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https://doi.org/10.31925/farmacia.2026.3.23 **ORIGINAL ARTICLE**

PERCEPTIONS OF DRUG-DRUG INTERACTIONS AMONG ONCOLOGISTS AND RADIOTHERAPISTS: EMERGING TRENDS IN ROMANIA

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Abstract

Despite increasing awareness and the availability of tools for evaluating drug-drug interactions (DDIs), variability persists in their identification and management in clinical practice. This cross-sectional survey assessed knowledge, attitudes, and practices related to DDIs among Romanian oncology and radiotherapy physicians. Data were collected through a structured online questionnaire distributed by e-mail with the support of the National Society of Medical Oncology from Romania (SNOMR). Among 100 respondents (71 medical oncologists and 29 radiotherapists), 55% reported frequent personal DDI checking (often or always), 66% considered DDI verification their own responsibility, and 97% considered a practical oncology DDI guideline useful. In multivariable logistic regression, high self-reported DDI familiarity (quite/very familiar *versus* not/slightly familiar) was independently associated with frequent DDI checking (adjusted odds ratio [aOR] 7.19, 95% confidence interval [CI] 2.41 - 21.42; $p < 0.001$), whereas years of specialist experience and specialty were not independent predictors. These findings support structured DDI guidance and multidisciplinary medication-safety interventions in Romanian oncology care.

Rezumat

În ciuda creșterii gradului de conștientizare și a disponibilității instrumentelor de evaluare a interacțiunilor medicament-medicament (IMM), există variabilitate în identificarea și gestionarea lor în practica clinică. Acest studiu transversal a evaluat cunoștințele, atitudinile și practicile referitoare la IMM în rândul medicilor oncologi și radioterapeuți din România. Datele au fost colectate printr-un chestionar online structurat, distribuit prin e-mail cu sprijinul Societății Naționale de Oncologie Medicală din România (SNOMR). Dintre cei 100 de respondenți (71 oncologi medicali și 29 radioterapeuți), 55% au raportat verificarea frecventă personală a IMM (des sau întotdeauna), 66% au considerat verificarea IMM propria responsabilitate, iar 97% au considerat util un ghid practic privind IMM în oncologie. În regresia logistică multivariată, familiaritatea autoevaluată cu IMM ridicată (destul de/foarte familiar față de deloc/puțin familiar) a fost asociată independent cu verificarea frecventă a IMM (odds ratio ajustat [ORa] 7,19; interval de încredere [IC] 95% 2,41 - 21,42; $p < 0,001$), în timp ce vechimea în specialitate și specialitatea medicală nu au fost predictori independenți. Rezultatele susțin elaborarea unor ghiduri structurate și intervenții multidisciplinare pentru siguranța medicației în îngrijirea oncologică din România.

Keywords: Romanian oncologists, radiotherapists, perceptions, knowledge, attitudes, drug-drug interactions

Introduction

Over the past two decades, there has been a substantial increase in the development of novel anticancer agents, alongside an expansion of therapeutic indications for existing treatments (1). Targeted therapies, particularly tyrosine kinase inhibitors (e.g., osimertinib, pazopanib, afatinib) and immune checkpoint inhibitors (*e.g.*, pembrolizumab, nivolumab, ipilimumab), account for a significant proportion of newly approved oncologic drugs and indications (2). Many of these agents are administered orally and are therefore susceptible to drug - drug interactions (DDIs), as well as drug - food and drug - herbal supplement interactions, which may significantly affect treatment safety and efficacy (3-5). DDIs are predominantly pharmacokinetic in nature, occurring at the levels of absorption, distribution, and metabolism. Alterations in gastric pH may influence drug bioavailability during absorption, while mod-ulation of transport proteins such as P-glycoprotein and breast cancer resistance protein (BCRP) can affect drug distribution. In addition, metabolic interactions frequently involve the induction or inhibition of cytochrome P450 (CYP450) enzymes, leading to changes in drug clearance. These mechanisms may result in subtherapeutic plasma concentrations, compromising efficacy, or increased exposure, thereby increasing the risk of toxicity (6 - 8). Genetic polymorphism also can modify drug's pharmacokinetics and pharmacodynamics, thus therapeutic effect (9).
The prevalence of potential DDIs in oncology patients is considerable, largely due to polypharmacy

