OPEN ACCESS

Research Article

Database study of lenalidomide (Revlimid®) in Germany: monitoring off-label use

Monitoring des Off-Label-Use von Lenalidomid (Revlimid®) in Deutschland

Michael Dörks[1]
Ingo Langner[1]
Sigrid Behr[1]
Antje Timmer[1]
Edeltraut Garbe[1]

1 Leibniz Institute for Prevention Research and Epidemiology – BIPS GmbH, Bremen, Germany

Abstract

Background: Lenalidomide, a derivate of thalidomide, in combination with dexamethasone is indicated for the treatment of multiple myeloma in patients who have received at least one prior therapy. In the USA, lenalidomide is also licensed for the treatment of a certain form of myelodysplastic syndromes (MDS). Monitoring of off-label use in Germany is part of the risk management plan mandated by the regulatory authority.
Material and methods: Our retrospective epidemiological study was based on claims data of the year 2007 from four statutory health insurances with more than 14 million enrollees. Annual incidence was calculated by dividing the total number of new lenalidomide users by the sum of person-years of the at-risk population. Potential off-label use was identified by an algorithm searching for a diagnosis of multiple myeloma in the quarter of the lenalidomide prescription and the four preceding quarters.
Results: In 2007, 235 lenalidomide users were identified. Incidence of lenalidomide use was 4.0 per 100,000 person years (95% CI: 3.5–4.5). In 40 (17.0%) users of lenalidomide, no diagnosis of multiple myeloma was found. Of the 40 off-label users, 29 (72.5%) had a diagnosis of MDS.
Conclusion: Off-label use of lenalidomide in Germany was low and mainly related to MDS.

Keywords: lenalidomide, off-label use, multiple myeloma

Zusammenfassung

Hintergrund: Lenalidomid, ein Derivat des Thalidomids, ist in Kombination mit Dexamethason indiziert für die Behandlung des multiplen Myeloms bei Patienten, die mindestens eine vorausgegengene Therapie erhalten haben. In den USA ist Lenalidomid zudem zur Behandlung einer Form des Myelodysplastischen Syndroms (MDS) zugelassen. Die Untersuchung des Off-Label-Uses in Deutschland ist Teil eines behördlich geforderten Risikomanagementplanes.
Material und Methoden: Im Rahmen einer retrospektiven epidemiologischen Studie wurden Abrechnungsdaten des Jahres 2007 von vier gesetzlichen Krankenkassen mit mehr als 14 Millionen Versicherten analysiert. Die Inzidenz von Lenalidomid-Verordnungen wurde als Quotient der Erstverschreibungen und der Personenzeit der Versicherten unter Risiko berechnet. Zur Bestimmung des Off-Label-Uses wurden sowohl das Quartal der Lenalidomid-Verordnung, als auch die vier vorherigen Quartale bezüglich einer Diagnose des multiplen Myeloms untersucht.
Ergebnisse: Im Jahre 2007 wurden 235 Patienten mit Lenalidomid behandelt. Die Inzidenz betrug 4,0 pro 100.000 Personenjahre (95% CI: 3,5–4,5). Für 40 (17,0%) der mit Lenalidomid behandelten Patienten konnte keine Diagnose eines multiplen Myeloms identifiziert werden.

Von diesen 40 Patienten wurde für 29 (72,5%) eine Diagnose des MDS ermittelt.
Schlussfolgerung: Der Off-Label-Use von Lenalidomid in Deutschland war geringfügig. Die häufigste Diagnose im Zusammenhang mit einer Off-Label-Verordnung von Lenalidomid stellte das MDS dar.

