SMS
Management & Technology
your vision. Delivered.

The path to codification of medical prescription restrictions in the Australian Pharmaceutical Benefits Scheme (PBS)

LINGUISTIC SEMANTICS IN CONTENT ANALYSIS

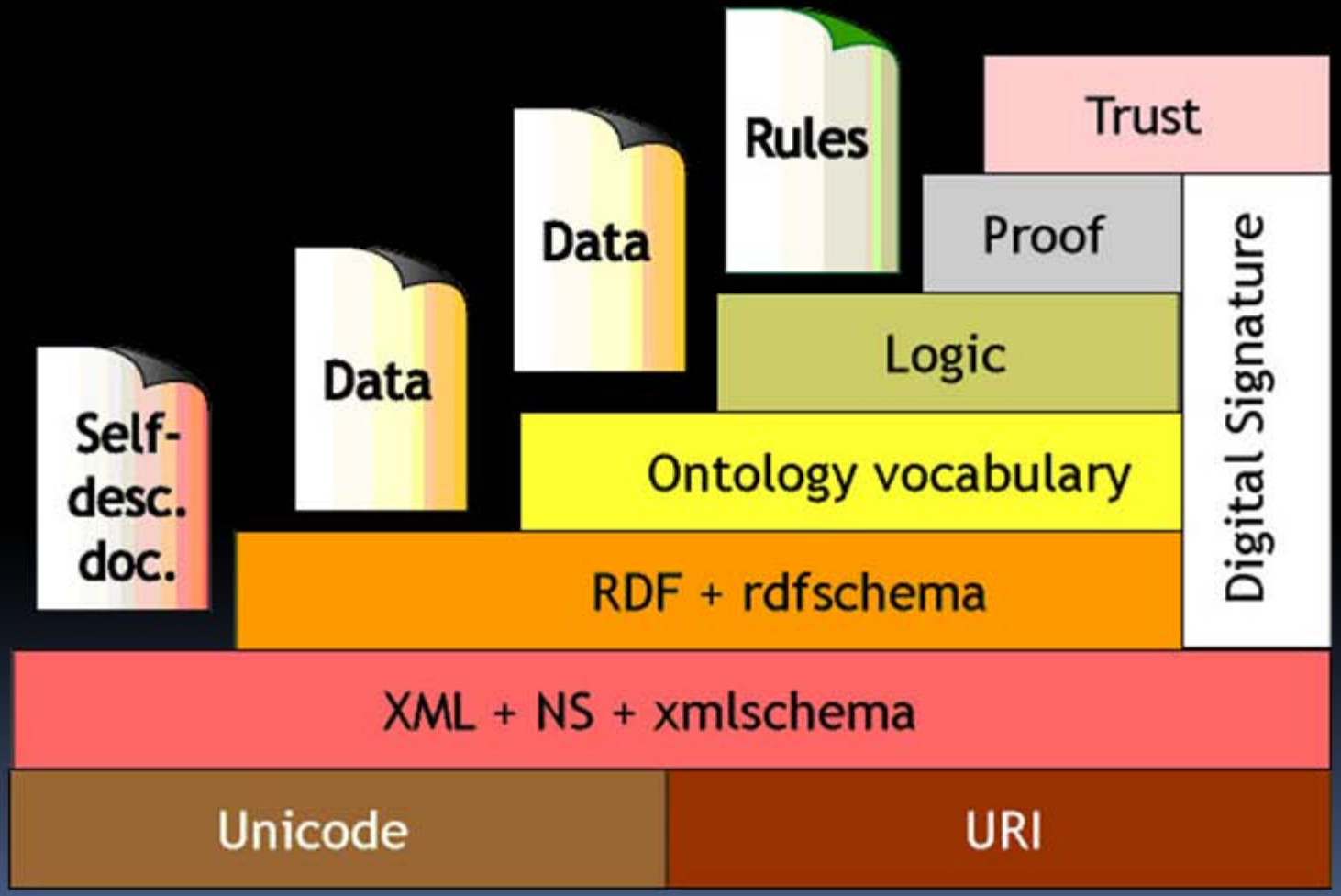
Matthew Hodgson, BSc (Psych), MKM
ISKO, London. June 2009

