FAKULTÄT FÜR !NFORMATIK
Faculty of Informatics

Appointment Scheduling in Small and Medium-Sized Medical Facilities

An Exemplary Design Based on Contextual Inquiry

DIPLOMARBEIT

zur Erlangung des akademischen Grades

Diplom-Ingenieur

im Rahmen des Studiums

Medizinische Informatik

eingereicht von

Sebastian Haas, BSc
Matrikelnummer 0925299

an der Fakultät für Informatik
der Technischen Universität Wien
Betreuung: Univ.Prof. Geraldine Fitzpatrick, PhD

Wien, 18. Februar 2018

Sebastian Haas	Geraldine Fitzpatrick

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DIPLOMA THESIS

submitted in partial fulfillment of the requirements for the degree of

Diplom-Ingenieur

in

Medical Informatics

by

Sebastian Haas, BSc
Registration Number 0925299

to the Faculty of Informatics

at the Vienna University of Technology

Advisor: Univ.Prof. Geraldine Fitzpatrick, PhD

Vienna, 18th February, 2018

Sebastian Haas

Geraldine Fitzpatrick

Erklärung zur Verfassung der Arbeit

Sebastian Haas, BSc
Schulz-Straßnitzki-Gasse 5/10, 1090 Wien

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Wien, 18. Februar 2018

Sebastian Haas

Acknowledgements

Firstly, I would like to express my sincere gratitude to my advisor, Prof. Fitzpatrick for the support and guidance during the writing of this thesis.

Besides my advisor, I would like to thank Florian Güldenpfennig for his help and support with the exemplary design as developed in the context of this work.

Finally, I want to express my gratitude to my family, especially my parents and grandparents, and to my partners and friends for providing me with support and continuous encouragement throughout my years of study and through the process of writing this thesis. This work would not have been possible without them.

Kurzfassung

Die Organisation von Patientenkontakten zählt zu den wichtigsten administrativen Aufgaben im Arbeitsablauf von kleinen und mittelgroßen medizinischen Einrichtungen. Mitarbeiter, welche mit der Vergabe von Terminen betraut sind, sehen sich einer Vielzahl an Herausforderungen gegenüber. So gilt es beispielsweise, einen Kompromiss zwischen hoher Auslastung und der damit verbundenen effizienten Nutzung von Ressourcen sowie der Zufriedenheit der Patienten zu finden. Die vorliegende Arbeit zielt darauf ab, die Problemstellungen und Abläufe in solchen, für Österreich typischen, kleinen Einrichtungen mit üblicherweise nicht mehr als einem Arzt zu beleuchten. In Recherchen vor Ort wurden die wichtigsten Anforderungen im Gespräch mit den am Prozess beteiligten Personen sowie durch Beobachtung der alltäglichen Betriebsabläufe ermittelt. Ein beispielhafter Entwurf einer Softwarelösung zur Unterstützung der Terminplanung wurde entwickelt, und in einer abschließenden Evaluierungsrunde mit einigen Stakeholdern diskutiert. Trotz guter Akzeptanz des vorgestellten Entwurfs zeigt die vorliegende Arbeit die Notwendigkeit von weiteren Entwicklungen und Recherchen auf.

Abstract

Scheduling appointments is a vital task in the flow of work in small and medium-sized medical facilities. People involved in making appointments are often facing the difficulty to find a middle ground between efficient usage of resources and patient happiness. This work aims to spotlight the challenges of small facilities with usually no more than one physician, a common model in the present health care structure Austria. A contextual inquiry was carried out to gain insight into the demands and processes on site. An exemplary design striving to meet requirements was developed and evaluated with key stakeholders in a concluding iteration. This work has shown that the necessities of facilities in the present domain are differing from bigger facilities or hospitals. While the prototype was accepted well, further investigation and development is required to provide small and medium-sized facilities with an optimal solution for scheduling appointments.

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CHAPTER 1

Introduction

Ensuring accessibility of health care services requires efficient management of resources. Scheduling appointments with patients, is a key part of practice management. This work strives to explore the characteristics of appointment scheduling in the context of small and medium-sized medical facilities. Due to regional characteristics of public health care structures, general practitioners (GPs)/primary care physicians (PCPs) in Austria are organized differently and are therefore facing unique challenges. With previous studies in the area of appointment scheduling in health care being mainly focused on larger clinics or hospitals, this work aims to provide an insight into the present domain of small and medium-sized medical facilities specifically. On-site interviews with people working in the field are carried to collect expertise and document typical workflows.

Today, everyone wants to see a doctor whenever they want and extensive waiting times are often perceived as a result of mismanagement. With access to primary care playing an important role in public health care, this work seeks to investigate these organizations, what tasks people in the domain are facing in their daily routines and how technology can help them making their jobs easier.

1.1 Primary Care in Austria

The needs and use cases specific to the group of medical facilities in question, are linked with their organizational form. Hospitals and larger facilities are facing challenges quite different from those of a single physician. Focusing on small and medium-sized medical facilities, this work is set to research into the operational requirements of a subset of the $44,000$ doctors in Austria only. [1] Apart from hospitals and centers of excellence (COEs), GPs/PCPs are coping with a major share of the overall Austrian demand for health care. As of 2015, around $7,200$ doctors holding a permanent contract with the compulsory social insurance body were reported. With 55% $(4,000)$ practicing general medicine, this group takes up for the largest number of contracts with national insurance, and

represents what is generally referred to as GP or PCP. The remaining 3,200 physicians are practicing in different medical specialties. [1][2]

In addition to these, around 10,500 physicians were registered as Wahlarzt, about 5,000 of them full-time or without any other employment. Wahlarzt, in the context of this work, relates to the Austrian "doctor of choice", a physician without a permanent contract with the compulsory social insurance body, a model specific to Austria. Patients can submit treatment expenses, and may be eligible for a partial refund afterwards. [2][3]

Patients wanting to see doctors in private practice, will have to compensate for their treatment costs by themselves or through private health care insurance. Different surrounding conditions, such as the legal framework, are adding up to demographic characteristics of patients and organizational structures unique to the three groups of PCPs in Austria described above. While those physicians in contract with the national insurance body are obligated to accept any patient seeking for medical advice, doctors in private practice are able to organize their schedule more freely. For instance, to allow for appointments to be made on shorter notice.

In the future, following an international trend, the Austrian health care system is expected to shift towards group practice and primary care centers as it gets harder to fill vacant GP positions in rural regions.

Due to the lack of an internationally common, prevalent term for describing the types of physicians discussed above, any reference to GPs or PCPs in the context of this work is literally encompassing any primary care provider. The terms Wahlarzt or physician in private practice will be used in those cases, where something doesn't apply to all types of doctors.

1.2 Present Situation

How appointments are made, is also subject to the medical specialty a facility is operating in. Different medical conditions require to be handled differently depending on acuteness, severity or a certain treatment plan. The field investigation carried out for this work, has shown that in Austria, physicians in general medicine will typically face more walk-in patients than internal specialists, surgeons, radiologists etc., who will more likely have a fixed schedule and require their patients to make appointments beforehand.

Depending on the overall size of a facility, managing appointments usually accounts for the better part of administrative staff's daily amount of work. Managing a facility's schedule not only includes making appointments, but also admitting patients at the front desk, calling them in for treatment, planning follow-up examinations, receive cancellations or checking up on patients who are late for their appointment. With multiple people working on these matters, a central paper calendar can eventually become difficult to maintain. Furthermore, the spatial situation at a facility can render a central point of information impracticable. For instance, with the examination room separated from the front desk, a doctor has to change room to retrieve information on the current

booking situation. All of the facilities considered in this research were using some sort of information technology supporting their flow of work. However, the most frequently used systems, usually some sort of Medical Practice Management Software (PMS), often lack functionality for managing a facility's schedule. Even amongst those participants who were actively using an electronic booking system, a high number indicated they were using a paper calendar as a backup, or even as the main source of information, with the electronic system just being used for formal reasons.

1.3 Motivation and Problem Statement

Learning about the current state of technology and its acceptance amongst medical facilities, has been one of this work's driving forces. With previous studies in the area of appointment scheduling in health care being mainly focused on larger clinics or hospitals, this work strives to provide an insight into the present domain of small and medium-sized medical facilities. Due to their size and organizational form, these are facing unique challenges when it comes to coordinating staff and patients, incomparable to, for instance, hospitals with multiple operating room (OR)s. Little to no literature was found that specifically deals with issues arising in settings where a team of, typically, no more than five people form a primary care unit. When thinking about electronic solutions that potentially support scheduling appointments and coordinating processes, it might be even helpful to take a look on similar forms of collaboration beyond the medical domain. In his approach on a "Participatory Design of an Inkable Family Calendar", [4] Carman Neustaedter investigates into how families stay organized and coordinate activities and appointments. The number of people involved as well as the flexibility required in terms of spatial and temporal availability, makes a family calendar system an adequate model case for an appointment scheduling solution in the present medical domain.

Coordinating people Exploring health care technology for a domain that is outside the industry's main focus exploring cheaper solutions exploring potential of state-of-the-art connected web technology in health care reduce scheduling workload? Establish a nishe where this research fits in!

1.4 Research Questions

Technology already plays a role in the vast majority of small and medium-sized medical facilities. However, little is known about how these systems are actually being accepted by the different stakeholders. One of this work's research goals is to gain insights into the present situation by taking a look at what systems are being used by whom, when and where, how people concerned with scheduling appointments feel about the technology they are using and whether it actually enables them to deal with appointment-related matters more easily or if electronic solutions are being perceived as more of a hindrance and additional effort. In addition to this, identifying unused potential of electronic

systems, possibly of those already at hand, is considered a desirable side-effect of this research.

Evolving straight from these questions, exploring new technical possibilities is another key issue of this work. Fast-changing technology makes it hard for software vendors to provide medical facilities with solutions powered by the most current and suitable technology at any given time at equitable cost. Within the context of this work, an exemplary design based on state-of-the-art technology is to be proposed, incorporating the insights gained in the course of the user studies. This design is then reviewed to learn about challenges and opportunities, reveal shortcomings and find out where technology actually enables people to do their job more easily and straightforwardly. In short, whether there is potential of reducing workload.

New technology often resides in an area of conflict between the prevailing, pristine method of achieving something and its digital counterpart. In case of scheduling appointments and coordinating people, the traditional paper calendar is considered one of the predominant means. For new technologies to find user acceptance, they have to keep up with or even surpass them in all aspects of the original tools, while adding some distinct, additional value. With many of these additional benefits, such as collaboration, remote accessibility, auditing capabilities or unambiguousness have been proven in numerous cases where digital technology replaced its paper equivalent. Investigating into more subtle, concealed aspects of paper versus electronic systems, potentially very specific to the present domain of appointment scheduling in small and medium-sized medical facilities, however, is far less elucidated and therefore another important goal of this work.

1.5 Outline of this work

Following this introduction, chapter 2 presents literature related to appointment scheduling in the field of health care, including scheduling techniques in general as well as a studies on reducing no-show rates, sending reminders and finishes with a selection of comparable commercial solutions. Methods of this work are presented in chapter 3. The results of the contextual inquiries are listed and discussed in chapter 4. Chapter 5 proposes an exemplary design of a web-based scheduling solution, based on the knowledge, requirements and use cases gathered in the previous chapters.

CHAPTER 2

Related Work

While appointment scheduling in health care has found big response in literature over the past, most research is focused on larger facilities, clinics or hospitals. The goal of this chapter is to identify core aspects of appointment scheduling in health care as, mostly for large health facilities, discussed in literature and to assess their relevance to small and medium-sized facilities where possible. Starting with scheduling basics, e.g. strategies to organize appointments efficiently or reasons and implications of missed appointments, this review of literature is targeted to shed light also on various technology-enabled aspects, such as sending automated reminders or patient-led appointment scheduling where patients are able to assign themselves an appointment with the help of Internet-technology. Besides establishing a sound basis of general knowledge on the matter, the outcome of this review of literature will also be used to refine the research goals for the contextual inquiry documented in chapter 4.

Starting with an overview of strategies on how to organize appointments, this chapter provides a broad introduction to topics like causes and effects of missed appointments, how to confront this issue by sending patients reminders or influences of electronic booking systems on waiting times. Existing literature on these topics will be discussed in the first half of this chapter, followed by an analysis of existing solution in the concluding sections.

2.1 Strategies to Organize Appointments

Proposing strategies for managing schedules is not subject of this work. Nonetheless, a basic understanding of possible ways of organizing patient's appointments can be a valuable resource when designing an electronic system that supports health care professionals in this regard. Appointment scheduling in health care is well-covered in literature, however, focus is set on larger clinics or even OR scheduling in a majority of times. This section aims to filter out and present a few approaches that are believed

to be suitable for small and medium-sized medical facilities. Comprehensive reviews of appointment scheduling literature have been published by Cayirli and Veral (2003) [5], Cayirli et al. (2006) [6] or Gupta and Denton (2008). [7]

2.1.1 Sequential scheduling

Sequential scheduling can be considered the most intuitive way of organizing appointments. Given a certain session's length T, that total available time T has to be divided by the number of patients n who need to be seen in that session, resulting in b blocks, each with a length t_b. The decision variable is n, as it determines the number of blocks to be made. For instance, with $T = 480m$ being a physician's working day from 8:00 AM to 4:00 PM and $n = 30$, a total of 30 ($b = n = 30$) slots with 16 minutes length each ($t_b = T/n = 16$) will have to be planned. Discussion of sequential approaches can be found in Gupta and Denton (2008) [7] or Penneys (2000) [8]. Obviously, this approach does not take walk-ins, no-shows, patient preferences regarding time or, if choice is available, physician, different time required for consultations or breaks into account.

2.1.2 Block scheduling

Just as sequential scheduling, block scheduling is based on the idea of having a certain available session length T which is divided into b blocks of equal length t_b. In this case, the decision variables are one or more n_is, representing the number of patients asked to arrive on the beginning of each block. The number of blocks b is depending on these n_is so that $\sum_{i=1}^{b} n_i = n$. Choosing the number of patients to be scheduled for a block, requires experience and is always a trade-off between patient waiting times and physicians idling. Just as sequential scheduling, block scheduling follows a first-in first-out (FIFO) protocol. Gupta and Denton (2008) [7] discuss various approaches on choosing n_is, but also point out the two extrema of block scheduling where staff idleness is minimized by choosing $n_i = n_0 = n$, with $b = 1$ or patient waiting times are intendedly minimized by choosing $b = n$. Given the latter selection of parameters, block scheduling is effectively reduced to sequential scheduling. Heaney et al. (1991) propose that inserting an idle time somewhere at the middle of the session can help doctors catching up with their schedule and therefore reducing stress. A similar suggestion was made by Chung (2002): "With modified-wave scheduling[1], if a physician begins to run late, the effect isn't cumulative: There is time built into the schedule at the end of the hour to catch up." [9] Robinson and Chen (2003) have done a review of (heuristic) policies to improve block scheduling approaches by incorporating effects of different service times and early or late patient arrivals. For instance, Kaandorp and Koole (2007) discuss a model based on block scheduling with exponentially distributed patient service times. [10]

[1] Chung is using the term "wave scheduling" rather than block scheduling, with "modified-wave scheduling" being an enhanced approach where idle times are inserted at the end of every hour.

2.1.3 Periodic arrival processes

Period arrival processes are another group of scheduling approaches based on queuing theory. Patient's are scheduled to arrive in equal time intervals and will be called for treatment FIFO. The length of the time interval between each scheduled patient is the decision variable for periodic arrival processes. [7] Models for this class of scheduling strategies have been introduced by, amongst others, Mercer in 1960 and 1973 [11][12] who takes patients tardiness into account, by expecting patients to arrive in an interval $(n-1, n+1)$, where $0, 1, 2, n$ are the times of scheduled arrivals, or arrive in any later interval. Both patient tardiness and service times are modeled using common probability functions here.

2.1.4 Advanced access scheduling

Initially introduced as "Open-Office Scheduling" by Herriot in 1999 [13], advanced access scheduling was reportedly developed after "several consecutive quarters of substandard patient-satisfaction scores", and has led to improvements in both productivity and patient/staff satisfaction thereafter. It is based on the idea of splitting time available into blocks which are being held open for same-day appointments, blocks which will be used for follow-up consultations and blocks for appointments that have been made weeks in advance. Herriot calls this last group of bookings "prescheduled appointments". Those slots reserved for same-day requests, will be given to patients asking for an appointment the same day only. Herriot suggests a few techniques to optimize the placement of these slots, e.g. avoiding early-morning hours for open blocks, distributing open blocks over the whole day etc. Slots for follow-up consultations will be assigned directly during a visit that turns out to require one or more follow-up checkups. If period of time between the initial and the follow-up consultation exceeds a certain limit, a slot for prescheduled appointments will be used instead. Herriot suggests that unused follow-up slots of the current day can be converted to open slots in the morning. The article concludes that productivity was improved, and both patients and staff were continuously becoming more satisfied in the first years after introducing advanced access scheduling. It remains uncertain whether these results can be expected from this work's target group as well, as Herriot's survey is based on data from a clinic with multiple physicians rather than a small GP.

However, a study by Dixon et al. published in 2006 [14], aiming to assess advanced access in general practices, concludes that it can be associated with reduced waiting times and a higher number of patients being seen on the day of their choice. Contrary to the beneficial effects on availability, waiting times and appointments per day, Dixon et al. found that implementing advanced access in general practice might disadvantage certain groups of patients such as the elderly or patients with long-standing problems. Furthermore, an evaluation of stressfulness of advanced access to staff members was yielding mixed experiences.

Similar, slightly tending toward advanced access, observations were made in studies by

Pickin et al. (2004) [15], Salisbury et al. (2007) [16], O'Hare and Corlett (2004), [17] or Tantau (2009). [18] A review of studies on advanced scheduling outcomes in primary care settings by Rose et al. published in 2011 [19] also suggests that advanced scheduling can benefit wait time, however, both patient and staff satisfaction levels were found to be diverging.

Muthuraman and Lawley (2008) propose a stochastic overbooking model based on advanced access while taking no-shows into consideration. Here, a certain now-show probability is compensated by carefully overbooking blocks following policies introduced in their work. [20] Reasons for missed appointments as well as impacts on practices' flow of work are discussed in section 2.2.

2.2 Missed Appointments

Neal et al. [21] found that patients participating their study that were living in more deprived areas were more likely to miss an appointment than others. Apart from that, young adults were found to be more likely to miss their appointments than children or older people. Results are based on data collected from four GPs in the United Kingdom in 1998.

Patients' age as important factor for explaining no-show behavior was also suggested by George and Rubin in their 2003 review on non-attendance in primary care mentioning a group of patients between 17 and 40 years. Patients with chronic diseases or those feeling an urgent require to see a doctor can be expected to be better attenders. [22]

Another study conducted by Neal et al. in 2005 focusing on reasons for missed appointments in seven general practices in the UK, found "mistakes and misunderstandings (frequently by the practice) and forgetfulness" as most common reasons for missing an appointment. [23] In addition, Neal et al. suggest that that there is a high chance that patients who missed an appointment will "subsequently consult within a three month period".

A survey aiming to understand the perceptions of health care staff as to why patients miss appointments done by Husain-Gambles et al. in 2004 [24], showed that staff members at the considered GPs tend to think negatively about patients who miss appointments and blame them in case of misunderstanding. This was reported to be a cause for intervention strategies based on punishment.

In their study taking place at GPs in Leeds (UK) in 1995, Eisner and Britten named appointment problems as one of the four main reasons causing stress to receptionists, surpassed only by difficult patients and pressure of work. [25]

All surveys within this section (2.2) stand out due to their relevance to this work for mainly exploring GPs and hence having the same target group.

2.3 Automated Scheduling

Cayirli and Veral provided a comprehensive review of literature on medical appointment scheduling. [5] Focusing on effective automated scheduling, this work furthermore presents a general overview of the area of scheduling appointments and presents formal methods to analyze and assess schedules. Furthermore, they present and discuss methods used in previous research.

2.4 Patient-led Appointment Scheduling

Despite the drawbacks on doctors' side, such as having to hand over control over appointments or to block certain time slots for patients to book online, it can be assumed that not all patients are able or willing to use Internet technology to make an appointment at their physician. In a study carried out in a hospital in China in 2010, Cao et al. state that the most important reason (52.9%) for people not to book appointments online is being unaware of the possibility to do so. [26] Other reasons were people not trusting the Internet or lacking ability to operate a computer.

2.4.1 Influence on waiting times

Online scheduling software can help to significantly reduce waiting times for patients by improving operational procedures in medical facilities as shown in various studies. In a study by Cao et al., carried out in a hospital in China in 2010, outpatients who previously booked an appointment online, experienced dramatically shorter (98 vs. 7 minutes, $P < 0.001$) waiting times than those patients without an appointment. [26] However, due to the survey's setting and the fact that waiting times of patients with online appointments are compared against those of patients with no appointment at all, the significance of how an appointment is made when it comes to waiting times remains unclear.

2.5 Reminders

Dey and Abowd discuss strategies on how and when to deliver reminders most effectively in their work on a context-aware system for supporting reminders. [27] The paper highlights the importance of context-sensitivity for reminder systems, stating that many present solutions fail to present the right information at an appropriate time. After discussing pros and cons of existing approaches such as to-do lists, email, paper post-its or even human assistants, a list of desired features of a reminder system is presented. Dey and Abowd suggest an ideal reminder system should support "the use of rich context for specifying reminders, beyond simple time and location and for proactively determining when to deliver them" amongst the possibility to receive reminders on a variety of devices of the user's choice.

A number of studies deal with the question whether reminders can be considered an effective way to reduce non-attendance rates in primary care. Junod Perron et al. found that the number of missed appointments was similar using text message and phone reminders in a randomized controlled trial carried out at the primary care division of the Geneva University Hospitals.[28] Patients received a reminder 24 hours before the appointment. While the results did not show significant difference, only text message reminders turned out to be cost-effective. The work furthermore states that patients did not report disturbances related to reminders.

In a study by Witter, Steele, McEwen and Mehler, it was found that sending reminders had a "modest beneficial effect on decreasing no show rate".[29] The reminders in this study were delivered 24 to 72 hours before the appointment via phone, using a synthetic voice provided by CTI (Computer Telephony Integration) technology.

Nelson at al. found that patients receiving a voice message as an appointment reminder had a slightly lower non-attendance rate than patients receiving a text message reminder. [30] Furthermore, it was shown that younger patients are more likely to miss an appointment than older patients with the setting of the study being the pediatric dentistry clinic at the University of Washington.

Fairhurst and Sheikh however failed to demonstrate that sending text reminders to patients who previously missed two or more appointments leads to a significant reduction of missed appointments.[31] The paper features a randomized controlled study at a GP in Lothian, Scotland.

2.6 Paper and its Role in the Modern Office

Concluding the review of literature on strategies, procedures and problem areas related to scheduling appointments, this section aims to spotlight the role of paper in modern workplaces. In their book "The Myth of the Paperless Office" [32], Sellen and Harper discuss how technology has changed offices yet failing to fulfill the often anticipated paperless environment. They conclude that paper has stuck around for a reason, it's often more flexible, suitable and extensible than its technology counterparts. Entry barriers, in the form of initial costs and know-how required for using technology efficiently, are usually lower with paper than with electronic systems. Sellen and Harper believe that the versatile range of applications account for its success, stating that the "affordances of paper... are about what people can do with paper".

Besides its strengths in flexibility of use, paper also has its deficiencies. In "The Myth of the Paperless Office" [32], Sellen and Harper got to the bottom of what is wrong with paper and why so many efforts to ban it from offices were made. They adduce three main factors to explain the situation, starting with paper being a "symbol of the old-fashioned past" that does not fit in environments that are supposed to represent a modern technological society. Apart from the lower initial costs for paper as mentioned at the outset, paper entails tremendous costs for storage and maintaining indexes. Using

paper to document work processes furthermore causes interactional problems requiring physical delivery if sharing across multiple people is required. Also, paper documents can only be accessed at one location at a time, are hard to revise, change and replicate.

Making the transition from paper to digital technology is generally considered a complex task to achieve. In "The Myth of the Paperless Office" [32], Sellen and Harper propose that successfully adapting companies to computer technology requires a fundamental change of the corporate mindset rather than a superficial change of operational procedures. Their perception is based on findings from two case studies reviewing companies who aspired to go paperless. In another study, Harper, O'Hara, Sellen and Duthie review the advantages or disadvantages of shifting from paper to electronic documentation in Preoperative Risk Assessment (PRA). [33] Resulting from their ethnographic work, they conclude that paper has substantial merits such as flexibility of use or its non-disruptive nature (e.g. when taking notes during a consultation) that are hard to translate into digital technology. They accompanied an attempt of installing an electronic system for PRA in a hospital, that failed to find acceptance by health care professionals. Instead of using the electronic form in the first place, anesthetist continued to use the paper form throughout the whole process, from the waiting room to the OR. Transferring information from paper to the electronic form was reportedly done out of a moral, corporate obligation rather than actual benefits for patients or doctors. They believe that improper constraints, poor availability of information required and meager User Interface (UI) experience led to rejection of the new system, depicting the outstanding importance of iterative design processes and exhaustive knowledge on the demands of health care professionals and work processes when introducing new technology.

Summing up previous research on the role of paper in nowadays offices, little doubt exists that paper still plays an important part and will continue to do so for a while. Being aware of this situation, can be a crucial resource during the design of new health care technology. Bardram, Baldus and Favela mentioned the use of digital pens on special paper forms as a potential way to overcome the boundaries between paper and technology by enabling "seamless transition between the physical and digital domains." [34]

2.7 Analysis of Existing Solutions

2.7.1 Choose and Book

Choose and Book was an electronic booking solution of the UK's National Health Service, allowing patients that needed an outpatient appointment at a hospital to choose a suitable facility, date and time online and on their own. Patients were referred by their own GP for continuing examinations but were able to take control of the details.

In their article, Green et al. conclude that Choose and Book fails to measure up to patient's expectations regarding flexibility in the choice of appointments. [35] Although it doesn't focus on whether choice was given on time and date exclusively, but also whether patients were given the opportunity to choose the facility, which is not relevant

in the present work's domain, the article recommends that availability of choice has to be promoted and the methods used for scheduling appointments have to be evaluated attentively. The study was conducted at the Hillingdon Hospital, where the booking method was identified as one of the key factors contributing to the experienced degree of choice. In their conclusion, Green et al. state:

> Choice is only meaningful if there are realistic options and an experience of choice. We suggest our results reveal both a symptom and a cause: the lack of experienced choice may be a symptom of a lack of meaningful choice in the system, while aspects of the system's design may cause patients to experience less choice than intended.

Choose and Book was shut down in 2015, following a drop of usage after certain financial inventive schemes have been dropped and replaced by a newly developed e-Referral service.

2.7.2 Mednanny

Mednanny [36] is an online appointment scheduling system for medical facilities. Mednanny claims to be "the field-tested browser-based solution for cost-saving and service-enhancing coordination and communication between doctors and patients". [36] Users can choose slots that are available to patients through the provided online mask as shown in figure 2.1. All online scheduling services provided by mednanny are carried out via their platform. Doctors can embed the Mednanny website on their page using an iframe only, potentially causing a break in the site's look and feel. Furthermore, according to their marketing page, functionality to find free time slots is included ("Service, simplification und [sic] innovation are at the forefront, i.e. by time-saving functions to find free time-slots with a single click, very useful at the reception" [36]). The website also indicates that "Reporting and statistics assist doctors to keep focussed [sic] on their goals an [sic] support qualified decision making and steering" which is concretized as statistics about waiting times on the pricing page. The solution is advertised to be optimized for mobiles and small screens as well, marketed as "mednanny mobile". Various packages offering a different set of features and resources like additional calendar columns or users are available. For a basic package, containing scheduling core features comparable to the prototype developed in chapter 5 as well as a maximum of three users, a facility is charged about 120€ per month. [37] However, certain features like statistics or more than ten users are included in their most comprehensive plan only, which is offered for about 1800€ per month.

