

Knowledge Engineering

Librarians driving the management of consumer health information at
Healthdirect Australia

James Humffray
Information Manager



Agenda

- About Healthdirect Australia
- The Australian Health Thesaurus (AHT)
- Healthdirect article content
- Healthdirect medicines
- Current issues
- The Healthdirect Knowledge Graph



I would like to acknowledge the Traditional Custodians of the land I am on today, the Dharug Nation and acknowledge the Traditional Custodians of the many lands from which others join this meeting.

I would also like to pay my respects to Elders past and present and I extend that respect to other Aboriginal and Torres Strait Islander peoples who are present today.

Healthdirect Australia

Established by Australian governments to improve access to healthcare

Free, health
information
and advice,
anywhere, anytime

Scalable
virtual health
services

Connect people
to appropriate
levels of the
health system

Improve
health
literacy

Rapid
response to
health
emergencies



Australian Government
Department of Health



Government of South Australia
SA Health



About Healthdirect Australia

We help Australians actively manage and improve their health by providing trusted information and virtual services anywhere and anytime.

healthdirect

healthdirect
after hours GP helpline

healthdirect
Video Call

pregnancy birth&baby



get healthy
Information & Coaching Service



The NSW Palliative Care
After Hours Helpline

COVID-19 Services

National Coronavirus Helpline
NSW COVID Connexion
COVID-19 Health Professionals
Disability Advisory Service
Vaccine eligibility checker / vaccine
clinic finder
COVID-19 Symptom Checker
COVID-19 Vaccine Side Effects
Symptom Checker
NSW Booking Support Helpline
Vaccine Information Kiosk Support
Priority Support Line

Telehealth channels

Helplines
Websites
Mobile app
Video Call
Service directory
Medicines information
Self-help tools

Supporting Australians and governments through COVID

Healthdirect services were used by millions of Australians for health information and advice in FY22



Calls

9.7M

+43% since FY20



Calls received in the after hours

70%



Video consultations

1.6M

+420% since FY20
1 in 5 for mental health consults



Calls from rural Australians

28%



Callers identifying as First Nations people

5%



Multicultural community connections

10M+

The surge in demand for digital info and self-help tools also continued in FY22



Website visits

117M

+170% since FY20



Healthdirect app downloads

90K

Total 380K downloads



Vaccine Clinic Finder integrated with 15 booking engines

15

For seamless vaccine appointment bookings



Vaccine Clinic Finder language options

16

Top language is Vietnamese



National Health Services Directory powered result searches to find a health service

400M

The COVID-19 response provided essential support and pathways for the community across multiple services