and the complexity of anticancer regimens. Studies have reported that a substantial proportion of patients receiving systemic anticancer therapy are exposed to at least one clinically relevant interaction. These interactions may lead to treatment delays, dose reductions, increased hospitalization rates, and, in severe cases, life-threatening adverse events. Furthermore, the narrow therapeutic index of many anticancer agents makes them particularly susceptible to even minor pharmacokinetic variations. Despite growing awareness, DDIs remain underrecognized in routine clinical practice, emphasizing the need for improved detection and management strategies (10, 11). Patients with cancer frequently present with multiple comorbidities, including hypertension, diabetes, cardiovascular, musculoskeletal, and respiratory diseases, requiring chronic concomitant treatments that may further increase the risk of DDIs and influence therapeutic outcomes (12). A multidisciplinary approach, involving oncologists, radiotherapists, radiologists, surgeons, and other specialists, in collaboration with nurses, clinical pharmacists, psychologists, and nutritionists, is essential for optimizing cancer care. Such an approach is associated with improved adherence to clinical guidelines, better treatment outcomes, and enhanced patient safety (13). Within this framework, systematic assessment of potential DDIs, comprehensive medication reconciliation, and continuous monitoring are critical for ensuring treatment safety and optimizing therapeutic efficacy (14).

Multiple databases are available for the identification of DDIs, including both freely accessible and subscription-based resources, each with differing levels of sensitivity and specificity (15). In many settings, DDI screening tools are integrated into electronic prescribing systems, where clinically significant interactions trigger automated alerts (16). However, to be effective, these systems must be context-sensitive and tailored to the clinical scenario, minimizing alert fatigue while promoting safe and efficient patient care (17). Clinicians must therefore critically evaluate the clinical relevance of identified interactions and incorporate this information into therapeutic decision-making (18).

Despite the availability of these tools and increasing awareness of DDIs, variability persists in how clinicians identify and manage such interactions in daily practice. Differences in training, access to resources, and clinical workload may influence the consistency of DDI assessment. Moreover, data regarding physicians' knowledge, attitudes, and practices related to DDIs remain limited. Understanding these aspects is essential for identifying gaps in clinical practice and for developing targeted interventions aimed at improving medication safety (19, 20).

The aim of this study was to assess physicians' knowledge, perceptions, and current practices regarding DDIs in clinical oncology. To our knowledge, this is the first study of its kind conducted among Romanian physicians specialized in oncology and radiotherapy.

Materials and Methods

Study Design and Participants

To evaluate physicians' perspectives on DDIs, a nine-item questionnaire comprising four sections (demographic and professional characteristics, knowledge of DDIs, clinical practices, and perceptions of responsibility and need for additional tools) was developed and distributed to oncology and radiotherapy practitioners. This quantitative observational study was based on an online questionnaire designed to evaluate the perception of oncologists and radiotherapists regarding drug - drug interactions (DDIs) in clinical practice.

Participants were recruited through email distribution of the questionnaire, with the support of the National Society of Medical Oncology from Romania (SNOMR). Eligible participants were physicians practicing oncology and/or radiotherapy. Participation was voluntary and anonymous, as stated in the introductory section of the questionnaire.

Questionnaire Design

Data was collected by a structured questionnaire developed using the Google Forms platform. The questionnaire with a single-choice answer consisted of 9 items organized into the following domains: (i) demographic and professional characteristics: seni-ority in specialty (0 - 5 years, 5 - 10 years, 10 - 20 years, > 20 years); medical specialty (oncology or radiotherapy); Age interval; county of practice; (ii) self-assessed knowledge of DDIs: level of familiarity with drug - drug interactions (ranging from "not at all familiar" to "very familiar"); (iii) clinical practices related to DDIs: frequency of checking for DDIs (from "not at all" to "always") and delegation of responsibility for checking DDIs (pharmacist or medical resident); Use of databases for DDI verification (e.g., drugs.com, medscape, micromedex, lexicomp); (iv) perceptions of respo-nsibility and need for supplementary tools: perceived responsibility for DDI management (individual *vs*. multidisciplinary); need for additional tools (e.g., a dedicated DDI guide).

The questionnaire underwent a two-step validation process. First, content validity was assessed by experts from the Department of Pharmacology, who reviewed the questionnaire to ensure that the items were relevant, comprehensive, and appropriate for evaluating physicians' knowledge, perceptions, and practices regarding drug - drug interactions. Based on their feedback, minor modifications were made to improve the alignment of the questions with the study objectives.

Subsequently, the questionnaire was pilot tested on 20 physicians from Amethyst Radiotherapy clinics to assess face validity, including the clarity, comprehensibility, wording, and ease of completion of the questionnaire. The pilot participants were asked to provide feedback on the formulation and structure of the questions rather than on their scientific content. The feedback received led to minor revisions aimed at improving question phrasing, readability, and overall usability, while the content and intended meaning of the items remained unchanged. The final version of the questionnaire was then distributed nationwide.

