# *Oral and Subcutaneous Anticancer Therapy Training Course for Non-physician Healthcare Professionals: a Survey Evaluating the Relevance of its Content and its Implications in the Practice of Cancer Care*

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# Oral and Subcutaneous Anticancer Therapy Training Course for Non-physician Healthcare Professionals: a Survey Evaluating the Relevance of its Content and its Implications in the Practice of Cancer Care

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## Abstract

The creation of antitumor agents with an oral or subcutaneous route of administration has had important positive implications in the development of drugs to treat cancers, but issues such as false drug intake, uncontrolled side effects, and limited supervision may jeopardize the ability of these agents to improve treatment. A potential solution is the recruitment of non-physician healthcare professionals (i.e., nurses and physician assistants) and a special training course for them that focuses on the improvement of patient compliance. We developed and implemented three special professional training modules for non-physician healthcare professionals, which focus on the pharmacological aspects and side effects of oral and subcutaneous antitumor medications in regard to management strategies and communication issues that these non-physician healthcare professionals should address. Subsequently, we administered a questionnaire survey evaluating the course content and the implementation of the course in practice to the training participants to collect data for its implementation. Of 165 questionnaires that were administered, 44 (27%) were answered. The participants rated the course as being highly useful for their daily work. The participants reported a significant improvement in their professional expertise from the course. They emphasized the importance of medical topics and practical content to be included in the course delivery. The course encouraged 75% of the responders to start independent consultations with cancer patients that focused on questions of medication adherence for oral and subcutaneous antitumor medications, as well as the management of their side effects. Based on our results, at least a portion of the non-physician healthcare workforce is highly interested in engaging in active and autonomous co-supervision of patients who are treated with oral and subcutaneous antitumor medications. In addition to the theoretical basics of the treatment modalities, educational courses on oral and subcutaneous antitumor medications for non-physician healthcare professionals should focus on practical training and topics relevant to patient care.

**Keywords** Training course · Non-physician healthcare professionals · Oral and subcutaneous antitumor medications · Cancer patients

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## Introduction

Progress in oncology and hematology in recent decades has been conducive to the development of various oral antitumor medications (OAMs) and subcutaneous antitumor medications (SAMs), which have substantially enriched our therapeutic options and improved treatment results for cancer patients. Specifically, a class of drugs called oral tyrosine kinase inhibitors (TKIs) (imatinib, nilotinib, and dasatinib) has enabled highly efficient disease control. For example, it has led to sustainable complete molecular remission in patients with chronic myeloid leukemia (CML) [1]. More recently, oral inhibitors of epidermal growth factor receptor (erlotinib or gefitinib) became a standard first-line therapy for EFGR-mutated metastatic lung adenocarcinoma [2]. In addition to the advantages from the oralization of some conventional intravenous anticancer medications or those resulting from switching to their form that follows a subcutaneous administration, the shift toward OAMs and SAMs by clinicians and oncologists was fast-tracked significantly by the introduction of targeted therapies with outpatient regimens, such as enasidenib, a recently approved oral inhibitor of isocitrate dehydrogenase 2 (IDH2) for patients with acute myeloid leukemia (AML) [3–5]. Thus, within the last decade, OAMs and SAMs have been used in as many as 30–40% of current anticancer medication research projects, and dozens of OAMs have gained approval for use in humans by the US Food and Drug Administration [6–8]. The benefits of OAMs and SAMs over intravenous treatment include fewer hospital visits, freedom from fixed-term parenteral drug applications and intravenous access, minimization of psychological stress through taking the medication in a familiar home environment, and marginal waiting time in medical offices.