COVID-19 webpage visits

28M

Since March 2020



National Coronavirus Helpline calls

4.6M

Since March 2020



Vaccination Clinic Finder uses

50M

Since March 2021



COVID-19 Restriction Checker uses

17M

Since March 2021



COVID-19 Symptom & Antiviral Eligibility Checker uses

4M

6K+ daily users

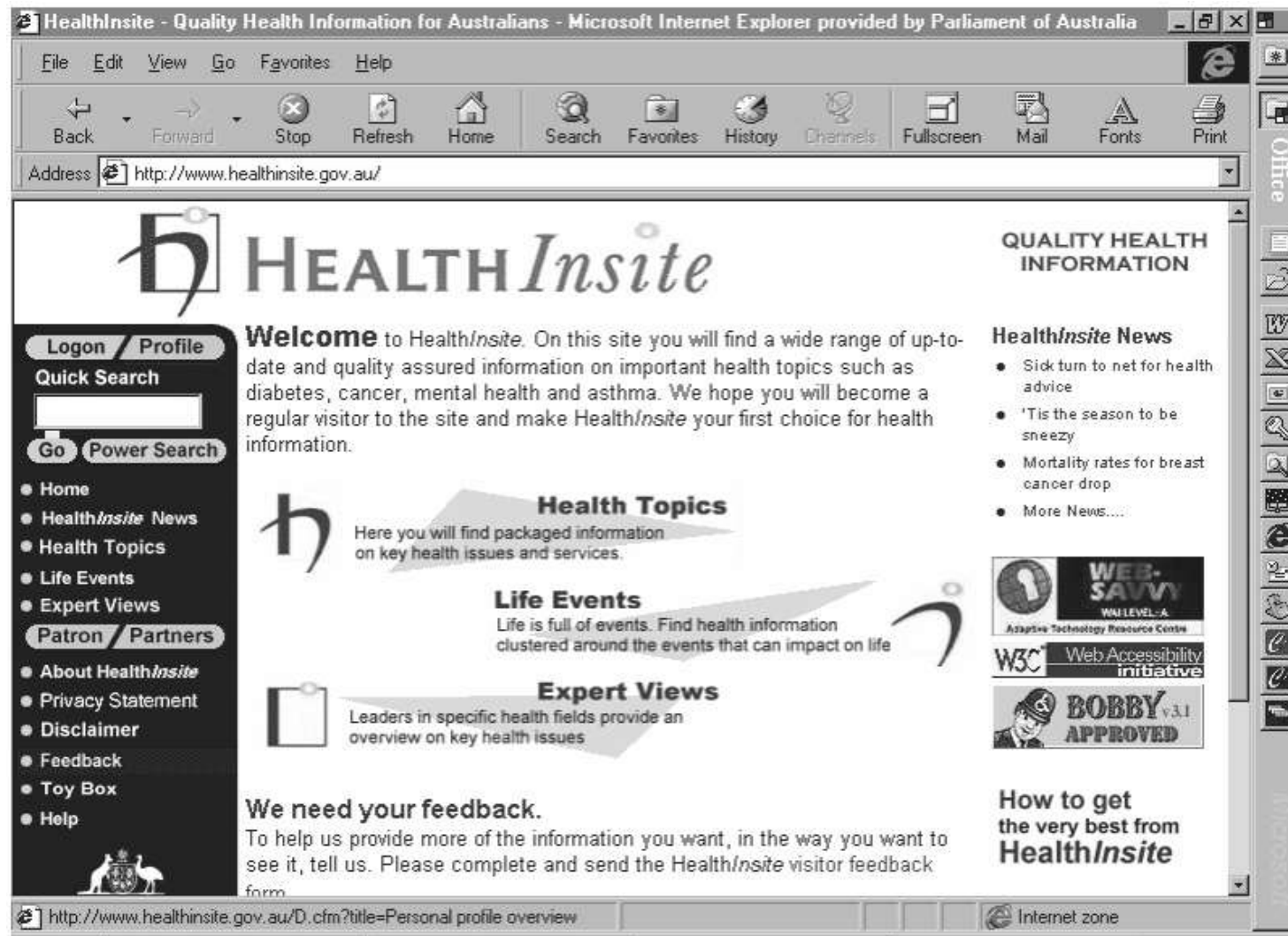


Patients connected to GPs

18.3K

400+ patients per day since Feb 22

Before there was healthdirect... there was HealthInsite



OFFICIAL

Australian Health Thesaurus (AHT)

Australian Health Thesaurus

Age groups (10)

Age groups Aboriginal and Torres Strait Isla

Age groups female (10)

Age groups male (10)

Age groups other (27)

Anatomy (14)

Australia (states and territories) (9)

Biomedical Sciences (7)

Chemicals and Drugs (5)

COVID-19 Pandemic (19)

Diagnosis (3)

Diseases and Disorders (35)

Economics (7)

Equipment and Supplies (11)

Facilities (5)

Information Management (5)

Languages (494)

MAC knowledge base (3)

Management (4)

Organisations (7)

People (18)

Physiology (13)

Population Characteristics (2)

Preventive Health (23)

Psychology (7)

Australian Health Thesaurus

528369f8-f000-4ae7-9af8-53d98979fb15

Metadata & Statistics

Concepts

Triples

SPARQL

Autopopulate

Visualization

Quality Management

History

Metadata

Statistics

ADMS

Class Statistics

Number of Concept Schemes34

Number of Concepts6265

Number of Suggested Concepts0

Label Statistics: en

Number of Preferred Labels6265

Number of Alternative Labels7981

Number of Hidden Labels43

Label Statistics: ar

Number of Preferred Labels2

Number of Alternative Labels0

Number of Hidden Labels0

Label Statistics: bn

Number of Preferred Labels1

Number of Alternative Labels0

Relation Statistics

Number of Broader/Narrower Relations5986

Number of Related Relations8631

OFFICIAL

Australian Health Thesaurus (AHT)

The screenshot displays the Australian Health Thesaurus (AHT) interface. On the left is a hierarchical tree of categories, with 'Osteoarthritis (0)' highlighted under 'Arthritis (7)'. The main panel shows the 'Osteoarthritis' concept page, which includes a URL, action buttons (Add to Collection, Add to Blacklist, Add to ExactMatch, Delete Concept), and tabs for Details, Notes, Documents, Linked Data, Triples, Visualization, Quality Management, and History. The 'Details' tab is active, showing SKOS information. It lists 'Broader Concepts' (Arthritis), 'Narrower Concepts' (none), and 'Related Concepts' (Joint Pain, Joints). It also shows 'Top Concept of Concept Schemes' (none), 'Exact Matching Concepts' (dbpedia.org/resource/Osteoarthritis, nlm.nih.gov/mesh/D010003), and 'Close Matching Concepts' (none). On the right, there are sections for 'Preferred Label' (Osteoarthritis), 'Alternative Labels' (Degenerative arthritis, Osteoarthrosis, Wear and tear arthritis), 'Hidden Labels' (none), 'Notation' (C.005.550.114.606, C.005.799.613), and 'Scope Notes' (A progressive, degenerative joint disease, the most common form of arthritis, especially in older persons. The disease is thought to result not from the aging process but from biochemical changes and biomechanical stresses affecting articular cartilage. In the foreign literature it is often called osteoarthrosis deformans).

Biomedical Sciences (7)

Chemicals and Drugs (5)

COVID-19 Pandemic (19)

Diagnosis (3)

Diseases and Disorders (35)

Bacterial and Fungal Diseases (2)

Blood and Lymphatic Diseases (2)

Blood-borne Infections (3)

Cardiovascular Diseases (2)

Childhood Illnesses (9)

Chronic Diseases (8)

Arthritis (7)

Fibromyalgia (0)

Gout (0)

Juvenile Arthritis (0)

Osteoarthritis (0)

Psoriatic Arthritis (0)

Rheumatoid Arthritis (0)

Sjogren's Syndrome (0)

Asthma (0)

Back Pain (1)

Cancer (0)

Cardiovascular Diseases (2)

Chronic Kidney Disease (0)

Diabetes (4)

Obesity (0)

Congenital, Hereditary and Neonatal Diseases (4)

