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# Two-Sided Markets at Netdosis

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## Case-2013-02-Netdosis-Two-Sided-Markets

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### 1 Introduction

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It was early in the morning of January 8, 2013. Markus Stipp, the CEO of Netdosis Aktiengesellschaft (AG), was sitting in his office at the Friedrich-Alexander-University Erlangen-Nürnberg (FAU) technology campus. He was in a meeting with Christoph Wille, CFO of Netdosis AG, about reviewing recent developments of Netdosis and discussing how the business should carry on. Netdosis was a web portal for pediatricians to share knowledge. It had created and was operating a two-sided market consisting of pediatricians on one side and pharmaceutical companies on the other.

Two-sided (or more generally multi-sided) markets are markets in which one or several platforms enable interactions between market participants and try to get the two (or multiple) sides (named the sellers' and the buyers' side) "on board" by enabling selling and buying opportunities. The market operator typically charged each side for use of the platform (Rochet and Tirole, 2003). For instance, Health Maintenance Organizations (HMO) act as platforms that link patients to health-care providers. In Netdosis' case the platform links the sellers' side of pediatricians (information provider) to the buyers' side including pediatricians (information receiver), pharmaceutical companies and hospitals.

Like the century-old chicken and egg problem, startup companies trying to establish two-sided markets are difficult to get off the ground. They need a large number of buyers for the sellers to be interested as well as a lot of sellers for the buyers to be interested. Thus, Stipp and Wille faced several important questions. Was a two-sided market achievable? Would it be sustainable for the business? Was Netdosis allowed to sell any data they received, taking legal and ethical issues into account? How to satisfy the two sides of the market? How to balance each side? These questions had to be answered in order to run a successful business.

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## 2 The Company

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### 2.1 Founding of the Company

In 2010, Stipp was performing his Diplomarbeit with Prof. Dr. Dirk Riehle, a professor at FAU. At that time, Stipp took the Agile Method and Open Source (AMOS) course, in which he led a course project with Prof. Riehle and a medical doctor from Cologne. The three of them conceived and developed an online wiki for drug dosage information for pediatricians. On the original idea of creating this wiki, Stipp had to say:

“When a medical doctor encounters a difficult case of determining drug dosage, he or she would research online. Some of them might write the dosage information down in a scrap-book and carry it around with them. Whenever they need help or gain new experience, they could refer to the scrap-book as well as add new dosage information to it. Therefore, the original idea was born to provide a wiki where doctors could sign up and provide their experiences.

“The wiki aims to replace the scrap-book. We noticed that most information is for adult patients, not for children or adolescents. One reason for the missing information about children is because it is hard to find ill children for study. The other reason is a financial issue — it is usually economically less interesting for pharmaceutical companies to license a product for children. So we set pediatrician as the target market.”

Based on the wiki idea, Stipp, Prof. Riehle, the medical doctor and some students developed a web portal named Mydosis. Scrum, the main agile development methodology taught in the AMOS course, was used as the development method for the Mydosis project. In the Scrum method, there are three roles, namely: product owner, Scrum master and Scrum team. Stipp played the role of product owner in the Scrum team and worked closely with the doctor who provided the requirements. A group of students took the responsibility of programming the *Mydosis Web Portal*, providing webpages to input and view data. Another group of students developed a mobile application using the Android system.

Three months later, when the AMOS course was completed, a web portal and an application with a very simple user interface design were delivered as a result of the efforts. Prof. Riehle thought that the project was successful and showed interest to make this business idea a reality. He asked the class if anyone was interested in joining the development. Stipp recalled:

“The project was finished and I wrote my Diplomarbeit about it. In November 2010, I finished my degree and was looking for a job. Then the question came up ‘How do we carry on?’ It is both about the project and me.”

After discussing with Prof. Riehle and the doctor, the decision to carry on with Mydosis was made. The doctor’s brother who happened to be a web designer, was introduced into the project. He adjusted the user interface and customized the web portal using HyperText

Markup Language (HTML)<sup>1</sup> developed by the students. In November 2010, Mydosis was launched. With the support of advertisements in December 2010, around 30 to 40 users registered for Mydosis. In February 2011, an Android application was rolled out and uploaded into the application store. By the end of 2011, the total number of online users reached 500.

Wille, an information systems student of FAU's *International Information Systems* degree program, was present when Prof. Riehle asked about students' interest in Mydosis. In October 2010, he called Stipp and expressed an interest in the business. While Prof. Riehle and Stipp tried to obtain funding from EXIST<sup>2</sup>, Wille was creating the business plan with Stipp. They collaborated using an online communications tool called Skype as Wille was doing his exchange semester in Mexico. In the end, a business model with two-sided markets was chosen with the help of Prof. Riehle and the funding request was handed in January 2011. The business model was that, on one side, the *Mydosis Web Portal* was open to pediatricians to provide information and learn from each other. On the other side the portal aimed to sell information to pharmaceutical companies.

In April 2011, Mydosis received EXIST funding for three people. At that time, one other person had dropped out and Mydosis needed to add a third person since there were only Stipp and Wille. In September 2011, Johannes Link, who was working as a freelance software developer, found the business interesting and joined the team as a programmer.

In August 2011, the medical doctor from Cologne quit the group due to family commitments. Later, they found a replacement from the Erlangen University Hospital and started a partnership with the hospital in October 2011. Working with a hospital provided credibility about the quality of the drug dosage data. In spring 2012, Mydosis developed a software which allowed Erlangen University Hospital to input their dosage information in a structured form.

Between January and April 2012, Mydosis participated in a business plan competition. Their entry was on how to expand the influence of a web portal as well as promote the business. This business plan ranked among the top 20 entries in first and second rounds.

Next, Mydosis developed and provided *Mydosis Formula* where Erlangen hospital pediatricians could input drug dosage experiences in text format. Mydosis Formula then extracted the drug dosage information from these inputs and published it to the *Mydosis Web Portal*. This also meant that the content was highly dependent on the active participation of Erlangen hospital. When reviewing the content of Mydosis, Stipp, Wille and Link realized that it took a long time to get information from the hospital and the doctors because and they were unable to create a community around Mydosis. Besides, Mydosis appeared to be only a student project. In June 2012, Mydosis was shut down but it was not the end of road for the business idea. Learning the lessons from Mydosis, the founders realized that it was critical to have content to attract more users in the startup phase. Stipp, Wille and Link adjusted their business model by deciding to hire and pay medical doctors to input the data and to open the market to the potential customers like hospitals, pharmaceutical companies and individual pediatricians.

In July 2012, Netdosis AG was founded. It quickly reconnected with FAU to carry on the business. Stipp became the CEO, Wille the CFO and Link the CTO (see Exhibit 1). Link de-

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1 HTML is the main markup language for creating web pages that can be displayed in a web browser.

