Toward medicines reuse: a review of the different classes and dosage forms of wasted medicines reported in the UK and internationally

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Toward medicines reuse

Medicine Waste

- Waste: Any substance or object the holder discards, intends to discard or is required to discard" is waste[1].

- According to the World Health Organisation (WHO) pharmaceutical or medicinal waste includes “expired, unused, spilt, and contaminated pharmaceutical products, drugs, vaccines and sera” [2].

1. Hazell B and Robson R. (2015). *Pharmaceutical waste reduction in the NHS.* Available: https://www.england.nhs.uk/wp-content/uploads/2015/06/pharmaceutical-waste-reduction.pdf. Last accessed 01/06/2016.

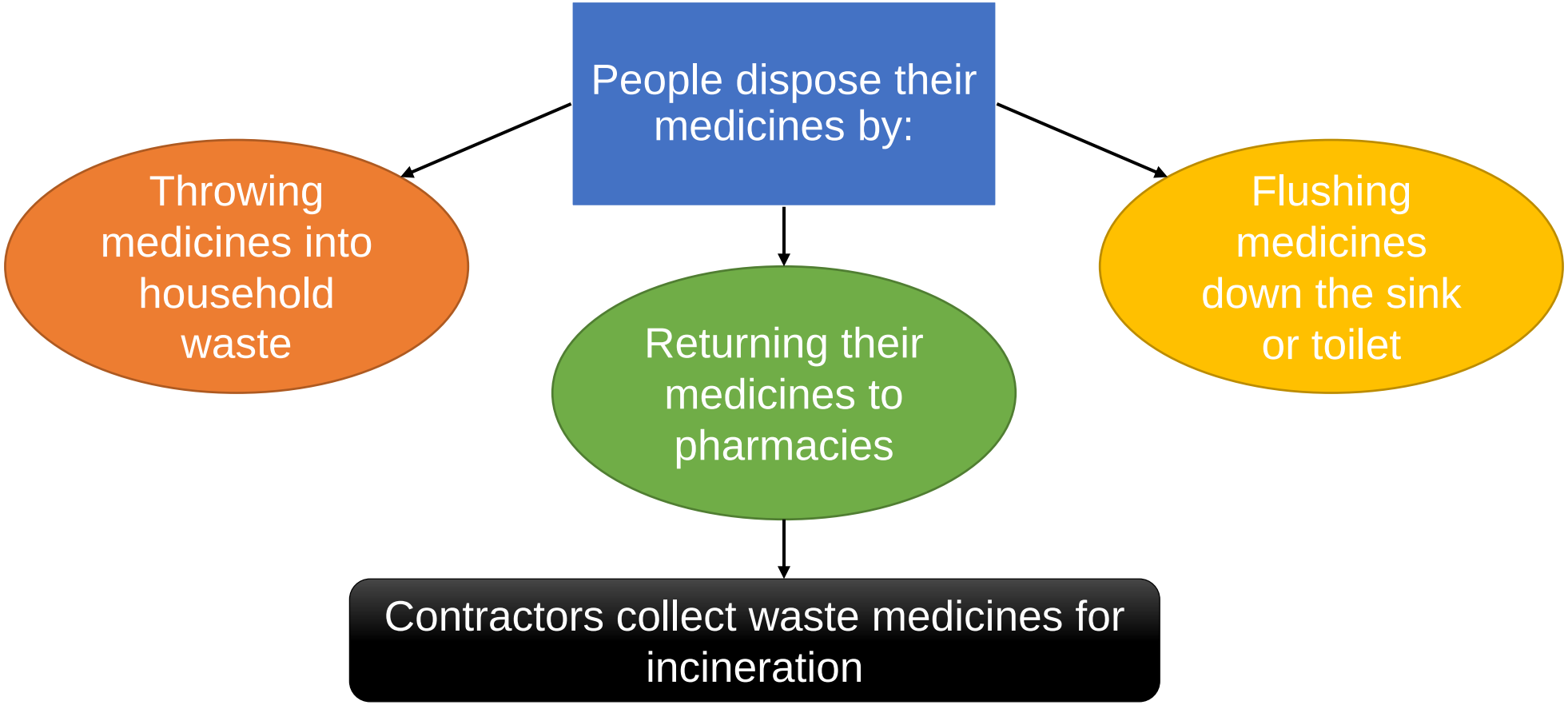
2. World Health Organization. Definition and characterization of health-care waste. Available: http://www.who.int/water_sanitation_health/medicalwaste/002to019.pdf. Last accessed 01/06/2016.