Acknowledging all of these benefits of OAMs and SAMs, on the other hand, they may lead sometimes to very complex and poorly predictable adverse effects in patients. Yet, a high demand for the thorough guidance of patients questioning the self-administration of medication, nutrition, and physical behavior has emerged. Thus, patients need to maintain a responsibility and awareness such that the optimal risk-benefit ratio of OAMs/SAMs may be achieved. The ADAGIO study demonstrated that only 14% of CML patients adhered perfectly at an adherence rate of 100% to prescribed imatinib. Consistent with this finding, the patients who showed a suboptimal response in this study had a significantly higher mean percentage of imatinib not taken than did those with an optimal response (23.2% versus 7.3%) [9]. The adherence to OAM and SAM treatment, in turn, may be compromised by either external (e.g., side effects of therapy, information deficiency) or internal factors (e.g., forgetfulness, carelessness, or personal beliefs of patients), both of which result in undertreatment or overtreatment, an inappropriate self-management of adverse effects, and decreased treatment efficacy. [10, 11]

Thus, the former oncology outpatient care system based on the medical control by healthcare professionals one or two times a month before and after parenteral anticancer treatment fails to address all considerations of modern oncology practice, which is increasingly relying on OAMs and SAMs. To prevent the drawbacks accompanying the introduction of OAMs and SAMs, novel patient care approaches have been developed for their implementation, including patient education to improve adherence to oral anticancer medicines [12, 13] and the development of special electronic software assisting patients in navigating treatment at home [14].

In this context, we propose the partial delegation of medication control to non-physician healthcare professionals (NPHCPs, i.e., physician assistants and nurses) to consult with patients who are receiving OAMs or SAMs. Such an approach can provide patients with daily and urgent professional medical support and avoid unnecessary contact with physicians in medical offices. Moreover, additional verbal communication with healthcare workers contributes to patient awareness and enhances adherence to treatment. The supervision of patients receiving OAMs or SAMs by NPHCPs has already proven to be effective in Germany [15, 16]. However, uniform education interventions preparing healthcare professional for this purpose are currently lacking.

Accordingly, we prepared and designed a special comprehensive educational course for NPHCPs, which has been implemented since 2013. At that time point, such a type of course was a pioneer approach in Germany. Here, we report about the results of this training intervention following a questionnaire-based survey given to the participants after the course. Thus, we aimed to evaluate the course program itself, as well its usefulness and applicability in daily and routine practice. We plan to use the results of this study to further develop educational trainings for NPHCPs who work in the field of oncology and administer OAMs and SAMs to their patients.

## Methods

### Course Timeframe and Requirements for Participation

In 2013, we developed three identical basic medical training courses for physician assistants and nurses in two German counties (Lower Saxony and Bavaria). We have subsequently implemented these training courses. Each course has a duration of 45 h, which is spread throughout to two 3-day sessions with an interval of 4 months in between. These training courses aim to provide necessary knowledge and expertise to NPHCPs such that they can independently guide their patients who are treated with OAMs and SAMs (Table 1). Participation in this training course is voluntary. Immediately following the completion of a course program, the participants are required to take a test that confirms their expertise in the field of oncology and treatment regimens

with OAMs or SAMs. It was suggested that an oral exam with open-ended questions related to the total content of the course would be given by the tutors. Following this, attendees received an "Assistant in oral and subcutaneous anticancer therapy" certification provided by the Conference on Oncology Nursing and Pediatric Nursing of the German Cancer Society (Deutsche Krebsgesellschaft, DKG). The speakers were certified. They were long-term experienced tutors (i.e., oncologists and oncology nurses) in outpatient oncology care and medical training.

Analogous to the central standards for outpatient oncologic care in Germany [17], the prerequisite for course enrollment was either the accomplishment of specialization in the field of medical oncology for physician assistants or at least 2 years of working experience for nurses in oncology medical offices or departments.

## Course Program

The course program is focused on the pharmacological mechanisms of OAMs and SAMs (chemotherapy agents, TKIs, antibodies, growth factors, and hormones), as well as the monitoring and management of adverse effects. Aspects of communication with patients and their family members were emphasized and included information about the medication itself, control of patient awareness concerning drug intake regimen, storage of the medication, and the prophylactic management of adverse effects. Particularly, the consequences of failing to adhere to OAMs or SAMs, recommendations for improvement, and limitations of the autonomy of the scope of practice of NPHCPs were discussed. The communication with patients was practiced via role play. The design of the course program considered the results of published studies in the field of OAMs/SAMs management and treatment adherence [9, 18–21].