Digestive System Diseases (6)

Disabilities (6)

Ear Nose and Throat Diseases (4)

Endocrine System Diseases (10)

Osteoarthritis

<http://thesaurus.healthdirect.org.au/ah/12113>

+ Add to Collection ⌵ Add to Blacklist ⌵ Add to ExactMatch 🗑 Delete Concept

Details Notes Documents Linked Data Triples Visualization Quality Management History

SKOS ClinicalRelationships Custom scheme AlfrescoScheme +

Broader Concepts

[Arthritis](#)

Narrower Concepts

Related Concepts

[Joint Pain](#)

[Joints](#)

Top Concept of Concept Schemes

[Link to PoolParty](#)

Exact Matching Concepts

<http://dbpedia.org/resource/Osteoarthritis> LOD Source: EnDBpedia

<http://id.nlm.nih.gov/mesh/D010003> Unknown Source: Unknown Source

Close Matching Concepts

Preferred Label

☒ Osteoarthritis

Alternative Labels

☒ Degenerative arthritis

☒ Osteoarthrosis

☒ Wear and tear arthritis

Hidden Labels

Notation

☒ ☒ C.005.550.114.606

☒ ☒ C.005.799.613

Scope Notes

☒ A progressive, degenerative joint disease, the most common form of arthritis, especially in older persons. The disease is thought to result not from the aging process but from biochemical changes and biomechanical stresses affecting articular cartilage. In the foreign literature it is often called osteoarthrosis deformans.

Australian Health Thesaurus (AHT)

The screenshot displays the Australian Health Thesaurus (AHT) web application. On the left is a hierarchical tree of categories, with 'Diseases and Disorders (35)' expanded to show 'Arthritis (7)', which includes 'Osteoarthritis (0)'. The main panel shows the 'Osteoarthritis' entry with its URL and various tabs. The 'Details' tab is active, showing a 'hasRiskfactor' relationship with 'Obesity' and a list of associated codes: ATC Code, ICD-10 (M19.99), SNOMEDcode (396275006), and SNOMEDuri.

Diseases and Disorders (35)

- Bacterial and Fungal Diseases (2)
- Blood and Lymphatic Diseases (2)
- Blood-borne Infections (3)
- Cardiovascular Diseases (2)
- Childhood Illnesses (9)
- Chronic Diseases (10)
 - Arthritis (7)
 - Fibromyalgia (0)
 - Gout (0)
 - Juvenile Arthritis (0)
 - Osteoarthritis (0)**
 - Psoriatic Arthritis (0)
 - Rheumatoid Arthritis (0)
 - Sjogren's Syndrome (0)
 - Asthma (0)
 - Back Pain (1)
 - Cancer (0)
 - Cardiovascular Diseases (2)
 - Chronic Kidney Disease (0)
 - Chronic Obstructive Pulmonary Disease (0)
 - Diabetes (4)
 - Obesity (0)
 - Osteoporosis (0)
- Congenital, Hereditary and Neonatal Diseases (1)

