How to meet patients’ individual needs for drug information - a scoping review

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Purpose: The aim of this study was to 1) describe drug information desired by patients and 2) analyze how such information could be customized to be presented to patients according to their individual information needs.

Materials and methods: We performed a scoping literature search and identified relevant drug information topics by assessing and clustering 1) studies analyzing patients’ enquiries to drug information hotlines and services, and 2) qualitative studies evaluating patient drug information needs. For the two most frequently mentioned topics, we further analyzed which components (ie, information domains) the topics contained and examined patients’ and health care professionals’ (HCPs) views on these components.

Results: Of 27 identified drug information topics in the literature search, patients most frequently requested information on adverse drug reactions (ADRs) and drug–drug interactions (DDIs). Hypothetically, those topics are composed of seven distinct information domains each (eg, ADR and DDI classification by frequency, severity, or onset; information on management strategies, monitoring, and prevention strategies). Patients’ and HCPs’ appraisal concerning the information content of these domains varies greatly and is even lacking sometimes.

Conclusion: Patients particularly request information on ADRs and DDIs. Approaches to customize such information are sparse. The identified information domains of each topic could be used to structure corresponding drug information and to thus facilitate customization to individual information needs.

Keywords: medication information, information needs, customization, adverse drug reactions, side effects, drug–drug interactions

Introduction

Patient-centered care (PCC) emphasizes patient participation in decision making in order to foster the alliance between health care professionals (HCPs) and patients to share power and responsibility.1 Patients appreciate this approach and several studies indicated positive effects on health outcomes as PCC improves communication, patient involvement, patient-HCP relationship, and treatment adherence.2,3 A prerequisite for shared responsibility is the empowerment of patients based on the provision of understandable information that matches the individual patients’ information needs.4 With regard to drug treatment, patients who have received clear and reasonable treatment recommendations and advice are more likely to adhere to their treatment.4

This may be explained by the fact that basic information on drug treatment is mandatory to fulfill the “Five Rights”,5 ie, taking the right drug by the right patient in the right dose at the right time following the right technique to prevent unintentional non-adherence. However, in addition to such evident information needs, patients evaluate the benefits of prescribed drugs (necessity belief) and weigh it against their concerns.
(concern belief). While a profound “necessity belief” appears to predict adherence, a deeper “concern belief” may lead to non-adherence, which, in this context, is often called intentional non-adherence. Especially in chronic conditions (e.g., hypertension) non-adherence is associated with increased overall health care costs, morbidity, and mortality. To efficiently address or prevent a patient’s concern and thereby mitigate at least one reason of non-adherence, the provision of subjectively desired information about treatment and drugs seems a promising approach.

Which information is relevant to a patient depends on several factors including age, socio-economic status, and comorbidities. Depending on the patient’s preferences, both receiving “too much” of unsolicited information and receiving not enough information may have negative effects on patient empowerment, thus amplifying patient concerns. Therefore, it is crucial to customize information toward the individual needs of each patient. However, systematic data on which drug information patients want and how it should be edited are sparse.

Unmatched drug information needs are reflected in the growing use of online health information services. Taking Germany as an example, approximately half of its population uses the Internet to get health-related information, and especially services such as medication checks and drug–drug interaction (DDI) checks are frequently accessed.

To satisfy such unmatched information needs, we aimed to 1) describe drug information desired by patients and 2) analyze how such information could be customized to be presented to patients according to their individual information needs.

Materials and methods

We followed the presumption that drug information can be divided into 1) basic drug information and 2) subjectively desired drug information. Basic drug information refers to drug information that is mandatory for every patient in order to be able to conduct the drug treatment following the concept of the “Five Rights”. Subjectively desired drug information, on the other hand, satisfies information customized to individual needs and considers concerns or beliefs with regard to the treatment.

While basic drug information often is straightforward, unambiguous, and therefore easily conveyed in medication schedules, no overview exists regarding scope and characteristics of subjective drug information needs.

To describe drug information desired by patients, an exploratory number of articles relating to patient information needs with one of the key words “patient information,” “drug information,” “medication information,” and “medicines information” in title/abstract, English or German language, and with a publishing date between January 2000 and February 2017 were searched. The search purposefully identified potentially relevant studies that were subsequently clustered into two groups: the first group 1) comprised studies analyzing patients’ enquiries to drug information hotlines and services, while the second group 2) comprised qualitative studies evaluating patient drug information needs. From the identified studies in the first group, the total number of drug-related enquiries, the enquiry topics, the provider of the information service, and the timeframe of data enquiry were extracted. The enquiry topics were classified according to those previously defined in the respective study by the authors. From the second group, the study design, population, study site, and raised drug information needs were extracted.

