>

**Procedures**

The children were escorted by a parent or close relative (in this thesis referred to as parent) and came to the radiology department either via a primary care centre or the emergency department at the hospital. Upon arrival at the radiology department, the children fitting the inclusion criteria and their parent were informed of the study at hand and asked about participation.

In Paper I, the participants were video-recorded during a radiographic examination for a suspected fracture in the upper or lower extremity. In the post-radiographic process, the children were interviewed individually in a quiet room close to the examination room about their experience of undergoing a radiographic examination. During some of the interviews, the child’s parent was present; this was the choice of each child.

In Paper II, video observations of children’s pain behaviour, using the Face, Legs, Activity, Cry, Consolability, Behaviour Scale (FLACC) (Merkel, Voepel-Lewis, Shayevitz, & Malviya, 1997), were collected during the radiographic examination. The children were also asked to rate their pain intensity as measured on the Coloured Analogue Scale (CAS) (McGrath et al., 1996) and their distress as measured on the Facial Affective Scale (FAS) (McGrath, et al., 1996). The children’s self-reported measurements were collected in the post-radiographic process and reported as experienced during the radiographic examination.
In Paper III, the children were asked to assess their experienced pain intensity on the CAS and their distress on the FAS three times during the peri-radiographic process, first pre-, then per-, and lastly post-radiographic. In the post-radiographic process, the children were also asked to draw a person in hospital, and their anxiety was measured according to the analysis instrument Child Drawing: Hospital (CD:H) (Clatworthy, Simon, & Tiedeman, 1999b), and to comment in writing on two open-ended statements relating to the examination.

In Paper IV, the children and, to some extent, also the parents and radiographers were video-recorded during the radiographic examination in order to gather data for the study of the verbal interaction between the child and the radiographer.

Data collection and instruments

Video recordings

Video recordings were used in the data collection in various ways through Papers I, II and IV. The same procedure was followed, as the same data collection was used in these studies, but it was analysed in different ways in each of the papers.

The video camera was stationed in a corner of the examination room, where the child could be captured on the recording during the entire examination. The researcher would start the recording when the child and parent entered the examination room and then withdraw to stand outside the examination room overlooking the process through the window between the examination room and the technique room. The radiographer was only captured on the recording when she was close to the child, as she would have to leave the room every time an image was to be exposed. The parent was seen on the recording in those cases when he or she was close to the child during the examination. In some cases, the parent was sitting on a chair in a corner of the room and, hence, was not involved in the examination. All the verbal interactions during the examinations were audible on the video recordings.

In Paper I, the children were video-recorded during the examination situation and the recordings were used when interviewing them. For the
youngest children, in particular, it was a way of recalling and focusing on the situation under study (Kortesluoma, et al., 2003) and for the researcher to relate to and ask questions about it.

In Paper II, the video recordings were used by the researchers when observing the children’s pain behaviour and analysing it using the FLACC (Merkel, et al., 1997).

In Paper IV, the video recordings were used when analysing the verbal interaction between the children, radiographers and parents during the radiographic examination. The analysis was performed directly from the recordings according to the RIAS (Roter, n.d.).

**Interviews**

The data collection in Paper I contained interviews based on open-ended questions adapted to the children’s levels of understanding. The children at the pre-operational stage (approximately 3-6 years), were asked the question: “If you were to tell a friend about your visit to the radiology department, how would you put it?” This was considered to help the children at this developmental stage to express their experiences. It is a time in life when children think in a concrete way, and the meaning of words and their linguistic capability may be more limited than that of adults. Questions are often answered accurately but only from the own perspective (Piaget, 2001). To the children in the concrete operational stage (approximately 7-11 years), the question was formulated as: “If one of your friends was injured and about to be examined in a radiology department, how would you explain to him or her what would happen?”. At this stage, children are more nuanced in their expression of experiences but still possess limited ability to think and express abstract concepts (Piaget, 2001). The children in the formal operational stage (approximate age from 12 years) were asked the question: “How do you experience coming to the radiology department and going through a radiographic examination?”. Children at this developmental stage are more mature and the question was therefore posed in a similar way to that for adults.

The use of open-ended questions helped the children to use their own words and the researcher who listened to the children’s own stories (Runeson, et al., 2007). The children were encouraged to talk freely, and the interview was not directed in any way. However, in some cases the
children were asked to clarify which was done by asking attendant questions like: “What do you mean?” and “What do you think?”. During the interview, the children were offered the opportunity to watch the video, recorded during the examination, which was especially helpful for the youngest children when recalling the situation. The video was also used by the researcher when relating to specific phases of the examination. The researcher then asked: “What did you think when you came into the examination room and saw the machines?” and “What was it like to lie under the X-ray machine?”.

Finally the children were asked a few specific questions regarding their visit to the radiology department: “Is this your first time in the radiology department?” and “Did you have any pain relief before you came to the radiology department?”.

The interview guide was initially piloted with five children. This data collection was included in the total sample, as no changes were made in the interview guide.

**Self-reports**

In Papers II and III, self-reports were used when collecting data on the children’s experience of pain and distress in conjunction with a radiographic examination. Self-reports have been considered to be the ‘gold standard’ when assessing subjective areas such as pain (Schiavenato & Craig, 2010).

It is important, to keep in mind, however, that self-rating measures may exclude a number of patients due to cognitive or communicative impairment. Non-verbal expressions and behaviours could be considered important in such situations (Schiavenato & Craig, 2010), e.g. using a behavioural tool.

The Coloured Analogue Scale (CAS) was used to assess pain and the Facial Affective Scale (FAS) to assess distress (McGrath, et al., 1996). Both are explained further elsewhere in the thesis.
**Drawings**

In Paper III, the data collection contained drawings. The children were asked to “draw a picture of a person in hospital” according to the Child Drawing: Hospital Manual (CD:H) (Clatworthy, Simon, & Tiedeman, 1999a; Wennström, Nasic, Hedelin, & Bergh, 2011). The use of drawings has been adopted with children in a variety of contexts (Brewer, Gleditsch, Syblik, Tietjens, & Vacik, 2006; Wennström, 2011), so even within the radiology department (Chesson, et al., 2002). It can be seen as a way to help children to be actively involved in the research. The use of drawings may facilitate children spending time thinking of what they want to express through them and they may also become rich illustrations of how children see the world (Punch, 2002).

**Questionnaire**

In Paper III, the participating children were asked in the post-radiographic process, through a questionnaire, to comment in writing on two open-ended statements relating to the examination: “This has worked out fine” and “This did not work out so well”. The statements were presented at the top of a paper and were followed by lines, as an invitation for the children to write down their thoughts. The children who were incapable of reading and/or writing were supported by the escorting parent. This way of gathering data has been suggested as suitable for research in radiography (Adams & Smith, 2003).

**Assessment of anxiety**

With regard to the assessment of anxiety and the instruments used with children, there is no agreed-upon ‘gold standard’ for self-reporting (Noel, McMurtry, Chambers, & McGrath, 2010). In Paper III, the Child Drawing: Hospital (CD:H) was used, which is an instrument designed to measure the emotional status, such as anxiety, in hospitalized children aged 5-11 years (Clatworthy, et al., 1999b). The child was equipped with an 8½ x 11 inch white sheet of blank paper and eight crayons in the basic colours: yellow, orange, red, purple, blue, green, brown and black. The material was placed on a table in front of the child and he or she was asked to “draw a picture of a person in hospital” (Wennström, et al., 2011).
The drawing was analysed using the CD:H Manual, which consists of three parts labelled A, B and C. Part A contains 14 items, which can be scored from 1, meaning the lowest level of anxiety, up to 10, indicating the highest level of anxiety, with a total of 140 points. The items in the drawing evaluated in this section are position, action, length of person, width of person related to length, facial expression, eyes, size of person compared to the environment, placement on paper, colour predominance, number of colours used, stroke quality, use of paper, presence of hospital equipment and developmental level. Part B contains 8 items of pathological indices, with a total score of 65 points. Part C is a rating of the child’s overall response to anxiety as expressed in the drawing, which is scored on a continuous scale of 1 to 10, with a maximum of 10 points (Wennström, et al., 2011).

In the Swedish version of the analysis manual, the total scores on CD:H can vary between 15 and 215 points (Wennström, et al., 2011), with scorings indicating various levels of anxiety (Clatworthy, et al., 1999b) (Table 4).

Table 4: Level of anxiety based on the total scores of the CD:H (Clatworthy, et al., 1999b).

<table>
<thead>
<tr>
<th>CD:H total score</th>
<th>Level of anxiety</th>
<th>Intervention required</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;43</td>
<td>Very low</td>
<td>Intervention with parents may provide means to foster child coping</td>
</tr>
<tr>
<td>44-83</td>
<td>Low</td>
<td>Intervention with child may prevent the development of difficulties</td>
</tr>
<tr>
<td>84-129</td>
<td>Average</td>
<td>Daily intervention with therapeutic play is advised</td>
</tr>
<tr>
<td>130-167</td>
<td>Above average</td>
<td>Continue daily intervention with therapeutic play, consult with mental health team</td>
</tr>
<tr>
<td>&gt;168</td>
<td>Very high</td>
<td>Refer to mental health team</td>
</tr>
</tbody>
</table>

The CD:H was designed for use when investigating experiences of anxiety and it is validated for use with children, aged 5-15 years (Clatworthy, et al., 1999a).
Assessment of pain

The assessment of pain was done in Papers II and III and could include a variety of clinical tools, e.g. self-reporting scales and behavioural tools, of which the self-reporting represent the ‘gold standard’ (Schiavenato & Craig, 2010). This method requires children to be able to rank their pain on a rating scale and to be able to choose the level that best shows their experience of pain intensity, as these tools are generally used to describe the quantification of pain intensity (McGrath, et al., 1996).
The Coloured Analogue Scale (CAS) is a visual self-reporting scale widely used to measure the experienced pain intensity. The child is asked to move a marker on a scale from light pink and narrow in width, indicating no pain, to deep red and wide in width, indicating intense pain (Figure 2). On the reverse side of the instrument, corresponding numerical values are shown from 0 (no pain) to 10 (intense pain) (McGrath, et al., 1996). The CAS has been recommended as suitable for the measurement of acute pain (Stapelkamp, Carter, Gordon, & Watts, 2011).

Figure 2: The CAS (McGrath, et al., 1996). The Swedish version printed with permission.

