A Generic Approach to Safety

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• .. solutions unique to one individual are ... irrelevant
• .. system-wide, generalizable approach .. is cornerstone to success*
• One way to achieve this
  – thorough analysis of relevant risk literature
  – abstraction & generalisation - formalisation
  – widespread computerised use & flexible reuse

• anti-cancer agents are highly toxic

• errors in chemotherapy are potentially catastrophic

• number of UK cancer patients receiving chemotherapy is increasing exponentially*

Making Chemotherapy Safer

- 2 serious chemotherapy overdoses at Dana-Farber Cancer Institute, Boston in 1994/95 - one fatal
- Customised $1.7M computer system combines drug order entry (Brigham & Women’s) and pharmacy check (Dana-Farber)

Complexity of Chemotherapy

- may involve sequences of action for long periods
- treatment reminders are important

| Bleomycin | ▼ ▼ ▼ |
| Vincristine | ▼ ▼ ▼ |
| Cisplatin | ▼▼ ▼▼ |
| Etoposide | ▼▼▼▼ |
| Ifosfamide | ▼▼▼▼ |
| Cisplatin | ▼▼▼▼ |
| Bleomycin | ▼▼▼▼ |

[Mead & Kaye, MRC]
Data Collection

- data interpretation is essential
- data collection can be sporadic

[B003, MRC]
Chemotherapy Hazards

- Drug dose is hazardous
- Use of multiple drugs can be hazardous
- Rate of administration can be hazardous
- Single cumulative lifetime
- Order interaction efficacy
- Drug concentration needs to be right
- Solution plasma affects toxicity
- Route affects efficacy needs to vary
- Drugs and equipment can interact
**Abstraction of risk management**

### Examples from Protocols

"Nephrotoxic antibiotics such as gentamycin should be avoided during & immediately after giving cisplatin"

### Safety Principles

- Avoid exacerbating hazards that are anticipated

## More Abstract Safety Principles

<table>
<thead>
<tr>
<th>Rule</th>
<th>Description</th>
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<tbody>
<tr>
<td>W1</td>
<td>Warn of hazards from inadequate execution of essential actions</td>
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<tr>
<td>W2</td>
<td>Monitor responses which herald hazardous situations</td>
</tr>
<tr>
<td>W3</td>
<td>Act quickly to ameliorate a detected hazard</td>
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<tr>
<td>W4</td>
<td>Prevent or ameliorate risks before executing hazardous actions</td>
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<tr>
<td>A1</td>
<td>Avoid exacerbating hazards that are anticipated</td>
</tr>
<tr>
<td>A2</td>
<td>Avoid diminishing the benefits of essential actions</td>
</tr>
<tr>
<td>R1</td>
<td>Ensure overall plans are efficacious in pursuing stated objectives</td>
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<tr>
<td>R2</td>
<td>Order (essential) actions temporally for best effect &amp; least harm</td>
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<tr>
<td>C</td>
<td>Critique proposal of some actions even if they appear well motivated</td>
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Reuse of generic safety principles

- **Risk management** during chemotherapy - generate warnings about proposed actions **outside protocol**

- **Design** new (chemotherapy) trials to generate safety clauses for protocol documents (Design-A-Trial)

- Handle **missing drug information** and still give useful advice

- **Generation of virtual hazards and patient scenarios** for simulation and **training** (US VA $47.6M)