Osteoarthritis

<http://thesaurus.healthdirect.org.au/ah/12113>

+ Add to Collection Add to Blacklist Add to ExactMatch

Details Notes Documents Linked Data Triples Visualization Quality Management

SKOS ClinicalRelationships Custom scheme AlfrescoScheme +

hasRiskfactor ⓘ

- Obesity

ATC Code ⓘ

+

ICD-10 ⓘ

M19.99

+

SNOMEDcode ⓘ

396275006

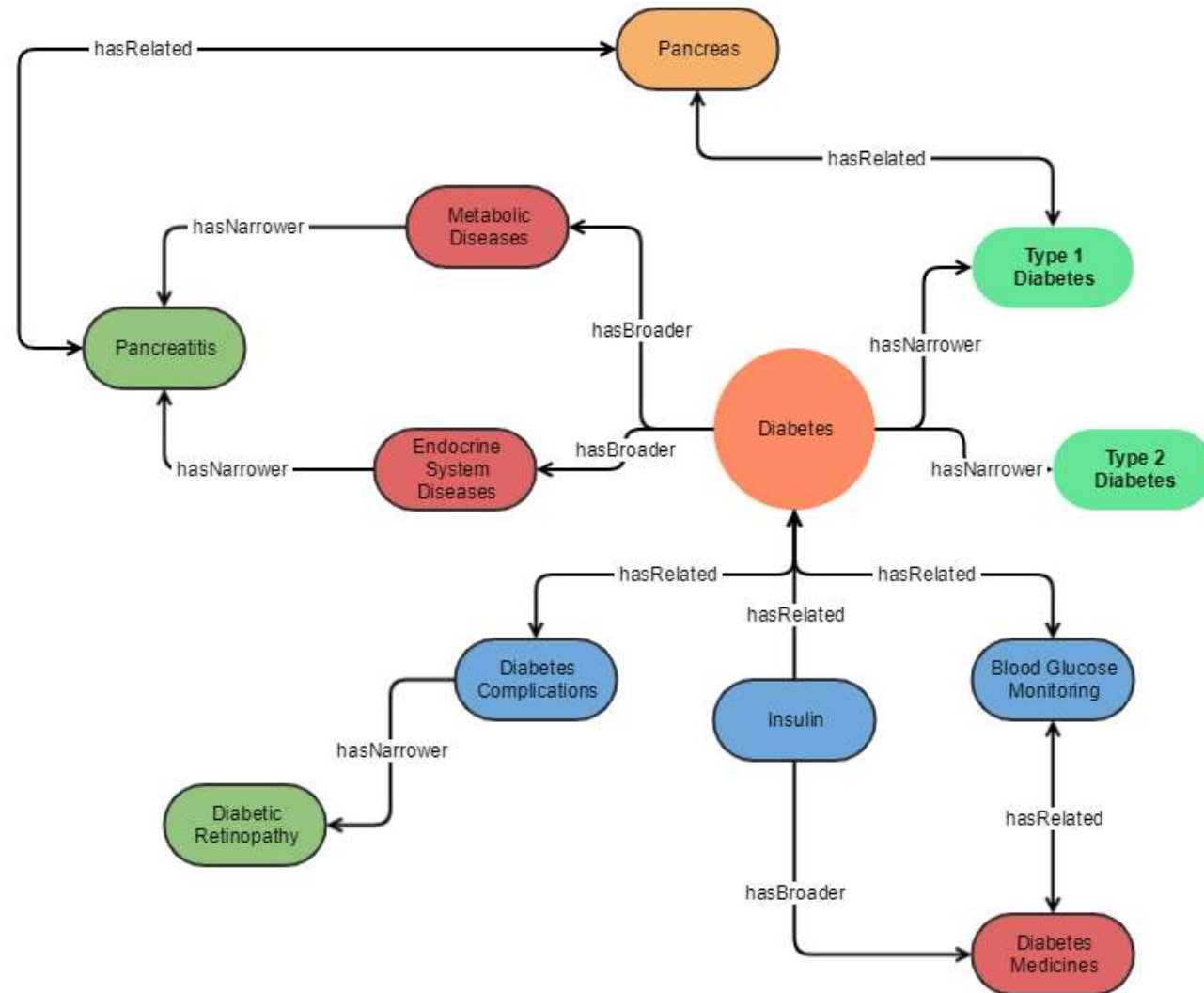
+

SNOMEDuri ⓘ

<http://snomed.info/sct/396275006>

+

Web of connected concepts



Gastroenteritis

7-minute read



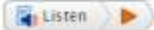
Print



Share



Save



Key facts

- Gastroenteritis ('gastro') is a common and often highly infectious condition that affects the stomach and intestines. It can cause vomiting and diarrhoea.
- Babies under 6 months should always be seen by a doctor if they have gastro.
- Gastroenteritis is treated by drinking fluids, and doesn't usually require medication.
- Reduce your risk of catching or spreading gastro by washing your hands well after using the bathroom, changing nappies or handling food.
- Children should not return to school and adults should not return to work until 48 hours after the last episode of diarrhoea and/or vomiting.

On this page

- What is gastroenteritis?
- How is gastroenteritis treated?
- What are the symptoms of gastroenteritis?
- Can gastroenteritis be prevented?
- When should I see my doctor?
- Resources and support
- What causes gastroenteritis?
- Related information on Australian websites
- How is gastroenteritis diagnosed?

What is gastroenteritis?

Related pages

- [Bowel infections](#)
- [Norovirus infection](#)
- [Parechovirus](#)
- [Rotavirus](#)

Search our site for

- Dehydration
- Diarrhoea
- Stomach
- Food Hygiene
- Inflammation
- Intestines

Symptom checker

Feeling pain in your stomach?

Select a symptom, answer some questions, get advice.

START YOUR SYMPTOM CHECK

Find a health service

- ☒ GP (General practice)
- ☐ Pharmacy
- ☐ Emergency Departments
- ☐ Hospitals

Search suggestions
Related pages
Search tags
Contextual display

Medicines search

healthdirect Free Australian health advice you can trust

Home Health topics A-Z ▼ Medicines Symptom checker Service finder Search



Medicines

Search by brand name or active ingredient

e.g. paracetamol **SEARCH MEDICINES**

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

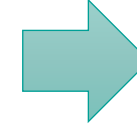
<https://www.healthdirect.gov.au/medicines>

<https://www.healthdirect.gov.au/medicines/brand/amt,3878011000036100/ponstan>

healthdirect medicines

Data sources

- **Australian Health Thesaurus (AHT)**
- **Australian Medicines Terminology (AMT)**
 - Medicinal Product (MP)
 - Medicinal Product Unit of Use (MPUU)
 - Medicinal Product Pack (MPP)
 - Trade Product (TP)
 - Trade Product Unit of Use (TPUU)
 - Trade Product Pack (TPP)
 - Containered Trade Product Pack (CTPP)
- **Therapeutic Goods Administration (TGA)**
 - Australian Register of Therapeutic Goods (ARTG)
- **Pharmaceutical Benefits Scheme (PBS)**
- **GuildLink**
 - Pill images
 - *Consumer Medicine Information leaflets (HTML)*
 - *Phonetic spellings*
 - *Sound files*



