

A grayscale X-ray image of a child's ankle and lower leg, showing the tibia, fibula, talus, calcaneus, and other tarsal and metatarsal bones. The image is positioned on the right side of the page, partially overlapping the teal and grey text boxes.

# THE LOW-RISK PAEDIATRIC ANKLE INJURY: SAY NAY TO THE X-RAY

**A toolkit for reducing unnecessary ankle x-rays in patients with low-risk ankle injuries.**

**Don't use routine radiography in children who present with acute ankle injuries and meet criteria for a low risk examination.**

SickKids Choosing Wisely List (2016)

Recommendation #5



## Inspiration for this Toolkit

Paediatric ankle injuries are a very common presenting complaint in both general and paediatric emergency departments. The vast majority of these are low risk injuries: soft tissue injuries (i.e., sprains) or clinically insignificant fractures that have been shown to heal without specific intervention or orthopedic follow up. The mainstay of care for these low-risk lateral ankle injuries is supportive care with judicious use of removable ankle supportive devices and/or crutches. Despite this, up to 95% of patients who present with ankle injuries receive ankle radiographs.<sup>1</sup> By reducing unnecessary imaging, children with low-risk ankle injuries avoid exposure to ionizing radiation and receive quicker and more appropriate care. Hospital resources are also saved, and unnecessary interventions (such as casting, referrals to orthopedics, follow up x-rays) are avoided.<sup>1-4</sup> Clinicians may feel that there is a risk for a decrease in patient or parental satisfaction if an ankle x-ray is foregone, however studies have shown that this is not the case.<sup>5</sup>

The research behind the *Low-Risk Ankle Rule* (LRAR) is robust, including its derivation, validation and follow up studies.<sup>1-4,6</sup> However, even at our institution (where the LRAR was originally conceived), we noted excessive x-ray rates of 91% for children presenting with ankle injuries prior to our intervention. We thus endeavoured to reduce unnecessary imaging for these patients by 30%. As a result of concerted educational outreach, along with workflow changes utilizing our existing EMR, we successfully and sustainably reduced imaging of low-risk ankle injuries by 32%. There was no significant change in the balancing measures (median length of stay and rates of return visits for the same complaint).

This toolkit was co-authored by Dayae Jeong, Greg Harvey, Daniel Rosenfield, Kathy Boutis, and Tania Principi, paediatric and paediatric emergency medicine physicians from the Hospital for Sick Children.



## Introduction

This toolkit was created to support interventions designed to reduce ankle x-rays in patients who are at low risk for having clinically significant fractures. This toolkit can be used by emergency physicians, family physicians, paediatricians, and allied health members who see children with musculoskeletal injuries in an ambulatory or acute care setting.



## Make sure this toolkit is right for you

This toolkit is helpful if you work in an office or institution that sees children age 3-16 for ankle injuries, sprains or fractures, especially if you have high rates of imaging. This toolkit is also right for you if you work in an emergency department that sees children, or work in an office or urgent care centre with access to x-rays.



## Key Ingredients of this intervention

If your institution or care centre has a high rate of imaging for paediatric ankle injuries, then the following steps will help your institution learn more about the LRAR, provide strategies to decrease rates of unnecessary x-rays in low-risk patients and improve patient care.

- 1) Establish effective project leadership and engage key stakeholder groups
- 2) Understand the x-ray ordering practices at your institution
- 3) Introduce educational measures around the LRAR
- 4) Automate application of the LRAR
- 5) Ensure patient-friendly resources are available

## 1. Establish effective project leadership and engage key stakeholder groups

The first step is to create a working group to carry forward this intervention. The leadership requirements for this intervention are relatively minimal, and really only need a local champion. However, it is very important to obtain support from stakeholders in key departments to facilitate and prioritize your project.