Blogs, Slideshare and Slidecasts

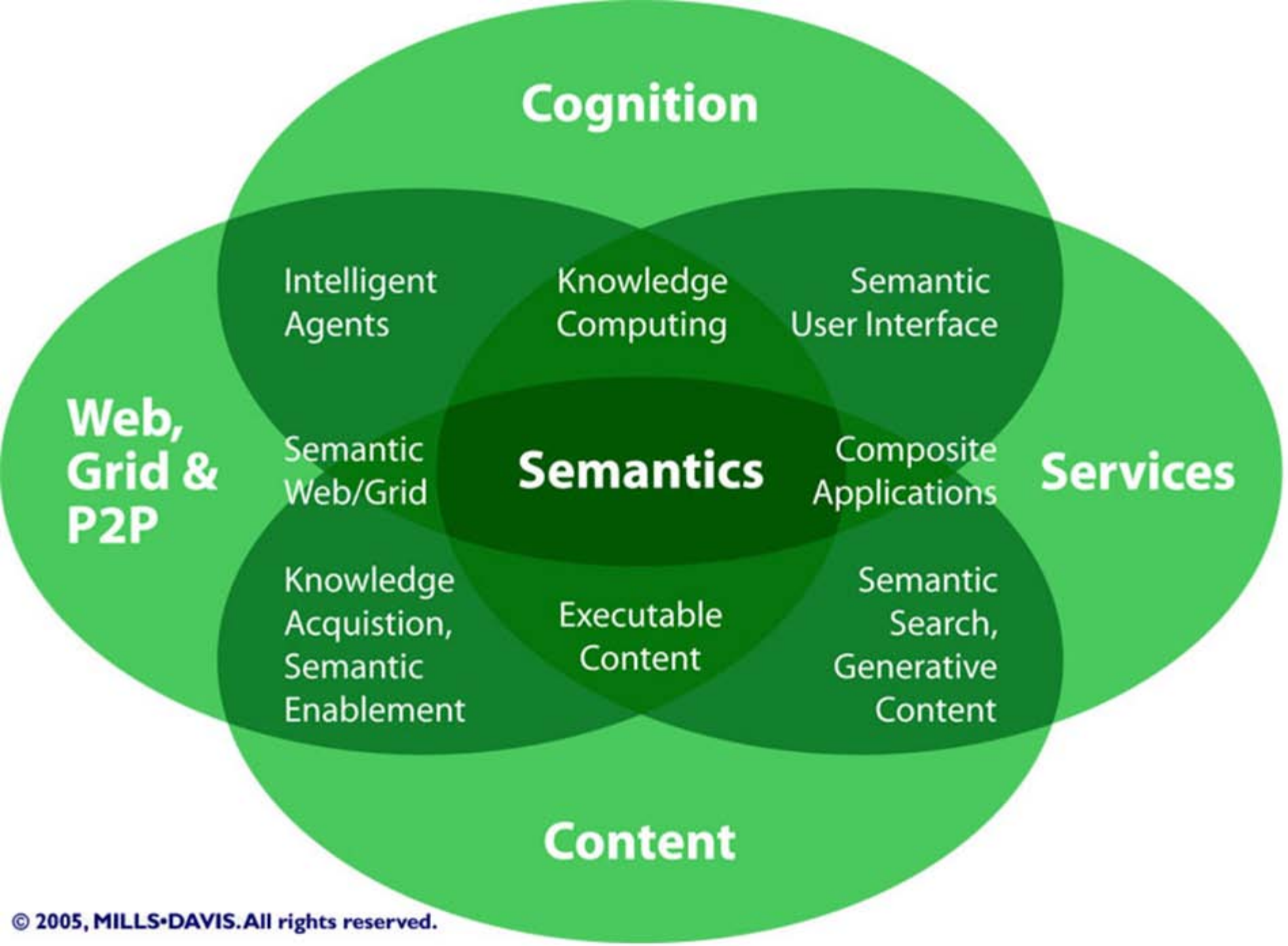
Slideshare: www.slideshare.net/magia3e

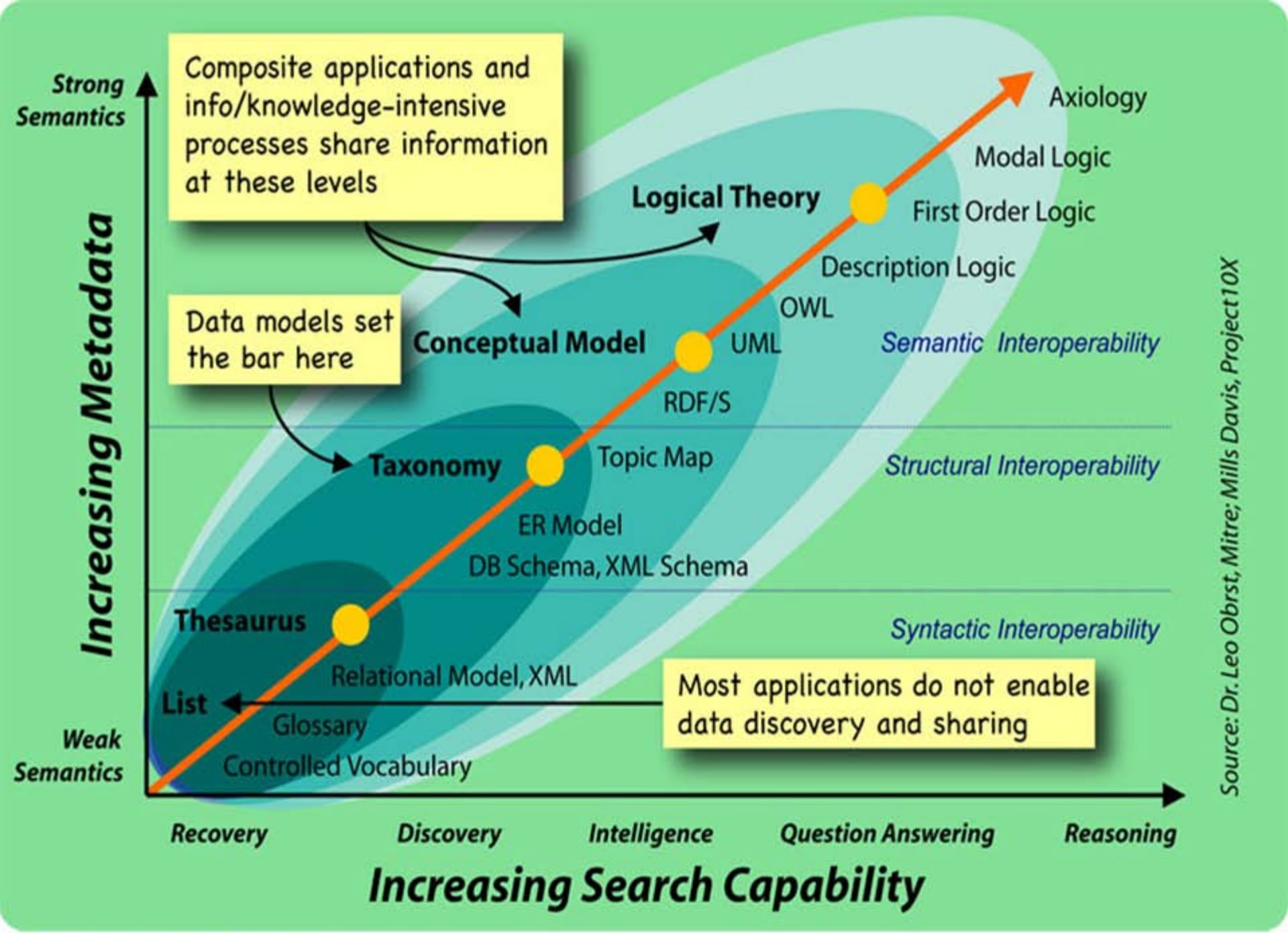
Blog: magia3e.wordpress.com

The Semantic Web is drawing nearer

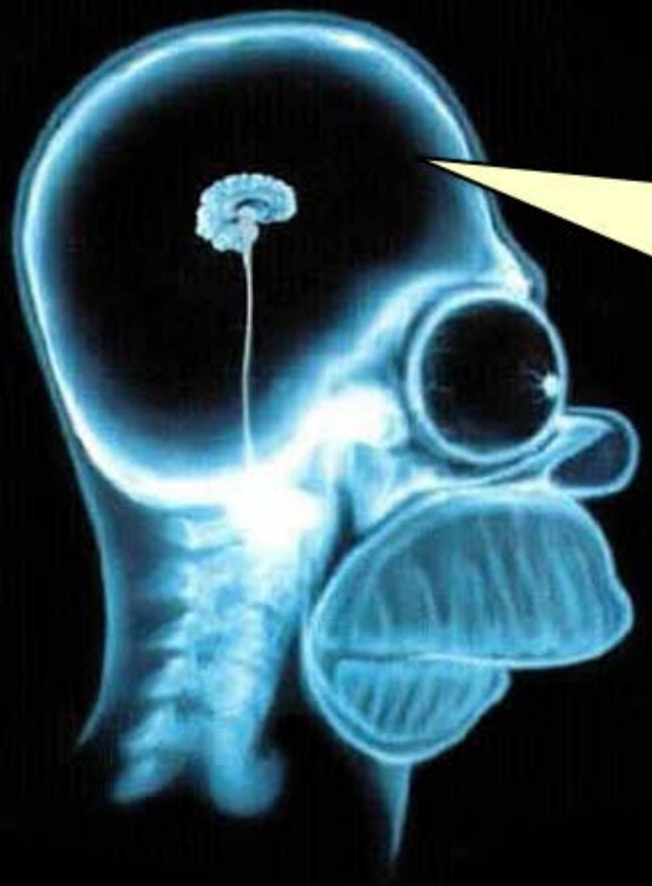


Source: Tim Berners-Lee., 2000





And at the end of the day . . .



Information still has to be produced ***and*** interpreted by human beings

THE CONTENT . . .

Any queries concerning the arrangements to prescribe etanercept may be directed to Medicare Australia on 1800 700 270 (hours of operation 8 a.m. to 5 p.m. EST Monday to Friday).

