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Management of risk

2.0 Assessment for diabetic foot care

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Introduction – identifying the risk

- International Diabetes Federation (IDF) estimated in 2019 that, globally, a lower limb is lost to amputation every 30 seconds as a consequence of diabetes [\(1\)](#).
- IDF in 2019 states comprehensive diabetic foot complications risk assessments and foot care based on prevention, education and support by a multi-disciplinary team **reduces foot complications and amputations by up to 85% [\(1\)](#)**.
- A statement by the WHO supports this by the 40-60% decrease in amputation rates during the last 10-15 years seen in countries with strong diabetic foot management services [\(3\)](#).

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Introduction – identifying the risk

- Appropriate foot care includes prevention (for example through good foot hygiene, wearing suitable shoes and healthy lifestyle changes), early identification of foot problems, wound management, offloading wounds to promote healing and lifestyle changes [\(4\)](#).
- The IDF in 2019 has identified the top ten countries with the highest prevalence of diabetes, with 7 out of 10 of these countries being in the Pacific [\(1\)](#).
- Mortality rates 5-years post amputation have been estimated at 56%-70% [\(4\)](#).

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**Assessment for diabetic foot care**

- Appropriate foot care includes: prevention (for example through good foot hygiene, wearing suitable shoes and healthy lifestyle changes), early identification of foot problems, wound management, offloading wounds to promote healing and lifestyle changes. (5)
- Appropriate and effective wound management is an important step in managing foot wounds and preventing amputation.
- The following series of modules have been developed to increase the knowledge and skills of personnel in the Pacific Islands to better assess people with diabetic foot problems.
  - Module 1: Assessment for diabetic foot care
  - Module 2: Vascular assessment with resources

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**Assessment for diabetic foot care**

M2: Vascular assessment with resources

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**Module 2: Vascular assessment with resources**

- **Target audience:** Health and rehabilitation personnel including: community health/rehabilitation workers, nursing staff, medical staff, allied health (physiotherapists, occupational therapists, prosthetist-orthotists) and others providing care to people with diabetic foot wounds.
- **Aim:** To provide personnel with more advanced methods of assessing vascular (blood) supply when resources are available.

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Module 2 – Training outline

	Estimated time to deliver
A: How to use a doppler	
B: Ankle Brachial Index (ABI)	

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Review – ways of assessing blood flow

- Think back to M1 Assessment.
- What are the ways of assessing blood flow?

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Tools for assessing blood flow

- Some places may have access to special tools to help assess blood flow. This includes:
  - Doppler
  - Blood pressure monitor
- The following slides will explain how to use these tools to accurately assess blood flow.

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**A: How to use a doppler**



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**Doppler**

A doppler is used to assess the quality (how good) and quantity (how much) of blood flow to the legs and feet.

A doppler assessment can be done:

- To give a baseline (starting) value that can be used to compare with over time
- To give information about how well a wound may heal
- To understand how severe arterial or vascular disease is
- To understand how much compression can be applied to the leg/foot for treatment
- To help locate pulses if they are hard to feel (may be deep arteries, swelling or 10% of people do not have a dorsalis pedis pulse).

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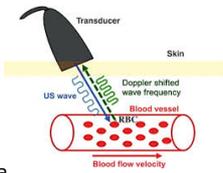
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**How does the doppler work?**

- A doppler ultrasound is a device that uses sound waves amplified (made louder) through a microphone to bounce off blood cells.
- The movement of blood in a blood vessel causes a change in pitch of the sound waves. This allows you to listen to the quality of blood flow of the artery.



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**Doppler**

A doppler is for:

1. Listening to the sound and quality of blood flow to the feet
2. Calculating the ankle brachial index (ABI) to check the amount (quantity) of blood flow to the feet



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**Doppler: how to use**

Use the diagram on the right to familiarise yourself with the doppler device:

- Turn on/off using the button on the transducer.
- Make sure you turn the device off once finished with, as battery will go flat.
- The probe is the part you will hold to the skin.
- Adjust the volume to ensure you can clearly hear the sound of the pulse.



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**Doppler: listening to foot pulses**

1. Turn on the doppler and increase the volume.
2. Put a small amount of ultrasound gel on the area of the pulse you are examining.
3. Gently hold the probe onto the surface of the skin and locate the pulse.