Data Collection Procedure

The questionnaire was disseminated online between November 2025 and February 2026. Participants were informed about the study objectives, the anonymity of responses, and the exclusive scientific use of the data.

Completion of the questionnaire implied informed consent. The estimated completion time was approximately 3 - 5 minutes.

Statistical Analysis

Descriptive statistics were used to summarize respondents' answers. Categorical variables were expressed as absolute frequencies and percentages. The primary clinical-behaviour outcome for inferential analyses was frequent personal DDI checking, defined as answering "often" or "always" to the question regarding verification of DDIs between chronic and prescribed treatments. Responses of "sometimes", "never", or delegation to a pharmacist or resident were coded as not frequent personal checking. Because only one participant reported being not at all familiar with DDIs, familiarity was dichotomized as high (quite/very familiar) *versus* low (not/slightly familiar). Perceived responsibility was dichotomized as own responsibility *versus* shared or another professional's responsibility. Professional experience was entered as an ordered variable with four categories (0 - 5, 5 - 10, 10 - 20, and > 20 years).

Associations among ordinal experience, familiarity, and checking behaviour were examined using Spearman rank correlations. Univariable binary logistic regression was used to estimate crude odds ratios (ORs) and 95% confidence intervals (CIs) for frequent DDI checking. A multivariable binary logistic regression model assessed independent predictors of frequent DDI checking and included four prespecified covariates: years of specialist experience, specialty (medical oncology *versus* radiotherapy), DDI familiarity, and perceived responsibility. Age was not simultaneously entered with professional experience because they were strongly correlated (Spearman rho = 0.804, $p < 0.001$). Results are reported as adjusted odds ratios (aORs) with 95% CIs. Model fit was summarized by the likelihood-ratio chi-square test, McFadden pseudo-R-squared, and area under the receiver operating characteristic curve (AUC). All tests were two-sided and $p < 0.05$ was considered statistically significant. Analyses were considered exploratory because of the sample size and sparse responses in some categories. Data preparation and descriptive summaries were conducted using Microsoft Excel (Microsoft Corp., Redmond, WA, USA) and GraphPad Prism 9.0 for Windows (GraphPad Software, Boston, Massachusetts, USA); inferential analyses were performed in Python 3.13.5 using stats models 0.14.6 and SciPy 1.17.0. The sample size was calculated with the Raosoft Sample Size Calculator (Raosoft Inc.).

Ethical considerations

The study respects ethical principles regarding research on human subjects. Participation was voluntary, anonymous and the collected data do not allow identification of respondents.

Results and Discussion

A total of 100 oncologists and radiotherapists completed the questionnaire. The study population was estimated at 999 physicians, according to official data obtained from the Romanian College of Physicians (registration no. 1925/12.02.2026). Based on this data, Raosoft calculated the required sample size at 278 respondents to achieve a 5% margin of error at a 95% confidence level (population size: 999; response distribution: 50%). However, the achieved sample size of 100 respondents corresponds to a margin of error of 9.3% under these parameters.

Regarding age distribution, the majority of respondents were aged between 30 and 40 years old (n = 52; 52%) (Figure 1). Twenty-six participants (26%) were aged 40 - 50 years, while 12 respondents (12%) were in the 50 - 60 years age group. Younger physicians were less represented: 5 respondents (5%) were under 30 years old. Similarly, 5 participants (5%) were over 60 years old.

Overall, the study population was predominantly composed of early- and mid-career physicians, with more than half of the respondents being under 40 years of age. This distribution suggests that the survey captured perspectives mainly from physicians in the earlier stages of their professional careers.