Schlüsselwörter: Lenalidomid, Off-Label-Use, multiples Myelom

Background

Multiple myeloma is a malignant plasma cell disorder that accounts for approximately 10% of all haematologic cancers. The disease is characterised by monoclonal proliferation of plasma cells in combination with overproduction of a monoclonal antibody, often accompanied by anaemia, hypercalcaemia, renal insufficiency and bone lesions [1].
Lenalidomide has been shown to be an immunomodulator, affecting both cellular and humoral components of the immune system [2]. Lenalidomide also has antiangiogenic properties [2]. On 22 March 2007, the European Medicines Agency's (EMA) Committee for Medicinal Products for Human Use recommended to grant a marketing authorisation for lenalidomide (Revlimid®) [3]. Subsequently, lenalidomide received EU marketing authorisation on 14 June 2007 and was licensed, in combination with dexamethasone, for the second-line therapy of multiple myeloma. The recommended initial dose is 25 mg except for patients with renal insufficiency, for whom a dose adjustment is required [4]. Furthermore, thrombocytopenia and neutropenia will potentially require adjustment of the dosage.
In the USA, lenalidomide is also approved by the Food and Drug Administration (FDA) for the treatment of transfusion-dependent anaemia due to low- or intermediate-1-risk myelodysplastic syndromes (MDS) associated with a deletion 5q cytogenic abnormality with or without additional cytogenic abnormalities [5]. In this respect, an initial dose of 10 mg is recommended in the U.S. Prescribing Information.
Since lenalidomide has a chemical structure resembling thalidomide, a number of measures have been taken to inform prescribers, patients, and pharmacists about the serious risks and safe-use conditions in order to minimise any risk of damage to unborn children of patients [3]. In Germany, a controlled distribution system and a quantitative monitoring of the off-label use of lenalidomide have been achieved by means of the special prescription form of the German Federal Institute for Drugs and Medical Devices (BfArM), referred to as "T-prescription form", introduced on 8 February 2009 [6]. The prescribing physician is required to specify in the designated fields on the T-prescription form whether the prescription is intended for in-label or off-label use. One of the conditions or restrictions with regards to the effective and safe use of the medicinal product, as specified by the marketing authorisation of lenalidomide, refers to the monitoring of the off-label use [7]. The term off-label use refers to the use of a drug outside the terms of its marketing authorisation, including use for an unlicensed indication. Due to its immunomodulatory and antiangiogenic effects, lenalidomide may be used off-label in other not authorised indications. In this case, particular attention must be paid to the teratogenic potential of the drug [8]. The aim of this study was to assess off-label use by indication for lenalidomide in Germany based on claims data. For potential off-label users of lenalidomide, other probable diagnoses of cancer or benign neoplasms were examined.

Methods

Source of data was the German Pharmacoepidemiological Research Database (GePaRD) which consists of claims data from four German statutory health insurances (SHIs) and includes data of more than 14 million insurance members comprising approximately 17% of the population from all regions in Germany [9]. Included in GePaRD are demographic data, hospitalisation data, outpatient prescription data and outpatient care data/diagnoses starting from 1 January 2004. Hospitalisation data comprise admission and discharge diagnoses with their corresponding admission and discharge dates and information on inpatient procedures. Outpatient care data include diagnoses, prescriptions, procedures, and non-drug treatments. All inpatient and outpatient diagnoses are coded according to the German Modification of the International Classification of Diseases, 10th Revision (ICD-10-GM). Outpatient prescription data contain the central pharmaceutical number of the prescribed drugs, the precise dates of prescription and dispensation, and the speciality of the prescribing physician. A pharmaceutical reference database is linked to the prescription data by the central pharmaceutical number. This reference database contains information on the generic and the brand-name of the drug, the defined daily dose (DDD), the Anatomical-Therapeutic-Chemical (ATC) Code, the drug strength, and the packaging size. Preliminary analyses regarding age and sex distribution, the number of hospital admissions, and drug use have shown the database to be representative for Germany [10], [11].
The study was based on data from 14 June 2007 to 31 December 2007. The study start corresponds to the EU marketing authorisation. All cases with a prescription of lenalidomide during this period were categorised as new (incident) users. Incidence of lenalidomide use was calculated by dividing the total number of incident lenalidomide users by the sum of person-years of the population at risk, which comprised all patients who were in-

sured at 14 June 2007. Confidence intervals (95%) were based on a Poisson distribution [12].