Causes of medicine waste[3]

Preventable	Non-preventable
Stockpiling of medicines at home	Patient death
Medicines past their expiry date	Medication no longer required because changed by prescriber (prescription changes)
Error of prescription, order or supply (e.g. excess supply of medicine, repeat prescription)	Adverse effect from drugs
Patient non-adherence	Medicines stopped by patients due resolution of symptoms

3. Jesson J, Pocock R, Wilson K. (2005). Reducing medicines waste in the community. *Primary Health Care Research and Development*. 6, 117–124.

Disposal practices of wasted medicines[5]



5. Vellinga A, Cormican S, Driscoll J, Furey M, O'Sullivan M, Cormican M. (2014). Public practice regarding disposal of unused medicines in Ireland. Science of the Total Environment. 478 (0), 98–102.

Medicines waste impact

Economic impact	Environmental impact
- In the UK £300 million is lost each year on medicine waste (2010)[6]. - There was an increase of prescription volume by 11% between 2010-2014[7]. - The NHS is facing financial challenges, which is estimated in the Five Year Forward View (2020/21) to be around £30bn	- There is increasing evidence of the presence of pharmaceuticals in the environment (including the water system)[8] - Disposal down the sink/toilet (e.g. beta-blockers, hormones and antibiotics) has an environmental impact as studies have documented the possible emergence of antibiotic resistance in waste water[9].

6. Trueman P, Taylor DG, Lowson K, Bligh A, Meszaros A, Wright D, Glanville J, Newbould J, Bury M, Barber N, Jani YH. (2010). Evaluation of the scale, causes and costs of waste medicines. Report of DH funded national project. UCL Discovery. Report (ISBN-13:978 090 293 620 1), 1-106.

7. NHS. (2014). *Five year forward view.* Available: https://www.england.nhs.uk/wp-content/uploads/2014/10/5yfv-web.pdf. Last accessed 01/04/2016.

8. Bound JP, Kitsou K, Voulvoulis N. (2006). Household disposal of pharmaceuticals and perception of risk to the environment. *Environmental Toxicology and Pharmacology*. 21 (3), 301–307.

9. Schwartz T, Kohnen W, Jansen B, Obst U. (2003). Detection of antibiotic-resistant bacteria and their resistance genes in wastewater, surface water, and drinking water biofilms. *FEMS Microbiology Ecology*. 43 (3), 325-335.