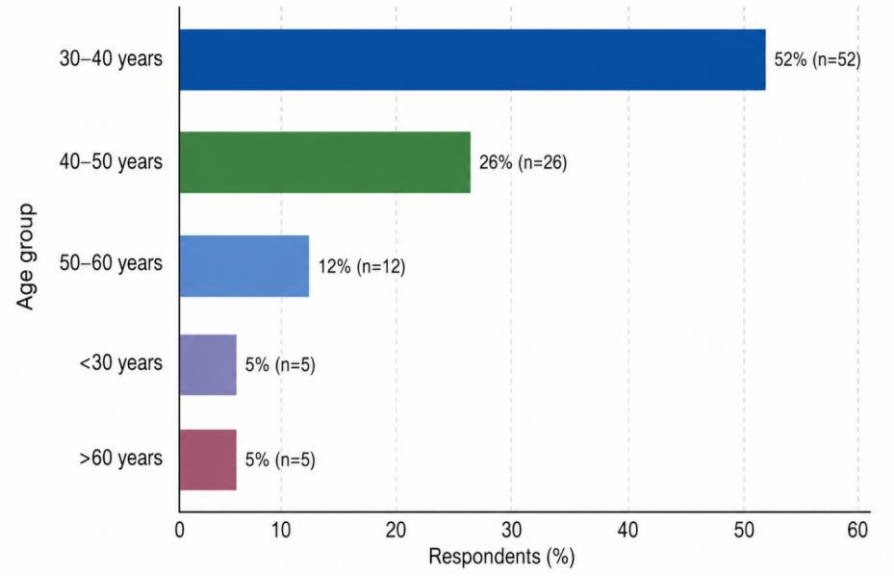

Figure 1.
Age distribution among respondents

Respondents reported practicing in a wide range of geographic locations (Figure 2). The highest number of participants practiced in Cluj County (n = 29; 29%), followed by Bucharest (n = 16; 16%) and Brașov (n = 9; 9%). Other counties with several respondents included Timiș (n = 6; 6%), Bihor (n = 6 6%), Neamț (n = 4; 4%) and Satu Mare (n = 4; 4%). A smaller number of participants reported practicing in Iași (n = 3; 3%), Alba (n = 2; 2%), Argeș (n = 2; 2%), Bistrița-Năsăud (n=2, 2%), Ilfov (n = 2; 2%), Maramureș (n = 2; 2%), Mureș (n = 2; 2%) and Vâlcea (n = 2; 2%). Single respondents were recorded from Bacău, Constanța, Gorj, Harghita, Sălaj and Tulcea (each n = 1; 1%).

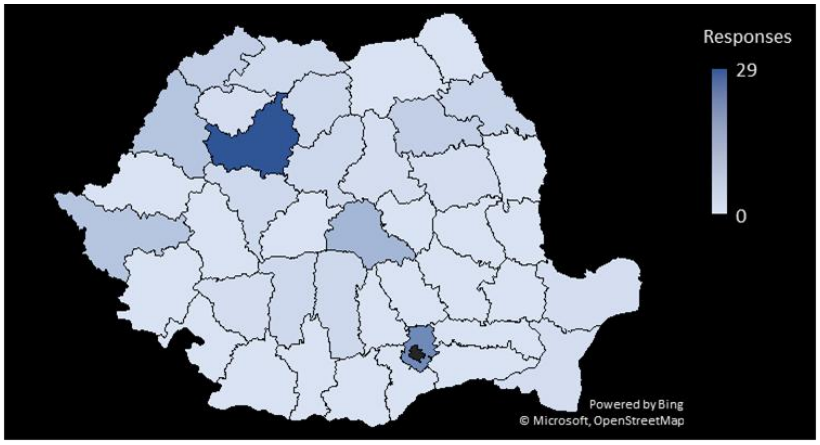

Figure 2.
National distribution of respondents. The darker the shade of blue, the more respondents in a specific county

In addition, two respondents reported practicing in Chișinău (Republic of Moldova), and one participant indicated practicing outside Romania (diaspora). Overall, the respondents represented a broad national distribution, with a concentration in major academic and oncology centres, particularly Cluj and Bucharest.

Regarding professional experience as specialists, the largest group of respondents had 0 - 5 years of experience (n = 43; 43%). Twenty-four respondents (24%) reported 5 - 10 years of specialist experience, while 16 respondents (16%) had 10 - 20 years of experience. Seventeen physicians (17%) reported more than 20 years of experience as specialists. Overall, the sample included physicians with a broad range of professional experience, with nearly half of the respondents being early-career specialists (≤ 5 years).

Regarding the primary medical specialty of the respondents, the majority were medical oncologists (n = 71; 71%), while 29 participants (29%) reported radiotherapy as their main specialty. Thus, the study sample was predominantly composed of medical

oncologists, with radiotherapists representing slightly more than one quarter of the respondents.

When asked about their level of familiarity with drug - drug interactions, most respondents (n=56, 56%) described themselves as quite familiar, 28 (28%) as slightly familiar, and 15 (15%) as very familiar, whereas only 1 respondent (1%) indicated being not familiar at all (Figure 3). When stratified by years of specialist practice, among physicians with 0 to 5 years of experience (n = 43), 20 (46.5%) were quite familiar, 16 (37.2%) slightly familiar, 6 (14.0%) very familiar and 1 (2.3%) not at all familiar. In the 5 to 10 years group (n = 24), 15 respondents (62.5%) were quite familiar, 7 (29.1%) slightly familiar, and 2 (8.4%) very familiar. Among specialists with 10 to 20 years of experience (n = 16), 10 (62.5%) were quite familiar, 2 (12.5%) slightly familiar, and 4 (25.0%) very familiar. In the group with more than 20 years of specialist practice (n = 17), 11 respondents (64.7%) were quite familiar, while 3 (17.6%) were slightly familiar and 3 (17.6%) were very familiar. When comparing oncologists (n = 71, 71%) and radiotherapists (n = 29, 29%), oncologists more frequently reported a higher level of familiarity with drug - drug interactions (77.5% *vs*. 55.2%).