Subsequently, we clustered the different enquiry topics (extracted from studies analyzing patients’ enquiries) and the raised drug information needs (extracted from qualitative studies) as defined in the studies into drug information domains, thereby merging enquiry topics according to their content into broader categories that were consistently defined and applied in both study groups (Table S1 and S2). This allocation was conducted by two clinical pharmacists until concordance was reached (MK and VSW). When this was not possible, a third clinical pharmacist was consulted for clarification (HS). The drug information topics were then counted throughout the different studies and arranged according to frequency in order to identify the most often reported drug information topics and to define the two most frequently mentioned ones (Figure 1).

To analyze how such information could be customized in order to be presented to patients, we focused on the two most frequently mentioned information topics and assessed in more detail which components (i.e., information domains) the topics contained. Subsequently, we evaluated patients’ and HCPs’ expectations toward the content and presentation of these information domains as described in the literature.

Results

Drug information desired by patients

We identified 12 studies analyzing patient enquiries to drug information hotlines and services. Most studies analyzed enquiries to drug information hotlines (number of studies [n]=10), while some analyzed enquiries to online information services (n=2). Studies originated from several countries,
namely Australia (n=5), the Netherlands (n=2), Germany (n=2), Finland (n=1), United States of America (n=1), and the United Kingdom (n=1). Most of the studies were performed with data originating from the Australian drug information hotline “National Prescribing Service MedicineWise” (NPS MedicineWise) and comprised a plethora of drug-related patient enquiries, most of which were safety-related, such as information on adverse drug reactions (ADRs) and DDIs (Table 1). In the second group, 15 qualitative studies that addressed drug information needs with different methods and in different settings and populations were identified.24–38 Studies were conducted in different countries, namely the Netherlands (n=3), United States of America (n=2), the United Kingdom (n=2), Norway (n=1), China (n=1), Armenia (n=1), Germany (n=1), Singapore (n=1), Australia (n=1), Canada (n=1), and Belgium (n=1). In addition, the studies were conducted in various settings, which were community pharmacies (n=8), residents not recruited in direct health care setting (n=3), hospitals (n=2), practices (n=1), and senior centers (n=1). Various study designs were used in the studies, namely semi-structured interviews (n=7), questionnaires (n=5), focus group discussions (n=2), and presenting commonly asked questions to assess interest in these (n=1). Also, in these studies the majority of the drug information topics raised by the patients were safety-related, most frequently seeking information on ADRs and DDIs (Table 2). Yet, there seemed to be some differences based on study context and setting. Patients in senior centers and hospitals were not interested in information topics like “drugs and driving” and “drug use and alcohol”.27,34,38