2 EXIST is a support program of the Federal Ministry of Economics and Technology aimed at improving the entrepreneurial environment at universities and research institutions and at increasing the number of technology and knowledge based business startups. The EXIST program is part of the German government's "High Strategy for Germany" and is co-financed by funding of the European Social Fund.

veloped a new software for a new database. This software then was used to generate the public drug dosage information database.

On their way to form Netdosis AG, Stipp, Wille and Link experienced typical startup problems such as unstable personnel, funding, expanding the business as well as finding potential customers. They solved these issues and the company was now moving on to new challenges.

## 2.2 Netdosis Business Model

In the field of medicine, a ‘clinical incident’ is defined as: “an adverse health care event or omission arising during clinical care and causing physical or psychological injury to a patient” (University Hospital South Manchester, 2013, p. 1). Numerous international studies have shown that medication errors rank among the ten most common causes of death in patients in clinical incidents (Rall and Oberfrank, 2006). A medication-related clinical error can occur at any point in the system, from ordering the medicine and prescribing to medicine supply or administration. The most frequently reported types of medication errors or incidents involve: wrong dose, omitted or delayed medicines and wrong medicine (National Health Services, 2013). The rate of medication errors varies by age group. The second highest rate of medication errors occurred in the 0-9 year age group. According to an analysis by Dr. Torsten Hoppe-Tichy of Heidelberg University Clinic, around 10 per cent of all medication prescribed to children were in error (see Figure 1).

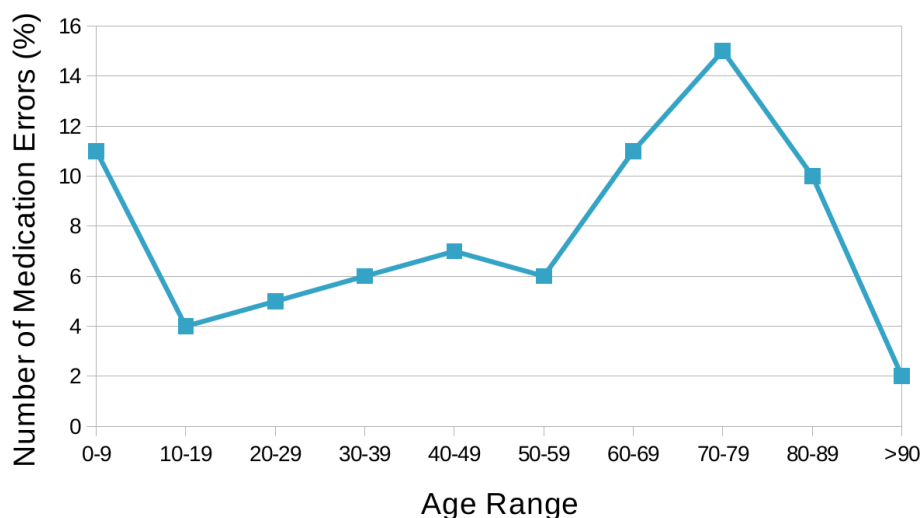


Figure 1: Age group percentage in medication errors (Hoppe-Tichy, 2010, p. 5)

For a startup company with a two-sided markets business model, it is important to think about how niche-focussed the company should be with the first iteration of the product. The more niche it goes, the smaller the market becomes. The smaller the market, the easier it is to gain a critical mass within it and become the de facto product for the audience. In addition, the smaller and more focused the market definition, the more the company can customize its offerings which will make the product a better option than the others (Gascoigne, 2013). Facebook gained popularity and spread widely in the early days when it only supported Harvard and other colleges in the United States of America (Gascoigne, 2013) rather than the broad audience it attracted later.

Netdosis provides services to practicing pediatricians. The Netdosis business model is depicted below in a two-sided markets format (see Figure 2). At the top, Netdosis products serve as the platform to interact between the seller side (left side) which contributes the data and the buyer side (right side) which consumes the data. The interaction happens, for example, when a pharmaceutical company pays for data contributed by pediatricians.

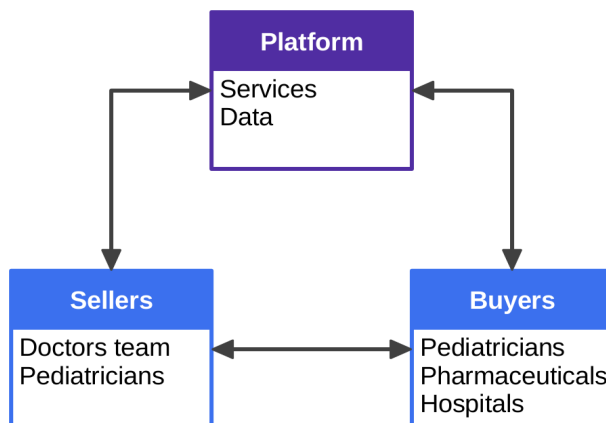



Figure 2: Netdosis Two-Sided Markets Business Model

## 2.3 Netdosis Products

Pediatricians, entering drug dosage information, use the *Netdosis Editor*. When the small  icon (see Exhibit 2) in the dosage information frame is clicked, a page will pop up allowing a pediatrician to input the dosage information for various age groups. It offers different text fields for age, single dose, daily dose, frequency of the dose and the approved option with which the dosage information could be published and read by other users. The inputted data is stored in the corresponding structured database.

There are two ways for users to view the information. One way is through the *Netdosis Web Portal*. The other way is through the mobile application. Using the mobile application users can check the dosage information offline which is convenient when there is no Internet. The homepage of Netdosis Web Portal lists the active ingredients with a quick description of function of the product (see Exhibit 3). When an ingredient is chosen, for example “Abacavir”, the dosage information of “Abacavir” is shown (see Exhibit 4). It lists the directions for use (e.g.: Oral or external) and licensed dosage information. In addition to this, the users can pay for privileged access which enables them to read comments by pediatricians discussing off-label use. It could easily search and list all the active ingredients already saved in the database and the off-label items among them. It offers active ingredient as well as treatment area search function which makes it convenient for the users to find exactly what they want.

Netdosis aims to create a high-quality drug dosage information database in which the data is stored in a structured way (see Exhibit 5). Therefore, the dosage information is not just stored in text form. If it were only stored in a text form in the database, it would be difficult to generate useful analytical data for data mining purposes.

Generally, data mining (sometimes called data or knowledge discovery) is the process of analyzing data from different perspectives and summarizing it into useful information that can be used to increase revenue, cut costs or both. With a structured database, the search functions can be easily executed with simple Structured Query Language (SQL) syntax. It is also conve-

nient to do data mining, which can provide more valuable data to the clients and generate useful reports to the clients based on their requirement. For example, a client might be interested in the dosage information of off-label use of all ingredients for the age group of less than one month. Compared to listing all the dosage information on one page, the information obtained from data mining is much more valuable.