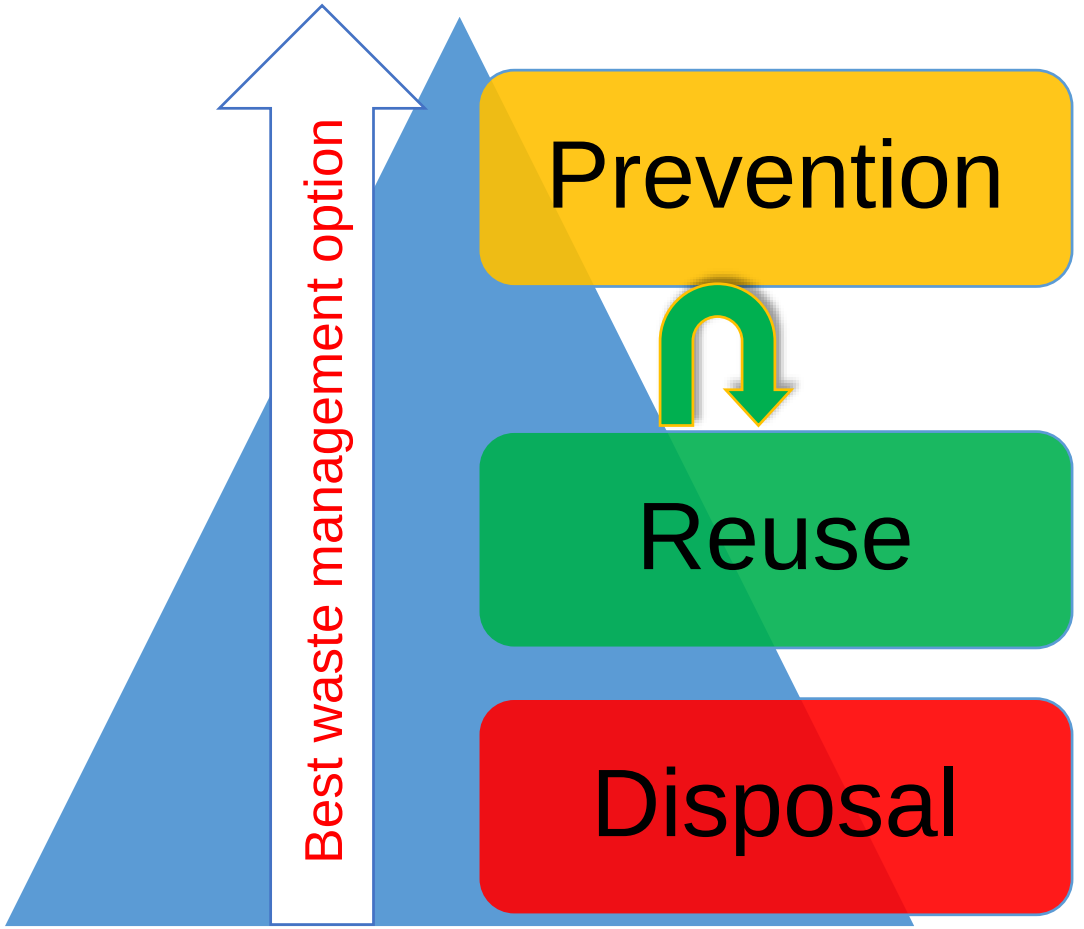
Ways to reduce medicine waste

- Most approaches attempt to prevent waste, as prevention is considered as the best waste management option in terms of the environment according to the Waste Hierarchy.

- At the bottom of the Waste Hierarchy is disposal, which is the current practice

- Alternative options within the Waste Hierarchy include reuse and recycle.

(An inhaler recycling scheme does exist, but the inhalers are not reused once returned back to pharmacies)



Interventions to reduce medicine waste

1. Limiting the prescription length to 28 days
2. Conducting medicines use reviews (MURs)
3. Improving patient education through medicines waste campaigns

However, a systematic review in 2014 showed a distinct lack of evidence about the effectiveness of the above interventions in preventing medicines waste[10].

10. West LM, Diack L, Cordina M, Stewart D. (2014). A systematic review of the literature on ‘medication wastage’: an exploration of causative factors and effect of interventions. *International Journal of Clinical Pharmacy.* 36, 873–881.

Review of literature

- **Aim**

To examine the published literature on medicines waste to report the most common therapeutic classes of wasted medicines and their dosage forms

Methods

- Electronic search of databases including PubMed, Cochrane library, Google scholar, grey literature (Open Grey and British Library only), NAO, NICE, IJPP were searched over a one-month period in May 2015 using Boolean combinations of a list of keywords.