## Statistical Analysis and Course Assessment

One year after the last course was completed, the participants were asked to answer a questionnaire (provided in the online Supplement), which was developed to assess the course utility and its implementation in a daily routine practice. In addition, epidemiological data, as well as the appropriateness of distinct

**Table 1** Characteristics of a training course for NPHCPs in the field of oncology and who administer OAMs and SAMs and participant demographics according to completed questionnaires

| Parameter | | Results | | |
|---|---|---|---|---|
| Courses, *n* | | 3 | | |
| Course duration, hr | | 45 | | |
| Key topics in course | Pharmacological aspects of OAMs and SAMs | | | |
| | Recognition and management of adverse effects caused by OAMs and SAMs | | | |
| | Communication: Training for patients in how to take OAMs and SAMs, including storage of the medications, prophylaxis of adverse effects, and importance of adherence to therapy | | | |
| Course participants, *n* | | 165 (100%) | | |
| Completed the questionnaire, *n*/% | | 44 (27%) | | |
| Occupation (physician assistant, *n*/%; nurse, *n*/%; others, *n*/%) | | 21 (47.7%) | 21 (47.7%) | 2 (4.6%) |
| Age of participants, yr (median, range) | | 45.5 (22–59) | | |
| Females:males | | 44:0 | | |
| Age by occupation, yr (median, range) | Physician assistant | 38 (22–59) | $p = 0.1353$ | |
| | Nurse | 50 (38–57) | | |
| | Others | 43.5 (37–50) | | |
| General working experience, yr (median, range) | | 25 (2–43) | | |
| General working experience by occupation, yr (median, range) | Physician assistant | 20 (2–43) | $p = 0.293$ | |
| | Nurse | 29 (7–37) | | |
| | Others | 24 (19–29) | | |
| Experience in oncology, yr (median, range) | | 10 (1.5–28) | | |
| Experience in oncology by occupation, yr (median, range) | Physician assistant | 9 (1.5–22) | $p = 0.293$ | |
| | Nurse | 15 (2–28) | | |
| | Others | 11.5 (8–15) | | |

*NPHCPs*, non-physician healthcare professionals; *OAMs*, oral anticancer medications; *SAMs*, subcutaneous anticancer medications

topics for planning future courses, were assessed. For the latter, open-ended questions were used. Each measured variable was rated on a Likert scale from one to ten according to the grade of participant satisfaction. Based on this, all answers were assigned to one of four assessment groups as follows: 1–2, not useful/not important at all; 3–5, less useful/important; 6–7, useful/important; and 8–10, very useful/important. The distribution of variables was reported descriptively; for nominal variables, absolute and relative frequencies were documented. For metric data, the minimum, maximum, mean, and median were calculated. The comparison between distinct participant groups was assessed using the Kruskal-Wallis test. Kendall's Tau correlation coefficient was used to assess the association between two ordinal variables. The significance level was set to $\alpha = 5\%$ for all statistical tests. In cases of multiple testing situations, $p$ values were adjusted with the Holm-Bonferroni method. All analyses were performed using the statistical software R (version 3.1.2, www.r-project.org).

## Results

### Characteristics of the Participants

In total, 165 physician assistants and nurses took part of three consecutive courses delivered in different German cities. Of the total 165, 44 (27%) participants answered the questionnaire that was distributed 1 year after the final course. All responders were female (100%), and they were working either as physician assistants (21/44, 47.7%) or nurses (21/44, 47.7%). The two remaining responders (4.6%) qualified themselves as other non-physician healthcare workers. The median age of the responders was 45.5 years, and this had a range of 22 to 59 years. The median number of years of general medical experience and oncology professional experience was 25 (range, 2–43) and 10 years (range, 1.5–28), respectively. The various occupation groups showed no significant differences regarding age or number of years of general and oncologic professional experience (Table 1).