The CAS has been validated to measure pain intensity in children from five years and above (McGrath, et al., 1996). Construct validity has been demonstrated when self-reporting on the CAS was assessed after analgesic administration in a study undertaken in the emergency department (Bulloch & Tenenbein, 2002). Reliability has been shown in children seen in the emergency department for injuries causing acute pain (Bulloch, Garcia-Filion, Notricia, Bryson, & McConahay, 2009).
The Face, Legs, Activity, Cry and Consolability, Behavioural Scale (FLACC) is widely used as a tool to observe children’s pain. The instrument has been validated for use with children from birth to assess behaviours associated with pain (Voepel-Lewis, Zanotti, Dammeyer, & Merkel, 2010). The FLACC contains five categories to be assessed for the child, each of which can obtain a score from 0 to 2 (Table 5), with a total score from 0 to 10 (Merkel, et al., 1997). A low score indicates no or little pain and a high score indicates intense pain. The FLACC has been recommended as suitable for use when measuring procedural pain (Stapelkamp, et al., 2011).

Table 5: The FLACC (Merkel, et al., 1997). Printed with permission.

<table>
<thead>
<tr>
<th>Categories</th>
<th>Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Face</td>
<td>No particular expression or smile</td>
</tr>
<tr>
<td>Legs</td>
<td>Normal position or relaxed</td>
</tr>
<tr>
<td>Activity</td>
<td>Lying quietly, normal position, moves easily</td>
</tr>
<tr>
<td>Cry</td>
<td>No cry</td>
</tr>
<tr>
<td>Consolability</td>
<td>Content, relaxed</td>
</tr>
</tbody>
</table>

The FLACC has been validated for use with children from birth (Merkel, et al., 1997; Voepel-Lewis, et al., 2010). Construct validity as well as reliability was demonstrated in a study using the FLACC to measure acute pain across populations of patients (Voepel-Lewis, et al., 2010).
Assessment of distress

In Papers II and III, the Facial Affective Scale (FAS) was used. This is a self-reporting scale consisting of sketches of nine faces, varying in levels from least distress, showing a happy face, to most distress, showing a crying face. Each face represents a corresponding numerical rating from 0.04 to 0.97 (Figure 3). The instrument has been recommended for use with children from five years (McGrath, et al., 1996). A low rating indicates no or little distress and a high rating indicates serious distress. The FAS has previously been used in studies to assess distress in conjunction with an unpleasant and maybe even painful procedure (Nilsson, et al., 2009; Page, et al., 2012).

![Figure 3: The FAS (McGrath, et al., 1996). Printed with permission.](image)

The FAS has been found to be valid and reliable for use with children from five years of age (McGrath, et al., 1996).

Assessment of verbal interaction

The Roter Interaction Analysis System (RIAS) is a validated instrument and the most widely used one for assessing verbal interaction in a variety of health care situations (Cox, Smith, Brown, & Fitzpatrick, 2009; Golsäter, Lingfors, Sidenvall, & Enskär, 2012; Kindler, Szirt, Sommer, Häusler, & Langewitz, 2005; Roter & Larson, 2002; Sandvik, Lind, Graugaard, Torper, & Finset, 2002). The RIAS is a highly adaptable instrument, that is considered capable of capturing unique contextual dimensions within health care situations (Roter & Larson, 2002). This instrument was used in Paper IV.

The analysis is done directly from an audio or videotape, with each utterance coded, taking into account the semantic structure, phrasing
and voice tone. An utterance is defined by a contained thought, and it may be a whole sentence or merely a single word. Each utterance can be coded into one of 49 different categories, with 33 categories for task-focused exchange, 15 for socio-emotional exchange and 1 for unintelligible utterances (see examples in Table 6). The RIAS has shown reliability and predictive validity for a variety of patients and contexts (Roter & Larson, 2002).

Table 6: Examples of categories within task-focused and socio-emotional exchange (Roter & Larson, 2002) used in Paper IV.

<table>
<thead>
<tr>
<th>Categories for task-focused exchange</th>
<th>Categories for socio-emotional exchange</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ask for opinion</td>
<td>Personal remarks, social conversation</td>
</tr>
<tr>
<td>Ask for permission</td>
<td>Laughs, tells jokes</td>
</tr>
<tr>
<td>Gives information - medical condition</td>
<td>Shows concern or worry</td>
</tr>
<tr>
<td>Gives information - therapeutic regimen</td>
<td>Reassures, encourages or shows optimism</td>
</tr>
<tr>
<td>Gives information - other</td>
<td>Shows approval</td>
</tr>
<tr>
<td>Asks closed-ended questions - medical conditions</td>
<td>Gives compliment</td>
</tr>
<tr>
<td>Asks closed-ended questions - therapeutic regimen</td>
<td>Shows disapproval</td>
</tr>
<tr>
<td>Asks closed-ended questions - other</td>
<td>Shows criticism</td>
</tr>
<tr>
<td>Asks open-ended questions - medical conditions</td>
<td>Empathy statements</td>
</tr>
<tr>
<td>Asks open-ended questions - therapeutic regimen</td>
<td>Legitimizing statements</td>
</tr>
<tr>
<td>Shows agreement or understanding</td>
<td>Asks for reassurance</td>
</tr>
<tr>
<td>Back-channel responses</td>
<td></td>
</tr>
<tr>
<td>Transition words</td>
<td></td>
</tr>
<tr>
<td>Gives instructions</td>
<td></td>
</tr>
<tr>
<td>Checks for understanding</td>
<td></td>
</tr>
<tr>
<td>Asks for understanding</td>
<td></td>
</tr>
<tr>
<td>Bid for repetition</td>
<td></td>
</tr>
</tbody>
</table>
Data analysis

Qualitative method

Qualitative design was used on its own in Paper I, and in Paper III it was used as part of a mixed method design.

A qualitative design is relevant when studying individuals’ unique experiences (Kazdin, 2003). Children’s opinions and experiences can be captured through interviews. Doing so in an adequate way compels the child to be informed of the substance of the interview and to be provided with the necessary time to think and reflect (Söderbäck, 2010).

Qualitative content analysis was used to analyse the interviews conducted in Paper I and the qualitative material gathered in Paper III. This method primarily focuses on the individual participant and the context under study in an attempt to emphasize differences and similarities within categories developed in the analysis process (Krippendorff, 2004). Content analysis was considered a suitable method, as the interviews were concise and did not build on any specific theoretical assumption. Consequently, the analyses were inductive.

Initially, each interview (Paper I) was transcribed verbatim and read through several times in order to obtain a deeper understanding of the content. In the analysis process, meaning units were extracted from the text, which could be words, paragraphs or whole sentences containing the same meaning. Each meaning unit was then condensed into a code, and similar codes were combined to form a subcategory. In a final step, the subcategories were abstracted into categories (Graneheim & Lundman, 2004).

In Paper I, the meaning units within each subcategory under the categories were quantified (Krippendorff, 2004), according to age groups based on the developmental stages theorized by Piaget (1929), meaning 3-6 years, 7-11 years and 12-15 years. This was done in an attempt to value what children of various ages attach importance to.

A similar procedure was followed when analysing the written comments in Paper III, but, here, the quantification was done in regard to the positive or negative nature of the comment under study.
Quantitative method

Quantitative design was used on its own in Papers II and IV, and as part of a mixed method design in Paper III.

In Paper II, observations of children’s pain behaviour, using the FLACC were collected during the radiographic examination. Self-reports on pain intensity, assessed by the CAS, and distress, assessed by the FAS, were collected as experienced by the children during the radiographic examination. In Paper III, the same self-report instruments were used to assess pain and distress three times in the peri-radiographic process. In Paper III, participants were also asked to draw a person in hospital, assessing anxiety according to the CD:H.

The Predictive Analytics Software Statistics 18 and 19 were used to analyse the quantitative data, which were ordinal and nominal and accordingly, non-parametric statistics were applied (Kirkwood & Sterne, 2003).

Spearman’s correlation was used to calculate inter-rater reliability when using the observation instrument FLACC (Paper II) and the CD:H manual (Paper III).

When calculating for differences between the age groups, Fischer’s exact test was used in Paper II, the Chi-square and the Mann-Whitney U-test in Paper III and the Chi-square in Paper IV. The statistical significance was established at \( p<0.05 \).

In Paper IV, the verbal interaction derived from video recordings of children and radiographers was analysed using the RIAS manual and software (Roter, n.d.). The coding was done directly from the recordings applying the paediatric version of the RIAS. In the process of analysing the verbal interaction between the child, radiographer and parent, each utterance was coded into one of 49 different categories (Roter & Larson, 2002), as described previously. The researcher and co-supervisor had received training in the RIAS by Roter and Larsson, prior to the analysis process, achieving a status of authorized users of the manual and software. Five of the video recordings were analysed by the trained researcher and co-supervisor together in order to obtain consensus in the coding process. The remaining data were coded solely by the researcher.
During the radiographic examination, some of the children decided to have the parent wait outside the examination room and not be involved in the examination situation, and consequently, not all the verbal interaction involved parent data.

**Mixed method**

A mixed method was used in Paper II. This is a particularly useful design when a complex question is under study. The method implies an integration of the qualitative and quantitative data by merging the two together. Using a concurrent mixed method procedure implies collecting the qualitative and quantitative data at the same time and integrating the outcome into an overall interpretation of the results. Comparing the two data sets in an attempt to determine whether convergence, differences or combinations can be seen; can be considered triangulation (Creswell, 2009; Tashakkori & Teddlie, 1998).

Quantitative data from the participants’ self-reports and the analysis of the children’s drawings were merged with qualitative data from the inductive content analysis of the children’s written comments.

**Trustworthiness**

The qualitative research relies heavily on the descriptions of the experiences under study. Following this, it is very important that the description of experiences, feelings, thoughts, etc. are done in a way that captures the richness of those factors and the meaning they have for the individual participant (Kazdin, 2003), which may form the basis of the discussion on trustworthiness in the methods.

The inquiry into trustworthiness can be seen as a combination of confirmability, credibility, dependability and transferability (Lincoln & Guba, 1985).

Confirmability is similar to objectivity and accuracy of data and can also be seen in the degree to which the researcher has been able to bring out the core of the participants’ characteristics (Lincoln & Guba, 1985). This was obtained using open-ended questions, helping the children to share their experiences expressed in their own words. Confirmability was also
obtained by describing each step of the research process as distinctly as possible and by supporting the presentation of the findings with quotations from the interviews.