Written applications for authority to prescribe etanercept should be forwarded to:

Medicare Australia
Prior Written Approval of Specialised Drugs
Reply Paid 9826
GPO Box 9826
HOBART TAS 7001

Further prescribing information is on the Medicare Australia website at www.medicareaustralia.gov.au.

... this goes for **several** pages ...

Note:

TREATMENT OF ADULT PATIENTS WITH ACTIVE ANKYLOSING SPONDYLITIS

The following information applies to the prescribing under the Pharmaceutical Benefits Scheme (PBS) of adalimumab, etanercept and infliximab for adult patients with active ankylosing spondylitis. Where the term 'tumour necrosis factor (TNF) alfa antagonist' appears in the following NOTES and restrictions, it refers to adalimumab, etanercept and infliximab only.

A patient is eligible for PBS-subsidised treatment with only 1 of the 3 TNF-alfa antagonists at any 1 time.

From 1 March 2007, under the PBS, all patients will be able to commence a treatment cycle where they may trial each PBS-subsidised TNF-alfa antagonist without having to experience a disease flare when swapping to the alternate agent. Under these interchangeability arrangements, within a single treatment cycle, a patient may continue to receive long-term treatment with a TNF-alfa antagonist while they continue to show a response to therapy.

A patient who received PBS-subsidised TNF-alfa antagonist treatment prior to 1 March 2007 is considered to be in their first cycle as of 1 March 2007.

Within the same treatment cycle, a patient cannot trial and fail, or cease to respond to, the same PBS-subsidised TNF-alfa antagonist more than once. A patient who, prior to 1 March 2007, was authorised to receive PBS-subsidised initial treatment for ankylosing spondylitis with the same agent twice, is exempt from this condition in respect of applications approved prior to 1 March 2007.

Once a patient has either failed or ceased to respond to treatment 3 times, they are deemed to have completed a treatment cycle and they must have, at a minimum, a 5-year break in PBS-subsidised TNF-alfa antagonist therapy before they are eligible to commence the next cycle. The 5-year break is measured from the date of the last approval for PBS-subsidised TNF-alfa antagonist treatment in the most recent cycle to the date of the first application for initial treatment with a TNF-alfa antagonist under the new treatment cycle.

A patient who has failed fewer than 3 TNF-alfa antagonists in a treatment cycle and who has a break in therapy of less than 5 years, may commence a further course of treatmen within the same treatment cycle.

A patient who has failed fewer than 3 TNF-alfa antagonists in a treatment cycle and who has a break in therapy of more than 5 years, may commence a new treatment cycle.

There is no limit to the number of treatment cycles a patient may undertake in their lifetime.

(1) How to prescribe PBS-subsidised TNF-alfa antagonist therapy after 1 March 2007.

(a) Initial treatment.
Applications for initial treatment should be made where:
(i) a patient has received no prior PBS-subsidised TNF-alfa antagonist treatment in this treatment cycle and wishes to commence such therapy (Initial 1); or
(ii) a patient has received prior PBS-subsidised (initial or continuing) TNF-alfa antagonist therapy and wishes to trial an alternate agent (Initial 2) [further details are under 'Swapping therapy' below]; or
(iii) a patient wishes to re-commence treatment with a specific TNF-alfa antagonist following a break in PBS-subsidised therapy with that agent (Initial 2).

The context of medical restrictions content

Pharmaceutical Benefits Scheme (PBS) in Australia:

- Australian Government that provides subsidised prescription drugs to residents of Australia – est. 1948
- Critical part of its national health-care scheme
- Approx. 140 lifesaving and disease-preventing drugs
- Fastest growing area of government health expenditure
- 2001-2002 est. $4.837 billion – 13.6% cent more than previous year
- Last decade – est. average annual expenditure growth rate of around 14%

Audit of restrictions wording

Australian National Audit Office (ANAO):

- Restrictions wording for prescribing medicines is too complex
- Unnecessary administrative burden to prescribing
- Growing impact and complexity of restrictions – exponentially **increased from an average word** count of 19.4 in 2000 to 354.0 in 2005
- Medicines are not reaching the patient populations
- Results in under-utilisation of medicines
- Results in fewer health benefits being delivered to the Australian population

The core of the problem

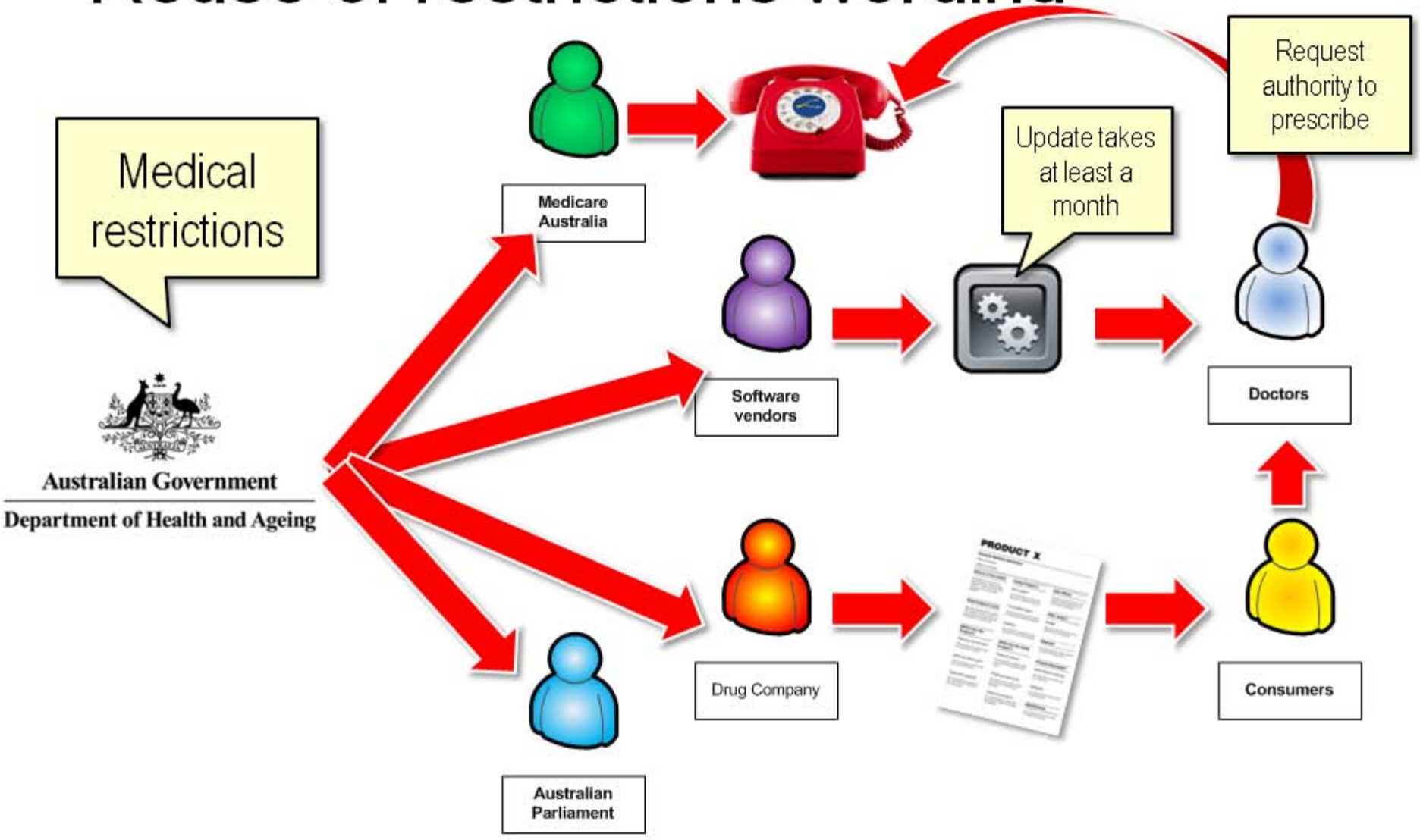
They couldn't explain what they did or how