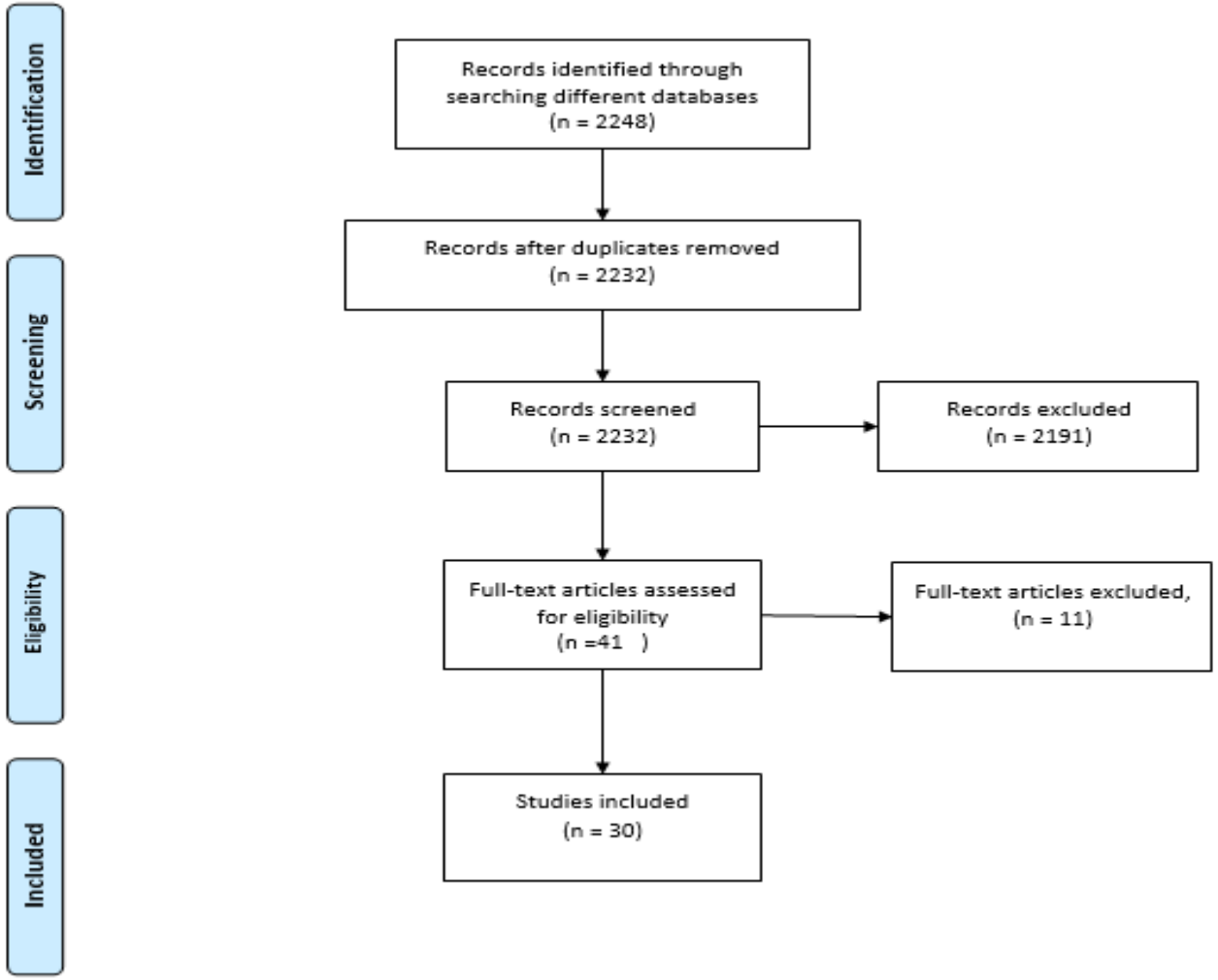
- Total of 2248 studies were generated. Study selection was carried out initially by screening all the study titles and abstracts, and then by screening full papers using inclusion and exclusion criteria.

NAO: National Audit Office
NICE: National Institute for health and Care Excellence,
IJPP: International Journal of Pharmacy Practice

Methods

Included Studies	Excluded studies
English language that described and reported the types of unused, leftover, and wasted medicines were included.	Studies describing waste as medical waste, medical waste devices, clinical tissue waste were excluded.

Results



Both **prescribed** and over the counter medicines (**OTC**) were included in the analysis of the reported unused wasted medicines in the majority of the studies

Three studies included **medicine samples** in addition to both prescribed and OTC

Results

Demographics
Only **15** studies (50% of the retrieved studies) described the **demographics** of participants.
From the 15 Only **7** studies were able to find the connection between the mean number of the returned items per patient and their age. The **majority** of unused wasted medications were reported to be collected from participants age range **(60-80)** in **6** studies and age range **(20-40)** in **1** studies.
Only **6** studies described the **gender** of participants. There was an equal split in the studies regarding unused wasted medications being more reported by men or women.