### Assessment of Course Utility

The course was perceived as very useful in daily routine work (mean, 8.6) among the responders (Table 2). Improvement in professional knowledge was found to be high (mean, 8.9). The responders assessed the received information as being well implementable (mean, 7.0) in their subsequent daily routine practice. One year after the last course had completed, 75% (33/44) of the participants had advised patients under OAMs or SAMs on their own at least once; 22.7% (10/44) had consulted less than five patients; 22.7% (10/44) had more than five but less than 10; 13.6% (6/44) of participants were supervised in up to 20; and 16.0% (7/44) had more than 20 patients each. Yet, the satisfaction rate of NPHCPs in the delegation of OAMs and SAMs therapy subtasks to them was highly appreciated (mean, 6.6). The course was valued to be worth for spending time on it (mean, 9.0). Particularly, a significant correlation ($p = 0.0021$) [22] was found between the categories "usefulness of course in daily and routine work" and "worthiness of time spent on course." In other words, the more courses were valued as useful for daily routine work, the higher worthiness of time spent on courses was given. Notably, the assessment for the course lacked finding a significant difference among the different occupational groups (physician assistants, nurses, and other non-medical healthcare professionals). Indeed, this applied to course utility for professional knowledge and daily work routine, implementation of the new knowledge into daily practice, delegating control of compliance with anticancer therapy, demand of such courses in the future, worthiness of the time spent on the course, and recommendations to other colleagues to participate. The same evaluation categories were assessed separately according to age (< 35, 35–45, and > 45 years), general clinical (< 10, 10–30, and > 30 years), and oncology professional experience (< 5, 5–15, and > 15 years) of the participants. Again, no significant differences were observed among these groups (Supplemental Table S1).

### Satisfaction with Course Content

Taking into account the planning of future courses (Table 2), responders valued especially highly and would like to be trained further in the fields of mechanism of action, implementation, and side effects of OAMs and SAMs and palliative nursing care, as well as in the relevance of internal disorders for oncological patients and prophylactic strategies to prevent burnout. Also important but less valuable for future courses were geriatric oncology and case management topics. On the other hand, topics like clinical investigations and their documentation (GCP), as well as basics of scientific works, showed no significant interest (Table 2). All participants favored providing of similar courses in the future (mean, 9.5) and would recommend it to their colleagues (mean, 9.6) (Table 2).

Considering the open-ended questions, the participants highlighted especially relevant and feasible patient-oriented communication practiced within the course, as well as the recognition and management of side effects of OAMs and SAMs. The responders wished they had more time for practical training within the course, especially in the context of patient education and the side effects of OAMs and SAMs. Moreover, lectures should be accompanied by printed manuals, and refresher courses should be made available. In addition, the theoretical program was found to be too intensive in relation to the course duration. The reasons prohibiting implementation of the course into real practice were reported as

**Table 2** Assessment of the utility of the course and its distinct topics administered to participants and used to guide the planning of future sessions of the course