2.7.3 ZocDoc

ZocDoc [38] is an online platform operating in the United States. While it is focused on helping patients to find and choose a doctor in their area based on verified patient reviews

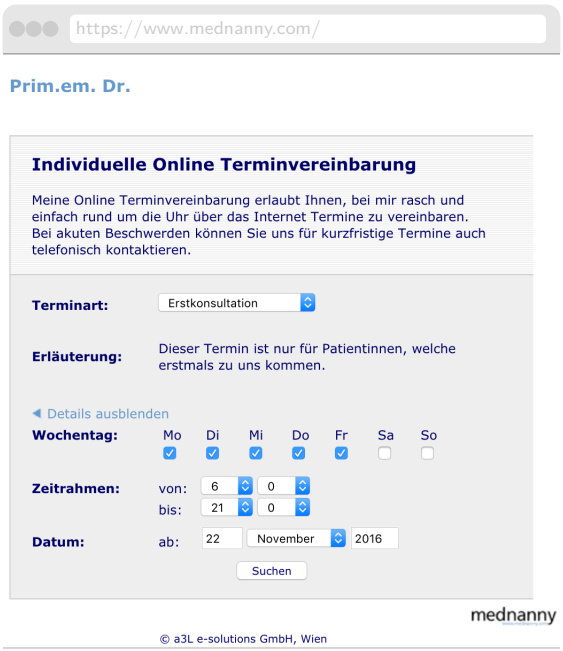


Figure 2.1: A screenshot of Mednanny's online booking form. From `https://www.mednanny.com/`, accessed on 22nd November, 2016

[39], it is possible to "see doctors' open appointment times and book instantly online" as well. [38] A screenshot of this booking form can be found in figure 2.2. Doctors are able to specify available times, their specialty and offered procedures as well as accepted insurance carriers, allowing patients to conduct searches based on these criteria on a "centralized marketplace" [39]. The impact of check-in times on a facility's flow of work will be discussed in 4.14, however, ZocDoc is offering a way for patients to provided basic information online before the actual visit. When making an appointment with a physician that chose to participate in ZocDoc's online check-in, it is possible to "securely fill out your doctor's paperwork online before the visit – and save it for your future appointments". [40] This feature was found to be unique amongst the analyzed solutions. Such as service requires handling with medical information beyond basic personal data like name, date of birth etc. on a large scale, which has substantial legal implications in most countries. US-based ZocDoc is therefore using 128 bit Galois/Counter Mode (GCM) encryption on their site and holds Federal Information Processing Standard (FIPS) 140-2 certification. [41][42][43] Regardless of the specific legal situation, a sensitive handling of medical information will require great financial efforts to be made. This will increase prizes for end customers, making it harder for small and medium-sized health care providers to obtain while staying withing their budget. ZocDoc is also available via native Android and iOS applications. A screenshot of the Android application showing an overview of an upcoming appointment can be found in figure 2.3. Although not publicly stated on their website, various sources mention an annual fee between 250$ and 300$

for doctors to be listed on ZocDoc. [44][45][46]

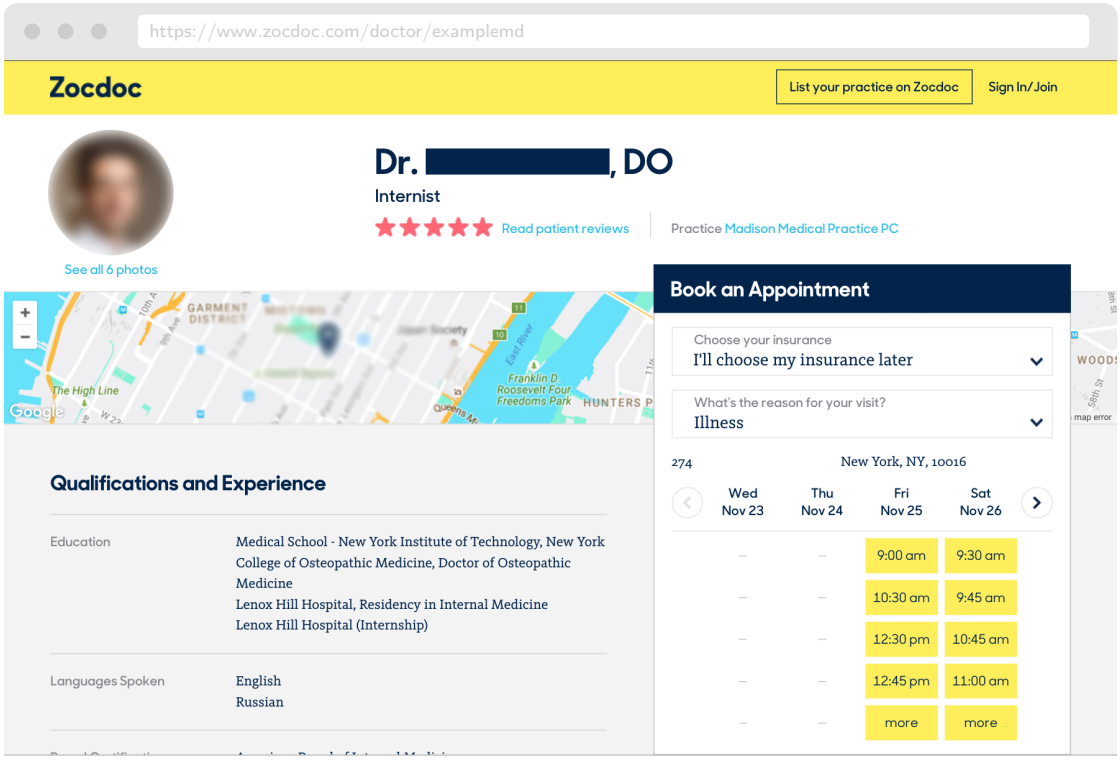


Figure 2.2: A screenshot of ZocDoc's doctor overview page with an online booking form included. From `https://www.zocdoc.com/`, accessed on 23rd November, 2016

2.7.4 Samedi

Samedi is another web-based health care professional network based in Berlin. The service offered is similar to ZocDoc and Mednanny described in 2.7.3 and 2.7.2. Just as Mednanny, Samedi provides a calendar management to be used for all appointments, both internally booked and booked by patients over the Internet. Samedi is reported to be able to know "exactly how long a treatment takes and which resources in your practice are needed" as well as to arrange "the appointments intelligently so that idle time is reduced throughout the day". [47] A screenshot of the online booking form can be found in 2.4. Their standard packaged called "Comfort-Praxis" is available for around 50€ per doctor/month. [48]

2.8 Summary

While a profound basis of research on appointment scheduling in general or in larger medical facilities such as hospitals was found, little to no literature was discovered dealing

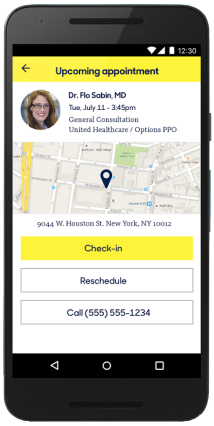


Figure 2.3: ZocDoc's mobile app showing an upcoming appointment. From `https://play.google.com/store/apps/details?id=com.zocdoc.android`, accessed on 23rd November, 2016

with small and medium-sized facilities as considered within the context of this work. Findings from previous research have to assessed regarding their relevance to the present domain. Substantial differences between the requirements of large facilities or hospitals and small and medium-sized facilities were discovered during the course of the contextual inquiry as described in chapter 4. The methods used for these inquiries will be presented in the following chapter.

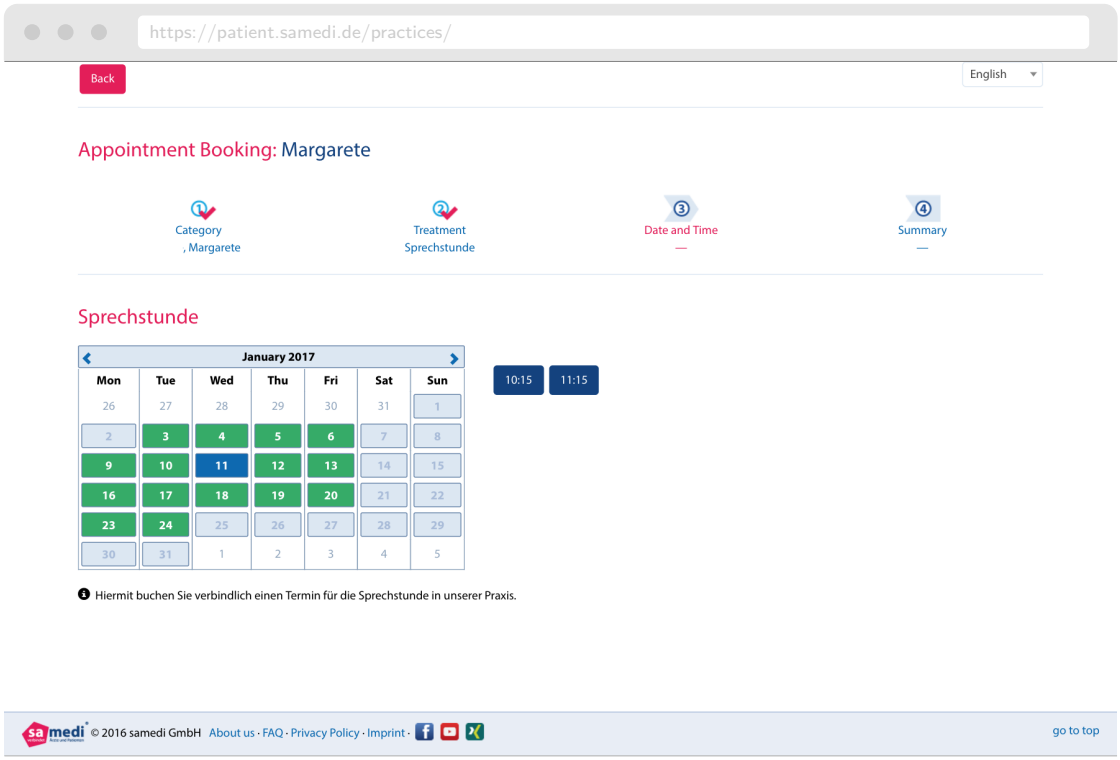


Figure 2.4: A screenshot of samedi's booking form. `https://patients.samedi.de/`, accessed on 23rd November, 2016

CHAPTER 3

Methodology

In the following chapter, the research methods and why they were chosen for this work will be discussed. As stated in chapter one, following a review of previous literature on the topic, interviews with people in charge of managing appointments at small and medium-sized medical facilities were held to gain insights in to the typical flow of work, to learn about the domain-specific challenges and requirements and to develop a better understanding of the obstacles to be overcome on the way towards technology allowing for smooth and efficient human-computer interaction.

Starting with a section on how participants were recruited, the interview approach, the techniques used for analysis of the gathered data as well as the setup of the evaluation concluding this work will be presented.

3.1 Selection of Participants

The interviews took place in twelve different medical facilities in the area of Salzburg, Austria. Although within the limits of the chosen domain, the facilities differ in size and type.

A variety of different types of facilities was chosen to get a comprehensive picture. The considered facilities therefore cover a broad spectrum of medical specialties, including radiologists, gynecologists, dentists, surgeons, urologists, internal specialists and general practitioners. This work pursues the goal to provide a viable solution for a preferably high number of facilities in the identified domain. In order to achieve that, gathering expert knowledge and use cases from differing scenarios led to the selection of facilities above.

Since appointments for the contextual inquiries were made with facilities rather than single persons, all interviewees were approached on-site after learning about the facility's organizational structure first. The inquiry was targeting staff in charge with managing

Name	Facility	Specialty	Position	Transcript
Christian	I	General Medicine	Physician	-
Claudia	I	General Medicine	Administrative Staff	Interview X
Olivia	II	Surgery	Administrative Staff	Interview IX
Jasmin	II	Surgery	Administrative Staff	Interview IX
Elke	III	Internal Medicine	Administrative Staff	Interview V
Katrin	IV	Internal Medicine	Administrative Staff	Interview I
Tobias	IV	Internal Medicine	Physician	-
Birgit	V	Urology	Administrative Staff	Interview VIII
Christine	VI	Internal Medicine	Administrative Staff	Interview IV
Annika	VII	Dentistry	Administrative Staff	Interview VI
Andrea	VII	Dentistry	Administrative Staff	Interview VI
Katja	VIII	Gynecology	Administrative Staff	Interview III
Daniela	IX	General Medicine	Administrative Staff	Interview VII
Sabrina	X	Radiology	Administrative Staff	Interview II
Nadine	X	Radiology	Radiology Technologist	-
Andreas	X	Radiology	Physician	-

Table 3.1: List of interview partners with the respective facilities' specialties, position and transcript reference.

appointments, allowing to follow their regular flow of work and gaining vital insights into actual practice. Table 3.1 lists participants, their position and the medical specialty to provide extra context. As stated in 3.1, interviews with sixteen participants took place in ten different facilities in Salzburg, Austria and surroundings as well as in Vienna, Austria. Real names of participants have been replaced by names that were popular with Austrians at the approximate time the participant was born. This was done to preserve an authentic, human impression of the data while protecting participant's privacy.[49][50][51]

All participating facilities were given a consent form stating that no sensitive or personal data will be disclosed in this work. Contact to the participating facilities was established via the professional network of the author's father.

3.2 Interview Approach

All interviews were held at the participant's place of work and during regular working hours. The facilities kept operating meanwhile. Typically, questions and corresponding explanations were handled in between regular patient-staff interaction, e.g., for an interview with a receptionist, talking was done in the minutes between the arrival of patients or phone calls. Observing patient contact and how appointment requests coming in by phone were dealt with, allowed to gain vital insights into the flow of work in health care facilities. This approach was based on the idea of "Contextual Inquiry" by Holtzblatt,

which "provides techniques to get data from user in context: while they work at real tasks in their workplace." [52] According to Holtzblatt and Beyer (1993), confronting users with questions about what they have been doing just a moment ago and why, gives the interviewer a chance to discover things that eventually would have been implicitly assumed trivial by users otherwise. They furthermore believe users are able to talk about specific problems much easier than about general affairs. A users' real work experience is assumed to be their irreplaceable core input, meeting them in their usual setting can therefore help preserving this potential.

All interviews were held face-to-face in a semi-structured manner as described by Wood (1997). [53] Wood organizes expert knowledge in object knowledge and process knowledge, with object knowledge including typical naming conventions, domain-specific entities and taxonomies and their characteristics. Process knowledge is described as "knowledge required to accomplish the intended work using relevant concepts and objects." The set of outlining questions used for the interviews is listed in table 3.2. The question's type according to Wood (1997) is identified along with every question. This set of questions has been refined during the course of the interviews, some were changed or dropped while others were added. Coming from this set of questions, more in-depth inquiry was conducted whenever necessary.

To gain informed insight into the facilities' work routines, the contextual inquiries were usually expanding over the morning or afternoon, depending on opening hours. Considering all investigation was done during regular operation, patients arriving at the front desk require ongoing interviews to be put on hold for the time of patient interaction. A typical conversation with a member of the administrative staff in the course of this research took between forty-five and ninety minutes.

Given the interview partners' agreement, audio recordings of the interviews were made. These recordings were transcribed the same day the interview took place. The transcripts attached to this work can be found in appendix A. Handwritten notes were taken mostly while observing patient-staff interaction to collect additional observations and metadata such as facilities' spatial layouts or (technical) equipment.

3.3 Analysis

The data used for analysis as described in this section consists of the transcribed audio protocols originating from the interviews and handwritten notes of additional observations that were made on-site.

3.3.1 Techniques

Analysis was done with the help of Atlas.ti, a proprietary software tool for qualitative research.[1] A number of approaches to analyzing data was evaluated before the final

[1] http://www.atlasti.com/

Type	Question
Grand Tour	What happens if a patient phones in for an appointment?
Grand Tour	Does is happen often that patients don't show up?
Grand Tour	Do you work with time buffers?
Grand Tour	Do you offer reminders?
Grand Tour	Are there any plans to change any aspects of your flow of work in the future?
Case-Focused	Is there anything in the last couple of weeks or months that has been particularly inconvenient or badly organized?
Case-Focused	How much of your working day do you spend on managing appointments?
Case-Focused	How much into the future do you schedule appointments?
Case-Focused	How is the time required for an appointment being estimated?
Case-Focused	How do you usually make appointments? By phone, email or face-to-face?
Case-Focused	Do you require your patients to make appointments for all visits?
Case-Focused	Do you group certain examinations in blocks at certain times?

Table 3.2: List of core questions used during the interviews

decision. The information was then structured using a set of codes, largely based on the core questions identified during preparation of the interviews as listed in table 3.2. An enumeration of the codes used during analysis can be found in table 3.3. Quotations were identified within the transcripts and then linked to relevant codes, allowing to perform queries on collected information. Codes were derived a priori from the core questions listed in table 3.2 on the one hand, but also added later during analysis as emergent from the data on the other hand. A screenshot of an interview transcript with coded quotations in Atlas.ti can be found in figure 3.2. The number of occurrences in the transcripts is indicated for each code in table 3.3 as well. Exemplary queries can go from simple, enumerating inquiries to more complex ones, e.g. co-occurrence analyses. To facilitate a breakdown of information, such annotated data can also be visualized as a network, possibly providing more intuitive insight in how findings are related to each other. An example of such a network created using Atlas.ti, is shown in figure 3.1. It provides a graphical representation of how certain aspects or topics co-occur in various transcripts and makes it easy to identify the corresponding passages.

3.4 Development of a Prototype/Exemplary Design

Considering experiences from the literature review and the on-site interviews, an approach towards an exemplary design of a software solution to deal with the challenges pointed out was attempted. With an actual implementation on production level being outside the scope, this work focuses on demonstrating one possible design for a web-based

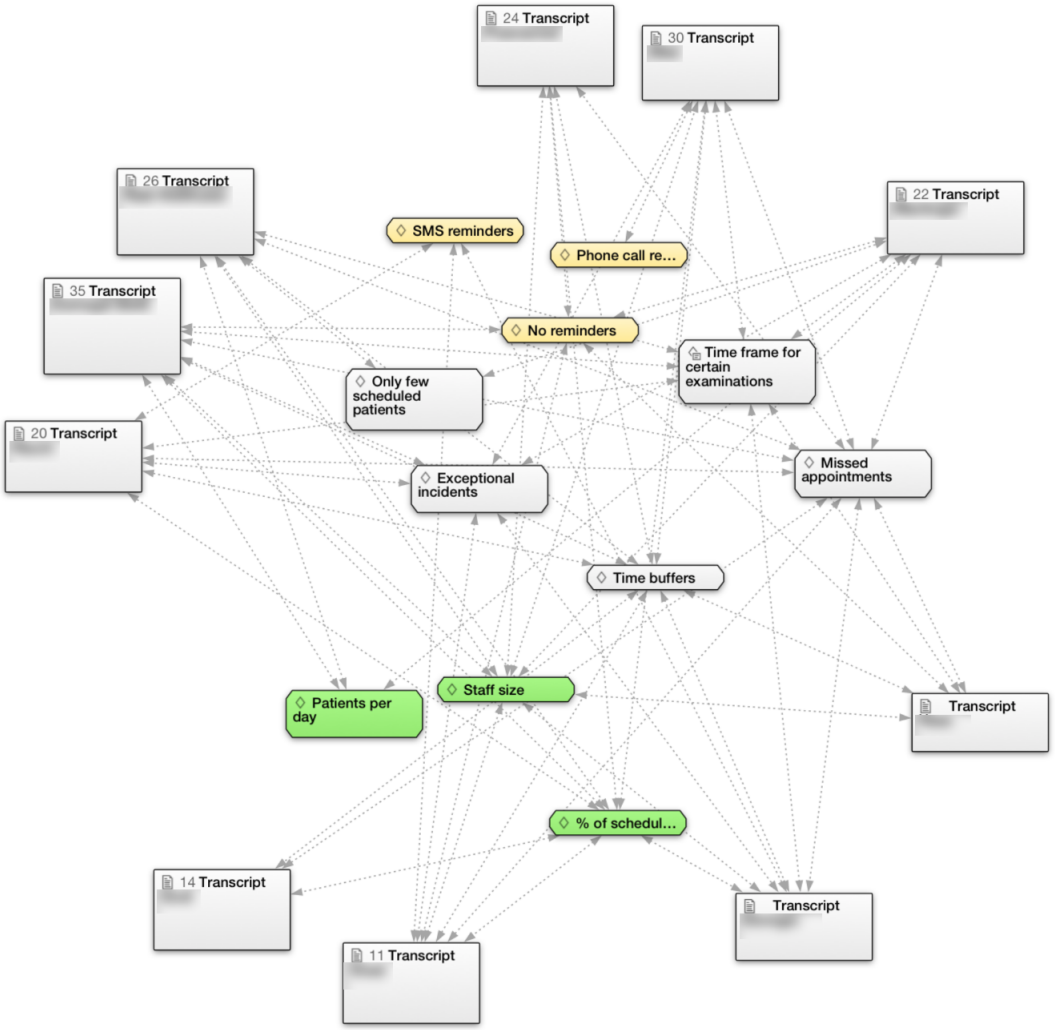


Figure 3.1: An exemplary network of a few codes and transcripts created using Atlas.ti allowing for a more intuitive analysis of data. For instance, with the given network, finding those facilities which are using time buffers is easy by tracing back the edges of the corresponding code's node.

Name	Groundedness
Advantages of paper	1
Appointment by mail	4
Appointment by phone	7
Appointment personally	3
Certain order of examinations	1
Changes in the past	5
Color coding	2
Division of work	3
Drawbacks of paper lists	1
Duration of appointments	17
Exceptional incidents	7
Future appointments	3
Missed appointments	16
No reminders	5
Only few scheduled patients	2
Patient satisfaction	1
Patients per day	3
Phone call reminder	2
Plans for the future	7
Scheduling	17
Self-assigning appointments	4
SMS reminders	6
Staff size	10
Tablet computer	1
Time buffers	16
Time frame for certain examinations	9
Today's appointments	4

Table 3.3: List of codes used to tag quotations during analysis.

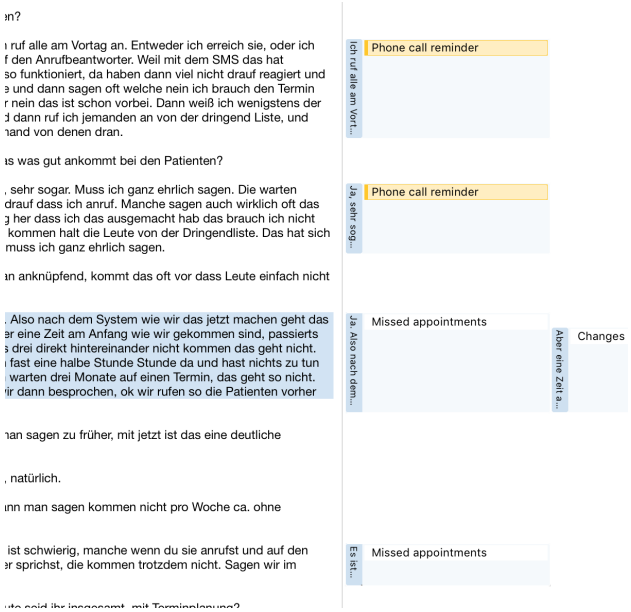


Figure 3.2: A screenshot of an interview transcript with coded quotations in Atlas.ti.

appointment scheduling system that aims to suit the needs of small and medium sized medical facilities.

3.5 Evaluation

In a final iteration, a clickable prototype developed with standard web technologies, as described in 5.4, based on the findings from the previous steps was shown to two members of the administrative staff in one of the participating facilities and one physician, who was showing personal interest in participating in the final evaluation phase. These demonstrations were either done face-to-face or via phone. Participants were introduced to the exemplary solution first, and then asked to perform a few steps of typical procedures like making an appointment. To be able to assess the design's quality apart from verbal feedback, the prototype has been equipped with additional functionality to gather usage data for analysis as described in the following section.

3.5.1 Techniques

The prototype has been equipped with tracking technology to record user sessions in terms of session duration or page-to-page navigation activity. Furthermore, metrics such as clicks, scrolling and mouse pointer movement are being collected to support evaluation as described above. Three proprietary tracking solutions, Clicktale[2], Hotjar[3]

[2] https://www.clicktale.com/
[3] https://www.hotjar.com/

and Mouseflow[4], as well as a custom approach based on the open-source heat map library simpleheat[5] were evaluated for this purpose. All of the three proprietary solutions turned out to be able to meet requirements with reasonable pricing, rendering a custom solution from scratch uneconomic. Hotjar and Clicktail failed to deliver in combination with a Single Page Application (SPA) (see chapter 5 for information about the technology stack used for the prototype), leaving Mouseflow as the only option. The prototype was deployed to Heroku[6], a popular Platform as a Service (PaaS) provider. Heroku offers a free plan that allows serving the prototype accessible from everywhere and at little maintenance costs. More information about Heroku can be found in books by Middleton and Schneeman (2013) [54] or Hanjura (2014). [55] Hosting the prototype publicly on the Internet eliminates the need for a specially prepared demonstration environment. Since it is available from any personal device, barriers resulting from users being unfamiliar with certain hardware or technology used in a test set-up can be sailed round.

[4] https://www.mouseflow.com/
[5] https://github.com/mourner/simpleheat/
[6] https://www.heroku.com/

CHAPTER 4

Contextual Inquiry

In this chapter, the outcome of the interviews will be presented. Before the actual findings, a brief introduction of the participants involved is given.

Unless noted otherwise, all quotations in the following sections are originating from the transcripts of the interviews done in the context of this work. All interviews were held in German language and therefore, quotations in this chapter have been translated to English by the author. Quotations can be reviewed in the original context and language in appendix A.

4.1 Scheduling in General

Almost all participating facilities require their patients to make appointments beforehand. The reasons for that, however, are diverse. A, in comparison to the other participants, much frequented facility is making appointments to optimize the rate of examinations by grouping certain procedures at certain points in the week, therefore reducing waiting times for patients. Also, working hours of staff qualified for a particular examination needs to be taken into account when making appointments. While they do offer the possibility for patients to come in without prior notice for a few basic examinations, this is not possible for more advanced or longer-lasting ones.

The majority of the attending facilities are treating patients without an appointment only in case of an acute health condition. All other patients will have to make an appointment.

Some of the considered facilities, all in general medicine, do not offer appointments at all. Due to the spontaneous nature of the consultations in this certain area, scheduling appointments seems not to be considered as an effective measure to coordinate patient contacts here. Typically, GPs holding a contract with national health insurance in Austria will encounter patients in need for prescriptions, medical leave or other acute but usually non-serious health conditions. Obligated to provide for medical care as stipulated by

contract, these facilities are likely to face a much higher number of consultations per day than practitioners operating in medical specialties other than general medicine. A high number of patients, comparably short consultation times and mostly acute cases contribute to an environment where pre-scheduled appointments are hardly a viable approach.

4.2 Duration of Appointments

Estimating a consultation's duration is one of the most crucial parts in appointment scheduling. While a tight schedule makes for a good degree of efficiency, unforeseen delays have much bigger impact on the daily routine than with more generously estimated time-assumptions.

4.2.1 Influencing factors

The usual duration of an examination was often described by participants as something they have learned over time by constantly improving initial assumptions. It can be inferred, that frequently carried out examinations are easier to plan than rare procedures. Furthermore, it appears that there are examinations with little deviation from their usual duration, such as medical imaging techniques or small, highly standardized consultations like compulsory medical checks before obtaining driving licenses etc. On the other hand, especially appointments with a more conversational nature, such as initial consultations, or complex, individualized treatments can vary strongly in duration.

In particular, those examinations are also greatly influenced by the patients themselves. People working in admission even indicated they would add some extra time for certain patients that are already known for requiring special attention. The importance of local personnel knowledge became evident in numerous occasions, with awareness of certain patients' needs or idiosyncrasies being one of them.

Collecting informed consent or discussing the findings of a previous examination turns out to be hard to estimate in terms of time required.

Those facilities with more than one physician in-house, described the actual required time for examinations as highly depending on the executing physician also.

Another mentionable tendency when it comes to time estimates amongst the considered medical facilities, is their contractual situation. Those having a fixed contract with the Austrian statutory health insurances seem to lean towards tighter schedules, allowing for a higher number of patients to be treated and therefore reducing waiting times. Those with no fixed agreements however, reportedly strive to offer an alternative route that requires a more generous approach on estimating a consultation's duration.

4.2.2 Present approaches

In all of the considered facilities, appointment scheduling is carried out by administrative staff rather than the physicians themselves (see 4.11 and 4.13). Therefore, a transfer of knowledge about certain examinations from medical to administrative staff has to be ensured.

During the interviews, it turned out that this is often achieved by a predetermined set of examinations in combination with their usual duration, which is then used to identify the time typically required for an appointment. This basic idea has been observed in all facilities that do make appointments. While the administrative staff in the most frequented facility have their respective estimations coded into the electronic calendar management system, more standardized time blocks, e.g. twenty or forty minutes, are used in smaller ones.

Although the methods mentioned above greatly support administrative staff, the importance of expert knowledge and experience became evident during the interviews due to the large number of factors that can affect the duration of an examination. An electronic system supporting staff to make accurate estimations on an appointment's duration would have to incorporate knowledge about medical procedures, availability of staff and equipment, certain patient's idiosyncrasies, etc., while still be capable of reacting to unforeseen events. It is to be discussed if the benefits of such a system justify its complexity. This idea will be taken on in 8.2.