Some information topics like “cost, refund, and prescription requirement” and “stability, storage, and disposal” were predominantly mentioned in ambulatory settings (ie, pharmacies and residents).28,29,36 Such topics were also more often mentioned in studies analyzing patient enquiries to drug information hotlines and services. The majority of raised drug information topics were largely identical in the examined studies regardless of whether semi-structured interviews or questionnaires were used. Focus groups that were held between patients and researchers,36 and patients, physicians,
<table>
<thead>
<tr>
<th>Study</th>
<th>Study characteristics</th>
<th>Enquiry topics$^a$ as classified in the respective studies and sorted by descending frequency</th>
</tr>
</thead>
</table>
| Crunkhorn et al$^{12}$ | Analysis of (i) enquiries made by or concerning people aged 0–17 years and (ii) enquiries made by or concerning people ≥18 years to a MCC. | (i) Made by or concerning people aged 0–17 years: 1. Lactation  2. Treatment/prophylaxis  3. Dose  4. Adverse drug reaction  5. Interaction  6. Vaccination  
| Kloosterboer et al$^{15}$ | Analysis of (i) cough and cold related and (ii) other enquiries to a MCC.              | (i) Cough and cold related:  1. Interaction  2. Other types of concern  3. Pregnancy and lactation  4. Treatment/prophylaxis  5. Adverse drug reaction  
| Source                      | Analysis of enquiries to a MCC available exclusively for patients | 1. Adverse drug reaction  
2. General information about drug  
3. Information about therapy  
4. Drug interactions  
5. Indication/contraindication of drug  
6. Cost/refund/prescription requirement/drug-related legislation  
7. Self-medication/dietary supplement/alternative medicine/medical devices  
8. Application/dosage of drug  
9. Change of medication  
10. Mechanism of drug action/pharmacokinetics  
11. Pregnancy/breastfeeding |
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<tbody>
<tr>
<td>Huber et al17</td>
<td>Provider: Technical University Dresden, Germany</td>
<td>Time: August 2001–January 2007</td>
</tr>
</tbody>
</table>
|                           | Analysis of enquiries to a MCC available exclusively for patients | 1. Costs and reimbursements  
2. Drug–drug interactions  
3. Dosage  
4. Adverse effects  
5. Indication  
6. Efficacy  
7. Drug use and alcohol  
8. Effective substance  
9. Mechanism of action  
10. Taking medicine correctly  
11. Contraindication  
12. Storage  
13. Breaking up medication  
14. Safety of drugs during pregnancy  
15. Formulation  
16. Drugs and driving  
17. Dependency |
|                           | Provider: Helsinki University Pharmacy, Finland                  | Time: 1 week during August 2002                                   | Total number of enquiries: 780                                    |
|                           | Analysis of enquiries to a community pharmacy-operated MCC       | 1. ADR (adverse drug reaction)/drug interaction                    |
|                           | Provider: Helsinki University Pharmacy, Finland                  | 2. Information about drugs or therapies                           |
|                           | Total number of enquiries: 2,049                                 | 4. Indications/contraindications                                   |
|                           |                                                                   | 5. Dosage and administration                                       |
|                           |                                                                   | 6. Pharmacokinetics                                                |
|                           |                                                                   | 7. Refund and legalties                                            |
|                           |                                                                   | 8. Miscellaneous                                                   |
| Maywald et al19           | Analysis of enquiries to a MCC available exclusively for patients | 1. Indications, efficacy, mechanism of action                      |
|                           | Provider: Technical University Dresden, Germany                  | 2. Adverse effects                                                 |
|                           | Time: September 2001–September 2003                             | 3. Other (non-health-related)                                      |
|                           | Total number of enquiries: 2,049                                 | 4. Other health-related questions                                  |
|                           |                                                                   | 5. Drug identification                                             |
|                           |                                                                   | 6. Drug–drug or drug–food interactions                             |
| Assemi et al20            | Analysis of enquiries submitted to an online “Ask Your           | 1. Indications, efficacy, mechanism of action                      |
|                           | Pharmacist” drug information service                             | 2. Adverse effects                                                 |
|                           | Provider: University of California at San Francisco, USA          | 3. Other (non-health-related)                                      |
|                           | Time: 1999–2000                                                  | 4. Other health-related questions                                  |
|                           | Total number of enquiries: 1,087                                 | 5. Drug identification                                             |
|                           |                                                                   | 6. Drug–drug or drug–food interactions                             |

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Table 1 (Continued)

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<th>Study</th>
<th>Study characteristics</th>
<th>Enquiry topics a as classified in the respective studies and sorted by descending frequency</th>
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<tbody>
<tr>
<td></td>
<td>9. Drug stability</td>
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<tr>
<td>Weersink et al 1</td>
<td>Analysis of enquiries related to (i) antipsychotic drugs and (ii) rest of enquiries to a MCC</td>
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<tr>
<td></td>
<td>Provider: NPS MedicineWise, Australia</td>
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<td></td>
<td>Time: September 2002–June 2010</td>
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<td></td>
<td>Total number of enquiries: (i) 6,295 (ii) 119,624</td>
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<td>Time: 6 months in 2008</td>
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<td></td>
<td>Total number of enquiries: 500</td>
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<td></td>
<td>Time: February 2000</td>
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<td></td>
<td>Total numbers of enquiries: (i) hotline: 305 (ii) website: 183</td>
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Notes: ‘Enquiry topics of studies, besides those by Pijper et al 11 are listed according to their frequency in each individual study. In some studies, one call could contain more than one enquiry topic. Names of enquiry topics were extracted verbatim from the respective studies. In total, there were 24 different themes according to which the patients’ questions were categorized.

Abbreviations: MCC, medicines call center; NPS MedicineWise, National Prescribing Service MedicineWise.
Table 2 Qualitative studies evaluating patient drug information needs