Results

Dosage forms
18 studies out of the total 30 reported the **dosage forms** of the wasted medicines.
Results from **11** studies out of 18 which quantified these dosage forms, showed that **oral solid dosage forms** were the **most common** reported dosage form of unused wasted medicines with percentages ranging from **40.6% - 95.6%** of all unused wasted medicines. From oral dosage forms **tablets** were reported to be the commonest.

Results

- The wasted medicines were reported by their therapeutic classes **except** in three studies which reported the unused wasted medicines individually, by **generic** or **brand name**.

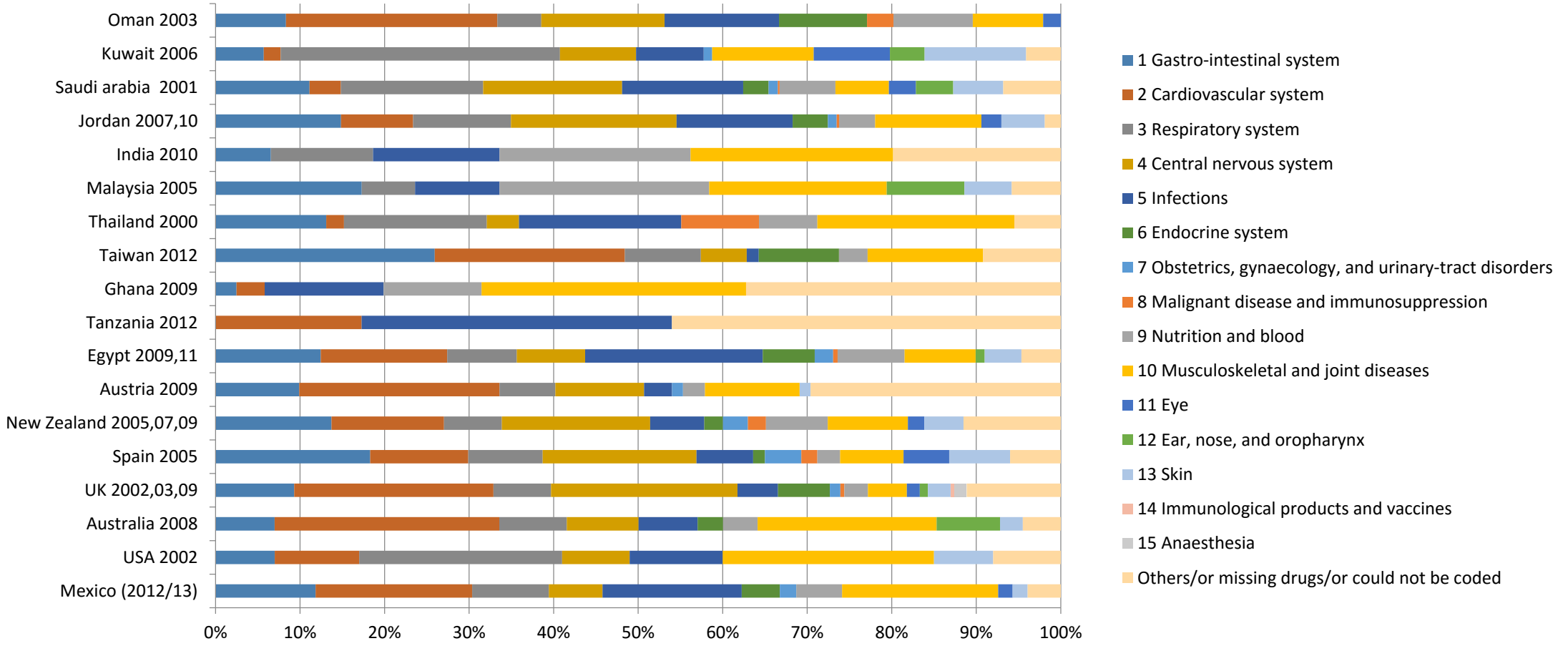
Therapeutic categorization of the wasted medicines
- **British National Formulary (BNF)** in **7** studies.
- **Anatomical Therapeutic Chemical coding (ATC)** of World Health Organisation in **5** studies.
- **Monthly Index of Medical Specialities online (MIMS)** in **1** study.
- **National coding** such as **Saudi National Formulary (SNF)** in **1** study.
- The remaining studies according to **disease and class of medicine such as diabetes/anti-diabetic**.