4.3 Time Buffers

The majority of the facilities regarded indicated they are adding time buffers to their schedule to compensate for appointments taking longer as expected. People are having very different approaches on time buffers. In a more passive way, a certain amount of time added between each appointment or at fixed times each day, can act like a safeguard. That way, buffers help keeping up with the schedule, reducing waiting times for patients and avoiding potential stressful situations. Some facilities mentioned they are using time buffers in a proactive way, not to compensate for inaccurate time estimates, but rather to reserve slots for patients with acute health conditions whose treatment otherwise would disorganize the day's schedule. This was described as follows by a member of the administrative staff at an internal specialist's practice:

> And here [on the margin of the calendar sheet[1]] I have put a certain mark telling me that there is a time slot open for acute examinations, for instance a gastroscopy. And if its still open on Wednesday for Thursday, and somebody calls me for an echocardiography, I would give it to them.
>
> Christine, Administrative Staff

[1] note from the interviewer

On the downside, unused time buffers can lead to idle capacities, making them uneconomical and causing longer waiting-times for patients who need to get an appointment. This was brought forward as the main argument against time buffers during the interviews. Figure 4.1 shows an exemplary schedule with fifteen minutes time buffers after each patient contact next to an imaginary record of a possible actual record of events. In the presented scenario, Appointment 1 starts a little late and takes longer than expected, however, a time buffer between 9:45 and 10:00 is able to compensate for that, allowing Appointment 2 to start on time. Since Appointment 2 takes about as long as estimated, the subsequent time buffer is made redundant leading to idle resources during that period.

Just as for estimating the duration of an appointment, people working in the area described the approach on time buffers used in their workplace as something that is undergoing constant improvement and adaption.

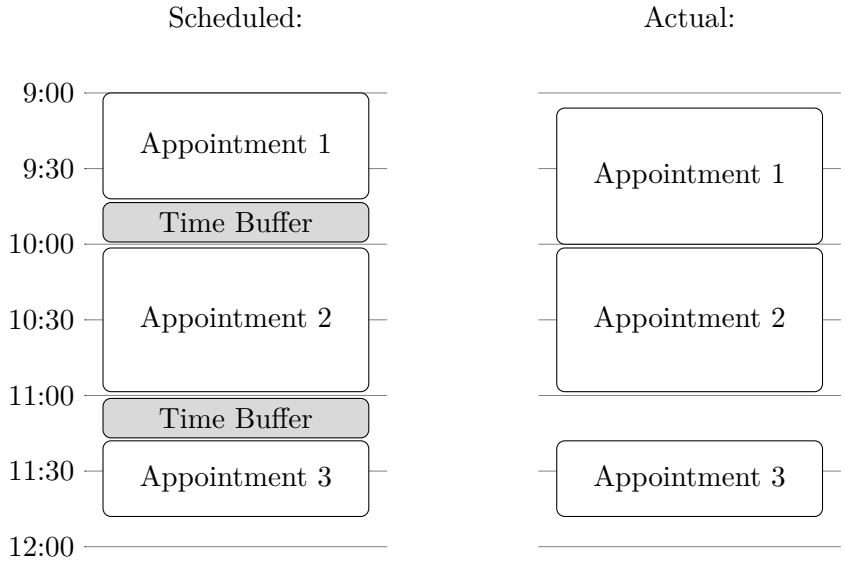


Figure 4.1: An approach on time buffers using small block between every appointment as observed during the interviews

4.4 Missed Appointments

The number of patients to miss an appointment is believed to be influenced by a number of factors discussed subsequently. At the administration of a radiologist, the following reasons were given for missed appointments:

> Either patients forget about their appointment, or, if the waiting time is long, they try another facility, get an earlier appointment than with us and forget to cancel the existing appointment. Things like that. Rather not because of sickness, most patients call in sick. Mainly patients that make

> appointments here and there but do not cancel anymore.
> Sabrina, Administrative Staff

This facility also stated, they have patients missing their appointments every day.

Another surprising insight is that the weather is believed to influence medical appointment scheduling as described by a member of the administrative staff at an internal specialist's office, when asked whether their patients would miss appointments on a regular basis:

> If the weather is nice, yes. Really, during summer, when it's sunny outside, they sometimes just don't show up anymore. Olivia, Administrative Staff

Missed appointments do present a problem by causing uneconomic idle time. Some facilities mentioned they would try to reach patients in case they haven't arrived until the beginning of their appointment for the sake of clarity. Knowing a patient will be late, might give the opportunity to reorder appointments in order to keep waiting times as low as possible.

Another aspect was revealed during an interview with an administrative staff member, asked whether missed appointments present a problem at their facility:

> Sometimes, it's a bit annoying if it happens in the middle of the day. You've always got something to work on. But since we are only open two half days a week, patients have to wait for a new appointment then, and sometimes they get grumpy if they don't immediately get a new appointment. But... that's their own fault. Katrin, Administrative Staff

Clearly this is not a favorable situation for both parties. Especially for private practices depending on their regular clientele, patient satisfaction was reported to be a major objective. Strategies to avoid missed appointments include reaching out to patients as soon as they appear to be late as well as sending various kinds of reminders beforehand. Observations made during the inquiry conform to the prevailing techniques present in relevant literature. Studies on the effectiveness of some of these methods have been presented in chapter 2, section 2.5.

4.5 Reminders

An introduction to the opportunities and challenges that sending automated reminders brings about, has been given in 2.5. Half of the considered facilities indicated they would not give reminders to their patients, with the other half stating they are sending text message reminders or calling patients before an appointment.

Albeit sending automated text message reminders may be a feasible solution in most cases, an insufficient technical approach can lead to frustration and loss of valuable

resources. This was described by a member of a dentist's administrative staff, being asked whether they would have to manually trigger the sending of text messages:

> Yes. I have to be insanely careful when selecting the proper date. By default, three days are preselected but I only want to select one day, the next one. If I select the wrong date, we run into horrendous trouble since all patients will start to think they are having an appointment the next day and our telephones won't stop ringing. Annika, Administrative Staff

In the presented case, a template for the content of the text reminders was configured containing the word *tomorrow* rather than an absolute date, with the time being the actual appointment's time. If patients with appointments on different dates are selected together, that template can lead to ambiguous results. Asked for their personal feeling about sending text reminders, the same person answered:

> It is convenient for patients, but causes a lot of work for me. I usually do that in between of other things, and if I make a mistake the damage is done. But there is no other option for now. Annika, Administrative Staff

In the considered facilities, choosing the most appropriate transport for reminders was eventually described as a trial-and-error process. Whether text or phone based reminders work best in the given situation, is presumably depending on multiple factors. Section 8.3 describes ideas on developing solutions to approach this issue in potential future works. The following excerpt is taken from the transcript of an interview with a member of an internist's administrative staff, talking about how they are calling people instead of the text reminders they used to send previously.

> I'm calling all of them on the day before their appointment. Either I get to talk to them personally or I leave them a message. Sending text messages somehow did not work out well for us, a lot of people did not react to a text, and this way [calling them by phone[2]] I get hold of them. Often people are telling me they don't need that appointment anymore. Or their symptoms have passed. That way, at least I know they're not coming so I can give that appointment to a patient on our urgent list. Elke, Administrative Staff

As noted in 4.7, some schedulers prefer to give patients handwritten notes with their appointment details. This approach was described as particularly popular with elderly patients.

[2] note from the interviewer

4.6 Timing of Examinations

Due to organizational reasons, e.g. availability of staff, equipment or premises, it can be necessary to group certain examinations at a certain time of the day or week. During the interviews, no distinct pattern regarding the timing of examinations was identified amongst the participating facilities. However, there seems to be a tendency towards a diversified working day where possible.

As mentioned at the beginning, availability of equipment and staff can dictate work flows. Reserving certain time frames for certain examinations can help to plan staff and tools more efficiently. The following excerpt is taken from an interview at an internal specialist's practice.

> Monday, Tuesday and Thursday are our mixed days, our laboratory staff is working on those days too. Three days a week. On Wednesday we are carrying out endoscopies. That means we are having gastroscopies and coloscopies, with doctor-patient discussions in between. We don't do other examinations on that day. Until 5 pm. On Thursday, we are always make two appointments with the third one being a gastroscopy. That way, every hour we carry out one gastroscopy and two other examinations. Elke, Administrative Staff

A similar observation was made at a surgical medical practice, as documented in the interview excerpt below.

> We pursue a plan. It all depends on the number of devices we have at our disposal, plus we cannot have the same examinations one after another since the equipment has to be cleaned. Thus we have to allow some time for the devices to be cleaned. We need to rotate the order of examinations or squeeze in an appointment for which we don't need equipment. So here [calendar management on the screen[3]] you can see, today we have a coloscopy, a gastroscopy next and in the meanwhile cleaning is already done.
>
> Olivia, Administrative Staff

In contrast to the highly specialized and technically demanding examinations addressed in the above excerpts, more ordinary consultations might allow for a flexible planning. The assumption that those facilities having to mainly admit acute patients are likely to be more flexible in their timing of examinations, is likewise obvious as corresponding to observations made during the interviews. Especially general practitioners seem to offer great flexibility when it comes to timing of examinations.

[3] note from the interviewer

4.7 How Appointments Are Made

A majority of the facilities' appointments are being arranged either by phone or personally. While making appointments in writing might have the merit of presenting an unambiguous agreement on time and date, it reportedly has its drawbacks too. Using the example of email, agreeing on an appointment usually requires a few messages, which was described by a member of an radiologist's administrative staff as follows:

> Well, we're actually reluctant to make appointments via email. It does happen from time to time that we receive an email, but we would usually reply them asking for a call instead. Otherwise it goes back and forth so therefore we prefer a phone call. [...] Mainly by phone, or personally at the admission- some patients show up with a referral if they happen to be close-by. But via phone for the most part actually. Sabrina, Administrative Staff

Another issue, originating from the definitive nature of written communication, was described by an employee working at the admission of a gynecologist after asking her whether a lot of patients are sending appointment requests by email:

> Yes, not plenty though, but there are a few. I dislike that very much, it annoys me, I find it irritating, those mails usually are full of questions, sometimes I can't even answer all of them by mail and I also don't want to. Because everything you write, people pin you down on it. And that is something that is wearing you down, but it's probably something specific to the clientele at a Wahlarzt. Katja, Administrative Staff

With more than one person working in the area of appointment scheduling, email can cause concurrency issues and requires all offered slots to be blocked until the patient confirms the date, as described in the following excerpt from the same interview as above:

> If a patient is requesting an appointment via email, and they put their phone number, I would call them or write them back asking them to call me. I don't make appointments in writing, e.g. via email. Because we are four people working in appointment scheduling, depending on the doctor in charge, we all have access to the calendar. Therefore it could happen that a colleague is making an appointment, but doesn't know that I already offered that date to somebody else by mail. That's why we don't do that.
>
> Katja, Administrative Staff

It can be safely assumed that the considered facilities carry out almost all their appointment scheduling by the use of telephone. As for the case where an appointment is made personally, it was further noticed that it is common practice to hand out a written confirmation of the appointment, which is reported to help patients remembering the exact date. This is also described in 4.5.

4.8 Merits of Paper

A paper calendar can offer substantial advantages over electronic scheduling systems. Paper is usually believed to have a, compared to a digital equivalent, low entry barrier. This is especially true for people not used to dealing with computer technology. This suspicion has been confirmed during the course of the inquiries. The following excerpt demonstrates in an exemplary manner, how technology can fail to be accepted. Asked about the paper calendar in front of the computer screen at a facilities front desk, and whether it is being used in parallel with an electronic booking solution, a member of the administrative staff answered:

> Exactly, but that's because I'm used to it [the paper calendar[4]]. I've been doing it like that since 40 years, I got everything at a glance and I know what is going on. I find it hard to get used to the small words [font size on screen[5]]. I'm taking lots of additional notes, they don't fit in the computer, on paper I turn over a page and everything important and relevant is right there on the face of it. Of course it's twice the work, and it's a matter of habit, I have to admit. Elke, Administrative Staff

Apart from being more intuitive for people less comfortable with computer technology, paper is also less opinionated on work flows and the way information can be structured and presented while computer technology generally relies on certain data structures. Another interesting observation was made at an internal specialist's office, targeting the differences in form factor. While it is usually easy to pick up a paper calendar and show it to another person, e.g. a patient on the other side of the front desk, this is hard to achieve with a common computer monitor. Being able to show certain aspects to patients, can help to explain a tight schedule situation by illustrating it. This was described as follows, after being asked whether they have thought about replacing the current paper calendar with an electronic scheduling system.

> Maybe. We thought about turning down on our paper calendar. There is a scheduling system available that's connected directly with patient records. It's supposed to be faster. On the other hand, I like the way it is right now. One of my relatives is a dentist, they only have computers. So when you ask them for an appointment, they look to the screen and realize there is no open slots and so they offer you an appointment in September. [This interview was held in beginning of March.[6]] Then you can see how people start to get a suspicious look on their face, thinking that this is not truth perhaps. Here with me, people can see what is going on, I would show our schedule to them, telling them that, for instance, here we have one last slot left I can

[4] note from the interviewer
[5] note from the interviewer
[6] note from the interviewer

> offer them. In terms of communicating scheduling decisions, that's not a bad thing, we put our cards on the table. Using an electronic solution, I tell the patients "September it is" and they think "well, probably I'm not important enough", but here, using the paper calendar, I'm able to demonstrate that I'm actually making the effort. And then people say "wow, your schedule is packed but still you're offering me an appointment", so that greatly increases our credibility. And after all, we've been doing it like this for such a long time now. Christine, Administrative Staff

In this scenario, appointments and patient names were written to the calendar using a pencil, allowing for later editing. It is virtually impossible, also due to the nature of handwriting, for the observer to catch details of the schedule from their position but it is still a good way to put the message across.

Another scenario where paper was chosen over technology is detailed in section 4.14, describing facilities' processes from registration of a patient to treatment. The strength of paper in flexibility of use emerged from the observations made on-site. Many interviewees indicated they would be using paper to be able to take notes in context, highlight information, cross out finished tasks, rearrange schedules (e.g. on a list of today's patients) or simply to scribble ideas and feel connected with their work environment more intuitively.

These observations coincide strongly with the findings from reviewing literature on the role of paper in modern offices as presented in 2.6. In their book "The Myth of the Paperless Office" [32], Sellen and Harper conclude that technology failed to replace paper but changed the way and the scenarios in which paper is used at work. This perception has been reconfirmed during the course of contextual inquiries, making for an important lesson learned in view of the exemplary design to be prototyped in chapter 5.

4.9 Future Appointments

As a result of offering consultation by appointment only, the schedule can extend far into the future. Although the number of patients seeking for medical advice might not be subject to the reach of single facilities, the impact on appointment scheduling is evident and therefore must not be excluded from a comprehensive overview. Besides from recurring appointments such as annual routine check-ups, schedules of facilities considered in the context of this work, extend from two weeks up to three months into the future. It can be noted that waiting times might vary considerable amongst different examinations.

4.10 Consultations per Day

A considerable part of the participating facilities were not able to state an absolute number of consultations per day. While the indicated values reach from ten to 150 patients

per day, it is important to note that especially in the area of general practitioners, a lot of patient contacts are carried out without any physician being actually present. For instance, dispatching a previously prepared statement, issuing prescriptions or basic consultation over the telephone. At facility I, asked for their average number of patients a day, the following answer was given:

> Usually between 70 and 80. Until now we had 16, that's not worth mentioning. [This interview was held in the morning, one hour after opening.[7]]
> Christian, Physician

The upper limit was believed to be around 150 patients a day and strongly depending on the weather situation. Another GP stated to have 20-40 consultations with the doctor, but around 100 patient contacts in total a day.

> We have around 20-40 patients who need to see the doctor in person, but with those who just need prescription the number goes up to 100, on average. When the going gets tough, with statements and prescriptions it can be as much as 150 patients a day. Daniela, Administrative Staff

4.11 Administrative Staff Size

Table 4.1 contains reported or observed staff sizes at the explored facilities. It is not possible to make a clear separation of administrative and medical staff. For the small and medium-sized facilities considered in the scope of this work, no such distinction can be made. Low numbers in personnel can reportedly lead to an allocation of work to all members of the staff. In order to properly reflect this situation, table 4.1 aims to demonstrate proportions of people involved in appointment scheduling regardless of their actual position of profession, and people not directly involved in managing appointments. Where available, values in parentheses are total staff sizes alongside the number of people on duty at once. Facilities I and IX indicated to deal with a small number of appointments only. However, managing walk-in patients is considered as a task related to scheduling here.

Figures in table 4.1 clearly show that managing appointments takes up a big part in the overall work load of the analyzed facilities. Improving the scheduling process has the potential to have a considerably positive impact on the facility's overall operation.

4.12 Appointment Scheduling in Daily Work Routine

The number of people engaged in appointment scheduling alone reveals its significance in the daily work routine of a medical facility. The administrative staff size in the considered

[7] note from the interviewer

Facility	Total	Involved	Not Involved
I	3	2	1
II	5	4	1
III	4	1	3
IV	4	2 (1)	2
V	4	3 (2)	1
VI	3	1	2
VII	5	2	3
VIII	3	1	2
IX	3	2	1
X	19	9	10

Table 4.1: A listing of total staff sizes at the explored facilities itemized by involvement with scheduling processes. Staff sizes include physicians, medical and administrative staff. Values in parentheses indicate the number of people on duty at the same time.

small and medium-sized facilities varies from one up to nine people as described in 4.11, in the latter case almost doubling the number of physicians in the facility. Asked about how much time making appointments takes up on their regular working day, members of the administrative staff indicated values between forty and 100 percent of the total work load. A few interview excerpts of people going into detail on this question are presented in the following.

> Actually all the time. Yeah. That is my main task. You often realize that almost a week or at least three days are fully booked after a day of scheduling, that's how fast it goes. Sabrina, Administrative Staff

> 100% during the morning, actually almost the same in the afternoon. Annika, Administrative Staff

> Quite a lot altogether. Of course it depends on how many calls I have to answer. But 50%, roughly speaking. Daniela, Administrative Staff

> About half of the time. It's quite varying. It's more after holidays. I'd say about 40% in general. Elke, Administrative Staff

4.13 Premises, Equipment and Office Environment

Since no appointments other than for preventive medical checkups are made at facility I, a small GP, the main task for administration is to register walk-in patients. Two paper calendars (one for private practice, one for all other patients) were being used

for managing the few appointments they make. The front desk was situated within the waiting room, offering two workstations. Both the front desk and the examination room were equipped with desktop computers running a Windows Operating System (OS).

With examination rooms located one level higher than the front desk within the waiting area, facility II was found to be equipped with an advanced telephony solution since also internal communication would be carried out over phone for the most part. All computers were running a Windows OS. A headset was connected to the telephone at the front desk, enabling hands-free calls. When asked about any changes in the past that improved their work flow, the following answer was given:

> Olivia: We got the hearing aid. [points at the headset[8]] Jasmin: Before, I used to sit buckled while on the phone, you're going to need a physiotherapy. You need to have both hands free. Olivia & Jasmin, Administrative Staff

Facility III was the only reporting to have an actual Computer Telephony Integration (CTI) in use for appointment scheduling. Tightly integrated with their Electronic Health Record (EHR) software, this enabled them to navigate quickly to the file of the patient on the incoming call without the need to ask for the caller's name (plus date of birth if ambiguous), conduct a search in the patient database and open the respective file. Also making a call from a patient's file without having to dial manually was demonstrated during the interview. CTI was reported to be an expensive tool, that substantially improved working conditions and the time required to manage appointments by phone. All rooms were equipped with desktop computers running a Windows OS.

Two people taking turns in managing appointments at facility IV, and the practice is reported to open on a few days a week only. Appointment scheduling therefore needs to be done in an asynchronous manner and from different locations. Both portable and desktop Windows computers were observed on-site, complemented by a tablet computer running an Android OS used for scheduling appointments from anywhere outside the premises as detailed in the following interview excerpt:

> It's quite convenient like that. We have a tablet computer, and the one carrying the office cell phone gets the tablet too. Actually I own one myself and my colleague has one herself and we do that from home. We don't need to actually sit here but can work from home using mobile and tablet. That's really convenient because you always have it with you. Also, I think that patients enjoy us being on call most of the time, it works really well. I think we could stick with this process. Katrin, Administrative Staff

Facility V were observed using Windows desktop computers in all rooms. The medical practice was divided into a waiting area, an office with the front desk connected to the waiting area through a window and two separate examination rooms.

[8] note from the interviewer

The room layout at facility VI was found to be pretty much like at V. An additional compartment for small operations like venipunctures or injections was situated next to the waiting room, with no additional equipment for data processing or managing work flow.

At facility X, operating in the area of radiology, more than 5 people were assigned with scheduling tasks. A separate office, isolated from the front desk and the waiting area, was used to carry out phone calls and managing the entire operating schedule. The front desk was used solely for face-to-face communication with attendant patients, e.g. to register them on arrival and call them before their treatment. No phone calls were accepted on the front desk. The entire facility was equipped with desktop computers running a Windows OS. The interviews took place at the administration's office, a conference room and the console room of the tomography site.

4.14 From Registration to Treatment

As mentioned previously in 4.13, registering walk-in patients appeared to be the main task of a GP's administration staff. They are required to collect patient data and information about current medication or vaccinations. Both GPs in this study, I and IX, indicated that they are not making any appointments besides preventive medical checkups. In both facilities, patients would wait after registration to be called for treatment. It was furthermore observed that registering a walk-in patient both at I and IX, takes approximately five minutes. With an average number of 70-150 consultations at I, and 20-100 consultations at IX as described in 4.10, even a registration time of five minutes has the potential to become a bottleneck.

Transporting information about today's schedule as well as informing about attendant patients in the waiting area, is required in any medical facility where staff size goes beyond the actual physician. Multiple approaches on transferring this information have been observed during the interviews. Facilities I, VI and IX, all with small staff, would require the physician to walk patients back to the front desk after each consultation and verbally exchange information about who is next in line and who was registered in the meanwhile with their front desk personnel.

At facilities VII and X, a list of patients with an appointment for the day is printed and handed out to everyone involved. The following quotation is the answer given to the question why the decision to print their daily schedule at facility VII, a dentist, was made.

> We have four paper lists and I would check our files on the day before and write down whether we need to make a radiography or not for all oral hygiene appointments. We post up the lists in all our treatment rooms, so the boss has them at hand. Also, when people come through the door I can have a look at the list and see who that is. We would need a second screen

> where I can always see my schedule otherwise. With the help of the list, I always know who is supposed to arrive next so it's useful to always have it here on my desk. Of course it would be convenient to have a seconds screen for appointment scheduling only. Annika, Administrative Staff

Having a printed list of of today's schedule has its own problems though, as pointed out at facility X where short-term changes of the schedule lead to inaccurate or simply outdated information. This situation is reported to potentially cause tensions since administrative staff is required to make several internal phone calls a day, informing co-workers about changes in the schedule. The decision of choosing printed lists over having them on screen, was put out to be due to insufficient filtering and viewing options of the software solution in use. In the present scenario, the on-screen list was lacking functionality to display all appointments for a certain room or for certain examinations combined. Also, the paper list enabled people to mark patients using different colors and to strike through finished appointments.

Facilities II, III, IV, and V are all using specialized software to keep track of today's schedule, attending patients and ongoing examinations.

During observation of daily work routines at the respective facilities, it became evident that the list of patients scheduled for a certain day is part of the core information required at the front desk.

4.15 Summary

The contextual inquiries carried out in the course of this work have confirmed the initial assumption, that managing appointments takes up substantial time of administrative staff in the considered small and medium-sized facilities. All of the participating facilities had at least one employee who's main responsibility is to schedule appointments and admission patients. Given the typical size of the establishments in question, this induces sensible costs and reveals the anticipated room for operational improvement.

While the proportionally hight effort required for scheduling appointments was found to be a commonality, facilities shown to have distinct ways of handling appointments. While some facilities indicated not to make appointments at all, others were fully booked months in advance even though their number of consultations was much lower. The reasons for this situation were found to be diverse. The most obvious approach on explaining the described differences is to take a look on facilities grouped by medical specialty. The on-site inquiries have shown that the medical specialty a facility is operating in strongly influences operational procedures and leads to an altered, adjusted profile of requirements for appointment scheduling. While some medical specialties will typically deal with acute but non-emergency conditions, others will carry out complex examinations that require careful resource-planning beforehand.

Albeit rather obvious, a facility's size was found to be another influencing factor in terms of how appointments are made. A facility with multiple physicians or rooms will usually have to invest more into management of resources than facilities with a single physician. Availabilities of rooms or doctors will interfere with or even dictate the scheduling of examinations.

The differences between health care facilities in Austria in regard to their contract situation with public health insurance have already been outlined in 1.1. Emerging from their contract situation, facilities will usually face different groups of patients with different demands. The initial assumption that Wahlarzt-facilities and physicians in private practice will have to assure that waiting times for patients to see their doctor are significantly lower to hold some additional benefit was confirmed. Employees at Wahlarzt-facilities mentioned they would eventually encounter patients demanding advanced care, like detailed preliminary information via phone or email, appointments at specific dates and times etc., which is reportedly perceived as "something that is wearing you down, but it's probably something specific to the clientele at a Wahlarzt".[9] Providing extra service like that does exert influence over a facility's schedule and needs to be taken into account when designing solutions for such settings, e.g. by facilitating making appointments via email, CTI capabilities or providing quality metrics like waiting times.

None of the considered facilities have pointed out to be using algorithms or heuristics for scheduling appointments, albeit some of them were found to be implementing advanced techniques such as time buffers or blocking slots for acute patients, that can be found in some of the scheduling strategies presented in 2.1. Furthermore, none of the facilities participating in this research reported any substantial disturbances or dissatisfaction with their way of handling appointments, rendering the need for automated scheduling approached less urgent than initially assumed.

The contextual inquiry as documented in this chapter has helped to refine the requirements for a prototype as described in chapter 5. It has shown the need for improved communication methods such as CTI or enriched email correspondence, the importance of a clear, accessible attendance list, the particular architectural requirements in terms of available hardware and software and numerous other details that will gain recognition in the following chapter.

[9] Quotation from Interview III

CHAPTER 5

Combining Results - An Exemplary Approach

Based on the findings from chapter 2 and 4, an exemplary design of a software solution capable of supporting scheduling of appointments in small and medium-sized medical facilities is proposed in the following. This chapter is structured following a traditional requirements engineering approach [56][57][58] with requirements elicitation based on interviews and observation of users in their workplace as described in the previous chapter. For introducing the exemplary design, a sequential paradigm has been chosen since disadvantages of these methods are usually resulting from additional iterations required due to technical, implementation-bound problems occurring at late stages. [59] For the purpose of this work, no actual implementation further than a clickable prototype will be done, rendering most of these disadvantages irrelevant. [60]

This chapter is structured in four main blocks. Requirements, derived from previous analyses, are listed at first, followed by a section outlining core use cases. Afterwards, a minimum data model, able to fulfill the described requirements and use cases, is proposed. The architectural description of the proposed design is concluded with a summary of the most vital views.

Sections 5.7 to 5.11 present advanced aspects and features, aiming to to provide a practical proposal that meets the requirements as collected in the previous chapters. These features complement the basic design introduced in this chapter.

5.1 Functional Requirements

5.1.1 User management

As documented in 4.7, 4.2.2 but also in 4.12, the interviews have shown that appointment scheduling, even in small facilities, usually involves multiple people. Some facilities even

reported that scheduling tasks are carried out remotely, outside normal working ours and even on personal devices. A system that aims to support the observed flow of work as discussed in the previous chapters, must offer an authentication mechanism to identify authorized users and grant or deny permission to access information and carry out tasks. The present legal framework might require keeping track of the individual activities of single users to document system usage and access to data in the form of Audit Trails.

Authentication methods

The list of possibly applicable authentication methods encompasses the use of basic login credentials such as name and password, smart cards (i.e. asymmetric cryptography) or Single Sign-On (SSO) capabilities in the existing infrastructure. If remote access is required on regular basis, adding a two-factor authentication layer is advisable. This can be realized by the use of mobile authentication applications or codes transmitted via SMS.

Audit trails

An Audit Trail is described by the NIST Computer Security Resource Center as a "series of records of computer events, about an operating system, an application or user activities" and can help in "detecting security violations, performance problems and flaws in applications". [61] The Integrating the Healthcare Enterprise (IHE) IT Infrastructure Technical Framework, Volume 1 (ITI TF-1): Integration Profiles [60] takes this idea on and recommends the use of the RFC 3881 format [62] for audit messages. Furthermore, for transporting logs, it is proposed that this should be done in a standardized way, such as syslog [63] specified in RFC 5424. The system should be capable of sending encrypted syslog messages via User Datagram Protocol (UDP) or Transmission Control Protocol (TCP) such as specified in the IHE's framework.

5.1.2 Availability

As already mentioned in the previous section, some facilities request their administrative staff to answer calls and make appointments outside normal working hours. Others mentioned they would operate in different premises on certain days. All of the facilities regarded within the scope of this work's contextual inquiry, had at least two separated workstations in different rooms. Combining these factors, a system capable of operating in this domain must be available twenty-four-seven and from any possible location. Attention has to be paid to the system's scalability. Although this work is considering small and medium-sized facilities, the staff sizes and number of people actually involved with scheduling appointments, as described in 4.11, turned out diverging. An electronic solution to support facilities within the present domain, must be capable of easily handling the expectable workload of any of the mentioned staff configurations.