Any explanation of process was always different

Restrictions wording process:

- No explicit knowledge of the process
- **Multiple authors involved** with different levels of auth
- Relies on human memory for consistency – **highly variable outputs**
- Lots of waste in the process – esp. time
- Produces highly **complex** sentence structures, pseudo-legalese
- Produces a language style reflects the author rather than the meaning in the communication
- Used by multiple audiences – content is **reused** by lots of other processes

Reuse of restrictions wordina



The challenge

Reduce **re-use** timeframes to:

- End-users – Consumers, Doctors, Medicare, Drug Companies, Software Vendors

Enhance:

- Consistency, flow, readability, **capability for re-use**

Simplify:

- **The process** and 'garbage' output
- Language – style, complexity, structure

This is what the ANAO wanted

Use (latent) semantic indexing?

Output codified content:

- Codify and index existing content
- Produce XML updates for re-use in prescribing software

Issues:

- Expensive given project budget
- Solution exploration not possible in project timelines
- Won't fix the problem inherent in the **process**

The approach

Application of linguistic semantic theory:

- There is a predicable structure in the chaos
- It's all just **Lego** building blocks (nouns, verbs, verb phrases, etc)
- Implied **meaning** can be made overt
- Identify overt structure – meaning can then be **inferred** about the process
- Identify improvements in user-experience of content to enhance consistency, readability
- Make input easier for codification for output to XML

Language as Lego

Building blocks:

- Subject (S)
- Verb (V)
- Object (O)

Order of blocks:

- Differs depending on the language

Order from chaos

SVO languages

- English, French, Chinese, Bulgarian, Swahili

SOV

- Japanese, Turkish, Korean

VSO

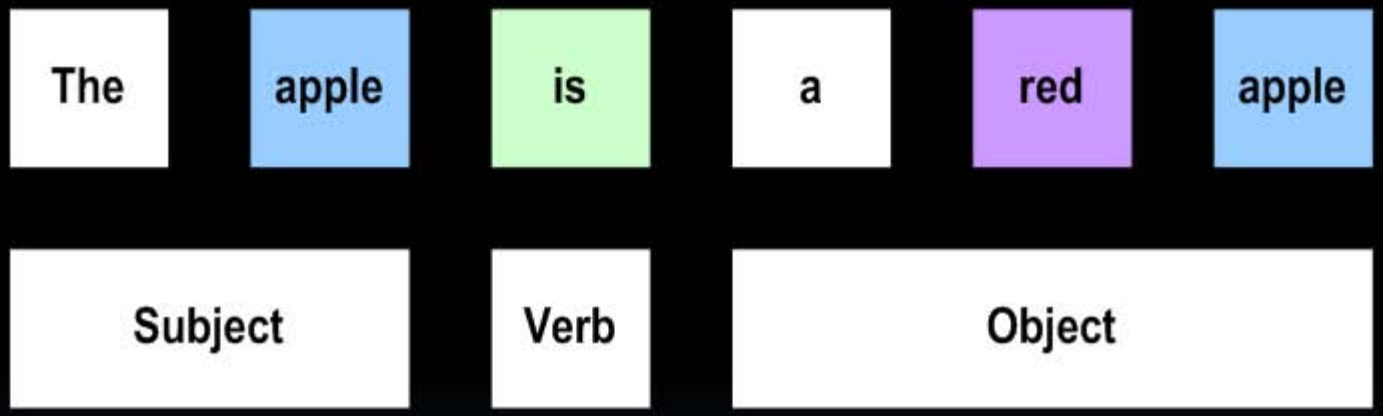
- Classical Arabic, Celtic and Hawaiian

VOS

- Fijian
- Yoda's amusing ramblings

Subjects, objects and verbs

- **The apple is red** ***or***
- **The apple is a red apple?**



- Analysis of the sentence components allows us to differentiate between the subject and the object and identify the *who* and *what*

Semantic analysis

Some examples of the medical restrictions wording:

Restricted benefit

Gastro-oesophageal reflux disease;
Scleroderma oesophagus;