Results

The most common category of wasted medicines were:

- Cardiovascular system (CVS) drugs in 8 studies.
- Central nervous system (CNS) drugs in 4 studies
- Analgesics & Antipyretics in 3 studies
- Non-steroidal anti-inflammatory drugs (NSAIDs), respiratory system drugs, alimentary tract and metabolism, and antibiotics **each** in 2 studies
- Musculoskeletal system drugs in 1 study
- Analgesics and NSAIDs in 1 study

Results


Oman 2003
Kuwait 2006
Saudi arabia 2001
Jordan 2007,10
India 2010
Malaysia 2005
Thailand 2000
Taiwan 2012
Ghana 2009
Tanzania 2012
Egypt 2009,11
Austria 2009
New Zealand 2005,07,09
Spain 2005
UK 2002,03,09
Australia 2008
USA 2002
Mexico (2012/13)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
1 Gastro-intestinal system
2 Cardiovascular system
3 Respiratory system
4 Central nervous system
5 Infections
6 Endocrine system
7 Obstetrics, gynaecology, and urinary-tract disorders
8 Malignant disease and immunosuppression
9 Nutrition and blood
10 Musculoskeletal and joint diseases
11 Eye
12 Ear, nose, and oropharynx
13 Skin
14 Immunological products and vaccines
15 Anaesthesia
Others/or missing drugs/or could not be coded

Data from UK literature

Data from UK studies which categorised unused wasted medicines according to the British National Formulary (BNF) constantly showed (from all 4 studies) that:

Cardiovascular system (CVS) drugs are the most common reported therapeutic class of unused wasted medicine[6,11,12,13].

CV medicines are one of the most commonly prescribed (because of prevalence of CV diseases) and amended class of medicine (because of frequently-updated guidelines)[12].

6. Trueman P, Taylor DG, Lowson K, Bligh A, Meszaros A, Wright D, Glanville J, Newbould J, Bury M, Barber N, Jani YH. (2010). Evaluation of the scale, causes and costs of waste medicines. Report of DH funded national project. UCL Discovery. Report (ISBN-13:978 090 293 620 1), 1-106.
11. Bradley M. (2009). Waste Medication Community Pharmacy Audit Report 2008/09. NHS Cumbria (Audit report), 1-13.
12. Langley C, Marriott J, Mackridge A, Daniszewski R. (2005). An analysis of returned medicines in primary care. *Pharmacy World and Science*. 27 (4), 296-299.
13. Mackridge AJ, Marriott JF. (2007). Returned medicines: waste or a wasted opportunity? *Journal of Public Health (Oxford University)*. 29 (3), 258–262.

Conclusion

- Although there was variability between the levels of waste reported in different countries, the findings that related to the UK were relatively consistent.

- In the UK, **cardiovascular medicines** were the category of medicine most associated with waste.

- This study provides a basis for a feasibility study investigating tablets prescribed for cardiovascular conditions as candidates for medicines reuse.

Current study and Future plan

Research Question & Aim

What are the public attitudes toward reuse of medicines returned to the pharmacies?