5.1.3 Connectivity

A simple way to minimize costs when introducing new technology, is to reuse existing systems and setups where possible. This might include present hardware, patient databases, PMS, backup and accounting solutions, calendar services etc. To ensure best possible connectivity, the use of popular, common standards for accepting, storing and processing information is essential. This includes all aspects of the system to be designed, starting with SSO capabilities as described in 5.1.1 so that existing user management solutions can be reused. Also log files should be produced in a standard format and published using common transports, e.g. syslog [63] specified in RFC 5424 mentioned previously in 5.1.1. Exchanging appointment and calendar information can be simplified by implementing the Internet Calendaring and Scheduling Core Object Specification (iCal) standard as specified in RFC 5545, allowing to connect to existing calendar services both local and remote or to include, merge and compare existing external calendars with the facility's schedule more easily. A potential use case of this approach will be outlined in 8.9.

A system with a modular and extensible structure capable of integrating with existing technology, will potentially reduce costs for maintenance and development of additional features and components due to its open nature.

5.2 Non-Functional Requirements

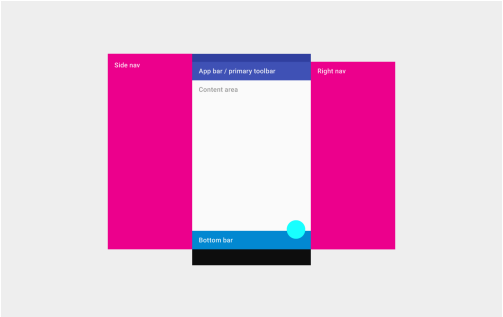
5.2.1 Costs for setup and during operation

Due to their size, facilities considered within the scope of this work will typically be lacking a big budget for a computer based appointment scheduling solution. Also costs for operating and maintaining computer systems have to be kept down. A solution that comes up to these requirements has to be able to run on commodity hardware, operate on a large variety of OSs including both different versions of a certain platform but also different architectures, be fail-safe and able to recover from distress automatically and be able to receive remote updates.

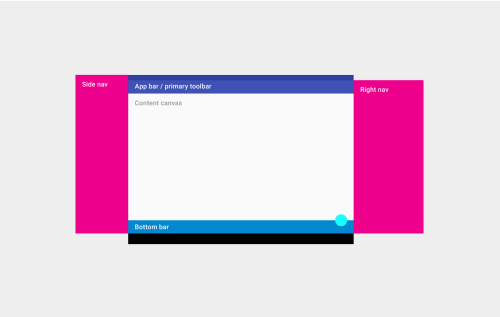
5.2.2 Easy to use and clean design

For the prototype, a ready-to-use set of UI design principles and a clear, concise navigation structure was needed. Due to its wide reception as part of Google's mobile OS Android[1], its extensive specifications and the number of third-party libraries providing accordingly styled components for numerous technologies, Google's Material Design[2] was chosen. It has been created to work with different screen sizes and platforms, making it a good fit for the prototype to be created. Its fundamental UI structure on mobile, tablet and desktop devices is shown in figure 5.1.

[1] `https://developer.android.com/design/material/index.html`
[2] `https://material.io/guidelines/`



(a)



(b)

(c)

Figure 5.1: Material Design's UI structures on a mobile (a), a tablet (b) and a desktop (c) device. All graphics were taken from `https://material.io/guidelines/layout/structure.html#structure-ui-regions`.

5.2.3 Future-proof

To avoid high maintenance costs, a careful selection of future-proof technology which is expected to be actively maintained during the projected lifespan of the system has to be made.

5.3 Use Cases

Typical use cases of a software solution for scheduling appointments in medical facilities were extracted from the observations made during the interviews, the information shared by people working in the area as well as from related literature and comparable software products. The core set used for building a prototype within the scope of this work, is listed in table 5.1. Table 5.2 shows use cases dealing with test data which are relevant to a prototype only.

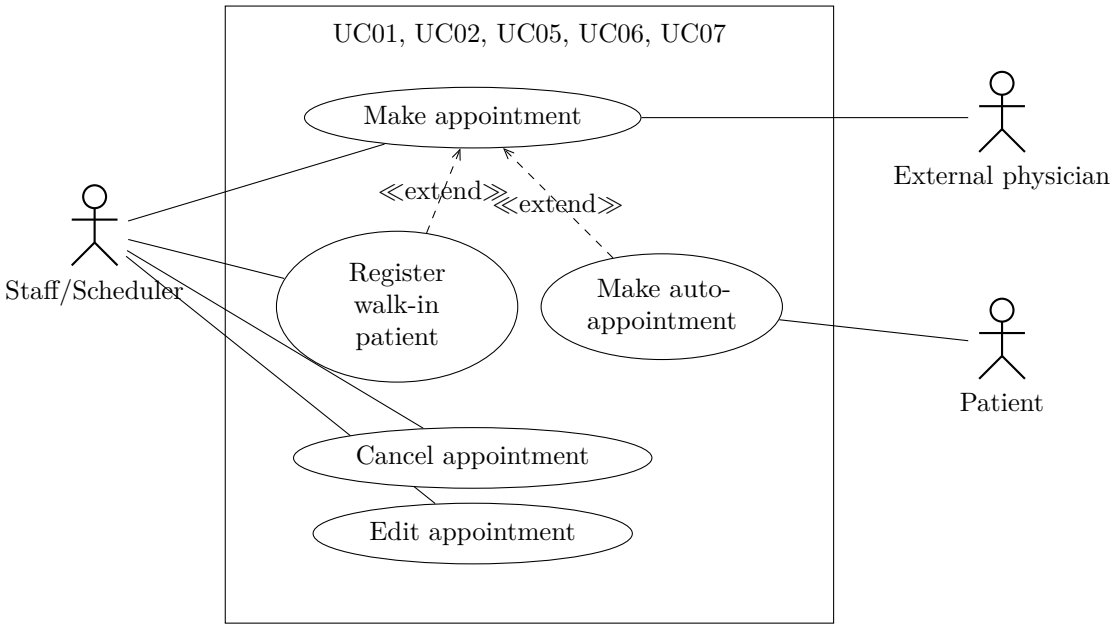


Figure 5.2: A use case diagram showing all use cases related to manipulating appointments.

Figure 5.2 combines all use cases related to making, editing or canceling appointments from the perspectives of all potential stakeholders. Unified Modeling Language (UML) use case diagrams of all identified use cases can be found in appendix B, section Use Case Diagrams.

Id	Name	Description
UC01	Make appointment	A staff member makes an appointment for a patient.
UC02	Cancel appointment	A staff member cancels an appointment for a patient.
UC03	Get schedule overview	A staff member retrieves an overview of the appointments for a certain period of time, optionally grouped by a certain resource. E.g. Appointments of a certain month, week or day, optionally grouped by room.
UC04	Get appointment details	A staff member wants to get detailed information about a certain appointment.
UC05	Edit appointment	A staff member makes changes to an existing appointment.
UC06	Register walk-in patient	A staff member registers a walk-in patient with no previously made appointment.
UC07	Make an appointment using the anonymized calendar view	A staff member makes an appointment for a patient standing at the front desk, utilizing an anonymized version of the facility's schedule that supports communicating the current booking situation in a credible way.
UC08	View attendance list	A staff member takes a look at the list of patients that are either having an appointment for the present day, patients currently in the waiting area or under treatment and patients that have been attending earlier that day.
UC09	View statistics	A staff member examines statistics related to appointments and attendance.
UC10	Get patient overview	A staff member requires a certain patient's core data as well as a list of all appointments scheduled for this patient.

Table 5.1: List of use cases.

Id	Name	Description
UC11	Delete all data	A user wants to delete a specific type of information from the system. E.g. Attendances, Appointments, Examinations etc.
UC12	Insert test data sets	A user inserts a given set of sample data like patients, examinations and rooms.
UC13	Create random appointment data	A user requires random, but plausible appointments as well as corresponding attendance to be created.

Table 5.2: List of use cases required for demonstration purposes only.

5.4 Choice of Technology

To meet requirements listed in 5.1 and 5.2, the prototype has been developed as a web-based application. The web was found to be the most suitable platform to cover all aspects of appointment scheduling in the context of small and medium-sized medical facilities. Due to the vast number of web-enabled devices available nowadays, web applications offer great flexibility in terms of accessibility. Modern web technology is capable of delivering consistently rich user experience to a wide range of screen sizes and device form factors, from mobile phones to desktop computers. Adapting web applications to different devices and providing access from anywhere, requires much less effort compared to native applications. While native applications do offer certain benefits over web applications when it comes to speed or access to native hardware resources, in the context of a proposing a design for small and medium-sized health care facilities, the merits of web applications outweigh any other approach in terms of development and maintenance costs.

The prototype for evaluation in the course of this work was developed using state-of-the-art technology, capable of meeting all requirements listed in 5.1 and 5.2. The popular open-source framework Angular[3] was chosen for this purpose, offering a set of fundamental building blocks like navigation (routing), clean separation of design and logic etc. and enforcing high code quality standards.

5.5 Data Model

The data model was developed based on knowledge gained during the literature review, the analysis of existing solutions as well as from the insights from the on-site interviews. The data model of the prototype proposed in this work is described in the following using

[3] https://www.angular.io/

Entity Relationship Diagram (ERD) as diagrammatic technique. ERD, as introduced by Chen in 1976 [64], is used "as a basis for unification of different views of data" and helps identifying an enterprise view of the data to design "a logically meaningful and consistent database". [64][65]

A naive approach to describe the data model of an appointment scheduling system in the context of small and medium-sized medical facilities can look similar to figure 5.3. An instance of an entity representing an appointment's details is linked to some patient information.

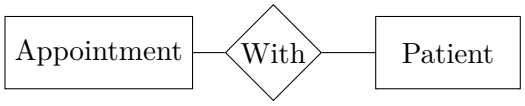


Figure 5.3: ERD showing a naive design of a possible data model.

During the interviews, the outstanding importance of the intended examination in regard to a proper time estimation became evident. As described in 4.2.2, an appointment's underlying medical matter is commonly considered as the main factor for a time estimate. With that in mind, modeling an appointment's examination as a distinct entity rather than a simple attribute of the appointment, is an obvious decision to make. That way, additional information such as an approximate duration or required resources can be added to the examination entity and reused for other appointments later. Modeling the examination as an attribute of an appointment would cause redundant data being held in the storage. The extended ERD is shown in figure 5.4.

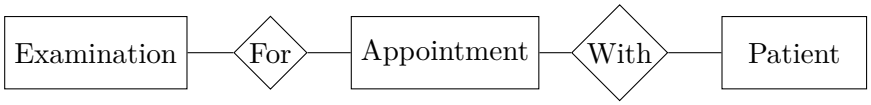


Figure 5.4: ERD from 5.3 extended by an examination entity.

With the type of examination determined, it is typically possible to identify the resources needed for an appointment. As learned from observing scheduling processes on-site at the participating facilities, administrative staff is usually required to check for a free slot where the required room, staff and equipment is available. To order to be able to keep track of these resources and avoid double bookings, marking them as occupied during a certain appointment is inevitable. Just as for examinations discussed above, modeling resources as distinct entities rather than just attributes of an appointment brings about advantages in terms of avoiding redundancy. Identifying resources important enough to be modeled as a standalone entity, however, is hard and strongly depends on the medical facility's organizational structure. In the present domain of small and medium-sized facilities as considered for the contextual inquiry, the most common scenario was found to

be a single physician with one or two rooms, probably equipped with different instruments. The ERD in figure 5.5 shows the data model extended by an additional entity representing a room or site. In cases where more resources than rooms or sites are required, those can

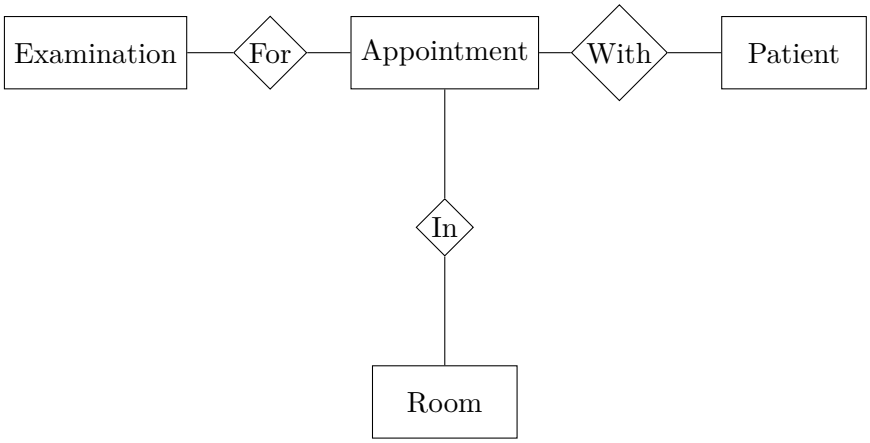


Figure 5.5: ERD from 5.4 extended by a room entity.

be either modeled as distinct entities in the pattern of ERD 5.5, or using a more generic approach where resources carry additional information about the type of resource. An example of a data model incorporating this configuration can be found in figure B.18 appendix 8.14.

In order to be able to represent the current attendances in a facility, it is necessary to record patients when they check in to and leave the medical practice. If an overview of patients in the waiting area is desired, an additional mark as soon as they are under treatment is required to distinguish between those in the waiting area and those being currently under treatment. Observations made on-site have proven that also small facilities with only on physician usually implemented some sort of process that allows any member of staff to gain a quick summary of the patients scheduled for a day, the patients in the waiting area and the patients currently under treatment. An extended ERD incorporating an attendance entity is shown in figure 5.6.

Reminding patients of upcoming appointments, has been discussed previously in both chapters 2 and 4 (2.5, 4.5). Implementing a reliable and accurate notification system, requires all scheduled notifications to be held in storage until they get picked up by delivery workers asynchronously at the moment of planned transport. Holding scheduled notifications in a central, non-volatile storage is the key part of safeguarding against failure and building a robust notification system. Scheduled notifications will be available for transmission as long as required, allowing for multiple retries. Email and text messages were found to be the most used transports amongst the facilities considered within the scope of this work. The extended data model shown in figure 5.7 however, is flexible enough to quickly accommodate any number of additional transport methods

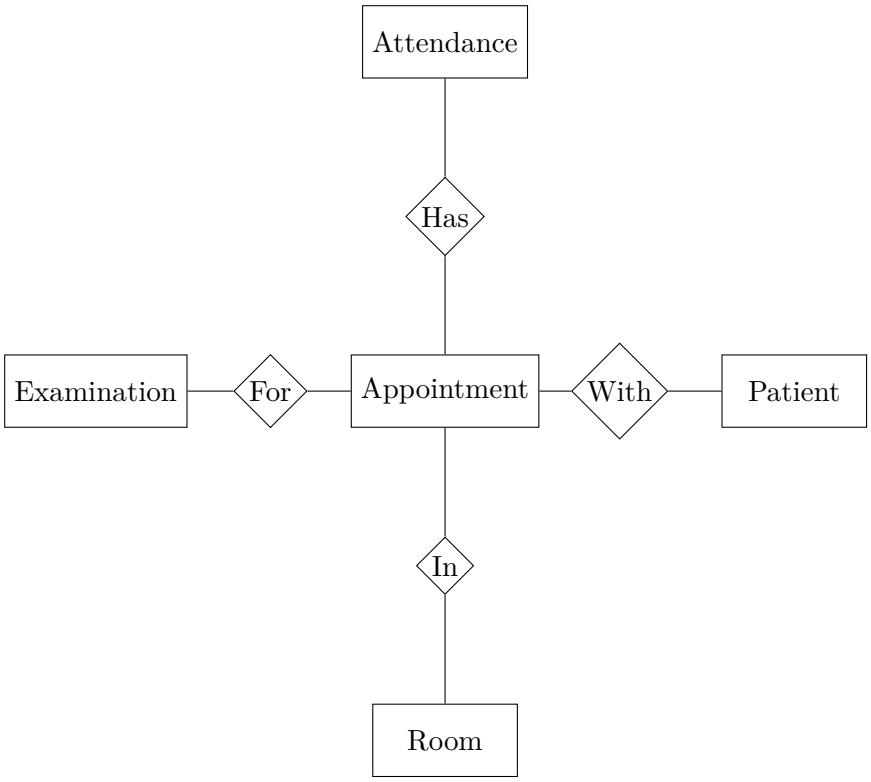


Figure 5.6: ERD from 5.5 extended by an attendance entity.

with no changes in the underlying data structure. The notification-transport entity holds information about how to deliver a notification. Modeling this a one-to-many relationship to render transmission using multiple protocols possible is an obvious decision to make at this point.

The ERD shown in figure 5.7 presents a solid groundwork in terms of an applicable data structure for a web-based appointment scheduling software solution for small and medium-sized medical facilities according to the experiences, knowledge and insights gained during the analysis carried out in the previous chapters. Figure B.19 shows an ERD of the data model extended by cardinalities and a basic set of obvious attributes to round off this section.

5.5.1 Standardized file formats for handling and exchanging calendar informations

For handling calendar information, the use of a well-established standard, such as the iCal as specified by RFC 5545 [66], is preferred. Due to technology decisions proposed in 5.4, the JavaScript Object Notation (JSON)-based [67], iCalendar-related format jCal as

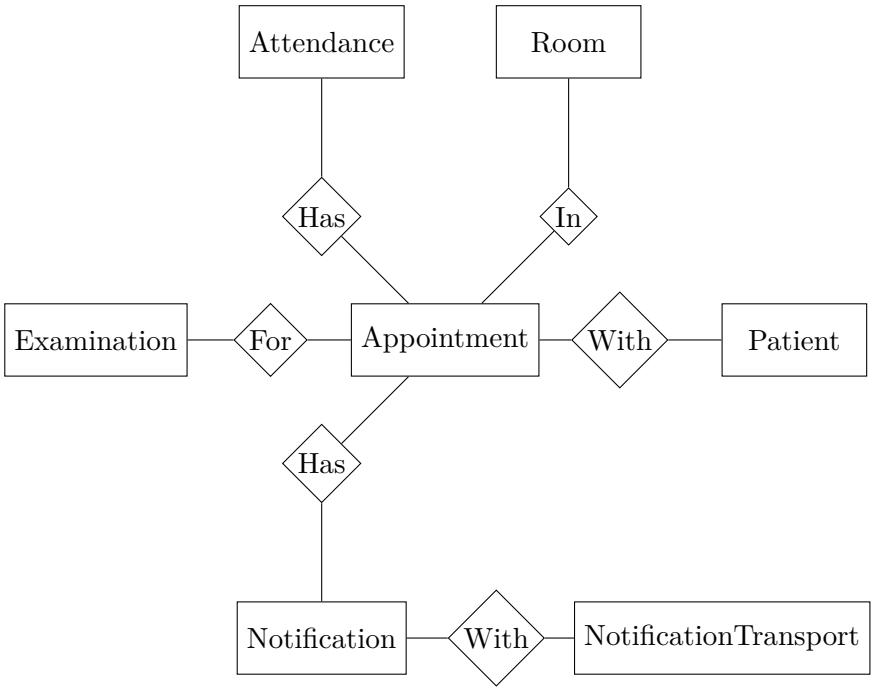


Figure 5.7: ERD from 5.6 extended by a notification entity.

specified by RFC 7265 [68] is an obvious choice in order to stay close to the chosen core technology. While RFC 7265 currently holds the PROPOSED STANDARD status [69], ready-to-use JavaScript libraries transforming between the two formats do exist. [70] An exemplary jCal object holding scheduling information can be found in listing 5.1.

5.6 Views

Resulting from the literature review carried out in chapter 2, the experiences and insights gained during the interviews as described in chapter 4 and the derived use cases described in 5.3, a core set of views that lay the fundamental groundwork for an electronic scheduling application in the context of small and medium-sized medical facilities was obtained. The identified views according to the findings in the previous chapters are described in the following, but also summarized in table 5.3 as a compact overview.

5.6.1 Calendar views (V1, V2 and V3)

The most fundamental and obvious view to have in a scheduling application is a calendar-style overview of appointments. With no exception, all participating facilities were using some sort of calendar for managing their appointments. No matter whether a paper calendar or specialized software was used, the most common perspectives were weekly

```
["vcalendar",
  [
    ["calscale", {}, "text", "GREGORIAN"],
    ["prodid", {}, "text", "-//Example Inc.//Example Calendar//EN"],
    ["version", {}, "text", "2.0"]
  ],
  [
    ["vevent",
      [
        ["dtstamp", {}, "date-time", "2008-02-05T19:12:24Z"],
        ["dtstart", {}, "date", "2008-10-06"],
        ["summary", {}, "text", "Planning meeting"],
        ["uid", {}, "text", "4088E990AD89CB3DBB484909"]
      ],
      []
    ]
  ]
]
```

Listing 5.1: An exemplary jCal object holding typical scheduling information.

and daily overviews. Due to the, in comparison to a personal calendar, relatively high number of appointments per day (see 4.10), a monthly overview is most probably not able to provide a sufficient amount of screen-space for each day to display a reasonable, telling amount of appointments.

Albeit not the default view of choice amongst the analyzed participants, a monthly view can be superior to per-week/per-day views when it comes to getting a general idea of the booking situation in a facility, like checking for free days or even managing staff on vacation. View **V1** provides an overview of all days with their respective appointments in a certain month. Days are represented as rectangular areas with appointments printed inside.

View **V2** shows appointments grouped per week. Days are represented by columns, one for each working day of a certain week. Appointments can be displayed in an agenda-style providing a time grid of working hours, just liked when using a paper calendar. Appointments are then sized depending on their duration, the longer an appointment takes, the more space it consumes on the agenda to provide visual hints on an appointments length without having to read detailed information. An agenda view makes it easy to spot free slots and get an overview of a day's booking situation. **V2** is also capable of displaying appointments in a list, ordered by time. A list-based view might provide a cleaner look on the day's schedule by not encoding duration and start time information in appointments' spatial representation. Figure 5.8 shows a screenshot of **V2** in list mode.

The presented views **V1** and **V2** are likely to be sufficient for most use-cases in this

Id	Name	Description
V1	Calendar view (month)	A calendar-style overview of appointments for a month.
V2	Calendar view (week)	A calendar-style overview of appointments for a week. Both a list and an agenda might be good to have.
V3	Calendar view (day)	A calendar-style overview of appointments for a day. If necessary, separated by resource (e.g. rooms or doctors) to avoid overlapping events.
V4	Today's schedule	A list of all appointments for the present day.
V5	New appointment form	A form for entering a new appointment.
V6	Edit appointment form	A form for editing and cancelling an existing appointment.
V7	Patient information	An overview of appointments related to a certain patient plus, if available, patient contact information.
V8	Attendance list	An attendance list to quickly get an overview of patients scheduled for today, patients waiting or patients currently being under treatment.
V9	Anonymized view	An anonymized view of the current week or month. See 4.8 or 5.9.
V10	Walk-in patients	A form that allows quick admission of walk-in patients.

Table 5.3: List of identified views.

work's domain. However, with multiple resources available, appointments taking place at the same time can present a problem. While **V2** in list-mode presents a viable solution for displaying concurrent events, an agenda tends to quickly become confusing when dealing with multiple appointments at the same time. Depending on the available horizontal screen space, a maximum of two or three events can be expected to fit alongside without overlapping or loosing information. To overcome this issue, **V3** offers a view on appointments of a certain day, grouped by resource. As for the prototype, with rooms being the only resource considered in the data model from 5.5, a facility with three rooms will result in **V3** showing three columns, each column representing a room. This idea can be applied to any number of additional resources. Figure 5.9 shows a screenshot of **V3**.

5.6.2 Today's schedule (V4)

V4 delivers a quick insight in today's schedule. Without having to deal with selecting the proper date, resource or whatever additional filtering may be available, this view is intended to show all appointments that are scheduled for the current day. Due to problems with concurrent appointments as described in 5.6.1, **V4** is implemented as list of appointments.

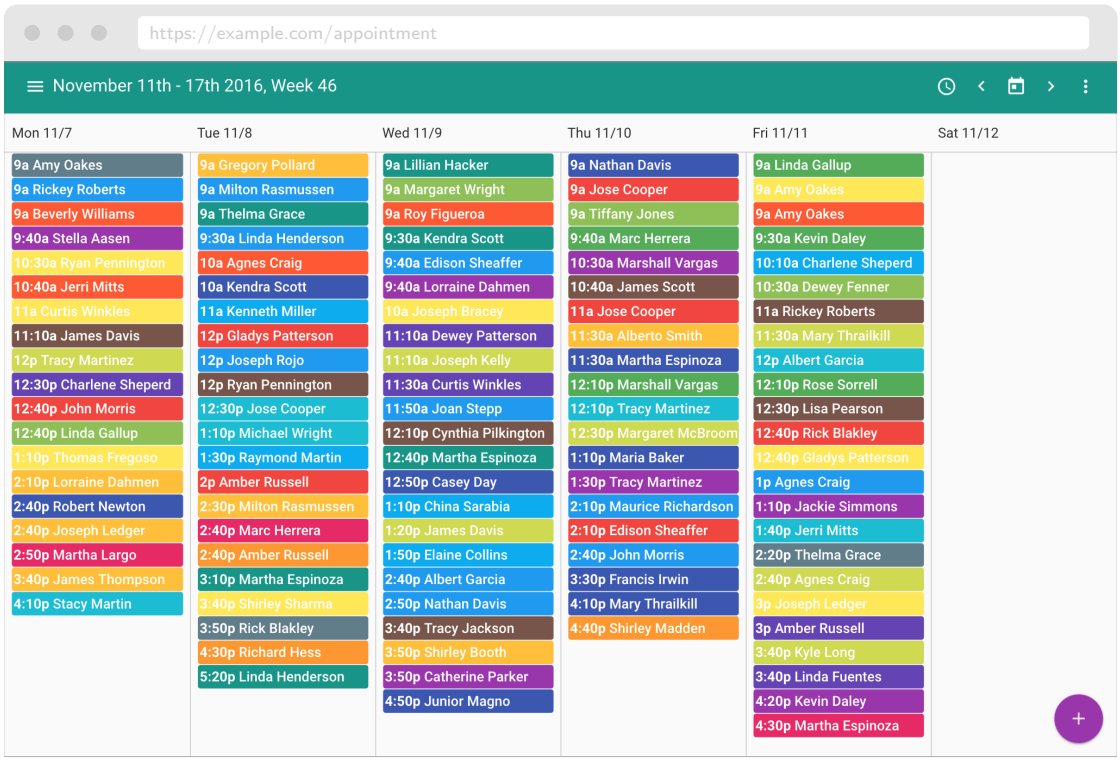


Figure 5.8: A screenshot of the schedule overview for a week in list mode.

5.6.3 New appointment form (V5)

Designing a form for entering new appointments presents a substantial challenge when designing a scheduling solution. Observing users on-site during their regular course of work, has shown that even forms that may not seem intuitive or visually appealing can work out well in the day-to-day work life. Members of the administrative staff observed during the interviews have proven great adaptability when dealing with scheduling management software. Providing keyboard-only paths through the application can help making a new appointment less time-consuming, a key factor of an efficient scheduling solution as mentioned in section 4.12, where the extent of scheduling-related tasks in the daily work routine of administrative staff has been discussed.

The form for entering new appointments should follow the basic concepts of the technology and design language that have been chosen for the application to be developed.

Required fields for a valid appointment involve date, time, duration, patient and, if available, required resources (e.g. room, physician or equipment). The form should not accept an appointment with any of the mentioned fields missing to ensure data integrity.