| Variable | Min. | Median | Mean | Max. |
|---|---|---|---|---|
| Usefulness of course in daily and routine work | 4 | 9 | 8.6 | 10 |
| Improvement of professional knowledge | 7 | 9 | 8.9 | 10 |
| Implementation of new knowledge into daily practice | 1 | 7 | 7.0 | 10 |
| Demand for similar courses in the future | 6 | 10 | 9.5 | 10 |
| Delegation of co-supervision of patients under OAMs and SAMs to course participants | 1 | 7 | 6.6 | 10 |
| Likeliness of course participants to recommend the course to colleagues | 7 | 10 | 9.6 | 10 |
| Worthiness of time spent on course | 3 | 10 | 9.0 | 10 |
| Ability of course participants to consult patients after the course | Consultations (*n*) | | 33/44 (75%) | |
| | < 5 | | 10 (22.7%) | |
| | < 10 | | 10 (22.7%) | |
| | < 20 | | 6 (13.6%) | |
| | > 20 | | 7 (16.0%) | |
| Relevance of topics for future course sessions | | | | |
| Geriatric oncology with comprehensive geriatric assessment | 2 | 7 | 6.9 | 10 |
| Clinical investigation and documentation (e.g., good clinical practices, GCP) basics | 1 | 5 | 5.0 | 10 |
| Scientific works (performing literature searches, composing posters and articles, etc.) | 1 | 5 | 5.2 | 10 |
| Relevance to internal diseases in oncology patients | 4 | 10 | 9.0 | 10 |
| Prophylactic strategies to prevent burnout | 1 | 8.5 | 8.2 | 10 |
| Task management and supervision of the nursing team: Case management, motivation of coworkers, etc. | 1 | 7 | 6.8 | 10 |
| Oncology nursing palliative care basics | 5 | 10 | 8.9 | 10 |
| Improvement of knowledge in the mechanism of action, implementation, and side effects of OAMs and SAMs | 4 | 10 | 9.4 | 10 |

Each parameter was rated on scale from 1 (indicating not useful/not important) to 10 (indicating very useful/very important). *Min.*, minimum; *Max.*, maximum; *OAMs*, oral anticancer medications; *SAMs*, subcutaneous anticancer medications

follows: lack of usage of OAMs and SAMs in the medical office or lack of support from physicians, established control of such patients only by physicians, and shortage of time and personnel.

## Discussion

OAMs and SAMs have been increasingly used in recent years, and this trend is expected to continue further [6, 8]. Accordingly, diligent adherence of cancer patients to OAMs and SAMs supported by optimal treatment supervision is becoming the focus of current concerns in oncologic care. According to WHO research projects, only half of patients take their medications as prescribed [10]. Thus, thorough patient guidance by medical professionals is even more crucial. This holds true especially in the field of oncology, wherein the ignorance of even small details may be transformed clinically into severe side effects, drug resistance, insufficient therapy response, disease progression, and even life-threatening complications [23, 24]. Special training courses for NPHCPs in co-supervising oncologic patients may have a positive impact on patients undergoing therapy with OAMs and SAMs [15, 16, 18]. So far, these programs are still individualized. The results of our study may contribute to further standardization and development of training programs and improve practical approaches for NPHCPs aiming to guide patient treatments with OAMs and SAMs.

No significant differences were documented among any of the different occupational groups (nurses, physician assistants, and other NPHCPs) considering age and duration of working experience. The female preponderance of 100% and the average age of 45.5 years were similar to the distribution documented by the German Federal Statistical Office among NPHCPs (women, 91.1%; average age, 42.6 years) [25].

The response rate of 27% in our study was slightly below the expected average range of 37–57% for medical professionals in general [26–28]. Yet, nurse surveys are prone to a

lower level of response ranging at times, as much as from 20 to 30% according to the literature [29]. A lack of time and an absence of a financial award and of written reminders may contribute to explain this phenomenon, according to the literature [27, 29]. In addition, the interval of the survey performed 1 year after the accomplishment of the last course also contributes the low response rate.

Evaluating the course, the responders emphasized the importance of medical topics (e.g., concomitant disorders of tumor patients, palliative nursing) and practical content (e.g., management of OAMs/SAMs side effects, communication). In addition, the participants put emphasis on practice training used in the course. Yet, the theoretical teaching in the course seemed to be too intensive for the short course duration. The responders showed less interest in additional skills, referring less clearly to direct patient care such as clinical investigations and basic scientific work. These results indicate that the training of practical skills and practice-oriented situations important for everyday care of cancer patients should provide the basis for such courses. Indeed, the benefits of practical trainings have already been demonstrated in nursing education [30]. Repetitive programs were desirable among the participants, and they are already documented as being effective and reasonable in nursing education [31]. As stress and psychological pressure play an increasing role in the success of NPHCPs and may influence their quality of work significantly [32], strategies for burnout prophylaxis were deemed important by the responders. Thus, strategies for preventive stress management should be part of future training content [33].