Authority required

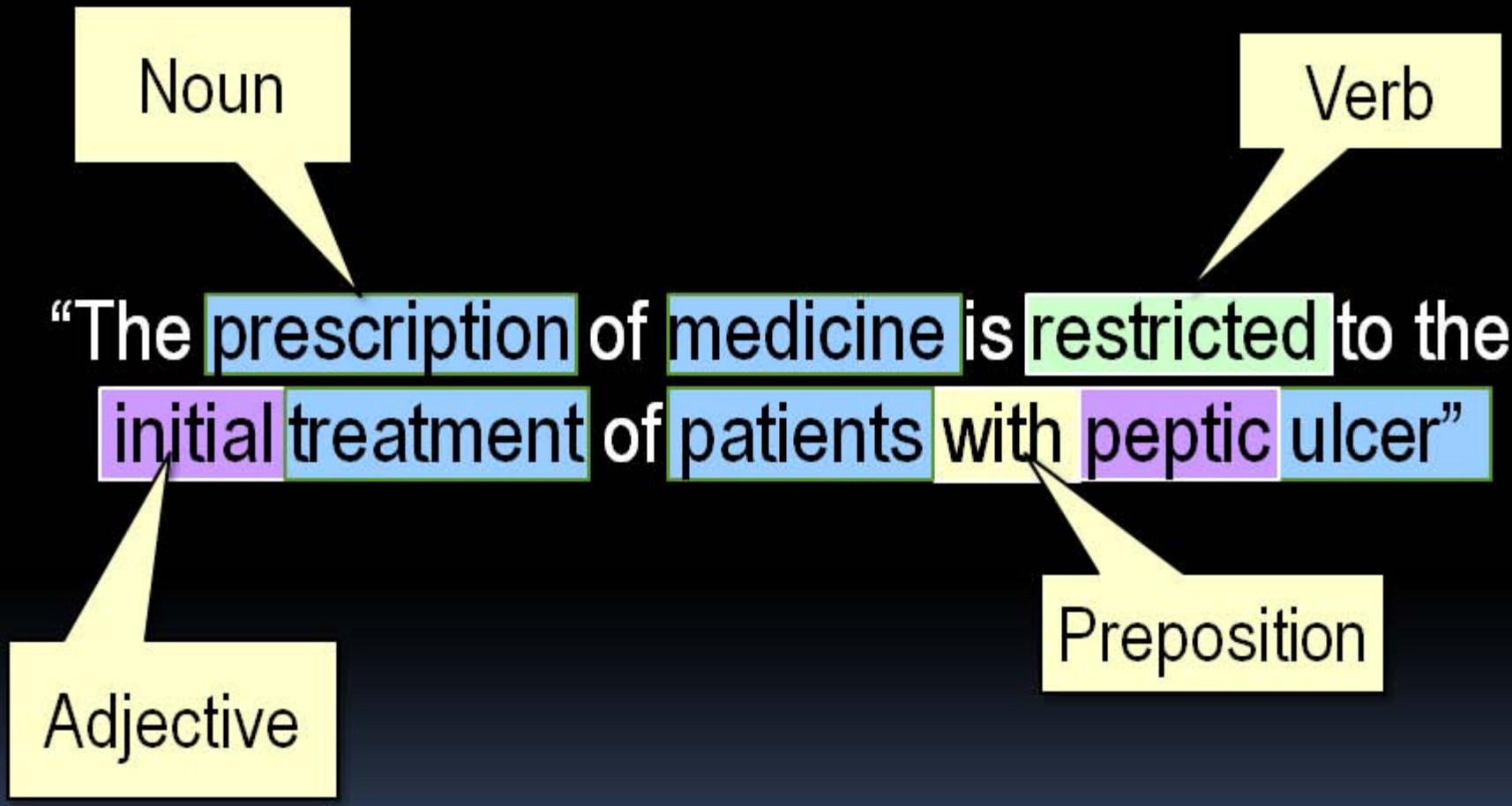
Peptic ulcer

Started with the simplest one I could find to analyse!

Semantics in action: overt meaning

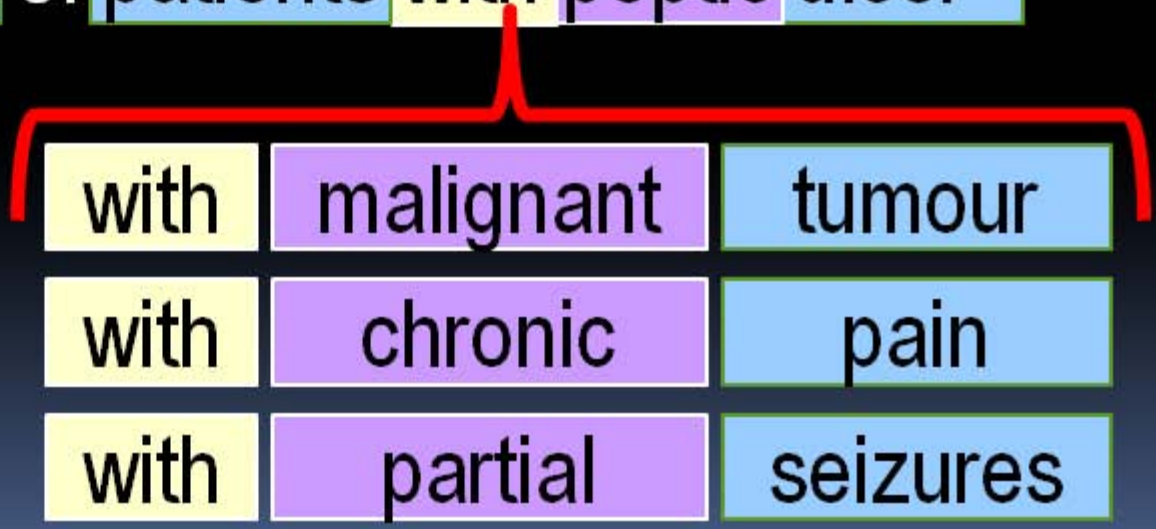
"The prescription of medicine is restricted to the initial treatment of patients with **peptic ulcer**"

Semantics in action



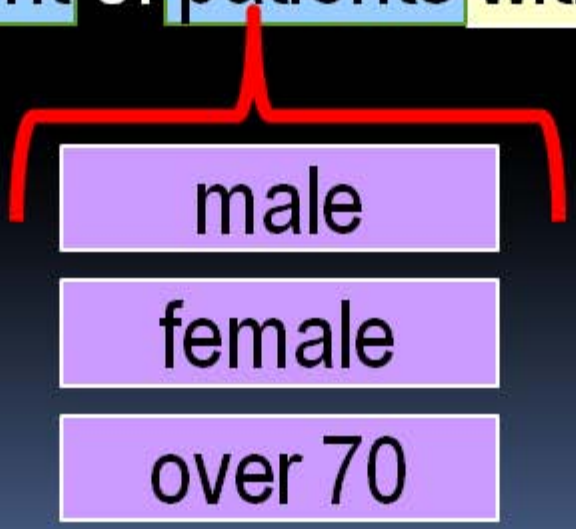
Identifying patterns: conditional clauses

"The prescription of medicine is restricted to the initial treatment of patients with peptic ulcer"



Identifying patterns: conditional clauses

"The prescription of medicine is restricted to the initial treatment of patients with peptic ulcer"