Credibility is achieved when confidence in the truth of the data and the researchers’ interpretations are brought forth (Polit & Beck, 2008). Credibility was obtained when the researcher and co-authors who had prior experience of qualitative research, discussed the analysis in general and the final categories in particular until a consensus was reached.

Dependability refers to the stability of data, meaning that the findings would be repeated if the study was carried out with similar participants in a similar context (Polit & Beck, 2008). This would most probably be plausible, as different samples were used in the data collection for the different papers yet showed similar results.

Transferability refers to the generalizability of the findings if they were transferred to other settings or samples (Polit & Beck, 2008). The context and procedures had been described carefully and, accordingly, transferability was considered possible. The radiology departments in which the studies were carried out and the way the examinations were performed are not in any way unique to the context and are comparable to radiology departments elsewhere in Sweden.

The quantitative methods are judged by assessing reliability and validity, where reliability refers to the accuracy and consistency of the results and validity to the results being well grounded and unbiased. Reliability is also associated with the accuracy of the measurement instruments used in the collection of data and the statistical probability that the result is an accurate reflection of a wider group than the investigated sample. Validity is a manifestation of the methods really measuring the concepts intended to be measured (Polit & Beck, 2008). The instruments used are reliable and have been validated for use in similar samples to those in these studies, which are described elsewhere in the thesis.

Whenever children are assessed with regard to their experience of anxiety, pain or distress, validity and reliability are essential qualities for the specific psychometric tool used to measure the present situation. The meaning of this is the importance of the tool firmly measuring the domain under study (Stapelkamp, et al., 2011).
Ethical considerations

Studies I, II and IV (Dnr M82-09) and Study III (Dnr 2011/438-31) were approved by the Research Ethics Committee in Linköping, Sweden. When conducting research with human beings, the four ethical principles should be considered. This was done by taking into account the meaning of autonomy, beneficence, non-maleficence and justice (Beauchamp & Childress, 2013).

When conducting research that involves children, it is vital to consider the ethical issues. Children rely on adults’ protection, as they are in a vulnerable position when in hospital (Kortesluoma, et al., 2003). Under such circumstances, it could be difficult to decline participation in a research study (Kirk, 2007), and it is therefore important that the child and parent are informed of the study and meaning of participation in a way they understand.

The information for the studies was designed in an age-appropriate way and presented both verbally and in writing in a way adapted to the child’s developmental level (Angell, Biggs, Gahleitner, & Dixon-Woods, 2010). The child and parent were left in private to discuss participation before the researcher offered the opportunity of clarification if needed before consent was obtained (Hallström & Elander, 2004). The informed consent should be based on the individual’s right to self-determination and proceed from ethical principles of respect for the integrity of each human being (Miller & Boulton, 2007). Such a procedure should be predominant before the participant decides on informed consent, and it may need to be repeated in order for the child to gain a deeper understanding of the meaning of involvement in research (Nilsson, et al., 2013).

Whether or not the children decided to participate in one of the studies, they were examined routinely, meaning that the examination was not arranged due to the research going on. Participation, however, also meant being video-recorded (Papers I, II and IV), interviewed (Paper I), self-reporting (Papers II and III), making a drawing (Paper III) and making comments on a questionnaire (Paper III), all of which may have influenced the children somehow. Voluntariness was stressed, meaning that the participants could discontinue their involvement in the study at any time, without having to explain why they wanted to withdraw and without any negative consequences for the examination procedure or care (Hallström & Elander, 2004).
The children involved in the data collection were physically injured, and some were also anxious, distressed and in pain. Conducting research with such a category of children requires the researcher to be skilled in understanding the nature of children’s cognitive development and also sensitive to children’s needs (Kortesluoma, et al., 2003). This was accomplished by virtue of the researcher being educated and experienced in the field and sensitive to the children’s emotional status. Being video-recorded during an examination situation may be experienced as an encroachment of integrity (Heath, Hindmarsh, & Luff, 2010). During the interview, when the children were offered the opportunity to watch the video-recorded material, the researcher established whether each child was comfortable in the situation or would prefer the video to be turned off. At the end of each interview, the researcher, together with the child and parent, also ensured that they were in a good state and not in need of further counselling.

**Autonomy**

The aim of autonomy is to protect the individuals integrity (Beauchamp & Childress, 2013). Each potential participant was informed of the study, verbally and in writing in age-specific language, to ensure they understood the meaning of involvement. The autonomy principle was obtained by the fact that no potential participant was forced to be involved in a study. Voluntariness was stressed and informed consent required from all participants before involvement (Silverman, 2006). The child and parent both had to give consent in writing. The children who were not able to write gave their verbal consent. The radiographers involved in the examinations were informed of the studies and the meaning of participation and gave their verbal assent to be video-recorded (Papers I and IV).

The participants were assured of confidentiality, which was obtained by safe storage of the data in order to protect the identity of the participants. When reporting the data, it was done in a way that ensured no individual participant could be identified.

**Beneficence and Non-Maleficence**

Children in health care are especially vulnerable, and in order not to expose children to unnecessary strain, they should only be involved in
research in those cases when knowledge cannot be derived otherwise (MRF, 2002). Participating in a research project and being video-recorded when undergoing an examination may be experienced as an encroachment of integrity, which may be seen as a risk. However, the knowledge generated from the data in this regard was considered to make up for that. Trauma patients were excluded as it was judged inappropriate to include such patients due to the severe conditions.

The principle of doing good and no harm was taken into consideration by not adding anything to the examination other than that which is routinely included. However, participation included self-reporting of pain and distress (Papers II and III), which may have brought up an awareness of unpleasant feelings. This was accounted for by the researcher informing each child and his or her parent whether further counselling was needed (Paper II). All the participants confirmed they were in good condition. For the data collection for Paper III, radiographers were appointed in each of the radiology departments and advised of the procedure for data collection. They were then responsible for the tasks that that entailed, including assurance that all the participants were in a satisfactory condition and comfortable with their participation.

**Justice**

Children matching the inclusion criteria were informed of the study and asked about participation. The inclusion criteria could exclude children due to not understanding or speaking Swedish, which might be seen as a threat to justice. The design of the inclusion criteria, however, was due to practical and economic reasons. Even though the individual participants may gain little or nothing from participation in one of the studies, the overall research can be justified by being seen in a wider perspective in which little has been done within the specific subject and context and new knowledge is seriously needed. Research-based knowledge is needed to implement evidence-based radiography in clinical practice (Hafslund, et al., 2008) and findings from this research may contribute to expounded routines and therefore be beneficial for future children being examined in a radiology department and nearby contexts.
Results

Children’s experience of radiographic examination
(Papers I, II, III and IV)

The interviews conducted with children in the post-radiographic process (Paper I) ranged from 5.6 to 13.2 minutes (mean 8.6) and showed that children, aged 3-15 years had both positive and negative experiences in conjunction with acute radiographic examinations after being exposed to a physical injury. This became visible in the analysis, when two main categories appeared, namely ‘feeling uncomfortable’ and ‘feeling confident’, and three subcategories in each of these (Table 7).

Altogether 164 statements were made and these could be contained in both categories in the same interview.

In Paper III, children aged 5-15 years were asked to comment in writing on two open-ended statements regarding the experience of the examination, ‘This has worked out fine’ and ‘This did not work out so well’.

A total of 105 comments were collected, and they showed that the children had both negative and positive experiences of going through an acute radiographic examination. The categories that emerged in the analysis were, ‘pain’, ‘waiting time’, ‘information’ and ‘caring approach’ (Table 8). There were no overlaps in the comments; a comment was either negative or positive.
Table 7: Overview of the qualitative analysis in Paper I.

<table>
<thead>
<tr>
<th>Participants</th>
<th>Statements</th>
<th>3-6 years n=5</th>
<th>7-11 years n=20</th>
<th>12-15 years n=7</th>
<th>Total statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category</td>
<td>Subcategory</td>
<td>n_s=33</td>
<td>n_s=102</td>
<td>n_s=29</td>
<td>n_s=164</td>
</tr>
<tr>
<td>Feeling</td>
<td>Uncomfortable</td>
<td>Pain in relation to injury and examination</td>
<td>11 (33%)</td>
<td>30 (29%)</td>
<td>7 (24%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The waiting time is strenuous</td>
<td>4 (12%)</td>
<td>12 (12%)</td>
<td>1 (3%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Worries for the future and consequences of the injury</td>
<td>0</td>
<td>4 (4%)</td>
<td>9 (31%)</td>
</tr>
<tr>
<td>Feeling</td>
<td>Confident</td>
<td>Confidence in parental presence</td>
<td>5 (15%)</td>
<td>2 (2%)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Confidence in radiographic staff and examination procedure</td>
<td>8 (24%)</td>
<td>33 (32%)</td>
<td>6 (21%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Recognition entails familiarity</td>
<td>5 (15%)</td>
<td>21 (21%)</td>
<td>6 (21%)</td>
</tr>
</tbody>
</table>

Table 8: Overview of the qualitative analysis in Paper III.

<table>
<thead>
<tr>
<th>Category</th>
<th>5-11 years n=70</th>
<th>12-15 years n=40</th>
<th>Total comments n_c=105</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>n_c=14</td>
<td>n_c=2</td>
<td>16 (15%)</td>
</tr>
<tr>
<td>Waiting time</td>
<td>n_c=6</td>
<td>n_c=16</td>
<td>22 (21%)</td>
</tr>
<tr>
<td>Information</td>
<td>n_c=5</td>
<td>n_c=4</td>
<td>9 (9%)</td>
</tr>
<tr>
<td>Caring approach</td>
<td>n_c=41</td>
<td>n_c=17</td>
<td>58 (55%)</td>
</tr>
</tbody>
</table>

**Negative experiences**

All the children included in the studies had been physically injured through indoor or outdoor play or sports, and going through a radiographic examination after being exposed to a musculoskeletal injury was associated with anxiety (Papers I, III) and pain (Papers I, II, III, IV). This was also experienced as distressing (Papers I, II, III), especially as the radiographic examination required the children to sit
or lie still and the radiographer sometimes needing to touch the injured site.

“I have so much pain.” (7-year-old girl, Paper I)

“It did hurt in my hand when they X-rayed my hand.” (11-year-old girl, Paper III)

Children who proceeded through the peri-radiographic process quickly, expressed appreciation for that. However, children who were exposed to a prolonged waiting time experienced this as rather stressful and exhausting, especially those who were in pain. They also found it difficult not to be allowed to eat before the official diagnosis (Papers I and III).