We recommend specifically engaging these stakeholders:

- Staff who provide care for paediatric patients presenting with acute injuries, including physicians, physician assistants, nurse practitioners, orthopedic technicians, etc.
- Staff who assist in managing work and patient flow in the clinic or department to which these patients present
- The Diagnostic Imaging (DI) department of your institution or a nearby clinic to ensure a reliable workflow change to the x-ray ordering process
- Patients, families, and caregivers who use your facility

If you work at a larger institution, you may also want to consider engaging the following:

- The Information Technology (IT) or analytics department for assistance in extracting data, altering orders and making any necessary changes if you use an EMR
- The communications department, if available, to design or adapt educational and promotional materials
- A family advisory council, if available, to provide input on educational materials

Consensus amongst stakeholders can be achieved by grounding stakeholders in the robust research underlying the LRAR. In particular, it is useful to focus on the patient-centric outcomes this rule achieves such as decreased exposure to radiation, reduced length of stay and unnecessary follow-up visits without affecting patient satisfaction or outcomes. The LRAR has also been shown to reduce health care costs, but this should not be the focus of discussion. Frontline providers must be on board with the intervention plan, which may be challenging to those who perceive the need to practice “defensively,” and individual outreach may be necessary at times.

Routine feedback with transparent updates to the group on successes and failures can help to maintain forward momentum.

## 2. Understand the x-ray ordering practices at your institution

It can be helpful to understand the reasons why your institution has a high rate of x-ray ordering for paediatric patients presenting with ankle injuries. Strategies to reduce imaging at your centre may need to be modified based on local factors.

Reach out to your stakeholders and explore the following questions:

- Who are the health care providers involved in the care of these patients? They may include physicians, physician assistants, nurse practitioners, nurses if there is a medical directive for x-rays in place, and learners.
- Is there a high rate of ankle x-rays ordered from your department or institution which are normal or show clinically insignificant fractures? The stakeholders from the DI department may be especially knowledgeable for this question.
- What are the key factors leading to ordering x-rays even when suspicion for a clinically significant fracture is low? These may include concern for patient or parental satisfaction, fear of missing a fracture, discomfort with paediatric musculoskeletal injuries, etc.
- Are the health care providers you identified aware of or already using the LRAR? What are their opinions on it?
- Are the health care providers you identified aware of or already using any other paediatric ankle injury rules?
- Do the stakeholders feel that it would be possible to reduce the number of ankle x-rays without impacting patient care?

If the answers to the questions above generally align with the notion that providers are not familiar or comfortable with applying the LRAR, the next step is to implement educational strategies around this rule.

## 3. Introduce educational measures around the LRAR

Firstly, the clinical group should be informed of the campaign background, including the rationale, incentives for practice change (improved patient care and reduced health care costs), and the role of the LRAR. This outreach can be done through emails as well as through local rounds sessions or division meetings. The outreach should highlight how to apply the LRAR: healthy children aged 3-16, with isolated tenderness to the distal fibula and/or adjacent lateral ligaments distal to the tibial anterior joint line do not need an ankle x-ray and can be treated with supportive care alone provided a comprehensive ankle exam is performed.<sup>1</sup> Clinicians should be assured that the research shows that no major injuries will be missed by using this approach. Since the Ottawa Ankle Rules may be more familiar to clinicians, specifically addressing the key difference (the lack of requirement to weight bear, reduction in x-rays) is key.<sup>8</sup>

Once the campaign has been introduced, it is important to also use supporting tools such as visual signage in appropriate clinical areas or computer screensavers (example shown in [Appendix 1](#)), availability of one-to-one support in applying the LRAR, refresher sessions, and reminder emails. Audits with feedback may be another useful strategy for individuals to learn about their own ordering practices relative to peers.