The Netdosis website and mobile application also allow pediatricians to discuss the drug dosage information they enter and any concerns they may have. Sentiment analysis can be applied to the comments of pediatricians. Generally speaking, sentiment analysis aims to determine the attitude of a speaker or a writer with respect to a topic. Netdosis provides functionality for listing differing opinions of two pediatricians, on which other pediatricians can comment. Sentiment analysis can infer both positive and negative attitudes of the opinion. The user can form an opinion more quickly by directly viewing the information without having to search for it. Netdosis buyers like pharmaceutical companies were very interested in learning about difficult drug dosage situations.

## 2.4 Seller Side of Netdosis

For a newly launched website that is unknown to most people, it is hard to attract users to join, if there is no useful data in the website. The more data there is, the more valuable the site becomes to the users. Therefore, the internal doctors team of Netdosis inputs the dosage information to make sure the Netdosis database has enough starting data which will spur potential clients ('Buyer' in Figure 2) to start using Netdosis. The internal doctors team has privileged permission to approve the dosage information added to the database. Once the information is approved, it will be published and displayed on the web portal. Having an internal team of doctors is only a strategy to get started. The final aim of Netdosis is to build a large community of pediatricians willing to share their treatment dosage information, input their medical experiences and comment on others' information: a product with information "by doctors, for doctors". As of January 2013, there were 150 registered users in Netdosis. On average, there were about 1000 visits per month.

## 2.5 Buyer Side of Netdosis

Speaking of Netdosis' potential clients, Stipp had to say:

"We have developed a new software with a structured database which makes our pediatric data more valuable and meaningful to users. As a startup company, we need to find customers who are interested in our data."

As shown in Figure 2, the buyer side is segmented into three main areas: individual pediatricians, pharmaceutical companies and hospitals. Normally, when the pediatricians do not know how to prescribe for a disease or if they are not sure how much to prescribe, they check medical books or just call and ask their doctor friends. This method is time-consuming and inconvenient. The pediatrician may also feel pressurized when parents inform the pediatrician of a particular treatment that they might not know about. Then they face a situation where they might lose the customer. The individual pediatrician will be the one who directly benefits from Netdosis and is thereby considered Netdosis' target customer for the data.

Meanwhile, the pharmaceutical companies are also concerned about the dosage information data — especially those about off-label drug use. "Off-label" use of drugs means the use of

drugs in situations for which they have not been declared nor approved. The use of the drug is not “on the label” coming with the drug package.

Off-label use is a common (and legal) practice. For example, for many illnesses, there are no official drugs approved to cure it. Thus the patient may have to rely on drugs to survive that have not been approved for curing the illness at hand. According to the law, the pharmaceutical companies are not allowed to promote off-label drug use. But the process of approving a drug is complex and time and cost consuming. The dosage information provides practical statistics to the pharmaceutical companies when they market to their clients. Therefore, Stipp believes that the pharmaceutical companies will be interested in this information and views companies as future paying customers.

Netdosis’ former incarnation — Mydosis — had a cooperation with Erlangen University Hospital. A hospital typically follows standard procedures from the time the patient comes to the receptionist until the services are rendered to the patient. Streamlining these procedures helps in improving the efficiency and productivity of the hospital. Considering this need, the *Netdosis Software* supports hospitals and helps standardize their procedures. Depending on the requirements of a hospital, Netdosis either installs only the software while the data is stored in the central database of Netdosis or sets up the whole technical environment at the hospital so that they could have their own database. In the second situation, the isolated database of the hospital cannot be accessed by Netdosis. The customers pay an annual fee for the software and database, and the Netdosis updates the software as well as the database every three months for its customers.

## 2.6 How to Satisfy Each Side?

By charging each side, platforms attempt to make money. But in the two-sided markets theory, price is different or discriminated between two distinct groups of users. In addition, the question how to sell one group’s information to another group, never goes away. Hence, it is necessary to get the pricing strategy right, in order to be profitable. This is one of the key challenges in two-sided markets. One principle in the price strategy is to subsidize one user group while charging the other a premium for access to the subsidized group.

The reason for subsidizing one group of users is because the two groups have different quality- and price-sensitivity. For example, Adobe’s Acrobat PDF market comprises document readers and writers. Readers pay nothing for Acrobat software. The document producers however, who prize this 500-million-strong audience, had to pay US\$299 in 2013. If the PDF document readers were charged even a tiny amount, Adobe Acrobat Reader’s reader-base would dwindle, lowering the document producers’ interest and their willingness to pay a premium for access to the reader. This is because, the readers who are much more price-sensitive than document producers, wouldn’t pay for access to a bigger base of writers. Thus, it is better to charge the group that is not price sensitive.

Even after the price strategy is set, changing the price will cause a problems later. The Compact Disc Database (CDDDB) was a large Internet database containing information about thousands of CDs (Gracenote, 2013). Early announcements asserted that access to the CDDDB service would remain 100 per cent free to software developers and consumers (Gracenote, 2013, para. 2). At some point, CDDDB was renamed Gracenote. The owners decided that they needed to make money by starting to charge the developers to use their new CDDDB2 technology whilst phasing out the original version of CDDDB. The developers did not like being charged for the service and set up freeDB to provide a similar service for free. Consequently,

Gracernote lost a large part of its developer- and customer-base. They later realized their mistake and made CDDDB2 free to use in non-commercial applications.

Coming back to the two-sided market of Netdosis, pediatricians might feel protective of their medical experience and chose not to share it with others. They might fear that they lose a knowledge advantage and subsequently their patients as well. Also, medical doctors are highly aware of media attention because bad coverage might ruin their reputation. If a product of a pharmaceutical company is discovered to have serious problems, it is likely to receive negative media coverage. Thus, medical doctors might not want to be on the record for using this product.

Netdosis also faces the problem of whether the pediatricians would want to input the information on a public website. If they choose to do so, do they allow Netdosis to sell their information to other pediatricians and pharmaceutical companies? Netdosis has to figure out the challenge on how to satisfy the pediatricians as well as the pharmaceutical companies by offering what they really want.

Other than that, in two-sided markets, the two groups are closely connected and the value of one group highly depends on the numbers of the other group. If there are not enough users on the left side (Figure 2), it is harder to maintain revenues on the right side. It is also difficult to distinguish whether a pediatrician belongs to the price-sensitive group or the group that is not price sensitive since pediatricians exist on both sides. Balancing each side is one of the biggest challenges that Netdosis has to solve.

As long as pediatricians provide drug dosage information, Netdosis does not charge them for basic access to the website. Even more, Netdosis offers them a discount when they want to buy software and data for use in their practice. For non-discounted access, Netdosis charges a €50 fee for annual access.

Netdosis also offers a software tool to hospitals. For example, a hospital normally has a standard procedure to take care of patients. Netdosis offers a tool to help the hospital efficiently standardize their procedure and manage it better. If the hospital creates its own drug dosage data and would be willing to share its knowledge, then Netdosis would offer a reduced price for the software. The price for each hospital is different depending on the size of the hospital — roughly between €3,000 and €10,000. In the beginning, Netdosis was cooperating with just one hospital: Erlangen University Children's Hospital. Later, it approached the German Center for Children- and Youth Rheumatology in Garmisch-Partenkirchen. Also, Netdosis had its eyes set on cooperation with pharmaceutical companies.