- Dextran-1 (0)
- Dextran-70 + Hypromellose (0)
- Dextromethorphan (0)
- Dextromethorphan + Diphenhydramin
- Dextromethorphan + Phenylephrine (
- Dextromethorphan + Pseudoephedr
- Dextromethorphan + Pseudoephedr
- Dextropropoxyphene (0)
- Dextropropoxyphene + Paracetamol
- Diazepam (0)**
- Diazoxide (0)
- Dibasic Potassium Phosphate + Mon
- Dibasic Sodium Phosphate + Monoba
- Dibromopropamide (0)
- Dichlorobenzyl Alcohol + Amylmetacr
- Dichlorobenzyl Alcohol + Zinc Oxide (
- Diclofenac (0)
- Diclofenac + Misoprostol (0)
- Dicloxacillin (0)
- Dicobalt Edetate (0)
- Didanosine (0)
- Dienogest (0)
- Dienogest + Ethinylestradiol (0)
- Digoxin (0)
- Digoxin-specific Antibody Fragment F
- Dihydrocodeine (0)
- Dihydroergotamine (0)
- Dill Seed Oil + Meadowsweet Extract
- Diltiazem (0)
- Dimenhydrinate (0)
- Dimenhydrinate + Hyoscine hydrobro
- Dimethyl Fumarate (0)
- Dimeticone (0)
- Dimeticone-100000 (0)
- Dimeticone-350 (0)
- Dimeticone-350 + Cetrimide (0)
- Dimeticone-350 + Glycerol (0)
- Dimeticone-350 + Zinc Oxide (0)

Diazepam

<http://thesaurus.healthdirect.org.au/aht/20759>

Active Ingredient

+ Add to Collection - Add to Blacklist

DetailsNotesDocumentsLinked DataTriplesVisualizationQuality ManagementHistory

SKOSClinicalRelationships Custom schemeAlfrescoScheme+

No relations defined yet.

AMT uri

AMT code

ATC code

Beers Criteria

Pregnancy Category code

AMT code ⓘ

<http://resource.healthdirect.org.au/AMT/21688011000036107>

AMT_Medicinal_Product_shortId ⓘ

21688011000036107

ATC Code ⓘ

N05BA01

+

Beers criteria ⓘ

⊗ true

DrugBank Accession Number ⓘ

DB00829

+

ICD-10 ⓘ

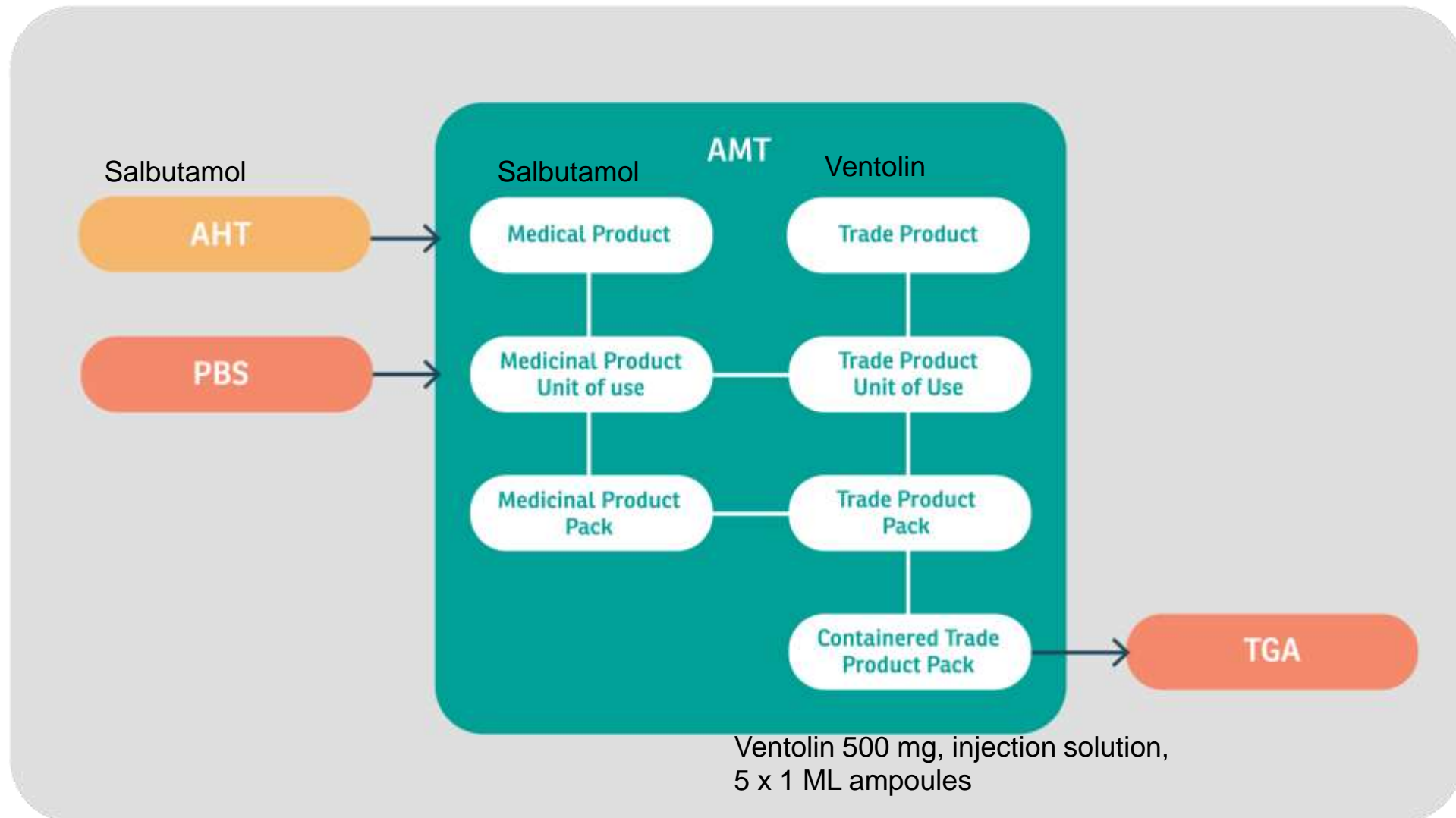
+

Pregnancy_Category ⓘ

C

+

Medicines search



healthdirect medicines pages

Brand name: Valium™

Active ingredients: [diazepam](#)

What it is used for	Over 65?
How to take it	Pregnant or planning a pregnancy?
Side effects	Download leaflet
Taking other medicines	Reporting side effects
Visual appearance	Data sources
Do I need a prescription?	Disclaimer
Is this medicine subsidised?	