“I wanted to go home then.” (3-year-old boy, Paper I)

“The waiting time and not being able to eat [was not good],” (12-year-old girl, Paper III)

For the older children, the time spent in the radiology department was associated with thoughts of the future and embraced worries about possible consequences of the injury (Paper I).

Positive experiences

Overall, the children were satisfied with the care provided in the peri-radiographic process. They felt confident in the radiographic staff, who they perceived as skilled for the task, sensitive to their needs and as providing the help required for the individual child (Papers I and III).

“It’s very good that you take such good care of me.” (15-year-old boy, Paper I)

“They have taken very good care of me and have been careful in case something is broken.” (6-year-old girl, Paper III)

“The radiographer was very kind, and I received the help that I needed.” (13-year-old boy, Paper III)
The children expressed that they were treated well and that the information was presented in a way that they could easily understand in order to know what to do (Paper III).

“I am very satisfied that they talked to me during the examination in a way so that I knew what to do.” (10-year-old girl, Paper III)

The children gained confidence by having a parent or relative close by during the examination, for example, when helping to fixate the injured extremity during examination (Paper I).

“Yes... good that Mum was there.” (5-year-old girl, Paper I)

**Anxiety (Papers I and III)**

Anxiety in conjunction with a radiographic examination was a concern for the children. The qualitative findings (Paper I) showed that the older children, in particular, experienced anxiety in conjunction with a radiographic examination as they were worried about the diagnosis and eventual consequences of the injury.

“I felt worried and then it [going through the examination] was rough with my finger.” (13-year-old boy, Paper I)

The CD:H manual was used when analysing the children’s drawings as performed in the post-radiographic process. The inter-rater correlation was calculated as $r_s=0.89$ ($p<0.01$). The measured scores ranged from 34 to 159 (md=78), with older children, 12-15 years, showing more anxiety (md=84) than younger children, 5-11 years (md=73). The Mann-Whitney U-test showed no statistically significant differences between these age groups ($p=0.09$). The quantitative findings also showed that 46 (42%) experienced average or worse anxiety according to the levels provided in the CD:H manual (Table 9). The Chi-square showed no statistically significant differences between age groups ($p=0.50$) (Paper III). The distribution of scores from the CD:H analysis (Paper III) is shown in Table 9.
Table 9: Levels of anxiety, measured with CD:H. Results from Paper III.

<table>
<thead>
<tr>
<th>CD:H total score</th>
<th>Level of anxiety</th>
<th>Study result for children 5·11 years (n=70)</th>
<th>Study result for children 12·15 years (n=40)</th>
<th>Total study result (n=110)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;43</td>
<td>Very low</td>
<td>6 (8%)</td>
<td>1 (3%)</td>
<td>7 (6%)</td>
</tr>
<tr>
<td>44·83</td>
<td>Low</td>
<td>38 (54%)</td>
<td>19 (47%)</td>
<td>57 (52%)</td>
</tr>
<tr>
<td>84·129</td>
<td>Average</td>
<td>23 (33%)</td>
<td>19 (47%)</td>
<td>42 (38%)</td>
</tr>
<tr>
<td>130·167</td>
<td>Above average</td>
<td>3 (5%)</td>
<td>1 (3%)</td>
<td>4 (4%)</td>
</tr>
<tr>
<td>&gt;168</td>
<td>Very high</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Pain (Papers I, II, III and IV)

Being exposed to a radiographic examination after a physical injury was associated with pain, which was expressed verbally or through bodily behaviour, crying or self-reports (Papers I, II, III and IV).

Children were asked open-ended questions adapted to the child’s level of understanding regarding the experience of undergoing a radiographic examination, and 29% of the statements contained pain as a concern (Paper I).

“It did hurt quite a bit when she [the radiographer] put a small pillow under my finger [while performing the examination].” (13-year-old boy, Paper I)

When analysing the verbal interactions between the children and radiographers (Paper IV), the nature of the verbal interaction contained various expressions of pain by the children, such as, for example, disagreement, information regarding pain intensity and crying (Tables 12 and 13).

The children’s pain behaviour was assessed using the FLACC scale pre- and per-radiographically (Paper II). The inter-rater correlations in the assessment were calculated as $r_s=0.60$ and $r_s=0.84$ respectively for the two assessment occasions. The observed scores ranged from 0.0 to 6.0 (md=2.0), and Spearman’s correlations showed statistically significant
correlation with the self-reported pain as assessed on the CAS and the distress as assessed on the FAS (Paper II) (Table 10).

Table 10: Correlations between scores on the CAS, FAS and FLACC (Paper II).

<table>
<thead>
<tr>
<th>Distress (FAS)</th>
<th>Pain (CAS)</th>
<th>Pain (FLACCpre)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.29</td>
<td>0.53**</td>
</tr>
<tr>
<td>Pain (FLACCpre)</td>
<td>0.36</td>
<td>0.45*</td>
</tr>
<tr>
<td>Pain (FLACCper)</td>
<td>0.61**</td>
<td>0.61**</td>
</tr>
</tbody>
</table>

*p<0.05, **p<0.01

The self-reported pain as assessed on the CAS during examination ranged from 1.5 to 10.0 (md=6.3) (Paper II) and ranged from 0.0 to 10.0 (md=5.6) (Paper III). In Paper III, the self-reported pain was also assessed pre-radiographically (md=5.5) and post-radiographically (md=5.0).

When calculating Spearman’s correlation, statistically significant correlations were obtained between the pain levels, as assessed on the CAS, and the experienced distress as assessed on the FAS (Paper III) (Table 11).

Table 11: Correlations between scores on the CAS, FAS and CD:H (Paper III).

<table>
<thead>
<tr>
<th>Distress (FAS)</th>
<th>Pain (CAS)</th>
<th>Distress (FAS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety (CD:H)</td>
<td>0.55**</td>
<td>0.39**</td>
</tr>
<tr>
<td></td>
<td>0.21</td>
<td></td>
</tr>
</tbody>
</table>

**p<0.01

Fischer's Exact test showed no statistically significant differences in the self-reported pain levels or observed pain behaviours between children who were diagnosed as having a fracture and those who did not have a fracture (p=0.55 and p=0.20 respectively) (Paper II).

Integrating the qualitative and quantitative findings (Paper III), for the experience of pain was endorsed by children mentioning pain to be a concern and also showing it on the measurement instrument, with 85% reporting a pain level above 3.0 on the CAS. Of the total sample, 56% had received pain relief in the emergency room prior to the examination and 26% at home, but 29% of the children had not received any pain relief at home or in the emergency room (Paper III).
Distress (Papers I, II and III)

Distress was mentioned by the children as a concern in conjunction with a radiographic examination after a physical injury, mostly as the context was new and unknown but also due to worries for the consequences of examination and diagnosis (Paper I).

“We can just hope that there isn’t a crack or a break in the leg – or anything…” (15-year-old boy, Paper I)

The self-reported distress as assessed on the FAS during examination ranged from 0.04 to 0.79 (md=0.47) (Paper II) and ranged from 0.04 to 0.97 (md=0.59) (Paper III). In paper III, the self-reported distress was also assessed pre- and post-radiographically and showed similar scores (md=0.59).

The self-reported scores as assessed on the FAS correlated significantly with the observed pain behaviour during examination (Paper II) (Table 10) and the self-reported pain (Paper III) (Table 11).

Average scores (0.59) on the FAS or above was obtained in 43% of the children when assessed during examination (Paper III).

Verbal interaction (Papers I, III and IV)

Children expressed satisfaction with the interaction in general and the information, in particular, during the examination (Paper I, III). The findings also showed that 92% of the verbal interaction during an acute radiographic examination with children aged 3-15 years took place between the radiographer and the child and the remaining 8% between the radiographer and the parent (Paper IV) (Figure 4).

The data collection was derived from 32 acute radiographic examinations with a duration of 4.0 to 21.2 minutes (mean = 8.7 minutes), depending on the type of examination for which the child was referred. The data contained a total of 3328 utterances and yielded 17 categories involving task-focused exchange and 11 involving socio-emotional exchange together with one category of unintelligible utterances (Table 12 and 13) (Paper IV).
Of the radiographer’s verbal interaction with the children, 78% contained task-focused categories, of which the most frequently used was ‘gives instructions’ (Table 12). The remaining 22% contained socio-emotional categories, of which the most frequently used was ‘personal remarks’ (Table 13) (Paper IV).

Of the children’s verbal interaction during the radiographic procedure, 34% contained task-focused categories, of which the most frequently used was ‘shows agreement or understanding’. The remaining 66% contained socio-emotional categories, of which the most frequently used was ‘personal remarks’ (Paper IV).

The frequency of utterances varied with regard to the child’s age, with an average of 63 utterances used with children 3-6 years, 39 with children 7-11 years and an average of 23 utterances used with children 12-15 years (Paper IV).
Table 12: RIAS coding categories for task-focused exchange used in the analysis (Paper IV).

<table>
<thead>
<tr>
<th>Category</th>
<th>Total number of utterances</th>
<th>Examples of utterances radiographer to child</th>
<th>Examples of utterances child to radiographer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gives instructions</td>
<td>970</td>
<td>You have to sit over here.</td>
<td>---</td>
</tr>
<tr>
<td>Transition words</td>
<td>440</td>
<td>Let’s see.</td>
<td>Aah…</td>
</tr>
<tr>
<td>Shows agreement or understanding</td>
<td>319</td>
<td>Ok.</td>
<td>Yes, I will do my best.</td>
</tr>
<tr>
<td>Gives information - Therapeutic regimen</td>
<td>204</td>
<td>We need to perform some comparative images.</td>
<td>I have had an X-ray before at the dentist.</td>
</tr>
<tr>
<td>Gives information - medical condition</td>
<td>145</td>
<td>Your leg is rather swollen.</td>
<td>It is right here on the finger it hurts.</td>
</tr>
<tr>
<td>Asks closed-ended questions - medical conditions</td>
<td>98</td>
<td>Is it your left hand that hurts?</td>
<td>---</td>
</tr>
<tr>
<td>Checks for understanding</td>
<td>67</td>
<td>Ok, so this is where you feel pain.</td>
<td>---</td>
</tr>
<tr>
<td>Asks for understanding</td>
<td>66</td>
<td>Do you understand what I mean?</td>
<td>Am I supposed to sit like this?</td>
</tr>
<tr>
<td>Asks open-ended questions - medical condition</td>
<td>49</td>
<td>Where does it hurt?</td>
<td>---</td>
</tr>
<tr>
<td>Back-channel responses</td>
<td>38</td>
<td>Mmm-huh</td>
<td>---</td>
</tr>
<tr>
<td>Asks for opinion</td>
<td>31</td>
<td>This will do, don’t you think?</td>
<td>---</td>
</tr>
<tr>
<td>Asks for permission</td>
<td>29</td>
<td>Can I wipe away your tears?</td>
<td>---</td>
</tr>
<tr>
<td>Asks closed ended questions - therapeutic regimen</td>
<td>22</td>
<td>Have you had an X-ray before?</td>
<td>Can I have a look at the images?</td>
</tr>
<tr>
<td>Gives information - other</td>
<td>9</td>
<td>I can help you take on your socks.</td>
<td>It’s a little difficult when having the shoe on.</td>
</tr>
<tr>
<td>Asks closed ended questions - other</td>
<td>6</td>
<td>Can you pull up your pants over your knee?</td>
<td>---</td>
</tr>
<tr>
<td>Bid for repetition</td>
<td>5</td>
<td>What did you say?</td>
<td>What?</td>
</tr>
<tr>
<td>Asks open-ended questions - therapeutic regimen</td>
<td>2</td>
<td>---</td>
<td>What does this mark/sign mean?</td>
</tr>
<tr>
<td>Unintelligible utterances</td>
<td>2</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>
Table 13: RIAS coding-categories for socio-emotional exchange used in the analysis (Paper IV).