Additional, non-required fields might be a description or an alternative title that can be

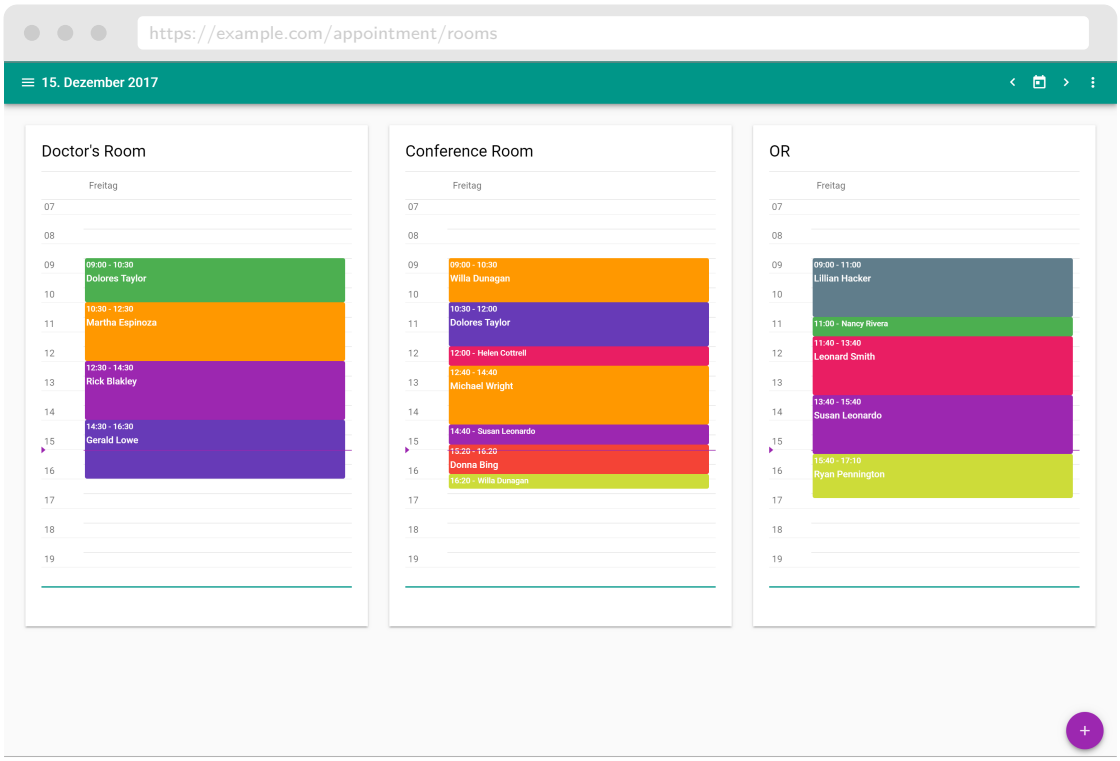


Figure 5.9: A screenshot of the schedule overview grouped by rooms.

displayed together with or instead of the patient's name in any of the views **V1**, **V2**, **V3** or **V4**.

After making an appointment, some facilities were observed to hand over some piece of paper with the appointment details to their patients. Other's ask for patients' phone numbers to be able to send them a text message reminding of an upcoming appointment. The importance of reminding patients of appointments has been discussed in multiple occasions (2.5, 4.5), therefore the prototype has been equipped with basic reminder functionality. For a plain version, it might be sufficient to let users decided whether to send an reminder or not, and to choose the preferred transmission method. Deciding when to send an reminder is a difficult thing to do. No evidence of a possible golden ticket for this issue was found in literature (2.5) and aside from that, most facilities sending reminders were using a static pattern for when to actually deliver the notification (e.g. 1 PM the day before the appointment). Sending reminders as a feature, rather than a part of a view, is going to be discussed in section 5.8.

A screenshot of view **V5** can be found in figure 5.10.

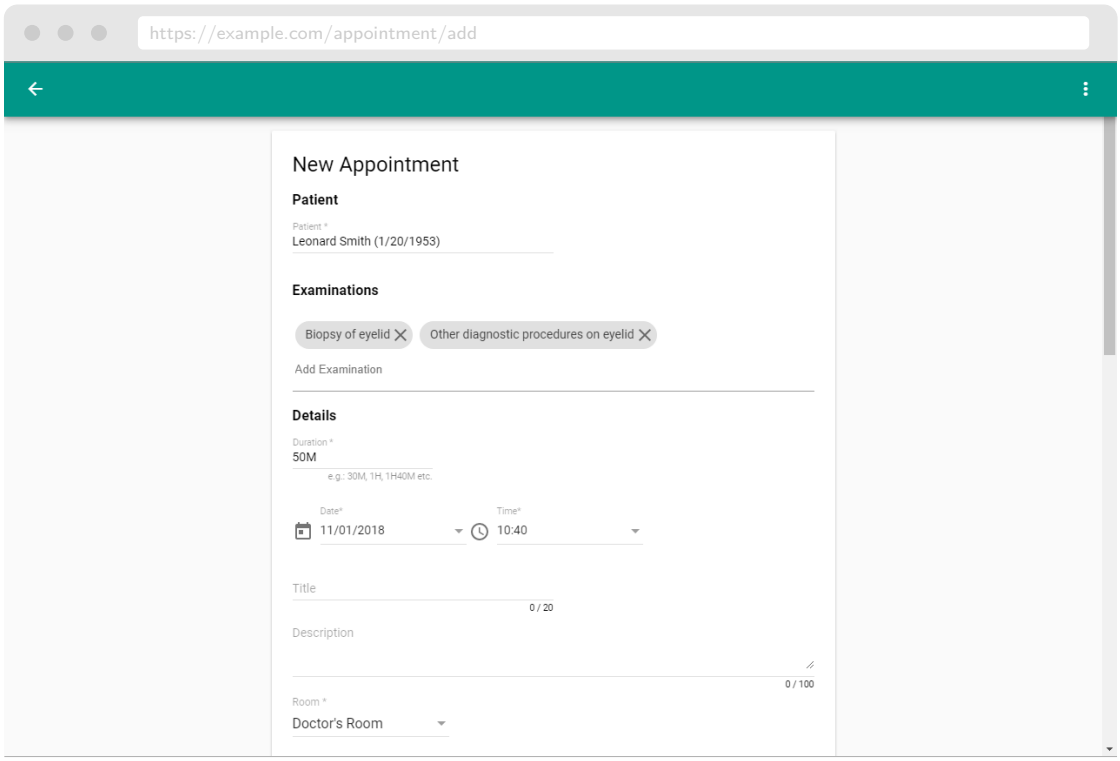


Figure 5.10: A screenshot of the edit form for an appointment.

5.6.4 Edit appointment form (V6)

The form for editing and deleting appointments **V6** should look the same as **V5** for an intuitive and consistent user experience.

5.6.5 Patient information (V7)

One of the most beneficial aspects of electronic scheduling solutions in comparison to a paper calendar was found to be the ability to search for appointments by patient. In fact, multiple participating facilities were using both paper and electronic calendars, as described in section 4.8. The paper calendar for a more convenient handling of appointments plus the electronic calendar for the ability to search for appointments by patient.

V7 presents patient details such as name, date of birth, insurance information and combines it with a list of upcoming appointments.

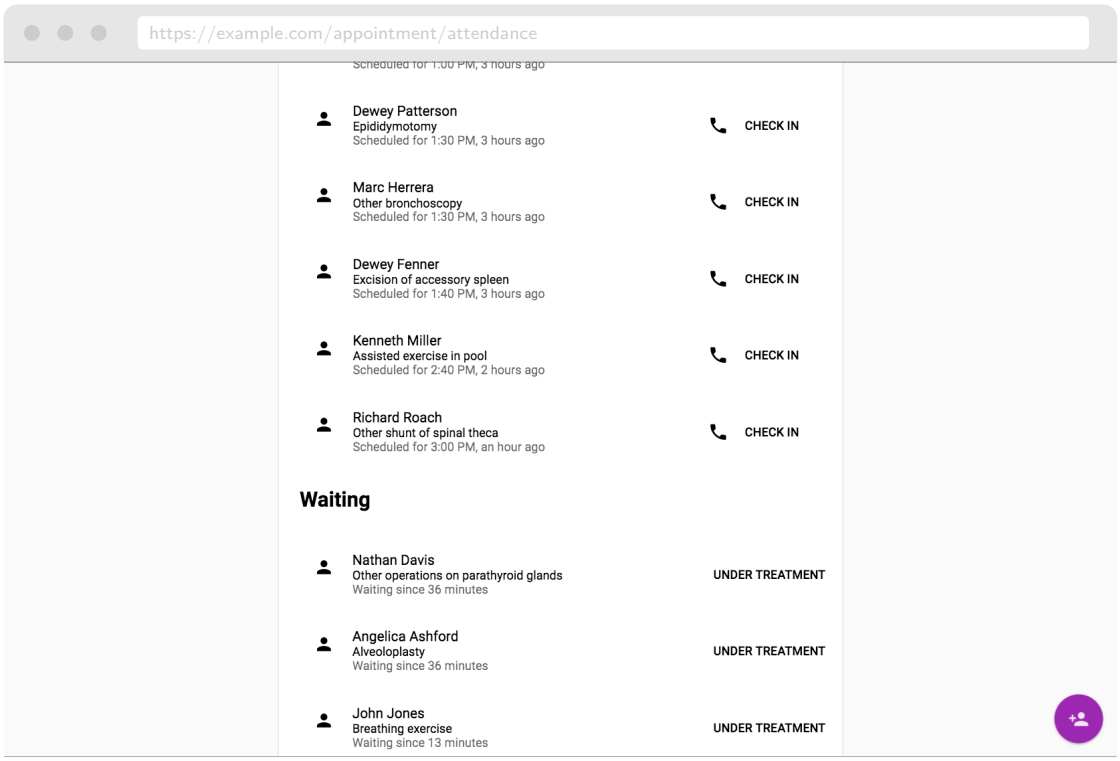


Figure 5.11: A screenshot of the attendance list.

5.6.6 Attendance list (V8)

V8 represents a list of today's appointments, grouped by state of attendance. A way to represent patient attendance was already described in 5.5. According to this model, **V8** will have sections for scheduled patients, patients who are waiting, patients currently under treatment and patients who finished their appointment.

While observing administrative staff, it became evident that an attendance list as represented by **V8** is the core view required by users at the front desk of a medical facility. It provides a useful summary of the patients arriving next as well as an overview of the currently attending patients. If a patient arrives at the front desk, or is called in for treatment, **V8** allows to easily move a patient to the next section, e.g. from "scheduled" to "waiting" or from "under treatment" to "finished". Furthermore, since some facilities indicated they would try to reach patients in case they don't arrive in time, a button initiating a phone call is available for every entry in the section of patients scheduled for this day. A possible way to place phone calls from a web application is described in section 5.11. Figure 5.11 shows a screenshot of the attendance list as drafted for the prototype.

5.6.7 Anonymized view (V9)

Due to its nature as a feature rather than a view, **V9** is described in detail in section 5.9. **V9** is a specialized form of **V1** or **V2** with all personal and medical information removed.

5.6.8 Walk-in patients (V10)

Especially for those facilities with little or no scheduled appointments, efficient handling of walk-in patients is crucial. Checking in a walk-in patient usually requires the same information as making an appointment beforehand. **V10** is a modified version of **V5**, with some form fields prepopulated, e.g. the date and time field set to now to save time. Since many facilities are using electronic attendance lists to support their flow of work, registering walk-in patients is necessary not only for legal or insurance technical reasons, but also to support the facility's organizational processes.

5.7 Computer-aided Proposal of Appointments

Searching for a free time slot turned out to be the most time-consuming task when making an appointment with a patient. Evidence of this was gathered while observing users at their workplace.

The prototype has been equipped with functionality that proposes a number of possible time slots for the appointment to be made. Suggestions will be displayed as soon as enough information is available to find suitable time slots. For instance, as soon as patient and examination are chosen, the prototype will suggest a number of possible dates where the resources (time, room, equipment etc.) for the selected examination is available. By default, the prototype system offers the soonest available slot, a slot in the upcoming week, a slot in fourteen days and a slot in one month. This pattern was developed based on insights of the on-site interviews where administrative staff was observed while agreeing on dates with patients and strives to make a manual selection of a suitable date unnecessary in most situations.

5.8 Reminders

Reminding patients about upcoming appointments is a controversial topic and has turned out to be handled quite differently amongst the different medical facilities observed. It goes without saying that those facilities making little to no appointments at all, showed less interest in sending notifications than those with a tight schedule and highly specialized examinations that require particular equipment and personnel. The most common way of delivering appointments was found to be the use of text messages over cell network. However, sending text messages imposes a technical challenge as most office desktop computers are not equipped with a SIM card allowing them to access cell networks. Modules for existing PMS were reported to involve expensive per-month subscription

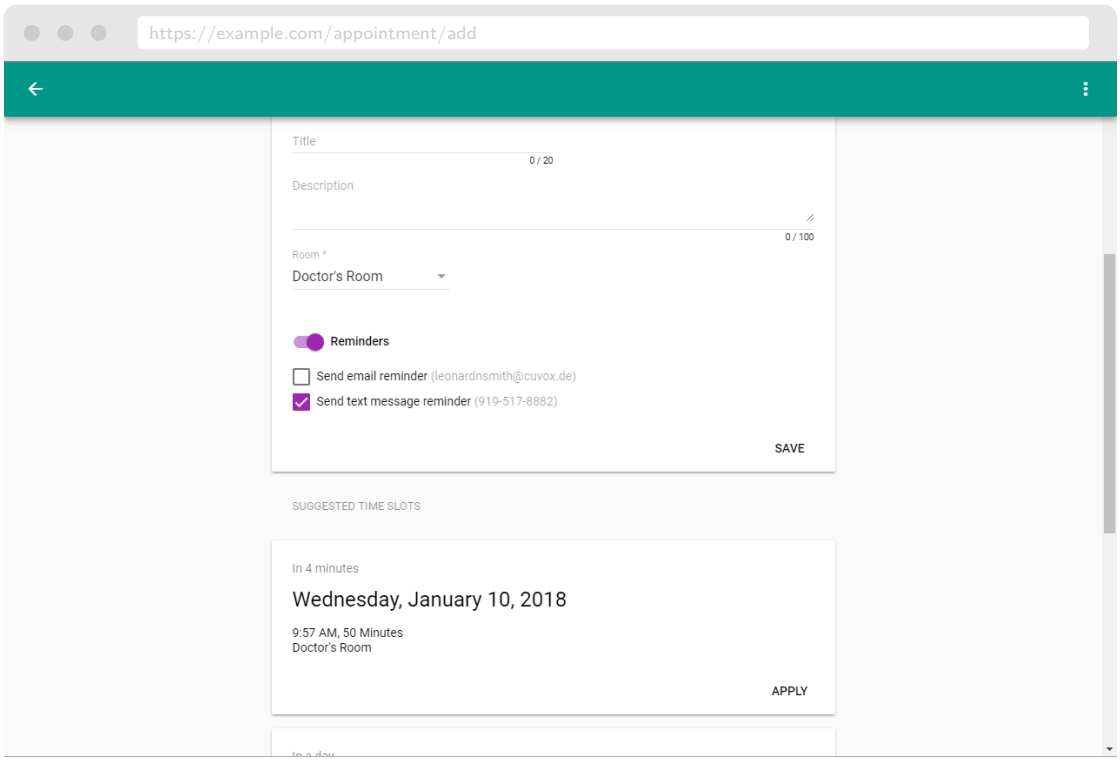


Figure 5.12: A screenshot of reminders section of the appointment form.

models. Participants even reported they were actively testing such a system, but found it to deliver not enough value for money.[4].

For the present exemplary design, delivering SMS and email-based reminders is carried out by online service providers that connect to the application's scheduling system. When creating a new appointment, a user can order to send a reminder by SMS or email. At a configurable time before the actual appointment, the system triggers the delivery of the reminder via the mentioned online services. A screenshot of the section in the appointment form that deals with reminders can be found in figure 5.12.

By handling reminders at the time of scheduling the appointment, people involved with making appointments often have the chance to ask patients about their preferences regarding delivery of reminders directly. Also, they can clear their minds after saving the appointment as the system will handle delivery at the appropriate time, eliminating the need for "sending reminders" sessions after opening hours the day before or in the morning before opening hours as reported by multiple facilities.

[4]The corresponding statement can be found in appendix A, transcript 7

5.9 Anonymized Calendar View

Using paper for managing appointments brings about some merit in the face of electronic systems. One of them was described in section 4.8 where one the interviewees mentioned that they would show their paper calendar to patients in order to help communicating their current booking situation. The prototype developed along with this work, strives to translate this paper feature into a software equivalent. The critical challenge with this task is to overcome form factor and privacy issues. Screenshots of the prototype in this regard can be found in figure 5.13 and 5.14.

Using regular computer monitors, it can be tough to enable patients to throw a glance at the current schedule due to (fixed) positioning or viewing angle of the displays. The proposed solution is therefore designed to remain readable on a wide range of different aspect ratios, screen sizes and resolutions.

It might be acceptable to demonstrate the overall booking situation to patients using the actual schedule on paper, however, protection of privacy becomes an issue with the use of electronic displays. Most likely, as described in 4.8, handwriting will render a leak of personal patient data impossible. Clear fonts and high resolution displays require a different approach though. Any patient-related data is hidden from the anonymized view in the prototype while preserving the intended look on the degree of capacity utilization.

5.10 Appointment Scheduling via Email

In multiple occasions, as documented in 4.7, the interviews clearly put forth the telephone as prevailing communication channel for making appointments. Apart from that, a certain demand of email-based and face-to-face scheduling became evident as well. Albeit more often than not disliked by administrative staff, email bears distinctive advantages over communicating by phone or face-to-face.

To overcome the deficiencies outlined in 4.7, an electronic scheduling solution can assist in making appointments via email. Email-based appointment scheduling typically involves the following steps:

1. Process the incoming request for an appointment.
2. Find a number of free slots to be offered.
3. Block the slots.
4. Offer time slots to patient.
5. Once the patient has accepted a slot, release all other blocked slots.

While steps 2-5 can be considered time-consuming and error-prone for humans, extracting patient details and the type of appointment for a proper estimation of duration as in step 1 is harder to do for a machine. The required business logic for implementing an auto-reply service able to offer appointments can be found as pseudo-code in algorithm 5.1 and modeled in a sequence diagram in 5.16.

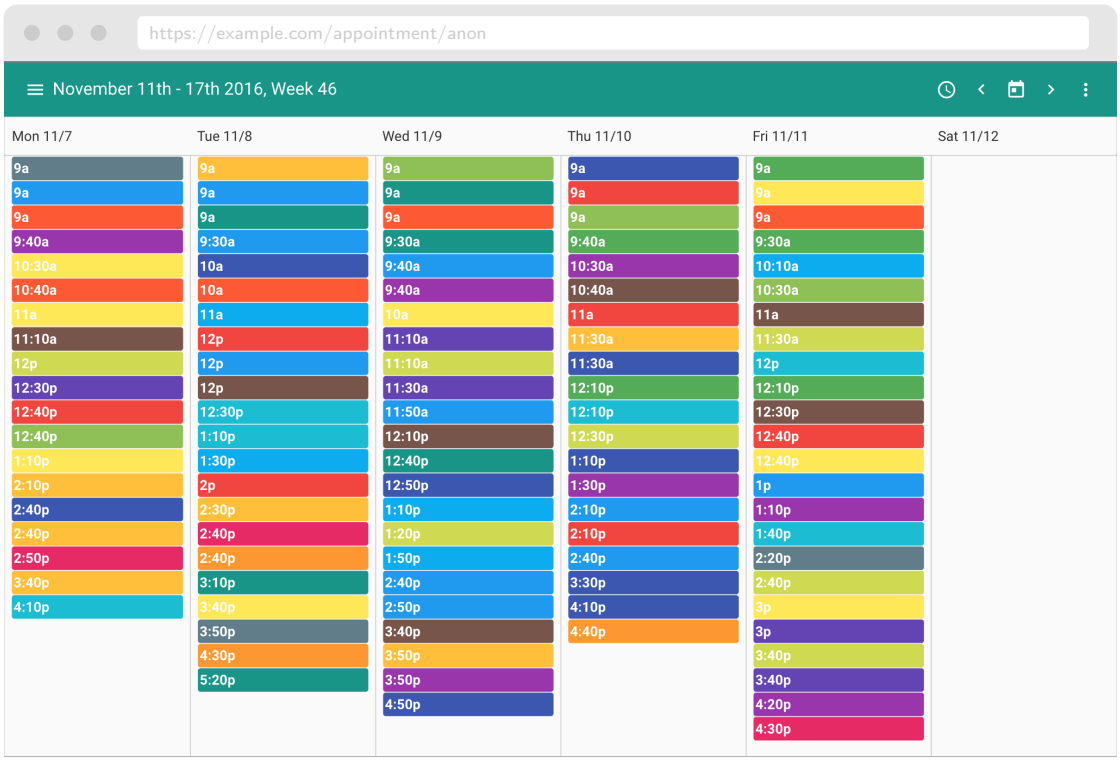


Figure 5.13: A screenshot of the anonymized overview of the current schedule in agenda-style.

5.11 Telephony Integration

The contextual inquiry revealed the outstanding importance of the telephone in the present domain. Not only are most appointments made by telephone (4.7), sometimes even consultations are carried out by phone (4.10). Some facilities indicated to handle internal communication via phone too (4.12). Details about the typical telephony infrastructure of the facilities in question, can be found in section 4.13.

Additionally, general information about CTI can be found in an article by John Lynch (1995). [71] Lynch also talks about one of the key aspects of CTI in medical facilities, providing functionality "so that as a call is answered, the customer's details appear on the screen of the person taking the call." Patients phoning in to reschedule or cancel upcoming appointments are a perseverative factor in any medical facility. Not having to ask for a patient's name and manually search for their appointments has already proven to be a time-saving feature in some of the participating facilities.

One of the downsides of CTI however, are the costs for acquiring and maintaining the required hardware and software components, outlined in 4.13. In some cases, facilities reported to having to refrain from getting a CTI solution as it, despite blatant advantages,

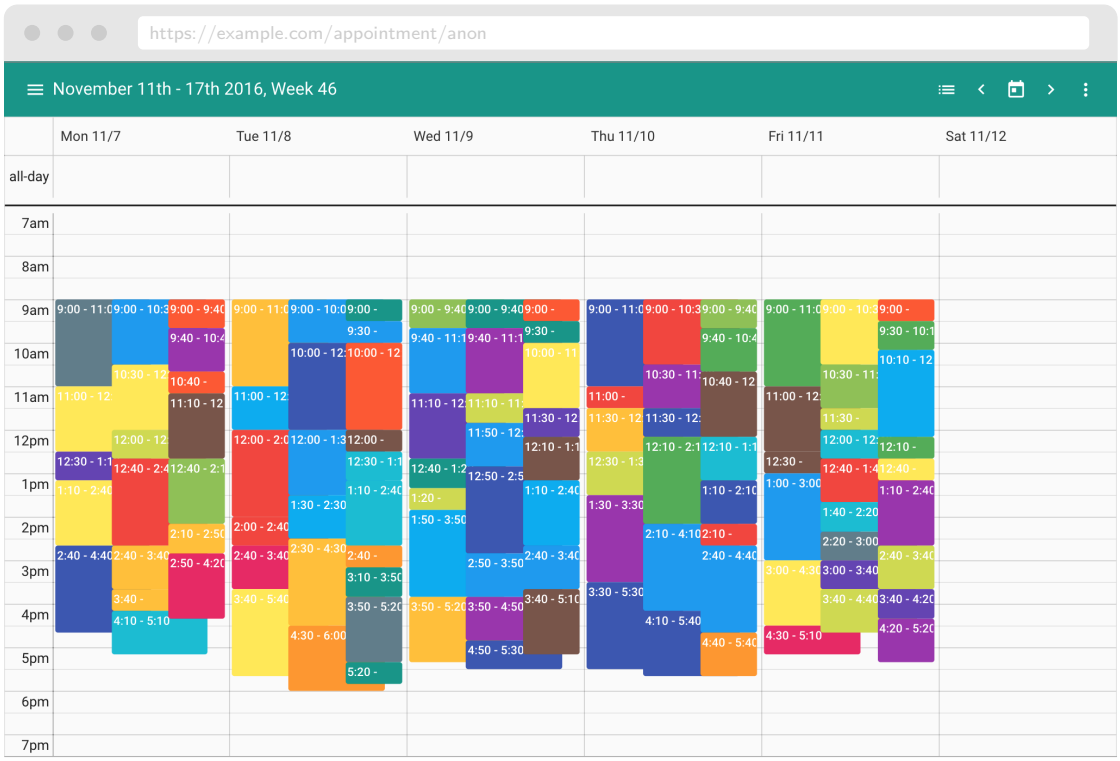


Figure 5.14: A screenshot of the anonymized overview of the current schedule in list-style.

emerges economically unviable. In the given domain of small and medium-sized medical facilities with little budgets to spend on information systems, a viable CTI solution has to be aimed at incorporating existing hardware and ideally work at no additional cost. It should be able to pass phone numbers of incoming calls on to the PMS for quickly referencing of patients. Dialing a patient's number directly from management software, without having to enter the phone number or search for a patient in the phone's address book manually, should be supported just as well. Sequence diagrams showing the basic flow of information of such an architecture can be found in figure 5.16 and 5.17.

Many of the participating facilities were providing regular smartphones or tablet computers to their staff (4.13). Surprisingly, as of the time of writing, no free of charge, open-source solution was found that uses ordinary smartphones as CTI host. With the goal of this work being an exemplary design of a web application, a solution to bridge a consumer smartphone with a variable number of running instances of such a web application has to be found. A tiny application running a CTI host as a background service on a mobile phone can be implemented easily. This service listens for incoming requests from the web application and dials the received number. It also listens for incoming phone calls and forwards the caller's number to the web application. Communication between the variable number of active web application instances and the mobile phone acting as

Algorithm 5.1: Automated Scheduling via Email

```
1  Function ProcessRequest(E):
       Data: An incoming mail containing an appointment request
2
3      P, A = ParseEmail(E)
4      S = FindAndBlockSlots(P, A)
5      send reply containing offer S
6      in 30 minutes do
7          if slots still blocked then
8              release slots
9          end
10     end
11 return
12
13 Function ParseEmail(E):
       Data: an incoming mail containing an appointment request
       Result: extracted patient and appointment information
14
15     extract information from email sender and body
16 return P, A
17
18 Function FindAndBlockSlots(P, A):
       Data: the patient and type of appointment to find available slots for
       Result: a set of slots, reserved for patient P
19
20     find free slots S of length A_duration
21     reserve slots S for patient P
22 return S
```

CTI host, must meet a number of requirements. Low latency, so that the incoming call notification or related patient information can be shown before the caller hangs up. It must not cause lots of network traffic to be able to work sufficiently on slow connections but also for a lower energy and performance impact on the host.

The WebSocket Protocol outperforms common HTTP polling, which was not designed for full-duplex real-time communication initially, and provides better latency. [72] Furthermore, WebSocket is able to handle multiple connected instances of a web application with no additional efforts to be made, making it a more than practicable protocol for

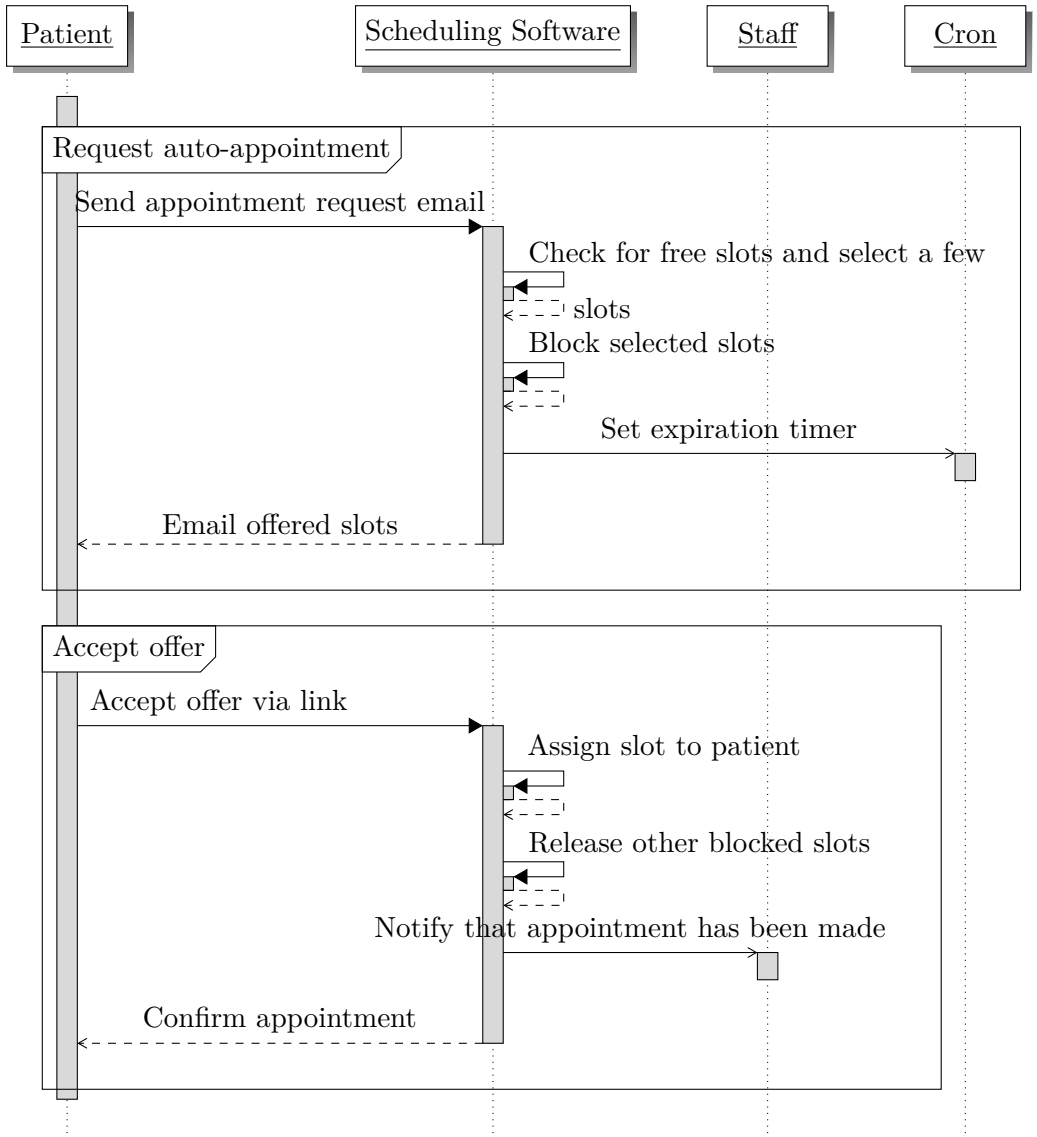


Figure 5.15: Sequence diagram showing application logic to automatically offer appointments by email (SQ01)

handling communication in the proposed CTI architecture.[5]

In the prototype, users are interacting with the CTI service through a Material-specific

[5]To demonstrate such functionality in the course of the evaluation carried out in chapter 6, a minimal Android application, providing a CTI service as described above, was developed. This package is open-source and located at `https://github.com/sebastianhaas/cantycti`.