What it is used for

Valium is indicated for the management of [anxiety disorders](#) or for the short term relief of the symptoms of anxiety. Anxiety or tension associated with the stress of everyday life usually does not require treatment with an anxiolytic. In acute [alcohol withdrawal](#), VALIUM may be useful in the symptomatic relief of acute agitation, tremor, impending or acute delirium tremens and hallucinosis. VALIUM is a useful adjunct for the relief of reflex muscle spasm due to local trauma (injury, inflammation) to muscles, bones and joints. It can also be used to combat spasticity due to upper motor neuron lesions such as [cerebral palsy](#) and paraplegia, as well as in athetosis and stiff-man syndrome. Intravenous VALIUM is useful in controlling status epilepticus and the spasms of [tetanus](#).

How to take it

The way to take this medicine is: Oral. This medicine is taken by mouth.

- Store below 30 degrees Celsius
- Shelf lifetime is 5 Years.

You should seek medical advice in relation to medicines and use only as directed by a healthcare professional.

Always read the label. If symptoms persist see your healthcare professional.

Visual appearance

Cylindrical, biplanar, yellow tablet, upper face marked ROCHE 5, lower face scored.



Images are the copyright of the Pharmacy Guild of Australia

Do I need a prescription?

This medicine is available from a pharmacist and requires a prescription. It is [Schedule 4 : Prescription Only Medicine](#).

Is this medicine subsidised?

This medicine was verified as being available on the PBS (Pharmaceutical Benefits Scheme) on February 1, 2020. To learn more about this subsidy, visit the [Pharmaceutical Benefits Scheme \(PBS\) website](#).

Over 65?

This medicine contains the active ingredients:

- [diazepam](#)

If you are over 65 years of age, there may be specific risks and recommendations for use of this medicine. Please discuss your individual circumstances with your pharmacist, doctor or health professional. For more information read our page on [medication safety for older people](#).

Pregnant or planning a pregnancy?

For the active ingredient [diazepam](#)

You should seek advice from your doctor or pharmacist about taking this medicine. They can help you balance the risks and the benefits of this medicine during pregnancy.

Download leaflet

For side effects, taking other medicines and more

Download consumer medicine information leaflet (pdf) from the [Therapeutic Goods Administration \(TGA\) website](#)

Reporting side effects

You can help ensure medicines are safe by reporting the side effects you experience.

You can report side effects to your doctor, or directly at www.tga.gov.au/reporting-problems

Data sources

- [Australian Health Thesaurus](#)
Last updated on: February 7, 2020
- [Australian Register of Therapeutic Goods \(ARTG\)](#)
Last updated on: February 5, 2020
- [GuildLink](#)
Last updated on: February 6, 2020

For more information, see [Medicine Information sources](#)

COVID-19 support

- COVID-19 Pandemic (19)
 - About COVID-19 (COVID-19) (5)
 - Aged care facilities (0)
 - Clinical management (COVID-19) (18)
 - Contact tracing (COVID-19) (4)
 - COVID-19 restrictions (12)
 - Diagnosis and testing (COVID-19) (7)
 - Disability advisory service (10)
 - Education and childcare (5)
 - Healthcare workers (7)
 - Isolating and distancing (COVID-19) (7)
 - Living with COVID-19 (5)
 - NSW Health only (0)
 - Prevention (COVID-19) (6)
 - State and territory information (COVID-19) (9)
 - Support services (COVID-19) (8)
 - Symptoms (COVID-19) (5)
 - Travel advice and restrictions (COVID-19) (8)
 - Vaccines and vaccination (COVID-19) (3)
 - Workplace (3)

healthdirect
National Coronavirus Helpline – Knowledge Base

CONSUMERS HEALTH PROFESSIONALS

Search for questions

Type keywords or questions

You can also browse the categories below to find what you are looking for.

Popular questions

Where can I get advice from my state or territory on managing COVID-19 at home?
Can I get a COVID-19 vaccine and the flu shot at the same time?
How is COVID-19 treated, including with antiviral medication and other medicines?
How are COVID-19 cases and close contacts managed in NSW?