Methods

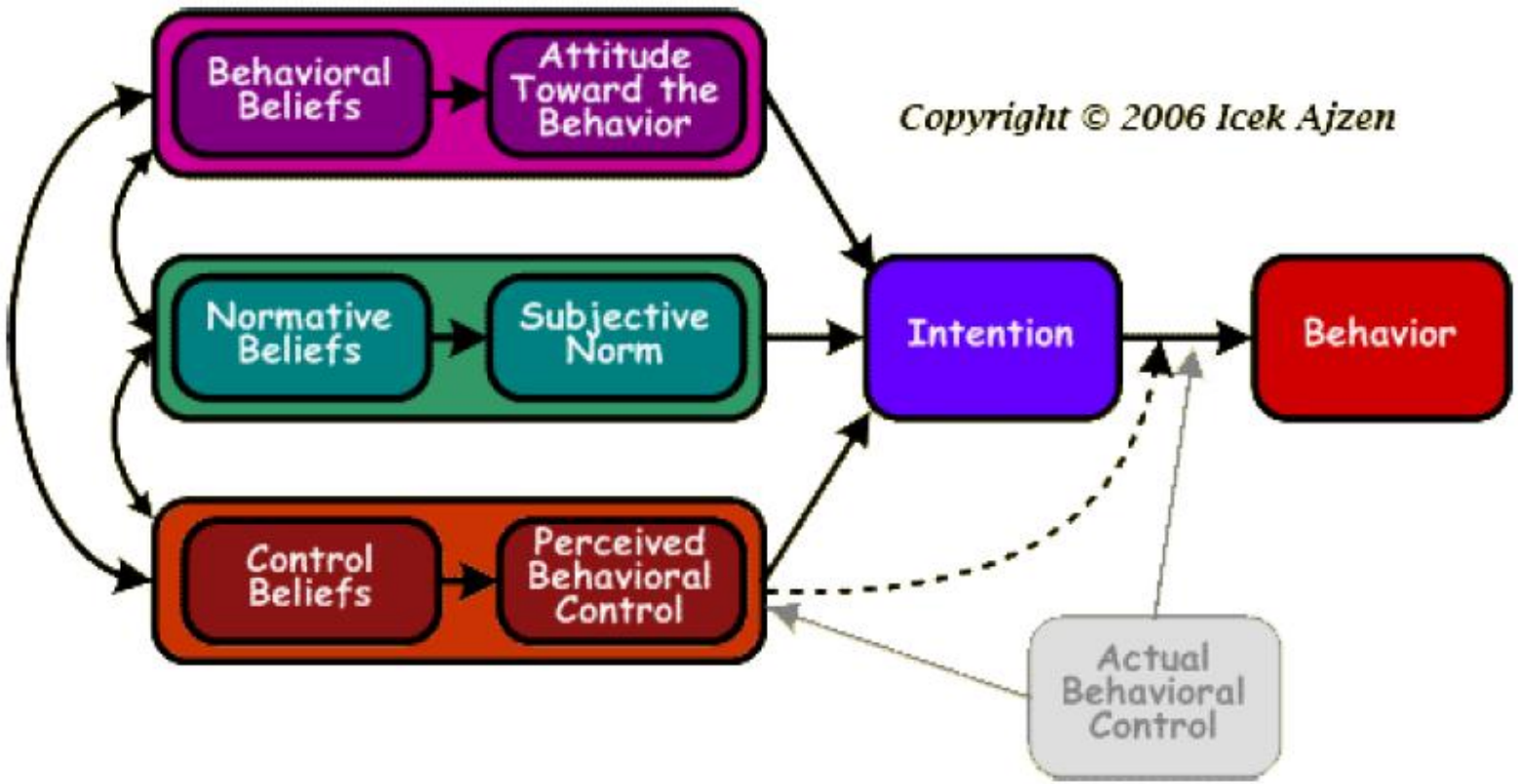
Mixed methods study using qualitative interviews (Phase I) to identify themes and domains for development and validation of a questionnaire to measure public attitude towards medicines reuse (Phase II).

Phase I

Interview schedule was designed based on the Theory of Planned Behaviour (TPB). Thematic analysis was used to analyse the interviews.
Themes obtained will be classified according to TPB to design a robust questionnaire that will measure people's intentions towards reusing medicines (Phase II).

Thank You

TPB


Behavioral Beliefs
Attitude Toward the Behavior
Normative Beliefs
Subjective Norm
Control Beliefs
Perceived Behavioral Control
Intention
Behavior
Actual Behavioral Control
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