For the assessment of off-label use, only patients with a continuous insurance time of at least four quarters preceding the quarter of the lenalidomide prescription until 31 December 2007 or until death were included in the study. In these lenalidomide users, descriptive analyses were conducted with respect to sex and age, occurrence of death and characteristics of lenalidomide use (initial dose, dose changes and frequency of prescriptions). In this latter analysis, the dose was defined as the strength of one tablet. Dose changes were examined for patients who received at least two prescriptions of lenalidomide.

For the assessment of off-label use, diagnoses were considered in both, outpatient and hospital data. Diagnostic certainty is specifically coded for outpatient diagnoses in the database. In this respect, certain and suspected outpatient diagnoses were considered. Multiple myeloma was defined by a code of C90 in the ICD-10-GM Coding System. Potential off-label use of lenalidomide was identified by an algorithm searching for a diagnosis of multiple myeloma made by the prescribing, a hospital-based or any other physician. Once a lenalidomide user received a diagnosis code of C90 in the quarter of the lenalidomide prescription or in one of the four preceding quarters, the prescription was categorised as on-label use and the insurant was categorised as an on-label user. When no code of C90 was found during this time period, the patient was categorised as an off-label user. Patients with off-label use of lenalidomide were described with respect to age and sex. For these off-label users, other potential diagnoses of cancer or benign neoplasms (ICD-10 C00-D48) coded by any physician within the quarter of the lenalidomide prescription were examined.

Ethics

All involved SHIs, the Federal Ministry of Health (for federal SHI data) and the provincial health authority (for regional SHI data) approved the use of the data for this study. The utilisation of SHI data for scientific research is regulated by the Code of Social Law in Germany (SGB X). Informed consent of the involved insurants was not required by law.

Results

The total person-time of the population at risk was 6,680,111 years. Based on this, 264 incident lenalidomide users were identified. The incidence rate of lenalidomide use was 4.0 per 100,000 person years (95% CI: 3.5; 4.5).

For the assessment of off-label use, only patients were considered who had four quarters of continuous insurance time preceding the quarter of the lenalidomide prescription. Overall, 235 patients fulfilled this condition. These patients received a total number of 688 lenalidomide dispensations. Of these, 124 (52.8%) were male. The mean age of patients with lenalidomide prescriptions was 65.6 years. Their age and sex characteristics are displayed in Figure 1. Of the 235 lenalidomide users, 23 (9.8%) died within the study period.

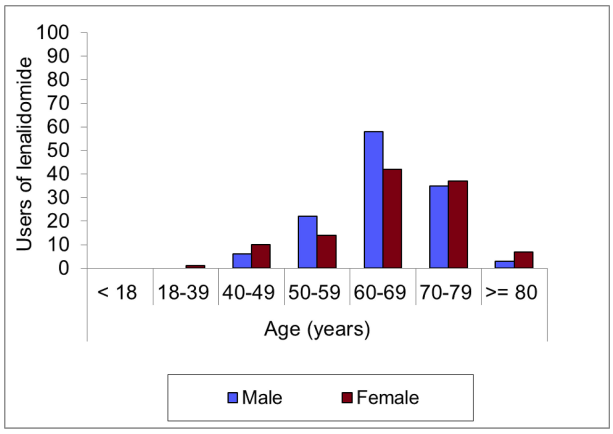

Figure 1: Users of lenalidomide within the German Pharmacoepidemiological Research Database between 14 June 2007 and 31 December 2007 by age and sex

Of all users of lenalidomide, 40 (17.0%) did not have a documented diagnosis of multiple myeloma in the quarter of the lenalidomide prescription or in the preceding four quarters, neither in the ambulatory setting nor in hospital. Of these, 16 were male. The mean age of these off-label users was 69.7 years. Four of them died within the study period. All diagnoses of multiple myeloma were identified in the quarter of the lenalidomide prescription.