#### **4. Automate use of the LRAR**

After education, a key strategy to enhance success is to decrease barriers surrounding the use of the LRAR. One strategy is to incorporate the LRAR into the x-ray requisition process for paediatric ankle injuries. This can be done in both institutions with paper requisitions and in those with computerized physician order entry (CPOE) systems. At our institution, automated use of the LRAR was initially achieved by creating a new, mandatory physical requisition for paediatric ankle injuries ([Appendix 2](#)). We then transitioned to a CPOE system, and so equivalent, mandatory modifications were made in the electronic order for ankle x-rays ([Appendix 3](#)). It is important to enable providers to obtain ankle x-rays for a patient despite meeting low risk criteria, however, it is important to capture the reasons why an x-ray was ordered, so that this can be further examined.

This workflow must be done carefully in conjunction with the diagnostic imaging department to reduce process loopholes. X-ray technologists should also be empowered to call the ordering clinician if the reason for the x-ray and LRAR are not completed. Alternatively, a policy could be implemented precluding technicians from performing the x-rays without a completed requisition. Stakeholders on the diagnostic imaging team can optimize success of the project by feeding back patterns of instances where the LRAR is not appropriately considered or applied to the larger working group.

If using an EMR, a documentation template specific to paediatric ankle injuries may also help with reiterating use of the LRAR.

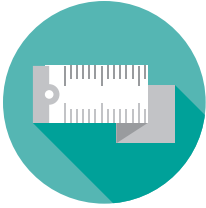
In institutions where medical directives exist for ankle x-rays it is imperative that those implementing the directive have knowledge of the LRAR, and the skill to examine the ankle and apply the rule. It should also be ensured that this process uses the same modified x-ray requisitions indicated above.

#### **5. Ensure patient/family-friendly resources are available**

Finally, patients and families should be notified of the use of the LRAR, briefly educated on the underlying rationale and ideally provided with discharge information appropriate for their low-risk injury. It may surprise families that an x-ray is unnecessary, but this is generally appreciated given the earlier disposition determination, avoiding radiation and a lack of difference in management. Furthermore, follow-up studies evaluating the LRAR have not shown a decrease in patient or parent satisfaction, and similar studies in adults have not shown a reduction in satisfaction without radiography.<sup>2,7</sup>

Discharge literature provided to parents should highlight injury expectations, advise how to manage pain, and provide clear reasons to return if symptoms are outside of normal injury patterns for low-risk injuries. Proper patient education around management of ankle injuries has the potential to instill confidence in families' abilities to manage their child's injury and may reduce repeat visits for these common injury mechanisms. The Hospital for Sick Children offers several free patient educational materials via "AboutKidsHealth," including a handout on low-risk ankle injuries ([Appendix 4](#)).





# Measuring Your Performance

## 1. Choose your measures

Pick the outcome, process and balancing measures that you will use to assess your intervention. These measures should be evaluated on a biweekly to monthly basis, depending on the volumes of children seen in your office or institution, and shared regularly with the clinical team for feedback and awareness. Keep in mind that you only need a small sample of charts (10-20) to audit at each time point and that your data does not need to be exhaustive.

### I. Outcome measures:

These are the primary improvements or end goals that you are trying to achieve.

- a. Proportion of healthy patients aged 3-16 years old presenting with acute ankle injuries who receive an ankle x-ray
- b. Percentage of ankle x-rays reported as 'negative'

### II. Process measures:

These are the measures used to ensure that the parts of the intervention are performing as planned.

- a. Proportion of staff who attended educational sessions
- b. Proportion of healthy patients aged 3-16 years old who receive an ankle x-ray using the developed ankle x-ray requisition
- c. Proportion of patients 3-16 years old with ankle injuries who had documentation of the LRAR within clinical notes
- d. Proportion of patients for which the developed ankle injury EMR template is used (if documenting electronically)

### III. Balancing measures:

These are the measures used to monitor whether the intervention is causing any unintended outcomes.

- a. Rate of return visits to emergency department within 72 hours for same reason
- b. Rate of missed clinically significant fractures
- c. Rate of referrals to the orthopedic or fracture clinic
- d. Length of stay for patients presenting to an acute care setting (i.e. the emergency department)

## 2. Set an aim

Set an attainable goal based on your primary outcome measure and baseline rates of imaging prior to the intervention. A SMART aim is one that is specific, measurable, attainable, relevant, and time-bound. For our intervention, our aim was to reduce ankle x-ray rates by 30% from baseline in patients aged 3-16 years old presenting with an acute ankle injury. It is helpful to state the aim in terms of absolute improvement rather than relative improvement, so that teams have a specific numerical target to strive for.