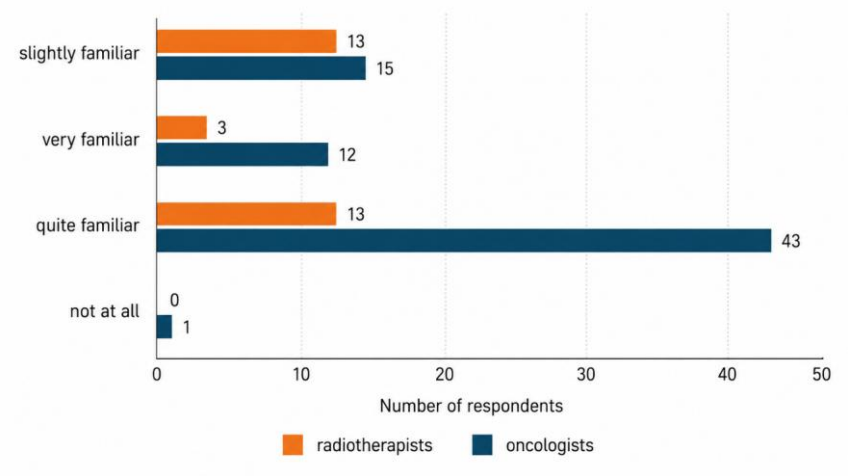

Figure 3.
The level of familiarity with the subject of DDIs among oncologists and radiotherapists

When analysed as ordered categories, years of specialist experience showed a weak positive association with self-reported DDI familiarity (Spearman rho = 0.201, p = 0.044). High familiarity (quite or very familiar) was also more frequently reported by medical oncologists than by radiotherapists (55/71 [77.5%] *versus* 16/29 [55.2%]; odds ratio [OR] 2.79; Fisher exact p = 0.031).

Participants were asked whether they check for drug - drug interactions among medications included in the patient's chronic treatment and the therapy they prescribe (Figure 4). The most frequent responses were "sometimes" (n = 35; 35%) and "often" (n = 34; 34%), while 21 physicians (21%) reported that they always check for such interactions. Thus, 90 respondents (90%) reported checking DDIs at least sometimes, and 55 (55%) reported frequent personal checking ("often" or "always"). A smaller proportion indicated delegation to a pharmacist or clinical pharmacist (n = 9; 9%), while one respondent (1%) reported never checking drug - drug interactions. Doctors who did not check interactions or delegated this task were mostly oncologists (n = 9 out of 10).

Overall, these findings suggest that while most oncologists and radiotherapists assess potential DDIs with some frequency, systematic verification is not universal and, in some cases, the responsibility is delegated to pharmacists.

When stratified by years of specialist experience, among physicians with 0 to 5 years of practice (n = 43), 25 (58.1%) reported checking interactions often/always, 17 (39.5%) sometimes, and 1 (2.3%) reported never/delegating to the clinical pharmacist/medical resident (Figure 4). In the 5 to 10 years group (n = 24), 13 respondents (54.1%) reported checking interactions often/always, 7 (29.1%) sometimes, and 4 (16.7%) never/delegating. Among specialists with 10 to 20 years of experience (n = 16), 6 (37.5%) reported often/always, 7 (43.8%) sometimes, and 3 (18.8%) never/delegating. In the group with more than 20 years of specialist practice (n = 17), 11 respondents (64.7%) reported checking interactions often/always, 4 (23.5%) sometimes, and 2 (11.8%) never/delegating.