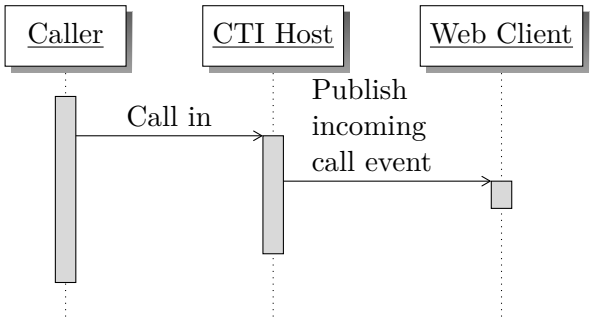


Figure 5.16: Sequence diagram of the proposed CTI architecture processing an incoming call.

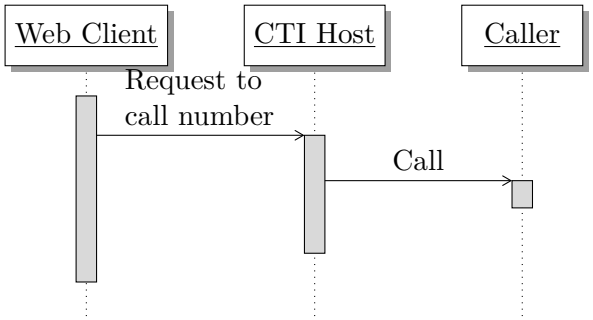


Figure 5.17: Sequence diagram of the proposed CTI architecture processing a call request coming from a web application instance.

design element called "Snackbar"[6], a small piece of material appearing from the bottom of the screen which contains caller information and a link to the respective patient's page. This UI pattern is context-independent in a way that incoming calls can be indicated no matter what action is carried out at the moment of the call. A screenshot of a CTI notification can be found in figure 5.18.

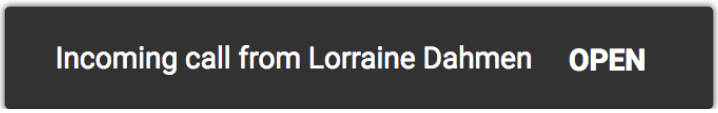


Figure 5.18: Notification of an incoming call triggered by the prototype's CTI system containing caller information and a link to the respective patient's page.

Besides being notified about incoming calls, also starting outgoing calls from the UI is possible with the proposed CTI technology. As learned during the the contextual

[6] https://material.io/guidelines/components/snackbars-toasts.html

inquiry, people working at the front desk often have to try to reach out to patients with an upcoming appointment, for instance if they are late, their examination has to be postponed or if they are required to bring some additional diagnostic findings. In that case, the proposed prototype offers a button in the attendance list that triggers a call with the respective patient. A screenshot of the button in context can be seen in figure 5.19.

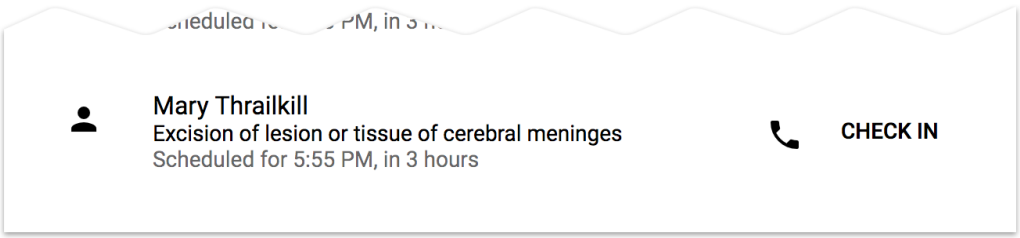


Figure 5.19: Call-patient button in the attendance list

5.12 Summary

This chapter has outlined the requirements for a software solution supporting small and medium-sized medical facilities with their scheduling work. Requirements analysis was done based on the findings from the literature review and the contextual inquiries as presented in the previous chapters. After listing requirements, an overview of the core use cases as well as a list of central views has been presented. The last section has examined a few core aspects of such a system in more detail. The following chapter will evaluate the concepts described in this chapter based on feedback from a few key stakeholders who were presented with an exemplary draft.

CHAPTER 6

Evaluation

In order to assess the quality of the design emerging from the previous chapters, a final iteration of interviews with people from the respective domain was carried out. As described in chapter 3, the prototype was discussed with two members of a participating facility's administrative staff and one physician. After a brief presentation of the design, the participants of this final evaluation were asked to perform a few basic tasks from their everyday work routine such as making or cancelling an appointment. This chapter documents the discussions, feedback from participants and insights from this work's concluding review stage, after a preliminary presentation of the preparative measures needed in order to achieve an immersive and smooth user experience during the reviews.

6.1 Preparation and Test Data

In order to present and discuss the prototype and its functionality properly, a number of preparative measures were taken to provide the feeling of a production-ready application. While primarily developed in English to be available to a broader audience, the user interface has been localized to German. This was done to allow every participant to assess the prototype in their first language. It has furthermore been filled with an extensive set of test data before the evaluation. This sections aims to point out how test data was designed and created, as well as the underlying considerations.

High value was set on providing realistic test data for the evaluation stage. With the prototype available in both English and German, all test data is being created in the respective language as well, to avoid breaking a continuous user experience. Interaction with the prototype's test data functionality was built directly into the user interface, allowing users to experiment with test data.

Test data required for a comprehensive demonstration of the prototype includes examinations, patients, resources such as rooms or equipment, appointments and patient

attendances to simulate, for instance, the admission process.

6.1.1 Examinations

A list of examinations was extracted from the International Statistical Classification of Diseases and Related Health Problems (ICD), Ninth Revision, Clinical Modification (ICD-9-CM) [73]. The dataset was retrieved from `www.cms.gov`.[1] For the German localized version of the prototype, examination strings were translated using Google's Cloud Translation API.[2]

The test data for examinations was revised after the first user evaluation, due to problems with the data set's size. As described in 6.2.2 later in this chapter, the number of examinations carried out in a typical medical facility will be much lower than the total number of examinations classified in ICD-9-CM (around 3800). Figure 6.1 is showing the form enabling users to select which section of the total data set is used.

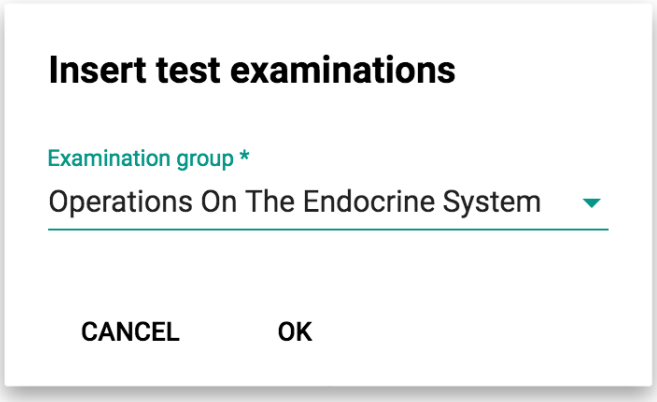


Figure 6.1: The dialog allowing users to choose a section of examinations close to the medical specialty they are working in.

6.1.2 Patients

Patient data was generated randomly, using an online tool.[3] Both an English and a German set of names, one hundred each, was generated and processed for use within the prototype. This approach was taken to make sure the user experience in both available locales is continuous. Patient test data contains name, surname, address,

[1] `https://www.cms.gov/Medicare/Coding/ICD9ProviderDiagnosticCodes/codes.html`

[2] `https://cloud.google.com/translate/`

[3] `http://www.fakenamegenerator.com/`

insurance information, email and phone number. The latter are used for demonstrating the prototype's reminder as well as CTI functionality.

6.1.3 Resources

The only resource taken into account for the prototype are rooms. A set of three rooms can be inserted. Given the typical size of the facilities in question, the number of three rooms may seem high, and was chosen only to be able to demonstrate the problems that occur when dealing with concurrent appointments due to multiple rooms in traditional calendar systems. Room test data can be inserted multiple times, allowing to test the prototype with 6, 9, 12 etc. rooms as well. This opportunity has actually been used during the evaluation phase, to show the impacts of more available resources on common calendar layouts.

6.1.4 Appointments

The prototype has been equipped with functionality to automatically and randomly create appointments for the current week using the examinations, patients and resources described above. The algorithm simulates the process of incoming appointment requests as observed during the contextual inquiry described in chapter 4. An infinite number of consecutive appointment requests is simulated until all resources of the current week are exhausted. The first request will be scheduled for the current week's Monday, at opening hours and in the first available room. The next appointment request will be scheduled to take place at the same time but in another room, or in the same room, but after the first appointment. Existing appointments that have been entered manually during the course of a demonstration, will be respected by the test appointment creation logic, so that appointments will be fit into the present schedule without double-booking.

6.1.5 Attendances

In order to demonstrate the attendance management and statistics view with plausible information, patients attending their virtual appointments have to be simulated.

Attendances can be created randomly for all present appointments. Virtually attending patients are expected to arrive at $t_{arr_{exp}} = t_{sched} + x$ with $x = -15m$, fifteen minutes before their appointment. Due to the lack of knowledge about the actual distribution of patient arrival times and examination times in the present domain, a sample is then picked from a normal distribution with $\mu = 0$ and $\sigma = 1$ using inverse transform sampling. This sample is then multiplied by x, to get the actual offset y. The final arrival time is $t_{arr} = t_{sched} + y$. This routine is carried out for the time the patient is called in for treatment t_{treat} with $x = 5m$. The time the patient leaves the facility is approximated by $t_{fin_{exp}} = t_{treat} + e_{dur} + x$ with $x = 10m$ and e_{dur} being the typical duration of examination e.

6.2 User Interface and Visual Issues

6.2.1 General feedback

The prototype's UI design has turned out to be practical and fairly intuitively in terms of handling. Whenever suggestions like "let's go and take a look at the weekly overview" were made by the interviewer, the test person was able to carry out the proposed actions. This perception seems to coincide with the data collected by the installed tracking tools (see 3.5.1), as little to no click rages (or similar metrics indicating user stress) were found in the collected data.

Figure 6.2 shows the cumulated mouse movements of all recorded sessions during the observation period. Since no information other than an approximative geographic location (derived from the client's IP address) is present, the collected data can not be used for evaluating the prototypes ability for serving in a medical environment. However, when assessing usability from a more general perspective, the information presented in figure 6.2 suggests a concise layout of navigational features and clickable elements, as the hot areas are centered around the screen's left and right edge, containing the main and test data menus.

However, the UI was perceived "minimalistic" in terms of design, fonts and colors used. A demand for personalization features can be derived from the statements made during the presentation. E.g., "is it possible to change this turquoise bar", "would it be possible to upload pictures of patients" etc.

The lack of a legend explaining appointment's color codes was subject to criticism. As observable in calendar-style overviews such as the screenshots in figure 5.8, 5.9 or 5.14, due to the way the appointments for the test data were created (described in 6.1.4), lots of different examinations with lots of different colors were randomly selected. In production, the number of colors actually used can be expected to be drastically lower. Adding a legend might be useful when beginning to use a scheduling software, however, it might also distract after a while.

Another point discussed during the presentation was the absence of functionality allowing to make a follow-up appointment by clicking on a patient's name anywhere in the UI. This was described as a common use case in the test person's facility.

Furthermore, an indication that today is a patients birthday, was described as a nice-to-have feature. This allows members of the staff to wish patients a happy birthday in case they call in or have an appointment on that day, presumably strengthening the physician-patient-relationship.

6.2.2 Appointment forms

The appointment forms **V5**, **V6** and **V10** are using auto-complete input fields, as described in 5.6.3, for patients and examinations. These fields were criticized as unclear and counterintuitive. Problems with reporting back the current state of the input field

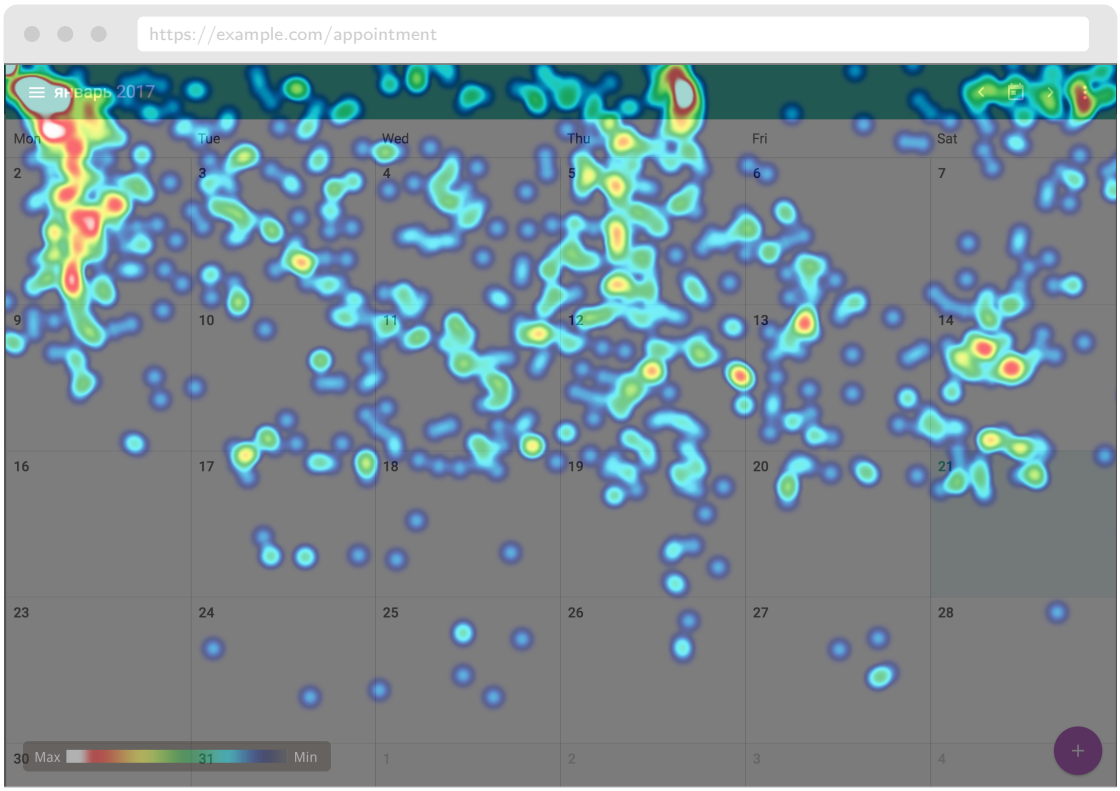


Figure 6.2: A heatmap showing mouse movements on the prototype during the observation period from October 2016 to January 2017. Approximately 120 unique sessions and 400 clicks were recorded per month. The page view rendered in the background does not necessarily reflect the users' actual view. An attempt was made to normalize different screen sizes.

to the user emerged. Although the prototype has not been optimized in terms of input components or forms, solving this issue has to be put on record for any actual future implementation.

Moreover, as for the examination input, not only the technical implementation as such but also the present data was subject to critique. Having to choose an examination from a list of suggestions can lead to problems in case the exact procedure is unknown at the time of making the appointment, is unknown to the person making the appointment or is not available in the list. The test person described the process of choosing an examination as "painful". Making a reasonable selection of examinations to present in the auto-complete field, is a task that is supposedly carried out best in close collaboration with the respective facilities.

As soon as an examination has been selected, the test person was expecting the appointment's duration to be updated automatically with the estimated duration for the selected

examination. The test person also proposed to link additional resources like rooms with certain examinations by default. For instance, certain procedures can never be carried out in a conference room, while doctor-patient discussions will usually not take place in an OR. The prototype has not been equipped with such functionality at the time of the presentation due to the apparently bad assessment of its importance.

Being able to choose whether to send reminders or not when entering a new appointment was very appreciated.

> That's a cool feature, I can choose to send a reminder to people of which I know that they're unreliable. And then I'm sending them a text message.
> Tobias, Physician

Another feature request with regard to reminders that came up during the demonstration, is an appointment information summary, printed on a small paper note to hand over to patients. Multiple facilities indicated they would give away handwritten appointment details. This feature might be especially useful for facilities focusing on elderly patients.

6.2.3 Calendar views

The calendar views **V1**, **V2** and **V3** turned out to be intuitive and easy to use. The possibility to switch between an agenda and a list-style for displaying appointments was accepted very positively. Little was feedback was retrieved on the actual usefulness of **V3** since all participants of the evaluation were working in a facility with only room used for examinations.

6.2.4 Attendance list

Also the list of today's attending patients **V8** was demonstrated live. A test patient with an appointment that was made just before to evaluate the forms, was checked in, called in for treatment and discharged.

As discussed previously in 4.14, also at the test person's facility, daily schedules are usually printed and handled manually by the administrative staff. This was mentioned once again during the evaluation of the prototype, and may therefore encourage further investigation into reasons for printing attendance lists and the benefits of paper in the present context as outlined in 8.13.

The overall layout of the attendance list was found to be suitable. The display of patient's names however, came under criticism for omitting academic titles. Welcoming patients at the front desk with their full name including the academic title was reported to be important at the facility of the evaluating physician. It can be assumed, that this applies for most facilities in Austria.

Another feature that was heavily criticized during the evaluation, is the display of patient's waiting times.

> That is causing stress, knowing since when patient's are in the waiting room. I don't have this information [in the current scheduling solution[4]], I don't want to know for how long somebody is waiting. I can look that up in the calendar anyway, if I'm really interested when the appointment was scheduled for. Tobias, Physician

The feedback received furthermore pointed out that sorting the list of patients in the waiting area by time of arrival, might be sufficient and appropriate in a lot of use cases. Apart from that, an interesting usage of notes and comments was described.

> The order of patient arrival is important. The front desk is adding notes to the appointment, for instance telling me that the patient is coming in earlier and just needs a prescription etc., so I can decide whether to give that patient precedence or not. But a display, saying that this patient is waiting for twenty-seven minutes, is just causing meaningless stress. [...] I wouldn't want that. That's causing stress and is of absolutely no use. The order of the list has to represent patient's time of arrival. But if someone is coming in to be informed about a procedure, and that is about to take three minutes, I would ask my patients in the waiting room if it's OK with them to call that patient up first. Tobias, Physician

6.2.5 Advanced features

The anonymized appointment view as proposed in 5.9 was praised as a potentially useful feature, allowing administrative staff to make appointments together with patients in a collaborative effort.

> An anonymized view is a good thing to have. A screen [a computer monitor on the front desk, facing away from the patient[5]] is always a barrier between staff and patients. Tobias, Physician

The prototype's built-in CTI solution was demonstrated using the author's smartphone as CTI host running an exemplary design of the architecture proposed in 5.11. The solution was accepted well, especially the prototype application's display of incoming calls together with a reference to the calling patient's overview page.

6.3 Summary

While the presented design's overall acceptance was satisfactory, the final feedback iteration carried out as described in this chapter has revealed the importance of further

[4] note from the author
[5] note from the author

investigation and development towards a more complete and specialized solution for managing appointments in small and medium-sized medical facilities. Many of the features and design decisions made for the present exemplary prototype require extensive field testing in order to gain vital insights on how they might or might not have a positive impact on the day in the life of stakeholder. A discussion of the learnings from this work and what has to be examined in future research is subject of the following, concluding two chapters.

CHAPTER 7

Discussion

This study was able to provide a fundamental insight into the challenges and opportunities of technology supporting appointment scheduling in small and medium-sized health care facilities in Austria. Interviews were held with people responsible for managing appointments in such health facilities in order to gain a better understanding of the strengths and weaknesses of digital technology compared to its analog equivalents. Learning about the status quo, e.g. the typical workflows, how and why technology is or is not being used, has been another research goal.

7.1 Overview

During the course of the contextual inquiries, a lot of recurring patterns were observed. Organizational structures amongst the considered facilities were found to have a great deal in common, resulting in surprisingly homogeneous expectations regarding scheduling solutions. All of the analyzed facilities were using some sort of electronic PMS. Software specifically designed to manage appointments in health care environments was used by a majority of the participants. A few persons, typically members of the administrative staff, indicated they were maintaining both an electronic and paper calendar- mostly due to diverging organizational policies or requirements and their personal preferences.

A comprehensive discussion about strategies to reduce no-show rates while increasing patient satisfaction and service accessibility, extending into sending reminders, planning time buffers and procedures was held based on on-site findings and reports.

The practice's flow of work was found to be subject of deliberate, ongoing evaluation and modification in all considered facilities. Great attention has to be directed to time estimates, which have turned out highly dependent on the acting human beings. Personal experience was described as key factor, allowing administrative personnel to compensate for individual quality of physicians or patients. Problems of communicational nature

were identified when it comes to explaining the current booking situation or agreeing on appointments via email.

The prototype based on the proposed exemplary architecture, was found to cover a solid set of requirements but exposed weaknesses in terms of usability. The goal of providing a viable, cost-efficient, minimal architecture that is able to handle typical booking and management processes, as they occur in the facilities in question, using state-of-the-art web technologies was met in large parts, but requires further investigation, development and in-field evaluation. The solution presented however, represents a solid fundament to start from.

7.2 Selection of Participants

The approach, to choose from a set of different medical specialties for the contextual inquiry, has proved beneficial. Some aspects were discovered to be unique for a certain kind of medical specialty, while others were found to occur in all facilities. The type of specialty furthermore seemed to have influence on the demographic structure of patients. With facilities having to account for the needs of their patients, this can be an important factor when organizing appointment scheduling. The selected facilities were not only differing in medical specialty, but also in size. Those on the lower end in terms of staff size, indicated different requirements regarding an appointment scheduling solution than those on the upper end. Realizing that staff size can be the dominating factor in terms of requirements towards software solutions, even in the scale of this work's domain (e.g. one vs. six employees), is an interesting finding, made possible by the selection of participants.

7.3 Area of Application

Primary health care was found to be structured very differently amongst countries or even smaller regions. Due the lack of research carried out in the area of appointment scheduling specific to the present situation in Austria, it was not possible to compare results and assess plausibility, consensus or discrepancies. Due to literature based on studies carried out in different countries, it can be assumed that there is indeed a strong discrepancy between the needs of PCPs in Austria and other parts of the world. Attention has to be payed when applying concepts proposed in this work on other health care infrastructures.

7.4 Identification of Requirements and Use Cases

Assumptions on whether the identified use cases and requirements are appropriate to enable people in charge with managing appointments in small and medium-sized medical facilities to get their work done more easily and efficiently can not be made without further in-field evaluation and trial runs. No fundamental features were found unintentionally absent during this work's evaluation.

7.5 Handing Over Control to Patients

This work failed to deliver a conclusion on the the actual benefit of an online booking form for patients. Due to the lack of research done in the area of appointment scheduling that is focused on small health care providers rather than hospitals, it was not possible to infer solid evidence that moving appointment booking to the web has to offer more despite another communication channel. Experience and expert knowledge as well as human intuition was repeatedly reported as key to successful appointment management during the interviews. Furthermore, making patients aware of the possibility to book appointments online remains a challenge to be addressed as shown in 2.4.

7.6 The Proposed Exemplary Design

7.6.1 Technology and operations

Based on the experiences with the prototype, the proposed technology stack was found to be suitable for the intended cost-efficient, state-of-the-art, web-based application. The architecture allowed for a quick development of additional features and provided a solid base for all features implemented in the final prototype. Deploying and maintaining an instance of the prototype was found to be easy enough for a non-technical person to achieve.

7.6.2 User interaction design

The chosen approach in terms of UI design did not exhibit substantial problems during the evaluation phase. A few usability issues in the prototype's forms were discovered, such as problems when picking dates, localized display of dates and times or auto-completing input fields. Mostly, those issues were related to third-party components and did not show substantial and conceptional problems with the proposed architecture.

CHAPTER 8

Conclusions and Future Work

After the evaluation of the prototype in the previous chapter, this work's concluding chapter will focus on potential areas of interest for future research. As pointed out before, requirements for software solutions supporting appointment scheduling in small and medium-sized medical facilities were found to be highly different from what can be found in hospital environments. With previous literature mainly focusing on large facilities or hospitals, additional research has to be carried out in order to achieve a better understanding of the challenges and needs in the domain specific to this work. The following sections will highlight the most crucial parts of a feasible solution for these areas, as developed based on the knowledge gained during the course of this work. They aim to provide a starting point for further investigations to be done in the future.

8.1 Automated Scheduling

While automating the process of scheduling appointments is beyond the scope of the design in this work, a module offering such functionality might still add great value. As mentioned in 2.3, numerous literature on the topic in general exists. Future work might focus in-depth on the needs of facilities within this work's scope.

Expertise as well as social intelligence were mentioned key factors in the interviews as described in chapter 4. Finding a suitable model for automated scheduling in all scenarios will be hard due to the heterogeneous nature of the facilities considered. Amongst others, such an approach would have to consider restrictions like holidays, staff and equipment availabilities, equipment cleaning or maintenance windows, patients preferences, medical-induced restrictions, availability of premises, over and under-booking strategies as described in 2.1 or operational policies like grouping appointments by examination.

8.2 Estimating Durations of Examinations

Estimating durations of examinations was found to be a complex tasks, strongly depending on local personnel knowledge and often subject to continuous adaptation and tuning. Its outstanding role in medical appointment scheduling has been highlighted in 4.2. Since none of the participating facilities reported bigger issues with their duration estimates, no efforts have been made to provide assistance in this regard while developing the prototype. In the future, however, comparing time estimates with actual durations of appointments, might have the potential to significantly improve the accuracy of facilities' schedules. Actual durations of appointments could be used to build a training set that allows running machine learning procedures that might be able to deliver better, more accurate estimates.

8.3 Reminders

Literature discussing effectiveness of reminders has already been presented in 2.5. Furthermore, a lot of the participating facilities were found to be using some sort of reminders to try and keep their no-show rates low as described in 4.5. However, during the course of the interviews, it became evident that some of the considered facilities are structured quite differently from the typical PCP in the mostly US-based studies presented in chapter 2. Future work analyzing and comparing effectiveness of different approaches on reminding patients of their upcoming appointments in this work's specific domain is needed.

In addition to that, future studies may investigate on criteria to decide which transport for reminders works best in which scenario. Collecting data on reminders and their acceptance amongst patients over a longer period of time might help to evaluate methods and even lead to a system that is able to send reminders using the most preferable transport based on the present situation. For example, the time of the day, season, weather, patient age etc. have all been reported to influence patients show rates in chapter 4.

8.4 Recurring Appointments

Many of the participating facilities stated they would have to deal with recurring appointments at least from time to time. Patients suffering from chronic diseases, patients who undergo long-lasting treatments or treatments that require follow-up examinations might create a need for recurring appointments. An application relying on RFC 5545 [66] as described in 5.5.1 for handling and storing calendar events, comes with a solid groundwork for recurring appointments at no additional cost.

However, providing meaningful forms for inputting recurring appointment data can be a tricky thing to do, as became evident during the interviews. Additional caution is inevitable when it comes to processing input data that might lead to multiple, recurring

and possibly erroneous undesired actions. An example for a controversial user experience in this regard can be found in 4.5.

Furthermore, some sorts of treatments might always require multiple appointments to be made. A system that combines automated scheduling as introduced in chapter 5 and extended in 8.1 with support for recurring appointments might be able to automatically suggest a certain number of follow-up appointments for a set of predetermined examinations.

8.5 Integration With Existing Information Systems

Integrating electronic appointment scheduling systems with existing information systems (e.g. EHRs, PMS etc.) can be divided into technical and legal/organizational problems.