<table>
<thead>
<tr>
<th>Study</th>
<th>Study characteristics</th>
<th>Raised drug information needs*</th>
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<tbody>
<tr>
<td>Sage et al²⁴</td>
<td>Presenting parents of children with &quot;attention deficit/hyperactivity disorder&quot; a list of commonly asked questions to assess interest in these</td>
<td>Questions of highest interest by parents (analogously extracted):</td>
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<tr>
<td></td>
<td>Population: 70 parents, mostly female</td>
<td>• Long-term effects</td>
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<td></td>
<td>Study site: Private pediatric practices, United States</td>
<td>• Treatment</td>
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<td></td>
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<td>• Side effects</td>
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<td></td>
<td></td>
<td>• Interaction</td>
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<td>• Dosage</td>
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<td></td>
<td></td>
<td>• Dosing schedule</td>
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<tr>
<td></td>
<td></td>
<td>• Indication and side effects</td>
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<td></td>
<td></td>
<td>• Availability and drug name</td>
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<tr>
<td></td>
<td></td>
<td>• Drug and driving</td>
</tr>
<tr>
<td>Abraham et al²⁵</td>
<td>Semi-structured interviews with thematic analysis to assess parents’ perspectives on pediatric medication</td>
<td>Essential drug information requested by parents:</td>
</tr>
<tr>
<td></td>
<td>Population: 19 parents, mostly female</td>
<td>• Drug interactions</td>
</tr>
<tr>
<td></td>
<td>Study site: Community pharmacies, United States</td>
<td>• Side effects</td>
</tr>
<tr>
<td>Twigg et al²⁶</td>
<td>Questionnaire to measure medication information satisfaction of patients who (i) received an advanced counseling service and (ii) those who did not</td>
<td>Score for the potential problems (SIMS score 2), unsatisfied with information on:</td>
</tr>
<tr>
<td></td>
<td>Population: Patients with more than one regular medicine, 232 assessed questionnaires</td>
<td>(i) Patients who received service</td>
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<td></td>
<td>Study site: Community pharmacies, United Kingdom</td>
<td>• Whether the medication will affect your sex life</td>
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<td></td>
<td>• Whether the medicine interferes with other medicines</td>
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<td></td>
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<td>• What are the risks of you getting side effects</td>
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<td>• What you should do if you experience unwanted side effects</td>
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<td>• Whether the medicine has any unwanted effects</td>
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<td></td>
<td></td>
<td>• Whether the medication will make you feel drowsy</td>
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<td></td>
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<td>• Whether you can drink alcohol while taking this medicine</td>
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<td></td>
<td></td>
<td>• What you should do if you miss a dose</td>
</tr>
<tr>
<td>Mamen et al²⁷</td>
<td>Structured questionnaire to assess patients’ need for drug information</td>
<td>Score for the potential problems (SIMS score 2), unsatisfied with information on:</td>
</tr>
<tr>
<td></td>
<td>Population: 162 elderly patients who used at least one prescription medicine</td>
<td>(ii) Patients who received no service</td>
</tr>
<tr>
<td></td>
<td>Study site: Senior centers, Norway</td>
<td>• What are the risks of you getting side effects</td>
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<td></td>
<td>• Whether the medicine has any unwanted effects</td>
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<td></td>
<td></td>
<td>• Whether the medication will affect your sex life</td>
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<td>• Whether the medicine interferes with other medicines</td>
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<td>• What you should do if you experience unwanted side effects</td>
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<td>• Whether the medication will make you feel drowsy</td>
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<td>• Whether you can drink alcohol while taking this medicine</td>
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<tr>
<th>Study</th>
<th>Study characteristics</th>
<th>Raised drug information needs&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
</table>
| Yi et al<sup>28</sup> | Questionnaires for patients and physicians to identify gaps regarding medication education, content, and delivery Population: 108 ambulatory care patients, 116 hospital clinics physicians Study site: Outpatient pharmacy and hospital clinics, China | Topics with largest difference between information desired by patients and received information:  
- What to do if adverse reaction experienced  
- Drug-food interactions  
- Drug-drug interactions  
- Adverse reactions  
- Onset of action  
- Duration of therapy  
- Medication storage |
| Kazaryan and Sevikyan<sup>29</sup> | Interview to identify patients' needs of drug information Population: 1,059 people who visited community pharmacies Study site: Community pharmacies, Armenia | Information requested by patients:  
- Indication  
- Dosage and method of administration  
- Contraindications  
- Adverse reactions  
- Simultaneous use of multiple medicines  
- Information about medicine's price |
| Mahler et al<sup>30</sup> | Standardized questionnaires consisting of SIMS-D and MARS-D to assess the extent to which patients are satisfied with drug information Population: 834 chronically ill patients Study site: Heidelberg, Germany | Score for the potential problems (SIMS score 2), unsatisfied with information on:  
- What are the risks of you getting side effects  
- Whether the medication will affect your sex life  
- Whether the medicine has any unwanted effects  
- What you should do if you experience unwanted side effects  
- Whether the medicine interferes with other medicines  
- Whether the medication will make you feel drowsy  
- What you should do if you miss a dose  
- Whether you can drink alcohol while taking this medicine |
| Ho et al<sup>31</sup> | Questionnaire to identify patients' needs of drug information Population: 201 patients in an outpatient pharmacy Study site: Outpatient pharmacy of a university hospital, Singapore | Information wanted:  
- Adverse effects  
- Dosing  
- Indication  
- Interactions (drug–drug, herb–drug)  
- Mechanism of action  
- Use of devices  
- Pregnancy or breastfeeding |
| Newby et al<sup>32</sup> | Telephone survey to investigate information seeking behavior and questions asked about drugs by drug users with (i) satisfied and (ii) unmet needs of drug information Population: 61 residents who completed follow-up interviews Study site: Residents in New South Wales, Australia | Questions asked about drugs:  
(i) Drug users with satisfied needs  
- Adverse effects  
- How well medicine worked for a particular condition  
- Advice on the best treatment for a particular condition  
- Other  
- Reason for taking the medicine  
- General inquiry about a medicine  
(ii) Drug users with unmet needs  
- Adverse effects  
- How well medicine worked for a particular condition  
- Other  
- Advice on the best treatment for a particular condition  
- General inquiry about a medicine  
- Reason for taking the medicine |
<table>
<thead>
<tr>
<th>Study</th>
<th>Methodology</th>
<th>Population</th>
<th>Study site</th>
<th>Information needed</th>
<th>Information wanted at start of treatment</th>
<th>Information wanted according to patients</th>
<th>Information topics discussed</th>
</tr>
</thead>
<tbody>
<tr>
<td>van Geffen et al&lt;sup&gt;13&lt;/sup&gt;</td>
<td>Semi-structured telephone interviews to identify patients’ information needs when starting with SSRi treatment</td>
<td>41 patients with first prescription of a SSRi</td>
<td>Community pharmacies, the Netherlands</td>
<td>How to use the medicine</td>
<td>Delayed onset of action</td>
<td>What is your medicine for?</td>
<td>Side effects and risk information</td>
</tr>
<tr>
<td>Zwaenepoel et al&lt;sup&gt;14&lt;/sup&gt;</td>
<td>Standardized interviews to explore information preferences of psychiatrics inpatients</td>
<td>279 psychiatric inpatients</td>
<td>Psychiatric hospitals, Belgium</td>
<td>How does the drug work?</td>
<td>How does the drug work?</td>
<td>How long will it take to act?</td>
<td>Range of treatment options</td>
</tr>
<tr>
<td>Lamberts et al&lt;sup&gt;15&lt;/sup&gt;</td>
<td>Semi-structured telephone interviews and patient focus group discussions to obtain insights into information needs of patients who have recently started treatment with oral antidiabetics</td>
<td>42 patients with first prescription of an oral antidiabetic, 11 further participating in 2 focus groups</td>
<td>Community pharmacies, the Netherlands</td>
<td>Whether the medicine interferes with other medicines</td>
<td>How long you will need to be on your medicine</td>
<td>What is this medication right for me?</td>
<td>Side effects and risk information</td>
</tr>
<tr>
<td>Nair et al&lt;sup&gt;16&lt;/sup&gt;</td>
<td>Focus groups to explore what patients want to know about their medication and how HCPs respond to these information needs</td>
<td>88 patients who had taken at least one medication, 27 physicians, and 35 pharmacists in 19 focus groups</td>
<td>Community pharmacies, the Netherlands</td>
<td>Interactions</td>
<td>How long it will take to act</td>
<td>How long to take medication</td>
<td>Range of treatment options</td>
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Table 2 (Continued)