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**Doppler: listening to foot pulses**

4. Hold the probe on a 45 degree angle to the pulse (angle against the blood flow).
5. You may have to change the angle or move the probe to find the pulse.
6. Locate and listen to both pulses on both feet.



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**Doppler: types of pulse**

There are three types of pulse quality:

- Monophasic
- Biphasic
- Triphasic

Try to visualise the sound a heart would make each beat to understand the sound of the pulse.

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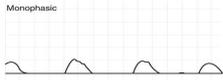
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**Monophasic pulse**

- This will make only one clear noise per pulse.
- A monophasic pulse means there may be reduced blood flow, a sign of peripheral arterial disease or atherosclerosis.



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**Biphasic pulse**

- You will hear two beats per pulse.
- This is considered normal – blood flow to the foot is normal.



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**Triphasic pulse**

- You will hear a triple beat per pulse.
- This may mean that pulses are bounding and elastic.
- This usually suggests, normal blood flow. Or may indicate high blood pressure.



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**Video: doppler**

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### B: Ankle Brachial Index (ABI)

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### Ankle Brachial Index (ABI)

- An ankle brachial index (ABI) will compare blood flow to the arms (close to the heart) with blood flow to the feet (far from the heart).
- The differences noted between the arms and the legs can help determine if there is a problem with blood flow.
- The ABI test calculates a number that helps to know more about the blood flow to the feet.
- If the ABI is less than 0.9 then there is likely PAD
- This helps to understand
  - how well a wound will heal and
  - the type of wound care treatment that will work best.

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### Prepare for ABI

- Explain to the person what you will do
- Check they are happy to do the test
- Have the person lie back slightly if possible (be careful if there is respiratory disease, heart disease or morbid obesity)
- Explain that you will be placing blood pressure cuffs onto the person and listening to their blood flow
- You will be doing this test to know more about their blood flow



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**Safety precautions** 

- Do not press (compress) on the ankle if the person has significant atherosclerosis or reduced blood flow.
- Do not continue a test if the person complains of pain or discomfort from the cuff.
- Do not place the pressure cuff over or close to an open wound or cut.
- Remember: Swelling may affect the accuracy and validity of this test.



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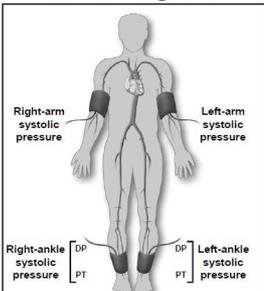
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**Measuring ABI**

- This image shows the areas where you will use the blood pressure cuff to measure the person's ABI



**PAD = ABI < 0.9**

Criqui. NEJM. 2004.

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**ABI: automated blood pressure cuff** 

**Step 1:**  
Use blood pressure monitor to take ankle systolic pressure in each foot.

**Step 2:**  
Use blood pressure monitor to take brachial (arm) systolic pressure in both arms.



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**ABI: automated blood pressure cuff**

**Step 3:**

- Calculate ankle to brachial index for each foot by dividing the ankle systolic pressure by the highest brachial (arm) systolic pressure.
- See the diagram for detail
- Where possible complete ABI with manual blood pressure cuff for more accurate results

**Right ABI:**  
Higher of the right ankle systolic pressures (posterior tibial or dorsalis pedis)  
Higher arm systolic pressures (left or right arm)

**Left ABI:**  
Higher of the left ankle systolic pressures (posterior tibial or dorsalis pedis)  
Higher arm systolic pressures (left or right arm)

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**ABI: automated blood pressure cuff**

**Step 4:**

- Record ABI findings
- Note we will discuss more what to do with the findings in later slides.



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**ABI: manual blood pressure cuff**

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ABI: manual blood pressure cuff

**Step 1:**

Position blood pressure cuff on ankle and find both pulses on feet using doppler.



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ABI: manual blood pressure cuff

**Step 2:**

Hold the doppler in place to listen to the pulse with one hand. Use other hand to inflate the cuff until sound of the pulse disappears. Take the pressure up another 20mm.



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ABI: manual blood pressure cuff

**Step 3:**

Slowly deflate the cuff and record the pressure when the pulse sound returns (this is the systolic blood pressure)



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ABI: manual blood pressure cuff

**Step 4:**

Repeat the process to find the systolic pressure for both pulses in each feet.



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ABI: manual blood pressure cuff

**Step 5:**

Repeat process to find systolic blood pressure for the brachial artery in each arm.