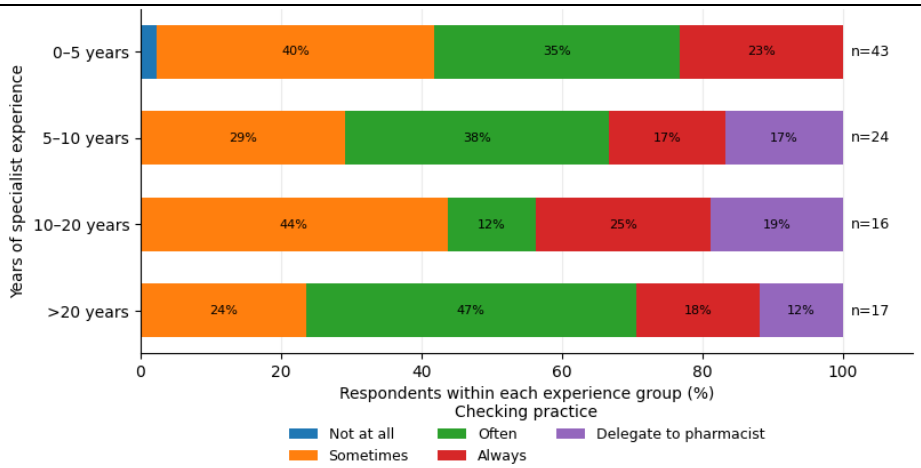

Figure 4.
The frequency of checking DDIs among oncologists and radiotherapists, stratified by years of specialist experience

When checking behaviour was coded ordinally (0 = never/delegation, 1 = sometimes, 2 = often, 3 = always), it was not associated with years of specialist experience (Spearman rho = -0.078, p = 0.439) but showed a positive association with self-reported DDI familiarity (Spearman rho = 0.267, p = 0.007).
Predictors of frequent personal DDI checking, for the prespecified outcome, 55 of 100 respondents (55%) reported frequent personal DDI checking (often or always). Frequent checking was reported by 37/71 (52.1%) medical oncologists and 18/29 (62.1%) radiotherapists, with no significant unadjusted association by specialty. In contrast, frequent checking was reported by 47/71 (66.2%) respondents with high familiarity compared with 8/29 (27.6%) with low familiarity (OR 5.14, 95% CI 1.99 - 13.31; p < 0.001). Participants who considered DDI checking their own responsibility also reported frequent checking more often than those selecting shared or other responsibility (62.1% *versus* 41.2%; OR 2.34, 95% CI 1.01-5.45; p = 0.048) (Table I).

Table I
Univariable associations with frequent personal DDI checking

Predictor/comparison	Frequent checking, n/N (%)	Crude OR (95% CI)	p value
Experience (per higher category; category frequencies shown below)	0 - 5 y: 25/43 (58.1%); 5 - 10 y: 13/24 (54.2%); 10 - 20 y: 6/16 (37.5%); > 20 y: 11/17 (64.7%)	0.97 (0.69 - 1.38)	0.879
Medical oncology *vs*. radiotherapy	37/71 (52.1%) *vs*. 18/29 (62.1%)	0.67 (0.28 - 1.61)	0.365
High *vs*. low DDI familiarity	47/71 (66.2%) *vs*. 8/29 (27.6%)	5.14 (1.99 - 13.31)	< 0.001
Own *vs*. shared/other responsibility	41/66 (62.1%) *vs*. 14/34 (41.2%)	2.34 (1.01 - 5.45)	0.048

Note: Frequent checking was defined as responding "often" or "always". OR for experience represents one higher ordered experience category; for other variables, the first group is compared with the second group.

In the univariable analysis, respondents with high DDI familiarity had over five times higher odds of frequent personal DDI checking compared with respondents with low familiarity. Respondents who perceived DDI checking as their own responsibility also had significantly higher odds of frequent checking. Neither professional experience nor specialty was significantly associated with frequent checking (Table II).

Table II
Multivariable logistic regression for frequent personal DDI checking

Predictor	Adjusted OR	95% CI	p value
Experience (*per* higher category)	0.88	0.59 - 1.31	0.516
Medical oncology *vs*. radiotherapy	0.47	0.15 - 1.41	0.176
High *vs*. low DDI familiarity	7.19	2.41 - 21.42	< 0.001
Own *vs*. shared/other responsibility	2.05	0.81 - 5.22	0.131

Note: Dependent variable = frequent personal DDI checking (often/always). aOR, adjusted odds ratio; CI, confidence interval; AUC, area under the receiver operating characteristic curve.

In the multivariable logistic regression model, high DDI familiarity remained independently associated with frequent personal checking (aOR 7.19, 95% CI 2.41-21.42; p < 0.001). Neither years of specialist experience (aOR per higher category 0.88, 95% CI 0.59-1.31; p = 0.516) nor specialty (medical

oncology *versus* radiotherapy: aOR 0.47, 95% CI 0.15-1.41; p = 0.176) independently predicted frequent checking. The association with perceiving checking as one's own responsibility was attenuated after adjustment (aOR 2.05, 95% CI 0.81-5.22; p = 0.131). The model was significant overall (likelihood - ratio chi-square (4) = 19.06, p < 0.001; McFadden pseudo-R-squared = 0.138; AUC = 0.738).