From a marketing point of view, Netdosis encountered an interesting challenge. The older generation of the pediatricians often did not use new technologies like mobile applications. They might have a computer but without an Internet connection. As Markus Stipp explained:

“We had to start with the younger generation. We believe, the older generation will be pressured later into using Netdosis because their patients might tell them that they have read something on the Internet and why the pediatricians did not offer similar services.”



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## 3 The Markets

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Netdosis is looking to sell to pediatricians, pharmaceuticals, and hospitals.

### 3.1 Practicing Pediatricians

Pediatricians deal with health of children. Pediatric medicine is different from adult medicine. Since the body size differs, congenital defects, genetic variance and developmental issues are of greater concern to pediatricians than to adult physicians. The pediatrician has to calculate the dose based on the child's weight. A child cannot make decisions for themselves. The issues of guardianship, privacy, legal responsibility and informed consent must always be considered in every pediatric procedure.

According to the statistics provided by the German Medical Association (American Cancer Society, 2013), there are 13,179 working pediatricians in Germany. As shown in Figure 3, young pediatricians under 35 years of age, account for only 3.83 per cent of the total number of pediatricians in Germany. The highest number of pediatricians belong to 50-59 age group (33.27 per cent), followed by the 40-49 age group.

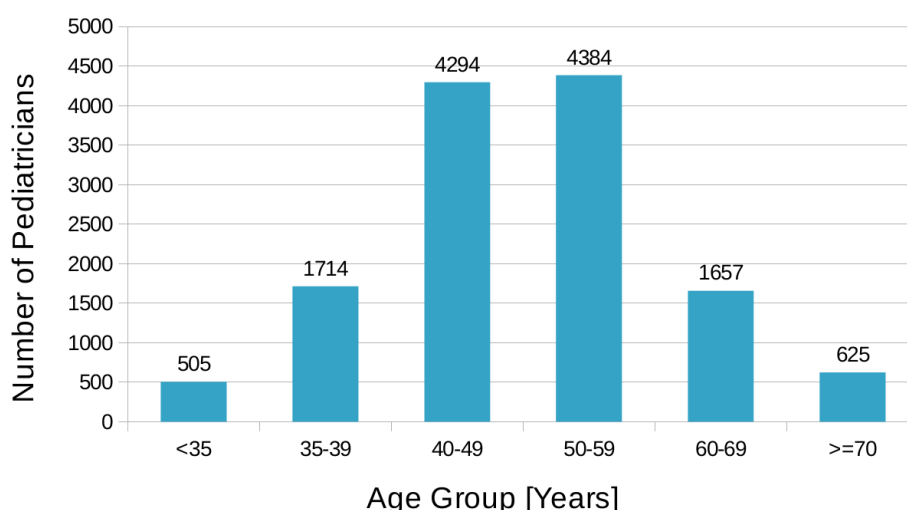


Figure 3: Number of pediatricians in different age groups (German Medical Association, 2013)

A report by the National Association of Statutory Health Insurance Physicians in Germany, chose the second quarter of 2011 and 2012 to do a comparison of incomes of pediatricians in Germany (Figure 4). Although, the average revenue of each pediatrician did not see a major difference, it did decline by 0.9 per cent from 2011 to 2012 (Hagiu and Wright, 2011).

Surveys of pediatricians in Germany report low levels of job satisfaction. According to a data collection experiment, a pediatrician's workday lasted 9 hours and 18 minutes on average. The time allocation of a typical pediatrician on a workday is displayed in Figure 5.

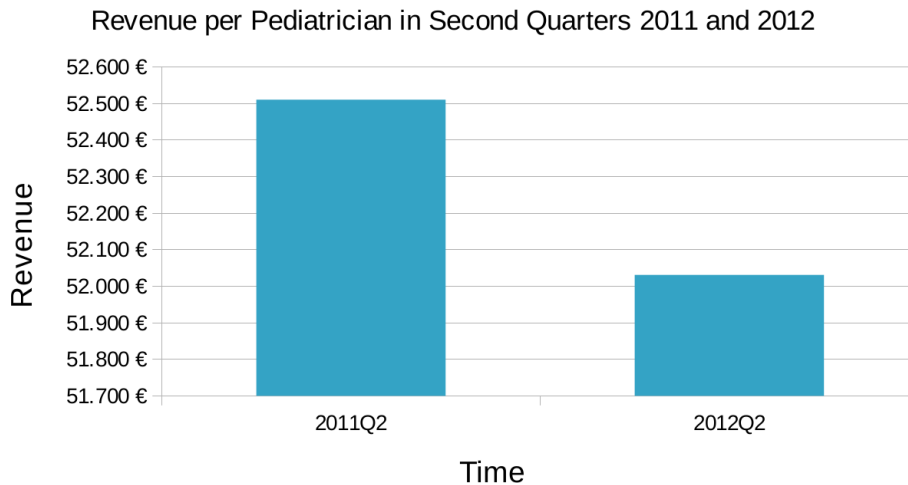


Figure 4: Average Revenue per Pediatrician in Germany (Kassenärztliche Vereinigung, 2012, p. 8)

From June 2006 to June 2007 a study evaluating off-label use was performed among 215 physicians at 43 German universities and academic teaching hospitals. In the results of the study (Ditsch et al., 2011), off-label use was found to be common among 91 per cent of the physicians. A major part of the information about off-label use was obtained from personal information of colleagues (66 per cent) and their own experiences (58 per cent). Furthermore, 83 per cent of the information about off-label use was extracted from technical literature and 63 per cent from medical conventions. Half of the physicians get information from product description provided by the drug producer (51 per cent), while a smaller percentage of physicians get their information through legal advice (17 per cent) and even less (8 per cent) obtain it from the Internet.

### Pediatrician's Task Percentage

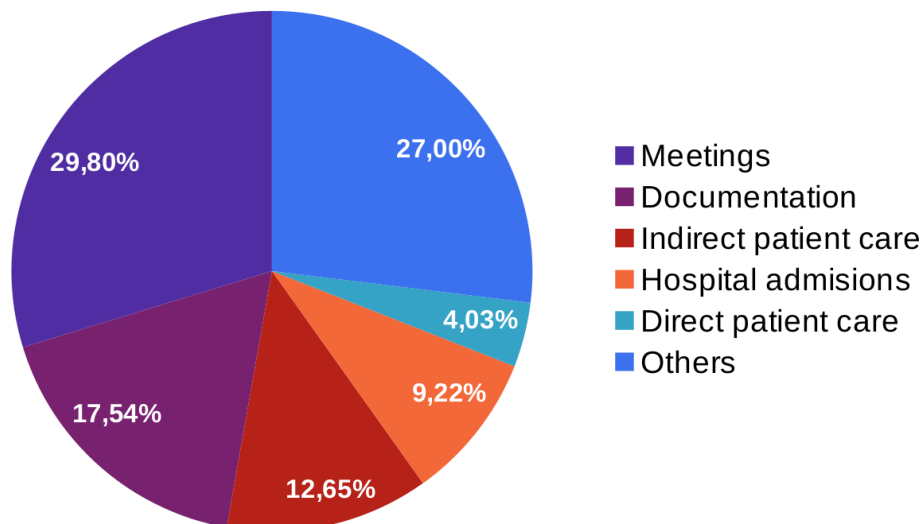


Figure 5: Pediatrician's task division in a workday (based on (Conroy et al., 2000))

Development of new technology influences pediatrics. One way of using technology to support medical doctors is to digitize the paper medical records. Pediatricians are increasingly using various information technology systems in order to quickly retrieve and store patient medical records.