## 3. Determine a collection method

Chart review: If data for measures are not obtainable through an EMR or other hospital reports, consider reviewing representative samples of patient charts, which contain the chief complaint of “ankle injuries” or other synonymous triage terms which typically encompass acute ankle injuries (i.e., lower extremity injury) to obtain baseline data and monitor progress. Reviewing a select number of charts can additionally help clarify factors pushing physicians towards ordering x-rays when one is not indicated by the LRAR (such as parent preference or mechanism). Try to randomly select from available charts so that results are not biased by specific provider practices.

## 4. Measure progress towards the aim

It is helpful to plot key measures over time, such as the monthly proportion of patients age 3-16 years who receive an x-ray for an acute ankle injury. A simple run chart can be created using common software such as Excel.<sup>9</sup> This will allow the team to see whether improvement efforts are leading to change. If initial efforts don't result in sufficient progress, continue to address barriers and test changes. Plan-Do-Study-Act cycles are a useful strategy for thinking about testing multiple changes in order to reach goals.



## Sustaining Early Successes

A strong initial educational outreach, a defined clinical pathway for obtaining ankle x-rays, and easily accessible educational materials can result in a sustained culture change when it comes to paediatric ankle injury care. As practitioners begin to incorporate the rule into their routine assessments, a cultural recognition of the unique management of paediatric ankle injuries can be achieved.

Practice change can be further maintained by:

- Routinely surveying a representative sample of charts or reviewing EMR data (every month or longer if rates have been sustained) to follow trends in x-ray rates, and using these trends to determine whether further educational reinforcement is required
- The maintenance of posters indicating the LRAR posted in key areas where clinical management of these patients is most common

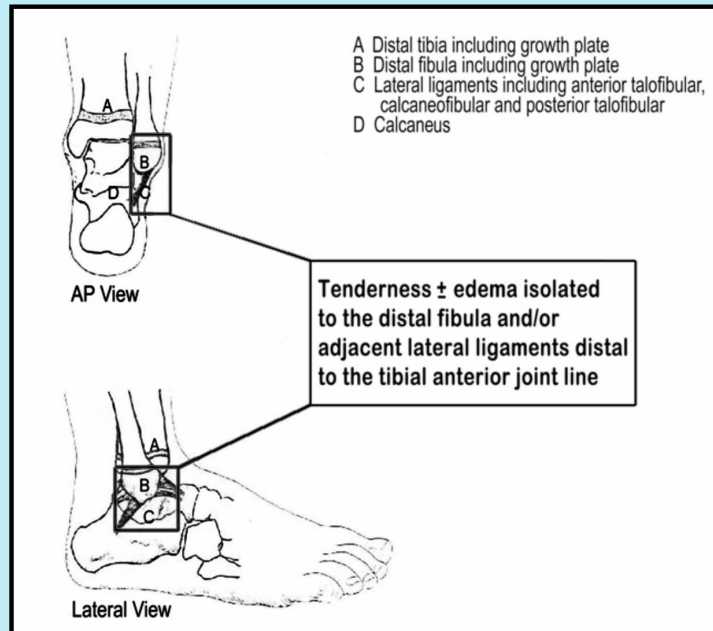
- Providing specific outreach to ED providers who may be unfamiliar with the rule due to recent employment or relative infrequency in seeing these patients
- Yearly inclusion of the LRAR in the curriculum for educational rounds
- Maintenance of the x-ray requisition pathway in conjunction with the diagnostic imaging team and adapting it through any major systematic changes (for example, adoption of an electronic medical record)