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<tr>
<th>Study</th>
<th>Study characteristics</th>
<th>Raised drug information needsa</th>
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<tbody>
<tr>
<td>Raynor et al37</td>
<td>Focus groups to examine the experiences with drug information of people with a chronic illness</td>
<td>Information need areas identified:</td>
</tr>
<tr>
<td></td>
<td>Population: 23 patients with asthma participating in 4 focus groups</td>
<td>• Name and purpose of treatment</td>
</tr>
<tr>
<td></td>
<td>Study site: Community pharmacies, United Kingdom</td>
<td>• When and how to take it; how long to take</td>
</tr>
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<td></td>
<td></td>
<td>• Side effects and what to do about them</td>
</tr>
<tr>
<td>Borgsteede et al38</td>
<td>Semi-structured interviews to explore patients’ needs of information about their medication at hospital discharge</td>
<td>Information aspects important for patients:</td>
</tr>
<tr>
<td></td>
<td>Population: 31 patients being discharged from the hospital</td>
<td>• Basic information (e.g., drug name, indication, use)</td>
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<tr>
<td></td>
<td>Study site: General teaching hospital, the Netherlands</td>
<td>• Information about side effects</td>
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<td></td>
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<td>• Information about alternatives</td>
</tr>
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<td></td>
<td></td>
<td>• What to do when medication problems are encountered</td>
</tr>
</tbody>
</table>

Notes: a In some studies, more than one information topic could be given by study participants; b The study used a German version of the SiMS; wording of the topics raised is according to the respective English version.