Another important way of integrating technology in pediatricians' practice is through mobile technology. Mobile applications allow pediatricians to immediately access information they might not be able to get readily. Despite the increasing influence of technology in pediatrics, different generations of pediatricians have different opinions on adoption of computer technology in the industry. For example, the younger generations who grew up with social networking and mobile applications easily integrate new technology into their work. It might take a bit longer for the older generation, who are used to books and experiences, to accept new technologies.

## 3.2 Pharmaceutical Industry

The pharmaceutical industry develops, produces and markets drugs or pharmaceuticals licensed for use as medications. This industry is heavily regulated in terms of requiring regulatory approval to market medical products. It takes at least 10 years (Lipsky and Sharp, 2001) for a new medicine to pass all tests before it can be prescribed. The average cost of bringing a single new drug to the market could be as high as €680 million (Boldrin and Levin, 2013).

Pharmaceutical companies are allowed to deal in generic and brand medications and medical services. They profit from the drugs they sell, so they have to create an incentive to affect consumers to buy the drugs they manufacture. It introduces a conflict of interest between the objective of pharmaceutical companies to maximize profits and the need of patients to receive the most safe, effective and individualized medications.

In the context of pharmaceutical marketing, consumers include patients as well as their prescribing physicians. In order to sell a prescription, a doctor must find it medically necessary and a patient must consent to it. Therefore, the pharmaceutical companies seek ways to influence both the physicians and the patients. It is estimated that pharmaceutical companies spend 36 per cent of their budget on marketing and only 11 per cent on research and development (Brezis, 2008). Of the total US\$27 billion spent on drug promotion in 2012, US\$24 billion was solely spent on marketing to physicians by the pharmaceutical industry in the US (Pew, 2013).

One of the most important global growth markets that has developed is health care. When this began taking place, the pharmaceutical industry in Germany was already a significant global player. In 2008, the pharmaceutical industry in Germany comprised of 243 companies, employing a workforce of 126,000 who helped generate a turnover of €41.5 billion. In terms of sales, Germany is the third largest pharmaceutical market in the world. More than 20 per cent of the pharmaceutical workforce have a university degree and in research-based pharmaceutical sector, the figure accounts for 30 per cent (Verband Forschender Arzneimittelhersteller, 2011). Pharmaceutical companies in Germany produced drugs with a market value of €27.1 billion in 2008 (Verband Forschender Arzneimittelhersteller, 2011). This represents an almost four per cent increase compared to the production levels of 2007. After deduction of legally mandated discounts, net sales were €22.5 billion in 2008 (Verband Forschender Arzneimittelhersteller, 2011). The number of packages sold in the German pharmacy market increased from 1.59 billion in 2007 to 1.61 billion in 2008 (Verband Forschender Arzneimittelhersteller, 2011). The annual increase observed in the German pharmacy market was largely achieved through prescription drugs and pharmacy medicine (both in euro and unit transaction volumes) (Verband Forschender Arzneimittelhersteller, 2011). With an added value of €122,000 per employee, the pharmaceutical industry is one of the best performing industries in Germany (Verband Forschender Arzneimittelhersteller, 2011).

More recently, pharmaceutical companies extended their marketing effort to online technologies and applications. The growth of online information services and patient forums can be seen as an encouraging development. These resources facilitate an unprecedented support community for millions of patients and provide invaluable health information, which is also useful to physicians.

Innovative and effective pharmaceuticals are of crucial importance. The pharmaceutical industry in Germany has a significant research and development (R&D) work force. Within research-based pharmaceutical companies, one out of every five employees is engaged in research. Around €5 billion was invested in R&D in 2008 and in the following year this number reached €5.2 billion (Verband Forschender Arzneimittelhersteller, 2011). The German federal government invests approximately €4 billion in its “High-Tech Strategy” each year. The German federal government planned to provide €1.2 billion for R&D projects within the health care and biotechnology industries in 2011 (Verband Forschender Arzneimittelhersteller, 2011).

For further development in pharmaceutical companies, the PriceWaterhouseCoopers report Pharma 2020 (PWC, 2013) outlined the trends and opportunities that will help define the pharmaceutical industry as well as the challenges the industry faces. Pharmaceutical companies should strengthen portfolios with more diversification as a way to prevent drug failures. The collaboration with non-industry organizations can be one solution for portfolio diversification. A lot of data is being generated because of the use of Information and Technology (IT). The pharmaceutical companies should make the most of *Big Data* and have the ability to develop more personalized treatments. A last but important challenge is to improve payers’ trust.

### 3.3 Hospitals

All in all, there are more than 2000 hospitals in Germany. About half the hospitals are public, with about 30 per cent of them being university clinics. One third of the clinics are private but non-profit, while the other hospitals in Germany are for-profit clinics. These numbers are steadily increasing (Internations, 2013).

Because of differences in size and level of each hospital, the revenues also differ accordingly. Table 1 shows the revenues of three hospital groups in 2011. Helios is a network of 74 clinics (Helios, 2013). In 2012, Helios increased its sales by 20.1 per cent to €3.2 billion (Helios, 2013). Sana Clinics AG has 48 hospitals, 1.59 million patients, 26,083 employees and offer a wide range of medical services (Sana, 2013). Vivantes Network for Health GmbH has 9 hospitals and 13 nursing homes. In 2012, there were 14,391 employees and the sales reached €900 million (Vivantes, 2013).

Hospital	Revenue in Billion Euro	EBIT <sup>3</sup> Margin in Percent
Helios	2.67	13.8
Sana	1.63	9.3
Vivantes	0.87	3.4

Table 1: Revenue of hospitals in Germany in 2011 (Statista, 2011)

3 EBIT: Earnings before interest and taxes

The current situation in Germany is that some Hospitals now are facing a lack of funding. Almost one third of German hospitals are in the red (Schreiner, 2013). Although improving the collection of data is of interest, the current high level services undertaken in Germany calls into question whether a programme seeking to drive quality of care improvements would be of use. A more systematic approach may be needed to assess whether Germany's citizens are receiving more services than medically desired (Organisation for Economic Co-operation and Development, 2013).