Technical problems will include different interfaces, different standards on data handling, security implications of cross-application sharing of data, high maintenance costs due to changing interface specifications or even low-level issues such as connectivity problems. Providing feasible solutions to these challenges requires an in-depth evaluation of the systems to be connected and will result in high costs for the end user.

Problems of legal or organizational nature may turn out to be even more challenging than finding a technical solution. Including actual health data, explicitly linked to patient records might cause the software solution to become classified as medical product depending on the present legal situation. In most cases, such a classification implies additional certifications and tests, again making it less favorable in terms of economic resources.

Any future consideration might deliberate about whether the possible benefits of integrating with existing information systems is able to justify the efforts needed to solve the challenges outlined above. From this work's point of view, it seems rather unlikely that such a feature is highly demanded amongst the participating facilities. Most existing software solutions offer some sort of scheduling extension, often on a subscription base, making a standalone scheduling application with PMS integration having to compete with those in terms of costs.

8.6 Integration With Health Care Networks

Integrating with health care networks, public, governmentally serviced and private or company-based ones, might be worth investigating in a future work. This special case of integrating with an existing information system might turn out to be significantly less complex in terms of the challenges described in section 8.5. Health care networks will most likely publish a well-documented set of standards used and interfaces to connect with. Also, legal terms are likely to be marked out much clearer than in the previous case.

In Austria, ELGA is not yet ready to support such an application as of the writing of this work. Access to the Zentraler Patientenindex (ZP-I), a patient index based on data from the national health care insurance provider would be required to allow scheduling software to create appointments linked uniquely to a patient.

8.7 Integration With Existing Patient Databases

Another particular case of integrating with an existing information system as described in 8.5 is an integration with a facility's local patient database. In case a simple, standard database of patients is maintained locally at a facility, establishing a connection might be easier to realize than with more complex systems like a PMS. Future work investigating on synchronization issues when trying to provide previously offline, local data in a web application as well as legal and security implications is needed.

8.8 Online Booking Forms for Patients

As discussed in 7.5, it appears unclear whether enabling patients to book appointments on their own through an online form is beneficial for the overall process. Little is known about levels of satisfaction of medical staff and patients using any of the existing solutions introduced in section 2.7 too. It might be reasonable to collect solid evidence on the matter before moving on to exploring additional ways of formalizing and automating scheduling processes using web technologies.

8.9 Integration With Patient's Personal Scheduling Solutions

It might be convenient for patients if they had the chance to overlay both the available dates for an appointment and their own calendar in order to choose a working date more easily. Privacy concerns, patients will rather not share their calendar with their physician's website, but it might be possible to create a temporary online calendar, containing free dates for an appointment. Since such a calendar does not contain sensitive information, it can be shared with patients allowing them to view it on top of their own schedule. It may be necessary to evaluate the use of such a solution, since doctor's appointments can be considered as high-priority to patients, who are therefore quite likely to be willing to move or cancel existing appointments.

8.10 Involving Patients

Since no interviews with patients were held in the context of this work, it may be of interest to include these in a continuing study. Questions to be investigated might include what makes patients choose a certain physician, how do they feel about the appointment scheduling process, what types of reminders do they prefer etc.

From the insights gained during the on-site interviews, patients can be expected to be a very heterogeneous group of people in most medical fields. Therefore, capturing a representative overview of their needs and habits will most likely require a high number of participants.

8.11 Reducing Registration Times

As described in 4.10, for GPs with 100 or more consultations per day, the time required to register a walk-in patient, even if it is as low as five minutes, can potentially become a bottleneck. While the facilities observed seem to fight this issue by increasing administrative staff sizes, investigating into potential solutions based on Internet technology might be a prolific thing to do. It seems worth mentioning that tasks like collecting patient data, gathering information about current medication, vaccinations etc. could be become obsolete when linked to a governmental health care network. As for Austria, ELGA has already been outlined in 8.6.

8.12 Local Patient Data Storage

Handling patient data is subject to different legal restrictions, depending on a facility's location. In many cases, storing patient data on any given third-party online software service, won't be possible. Dealing with these situations, and implementing approaches on how to incorporate patient data from secure (local) storage locations in a standardized way is another possible area for future research.

8.13 Advantages of Paper

As reported, during the contextual inquiry, in many occasions people involved with scheduling appointments in medical facilities reported the would prefer paper over digital solutions for certain tasks. Future research is required to understand the motivations of people in the present domain, making them avoid computer-aided tools and accept additional workload such as keeping their own, personal paper calendar in sync with the obligatory facility-wide electronic calendar.

While paper obviously has advantages whenever a medium for taking quick notes and drawing sketches is required, the people's reasons for choosing paper over the electronic equivalents are believed to be quite complex. During the course of this work, reasons for non-acceptance of electronic solutions were found to be ranging from bad UI design, confirmed habits, problems with interacting with computer systems, instability issues of the systems in place to a lack of money in order to afford the required software. Many of these problems may occur in bigger environments, such as hospitals, as well, but others might be specific to the present domain of small and medium-sized medical facilities. Learning and understanding about them is a crucial goal of future research on the matter.

It might not always be desirable to replace any usage of paper with an electronic equivalent. Finding out about those use cases where paper has to offer advantages over technology and trying to incorporate those usages in the work flow of a digital scheduling solution is another interesting potential aspect of future research.

8.14 Implement Scheduling Strategies

As outlined in chapter 2, numerous strategies for scheduling appointments in medical facilities are well-covered in literature. Finding out which of these strategies are likely to have a positive impact on the work flow of small and medium-sized facilities such as the ones regarded in the course of this work, is another task open to be discussed in future research.

Not only the effectiveness of scheduling approaches, but also how they can be implemented in electronic solutions supporting scheduling processes, is an interesting topic for further research. Systems that track the entire life cycle of a patient's visit at a facility, from check in, time in the waiting area, examination to check out, might even be able to analyze and evaluate the applied scheduling strategies and adapt their heuristics for better results.

In order to optimize the way appointments are being scheduled, collecting data on ongoing processes is required. Identifying core characteristics that can be used to quantify success of appointment scheduling workflows, may be an interesting topic for a future work. Establishing a set of meaningful metrics on appointment scheduling in medical facilities augmenting core figures (e.g. waiting times, number of appointments etc.) might enable automated scheduling processes to steadily optimize heuristics based on the feedback data collected.

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Glossary

Audit Trail "An audit trail is a series of records of computer events, about an operating system, an application, or user activities. A computer system may have several audit trails, each devoted to a particular type of activity. Audit trails maintain a record of system activity both by system and application processes and by user activity of systems and applications. In conjunction with appropriate tools and procedures, audit trails can assist in detecting security violations, performance problems, and flaws in applications." (from NIST Computer Security Resource Center [61]). 41, 42

ELGA "ELGA steht als moderne und sichere Infrastruktur allen Bürgerinnen und Bürgern und allen, die im österreichischen Gesundheitssystem versorgt werden, zur Verfügung. Als modernes Informationssystem erleichtert ELGA zukünftig Patientinnen und Patienten sowie berechtigten ELGA-Gesundheitsdiensteanbietern – behandelnde Ärztinnen und Ärzte, Spitäler, Pflegeeinrichtungen oder Apotheken – den Zugang zu Gesundheitsdaten. Ein wichtiges Ziel von ELGA ist somit insbesondere die Unterstützung der medizinischen, pflegerischen und therapeutischen Behandlung und Betreuung durch einen besseren Informationsfluss, vor allem, wenn mehrere Gesundheitseinrichtungen oder Berufsgruppen entlang einer Behandlungskette zusammenarbeiten." [74]. 81

FIPS The Federal Information Processing Standard is a standard published by the United States federal government for use in computer systems. [43]. 12

GCM Galois/Counter Mode (GCM) is an algorithm for authenticated encryption with associated data. [42]. 12

iCalendar "iCalendar is a data format for representing and exchanging calendaring and scheduling information such as events, to-dos, journal entries, and free/busy information, independent of any particular calendar service or protocol." (from RFC 5545 [66]). 50

iframe An HTML element that allows displaying a web page within another. From the W3C specifications for HTML 5.1 [75]: "The iframe element represents a nested browsing context.". 12

jCal "The iCalendar data format is a text format for capturing and exchanging information normally stored within a calendaring and scheduling application, for example, tasks and events. JSON is a lightweight, text-based, language-independent data interchange format commonly used in Internet applications." (from RFC 7265 [68]). 50

PaaS Platform as a service "systems are generally hosted, web-based application-development platforms, providing end-to-end or, in some cases, partial environments for developing full programs online. They handle tasks from editing code to debugging, deployment, runtime, and management." [76]. 23

syslog "The syslog protocol is used to convey event notification messages. This protocol utilizes a layered architecture, which allows the use of any number of transport protocols for transmission of syslog messages. It also provides a message format that allows vendor-specific extensions to be provided in a structured way." (from RFC 5424 [63]). 42

Wahlarzt Any usage of this term in the context of this work relates to the Austrian doctor of choice, a physician without a permanent contract with the compulsory social insurance body. A model specific to Austria. Patients can submit treatment expenses, and may be eligible for a partial refund afterwards. [2]. 1, 2, 32, 40

WebSocket "The WebSocket Protocol enables two-way communication between a client running untrusted code in a controlled environment to a remote host that has opted-in to communications from that code. The security model used for this is the origin-based security model commonly used by web browsers. The protocol consists of an opening handshake followed by basic message framing, layered over TCP. The goal of this technology is to provide a mechanism for browser-based applications that need two-way communication with servers that does not rely on opening multiple HTTP connections (e.g., using XMLHttpRequest or `<iframe>`s and long polling)." (from RFC 6455 [77]). 63

Acronyms

COE Center of Excellence. 1

CTI Computer Telephony Integration. 37, 40, 61, 62, 63, 64, 63, 62, 64, 65, 68, 73, 85

EHR Electronic Health Record. 37, 81

ERD Entity Relationship Diagram. 47, 48, 49, 50, 49, 85

FIFO First-In, First-Out principle. 6

FIPS Federal Information Processing Standard. *Glossary:* FIPS, 12

GCM Galois/Counter Mode. *Glossary:* GCM, 12

GP General Practitioner. 1, 2, 7, 8, 11, 25, 35, 36, 38, 83

iCal Internet Calendaring and Scheduling Core Object Specification. 42, 50

ICD International Statistical Classification of Diseases and Related Health Problems. 68

IHE Integrating the Healthcare Enterprise. 42

JSON JavaScript Object Notation. 50

OR Operating Room. 3, 5, 11, 71

OS Operating System. 36, 37, 38, 43

PaaS Platform as a Service. *Glossary:* PaaS, 23

PCP Primary Care Physician. 1, 2, 76, 80

PMS Medical Practice Management Software. 2, 42, 58, 61, 75, 81, 82

PRA Preoperative Risk Assessment. 11

SPA Single Page Application. 23

SSO Single Sign-On. 42

TCP Transmission Control Protocol. 42

UDP User Datagram Protocol. 42

UI User Interface. 11, 43, 64, 65, 69, 70, 77, 85

UML Unified Modeling Language. 45

WebSocket The WebSocket Protocol. *Glossary:* WebSocket, 63

ZP-I Zentraler Patientenindex. 81

Bibliography

[1] Statistik Austria. (Feb. 22, 2017). Personal im gesundheitswesen, Statistik Austria, [Online]. Available: http://www.statistik.at/web_de/statistiken/menschen_und_gesellschaft/gesundheit/gesundheitsversorgung/personal_im_gesundheitswesen/index.html (visited on 04/11/2017).

[2] Dr. Sabine Oberhauser, MAS Regierungsmitglied Bundesministerium für Gesundheit und Frauen, *Anfragebeantwortung durch die bundesministerin für gesundheit und frauen dr. sabine oberhauser, MAS zu der schriftlichen anfrage (10106/j) der abgeordneten dr. eva mückstein, kolleginnen und kollegen an die bundesministerin für gesundheit und frauen betreffend entwicklung der anzahl der niedergelassenen ärztInnen mit und ohne kassenvertrag*, 2016.

[3] Hauptverband der Österreichischen Sozialversicherungsträger. (2017). Wahlarzt / wahltherapeut: Rechnung einreichen, [Online]. Available: https://www.sozialversicherung.at/portal27/esvportal/content/contentWindow?viewmode=content&contentid=10007.751901 (visited on 04/11/2017).

[4] C. Neustaedter and A. J. Bernheim Brush, "Linc-ing"the family: The participatory design of an inkable family calendar", in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ser. CHI '06, New York, NY, USA: ACM, 2006, pp. 141–150, ISBN: 978-1-59593-372-0. DOI: 10.1145/1124772.1124796.

[5] T. Cayirli and E. Veral, "Outpatient scheduling in health care: A review of literature", *Production and Operations Management*, vol. 12, no. 4, pp. 519–549, 2003, ISSN: 10591478.

[6] T. Cayirli, E. Veral, and H. Rosen, "Designing appointment scheduling systems for ambulatory care services", *Health Care Management Science*, vol. 9, no. 1, pp. 47–58, Feb. 2006, ISSN: 1386-9620, 1572-9389. DOI: 10.1007/s10729-006-6279-5.

[7] D. Gupta and B. Denton, "Appointment scheduling in health care: Challenges and opportunities", *IIE Transactions*, vol. 40, no. 9, pp. 800–819, Jul. 21, 2008, ISSN: 0740-817X, 1545-8830. DOI: 10.1080/07408170802165880.

[8] N. S. Penneys, "A comparison of hourly block appointments with sequential patient scheduling in a dermatology practice", *Journal of the American Academy of Dermatology*, vol. 43, no. 5, pp. 809–813, Nov. 2000, ISSN: 0190-9622. DOI: 10.1067/mjd.2000.107761.

[9] M. K. Chung, "Tuning up your patient schedule", *Family practice management*, vol. 9, no. 1, pp. 41–45, 2002.

[10] G. C. Kaandorp and G. Koole, "Optimal outpatient appointment scheduling", *Health Care Management Science*, vol. 10, no. 3, pp. 217–229, May 23, 2007, ISSN: 1386-9620, 1572-9389. DOI: 10.1007/s10729-007-9015-x.

[11] A. Mercer, "A queueing problem in which the arrival times of the customers are scheduled", *Journal of the Royal Statistical Society. Series B (Methodological)*, vol. 22, no. 1, pp. 108–113, 1960, ISSN: 0035-9246.

[12] ——, "Queues with scheduled arrivals: A correction, simplification and extension", *Journal of the Royal Statistical Society. Series B (Methodological)*, vol. 35, no. 1, pp. 104–116, 1973, ISSN: 0035-9246.

[13] S. Herriott, "Reducing delays and waiting times with open-office scheduling - family practice management", *Familiy Practice Management*, vol. 6, no. 4, pp. 38–43, Apr. 1999.

[14] S. Dixon, F. C. Sampson, A. O'Cathain, and M. Pickin, "Advanced access: More than just GP waiting times?", *Family Practice*, vol. 23, no. 2, pp. 233–239, Apr. 1, 2006, ISSN: 0263-2136, 1460-2229. DOI: 10.1093/fampra/cmi104.

[15] M. Pickin, A. O'Cathain, F. C. Sampson, and S. Dixon, "Evaluation of advanced access in the national primary care collaborative", *The British Journal of General Practice*, vol. 54, no. 502, pp. 334–340, May 1, 2004, ISSN: 0960-1643.

[16] C. Salisbury, A. A. Montgomery, L. Simons, F. Sampson, S. Edwards, H. Baxter, S. Goodall, H. Smith, V. Lattimer, and D. M. Pickin, "Impact of advanced access on access, workload, and continuity: Controlled before-and-after and simulated-patient study", *The British Journal of General Practice*, vol. 57, no. 541, pp. 608–614, Aug. 1, 2007, ISSN: 0960-1643.

[17] C. D. O'Hare and J. Corlett, "The outcomes of open-access scheduling", *Family Practice Management*, vol. 11, no. 2, pp. 35–38, Feb. 2004, ISSN: 1069-5648.

[18] C. Tantau, "Accessing patient-centered care using the advanced access model", *The Journal of Ambulatory Care Management*, vol. 32, no. 1, pp. 32–43, Mar. 2009, ISSN: 0148-9917. DOI: 10.1097/01.JAC.0000343122.15467.48.

[19] K. D. Rose, J. S. Ross, and L. I. Horwitz, "Advanced access scheduling outcomes: A systematic review", *Archives of Internal Medicine*, vol. 171, no. 13, pp. 1150–1159, Jul. 11, 2011, ISSN: 0003-9926. DOI: 10.1001/archinternmed.2011.168.

[20] K. Muthuraman and M. Lawley, "A stochastic overbooking model for outpatient clinical scheduling with no-shows", *IIE Transactions*, vol. 40, no. 9, pp. 820–837, Jul. 21, 2008, ISSN: 0740-817X. DOI: 10.1080/07408170802165823.

[21] R. D. Neal, D. A. Lawlor, V. Allgar, M. Colledge, S. Ali, A. Hassey, C. Portz, and A. Wilson, "Missed appointments in general practice: Retrospective data analysis from four practices.", *The British Journal of General Practice*, vol. 51, no. 471, pp. 830–832, Oct. 2001, ISSN: 0960-1643.

[22] A. George and G. Rubin, "Non-attendance in general practice: A systematic review and its implications for access to primary health care", *Family Practice*, vol. 20, no. 2, pp. 178–184, Apr. 1, 2003, ISSN: 0263-2136, 1460-2229. DOI: 10.1093/fampra/20.2.178.

[23] R. D. Neal, M. Hussain-Gambles, V. L. Allgar, D. A. Lawlor, and O. Dempsey, "Reasons for and consequences of missed appointments in general practice in the UK: Questionnaire survey and prospective review of medical records", *BMC Family Practice*, vol. 6, p. 47, Nov. 7, 2005, ISSN: 1471-2296. DOI: 10.1186/1471-2296-6-47.

[24] M. Husain-Gambles, R. D. Neal, O. Dempsey, D. A. Lawlor, and J. Hodgson, "Missed appointments in primary care: Questionnaire and focus group study of health professionals.", *The British Journal of General Practice*, vol. 54, no. 499, pp. 108–113, Feb. 2004, ISSN: 0960-1643.

[25] M. Eisner and N. Britten, "What do general practice receptionists think and feel about their work?", *The British Journal of General Practice*, vol. 49, no. 439, pp. 103–106, Feb. 1999, ISSN: 0960-1643.

[26] W. Cao, Y. Wan, H. Tu, F. Shang, D. Liu, Z. Tan, C. Sun, Q. Ye, and Y. Xu, "A web-based appointment system to reduce waiting for outpatients: A retrospective study", *BMC health services research*, vol. 11, p. 318, Nov. 22, 2011, ISSN: 1472-6963. DOI: 10.1186/1472-6963-11-318.

[27] A. K. Dey and G. D. Abowd, "Cybreminder: A context-aware system for supporting reminders", in *Handheld and Ubiquitous Computing*, ser. Lecture Notes in Computer Science 1927, P. Thomas and H.-W. Gellersen, Eds., DOI: 10.1007/3-540-39959-3_13, Springer Berlin Heidelberg, Sep. 25, 2000, pp. 172–186, ISBN: 978-3-540-41093-5 978-3-540-39959-9.

[28] N. Junod Perron, M. D. Dao, N. C. Righini, J.-P. Humair, B. Broers, F. Narring, D. M. Haller, and J.-M. Gaspoz, "Text-messaging versus telephone reminders to reduce missed appointments in an academic primary care clinic: A randomized controlled trial", *BMC Health Services Research*, vol. 13, p. 125, 2013, ISSN: 1472-6963. DOI: 10.1186/1472-6963-13-125.

[29] J. Witter, A. Steele, D. McEwen, and P. Mehler, "The effect of computer generated appointment reminders on compliance with clinic appointments", *The Internet Journal of Healthcare Administration*, vol. 8, no. 2, 2001.

[30] T. M. Nelson, J. H. Berg, J. F. Bell, P. J. Leggott, and A. L. Seminario, "Assessing the effectiveness of text messages as appointment reminders in a pediatric dental setting", *The Journal of the American Dental Association*, vol. 142, no. 4, pp. 397–405, Apr. 2011, ISSN: 0002-8177. DOI: 10.14219/jada.archive.2011.0194.

[31] K. Fairhurst and A. Sheikh, "Texting appointment reminders to repeated non-attenders in primary care: Randomised controlled study", *Quality and Safety in Health Care*, vol. 17, no. 5, pp. 373–376, Oct. 1, 2008, ISSN: , 2044-5423. DOI: 10.1136/qshc.2006.020768.

[32] A. J. Sellen and R. H. Harper, *The myth of the paperless office*. MIT press, 2003.

[33] R. H. Harper, K. P. O'Hara, A. J. Sellen, and D. J. Duthie, "Toward the paperless hospital?", *British journal of anaesthesia*, vol. 78, no. 6, pp. 762–767, 1997.

[34] J. E. Bardram, H. Baldus, and J. Favela, "Pervasive computing in hospitals", *Pervasive computing in healthcare*, pp. 49–77, 2007.

[35] J. Green, Z. McDowall, and H. W. Potts, "Does choose & book fail to deliver the expected choice to patients? a survey of patients' experience of outpatient appointment booking", *BMC Medical Informatics and Decision Making*, vol. 8, no. 1, pp. 1–8, Aug. 1, 2008, ISSN: 1472-6947. DOI: 10.1186/1472-6947-8-36.

[36] A3L e-solutions GmbH. (2016). Mednanny, [Online]. Available: http://doc.mednanny.com/ (visited on 10/14/2015).

[37] ——, (2016). Mednanny | pricing, Mednanny, [Online]. Available: https://doc.mednanny.com/en/index.php?page=preis (visited on 11/22/2016).

[38] ZocDoc, Inc. (2015). About us - ZocDoc, [Online]. Available: https://www.zocdoc.com/aboutus (visited on 10/04/2015).

[39] "Consumer portal for healthcare appointments across practice groups", US20100070303 A1, U.S. Classification 705/3, 705/4, 705/2, 705/7.19; International Classification G06Q50/00, G06Q10/00, G06Q40/00; Cooperative Classification G06Q50/22, G06Q10/109, G06Q40/08, G06Q10/1095, G06Q50/24; European Classification G06Q50/22, G06Q10/109, G06Q10/1095, G06Q40/08, G06Q50/24, Mar. 18, 2010.

[40] ZocDoc, Inc. (2016). Making appointments archives, Zocdoc, [Online]. Available: https://www.zocdoc.com/about/topic/making-an-appointment/ (visited on 11/24/2016).

[41] ——, (2016). Data & privacy archives, Zocdoc, [Online]. Available: https://www.zocdoc.com/about/topic/data-privacy/ (visited on 11/24/2016).

[42] M. J. Dworkin, "SP 800-38d. recommendation for block cipher modes of operation: Galois/counter mode (GCM) and GMAC", National Institute of Standards & Technology, Gaithersburg, MD, United States, 2007.

[43] National Institute of Standards and Technology, "Security requirements for cryptographic modules: Federal information processing standards publication 140–142 (FIPS PUB 140–142)", National Institute of Standards and Technology (NIST), Gaithersburg, MD, United States, 2001.

[44] Jill Nastasia. (Oct. 23, 2012). Dental marketing: Is ZocDoc a wise investment? | MDPM consulting, mdpm Consulting, [Online]. Available: https://mdpmconsulting.com/dental-marketing-is-zocdoc-a-wise-investment/ (visited on 11/24/2016).

[45] S. Lohr. (Jan. 30, 2012). Lessons from ZocDoc, a health tech start-up that works, Bits Blog, [Online]. Available: http://bits.blogs.nytimes.com/2012/01/30/lessons-from-zocdoc-a-health-tech-start-up-that-works/ (visited on 11/24/2016).

[46] Laura Johnson. (2016). Is ZocDoc worth the cost? | foster web marketing, Foster Web Marketing, [Online]. Available: https://www.fosterwebmarketing.com/faqs/is-zocdoc-worth-the-cost.cfm (visited on 11/24/2016).

[47] samedi GmbH. (2015). Tour - organisation, Online appointment booking for patients & networking for doctors at samedi®, [Online]. Available: https://www.samedi.de/tour/02-organisation.html (visited on 10/04/2015).

[48] ——, (2016). Our prices, Online appointment booking for patients & networking for doctors at samedi®, [Online]. Available: https://www.samedi.de/en/preise.html (visited on 11/25/2016).

[49] B. Saunders, J. Kitzinger, and C. Kitzinger, "Anonymising interview data: Challenges and compromise in practice", *Qualitative Research*, p. 1 468 794 114 550 439, Sep. 23, 2014, ISSN: 1468-7941, 1741-3109. DOI: 10.1177/1468794114550439.

[50] K. Kaiser, "Protecting respondent confidentiality in qualitative research", *Qualitative health research*, vol. 19, no. 11, pp. 1632–1641, Nov. 2009, ISSN: 1049-7323. DOI: 10.1177/1049732309350879.

[51] D. Loviglio. (May 9, 2012). Picking pseudonyms for your research participants, Mozilla UX, [Online]. Available: https://blog.mozilla.org/ux/2012/05/picking-pseudonyms-for-your-research-participants/ (visited on 06/29/2016).

[52] K. Holtzblatt and H. Beyer, "Making customer-centered design work for teams", *Commun. ACM*, vol. 36, no. 10, pp. 92–103, Oct. 1993, ISSN: 0001-0782. DOI: 10.1145/163430.164050.

[53] L. E. Wood, "Semi-structured interviewing for user-centered design", *Interactions*, vol. 4, no. 2, pp. 48–61, Mar. 1997, ISSN: 1072-5520. DOI: 10.1145/245129.245134.

[54] N. Middleton and R. Schneeman, *Heroku: Up and Running*. "O'Reilly Media, Inc.", Nov. 7, 2013, 100 pp., Google-Books-ID: IS4KAgAAQBAJ, ISBN: 978-1-4493-4137-4.

[55] A. Hanjura, *Heroku Cloud Application Development*. Packt Publishing Ltd, Apr. 24, 2014, 577 pp., Google-Books-ID: 6E5sAwAAQBAJ, ISBN: 978-1-78355-098-2.

[56] F. Paetsch, A. Eberlein, and F. Maurer, "Requirements engineering and agile software development", in *Twelfth IEEE International Workshops on Enabling Technologies: Infrastructure for Collaborative Enterprises, 2003. WET ICE 2003. Proceedings*, Jun. 2003, pp. 308–313. DOI: 10.1109/ENABL.2003.1231428.

[57] R. S. Pressman, *Software Engineering: A Practitioner's Approach*. McGraw Hill, 2001, 860 pp., ISBN: 978-0-07-118182-2.

[58] I. Sommerville, *Software Engineering (2Nd Ed.)* Boston, MA, USA: Addison-Wesley Longman Publishing Co., Inc., 1985, ISBN: 978-0-201-14229-7.

[59] W. R. Bischofberger and G. Pomberger, *Prototyping-Oriented Software Development: Concepts and Tools*. Springer Science & Business Media, Dec. 6, 2012, 227 pp., ISBN: 978-3-642-84760-8.

[60] IHE, “IHE IT infrastructure technical framework, volume 1 (ITI TF -1): Integration profiles”, IHE, Revision 12. 1, Apr. 22, 2016.

[61] NIST Computer Security Response Center. (). Audit trails, [Online]. Available: http://csrc.nist.gov/publications/nistbul/itl97-03.txt (visited on 07/06/2016).

[62] G. Marshall, “RFC 3881 security audit and access accountability message XML data definitions for healthcare applications”, Sep. 2004.

[63] R. Gerhards, “RFC 5424 the syslog protocol”, Mar. 2009.

[64] P. P.-S. Chen, “The entity-relationship model - toward a unified view of data”, *ACM Trans. Database Syst.*, vol. 1, no. 1, pp. 9–36, Mar. 1976, ISSN: 0362-5915. DOI: 10.1145/320434.320440.

[65] ——, “The entity-relationship model: A basis for the enterprise view of data”, in *Proceedings of the June 13-16, 1977, National Computer Conference*, ser. AFIPS ’77, New York, NY, USA: ACM, 1977, pp. 77–84. DOI: 10.1145/1499402.1499421.

[66] B. Desruisseaux, “RFC 5545 internet calendaring and scheduling core object specification (iCalendar)”, Sep. 2009.

[67] T. Bray, “RFC 7159 the JavaScript object notation (JSON) data interchange format”, Mar. 2014.

[68] P. Kewisch, C. Daboo, and M. Douglass, “RFC 7265 jCal: The JSON format for iCalendar”, May 2014.

[69] S. Bradner, “RFC 2026 the internet standards process – revision 3”, Oct. 1996.

[70] P. Kewisch and J. Lal, *Mozilla-comm/ical.js*, version v1.2.1, Apr. 14, 2016.

[71] J. Lynch, “Computer-telephony integration”, *Work Study*, vol. 44, no. 7, pp. 8–9, Nov. 1, 1995, ISSN: 0043-8022. DOI: 10.1108/00438029510096544.