## References

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- 2) Boutis K., Grootendorst P., Willan A. et al. Effect of the Low Risk Ankle Rule on the frequency of radiography in children with ankle injuries. *CMAJ* 2013;185(15): 731-E738.
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- 7) Stiell IG, Wells GA, Vandemheen KL, et al. The Canadian C-spine rule for radiography in alert and stable trauma patients. *JAMA* 2001;286:1841-8.
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# Low Risk Ankle Rule



**X-ray is NOT needed**  
with lateral isolated tenderness or swelling

**Rule only applies if:**


**Patient is 3 to  
16 years old**

**Acute injury  
(<72 hours)**

**Whole ankle  
is examined**

# Appendix 2. Diagnostic Imaging Ankle X-Ray Form

Form required to be completed for all ED imaging requests for ankle views (outside of trauma scenarios).

 <p><b>Request for Diagnostic Imaging</b></p> <p>For MRI – Please complete <b>Request for MRI Form</b>          For IGT – Please complete <b>Request for IGT Form</b>          See reverse for the Modality contact information</p>	<p style="text-align: right;">APP. DATE: _____</p> <p>Name: _____          Sex: <input type="checkbox"/> M <input type="checkbox"/> F          HSC# _____          OHIP Health Card # _____          Date of birth: _____          Address: _____          City: _____ Province: _____ Postal code: _____          Parent / guardian: _____          Telephone: _____          Registration # _____ ADDRESSOGRAPH # _____</p> <p>Patient weight _____ kg Height _____ cm Age: _____</p>
<p><b>1. Sedation / GA:</b> Will the patient be able to be cooperative and remain still for this exam? <input type="checkbox"/> Yes <input type="checkbox"/> No          If not, the patient may require sedation or general anesthesia. See reverse of this form for guidelines.</p>	
<p><b>2. Exam requested</b>    <input checked="" type="checkbox"/> X-Ray    <input type="checkbox"/> GI-GU    <input type="checkbox"/> Ultrasound    <input type="checkbox"/> CT    <input type="checkbox"/> Nuclear Medicine</p> <p><input type="checkbox"/> LEFT    <input type="checkbox"/> RIGHT    <b>Ankle AP, Lateral and Mortise Views</b></p>	
<p><b>3. History and indications for exam</b> (working or known diagnosis, symptoms, clinical findings)</p> <p><input type="checkbox"/> "I have reviewed the Low Risk Ankle Rule and this child does NOT meet criteria. An X-ray is necessary to rule-out a high risk injury."  <input type="checkbox"/> "I have reviewed the Low Risk Ankle Rule and this child does meet criteria. But an X-ray is necessary because: _____          _____          _____</p>	
<p><b>4. Additional relevant history and comments</b> (previous reaction to contrast, allergies, isolation, cardiac anomaly, special positioning, etc.)</p>	<p><b>5. Preferred date of exam:</b> _____          Reasons for the preferred date: _____</p>
<p><b>6. Referring physician</b>          First name: _____ Last name: _____ Department: _____          Address: _____ Fax #: _____          Contact numbers: 1. _____ 2. _____</p>	
<p><b>7. Ordering clinician</b> Signature: _____ Print name: _____          Please print <b>SickKids STAFF physician name:</b> _____ Date: _____ Time: _____</p>	

**Incomplete, illegible or inaccurate forms will be returned to you, resulting in a delay in obtaining an appointment.**

<b>DI USE ONLY</b>		Patient pregnant    Y <input type="checkbox"/> N <input type="checkbox"/>
<b>Comments:</b>		
<p><b>Urgency</b></p> <p><input type="checkbox"/> Emergent (&lt;24 hours)  <input type="checkbox"/> Inpatient or Urgent (&lt;2 days)  <input type="checkbox"/> Semi-Urgent (&lt;10 days)  <input type="checkbox"/> Elective  <input type="checkbox"/> Specified time procedure</p> <p>Radiologist's initials: _____</p>	<p><b>Protocol:</b></p> <p>Technologist initials: _____          Radiologist initials: _____</p>	<p><b>Booking</b></p> <p>Date received: _____          Appt. date: _____          Appt. time: _____ Arrival time: _____          Referring MD notification date: _____          Family notification date: _____</p>

## Appendix 3. Electronic Ankle X-ray Ordering Form

Integration of the LRAR into the electronic ankle x-ray ordering form, acknowledgement of review of the LRAR required to sign the order.