An ICD-10 GM diagnosis related to C (cancer) or D (benign neoplasms) diagnoses could be identified for every off-label user of lenalidomide. The most common diagnosis for off-label users was MDS, which is coded by ICD-10 GM code D46. Of the 40 off-label users, 29 had a diagnosis of MDS, seven of whom had a diagnosis of both, MDS and acute myeloid leukaemia (AML, ICD-10 GM code C92.0). There were almost twice as many female off-label users diagnosed with MDS (19) as male ones (10). Four of the off-label users only had a diagnosis of AML without MDS. Further diagnoses for off-label users of lenalidomide were non-Hodgkin lymphoma (6, ICD-10 GM codes C82, C83, C85), leukaemia of unspecified cell types (5, ICD-10 GM code C95) and other neoplasms of uncertain behaviour of lymphoid, haematopoietic and related tissue (5, ICD-10 GM code D47). Table 1 displays the five most frequently identified diagnoses coded by any physician for off-label users in the quarter of the lenalidomide prescription.

Table 2 shows the initial dose of lenalidomide in off- and on-label users as well as dose changes in patients who had more than one lenalidomide prescription. The high initial dose of 25 mg was much more frequently observed in on-label users (65.6%) than in off-label users (5.0%). The most frequently dispensed initial dose in off-label users was 10 mg which was dispensed to 60.0% of all off-label users. Dose changes were observed in 23.7% of all on-label users and in 28.6% of all off-label users who received more than one lenalidomide prescription.

Table 1: The five most frequently identified diagnoses* for off-label users of lenalidomide between 14 June 2007 and 31 December 2007

Probable off-label diagnosis (ICD-10)	Number of off-label users N=40 (%)**
Myelodysplastic syndromes (D46)	29 (72.5%)
Acute myeloid leukaemia (C92.0)	11 (27.5%)
Non-Hodgkin lymphoma (C82, C83, C85)	6 (15.0%)
Leukaemia of unspecified cell type (C95)	5 (12.5%)
Other neoplasms of uncertain behaviour of lymphoid, haematopoietic and related tissue (D47)	5 (12.5%)

* Diagnoses of neoplasms (ICD-10 C00-D48) coded by any physician or in hospital in the quarter of the lenalidomide prescription

** Columns add up to more than 100%, because one patient can contribute to more than one row. For each patient, same diagnoses are only considered once

Table 2: Lenalidomide dose according to on-label use between 14 June 2007 and 31 December 2007

Patients with at least one prescription of lenalidomide	Dose	On-label use N=195 (%)	Off-label use N=40 (%)	Total N=235 (%)
First dose*	5 mg	10 (5.1%)	12 (30.0%)	22 (9.4%)
	10 mg	25 (12.8%)	24 (60.0%)	49 (20.9%)
	15 mg	32 (16.4%)	2 (5.0%)	34 (14.5%)
	25 mg	128 (65.6%)	2 (5.0%)	130 (55.3%)
Patients with > 1 prescription of lenalidomide		**On-label use N=156 (%)**	**Off-label use N=28 (%)**	**Total N=184 (%)**
Constant dose**	5 mg	4 (2.6%)	5 (17.9%)	9 (4.9%)
	10 mg	15 (9.6%)	14 (50.0%)	29 (15.8%)
	15 mg	14 (9.0%)	0 (0.0%)	14 (7.6%)
	25 mg	86 (55.1%)	1 (3.6%)	87 (47.3%)
Changing dose**		37 (23.7%)	8 (28.6%)	45 (24.5%)

* For this analysis of dose, only the first prescription of lenalidomide is considered

** For this analysis of dose, only patients with at least two prescriptions of lenalidomide are considered

Discussion

Off-label use of lenalidomide in Germany was infrequent and in almost three quarters related to a diagnosis of MDS, which is a licensed indication in the USA. Use of lenalidomide for treatment of MDS is included in the guideline of the German Society for Haematology and Oncology (Deutsche Gesellschaft für Hämatologie und Onkologie, DGHO) [13]. Other diagnoses for off-label use included AML and non-Hodgkin lymphoma. Several trials have shown efficacy of lenalidomide in these indications [14], [15], [16].