Abbreviations: HCP, health care professional; MARS, Medication Adherence Reporting Scale; SiMS, Satisfaction with Information about Medicines Scale; SSRi, selective serotonin reuptake inhibitors.

Discussion

Both ADR and DDI information may be composed of seven different information domains each (Table 3): ADR information could be customized according to the frequency, severity, or onset of ADRs (e.g., start of therapy vs. long-term), and management strategies including limitations of self-management (e.g., tools to cope with ADRs). For DDIs, customization could refer to the identification of DDIs, frequency, severity, or onset of DDIs. Furthermore, additional information on management strategies including limitations of self-management (e.g., different timing, lower dosages, and alternative medicines) could be given.

The subsequent literature search illustrated some of these domains with patients’ needs and HCP perceptions regarding extent of information wanted because especially classification of ADRs by frequency and severity was often mentioned in the assessed literature. However, the majority of the domains were never extensively assessed in patients or HCPs. Hence, knowledge of whether and to which extent patients require the diverse elements of information and to what extent HCPs support them is limited.
Figure 2 Arrangement of the allocated drug information topics according to frequency of mentioning in assessed 1) studies on drug information hotlines (solid bars) and 2) qualitative studies (open bars).

Notes:  *The frequencies (absolute number) with which a respective drug information topic was mentioned in the assessed studies were summed up.  "Drug information topics that can be considered to be mandatory to conduct the drug treatment ("Five Rights").

Abbreviations: ADR, adverse drug reaction; DDI, drug–drug interaction.

information hotlines and services. Undoubtedly, safety-related information on ADRs and DDIs is most often sought.30,37

In comparison to other drug information topics such as appropriate storage of drugs or indication of a drug, relevant information on ADRs and DDIs is broader and less explicit. Hence, if patients request information on ADRs, it typically remains unclear what they actually want to know. For instance, do patients want to learn only about the most frequent ADRs, or the most severe ones, or those they can independently monitor and manage? Nevertheless, such safety-related information might particularly interfere with patient concerns about their drug treatment and may hence also influence their adherence to drug treatment because lacking information might promote a deeper “concern belief” and thus non-adherence.7,8 Owing to the high diversity of ADR and DDI information, it is difficult to satisfy individual needs, identify information deficits, and provide missing details while avoiding to transfer information that is not sought or irrelevant in the current patient situation.

For both ADRs and DDIs, we identified seven distinct information domains that would allow for customizing information. Such customization would then enable HCPs to individually provide patients with the respective drug information of personal interest. Only little is published on patient attitudes toward these information domains and even fewer evidence exists on how patient needs could be assessed to identify unmet information needs.