Participants were also asked which drug - drug interaction checker or information source they most frequently use in clinical practice. The most reported tool was the Drugs.com Drug Interaction Checker, used by 45 respondents (45%). Other frequently used resources included the OncoAssist interaction checker (n = 20; 20%), Medscape Interaction Checker (n = 12; 12%), Mediately (n=7; 7%). Less frequently mentioned other resources were the Summary of Product Characteristics (SmPC) or medication package inserts (n=5; 5%), Google.com, Docviser, UpToDate or Vidal) (n = 6; 6%). A low number of respondents reported using Artificial Intelligence (AI) (n=1; 1%), while four respondents (4%) indicated that they do not use any interaction-checking engine.

Overall, the findings indicate that clinicians predominantly rely on dedicated online drug interaction databases, with Drugs.com being the most used tool among respondents.

Because the preferred interaction-checking resource was collected using several low-frequency and free-text response categories, tool choice was summarized descriptively and was not included as a predictor in the multivariable model.

Participants were asked whether they consider the verification of drug - drug interactions to be their own responsibility or that of another member of the healthcare team. Most respondents indicated that this task is their own responsibility (n = 66; 66%). Twenty-one physicians (21%) considered that the responsibility lies with the pharmacist within the multidisciplinary team, while 11 respondents (11%) believed that the responsibility is shared between themselves and the multidisciplinary team. A small proportion of participants (n = 2; 2%) considered that verifying drug interactions is primarily the responsibility of the family physician.

Overall, these results suggest that most oncologists and radiotherapists perceive drug - drug interaction checking primarily as their own responsibility, although a considerable proportion recognize the role of pharmacists within the multidisciplinary care team.

When stratified by years of specialist practice, among physicians with 0 to 5 years of experience (n = 43), 29 (67.4%) considered checking drug - drug interactions to be their own responsibility, 8 (18.6%) attributed it to the pharmacist, and 6 (14%) selected multidisciplinary team/other physician's responsibility. In the 5 to 10 years group (n = 24), 18 respondents (75%) selected my responsibility, 4 (16.7%) pharmacist responsibility, and 2 (8.3%) multidisciplinary team/other physician's responsibility. Among specialists with 10 to 20 years of experience (n = 16), 8 (50.0%) considered it their own responsibility, 5 (31.3%) attributed it to the pharmacist, and 3 (18.8%) selected team/other responsibility. In the group with more than 20 years of specialist practice (n = 17), 11 respondents (64.7%) selected my responsibility, 3 (17.6%) pharmacist responsibility, and 3 (17.6%) team/other responsibility.

For inferential analysis, perceived responsibility was grouped as own responsibility *versus* shared/other responsibility and evaluated as a prespecified covariate in the logistic regression model presented above.

Participants were asked whether a guideline on commonly encountered drug-drug interactions in the treatment of oncology patients would be useful. Based on the source database, 97 respondents (97%) answered "yes", whereas three participants (3%) indicated that such a guideline would not be necessary. When stratified by years of specialist practice, all physicians in the 0-5 years group (43/43; 100%) considered such a guideline useful. In the 5-10 years group, 23 of 24 respondents (95.8%) answered "yes"; among specialists with 10-20 years of experience, 15 of 16 (93.8%) answered "yes"; and among those with more than 20 years of practice, 16 of 17 (94.1%) answered "yes".

Overall, these findings indicate a near-unanimous perceived need for a practical drug - drug interaction guideline across all professional experience groups. Given the very small number of negative responses, differences between groups appear minimal and are unlikely to reflect meaningful variation in opinion.

Drug-drug interactions (DDIs) represent a particularly relevant challenge in oncology. Several risk factors contribute to the prevalence of DDIs in oncology, such as polypharmacy, advanced age and multimorbidity, and the use of complex, multi-agent cancer regimens, including targeted therapies (21). The involvement of multiple prescribers and settings, alongside gaps in medication reconciliation, can amplify DDIs risk (22). Additionally, the rise of oral cancer regimens and targeted agents, which often interact with common concomitant drugs such as acid reducers, antibiotics, psychotropics, further elevates DDI risk in cancer patients (23). KAP (knowledge - attitude - practice) assessments illuminate gaps between what oncologists know, how they view interactions, and what they actually implement in daily care, enabling targeted education, policy, and workflow interventions that can reduce potentially harmful DDIs and improve patient safety (24). As published data specifically evaluating Romanian oncologists' and radiotherapists' perceptions of

drug-drug interactions are currently lacking, we developed a survey to evaluate Romanian onco-logists' and radiotherapists' perceptions of DDIs in daily clinical practice.