The Summary of Product Characteristics recommends an initial dose of 25 mg for the treatment of multiple myeloma. This initial dose was observed in 65% of on-label users, but in only 6% of off-label users in whom an initial dose of 10 mg (63%) was most frequently prescribed. This lower dose is recommended for MDS in the U.S. Prescribing Information and accords with our observation of mainly off-label use for MDS. A dosage of 10 mg lenalidomide per day is also mentioned in the corresponding guideline of the DGHO for treatment of MDS with dose adjustment depending on the platelet count [13]. The proportion of patients with dose adjustments was slightly larger in off-label than in on-label users.

The T-prescription forms collected at BfArM provide another data basis to assess off-label use of lenalidomide. Between February and June 2009, 11.1% of all dispensed packages of lenalidomide were identified to be prescribed off-label in a quantitative evaluation by BfArM [17]. This figure is somewhat lower than our estimate of off-label use and could indicate that off-label use has further declined over recent years. Similarly to our study, the evaluation by BfArM found the lower doses (5 mg, 10 mg) to be more often prescribed off-label than the higher doses (15 mg, 25 mg) [17]. Overall, off-label use of lenalidomide is low compared to other drugs used in oncology [18], [19], [20], [21]. An obvious reason is the T-prescription form which is intended to obviate off-label use. It would

be interesting in this respect to compare figures in Germany with those of other countries where the T-prescription form has not been introduced.

Multiple myeloma is commonly first diagnosed in the sixth and seventh decade of life [22]. In our study, lenalidomide users were on average 65.6 years of age which is well in accordance with this. The investigation of pregnancies was not an intention of our study. Due to the advanced age of the identified lenalidomid users, use of lenalidomide in pregnancy is not a major concern in this group of patients.

Some strengths and limitations need to be considered. The study was conducted in a large database which provides data of more than 14 million insurants and therefore enables us to investigate treatment with rather infrequently prescribed drugs such as lenalidomide. The database has been shown in several analyses to be representative for Germany [9], [23] and provides data on the practice of drug prescription in a real-life setting on a population level. Since prescription data are available with the exact date of dispensal, there is a low potential for misclassification of drug exposure as compared to field studies based on interview data. However, we did not have the information whether patients were taking the dispensed drug. Not all variables contained information in the desired detail. Outpatient diagnoses in GePaRD do not have an exact date but are only related to the quarter of a year due to 3-monthly reimbursement. Our study did not assess more recent years, since the most recent update of the GePaRD including all four SHIs at the time of analysis was the year 2007.

In summary, off-label use of lenalidomide in Germany was infrequent and mainly related to MDS. Our study shows that electronic healthcare databases are a valuable source for the investigation of off-label use after licensing, since studies using these data do not influence prescribing behaviour of physicians. This is particularly relevant in the framework of risk management plans for new drugs, where increasingly investigations on off-label use are requested.

Notes

Conflict of interest

The study was financed by Celgene GmbH. The off-label use monitoring is part of the EMA-mandated risk management plan for Revlimid®.

Acknowledgements

The authors are grateful to all statutory health insurances which provided data for this study, namely the AOK Bremen/Bremerhaven, the Techniker Krankenkasse (TK), the DAK-Gesundheit and the hkk. We would also like to thank Manuela Preda and Ursula Helget from Celgene GmbH for their cooperation.