The screenshot shows a web-based form for ordering an X-ray of the right ankle. The form is titled "X-Ray Ankle RIGHT 3 Views" and includes an "Accept" button with a green checkmark and a "Cancel" button with a red X. The form fields are as follows:

- Frequency:** A dropdown menu set to "1 time imaging" with a search icon and a "Once" button.
- Starting:** A date picker set to "21/01/2021" with "Today" and "Tomorrow" buttons, and a time field set to "At: 1103" with a clock icon.
- First Occurrence:** "Today 1103".
- Scheduled Times:** A link to expand the list, showing "21/01/21 1103".
- Priority:** Radio buttons for "<4 Hours", "Emergent (<24 Hours)", "Urgent (48 Hours)", and "Elective".
- I have already spoken to a radiologist:** Radio buttons for "I have already spoken to a radiologist", "I will speak to a radiologist ASAP", and "X-ray order exempted".
- Reason for Exam:** A text input field.
- Portable procedure required?:** Radio buttons for "Yes" and "No" with a text input field.
- Referring Physician personal Phone / Pager:** A text input field containing "if located on West or discharged call 205807; East 205550; Hub 203399; admitted contact MRP".
- Low Risk Ankle Rule Review:** Two radio buttons. The first is selected and contains the text "I have reviewed the Low Risk Ankle Rule and this child does NOT meet criteria. An x-ray is needed to rule out high risk injury." The second contains "I have reviewed the Low Risk Ankle Rule and this child does meet criteria but an x-ray is required because...".
- Comments:** A rich text editor with a toolbar. The text area contains:  
Low Risk Ankle Rule applies if:  
- Otherwise healthy child over 3 years of age  
- Acute injury in past 72 hours  
- Tenderness and swelling isolated to the distal fibula or adjacent lateral ligaments distal to the tibial anterior joint line  
If Low Risk Ankle Rule applies then there is generally no need for ankle x-rays.

## Appendix 4. AboutKidsHealth (by the Hospital for Sick Children) Handout on [Minor Ankle Injuries](#)

# Minor ankle injuries

Reviewed by SickKids Hospital Staff | Last updated: November 4th 2019

Minor ankle injuries, such as ankle sprains or minor fractures to the fibula, are common in childhood. These injuries tend to heal quickly. Learn more about minor ankle injuries and their treatment.

### Key points

- Ankle injuries are common in children.
- Ankle injuries can cause pain and swelling.
- X-rays are usually not needed if your child has a minor fibular fracture or ankle sprain injury.
- See a doctor if you suspect a more serious injury such as a fracture, if there is pain anywhere other than the outside of the ankle or if things are not improving in a couple days or the pain is getting worse.