<table>
<thead>
<tr>
<th>Category</th>
<th>Total number of utterances</th>
<th>Examples of utterances radiographer to child</th>
<th>Examples of utterances child to radiographer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal remarks, social conversation</td>
<td>403</td>
<td>I am happy the spiders on your shirt are not alive.</td>
<td>Her name is Nin 'cause she’s a rabbit.</td>
</tr>
<tr>
<td>Shows approval</td>
<td>169</td>
<td>Excellent, perfect…</td>
<td>---</td>
</tr>
<tr>
<td>Asks for reassurance</td>
<td>103</td>
<td>Are you doing ok?</td>
<td>Will my leg be ok again?</td>
</tr>
<tr>
<td>Laughs, tells jokes</td>
<td>36</td>
<td>Laughs</td>
<td>Laughs</td>
</tr>
<tr>
<td>Shows concern or worry</td>
<td>50</td>
<td>I understand you are in pain.</td>
<td>Crying, ouch, ouch…</td>
</tr>
<tr>
<td>Reassures, encourages or shows optimism</td>
<td>21</td>
<td>You can do this - I know.</td>
<td>---</td>
</tr>
<tr>
<td>Shows disapproval</td>
<td>21</td>
<td>Be still – you just moved…</td>
<td>I don’t want to do this.</td>
</tr>
<tr>
<td>Empathy statements</td>
<td>14</td>
<td>Oh, dear honeypie…</td>
<td>---</td>
</tr>
<tr>
<td>Legitimizing statements</td>
<td>5</td>
<td>It’s usually like that at your age.</td>
<td>---</td>
</tr>
<tr>
<td>Gives compliment</td>
<td>3</td>
<td>You know exactly how to do.</td>
<td>---</td>
</tr>
<tr>
<td>Shows criticism</td>
<td>1</td>
<td>I really don’t think you are still now.</td>
<td>---</td>
</tr>
</tbody>
</table>

The distribution of utterances varied with regard to the child’s age (Table 14). The Chi-square showed statistically significant differences ($p=0.007$), with more task-focused interaction being performed with the older children and more socio-emotional interaction with the younger children (Paper IV).

Table 14: Distribution of aggregated categories within age groups. Results from Paper IV.

<table>
<thead>
<tr>
<th>Age groups</th>
<th>Task-focused utterances</th>
<th>Socio-emotional utterances</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-6 years</td>
<td>70.3%</td>
<td>29.7%</td>
</tr>
<tr>
<td>7-11 years</td>
<td>75.2%</td>
<td>24.8%</td>
</tr>
<tr>
<td>12-15 years</td>
<td>83.1%</td>
<td>16.9%</td>
</tr>
<tr>
<td>Total</td>
<td>75.0%</td>
<td>25.0%</td>
</tr>
</tbody>
</table>
Methodological considerations

Research with children differs from research with adults, mostly in that it is difficult for an adult researcher to understand the world as experienced from the child’s point of view but also because children’s use of language may differ from that of adults (Punch, 2002). Adults will never be able to see the world through the eyes of a child, but the adult’s knowledge and experience may assist in understanding the child (Kortesluoma, et al., 2003). Combining a variety of research methods has been suggested as an effective strategy in research with children (Punch, 2002). This was taken into consideration in the thesis by using data material based on interviews, self-reports, video recordings, drawings and a questionnaire. The analysis varied in that qualitative, quantitative and mixed method design were applied.

The methodological choice in the project is of great importance when attempting to answer the research questions in a proper and valid way (Burr, 2004). This also requires, that the researcher’s description and presentation of the world correspond to what is really there, irrespective of his or her own pre-understanding. However, the researcher’s pre-understanding may influence the interpretation of the results (Kvale, 1996). Experts in various fields were consulted as co-authors participating in the analysing of the material, and thereby bringing different perspectives to it by virtue of their professions. They were represented by a radiologist, a psychologist, a paediatric nurse, a school nurse, a pain management nurse and a radiographer.

It is essential for the researcher to possess a conceptual and theoretical understanding of the subject under study in order to establish a base on which new knowledge can be added and integrated. For example, obtaining a valid and common understanding of meaning from an interview is a process that may imply the possibility of a continuously deepened understanding of meaning (Kvale, 1996).

The questions investigated in health care are often complex, as was also seen in this research, and the use of either qualitative or quantitative methods may at times be insufficient to capture the complexity.
Combining qualitative and quantitative research in mixed method design (as done in Paper III) is considered to bring out the strength in both these research methods (Creswell, 2009).

Trustworthiness has been considered with regard to the qualitative studies. Validity and reliability have been considered with regard to the quantitative studies in order to draw valid inferences (Kazdin, 2003), which is further described in the following.

**Video recordings**

Video-based research may pose ethical, practical and methodological considerations (Heath, et al., 2010). These were dealt with in the studies by informing the participants of the meaning of involvement and that the video recordings could be stopped at any time. The procedures that were video-recorded were examinations with a specific aim in concordance with the participating children’s referrals. Consequently, the child, parent and radiographer had specific tasks on which to focus and they seemed not to bother or take notice of the video camera that was placed in a corner of the examination room. Hence, the video camera was considered not to influence the results of the findings (Heath, et al., 2010). In research with children, video observations may provide aspects in a situation that may not otherwise be visual (Punch, 2002), which could be seen as a strength in this research.

Based on the video recordings, the FLACC was used as an observation tool in assessing children’s pain behaviour, e.g. a score was given for the position of the children’s legs and body activity. The use of the FLACC as an observation tool for children undergoing a radiographic examination may have led to methodological bias when assessing those categories. It is important that the patient sit or lie still during the image exposure in order not to cause artefacts in the images and, hence, children could have been judged as being ‘tense’ according to the observation tool, when, in reality, they had been asked to sit or lie still. However, the observed pain behaviour assessed by the FLACC correlated with the self-reported pain assessed by the CAS (Paper II).

The FLACC has been validated for use with children from birth (Merkel, et al., 1997) and it was found to be reliable in measuring acute pain (Voepel-Lewis, et al., 2010).
When analysing the verbal interaction derived from the video recordings, the RIAS was used. This is a practical, flexible and functional tool (Roter & Larson, 2002) that made it easily applicable to the data collection. The RIAS has been used in a variety of contexts but not within the setting of a radiology department, which may be seen as a limitation. However, the RIAS has been used to assess the verbal interaction in similar medical interactions with children. Furthermore, the use of RIAS in the context of a radiology department was discussed with Roter and Larsson who agreed it was wholly applicable. The analysis has also been discussed in parts with Larsson. This course of action was considered a strength of the process.

**Interviews**

Children as young as three years of age were included in the research (Paper I). Nilsson et al., (2013) argue that children can be involved in research, to a greater extent than previously seen, if the methods used are adapted to facilitate the child’s perspective. Almquist et al., (2006) also found that children as young as 4 years are capable of expressing their experiences and that way contribute to research with valuable knowledge. The questions were posed to the children in different ways with regard to their age and developmental stage, and it may therefore be questioned whether that conveyed the same meaning. However, the findings showed that the children focused on similar concerns, e.g. pain. It is also important to be aware that adults will never see the world as children do but rather with the perspective obtained through experience, which, thus, may help when trying to understand children (Kortesluoma, et al., 2003).

**Self-reports**

Children would self-report on the CAS and the FAS, which has been suggested to be the ‘gold standard’ for use in assessment but may, however, exclude some children due to cognitive impairment or being overly distressed (Schiavenato & Craig, 2010). Younger children (5-6 years of age) have been found to be more likely to respond with either ‘a little’ or ‘a lot’, whereas older children (7-12 years of age) may be more capable of using the rating scale as a whole (Chambers & Johnston, 2002).
It may be questioned what the FAS actually assess, whether it is the child’s experienced pain or distress, which has been subject to diversity in previous research. This may be seen as a threat to validity in this regard. However, rather than distinguishing between the assessment of specific concepts such as pain and distress when using the self-reports, it may instead be seen as a strength that correlations are found between these two concepts (Paper III) implying that they appear to be intertwined.

The results obtained in Paper II, which showed no significant correlations between self-reported pain and distress, could be due to the sample being rather small and hence lead to a biased result. It could also be questioned whether it is faultless to have the children self-report in the post-radiographic process. Instead, a more correct course of action might have been to collect the data during the examination. However, it could be assumed that the reports were more likely to be underestimated than overestimated, as the children were more relaxed in the post-radiographic process.

Both the CAS and FAS have been validated and considered reliable for use with children from five years of age and above (McGrath, et al., 1996). The CAS has been found to be reliable for use with children in acute pain due to physical injuries (Bulloch, et al., 2009).

**Drawings**

A child’s drawing made on request may differ markedly from one done spontaneously (Ryan-Wenger, 2001; Wennström, 2011). However, drawings may be used in research as an extra cue when helping the child to report on certain events (von Baeyer, Marche, Rocha, & Salmon, 2004). For younger children, in particular, with lower literacy skills, drawing is a way in which they can express themselves. This research method has also been found to be the most popular among the younger children (Barker & Weller, 2003), in contrast to older children who are more likely to find this method inconvenient (Punch, 2002). The CD:H instrument was also designed to measure emotional status such as anxiety and has been validated for use with younger children 5-11 years (Clatworthy, et al., 1999b).