References

1. Maes K, Nemeth E, Roodman GD, Huston A, Esteve F, Freytes C, Callander N, Katodritou E, Tussing-Humphreys L, Rivera S, Vanderkerken K, Lichtenstein A, Ganz T. In anemia of multiple myeloma, hepcidin is induced by increased bone morphogenetic protein 2. Blood. 2010 Nov;116(18):3635-44. DOI: 10.1182/blood-2010-03-274571
2. Kotla V, Goel S, Nischal S, Heuck C, Vivek K, Das B, Verma A. Mechanism of action of lenalidomide in hematological malignancies. J Hematol Oncol. 2009;2:36. DOI: 10.1186/1756-8722-2-36
3. European Medicines Agency. Questions and answers on the positive opinion for Revlimid. London: EMEA; 2007 [cited 09.08.2012]. Available from: http://www.emea.europa.eu/docs/en_GB/document_library/Medicine_QA/2009/12/WC500017172.pdf
4. Rote Liste® Service GmbH. Fachinformation Lenalidomid. In: Rote Liste; 2007. Available from: http://www.fachinfo.de
5. Shah SR, Tran TM. Lenalidomide in myelodysplastic syndrome and multiple myeloma. Drugs. 2007;67(13):1869-81. DOI: 10.2165/00003495-200767130-00005
6. Bundesinstitut für Arzneimittel und Medizinprodukte. Erfahrungen mit dem Sonderrezept (T-Rezept) für Thalidomid und Lenalidomid. BfArM; 2009 [cited 09.08.2012]. Available from: http://www.bfarm.de/SharedDocs/1_Downloads/DE/Pharmakovigilanz/gremien/RoutinesitzungPar63AMG/64Sitzung/pkt-5-1.pdf
7. Bundesinstitut für Arzneimittel und Medizinprodukte. Thalidomid/Lenalidomide: Bedingungen für das Inverkehrbringen aus den zentralen Zulassungsverfahren. BfArM; 2007 [cited 09.08.2012]. Available from: http://www.bfarm.de/cae/servlet/contentblob/1019280/publicationFile/79256/pkt-3-1-3.pdf
8. Arzneimittelkommission der deutschen Ärzteschaft. Information für Ärzte zur Verordnung von Lenalidomid- und Thalidomid-haltigen Arzneimitteln. Dtsch Ärztebl. 2009;106:206-7.
9. Pigeot I, Ahrens W. Establishment of a pharmacoepidemiological database in Germany: methodological potential, scientific value and practical limitations. Pharmacoepidemiol Drug Saf. 2008 Mar;17(3):215-23. DOI: 10.1002/pds.1545
10. Schink T, Garbe E. Assessment of the representativity of in-patient hospital diagnoses in the German Pharmacoepidemiological Research Database. 26th International Conference on Pharmacoepidemiology & Therapeutic Risk Management (ICPE); 19.-22. August 2010; Brighton, England, p 420.
11. Schink T, Garbe E. Representativity of dispensations of non-steroidal anti-inflammatory drugs (NSAIDs) in the German Pharmacoepidemiological Research Database. 26th International Conference on Pharmacoepidemiology & Therapeutic Risk Management (ICPE); 19.-22. August 2010; Brighton, England. p 695.
12. Daly LE. Confidence limits made easy: interval estimation using a substitution method. Am J Epidemiol. 1998 Apr;147(8):783-90. DOI: 10.1093/oxfordjournals.aje.a009523
13. Hofmann W-K, Platzbecker U, Mahlknecht U, Stauder R, Passweg J, Germing U. Myelodysplatische Syndrome (MDS). In: Onkopedia Leitlinien. [cited 09.08.2012]. Available from: http://www.dgho-onkopedia.de/de/onkopedia/leitlinien/mds
14. Fehniger TA, Uy GL, Trinkaus K, Nelson AD, Demland J, Abboud CN, Cashen AF, Stockerl-Goldstein KE, Westervelt P, DiPersio JF, Vij R. A phase 2 study of high-dose lenalidomide as initial therapy for older patients with acute myeloid leukemia. Blood. 2011 Feb;117(6):1828-33. DOI: 10.1182/blood-2010-07-297143