Categories

Healthcare workers	About COVID-19	State and territory information
Isolating and distancing	Contact tracing	Support services
Workplace	Living with COVID-19	Diagnosis and testing
Disability advisory service	Aged care facilities	Symptoms
Prevention	Travel advice and restrictions	NSW Health Only
COVID-19 restrictions	Education and childcare	Clinical management
Vaccines and vaccination		

OFFICIAL

Healthdirect silos



National Health
Services Directory

Symptom Checker

Medicines

Alfresco CMS

- Local content
- Partner content
- DAM

NHSD data

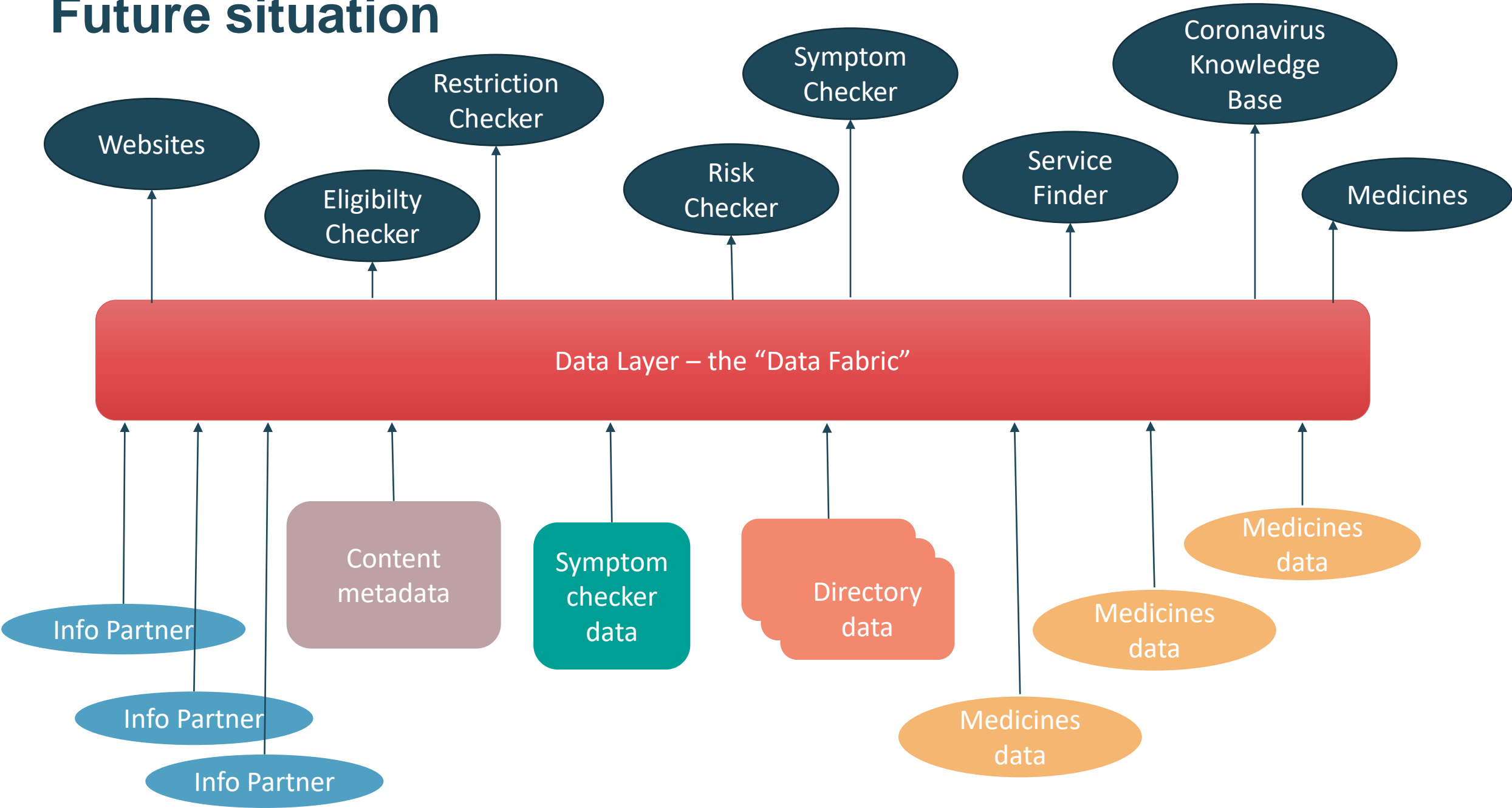
DMS

- Symptom Checker flows

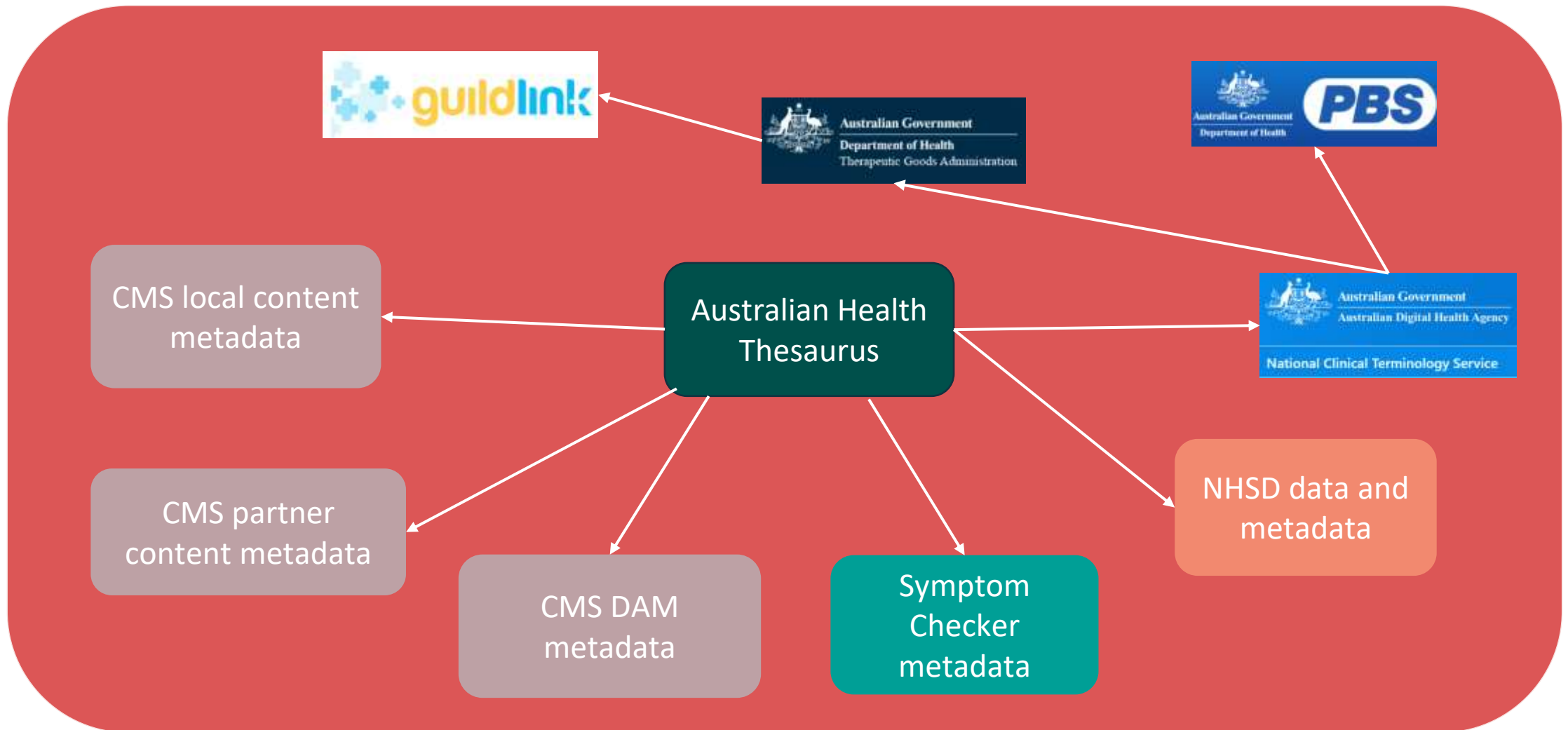
Terminology Server

- ARTG
- PBS
- GuildLink
- AMT
- AHT

Future situation



Inside the Data Layer – Healthdirect Knowledge Graph



Google Knowledge Graph

Google search results for "sydney".

Search results include:

- Sydney, Australia | Official Sydney Tourism Website**
Enjoy the best of Sydney! Discover places to visit, fun things to do this weekend, best restaurants & more on the official Sydney tourism site.
Top Things to Do in Sydney · Sydney City · United States · United Kingdom
- Sydney - Wikipedia**
Sydney (/ˈsɪdni/ (listen) SID-nee) is the capital city of the state of New South Wales, and the most populous city in both Australia and Oceania.
22.8 °C 73 °F · 14.7 °C 58 °F
Mean max temp · Mean min temp
Sydney Airport · Demographics of Sydney · Sydney (disambiguation) · Sydney Cove
- The University of Sydney**
The University of Sydney is one of the best universities in Australia, and is consistently ranked in the top 50 universities in the world.

Top stories

NEWS

- Melbourne set to overtake Sydney as Australia's largest city, data shows
2 hours ago
- The Sydney Harbour Herald**
Major U-turn in construction plans for Sydney's Western Harbour Tunnel
10 hours ago
- Broadsheet**