For instance, there are patients who decline to receive additional information and treatment willingness of some patients already diminishes when the mere presence of possible ADRs is mentioned, regardless of their likelihood of occurrence.61 Often, this fear of potential non-adherence is put forward by HCPs who are reluctant to offer what they deem too much additional information. However, this fear is not reflected in literature.62,63 At the other extreme, some patients want a full disclosure of all possible ADRs. Indeed, patients often seem to follow a safety-conscious strategy and opt for a maximum of information without a real understanding of risk and likelihood.39,46 Furthermore, patients seem to be particularly interested in risks considered most threatening for their own well-being regardless of their likelihood of occurrence.44
<table>
<thead>
<tr>
<th>Drug information topic</th>
<th>Information domains</th>
<th>Amount of information desired by patients and implications in the literature</th>
<th>Health care professionals’ perceptions and worries</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADRs</td>
<td>Classification by</td>
<td>• Some patients do not want any information(^{33,38-41})</td>
<td>• Physicians and pharmacists question the amount of ADR information as a cause of non-adherence(^{36,41,49-53}) and know patients who do not want any information(^{10})</td>
</tr>
<tr>
<td></td>
<td>Frequency according to SmPC using qualitative EU guideline descriptions (ie, very common, common, uncommon, rare, very rare)(^{30})</td>
<td>• Some patients want a full disclosure of all possible ADRs(^{30,38-41})</td>
<td>• Physicians and pharmacists question the amount of ADR information as a cause of non-adherence(^{36,41,49-53}) and know patients who do not want any information(^{10})</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Some patients want specific ADR information categorized by frequency with common ADRs being of greater interest(^{29,40-41})</td>
<td>• Physicians and pharmacists question the amount of ADR information as a cause of non-adherence(^{36,41,49-53}) and know patients who do not want any information(^{10})</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Patients do not want physicians to tailor ADR information for them(^{29})</td>
<td>• Physicians and pharmacists question the amount of ADR information as a cause of non-adherence(^{36,41,49-53}) and know patients who do not want any information(^{10})</td>
</tr>
<tr>
<td></td>
<td>Implications in the literature</td>
<td>• Using the qualitative EU guideline descriptions for frequency leads to massive overestimation of perceived risk(^{36})</td>
<td>• Physicians and pharmacists differ on who should discuss ADRs with patients because each profession considers itself more capable or the other profession responsible for doing so(^{33,41,49})</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Meta-analysis: risk of ADRs should be quantified numerically(^{47})</td>
<td>• Physicians and pharmacists differ on who should discuss ADRs with patients because each profession considers itself more capable or the other profession responsible for doing so(^{33,41,49})</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Higher desire for ADR information by patients with previous experiences of ADRs(^{34,39,40})</td>
<td>• Physicians and pharmacists differ on who should discuss ADRs with patients because each profession considers itself more capable or the other profession responsible for doing so(^{33,41,49})</td>
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</tr>
<tr>
<td></td>
<td>Severity (ie, serious or non-serious ADRs)</td>
<td></td>
<td>• Physicians and pharmacists differ on who should discuss ADRs with patients because each profession considers itself more capable or the other profession responsible for doing so(^{33,41,49})</td>
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<tr>
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</tr>
<tr>
<td></td>
<td></td>
<td>• Some patients want specific ADR information categorized by severity with dangerous ADRs being of greater interest(^{29,42-45})</td>
<td>• Physicians and pharmacists differ on who should discuss ADRs with patients because each profession considers itself more capable or the other profession responsible for doing so(^{33,41,49})</td>
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</tr>
<tr>
<td></td>
<td>Onset of ADRs (eg, start of therapy vs long-term effects)</td>
<td></td>
<td>• Physicians and pharmacists differ on who should discuss ADRs with patients because each profession considers itself more capable or the other profession responsible for doing so(^{33,41,49})</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Patients want information on ADRs occurring both early on and during long-term treatment(^{33,37,55})</td>
<td>• Physicians and pharmacists differ on who should discuss ADRs with patients because each profession considers itself more capable or the other profession responsible for doing so(^{33,41,49})</td>
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<td></td>
<td>Duration of ADRs (eg, long-term vs short-term)</td>
<td></td>
<td>• Physicians and pharmacists differ on who should discuss ADRs with patients because each profession considers itself more capable or the other profession responsible for doing so(^{33,41,49})</td>
</tr>
<tr>
<td></td>
<td>Classification by</td>
<td>• Patients want information on how to reduce ADRs(^{33})</td>
<td>No data available</td>
</tr>
<tr>
<td></td>
<td>Management strategies including limitations of self-management (ie, how to minimize ADRs and when to consult a physician)</td>
<td>No data available</td>
<td>No data available</td>
</tr>
<tr>
<td></td>
<td>Additional information on Monitoring</td>
<td>No data available</td>
<td>No data available</td>
</tr>
<tr>
<td></td>
<td>Additional information on Prevention strategies</td>
<td>No data available</td>
<td>No data available</td>
</tr>
</tbody>
</table>
| DDIs       | Empowerment to identify interactions | Some patients believe that drugs counteract with each other when taken together, while some trust their prescriber that no DDIs will occur.53
|           | • Identification of interaction partners | Patients request information on interactions between prescription drugs and OTC medications (11.4%).56
|           | • Some patients believe that drugs counteract with each other when taken together, while some trust their prescriber that no DDIs will occur.53
|           | • Patients request information on interactions between drugs and food (6.8%).56
|           | • Patients are interested in identification of interaction partners because 62% of the female participants wanted to learn more about DDIs between hormonal contraceptives and antiepileptic drugs.57
| Implications in the literature | Focus should be put on interactions with OTC drugs and food.58,59
|           | • Patients fail to transfer knowledge on DDi management into practice.60
| Classification by | Frequency (ie, the frequency with which a DDI may occur) | Patients request information on frequency (2.3%) and prevalence of DDIs (2.3%).56
|           | • No data available
| Classification by | Severity (ie, a serious or non-serious DDI effect) | Patients request information on seriousness (19.3%) and effects of DDIs (5.7%).56
|           | • No data available
| Classification by | Onset of DDIs (ie, most likely timing when a DDI occurs) | No data available
|           | • No data available
| Additional information on | Management strategies including limitations of self-management (ie, how to minimize DDIs and when to consult a physician) | Patients request information on management of DDIs (eg, influence of timing and dose) (2.3%).58
|           | • No data available
| Additional information on | Monitoring | Patients request information on signs of DDIs (3.4%).56
|           | • No data available
| Additional information on | Prevention strategies | Patients request information on how to prevent DDIs (eg, influence of timing and dose) (2.3%).58
|           | • No data available