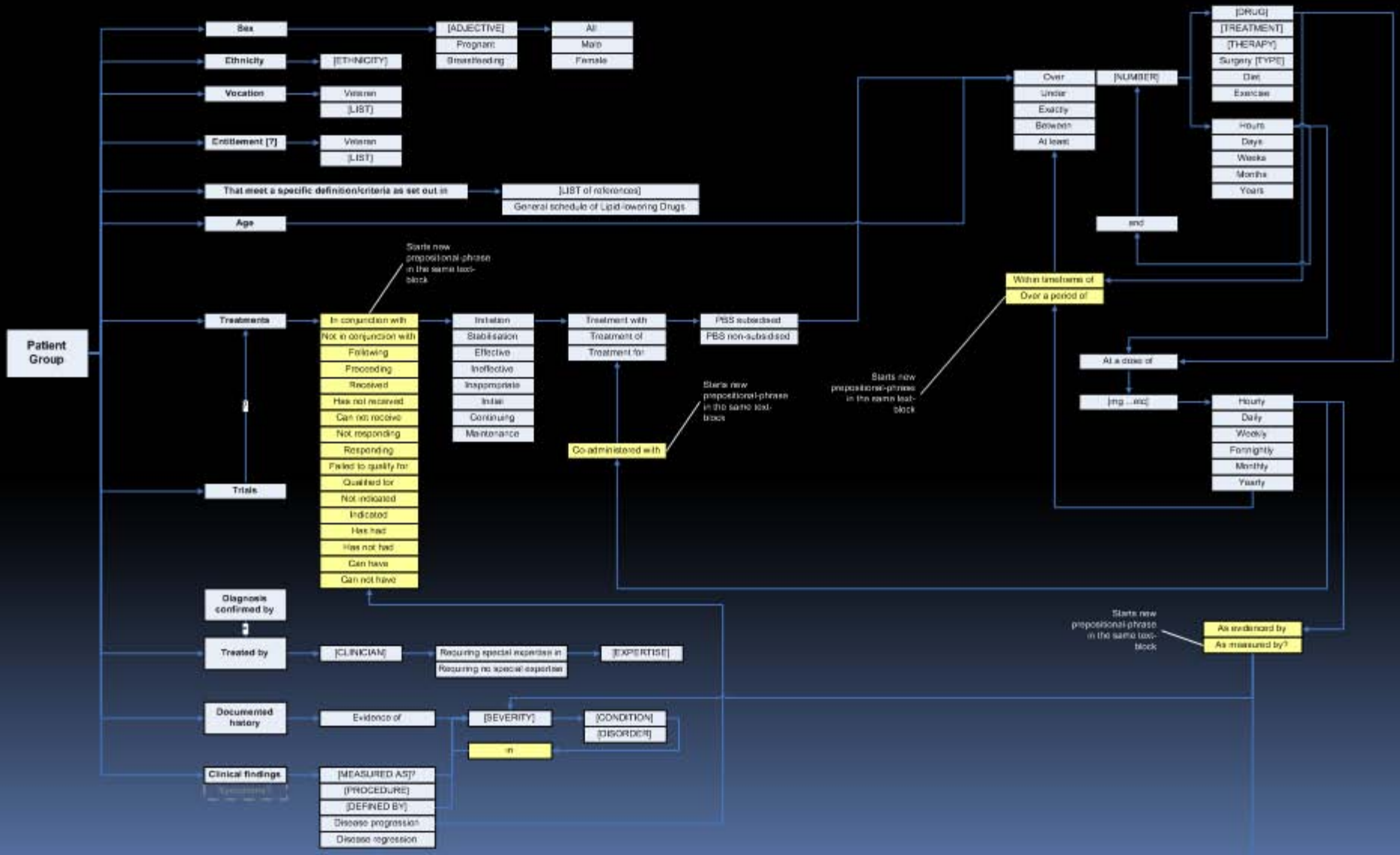


Emerging patterns

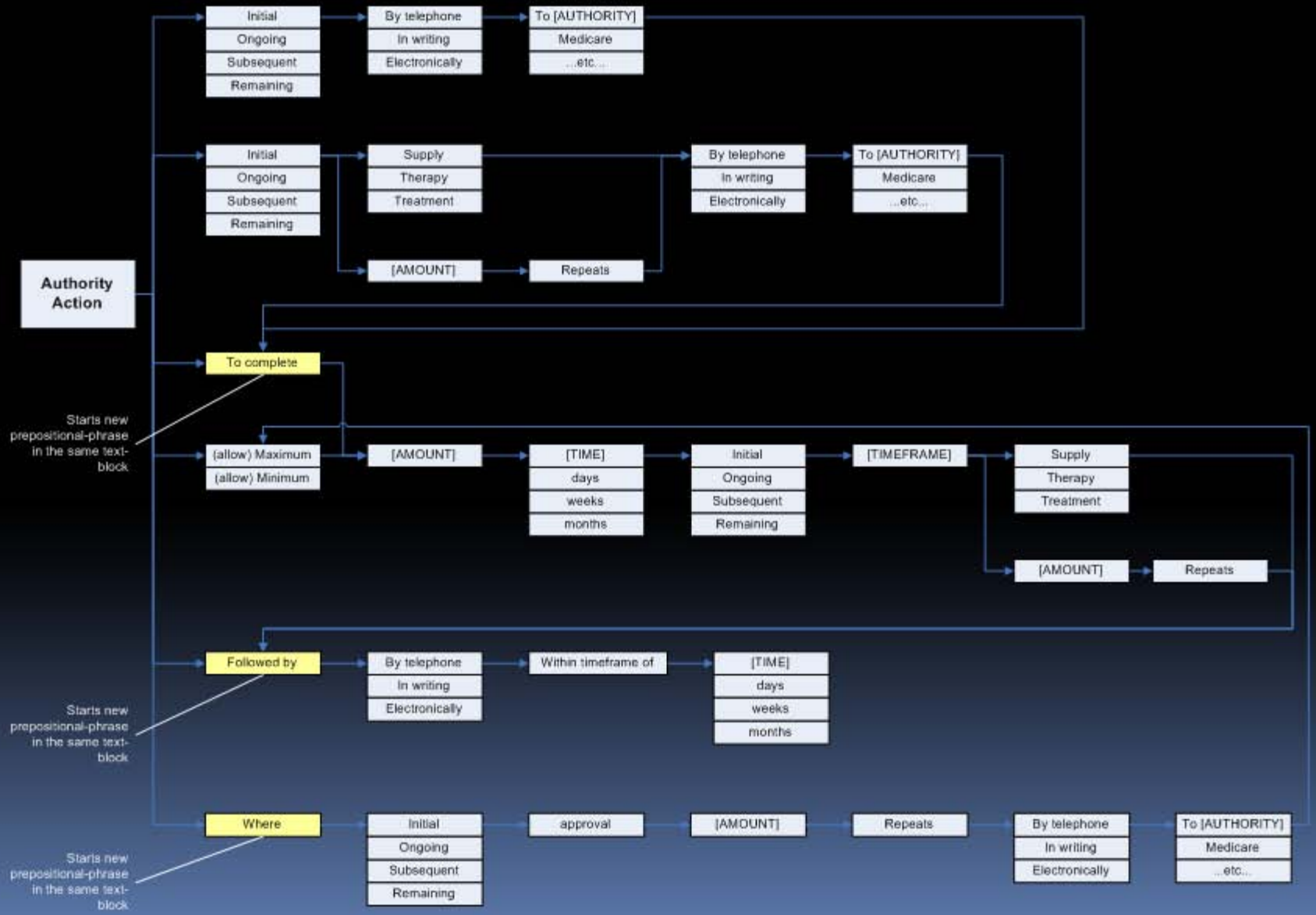
Core structure for all content:

- **Who treated** – patient information, clinical group, symptoms displayed
- **What condition** – disease, type, severity
- **Authority Action** – how medicine is authorised