Bite Size: Five New Things in Sydney You Need To Know This Week – November 4,...
53 mins ago
- Broadsheet**
A Broadsheet Editor's Guide to One Night in Sydney
53 mins ago

Sydney
City in New South Wales

Sydney, capital of New South Wales and one of Australia's largest cities, is best known for its harbourfront Sydney Opera House, with a distinctive sail-like design. Massive Darling Harbour and the smaller Circular Quay port are hubs of waterside life, with the arched Harbour Bridge and esteemed Royal Botanic Garden nearby. Sydney Tower's outdoor platform, the Skywalk, offers 360-degree views of the city and suburbs. — Google

Area: 12,368 km²
Elevation: 3 m
Founded: 26 January 1788
Weather: 20 °C, Wind E at 16 km/h, 58% Humidity [weather.com](#)
Local time: Friday 3:58 pm
Population: 5,312 million (2019)

Colleges and Universities [View 25+ more](#)

- The University of Sydney
- UNSW Sydney
- University of Technol...
- Macquarie University

Events

Google Knowledge Graph

“A knowledge graph is what doctors have in their minds when they are diagnosing you,” ...

"Doctors see relationships based on years of training and experience. This is their mental model that creates links between symptoms and diseases. We are translating a symbolic representation of medical knowledge like that into something we can feed to machine learning algorithms together with patient data."

New AI model tries to synthesize patient data like doctors do

<https://techxplore.com/news/2019-11-ai-patient-doctors.html>

NOVEMBER 13, 2019

by [Pacific Northwest National Laboratory](#)

FAIR data principles



Summary – role of librarians at Healthdirect Australia

- Guardians of standards
- Custodians of data and metadata
- Managers of information models
- Seekers of opportunities
- Engineers of knowledge



James Humffray

Information Manager

02 9263 9137

james.humffray@healthdirect.org.au

<https://www.linkedin.com/in/james-humffray-9bb09b7/>