In Paper III, drawings by children aged 5-15 years were included and analysed using the CD:H manual, which may be seen as a threat to
validity. However, the findings from the group of children aged 5-11 years were compared with the findings from the group of children aged 12-15 years, and no statistically significant differences were obtained.

**Questionnaires**

Data were collected through two open-ended statements in a questionnaire and analysed using qualitative content analysis (Krippendorff, 2004). This method of data collection has been used when e.g. investigating children’s experience of health and wellbeing (Kostenius & Öhrling, 2006) and it is also recommended when conducting research within a radiographic context (Adams & Smith, 2003). A threat to trustworthiness in this regard could be that important findings might have been lost due to the researcher not being able to ask follow-up questions, as in an in-depth interview. However, the quantitative findings supported the qualitative findings in this particular paper (III), which can be seen as a strength. Trustworthiness is considered to have been obtained by means of the researcher discussing the qualitative analysis (Papers I and III) with supervisors until consensus was reached regarding the core content of the analysis.

**Participants**

The size of the sample used for data collection in Paper II could be judged as small when performing a quantitative study using statistic calculations. Accordingly, the correlations between the CAS and FAS found in this paper could be due to the sample size being small and should be judged with this in mind.

The samples studied are consistent in composition with figures from the National Board of Health and Welfare which show that of all the children (0-17 years) seeking an emergency setting for a suspected fracture, about 40% are girls and 60% boys (Socialstyrelsen 2011). In Papers I, II and IV, the composition was 34% girls and 66% boys, which is considered representative. In Paper III, the distribution was 49% girls and 51% boys. Based on these assumptions, the findings may be transferable to similar settings and samples.
General discussion of the findings

The thesis comprises studies with physically injured children undergoing an acute examination in the high-technological context of a radiology department. The findings showed that children’s experience of an acute radiographic examination contained both positive and negative feelings. The positive experiences comprised satisfaction with communication and caring, whereas the negative experiences showed mostly anxiety, pain and distress. Previous research suggests that when assessed, attempts to minimize anxiety, pain and distress in children in conjunction with medical procedures can be performed by the use of proper preparation (Hemingway & Redsell, 2011). This supports the findings in the thesis, showing that the overall perception embraced confidence in the radiographers, who the children perceived as competent, sensitive and caring. This was found regardless of the children simultaneously experiencing anxiety, pain and distress in conjunction with injury and examination.

Little research has been performed and described regarding children’s experiences of radiographic procedures. However, the findings are in concordance with previous studies undertaken with school-aged children, showing that a visit to a radiology department for a radiographic examination is often conveyed by unpleasant feelings (Chesson, et al., 2002). As the research with children in this context is sparse, the results will be discussed in light of findings from a variety of other contexts.

Children’s experiences of radiographic examination

Children aged 3-15 years expressed their experience of the peri-radiographic process in general (Paper III) and the radiographic examination in particular (Paper I). Although not all of the participants may have wholly developed linguistic skills, they were able to express their opinions and they also contributed valuable knowledge to build on for future evidence-based practices.

A radiology department is a high-technological context that may be experienced as frightening to a child (Chesson, et al., 2002), especially when it is unknown and unfamiliar to him or her, maybe because it is the first time the child visit such a place (Runeson, et al., 2007). Under such circumstances, it is crucial that the child has confidence in the
radiographer, as this may be a prerequisite for the radiographer accomplishing a successful examination by (Andersson, et al., 2008).

The children expressed confidence in the radiographic staff, and this was closely linked to the perception that they were competent and skilled for the task, implying that the children expected the radiographer to be of help when caring for them while in the radiology department. This perception has also been seen in a study by Lundgren and Berg (2011), which showed that patients describe the care provided by professionals as characterized by their capability to listen and competence to assist with the help needed in relation to the health care procedures.

Children’s views of health care professionals when in hospital have been investigated in a number of studies (Brady, 2009; Coyne, Hayes, Gallagher, & Regan, 2006; Enskär & von Essen, 2000). Positive adjectives that were often used when describing a nurse were nice, kind, caring, helpful and listening (Coyne & Kirwan, 2012). This was also seen in the present thesis when children described the radiographer as kind, sensitive and careful. Furthermore, the younger children, in particular, found security in having a parent close by during the examination, which was also shown by Coyne et al. (2012) to help make hospitalized children feel more comfortable.

However, in some cases it may be difficult for a child to have a parent close by during a health care procedure, particularly when performing examinations using X-rays, where restrictions are to be followed regarding radiation protection (SSMFS 2008:51). Nonetheless, children’s rights need to be taken into account (NOBAB, 2014), as is the importance of the examination being performed in the best way to benefit each child. This is in order for the child not to think of unpleasant feelings, which may have long-term consequences (Rocha, et al., 2009).

All in all, regardless of the children’s level of experienced anxiety, pain and distress, they expressed satisfaction with the care being performed in the peri-radiographic process, which was perceived as supportive and tailored to each child’s needs.
Anxiety

The interviews (Paper I) and the drawings (Paper III) showed anxieties among the children in conjunction with injury and radiographic examinations. This is in concordance with a previous study with 7-14-year-old children undertaken in a radiology department, which showed that children felt anxious due to their injury and in conjunction with the examination (Chesson, et al., 2002).

Children who self-report high levels of anxiety have been found to be more likely to develop negative memories of pain, which may cause avoidance of future medical procedures (Rocha, et al., 2009). It is important for health care professionals to possess knowledge in this regard and to communicate simply with children and their parents in order to gain a deeper understanding of the emotional status of each child. Proper identification of the child’s experience of anxiety in the present situation is necessary in order to improve the child’s ability to cope with the situation (Pao & Bosk, 2011). Theorized by Swanson (1991), this is a strategy that can be used by e.g. the radiographer in the initial process of ‘knowing’ the child, when striving to understand the situation as it has meaning to the child.

The child’s cognitive development in relation to a memory of previous unpleasant events is vital to the understanding and perception of the examination at hand (McGrath, et al., 2008; Stinson, Yamada, Dickson, Lamba, & Stevens, 2008), which was also found in Paper I. The youngest children were concerned about the experience of pain, which they associated with the examination, whereas the older children were anxious about the outcome of the examination and consequences of the diagnosis. It is suggested that considerations target children’s memories as part of the preparation and pain management, which may lead to improved health care attitudes by the child (Cohen, et al., 2001; Rocha, et al., 2009) and probably less anxiety.

An early study by Edwinson Månsson (1992) concluded that children undergoing a radiographic examination benefit from improved preparation in the pre-radiographic phase by showing reduced signs of anxiety. Coyne et. al. (2006b) also found that when children were provided with adequate information in regard to their health and approaching procedures, they felt that they were treated as persons with rights and they were also happy and reassured. This, in turn, helped the children to feel prepared and less anxious about undergoing
procedures and treatment. Not knowing what is going to happen is likely to increase the experience of anxiety in contrast to when the child has obtained an understanding of the procedure at hand (Wennström, Hallberg, & Bergh, 2008).

A variety of strategies can be used by health care professionals when caring for an anxious child in an attempt to help the child to cope with the present and future health care procedures. It is important not to force the child or use physical restraint but to be flexible and sensitive when caring for and meeting the needs of each child (Berglund, Ericsson, Proczkowska-Björklund, & Fridlund, 2013).

The findings (Paper I) showed that children expressed anxiety due to pain and unfamiliarity with the situation. This is in concordance with previous research showing that anxiety is likely to be a consequence of the children being in pain (Kortesluoma & Nikkonen, 2006) combined with an unknown situation, which may be magnified in children with previous unpleasant experiences (Ortiz, et al., 2012).

**Pain**

When analysing the interviews (Paper I), the findings showed pain to be a concern for children in conjunction with radiographic examinations after being exposed to a musculoskeletal injury. When using self-reporting measurements with children aged 5-15 year, in the same condition but in five different radiology settings, the results showed levels on the CAS above the limit for being offered pain relief, md=6.3 (Paper II) and md=5.6 (Paper III). A level above 3.0 on the CAS has been indicated as a threshold for inadequate pain relief, implying an increase in the experience from discomfort to pain (Ene, Nordberg, Sjostrom, & Bergh, 2008). In this regard however, it is important to bear in mind that levels on the self-reported scores could differ between when the child is resting and when he or she is examined. However, levels assessed pre-, per- and post-radiographically in Paper III showed only minor variations over time, which could be explained by differences in the reports and not necessarily by the actual experience of pain.

A study by Korteslouma et. al. (2004) found that children, aged 4-11 years, associated having a fracture or dislocation of a bone with intense pain. In a study of 169 children, aged 5-16 years, with musculoskeletal injuries, headaches and abdominal pain, the median scores on the CAS
were correlated with the children's self-reported pain intensity as being mild, moderate or severe. The results showed that a median score for mild was 3.5, for moderate 6.0 and for severe 8.5 on a 0-10 scale (McConahay, Bryson, & Bulloch, 2006). A study investigating pain in post-operative children aged 7-16 years, offered pain relief for a score on the CAS above 4.0 (Nilsson, et al., 2009), and guidelines suggest further evaluation of the need for pain relief for scores above 3.0 on a 0-10 scale (Zempsky & Cravero, 2004). Protocols in the Pediatric Emergency Department where data collection for Paper II was carried out also indicate that children with an experienced pain level above 3.0 should be offered pain relief (per se). However, children with musculoskeletal injuries are often seen in the Orthopedic Emergency Department and are thus not treated according to protocols adapted for interactions with children.

When assessing children's pain behaviour through observations (Paper II), the scores ranged from 0.0 to 6.0 (md=2.0). Recommendations for pain relief have been put forward for ratings on the FLACC above 3.0 on a 0-10 scale. Moderate pain is considered as 4 to 6, and severe pain between 7 and 10 (Merkel, Voepel-Lewis, & Malviya, 2002).