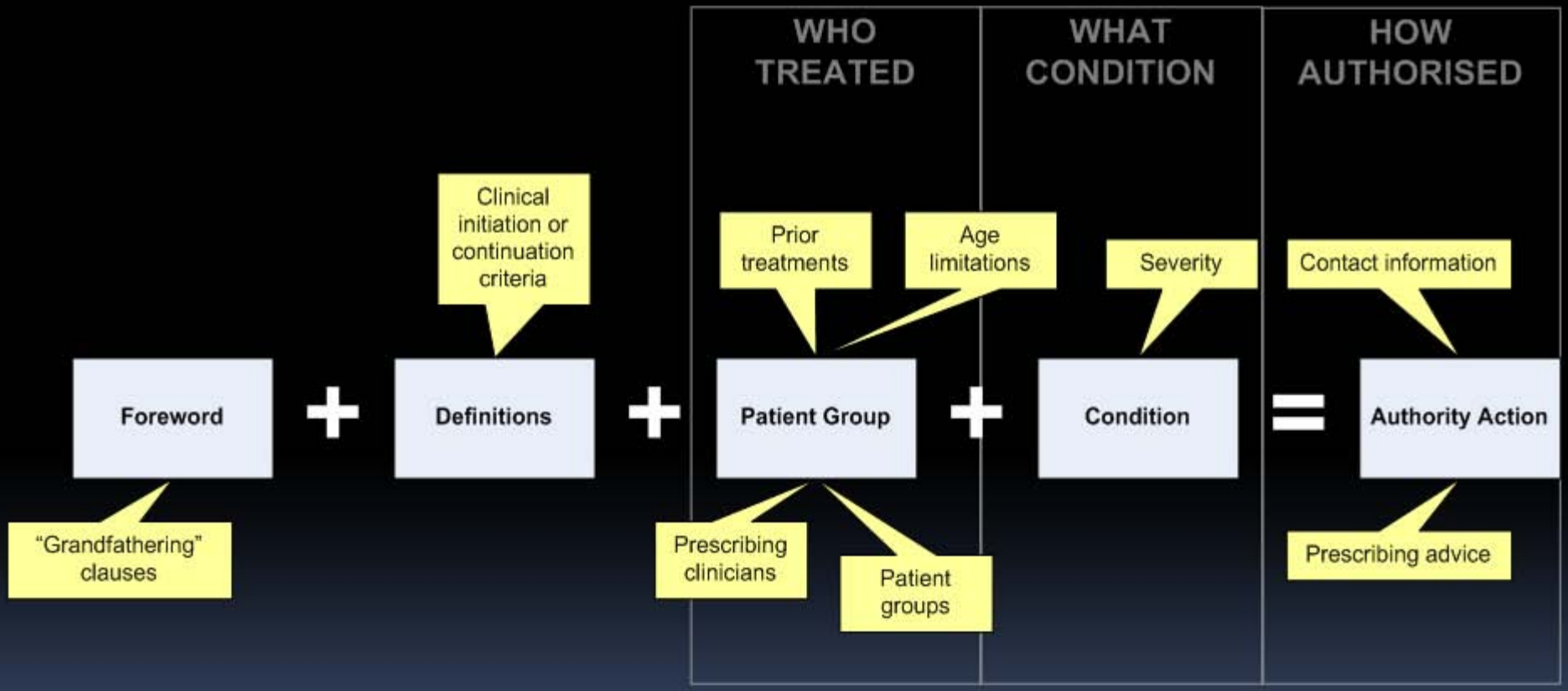
“Who Treated” semantic model



“Authority Action” semantic model



From Semantic Patterns to Pragmatics



<< Back to Restricted benefit

Search for existing restrictions to use here

+ Foreword and criteria for prescription

+ Definitions used in this restriction

+ Patient group - symptoms shown, treating specialist, treatments received, trials and other eligibility criteria

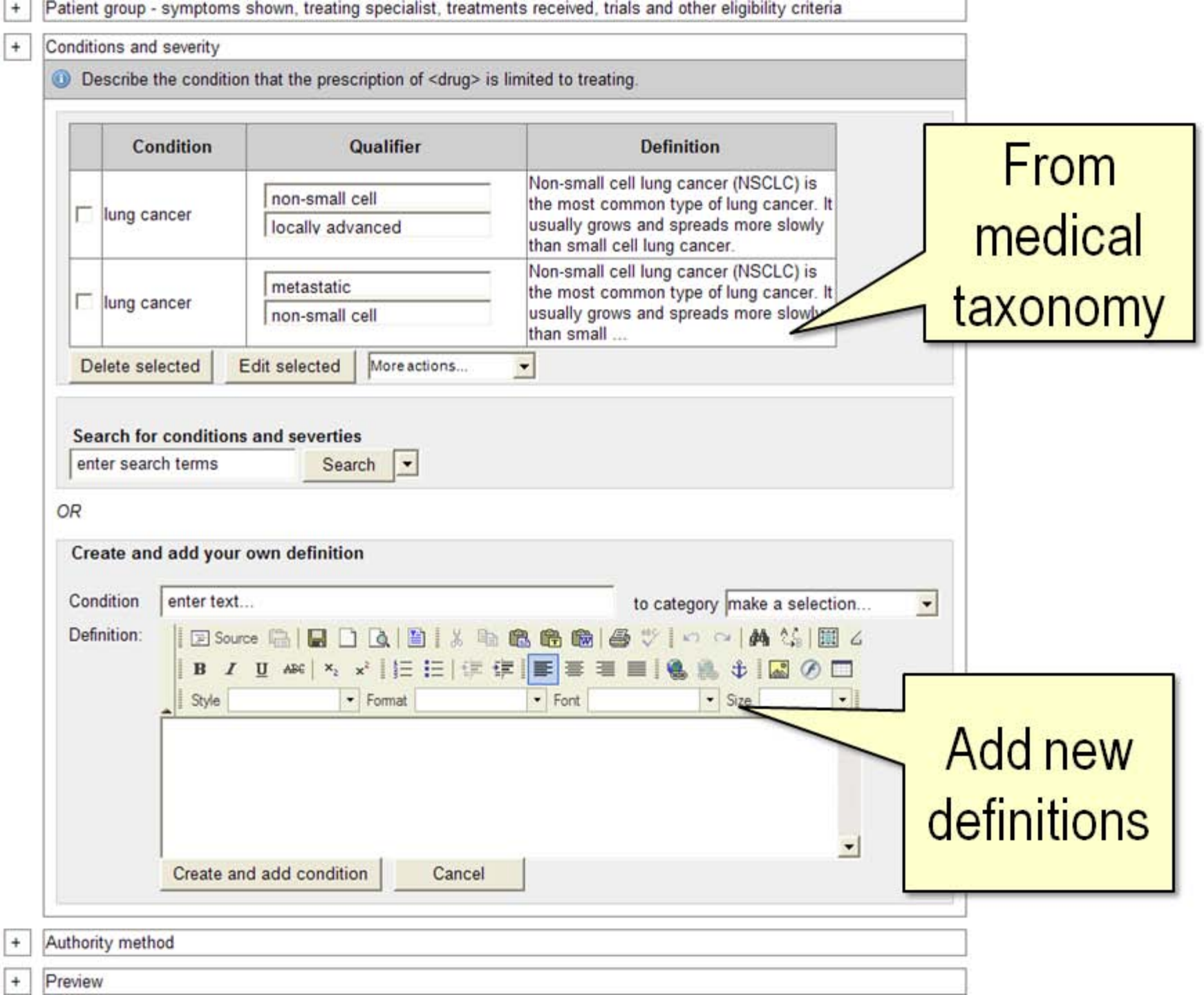
+ Conditions and severity

+ Authority method

+ Preview

Publish this restriction | Save as Draft

UI reinforces process and information categories


+ Patient group - symptoms shown, treating specialist, treatments received, trials and other eligibility criteria
+ Conditions and severity
Describe the condition that the prescription of <drug> is limited to treating.
Condition
Qualifier
Definition
lung cancer
non-small cell
locally advanced
Non-small cell lung cancer (NSCLC) is the most common type of lung cancer. It usually grows and spreads more slowly than small cell lung cancer.
lung cancer
metastatic
non-small cell
Non-small cell lung cancer (NSCLC) is the most common type of lung cancer. It usually grows and spreads more slowly than small ...
Delete selected
Edit selected
More actions...
From medical taxonomy
Search for conditions and severties
enter search terms
Search
OR
Create and add your own definition
Condition
enter text...
to category
make a selection...
Definition:
Source
Style
Format
Font
Size
Add new definitions
Create and add condition
Cancel
+ Authority method
+ Preview