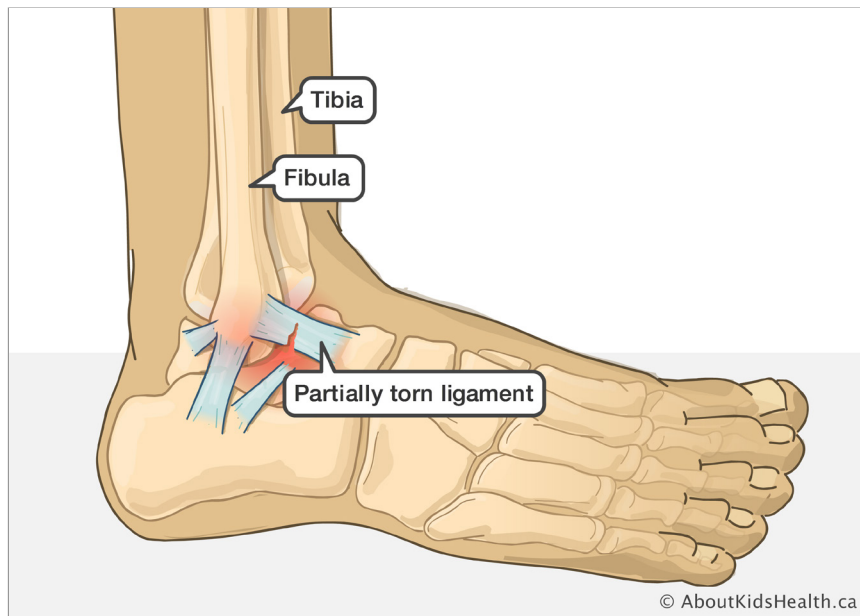
### What is a minor ankle injury?

A minor ankle injury is an injury to the ligaments of the ankle (sprain) and/or bone on the outside of the ankle (fibula fracture).

An ankle sprain is when the ligaments surrounding the ankle joint get stretched or torn.



## Ankle sprain

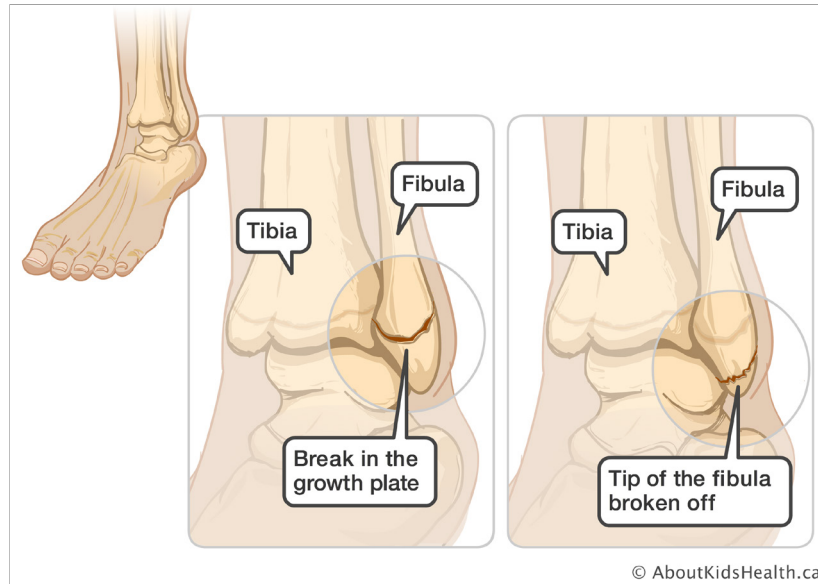


An ankle sprain is an injury to the small ligaments in the ankle. Sprains often occur during a fall when the foot is twisted onto its outer edge.

When the fibula is involved, this is called a minor ankle fracture. This can be due to either a break in the growth plate of the fibula or a chip from the tip of the fibula.



## Ankle fractures



A minor fracture of the ankle usually involves the fibula. Two types of fractures are most common in children. One involves a break in the growth centre of the fibula (Salter-Harris I or II fracture). The other involves a chip of bone on the tip of the fibula.

Minor ankle injuries are common in children. Your child may have twisted their ankle playing sports or landed on their foot in a strange way to cause this injury.

## Signs and symptoms of minor ankle injury

After an ankle injury, your child may have:

- a hard time walking
- mild to severe pain
- less movement in the ankle

Other signs may include:

- swelling and bruising around the front and side of the ankle
- tenderness around the areas of the bones
- little or no tenderness over the bony prominences (fibula)

## How is a minor ankle injury diagnosed?

A doctor can determine if your child has a minor ankle injury without X-rays by doing a detailed exam of the ankle. If your child has a minor ankle injury, your child does not need an X-ray to confirm the diagnosis. The X-ray results do not change how these injuries are managed.