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## 4 The Competition

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Almost every German doctor carries a large book called *Rote Liste*<sup>4</sup> which provides basic approved drug dosage information. This book normally costs €80. However, the pharmaceutical companies sponsor and offer the book to medical doctors for free. The book lists all active ingredient information and drug dosage information. Thus, Netdosis considers it as a direct competitor. A doctor might prefer to look for the information in Rote Liste because they need not pay anything and know that the information is derived from clinical trials. In addition, the time of searching will be faster when the doctor becomes familiar with the book.

Diagnosis, a company in Austria offers a digital version (see Figure 6) of the Rote Liste book. Diagnosis's website displays the dosage information in multi-languages and has gained many users. Netdosis does not consider Diagnosis as a direct competitor because it doesn't have a structured database.

### Usual Adult Dose for Asthma - Acute

Metered-dose inhaler: 2 puffs every 4 to 6 hours as needed.

Inhalation capsules: 200 mcg inhaled every 4 to 6 hours.

May increase to 400 mcg inhaled every 4 to 6 hours, if necessary.

Nebulizer: 2.5 mg every 6 to 8 hours as needed. (2.5 to 5 mg once followed by 2.5 mg every 20 minutes for acute bronchospasm).

*Figure 6: Dosage Information from Diagnosis*

Netdosis is the first company that provides fully structured information for off-label use. The data (e.g. days, which age group, dosage) is stored in different fields in the database. Although Netdosis has an internal doctor team, it intentionally wants to create a large network, which Stipp considers as a biggest advantage against Netdosis' competitors. Stipp said:

“Every competitor could reach our level in terms to product completeness and have their own team of doctors but they can never build an interactive network like ours.”

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4 Rote Liste is a book providing dosage information and lists of active ingredients.

The drug dosage information on the Diagnosia website does not have fields where the users could input their experiences and comments. The comment fields can be used for sentiment analysis to get to the attitude of the providers, which helps to gain the trust of other users.

In the future, if the data-selling business works well, Netdosis plans to extend the business to the adult market as well, since the interface of the software does not depend on the age group. Insurance companies and clinics would also be considered to be included into the network of the customers. Parents or guardians are the ones that usually talk with the doctors. It is good for them to know the basic drug dosage information, so that they can respond to changes in condition or communicate better with the doctors.

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## 5 Challenges of Netdosis

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### 5.1 Startup Personnel and Instability

Netdosis started out with a rough period of people turnover. As Stipp said:

“It was a really tough time for us. We found a programmer at first but it turned out later that he could not support us. We continued the search for a programmer. In August, the initial medical doctor had to quit due to family commitments and was more interested in a career in academia. Thanks are due to Prof. Riehle. He helped a lot. He sent mass email to his connection and tried every social network like Facebook, Twitter, LinkedIn and so forth. Finally he found Johannes.”

Instability consumed Netdosis’ energy and resources as they had to find new people. The development of the product was delayed, creating many potential risks. For example a competitor might copy the product idea and bring the product into the market earlier than Netdosis. Moreover, without a programmer, the product quality and service cannot be guaranteed.

### 5.2 Free Mentality

Netdosis’ business model is to sell data for a profit. However, the ‘free mentality’ is the biggest obstacle on the way. In the age of the Internet, one part of Internet culture that is wrecking financial models for businesses of all kinds is an expectation that the content should be available for free. Content is the core competitive point of a website and may be the king but ironically its perceived value today is being driven towards zero. In the eyes of consumers, content is a commodity (Chavez, 2013). The cheaper (or even free) the commodity, the better it is. Most Internet users take advantage of free services on a daily basis, many of which are profitable business ventures including search engines Google, social networking websites like Facebook, Twitter, Xing and LinkedIn.

There are lots of free and reliable information sources on the Internet, which makes it difficult to persuade people to pay for information. Even the Rote Liste is sponsored by pharmaceutical companies, so the cost of information is hidden from the doctors.

### 5.3 Ethical Issues

The field of ethics studies the principles of right and wrong. There is hardly any area in medicine that does not have an ethical aspect (National Institute of Health, 2013). Today, when a doctor prescribes a drug to a baby, in up to 90 per cent of all the tested cases that drug has not been approved for infants (Bücheler et al., 2002). The reason is that most approved drugs are only for the “standard person” (175 cm, 75 kg, male). Children are not usually considered in medical trials because those involve high costs and are not legally required. Also, there are ethical and legal concerns in studies with children.

A treatment of children with medication proven for adults is often unavoidable due to lack of alternatives. Pediatricians are forced to prescribe drugs beyond the scope of a drug’s approved use (‘off-label use’), which led to an increasing need for accurate information on how best to do so.

Generally, pediatric patients are unable to make informed health care decisions for themselves. So, the pediatricians have to deal with their parents or guardians. When it comes to the decision-making process for pediatric patients, there are also ethical issues. One of the primary ethical principles in medicine is to “do no harm” (Narvaez, 2012, para. 3). For example, the pediatrician learns a new treatment on the Internet for the child’s symptom which the parent might not have heard about. It leads to a disagreement between the parent and the pediatrician. The pediatrician has to make an ethical decision whether to switch to the new treatment to save the child or compromise to be on the safe side.

Normally, research should be carefully conducted and approved. The pediatrician might learn about something and post it on the Internet without further testing. Even if other pediatricians and Netdosis carefully checked the information on the website, it might not be applicable for all children. When something goes wrong, the issue of liability crops up.

### 5.4 Liability of Medical Advice

The question of responsibility raises a legal issue. Assume a scenario where a pediatrician needs to prescribe an off-label drug to a month old baby. The pediatrician takes the advice on drug dose from Netdosis and gets the parents’ consent. If the baby dies because of a wrong dose, there are four possible persons who can be considered to take responsibility for the death. They are: the pediatrician who prescribes the drug, the pediatrician who shares the information, Netdosis that publishes the information and the parents who gave consent. To avoid possible lawsuits, Netdosis has a law firm to deal with legal problems. The assumption is that whoever makes the final decision about the prescription, is fully responsible for the outcome. So, the pediatrician who makes use of the information provided by Netdosis, is responsible for any consequences.

### 5.5 Off-label Drugs Prescription

When a doctor writes prescription to treat a patient’s disease, the patient trusts the doctor and assumes that the drug has been approved for use by a government regulatory agency (Ger-

many: BfArM, Bundesamt für Arzneimittel und Medizinprodukte; USA: FDA, Food and Drug Administration). This assumption is reasonable but it is not always the case. When a doctor prescribes a drug for unapproved use, it's called an off-label prescription. The prescription could involve using a drug which is not within its approval for an unapproved age range (such as children), at an unapproved dose or in an unapproved form. According to the data of one study, the percentage of off-label drug prescriptions could be up to 91 per cent (Ditsch et al., 2011). 34 per cent of physicians think that off-label drug use is risky while 43 per cent of them consider it harmless. 65 per cent of this 43 percent comprise of young physicians (Ditsch et al., 2011). It seems that the prescription of off-label pharmaceutical drugs in Germany is a well-established practice. If a patient suffers from an off-label drug prescription, the only person who can be held liable is the physician who prescribed the medication – independent of his standard of knowledge (Ditsch et al., 2011).