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ABI: manual blood pressure cuff

**Step 6:**

You will now have the systolic pressure for the dorsalis pedis (top) and posterior tibial (ankle) for each foot, and the brachial artery for each arm.

You will use these values to calculate the ABI finding for each pulse and foot.

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ABI: manual blood pressure cuff

**Step 7:**

Record findings and use these values in the calculation on the following page.



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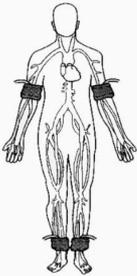
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D: Calculations



**Right ABI:**  
Higher of the right ankle systolic pressures (posterior tibial or dorsalis pedis)  
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Higher arm systolic pressures (left or right arm)

**Left ABI:**  
Higher of the left ankle systolic pressures (posterior tibial or dorsalis pedis)  
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Higher arm systolic pressures (left or right arm)

Giugliano G, et al 2012, 'Ankle/brachial index to everyone', Biomedical Centre Surgery, vol. 12, no. 1, [https://www.researchgate.net/publication/233765386\\_Anklebrachial\\_index\\_to\\_everyone](https://www.researchgate.net/publication/233765386_Anklebrachial_index_to_everyone)

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Calculations

**Manual:**

- ✓ Left dorsalis pedis systolic pressure
- ✓ Right dorsalis pedis systolic pressure
- ✓ Left posterior tibial pulse systolic pressure
- ✓ Right posterior tibial pulse systolic pressure
- ✓ Left brachial systolic pressure
- ✓ Right brachial systolic pressure

**Automatic:**

- ✓ Left ankle systolic pressure
- ✓ Right ankle systolic pressure
- ✓ Left brachial systolic pressure
- ✓ Right brachial systolic pressure

**Example Findings:**

Brachial artery = 130			
Left DP	115	Right DP	120
Left PT	110	Right PT	120

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**Example of ABI calculation:**

Brachial artery = 130			
Left DP	115	Right DP	120
Left PT	110	Right PT	120



**Right ABI:**  
Higher of the right ankle systolic pressures (posterior tibial or dorsalis pedis)  
Higher arm systolic pressures (left or right arm)

**Left ABI:**  
Higher of the left ankle systolic pressures (posterior tibial or dorsalis pedis)  
Higher arm systolic pressures (left or right arm)

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**Calculation**

**Example of ABI calculation:**

Brachial artery = 130			
Left DP	115	Right DP	120
Left PT	110	Right PT	120

**Calculations:**

Posterior Tibial Artery	=	Dorsalis Pedis:	=
Left	=	Left	=
Right	=	Right	=
ABI:		ABI:	

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**Calculation**

**Example of ABI calculation:**

Brachial artery = 130			
Left DP	115	Right DP	120
Left PT	110	Right PT	120

**Calculations:**

Posterior Tibial Artery		Dorsalis Pedis:	
Left	110/130 = 0.84	Left	115/130 = 0.88
Right	120/130 = 0.92	Right	120/130 = 0.92
ABI (Left):	0.84	ABI (Right):	0.92

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ABI: interpret the findings

ABI	Range	Meaning	Blood vessel
Greater than 1.3	Incompressible vessels	Calcified vessels	
0.9 - 1.2*	Normal	Healthy range	
0.7 - 0.9	Mild PAD	Reduced blood flow and healing ability. Refer to doctor.	
0.4 - 0.7	Moderate PAD	Poor healing ability and reduced vascular flow. Refer to doctor.	
0.00 - 0.40	Severe PAD	Severe blood obstruction likely ischaemia or gangrene. Refer to doctor.	

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Discussion:

When in your clinics would be a good time to use a doppler?

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Activity:

In a group use the doppler to:

- Palpate pulses
- Interpret the doppler reading (sound)
- Undertake an ABI
- Complete the ABI calculations
- Interpret the findings

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**Feedback**

As a group, discuss how you have found this session and if there is any suggestions you may have to help improve your learning experience

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**Questions**

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**Acknowledgements**

**Author:** Tom Fitzpatrick  
**Editor:** Lee Brentnall

**Pilot location:** Honiara Hospital, Solomon Islands

This module was developed with the support of the Government of Canada's *Canada Fund for Local Initiatives (CFLI)* programme.

Activity supported by the  
Canada Fund for Local Initiatives  
Activité réalisée avec l'appui du  
Fonds canadien d'initiatives locales

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