Sprains or minor ankle fractures heal well with time. If your child is diagnosed with a minor ankle injury, they do not need a cast or need to visit a bone specialist. If your child is having trouble walking, they may use crutches and/or an ankle brace that can support the injured ankle while it is healing.

## Taking care of your child at home

### Rest, ice, compression, elevate

Your child should limit activity for the first few days after the injury.

Apply ice to the injured area for the first two to three days. Make sure to cover the skin with cloth prior to applying ice and do not keep the ice on for longer than 15 minutes at a time.

If your child is having difficulty walking, you can use an ankle brace to support the ankle. If you are using a tensor bandage for support, ensure that it is not too tight and that the toes are still pink.

While your child is sitting or lying down, elevate their ankle to help reduce swelling.

### Medications

You might also need to use medication to control your child's pain. [Ibuprofen](#) and [acetaminophen](#) are usually recommended for managing pain.

Ibuprofen and acetaminophen do not interact with each other. Ibuprofen may be slightly better in treating pain and inflammation caused by an injury.

If your child has a pre-existing medical condition or is already taking other medicines, talk to your child's doctor to make sure that acetaminophen or ibuprofen is safe for your child.

## Return to activity

### Pain should be the guide of your child's activities

If an activity hurts, your child should stop doing that activity and try it again a few days later.

It may take up to three weeks for your child's ankle to heal. Your child can use ankle supports and/or crutches as needed to make them more comfortable while the ankle is healing. Feel free to remove

the support and/or stop using crutches any time your child says they feel little or no pain with activities.

## Return to sport

Your child can return to sports when there is full movement and full strength in the ankle. You can test ankle strength by asking your child to hop on the injured leg five times. Check if your child shows signs of pain or is unsteady while hopping. Also, see if your child can run easily in a little zigzag.

Before returning to highly competitive sport, you may want to see a doctor who knows about athletic and sport-related injuries.

It is normal to have pain and swelling once in a while for the first three months. However, most children are doing all the activities they were doing before, including sports, by three months after the injury.

## Your child should see a doctor if:

- The ankle is getting worse instead of better.
- You are worried about how your child's ankle is healing.
- There is still a lot of difficulty in walking and ongoing pain after 48 hours.
- The ankle is red or your child develops a fever.

[Visitez AboutKidsHealth.ca](http://AboutKidsHealth.ca) pour plus d'informations sur la santé des enfants.

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## This toolkit was prepared by:

**Dayae Jeong, MD**

Paediatrics Resident, The University of Toronto

**Gregory Harvey, MD, FRCPC**

Paediatric Emergency Medicine Physician, The Hospital for Sick Children  
Assistant Professor, University of Toronto

**Daniel Rosenfield, MD, MHI, FRCPC**

Paediatric Emergency Medicine Physician, The Hospital for Sick Children  
Assistant Professor, University of Toronto

**Kathy Boutis, MD, MSc, FRCPC**

Paediatric Emergency Medicine Physician, The Hospital for Sick Children  
Full Professor, University of Toronto

**Tania Principi, MD, MSc, FRCPC**

Paediatric Emergency Medicine Physician, The Hospital for Sick Children  
Assistant Professor, University of Toronto

## This toolkit has been peer-reviewed by:

**Samuel Campbell, MB BCh, CCFP(EM), FCFP,  
Dip PEC(SA), FCCHL, FRCP(Edin)**

Research Director, Elizabeth II Health Sciences Centre  
Professor of Emergency Medicine, Dalhousie University

**Jennifer Thull-Freedman MD, MSc, Dip. ABP**

Medical Director of Quality and Safety  
Paediatric Emergency Medicine Physician, Alberta Children's Hospital  
Clinical Associate Professor, University of Calgary



[www.ChoosingWiselyCanada.org](http://www.ChoosingWiselyCanada.org)



[info@ChoosingWiselyCanada.org](mailto:info@ChoosingWiselyCanada.org)



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