+ Authority method

+ Preview

This is a depiction of how the authority and restrictions text will appear when viewed through pbs.gov.au

Foreword

- Patients commenced on genetifib therapy between 1 july 2004 and 1 dec 2004 demonstrate that they would have met he criteria for initial pbs-subsidised treatment at the time treatment with genetifab was commenced

- Medical practitioners who wish to apply for authority to prescribe genetifib for patients who commenced on genetifib therapy prior to 1 july 2004 should contact medicare australia

Patient Group

- Measurement of WHO performance with status of two or less; AND (inclusive)
- Disease progression following treatment with at least 1 chemotherapy agent; AND (inclusive)
- Evidence of activating mutation(s) of the [epidermal growth factor receptor gene] in tumor material
- Demonstrated analysis/tested DNA sequence of the [epidermal growth factor receptor gene] (e.g. w pathology test done)

Condition

- Locally advanced non-small cell lung cancer; OR (inclusive)
- Metastatic non-small cell lung cancer

Authority Action

- Complete authority prescription form
- Complete a Gefitinib (iressa) pbs authority application for use in the treatment of locally advanced or metastatic non-small cell lung cancer - supporting information Form
- Obtain the authority form Medicare Australia website [url]
- Provide evidence of prior chemotherapy treatment, including the name of the drug and the day of the most recent treatment
- Details of the patient's WHO performance status
- A copy of the pathology report with evidence of the presence of activating mutation gene
- Queries concerning the arrangements to prescribe Gefitinib may be directed to Medicare Australia on 1800 242 697
- Written applications for authority to prescribe should be directed to medicare Australia - Hobart office

- No applications for increase maximum qty
- No applications for increased repeats

Final optimised content

Authority required

Print this restriction

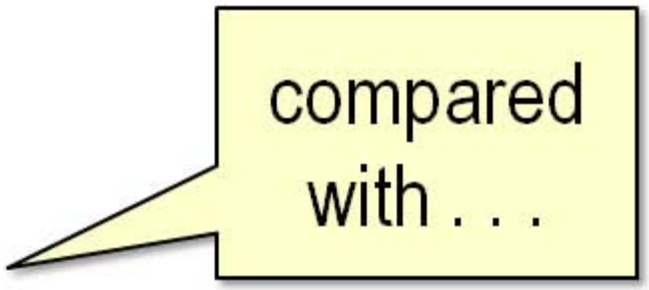
Note:

Any queries concerning the arrangements to prescribe etanercept may be directed to Medicare Australia on 1800 700 270 (hours of operation 8 a.m. to 5 p.m. EST Monday to Friday).

Written applications for authority to prescribe etanercept should be forwarded to:

Medicare Australia
Prior Written Approval of Specialised Drugs
Reply Paid 9826
GPO Box 9826
HOBART TAS 7001

Further prescribing information is on the Medicare Australia website at www.medicareaustralia.gov.au.



Note:

TREATMENT OF ADULT PATIENTS WITH ACTIVE ANKYLOSING SPONDYLITIS

The following information applies to the prescribing under the Pharmaceutical Benefits Scheme (PBS) of adalimumab, etanercept and infliximab for adult patients with active ankylosing spondylitis. Where the term 'tumour necrosis factor (TNF) alfa antagonist' appears in the following NOTES and restrictions, it refers to adalimumab, etanercept and infliximab only.

A patient is eligible for PBS-subsidised treatment with only 1 of the 3 TNF-alfa antagonists at any 1 time.

From 1 March 2007, under the PBS, all patients will be able to commence a treatment cycle where they may trial each PBS-subsidised TNF-alfa antagonist without having to experience a disease flare when swapping to the alternate agent. Under these interchangeability arrangements, within a single treatment cycle, a patient may continue to receive long-term treatment with a TNF-alfa antagonist while they continue to show a response to therapy.

A patient who received PBS-subsidised TNF-alfa antagonist treatment prior to 1 March 2007 is considered to be in their first cycle as of 1 March 2007.

Within the same treatment cycle, a patient cannot trial and fail, or cease to respond to, the same PBS-subsidised TNF-alfa antagonist more than once. A patient who, prior to 1 March 2007, was authorised to receive PBS-subsidised initial treatment for ankylosing spondylitis with the same agent twice, is exempt from this condition in respect of applications approved prior to 1 March 2007.

Once a patient has either failed or ceased to respond to treatment 3 times, they are deemed to have completed a treatment cycle and they must have, at a minimum, a 5-year break in PBS-subsidised TNF-alfa antagonist therapy before they are eligible to commence the next cycle. The 5-year break is measured from the date of the last approval for PBS-subsidised TNF-alfa antagonist treatment in the most recent cycle to the date of the first application for initial treatment with a TNF-alfa antagonist under the new treatment cycle.

A patient who has failed fewer than 3 TNF-alfa antagonists in a treatment cycle and who has a break in therapy of less than 5 years, may commence a further course of treatmen within the same treatment cycle.

A patient who has failed fewer than 3 TNF-alfa antagonists in a treatment cycle and who has a break in therapy of more than 5 years, may commence a new treatment cycle.

There is no limit to the number of treatment cycles a patient may undertake in their lifetime.

(1) How to prescribe PBS-subsidised TNF-alfa antagonist therapy after 1 March 2007.

(a) Initial treatment.
Applications for initial treatment should be made where:
(i) a patient has received no prior PBS-subsidised TNF-alfa antagonist treatment in this treatment cycle and wishes to commence such therapy (Initial 1); or
(ii) a patient has received prior PBS-subsidised (initial or continuing) TNF-alfa antagonist therapy and wishes to trial an alternate agent (Initial 2) [further details are under 'Swapping therapy' below]; or
(iii) a patient wishes to re-commence treatment with a specific TNF-alfa antagonist following a break in PBS-subsidised therapy with that agent (Initial 2).

Semantic analysis approach

Identified:

- The folk taxonomy (business language) used to inform writing of content
- The human processes for content production

Informed:

- The building of a taxonomical framework – i.e. SNOMED-CT as a starting point

Solution benefits

Improvements to process:

- Saved 1 full-time employee in time
- Informed the creation of tools to reinforce the process rules
- Enabled capture and **codification** of content during the creation process for re-use
- Reinforced consistency, reduced variation

Improvements to user-experience of content:

- **Reduction 50% word count**
- **Reduced cognitive complexity up to 75%**
- Improved consistency (reuse of core content components)

Benefits of using this approach

Help improve:

- Understanding of free-text content
- Objectivity in content analysis – puts science back into the process

Turn garbage into quality content:

- Content creation processes
- Content quality, flow, readability
- Prepare the way for the semantic web

Questions?

FIN

The path to codification of medical prescription restrictions in the Australian Pharmaceutical Benefits Scheme (PBS)

LINGUISTIC SEMANTICS IN CONTENT ANALYSIS

Management & Technology

your vision. Delivered.

Matthew Hodgson

ACT Regional-lead, Web and Information Management
SMS Management & Technology, Australia

Blog: magia3e.wordpress.com

Twitter: magia3e

Slideshare: www.slideshare.net/magia3e

Email: mhodgson@smsmt.com

Mobile: 0404 006695