The study population for our DDI questionnaire was predominantly composed of young physicians, with more than half of the respondents under 40 years of age and nearly half of the respondents being early-career specialists (≤ 5 years). This age and career-stage distribution align with patterns observed in professional-organization surveys of oncology practitioners, where younger cohorts often participate at higher rates and may differ in practice emphasis or familiarity with DDIs compared with more senior colleagues (25). The concentration of early- to mid-career responders has implications for interpreting knowledge and practice data, as it may reflect evolving training priorities and the integration of multidisciplinary pharmacovigilance in oncology care (26). Conversely, it may limit generalizability to practitioners with more experience, that manage DDIs differently.

Self-reported familiarity with DDIs increased weakly with professional experience in this sample, but the association was small. Medical oncologists more frequently reported high familiarity than radiotherapists, which may reflect their greater routine exposure to systemic anticancer therapy and its interaction profile. These findings suggest that specialty-related clinical exposure may influence perceived familiarity; however, the cross-sectional design does not permit causal inference.

The main additional finding of this study is that self-reported DDI familiarity, rather than experience or specialty, independently predicted frequent personal DDI checking. After adjustment, respondents reporting high familiarity had approximately seven-fold higher odds of checking DDIs often or always. Perceiving checking as one's own responsibility was associated with frequent checking in unadjusted analysis but did not remain statistically significant after adjustment. This suggests that practical training and ready access to reliable DDI resources may be more relevant intervention targets than seniority alone, while also supporting pharmacist participation in structured medication-review workflows.

When checking for DDIs, clinicians frequently turn to accessible, commercially or freely available DDI resources as a first-line check, reflecting convenience, familiarity and integration into routine workflows (23). The reliance on Drugs.com specifically is observed in broader surveys of prescribing clinicians where freely accessible databases are commonly cited as practical tools in fast-paced oncology settings (23, 27). These findings suggest that while online DDI databases are widely used as a convenient resource, optimizing patient safety in oncology requires formalized, team-based approaches and standardized reconciliation work-flows beyond individual database checks (28, 29).

Almost all respondents in the source database considered an oncology DDI guideline useful (97%), reinforcing the need for practical tools to standardize screening and management. The convergence of high perceived utility for guidance with incomplete frequent checking suggests an implementation gap: clinicians recognize the value of DDI assessment, but consistent implementation may require integrated workflows, decision-support resources, and pharmacist-led review processes.

This study has several limitations. Its cross-sectional design provides only a snapshot of current perceptions and does not capture changes over time or establish causality. The self-administered ques-tionnaire assesses reported familiarity and behaviour rather than objectively measured competence or observed clinical practice. Although the study gathered 100 responses, the sample remains modest for subgroup and multivariable analyses, and the predominance of early- and mid-career respondents may limit representativeness. The logistic regression was therefore prespecified and parsimonious, and its estimates should be regarded as exploratory; the wide confidence intervals indicate uncertainty that should be narrowed in a larger study. In addition, the binary definition of frequent checking combined "often" and "always" responses and may not fully distinguish routine from universal checking. Finally, voluntary participation may have selected clinicians with greater interest in drug safety or DDIs.

Nevertheless, these limitations do not diminish the value of the study as an initial overview of how Romanian oncologists and radiotherapists perceive the issue of DDIs, particularly among the newer generations of specialists.

Conclusions

Drug-drug interactions (DDIs) represent a clinically significant challenge in oncology practice. In this national survey of Romanian medical oncologists and radiotherapists, frequent personal checking of DDIs was reported by 55% of respondents and the need for a practical oncology DDI guideline was endorsed by 97%. Multivariable analysis identified high self-reported DDI familiarity as an independent predictor of frequent checking, while professional experience and specialty were not independent predictors. These results support educational inter-ventions focused on applied DDI recognition, standardized screening workflows, accessible decision-support resources, and structured integration of pharmacists into oncology care teams. Larger studies using objective measures of DDI knowledge and observed practice are needed to confirm these associations and inform national medication-safety strategies.

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Availability of data and materials

The data generated in the present study are included in the figures and/or tables of this article. The other data generated in the present study may be requested from the corresponding author.

Ethics approval and consent to participate

According to institutional regulations, formal ethical approval was not required for this anonymous questionnaire-based study involving healthcare professionals and no patient-related data. Participation was voluntary and anonymous, and completion of the questionnaire implied informed consent.

AI use disclosure

During the preparation of this manuscript, the author(s) used ChatGPT for editing assistance and language improvement, specifically to improve word choice, readability, and clarity. The author(s) reviewed and revised all outputs from these tools and take(s) full responsibility for the final content of the work.

Conflict of interest

The authors declare no conflict of interest.

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