In any case, the pain levels obtained with the children studied in this thesis are alarming, especially in view of the NOBAB standard implying that children should be spared experiencing pain whenever it can be avoided (NOBAB, 2014). However, it may not be preferable, or even possible to examine an injured child with a suspected fracture without the child experiencing pain, as fractures and dislocations of bones have been found to be associated with intense pain (Kortesluoma & Nikkonen, 2004; McGrath, et al., 1996). Nonetheless, it is not acceptable for examinations to be carried out with children in intense pain in particular as research has found that memories of previous painful experiences play an important role in a child’s response to future pain and may have long-term consequences for the acceptance of future health care procedures. Painful experiences from earliest infancy may be remembered and cause changes in children’s reactions to later painful events, including lower tolerance to pain, greater emotional distress and avoidance of future painful situations (Rocha, et al., 2009; Stinson, et al., 2008; von Baeyer, et al., 2004). Children’s negative, exaggerated memories of painful procedures may, over time, cause avoidance of expected painful health care procedures as adults (Noel, et al., 2010).
Children’s pain has been argued to be underestimated because of a lack of adequate measurement tools for use over the developmental stages (Zempsky & Cravero, 2004). A possible explanation for the findings of the present thesis, which show high rates for the children’s self-reports on pain and also correlate with the observed pain behaviour, may be that assessment is not routinely being performed in most radiology departments in the peri-radiographic process with children. Consequently, the radiographer does not have reports on each child’s condition in this regard to build on when planning and performing the examination. Such knowledge is important, as theorized by Swanson (1991), in the process of ‘doing for’ the child in order to comfort the child when performing the examination competently.

The first step to adequate management of anxiety, pain and distress, however, is appropriate assessment of it. It is essential that the instruments used to assess these factors are clinically applicable, reliable, valid and appropriate for the child’s age and developmental stage (Ortiz, et al., 2012). It has been recommended that assessment should preferably be done through children’s self-reports as the ‘golden standard’ when possible (Schiavenato & Craig, 2010), but in situations when children are unable to self-report, appropriate behavioural tools could be applied (Stapelkamp, et al., 2011). However, a number of previous studies have highlighted that children in various health care procedures are poorly managed for pain and distress as a result of lack of protocols underpinning such routines (Ali, et al., 2010; Ortiz, et al., 2012; Stinson, et al., 2008). This also was seen in Paper II, when none of the children had been offered pain relief prior to the examination, and in Paper III, when just 56% of the children had received pain relief in the emergency room before proceeding to the radiology department and 29% of the children were untreated for pain.

**Distress**

A child in pain may also be in distress (Cohen, et al., 2004), as found for the children who felt uncomfortable due to worries about the examination and diagnosis (Paper I). Children’s experience of distress in conjunction with radiographic examinations was also assessed by self-reports on the FAS showing $md=0.47$ (Paper II) and $md=0.59$ (Paper III). For most children, a radiology department in general and a radiographic procedure in particular are unknown territories that may imply distress (Paper II). A study conducted with 6-11-year-old children
in hospital found that the children rarely possessed knowledge of health care procedures in general and radiographic examinations in particular. The children also expected a radiographic examination to be painful (Runeson, et al., 2007), which may have caused distress when they did not really know what to expect (Linder & Schiska, 2007).

An early study by Fegley (1988) also found that children undergoing a radiographic examination experienced feelings of distress during the procedure. However, distress is a complex and subjective phenomenon, and Cohen et al. (2004) argued that the complicity of children’s reactions to acute procedures may be placed under the term ‘distress’ and could therefore include a variety of negative reactions due to sensory and affective components, e.g. anxiety and pain (Figure 5).

![Figure 5: Illustration of the interaction between anxiety, pain and distress as assessed in the thesis.](image)

The assessment of distress should therefore also include anxiety and pain, otherwise the assessment may only show part of the child’s experience of the procedure. It is vital to address the problem, identifying the impact on each child (Lau, 2002). In this regard, self-reports by children are recommended when applicable. This was also the method used in Papers II and III. In these studies, the findings showed scores above average. In view of previous research (Berde & Wolfe, 2003; Cohen, et al., 2004), it can be assumed that this was merely part of the negative experience, which is supported by observations and
self-reports on pain showing moderate to severe pain, and also above average levels when assessing anxiety.

Action needs to be taken in this regard, as it is known that both short-term and long-term consequences may be seen as effects of a child’s experience of distress. The short-term effects may influence the performance of examinations, leading to crying, fear and a lack of cooperation (Alexander, 2012). If a child develops a negative memory of such procedures it may cause long-term consequences, e.g. by implying intensified experiences and lower tolerance of distress during future procedures (Stinson, et al., 2008).

Attempts can be made in different ways to mitigate children’s experiences of distress in the peri-radiographic process by, for example, involving a parent, helping to fixate the body part under examination (Paper I) or distracting the child during the examination (Paper IV). The youngest children, in particular, found comfort in having a parent close by during the examination, as found also by Törnvist (2010) when investigating 3-9-year-old children undergoing a magnetic resonance tomography examination. The need for children to have a parent close by during hospitalization and health care procedures in order to feel more comfortable in the situation and less distressed is supported by previous research undertaken in a variety of contexts (Alexander, 2012; Coyne & Kirwan, 2012; Runeson, et al., 2002).

The radiographer can also take action to facilitate children feeling confident and less distressed during examination, e.g. through adequate and adapted verbal interaction. Swansson (1991) theorized that for health care professionals the meaning of ‘being with’ is to be emotionally present, which can imply spending time with and sharing feelings with the one being cared for. Listening to children and taking into consideration their experiences and wishes for involvement in the process may provide guidance on anticipating events perceived as stressful and thereby facilitate children coping and feeling less distress (Coyne, 2006a).

**Verbal interaction**

Communication is an important factor in radiographic quality work. Radiographers need to communicate appropriately in examination situations in order for the patient to understand the information and
instructions and how to cooperate in the examination, as this influences
the image outcome (Booth & Manning, 2006; Hillergård, 2013). When
interacting verbally with children in conjunction with radiographic
procedures, previous research has highlighted the importance of
children receiving accurate information regarding their situation in a
way they can understand (Chesson, et al., 2002; Edwinson Månsson,
1992), which is also in concordance with children’s rights (NOBAB,
2014).

The findings are supported by the aforementioned research, and they
reveal, that verbal interaction during a radiographic examination is
largely characterized by the radiographer giving information and asking
the child for assurance (Paper IV). This may be explained by the focus
often being placed on the technology and on the taking of diagnostic
images in order to obtain an optimal examination (Reeves & Decker,
2012). The children themselves found it important that the
radiographer listened to and equipped them with information they
could understand (Papers I and III) and this also conveyed a feeling of
confidence in the situation (Paper I). These findings are in concordance
with previous research in which the provision of information and
feedback could be used by the radiographer in the process of ‘enabling’,
i.e. helping the one being cared for to face unfamiliar situations
(Swanson, 1991).

A child-centred approach has been suggested when interacting with
children in health care situations in an attempt to support the children
through the procedure. For the health care professional, this ought first
of all to imply listening and questioning in order to clarify and help the
children to express their concerns. Such knowledge and understanding
may provide a perspective for each child and aid for the health care
professional in responding to his or her concerns and meeting the
child’s needs adequately for a successful outcome (Coyne, 2006a).

However, the interaction between the child and the radiographer is a
complex process influenced by a number of factors, such as, for example,
the radiographer’s personality and professional experience as well as
the child’s contribution and interaction style. The patient’s age is
considered a factor that influences the style and nature of the
interaction, but radiographers also use different communication styles
as strategies to achieve a diagnostic image (Booth, 2008). This supports
the findings in Paper IV, in which the distribution of task-focused and
socio-emotional exchanges differed significantly as a function of the
child’s age. It may be seen as a deliberate strategy by the radiographer to distract the youngest children by using more socio-emotional talk when encouraging and helping them through the examination. More frequent use of task-focused exchange was found in the interaction with older children, which is in concordance with findings from other health care settings (Tates & Meeuwesen, 2001).

Based on Piaget’s theory of cognitive development (Piaget, 1929), it may be assumed that older children function at a higher level of understanding and are therefore equipped with more information in conjunction with examination. A study by Brewer et. al. (2006) found that children in the concrete operational stage or older benefit from increased information and preparation, whereas younger children are more intuitive and focused on personal perceptions and may not pay attention to the information in the same way.

However, rather than distinguishing between more and less information being provided with regard to the child’s age, it is suggested that the information being tailored to each child’s level of understanding. A study conducted by Coyne et al. (2006b) found that children expressed a need for information in order to prepare themselves for procedures. Although the ability to pay attention to the child’s needs and to communicate and interact in an adequate way differs among the profession (Söderbäck, 2010), it is vital for the outcome of a procedure, of which the child may have little or no understanding, to provide the child with adequate information, taking into consideration the way it is presented and the timing, to be in accordance with the child’s level of understanding (Mansson & Dykes, 2004; Runeson, et al., 2007).
Theoretical reflection

Development of the Radiographer Caring Model

A comprehensive and accurate assessment of children’s emotional status including their experiences of anxiety, pain and distress is important when interacting with injured children in acute examinations. In order for children to feel comfortable during the peri-radiographic process and not procure negative memories, it is vital that they are treated with regard to individual preferences and needs. In order to be sensitive to each child’s needs, in addition to professional radiographic skills, the radiographer needs to possess knowledge and understanding of children’s cognitive development and present emotional status.

Swanson’s Theory of Caring (Swanson, 1991) has been applied in an attempt to illustrate the overall understanding of the findings in the thesis and when developing a model for clinical implications. This Theory of Caring has been translated into practice by e.g. the University of North Carolina Hospitals in an attempt to actualize caring theory in practice, promote patient satisfaction and ensure consistently high standards of performance. With the implementation, the level of patient satisfaction increased, as the theory postulated that it was just as important for health care professionals to care about the patient as to care for the patient through clinical procedures (Tonges & Ray, 2011). The findings will be discussed in light of Swanson’s Theory of Caring in an attempt to present the benefits of the results and point to possible implications in clinical settings (Table 14).

It is important for the radiographer to possess both professional skills and competence in radiographic procedures and children’s development when caring for children in the peri-radiographic process. Furthermore, being sensitive and taking into account each child’s capacity and preferences as a prerequisite for obtaining a succeeded examination is also more likely to minimize the child’s anxiety, pain and distress. The Radiographer Caring Model (Figure 6) has been derived from Swanson’s Theory of Caring (Swanson, 1991) and inspired by the Carolina Care Model (Tonges & Ray, 2011). The model visualizes the importance of the radiographer being both professionally skilled and sensitive when striving to maintain a belief in the capacity of the child and, hence, make
the child feel confident during the examination. The Radiographer Caring Model can be used in the peri-radiographic process as a tool for the radiographer to help the child feel confident in the encounter.

Table 14: Swanson's Theory of Caring applied to the results of the thesis.