15. Witzig TE, Wiernik PH, Moore T, Reeder C, Cole C, Justice G, Kaplan H, Voralia M, Pietronigro D, Takeshita K, Ervin-Haynes A, Zeldis JB, Vose JM. Lenalidomide oral monotherapy produces durable responses in relapsed or refractory indolent non-Hodgkin's Lymphoma. J Clin Oncol. 2009 Nov;27(32):5404-9. DOI: 10.1200/JCO.2008.21.1169

16. Wiernik PH, Lossos IS, Tuscano JM, Justice G, Vose JM, Cole CE, Lam W, McBride K, Wride K, Pietronigro D, Takeshita K, Ervin-Haynes A, Zeldis JB, Habermann TM. Lenalidomide monotherapy in relapsed or refractory aggressive non-Hodgkin's lymphoma. J Clin Oncol. 2008 Oct;26(30):4952-7. DOI: 10.1200/JCO.2007.15.3429

17. Bundesinstitut für Arzneimittel und Medizinprodukte. Erfahrungen mit dem Sonderrezept (T-Rezept) für Thalidomid und Lenalidomid. BfArM; 2009 [cited 09.08.2012]. Available from: http://www.bfarm.de/SharedDocs/1_Downloads/DE/Pharmakovigilanz/gremien/RoutinesitzungPar63AMG/65Sitzung/pkt-3-3-1.pdf;jsessionid=2E6481E8801D8687A53EB78A2E956D06.1_cid094?__blob=publicationFile

18. Lerose R, Musto P, Aieta M, Papa C, Tartarone A. Off-label use of anti-cancer drugs between clinical practice and research: the Italian experience. Eur J Clin Pharmacol. 2012 May;68(5):505-12. DOI: 10.1007/s00228-011-1173-6

19. Pfister DG. Off-label use of oncology drugs: the need for more data and then some. J Clin Oncol. 2012 Feb;30(6):584-6. DOI: 10.1200/JCO.2011.38.5567

20. Weissbach L, Riese J. Off-Label-Use in der Onkologie: ein Thema ohne Ende?! [Off-label use in oncology: an inexhaustible topic?!]. Urologe A. 2006 Nov;45(11):1410, 1412-4. DOI: 10.1007/s00120-006-1223-3

21. Weißbach L, Boedefeld EA. Off-Label-Verordnungen in der Onkologie. Bundesgesundheitsblatt, Gesundheitsforschung, Gesundheitsschutz. 2003;462-66. DOI: 10.1007/s00103-003-0625-2

22. Hillengaß J, Goldschmidt H. Multiples Myelom Epidemiologie und Stadieneinteilung. Onkologe. 2010;16:225-231. DOI: 10.1007/s00761-010-1792-z

23. Schink T, Behr S, Garbe E. Externe Validierung von Verschreibungsdaten nichtsteroidaler Antirheumatika anhand des Arzneiverordnungs-Reports. In: 54. Jahrestagung der Deutschen Gesellschaft für Medizinische Informatik, Biometrie und Epidemiologie (gmds). Essen, 07.-10.09.2009. Düsseldorf: German Medical Science GMS Publishing House; 2009. Doc09gmds281. DOI: 10.3205/09gmds281

Corresponding author:
Edeltraut Garbe
Leibniz Institute for Prevention Research and Epidemiology – BIPS GmbH, Achterstr. 30, 28359 Bremen, Germany, Phone: +49-(0)421-21856862, Fax: +49-(0)421-21856861
garbe@bips.uni-bremen.de

Please cite as
Dörks M, Langner I, Behr S, Timmer A, Garbe E. Database study of lenalidomide (Revlimid®) in Germany: monitoring off-label use. GMS Med Inform Biom Epidemiol. 2013;9(3):Doc12. DOI: 10.3205/mibe000140, URN: urn:nbn:de:0183-mibe0001403

This article is freely available from
http://www.egms.de/en/journals/mibe/2013-9/mibe000140.shtml

Published: *2013-07-10*