**Abbreviations:** ADR, adverse drug reaction; DDI, drug–drug interaction; EU, European Union; OTC, over-the-counter; SmPC, Summary of Product Characteristics.
The majority of patients probably is situated in between these two extremes, and while customization of information to satisfy individual needs is acknowledged, explicit endeavors remain scarce. Often, patients are left with patient information leaflets that follow a “one-size-fits-all” approach and the vast number of ADRs mentioned often causes undesirable emotional reactions (eg, fear) that might promote non-adherence. With regard to DDIs, some patients believe that a lot of drugs should not be combined because their efficacy could be altered, whereas other patients believe that co-prescribed medicines are unlikely to interact at all. Considering self-medication in particular, there is a need to inform patients and raise awareness about possible DDIs between prescribed drugs and those used in self-medication.

While extensive research has been undertaken to assess professional DDI checkers regarding their content, design, and use in a professional setting, there is very limited information on performance of DDI checkers informing patients and laypersons. Many available DDI checkers lack DDI severity information, contain only limited patient-oriented risk communication, and have only limited patient readability. Especially, lengthy and complex information on possible DDIs is not well understood. Future research is therefore necessary to facilitate 1) customization of ADR information and 2) customization of DDI information with advanced drug information management in order to enable customization possibilities. Besides enabling customization possibilities of drug information, a particular emphasis must be put on making this information easily accessible for future users (eg, patients). Therefore, in a subsequent step, low-threshold dissemination channels must be assessed and validated with patients.

A first step would be to develop, validate, and release a database that contains available drug information in commonly understood language and register that is structured according to relevant identified information domains (Table 3). Such a database would allow selecting only information domains important for the individual patient and would thus individualize information transfer. A second prerequisite would be a tool to assess and identify individual drug information needs and select information domains for which a patient wants additional information. There are already tools available to assess whether patients desire more or less information in general and about their drugs in particular, such as the “Extent of Information Desired” scale, and tools that help measuring overall satisfaction with drug information, such as the “Satisfaction with Information about Medicines Scale”. However, a tool to determine specific information domains on ADRs and DDIs to allow patients to select the amount and content of additional drug information is lacking. To recognize and identify boundaries and implications of customized drug information, it will be crucial on the one hand to identify patient populations benefiting from such a form of information. On the other hand, it will be equally important to find those patients who do not need additional information, and particularly those who are not served by such an approach while being in need of additional information – to this end, it may also be necessary to include further patient characteristics that influence information needs, predominantly the patient’s health literacy.

Looking at the literature, high desires for information were expressed for instance by patients with diabetes diagnosis, whereas patients with cardiovascular and respiratory diseases expressed lower desires for drug information. Additional factors like diseases and comorbidities may therefore also influence individual information needs. How and in which way such influence takes place should consequently also be assessed.

**Limitations**

The present work has several limitations. First, we conducted a narrative instead of a systematic review and only assessed a single (albeit large) database (PubMed). However, our aim was to identify the most relevant drug information topics and highlight how such information can be customized. With a narrative approach we were able to include a broad spectrum of articles and therefore widely assess drug information needs. The topics extracted from PubMed articles showed strong consistency and little deviation of topics mentioned, therewith suggesting an already sufficient approach. Furthermore, while not applying the full range of the “Preferred Reporting Items for Systematic Reviews and Meta-Analyses” (PRISMA) statement, we still applied various checklist items in our review process whenever possible (eg, eligibility criteria, information sources, data collection progress, synthesis of results, study characteristics, summary of evidence, limitations, conclusions, and funding).

Second, our approach to assess unsatisfied drug information needs by analyzing enquiries to drug information hotlines and services might be biased by the fact that actively calling a hotline requires some basic interest in drug-related topics and ambition to self-reliantly acquire information; therefore, more “empowered” and proactive patients may be selected by this approach and less empowered patients might be
missed. Nevertheless, the second assessment of unmatched information needs including a variety of qualitative studies yielded similar results, supporting the conclusion that these findings indeed reflect the drug information needs of a broad population of patients.

Conclusion
Patients particularly request safety-related drug information that exceeds the typical scope of medication schedules. While it is well known that extent and content of the favored information can vary, evidence on how to assess information needs and correspondingly customize information is sparse. This review suggests that for both ADRs and DDI, rather diverse but only limited information domains are needed and that individual patients largely differ with respect to their information needs.

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Disclosure
The authors report no conflicts of interest in this work.

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