<table>
<thead>
<tr>
<th>Results of the thesis</th>
<th>Areas</th>
<th>Meaning</th>
<th>Implying</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment using measurements Sensitive and adopted approach</td>
<td>Knowing</td>
<td>Striving to understand an event as it has meaning in life to the other</td>
<td>Avoiding assumptions Centring on the one cared for Assessing thoroughly Seeking cues Engaging the self of both</td>
</tr>
<tr>
<td>Taking time Listening Being sensitive</td>
<td>Being with</td>
<td>Being emotionally present for the other</td>
<td>Being there Conveying ability Sharing feelings Not burdening</td>
</tr>
<tr>
<td>Professional and competent Understanding of children's perceptions</td>
<td>Doing for</td>
<td>Doing for the other what he or she would do for the self if it were at all possible</td>
<td>Comforting Anticipating Performing competently Protecting Preserving dignity</td>
</tr>
<tr>
<td>Verbal interaction on the child’s level of understanding Balancing task-focused and socio-emotional interaction</td>
<td>Enabling</td>
<td>Facilitating the other’s passage through life transitions and unfamiliar events</td>
<td>Informing/explaining Supporting/allowing Focusing Generating alternatives Giving feedback</td>
</tr>
<tr>
<td>Being sensitive and professionally skilled</td>
<td>Maintaining belief</td>
<td>Sustaining faith in the other’s capacity to get through an event or transition and face the future with meaning</td>
<td>Believing in/holding in esteem Maintaining a hope-filled attitude Offering realistic optimism ‘Going the distance’</td>
</tr>
</tbody>
</table>

For the radiographer to be sensitive, it implies ‘knowing’ and ‘being with’. This can be approached by the radiographer taking time with the
child, listening and assessing the child’s experience of unpleasant feelings in conjunction with injury and radiographic examination. By doing so, the performance of the examination can be child-centred and adapted according to the child’s preferences in the present situation.

For the radiographer to be *professionally skilled* implies ‘doing for’ and ‘enabling’. It is vital that the radiographer possesses competence of radiographic procedures to be able to carry out the examination according to the child’s physical prerequisites at that time. Although age is the most used proxy in clinical practice in the radiology department, the radiographer needs to possess knowledge and understanding regarding children’s cognitive development. Such competence will support the verbal interaction when balancing the task-focused and socio-emotional exchange between the child and radiographer in an attempt to facilitate the child understanding the process at hand. As well as the radiographer being *professionally skilled* and *sensitive*, ‘maintaining belief’ in the child will be visualized, and it will most probably result in the child feeling *confident* in the peri-radiographic process.

![Figure 6: The Radiographer Caring Model, derived from the Swanson Theory of Caring (Swanson, 1991) and inspired by the Carolina Care Model (Tonges & Ray, 2011).](image-url)
Conclusions

The findings point to the conclusion that:

Children had both positive and negative experiences in conjunction with an acute radiographic examination after being physically injured.

Anxiety, pain and distress were experienced as being a concern in conjunction with examination, and were also assessed above the levels at which treatment or intervention is recommended.

The children were satisfied with the care provided during the peri-radiographic process. They felt confident in the radiographers who they perceived to be skilled in the task and sensitive to their needs.

Radiographers interacting with children during radiographic procedures were shown to balance task-focused and socio-emotional communication according to the child’s age.

Clinical implications

Clinical implications of the findings in the thesis:

It is suggested that children undergoing an acute radiographic examination after being physically injured, be assessed regarding their experienced anxiety, pain and distress as a prerequisite to provide child-centred care according to each child’s level of understanding and ability in the present situation.

It is suggested that protocols be developed with guidelines for meeting the needs of children in acute examination situations within a radiology department.
The findings can also be beneficial when developing theoretical courses for undergraduate students and when training radiographers in assessment and communication in acute procedures with children associated with anxiety, pain and distress.

The Radiographer Caring Model can be used by radiographers to help establish interactions with children during radiographic procedures based on mutual trust and respect.

**Research implications**

Interventions are suggested that apply distinct strategies from the Radiographer Caring Model provided to children in a radiology department to evaluate and guarantee a high standard of caring.

Further studies are needed that take into consideration the parents’ perception of the care provided to their child in the peri-radiographic process.

Studies are also needed that take into consideration disabled children’s and their parents’ perceptions of the peri-radiographic process when recurrently going through examinations.

Studies are needed that take the radiographer’s perspective when scrutinizing concerns and difficulties in interaction with children of various ages and in different examination situations.
**Summary in Swedish**

*Barn på röntgen - en studie avseende rädsla, smärta, oro och kommunikation*

I Sverige genomförs årligen över 5 miljoner röntgenundersökningar och nästan 1/10 av dessa är med barn i åldern 0-15 år. Att vara sjuk eller ha skadat sig och vara i behov av sjukvård kan innebära olika upplevelser och för ett barn kan sjukhusvistelse medföra rädsla, då miljön och procedurerna ofta är okända. Dessutom kan en röntgenundersökning vara förknippad med oro och i vissa fall en ökad smärtupplevelse.


En legitimerad röntgensjuksköterska i Sverige är ansvarig både för omvårdnaden om patienten och den medicintekniska utrustningen, inklusive säkerhetsaspekterna i utförandet av radiografisk undersökning. Röntgensjuksköterskan förväntas arbeta utifrån ett yrkesetiskt förhållningssätt, där patientens rätt till autonomi beaktas samt den personliga integriteten skyddas. Under den peri-radiografiska processen, är det viktigt att röntgensjuksköterskan balancerar sina olika ansvarsområden, för att uppnå en undersökning med adekvat diagnostisk kvalitet samtidigt som patienten får god omvårdnad.

Särskilt i interaktionen med barn kan detta innebära flera utmaningar: Mötet mellan röntgensjuksköterska och barnet är oftast kort, vilket kräver goda professionella och kommunikativa kunskaper. Ytterligare
utförs undersökningar vid de flesta röntgenkliniker med patienter i alla åldrar, vilket kan innebära att erfarenheten att undersöka barn blir begränsad. Forskning med barn inom radiologisk kontext är fortfarande sparsam och kunskaper har ofta fått hämtas från närliggande sammanhang. Ytterligare kunskaper och förståelse gällande barns upplevelse av den peri-radiografiska processen behövs för att utveckla vården i detta avseende.

I denna avhandling har fokus legat på att fånga barns upplevelser av att genomgå en akut röntgenundersökning vid misstanke om fraktur efter en fysisk skada. Resultatet av en intervjustudie med barn 3-15 år visade att rädsla, smärta och oro var ett bekymmer i samband med undersökning (delstudie I). Utifrån dessa initiala resultat har syftet brutits ner till mer specifika syften där empiriska studier har utförts för att undersöka barns smärta och oro i samband med undersökning (delstudie II), samt rädsla, smärta och oro i relation till upplevelsen av omhändertagandet i den peri-radiografiska processen (delstudie III). Slutfilen studerades kommunikationen mellan barn och röntgensjuksköterska vid en akut undersökning (delstudie IV).


Barns perspektiv på en akut röntgenundersökning framkom genom intervjuer med 32 barn, 3-15 år. Resultatet visade bland annat, att smärta upplevdes som ett bekymmer i samband med undersökning, samtidigt som barnen upplevde förtroende för röntgensjuksköterskorna som undersökte dem. Särskild de yngsta barnen upplevde det besvärande behöva undersökas när de hade ont, medan de äldre barnen var mer oroliga för utfallet av undersökningen och möjliga konsekvenser av diagnos.
Bedömning av smärta hos 29 barn (5-15 år), visade ett medianvärde på 6,3 på den 10-gradiga Coloured Analogue Scale (CAS), där barnen själva skattade sin upplevda smärta. Detta resultat korrelerade med det observerade smärtbeteende bedömt med instrumentet Face, Legs, Activity, Cry and Consolability (FLACC). Bedömning av smärta hos 110 barn (5-15 år), visade ett medianvärde på 5,6 när barnen själva skattade sin upplevda smärta med hjälp av CAS. Bedömning av oro i populationen om de 29 barn, visade ett medianvärde på 0,47 på en skala från 0,04 – 0,97 när barnen skattade sin upplevde oro med hjälp av Facial Affective Scale (FAS). Motsvarande värde i populationen om de 110 barn visade ett medianvärde på 0,59 på FAS. Dessa resultat ligger över de nivåer, där smärtstillande läkemedel rekommenderas. Gällande rädsla bland populationen om de 110 barn, visade analys med Child Drawing: Hospital Manual (CD:H) av barnens teckningar att 42% av barnen upplevde rädsla på eller över en nivå där intervention rekommenderas.

Oavsett om barnen upplevde rädsla, smärta och oro i samband med en akut röntgenundersökning, visade analysen av 105 anteckningar från barn 5-15 år, liknande resultat som intervjuerna med 32 barn. Här framkom även, att barnen var nöjda med omhändertagandet i den peri-radiografiska processen där röntgensjuksköterskan upplevdes som kunnig och lyhörd för barnets behov, samt anpassade informationen efter det enskilda barnet. Dessa resultat stärks av analys av den verbala interaktionen mellan 32 barn och 20 röntgensjuksköterskor vid akuta undersökningar, som visade att röntgensjuksköterskan använder sig av undersökningsrelaterad och social kommunikation i olika utsträckning beroende på barnets ålder. Till de yngsta barnen användes i större utsträckning social kommunikation som ett sätt att avleda och hjälpa barnet genom undersökningen, medan mer undersökningsrelaterad kommunikation och information ägde rum i interaktionen med de äldre barnen. Detta kan ses som ett sätt anpassa undersökningssituationen efter det enskilda barnet och en strategi för att hjälpa barnet genom undersökningen på bästa tänkbara sätt oavsett barnets upplevelse av rädsla, smärta och oro i situationen.

Grundad på Swanson’s Theory of Caring, och utifrån resultaten från de empiriska studierna i avhandlingen har The Radiographer Caring Model...

The Radiographer Caring Model utvecklades som en hjälp för röntgensjuksköterskan att förena sitt professionella kunnande och sin lyhördhet i arbetet att etablera en gynnsam interaktion där barnet kan känna sig tryggt i den peri-radiografiska processen. För att uppnå detta är de grundläggande förutsättningar goda radiografiska kunskaper samt kunskaper i barns kognitiva utveckling för att utifrån detta anpassa och balansera den undersökningsrelaterade kommunikationen med den sociala kommunikationen.
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