Many drugs used to treat children in hospital are either not licensed for use or are prescribed outside the terms of their product license (off-label prescription). Considerable concerns exist within Europe and the United States about the use of unlicensed and off-label drugs for children. However, little information is available about the extent to which these types of treatments are used. Therefore, a study (Conroy et al., 2000) of a pediatric medical ward was conducted during 1998 in each of the participating centers (Derby, United Kingdom; Uppsala, Sweden; Marburg, Germany; Bergamo, Italy; Rotterdam, Netherlands) and lasted for four consecutive weeks. In the resultant report, a total of 624 children were admitted to the general pediatric wards in the five participating centers and received 2263 drug prescriptions (see Exhibit 6). Over half of the children (421; 67 per cent) received an unlicensed or off-label drug prescription during their stay in hospital. In Marburg, Germany, 54 per cent children received an unlicensed or off-label prescription. This is higher than the percentage of the adult patients who were treated with off-label drugs, which stood at 34.6 per cent according to a project study in Nordbaden, Germany (Schlander et al., 2006).

The most common reasons for off-label prescriptions were that the medicine was prescribed at a different dose or frequency, in a different formulation, or in an age group for which it had not been licensed. Not all off-label drug use is inappropriate. In many cases, however, the risk of off-label drug use is not known because there is inadequate data. One risk raised by off-label drug use is that, a patient could have an unwanted or bad outcome from the treatment.

So, is off-label drug use legal or illegal? Based on the information provided in American Cancer Society website (American Cancer Society, 2013), the off-label use of FDA-approved drugs is not regulated but it is legal in the United States and many other countries. While it is legal for doctors to use off-label prescription, it is illegal for drug companies to market their drugs in any way for off-label usage.

Off-label marketing is often based on poor evidence. Therefore, physicians must carefully consider their decisions regarding off-label prescriptions and must not simply rely on marketing claims, but rather become as familiar as possible with the evidence for or against such usage.

Off-label use — unlike official use which has been through strict testing — highly depends on experience. Originally, Netdosis intended to provide a platform for the doctors to share their experiences and compile evidence on off-label drug use. Netdosis offers the first platform on which this expert knowledge can be gathered and discussed.



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## 6 Conclusion

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The meeting with Wille was over. Stipp went back to his desk and looked at the number of online users, which was growing but not quickly enough. He knew Netdosis faced a difficult situation. Without enough pediatricians participating, the company wouldn't have enough data to satisfy its customers. If the hospitals and pharmaceutical industries weren't interested in their products, there wouldn't be any profit. So far, no pharmaceutical company had shown interest in the product. Stipp believed that he had a good understanding of the needs and concerns of Netdosis' potential clients and that Netdosis had a solid value proposition for each.

Did Stipp miscalculate the size of the markets and the potential revenue from these markets? Are the problems simply a part of the expected challenge of a social application which requires critical mass to succeed, or is there a more fundamental misunderstanding of the market opportunities and threats? Can the medical doctors, the hospitals and the pharmaceutical companies all be satisfied with the two-sided market model, and how would Netdosis balance their interests?

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## List of Abbreviations

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AG	Aktiengesellschaft <sup>5</sup>
AMOS	Agile Method and Open Source
CDDB	Compact Disc Database
FAU	Friedrich-Alexander-University Erlangen-Nürnberg
HMO	Health Maintenance Organization
HTML	HyperText Markup Language
SQL	Structured Query Language

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5 Aktiengesellschaft (abbreviated AG) is a German word for a legal form of incorporation allowing for public share-based ownership. The term is used in Germany, Austria and Switzerland.

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## Appendix


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### Exhibit 1




*Picture of Netdosis founders in German newspaper*

## Exhibit 2



Vernetztes Wissen  
für die Medikation bei Kindern

⌘ Einstellungen für Markus Stipp   ⌘ Abmelden



- Wirkstoffe
- Krankheitsbilder / Indikationen
- Smartphone App
- Unser Blog
- Video Tour
- Häufige Fragen
- Für Eltern/Presse ...
- Editor**
  - Wirkstoffe bearbeiten
  - Indikationen bearbeiten
  - Änderungsvorschläge
  - Administrator ...

Geben Sie hier den Wirkstoffnamen ein...

🔍

Suchergebnisse: Beclometason Netdosis kennt 123 Wirkstoffe, davon 77 mit Off-Label-Informationen

### Beclometason

Änderungsvorschlag   Diskussion   Revision: 13   Geändert: 13.04.2013 11:53

Darreichungsformen: Inhalation (Dosieraerosol), Inhalation nasal, Inhalation (Pulver), Inhalation (Lösung)

Indikationen: [Asthma bronchiale](#), [Chronisch obstruktive Bronchitis](#), [Akuttherapie nach Rauchgasexposition](#), [Saisonale allergische Rhinitis](#), [Perenniale allergische Rhinitis](#)

#### Dosierung

**Asthma bronchiale, Chronisch obstruktive Bronchitis**

**Inhalation (Dosieraerosol)**

<b>≤ 11 Jahre</b>	Einzeldosis 100 - 200 µg, 2 x pro Tag, Tagesdosis 200 - 400 µg; max. 500 µg	✔️ Zugelassen
<b>≥ 12 Jahre</b>	Einzeldosis 200 - 400 µg, 2 x pro Tag, Tagesdosis 400 - 800 µg; max. 2000 µg	✔️ Zugelassen

Niedrige bis mittlere Dosis der inhalativen Corticosteroide nach nationaler Versorgungsleitlinie. Das Dosieraerosol sollte vor einer Mahlzeit angewendet werden, wenn dieses nicht möglich ist, sollte nach der Inhalation der Mund ausgespült werden.

**Inhalation (Lösung)**

<b>≥ 11 Jahre</b>	Einzeldosis 400 µg, 2 x pro Tag, max. Tagesdosis 1000 µg	✔️ Zugelassen
<b>Jugendl./Erwachsene (ab 12 Jahre)</b>	Einzeldosis 800 - 1600 µg, 2 x pro Tag, max. Tagesdosis 4000 µg	✔️ Zugelassen