The co-supervision of patients under OAMs and SAMs therapy administered by NPHCPs has become increasingly important in Germany. Likewise, the benefits of such nurse consultations have been steadily more recognized by doctors [15, 16, 34] and on an international level [13, 18]. Yet, a specialized education program presents a fundamental prerequisite for this new tool of oncologic patient care. All participants who responded perceived the proposed approach as being very positive and indicated that it could improve their professional knowledge and expertise for daily practice. In fact, the course encouraged 75% of the responders to start independent consultations with patients treated with OAMs and SAMs. In particular, seven participants answering the questionnaire in total performed more than 140 OAM or SAM consultations for cancer patients on their own in the first year after the course. Yet, only a portion of the physicians seem to positively recognize and encourage the contribution that NPHCPs provide in the care of patients receiving OAMs or SAMs. The participants frequently reported the lack of support from the physicians as a reason for not being able to implement their knowledge from the course into their professional routine. Therefore, physicians should become more involved and put more attention in delegating therapy subtasks to non-physician professionals in the future.

Interestingly, performing consultations on their own and the implementation of newly learned knowledge into day-to-day practice (Supplemental Table S1) were assessed as being equally high within all age groups and within both occupational groups (physician assistants and nurses). Nevertheless, it should be mentioned that the cohort of participants was, to some extent, biased by the course admission conditions. Specialization in the field of medical oncology for physician assistants and work experience of at least 2 years are required for nurses in oncological medical offices [17]. Thus, the implementation of comparable courses in ambulant oncology seems to be justified for all NPHCPs, independent of age, occupational group, and previous working experience. This already holds true in several regions of Germany where both nurses and physician assistants have consulted patients receiving OAMs and SAMs on their own within a pilot project [15]. Various studies analyzing patient satisfaction and the effects of co-supervision by NPHCPs on the management of side effects and adherence to medication have been initiated (e.g., Eudra-CT Nr.: 2016–000399-28; ClinicalTrials.gov identifier: NCT02828449; NCT03300310). Some of these have already demonstrated a beneficial impact [15, 16, 18]. Similarly, digital approaches for the care of cancer patients and the needs of modern antitumor therapies have gained importance. Recently, Passardi et al. proposed a software system for home-based management of OAMs in which patients may recognize adverse effects and manage them on their own according to instructions [14]. Several digital monitoring systems for oncology care were shown to reduce the side effects and increase overall survival for the patient population [35–37].

Despite these innovations, instructions by electronic devices are perceived correctly by only approximately half of patients [38]. Thus, comprehensive education courses for NPHCPs (physician assistants and nurses) empowering them to guide patients under oral and subcutaneous anticancer therapy deserve even more consideration. Considering the limited availability of such courses at present, oncologists and nursing specialists should emphasize and distribute the establishment and further development of such educational activities in the near future.

## Limitations

Acknowledging the positive assessment of the course by participants but concurrently the below average response rate, selection bias may exist in that only highly interested healthcare workers participated in the program and response survey.

## Conclusions

The co-supervision of cancer patients who are undergoing therapy with OAMs or SAMs by NPHCPs has gained importance in clinical practice. In addition to the theoretical basics of the scientific and medical material, educational courses in oral and subcutaneous anticancer therapy for non-physician healthcare workers should focus particularly on practical training and topics relevant for patient care. Based on our results, at least some of the occupations composing NPHCPs (both nurses and physician assistants) are highly interested in engaging in active and autonomous co-supervision of administering OAMs and SAMs to patients. Further studies will play a decisive role in the implementation of comparable patient care approaches in oncology.

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### Conflicts of Interest/Competing Interests

The authors declare that they have no conflict of interest.

**Consent to Participate** Not applicable.

**Consent for Publication** Not applicable.

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