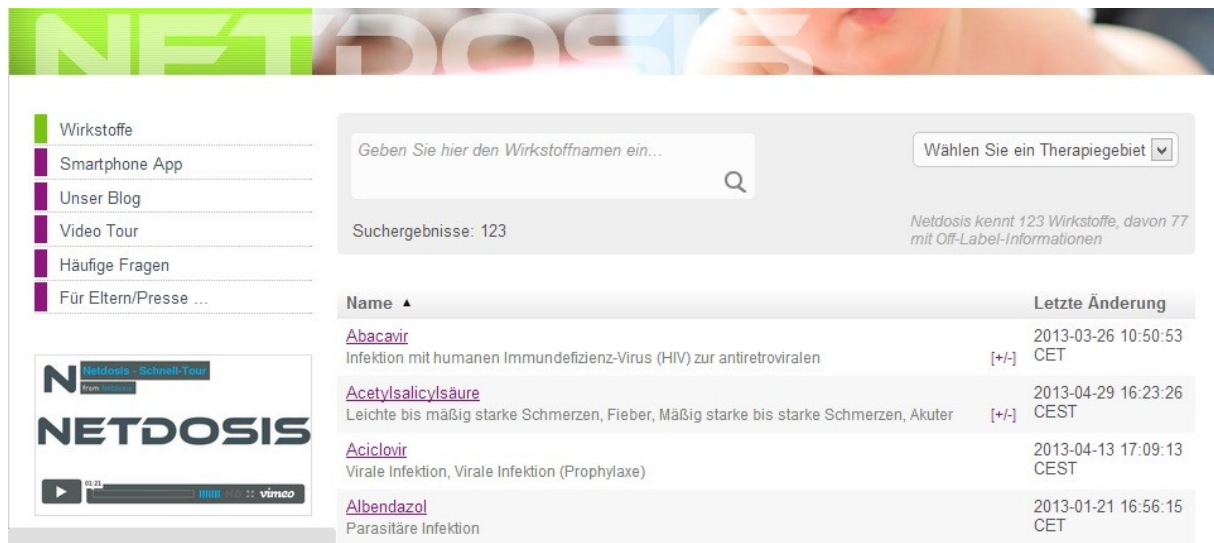
**Saisonale allergische Rhinitis, Perenniale allergische Rhinitis**





*Netdosis Editor with Privileged Permission*

## Exhibit 3



The screenshot shows the homepage of Netdosis. On the left is a navigation menu with links: Wirkstoffe, Smartphone App, Unser Blog, Video Tour, Häufige Fragen, and Für Eltern/Presse ... Below the menu is a video player for 'Netdosis - Schnell-Tour'. The main content area features a search bar with the placeholder text 'Geben Sie hier den Wirkstoffnamen ein...' and a dropdown menu for 'Wählen Sie ein Therapiegebiet'. Below the search bar, it displays 'Suchergebnisse: 123' and a note: 'Netdosis kennt 123 Wirkstoffe, davon 77 mit Off-Label-Informationen'. A table lists drugs with their names, descriptions, and last update dates.

Name ▲	Letzte Änderung
<a href="#">Abacavir</a> Infektion mit humanen Immundefizienz-Virus (HIV) zur antiretroviralen	2013-03-26 10:50:53 CET
<a href="#">Acetylsalicylsäure</a> Leichte bis mäßig starke Schmerzen, Fieber, Mäßig starke bis starke Schmerzen, Akuter	2013-04-29 16:23:26 CEST
<a href="#">Aciclovir</a> Virale Infektion, Virale Infektion (Prophylaxe)	2013-04-13 17:09:13 CEST
<a href="#">Albendazol</a> Parasitäre Infektion	2013-01-21 16:56:15 CET

*Homepage of Netdosis*

## Exhibit 4

### Abacavir

Änderungsvorschlag

Diskussion

Revision: 2

Geändert: 26.03.2013 10:50





ATC-Codes: J05AF06

Darreichungsformen: Oral

Handelsnamen: Ziagen

Indikationen: [Infektion mit humanen Immundefizienz-Virus \(HIV\) zur antiretroviralen Kombinationstherapie](#)

### Dosierung

Infektion mit humanen Immundefizienz-Virus (HIV) zur antiretroviralen Kombinationstherapie		
Oral 		
Neugeborene (bis Ende 1. Lebensmonat)	Einzel-dosis 2 mg/kg, 2 x pro Tag	 Off-Label
3 Monate - 11 Jahre	Einzel-dosis 8 mg/kg, 2 x pro Tag, max. Tagesdosis 600 mg	 Zugelassen
Jugendl./Erwachsene (ab 12 Jahre)	1 - 2 x pro Tag, Tagesdosis 600 mg	 Zugelassen

#### Quellen für Dosierinformationen

- Fachinformation Ziagen 20mg/ml, Stand: 10/2011

### Darreichungsformen im Handel

- Lösung 20 mg/ml
- Filmtabletten 300 mg

*Detailed information on one particular active ingredient*



## Exhibit 5

### Neue Revision für Amphotericin B, Liposomal

Name [?] \*     Synonyme [?]   
 Sichtbar in Wirkstoffliste [?]

#### Basisinformationen

ATC-Codes [?]     Handelsnamen [?]   
Erreger-Spektrum [?]

#### Indikationen [?]

<input type="text" value="ZNS-Aspergilliose"/> -	<input type="text" value="Kryptokokkose"/> -
<input type="text" value="Candida-Laryngitis"/> -	<input type="text" value="Candida-Sepsis"/> -
<input type="button" value="+"/>	

#### Darreichungsformen [?]

-   

#### ☉ Dosierinformationen

##### ☉ Standardregeln

**Regelbedingungen**

Indikationen [?]  -   

Darreichungsformen [?]  -   

Variante [?]     Regel-Zulassung [?]

---

**Altersgruppe [?]**     **Gewicht [?]**     **Zulassung [?]**

**Dosierschema [?]**

Zeitlicher Verlauf	Dosierung
<b>Häufigkeit:</b> <input type="text" value="2 x pro Tag"/>	<b>ED:</b> <input type="text" value="1 - 1,5 mg/kg"/>
<b>Dauer:</b> <input type="text" value="7 Tage"/>	<b>TD:</b> <input type="text" value="1 - 3 mg/kg"/>
	<b>Standard:</b> <input type="text" value="z.B. '3 x pro Tag 30 mg/kg'"/>

☉ **Anwendungshinweis**

*Version history of changes to one active ingredient*

## Exhibit 6

	Derby	Uppsala	Marburg	Bergamo	Rotterdam	Total
No. of patients	192	87	85	118	142	624
Age Range	21 days – 16 years	4 days – 15 years	28 days – 16 years	30 days – 12 years	4 days – 16 years	4 days – 16 years
Prescriptions	789	185	224	398	657	2263
Mean no. of prescriptions/Patient	4.2	2.1	2.6	3.4	4.6	3.6
No(%) of prescriptions unlicensed or off label	239(30)	57(31)	91(41)	264(66)	385(59)	1036(46)
No(%) of prescriptions unlicensed	58(7)	8(4)	8(4)	1(0.3)	89(14)	164(7)
No(%) of prescriptions off label	181(23)	49(26)	83(37)	263(66)	296(45)	872(39)
No(%) of patients receiving unlicensed or off label treatment	109(57)	37(43)	46(54)	101(86)	128(90)	421(67)

*Number of patients and prescriptions in selected set of medical centers*

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## About this Case

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This teaching case was taken from the [Product Management by Case](http://pmbycase.com) collection, a collection of free cases for teaching product management, available at <http://pmbycase.com>.

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