[72] V. Pimentel and B. G. Nickerson, “Communicating and displaying real-time data with WebSocket”, *IEEE Internet Computing*, vol. 16, no. 4, pp. 45–53, Jul. 2012, ISSN: 1089-7801. DOI: 10.1109/MIC.2012.64.

[73] World Health Organization. (2017). WHO | international classification of diseases, WHO, [Online]. Available: http://www.who.int/classifications/icd/en/ (visited on 01/25/2017).

[74] ELGA GmbH. (2017). Elga: ELGA im überblick, [Online]. Available: https://www.elga.gv.at/elga-die-elektronische-gesundheitsakte/elga-im-ueberblick/index.html (visited on 01/16/2017).

[75] World Wide Web Consortium (W3C). (2016). HTML 5.1: 4.7. embedded content, [Online]. Available: https://www.w3.org/TR/2016/REC-html51-20161101/semantics-embedded-content.html#elementdef-iframe (visited on 11/23/2016).

[76] G. Lawton, “Developing software online with platform-as-a-service technology”, *Computer*, vol. 41, no. 6, pp. 13–15, Jun. 2008, ISSN: 0018-9162. DOI: 10.1109/MC.2008.185.

[77] I. Fette, A. Melnikov, Google, Inc., and Isode Ltd., “RFC 6455 the WebSocket protocol”, Dec. 2011.

Appendix A

The names in the following chapters have been changed.

Interview I

INT: Wie läuft das bei euch ab wenn ein Patient anruft und einen Termin haben möchte?

B: Was passiert da... gut. Name, Geburtsdatum und dann gibt es schon die Unterscheidung kommt der zu einer Untersuchung weil er jetzt einen Endoskopietermin ausmachen will oder kommt er direkt in die Ordination her weil er einfach so Beschwerden hat.

Wenn jemand einen Endoskopietermin braucht, machen wir einen Termin in der Diakone (zweiter Standort an dem Endoskopien durchgeführt werden, Anm.) für ihn aus und bekommt aber zusätzlich einen Termin bei uns zur Aufklärung. Wir notieren die Daten und Telefonnummer des Patienten schreiben rein was wir machen müssen. Es ist gut die Telefonnummer zu haben falls wir eine Änderung machen müssen. Weil ich weiß ja vorerst wenn jemand das erste mal kommt nur den Namen, was er hat und die Telefonnummer.

Bei bestehenden Patienten ist es ein bisschen einfacher, das weiß man meistens schon was er hat.

INT: Wie schaut das aus, kann man das anschauen?

B: Nein, wir machen das im Google Calendar werden die eingetragen. Da gibts eh alle Ansichten ob Tag, Woche, Monat wie auch immer.

Wir haben die Termine farblich hinterlegt. Die rosaroten Termine sind die Endoskopietermine die sind in der Diakonie am Mittwochvormittag und alle anderen Termine zum Beispiel in der Ordination sind Mittwoch Nachmittag und Freitag Vormittag. Die roten sind die die direkt beim Arzt/der Ärztin ein Gespräch haben und eine Untersuchung machen und die lila Termine sind jene Termine wo die Patienten zur Infusion kommen. Die macht dann unsere Birgit, und die müssen immer in einem gewissen Abstand bei der Infusion sein, das macht dann sie selber aus. Das ist ihr Patientengut. Die müssen auch gar nicht immer zum/zur Arzt/Ärztin hinein. Die grünen sind auch Infusionsgeschichten. Das gelbe sind ganz kurze Termine.

INT: Die Farben sind also ganz grob nach Untersuchungsart eingeteilt.

B: Ja genau.

INT: Macht ihr das so, dass ihr zu gewissen Zeiten gewisse Untersuchungen geblockt habt? Oder gemischt?

B: Die Endoskopien sind immer an Vormittagen zu bestimmten Tagen und die Untersuchungstermine sind immer da in der Ordination aber gemischt. Aber

nur Mittwoch Nachmittag und Freitag Vormittag.

INT: Wie setzt sich die Dauer eines Termins fest?

B: Halbe Stunde primär, kommt der Patient das erste Mal. Und je nachdem was einer für eine Diagnose hat kommt er vielleicht eine Stunde. Und man kennt ja eh schon seine Pappenheimer das weiß man dann schon dass die halt mal nicht eine halbe Stunde sonder eine Stunde brauchen. Aber generell machen wir so eine halbe Stunde, wenn man mal ein bisschen schneller bei einem Patienten ist, hat man ein bisschen einen Puffer für den nächsten. Man kann das eh nicht so genau einhalten.

INT: Ok, aber ihr habt keine fixe Liste wo ihr sagt die Untersuchung dauert 20 Minuten und die 30 Minuten?

B: Nein. Eigentlich nicht. Primär eben diese halbe Stunde und ab und an mal eine Stunde.

INT: Und funktioniert das gut so? Geht sich das meistens aus?

B: Es geht sich meistens aus, ein bisschen eine Verspätung haben wir schon kann schon sein dass wir mal eine Viertelstunde Verspätung haben.

INT: Also tendenziell eher zu kurz geplant als zu lang?

B: Nein... Aber wenn einer mehr braucht bekommt er einfach einen Folgetermin, wenn einer wirklich mehr braucht. Es geht ja nicht nur um die Untersuchung es geht ja auch ums Gespräch. Das ist immer eine Kombination.

INT: Bei denen ist das ja denk ich egal weil die eh parallel laufen können.

B: Die laufen parallel genau.

INT: Habt ihr eigentlich Pufferzonen eingeplant von Haus aus?

B: Nein, das gibt es nicht.

INT: Ok, gibt es nicht. Weil da zum Beispiel zu Mittag jetzt ein Loch ist?

B: Nein, das ist ja weil das am Vormittag in der Diakonie ist, und natürlich muss man den Anfahrtsweg auch rechnen. Wir machen schon manchmal dass wir Mittag eine halbe Stunde Pause einrechnen, da muss man sich immer ein bisschen ausklinken weil es einfach anstrengend ist. So wie da. Da haben wir eine Viertelstunde Pause. Das reicht meistens. Weil es ja auch sein kann dass es irgendwo mal hakt, dass man ein wenig mehr braucht (Zeit, Anm.).

INT: OK. Also ihr macht so Puffer mehr nach Gefühl, das ist nicht so fix eingeplant?

B: Nein, am Nachmittag haben wir überhaupt keine Puffer, wenn dann am Vormittag mehr wenns zum endoskopieren ist. Aber meistens geht sich das gut aus, es kann höchstens sein dass sich durch eine Urlaubszeit etwas ansammelt und die muss man dann halt hinten dran tun. (Am Ende des Tages, Anm.)

INT: Macht ihr Erinnerungen für Patienten? In der Form von Email oder SMS.

B: Nein, das machen wir nicht. Die Patienten bekommen einen Zettel wenn sie zu uns kommen zur Kontrolle müssen sie einen Folgetermin ausmachen und da bekommen sie einen Zettel mit wo der Termin draufsteht.

INT: Das heißt der Rest ist dann Eigenverantwortung.

B: So ist es. Was wir schon machen, wenn jetzt zum Beispiel ein Patient 10 Minuten Verspätung oder so hat, ist dass wir anrufen ob er eh noch kommt. Aber meis-

tens steht er dann im Stau. Oder es ist irgendein anderer Grund. Manche haben aber auch vergessen.

INT: Wieder gutes Stichwort! Kommt das oft vor? Dass Patienten nicht kommen?

B: Nein, so schlimm ist es nicht.

INT: Ok, also nicht so dass man sagen kann jeden Tag?

B: Nein nein nein überhaupt nicht!

INT: Eher so einer pro Woche?

B: Nicht einmal. Manchmal sind Zeiten wo vielleicht sogar mal am Mittwoch einer und am Freitag einer und dann ist wieder eine Woche lang gar nichts. Oder manchmal ist es ein bisschen abhängig vom Wetter. Wenn, gerade in Salzburg, wieder mal nach ewiger Zeit das Wetter schön ist dann kann schon sein dass jemand nicht kommt.

INT: Ja das sagen sehr viele. Macht das dann Probleme für euch wenn jemand nicht kommt? Oder seid ihr dann eh froh dass einer weniger ist.

B: Wenn es zwischendrin ist, ist es manchmal ein bisschen ungünstig. Man hat eh immer Arbeit dass man etwas zu tun hat, aber weil wir ja eh nur zwei halbe Tage haben für die Ordination weil die müssen dann warten und dann sind die Leute oft ein bisschen grantig wenn sie nicht gleich wieder einen Termin bekommen. Nur... selber schuld.

INT: Das ist ja dann auch irgendwo Eigenverschulden.

B: Sehe ich auch so, ja!

INT: Kommt es oft vor dass ihr Termine verschieben müsst von euch aus?

B: Ja!

INT: Weil jemand anders stattdessen akuter wird?

B: Nein, eher weil vielleicht mal jemand krank wird oder eine Tagung dazwischen kommt oder irgendetwas unvorhergesehenes passiert.

INT: Wie funktioniert das dann?

B: Wir rufen die Leute an!

Das heißt, ihr habt beim Termin die Telefonnummer hinterlegt?

B: Wir haben da beim Termin den Namen und das Kürzel von dem der den Termin angelegt hat und die Telefonnummer.

INT: Und, gibt es irgendwas dass in letzter Zeit an diesem Prozess nicht so gut funktioniert hat? Wo man sagt das war eher schlecht oder hat gar nicht funktioniert?

B: Nein, so funktioniert das ganz gut weil wir eh gut zu erreichen sind.

Davor hat ja unser/e Chef/in immer das Telefon gehabt, jetzt machen wir's so dass die Kollegin das Telefon hat und wenn sie gerade, weil an dem Tag eigentlich keine Ordination ist, gerade einkaufen ist und dann ruft jemand an dann ruft sie ihn zurück. Das machen wir schon, wenn jemand anruft und wir gerade nicht abheben können, rufen wir die Leute zurück.

INT: Ok, also ihr seid so vier Leute im Betrieb?

B: Wir sind zu viert genau, unser/e Chef/in, ein/e DGKS/DGKP und wir zwei die da so den administrativen Bereich abarbeiten.

INT: Und an den Terminen sind eigentlich alle vier beteiligt weil selbst Termine gemacht werden (vom Arzt/der Ärztin und der/dem DGKS/DGKP, Anm.)?

B: Genau.

INT: Habt ihr irgendwelche Pläne oder Ideen wie man das in Zukunft anders machen könnte oder ist das alles ok so?

B: Nein, das ist ganz praktisch so. Wir haben nämlich ein Pad, und je nachdem ob derjenige das Ordinationshandy hat, hat das Pad. Wobei ich hab ein eigenes und die Kollegin hat ein eigenes und wir können das von daheim aus machen. Wir müssen uns nicht daher setzen quasi sondern können das von daheim mittels Pad und Telefon halt machen. Das ist total praktisch weil das hast du immer mit. Kommt auch glaub ich gut bei den Leuten an, wir sind gut zu erreichen, funktioniert gut. Ich glaub wir könnten das so lassen.

Was wir uns schon überlegt haben, dass wir, das machen wir jetzt wo Urlaub ist oder ganz viele Feiertage waren, dass wir mal auf einen anderen Tag ausweichen und dann wirklich in der Früh anfangen und das den ganzen Tag durchziehen. Da machen wir dann eine Mittagspause, aber das haben wir nicht so oft.

INT: Und eine Frage die noch nie jemand mit ja beantwortet hat aber die ich immer wieder stelle, es gibt keine Pläne irgendwie Patienten zumindest für einen gewissen Zeitraum in der Woche selbst einen Termin sozusagen nehmen können, wie auch immer das dann funktioniert?

B: Ja, wir haben schon einmal überlegt, aber... das Gefährliche dabei ist glaub ich da dass man den Kontakt zu seinen Patienten verliert. Das ist irgendwie so unpersönlich. Und, erstens, finde ich, sollte ich eine Wahlarztordination anders sein, da sollte man schon ein bisschen Service bieten dass man auch erreichbar ist. Die Leute erzählen auch viel am Telefon, oft wollen wir es eh nicht wissen, aber das gehört halt auch dazu und das ist schon nett. Ich würde mir persönlich niemals einen Termin bei einem Arzt online ausmachen, das finde ich unsympathisch.

Es gibt aber FÄ die das machen, viele Gynäkologen zum Beispiel machen das.

INT: Da sind vielleicht auch die Untersuchungen ähnlicher.

B: Genau, aber es ist so schwierig weil dann ist der Patient vielleicht traurig darüber dass er jetzt nicht den Termin bekommt den er will und so kann ich halt mit dem Patienten reden, kann ihm schon mal das ein oder andere erklären und da nimmt man schon ganz viel Beschwerdepotential weg.

INT: Ja, stimmt. Ich nehme an ihr habt dann drinnen und oben einfach noch einmal den selben Kalender?

B: Genau, kann jeder zugreifen.

INT: Und nachschauen wer jetzt als nächster drankommt und so?

B: Ja, wir haben schon wenn wir den Patienten aufgenommen haben so ein Hakerl (medXpert) da ist der Patient dann in der Warteliste, dann weiß er auch die Reihenfolge drinnen.

Interview II

INT: Werden bei euch Termine einzeln nach Untersuchung gruppiert eingetragen oder nicht?

B: Einzeln eingetragen, Radiologie haben wir unterteilt in Mammographie Ultraschall und Durchleuchtung. Abdomen Gelenke Hals können noch einzeln eingetragen, so genau ist es nicht aber einfach dass wir gewisse Sparten haben.

Wir haben auch immer gewisse Puffer drinnen wo wir nichts planen, zum Beispiel

wenn Mittag ist weil doch immer mal wieder auf Mittag geht, am Nachmittag kann man dann wieder mehr eintragen da sind wieder alle da.

INT: Aber haben alle Patienten bei euch prinzipiell Termine? Weil ich gesehen habe auf der Homepage dass man zum normalen Röntgen am Vormittag einfach so kommen kann.

B: Ja genau, normales braucht keine. Aber so spezielle Sachen wie Mammographie, Durchleuchtung und Ultraschall schon. Für Röntgen kann derjenige jederzeit vorbeikommen. Genau.

B: Da kann man CT auswählen, da haben wie die CTs drinnen. Da haben wir die einzelnen Untersuchungen mit einer Dauer hinterlegt. Am Vormittag kriegen wir halt mehr Ultraschalle hin weil mehr Leute da sind, und am Nachmittag haben wir es mir 30 Minuten drin, damit man nicht ganz so viele einteilen kann.

B: Diese schwarzen Buffer da können wir aber selbst aufmachen, damit wir nicht immer jemanden anrufen müssen. Das können wir selber machen. Wir haben auch verschiedene Hintergrundfarben (im Kalender Anm.). Zum Beispiel die ganzen Knie-MR haben wir blau hinterlegt, das ist auch für uns leichter.

INT: Ah ok, die werden also auch zur selben Uhrzeit ungefähr in Blöcken geplant.

B: Genau, das ist immer gleich eigentlich. Die Knie sieht man da in der Früh und am Abend, drum werden die immer da extra eingeteilt. So grün zum Beispiel sind Wirbelsäulen nicht operierte, und das sind Angiographien also wir haben das da immer hinterlegt, dass das dann jeder sieht. Jeder weiß ja dann mit der Zeit was was ist.

B: Beim Puffer-setzen haben wir dann noch diese Akutpuffer, die setzen wir uns auch selber. Die sind jetzt eben wenn Ärzte anrufen und was dringendes brauchen, damit wir wissen dass wir da nichts reintun. Dass wir da die nicht belegen. Die bleiben offen, die sind so drinnen.

INT: Ok, das sind aber nur 15 Minuten sozusagen?

B: Ja genau. Eigentlich sind bei uns alle Termine mit 15 Minuten drinnen am Vormittag. Wenn dann was ist hier zum Beispiel wo beide Füße gemacht werden, dann ändern wirs selber auf 30. Aber wenn wir standardmäßig reingehen, haben wir eigentlich alle auf 15 drinnen. Nur am Nachmittag haben wir manche mit 30 drinnen.

Wir können dann hier auch nochmal die Farbe ändern, wenn zum Beispiel ein spezieller Arzt oder eine spezielle Ärztin die Untersuchung machen soll dann suchen wir auch oft noch eine Farbe raus die im Terminkalender eher nicht vorkommt die setzt das so hervor und dann schreib ich auch noch was dazu.

Sonst vom eintragen her kann man die Untersuchungsregion auswählen, wenns das nicht gibt kann man hier freien Termin auswählen.

INT: Ah und dann kann man selbst hinschreiben was gemacht wird?

B: Ja genau, aber sonst kann man hier eigentlich alles auswählen. Dann Geburtsdatum eingeben, dann schlägt es mir hier schon mit Geburtsdatum Patienten vor die schon mal da waren. Die kann ich dann auswählen und dann hab ich auch schon die Daten da herinnen. Das heißt ich überprüf dann einfach noch mal die Telefonnummer ob die stimmt und der Zuweiser den muss man eh jedes mal fragen, aber sonst übernimmt es eigentlich alle Daten.

Da geht nochmal das Fenster da auf da haben wir es verknüpft mit dem

Patienteninformationssystem, da steht nochmal wenn der Patient irgendwelche Allergien hat dann erscheint das da rot. Steht dann ganz fett drinnen dass der Patient eine Kontrastmittelallergie hat, da steht auch nochmal drinnen das ist verknüpft mit der e-card ob der Patient schon freigeschalten ist für die Vorsorgeuntersuchung z.B. Das ist da eben alles verknüpft eigentlich.

Was auch noch wichtig ist, da bei MR und CT haben wir das mit den Kassen da oben, diese Statistik im Hintergrund. Da sehen wir immer wieviele wir machen können bis Ende des Jahres, was wir gezahlt bekommen bis Ende des Jahres von der Versicherungen her, da ist jetzt z.B. die BVA die wir da sechs Personen pro Tage machen können und wenn wir das so einhalten, dann bekommen wir das ganze Jahr BVA Patienten bezahlt zum Beispiel. GKK kann man voll viele nehmen. Das sind die Richtlinien, dass ich seh ok da kann ich jetzt noch 4 eintragen. Das ist für uns so eine Hilfe. Das aktualisiert sich über Nacht, also nicht jetzt gleich sondern über Nacht. Und da müssen wir auch genau schauen dass die Kassa richtig eingetragen ist, dass muss genau richtig geschrieben sein damit das übernommen wird.

INT: Ok, und diese Kontingente sind für jeden Tag?

B: Genau, für jeden Tag. Nach Möglichkeit wird das optimal ausgelastet. Aber natürlich wenn jetzt an einem Tag viele anrufen, dann wird s nicht aktualisiert dann kann schon passieren dass zwei zu viele da sind aber das ist auch nicht so tragisch.

B: 20)

B: Ansonsten, die Farben, wie gesagt, ich glaub die sind immer fix drinnen das ändert sich jetzt auch nicht wirklich. Wir können die Farben aber auch selber ändern. Das ist ganz praktisch. Hast du noch Fragen?

INT: Wie funktioniert das bei euch wenn jemand einen neuen Termin braucht? Ist das hauptsächlich Telefonisch oder per Mail?

B: Also per Email machen wir es eigentlich ungern, es kommt schon manchmal vor dass ein Email reinkommt aber denen schreiben wir meistens zurück sie sollen anrufen telefonisch oder so weil das geht dann hin und her und da haben wir lieber ein Telefonat. Hauptsächlich Telefon, oder sonst halt bei der Annahme dass halt jemand zufällig mit einer Überweisung kommt oder zufällig in der Nähe ist, aber das Meiste ist eigentlich per Telefon.

INT: Und das funktioniert gut für euch?

B: Ja eigentlich schon.

INT: Und da hat man dass dann so nebenbei offen? (Den Kalender Anm.)

B: Ja genau und dann schaut man halt was der möchte, also die sollen sagen was sie brauchen ob Röntgen MR oder CT und dann tu ich mir den Terminkalender immer her. Ich tu mir halt die Ansicht her (Woche)

INT: Samstage habt ihr generell zu?

B: Generell zu, jetzt haben wir ab und zu welche offen damit wir die Wartezeit ein bisschen verkürzen. Immer wieder machen wir den auf. Und das ist auch etwas dass wir selber machen können, das ist auch super dass man da nicht extra jemanden anrufen muss.

INT: Das ist also wenn ihr merkt, jetzt ist schon Wartezeit drei Monate dann nehmt einen Samstag dazu.

B: Genau, dann schauen wir dass wir 5-6 Samstage aufmachen, dass wir ein bisschen eine Zeit reinholen. Genau.

Wenn jemand anrufen eben, ich frag halt dann, es ist oft nicht so leicht, auf der Überweisung steht oft schonmal was oben was der Patient nicht versteht und dann fragst du halt nach steht da vielleicht etwas von MR, CT so halt aber das hat mit dem Terminkalender selber nix zu tun.

INT: Kommt das oft vor dass die Leute selber nicht wissen was sie eigentlich brauchen?

B: Ja eigentlich schon, dann fragen wir halt können sie uns die Überweisung schicken per Mail wenn sie anrufen damit wir uns das selber anschauen können. Oder die kommen nochmal halt vorbei wenn sie nicht weit weg wohnen. Da fährt man eh manchmal vorbei. Natürlich ists auch so dass eher Ältere Leute anrufen, das ist halt oft schwierig.

Aber sonst Termine ausmachen oder planen geht eigentlich super wir haben da für gewisse Sachen noch Hinweise hinterlegt, bei der Mammographie zum Beispiel dass sie eben nüchtern sein müssen, dass das Zyklus passt dass sie einen Befund mitnehmen müssen dass die Bewilligung nicht fehlt. Also das ist wirklich super für uns, sicher, nach der Zeit weißt du das eh auswendig aber wenn man immer wieder mal telefoniert kann man das auch vergessen.

Beim Knie gibt es eine eigene Prothesenplanung, 20 Minuten weil die dann beim Gerät länger brauchen und da müssen wir längere Zeit einplanen. Oder wenn der Patient im Vorhinein aufgeklärt wird wegen Kosten das ist wichtig dass man das im Vorhinein gesagt wird.

Ich kopier mir das aber immer (in das Terminanmerkungsfeld Anm.) da unten rein damit ich das beim fertigen Termin weiß was schon gemacht worden ist, z.B. Patient weiß über Kosten bescheid oder ob das ein bestimmter Arzt/eine bestimmte Ärztin machen soll und ob der operiert ist oder nicht.

INT: Ihr macht SMS Erinnerung?

B: Ja genau, einen Tag vorher SMS kriegen die an die Nummer die hinterlegt ist. Außer bei denen die ganz in der früh sind, bei denen sagen wir meisten 15 Minuten früher weil dann steht man im Stau oder sie müssen was ausfüllen und das ist für uns so ein Spiel und die kriegen auch das SMS dann mit den 15 Minuten früher. Weil sonst denken sich die Leute na die 15 Minuten schlaf ich auch noch länger.

INT: Ist das etwas das ihr generell macht oder nur für die in der Früh?

B: Nein für gewisse Sachen. Also die am Vormittag bekommen ganz normal, und für die beim CT gibts das Abdomen CT die müssen was trinken vorher die bestellen wir zwei Stunden vorher. Die kriegen auch die SMS dann eine halbe Stunde früher.

INT: Und wie funktioniert das?

B: Im Hintergrund? Das weiß ich nicht.

INT: Also wie wird das bestimmt wer jetzt, ist das automatisch so dass wenn jetzt diese ganz bestimmte CT-Untersuchung ist dass der dann das SMS eine halbe Stunde früher kriegt?

B: Ja genau, wenn ich das hier eingebe, das ist bei dem Abdomen oder bei Becken ist das Hinterlegt dass der es eine halbe Stunde früher kriegt. Aber sonst kriegt er es genau zur Uhrzeit.

(Gespräch über dringende Termine die eingefügt werden)

Ab und zu kommt es halt vor dass jemand anruft wieso die SMS jetzt doch 15 Minuten später ist als ausgemacht war wenns nicht hinterlegt war.

Manche schauen eh nicht so auf die SMS sie verlassen sich lieber auf die frühere Zeit, die sie am Telefon gesagt kriegen.

INT: 15 Minuten?

B: Ja genau. da kommt auch das SMS 15 Minuten früher. Und es ist ja gut dass die SMS rausgeht, weil dadurch eben viele Termine nicht vergessen werden vor allem wenns erst so spät ist, in einem Monat zum Beispiel. Wenns in einer Woche ist das geht noch, aber generell denkt man halt nicht mehr so dran dass man einen Termin ausgemacht hat.

INT: Das Erinnerungs-SMS ist also eine gute Sache?

B: Ja, sicher. Also das sagen auch total viele Patienten. Die sagen danke für die SMS sonst hätte ich eh vergessen, das kommt oft.

INT: Fühlen sich Leute nicht gestört durch SMS?

B: Nein. Das hat noch nie jemand gesagt. DAs ist glaub ich wirklich gut, vor allem heutzutage da tut eh jeder mehr mit dem Computer Handy und das ist ja immer mehr im kommen und da ist dass sicher eine gute Lösung. Und für uns ists eine Hilfe, ich brauch nicht jeden Patienten durchrufen. Weil sonst müsstest du das auch noch machen. Es gibt ja auch welche die das auch noch machen.

Das einzige was wir zum Beispiel machen, die Kollegin die heute Spätdienst hat, die schaut beim übernächsten Tag und schaut nochmal die doppelten nach, also die länger als 15 Minuten brauchen, und die rufen die dann selber nochmal an. Weil da fallen uns, wenn der ausfällt, dann hätten wir da quasi 2 Patienten hineinbekommen. Das machen wir schon nochmal extra.

INT: Wie oft kommt das vor? Ungefähr? Dass Patienten nicht kommen?

B: Ja schon öfter. Jeden Tag eigentlich.

INT: Was sind da die Gründe dafür?

B: Vergessen, oder was haben wir noch. Weil vergessen, entweder dass die Wartezeit länger war und probieren es noch wo in einem anderen Institut, kommen vorher dran und vergessen aber den Termin abzusagen. Solche Dinge. Krankheit eher nicht, da rufen die meisten eigentlich an und sagen Bescheid. Aber die sich halt bei dem, bei dem, bei dem anmelden und dann nicht mehr absagen.

Viele lassen sich auch auf die Warteliste setzen, das kann ich dir auch noch zeigen.

INT: Aber da könnte man vermuten, dass wenn es unkomplizierter wäre sich abzumelden, dass das dann vielleicht mehr Leute machen würden?

B: Naja. Sicher. Mit einer SMS oder? Das stimmt schon. Das einzige ist halt oft, das ist blöd wenn man so viele Termine hat warum steh ich da nicht mehr drinnen. Dass du auch nicht mehr nachschauen kannst ob der gelöscht worden ist. Der ist dann weg.

INT: Also da kann man auch nicht suchen im Kalender?

B: Kann man schon, die, die eingetragen sind. Du kannst nach Geburtsdatum nach Patient suchen oder mit dem Zuweise kann ich welche rausfiltern. Aber natürlich die gelöscht sind, seh ich nicht mehr im Terminkalender. Das ist halt dann oft, dass man nicht mehr weiß was los gewesen ist ob das durch ein Telefonat abgesagt worden ist oder was auch immer.

INT: Also das wäre etwas was man als negativ bezeichnen kann dass man nicht nachvollziehen kann ob ein Termin gelöscht

worden ist und von wem und vl aus welchem Grund?

B: Genau. Das wäre oft super. Dadurch dass wir doch viele sind, und viele Arbeitszeiten wenn ich da reinschreiben kann Termin abgesagt und den auch irgendwo speichern im Hintergrund dann ist das schon auch super. Das ist halt dann oft schwierig was ist da passiert. Da musst du dann oft sagen, was tuen wir da jetzt, jetzt kann der nicht noch zwei Monate warten wenn der jetzt eigentlich nächste Woche einen Termin hätte. Und da kann man nicht sagen liegt es an uns oder woran. Da könnte man dann sagen die Kollegin hat reingeschrieben sie haben angerufen und so.

Und dann gibts eben da noch die Warteliste, die machen wir nur bei bestimmten Untersuchungen, also die die nüchtern sein müssen eher nicht die können ja nicht immer nüchtern bleiben, aber bei so ganz einfachen Untersuchungen die tun wir dann schon auf die Liste. Oder wenn es heißt drei Stunden vorher soll er nüchtern sein, dann schauen wir halt dass der nicht gerade Schnitzel oder Schweinsbraten gegessen hat. Ich kann den Patienten dann auf Abruf eintragen, dann ist der auf der Warteliste. Und wir schreiben uns dann immer rein zum Beispiel der braucht jetzt 15 Minuten her und der Patient ist nicht operiert. Das ist halt dann für uns noch wichtig. Da ist der von da bis da auf urlaub von da bis da nicht und so etwas schreiben wir dann da noch rein.

Und wenn die beim MR sagen ich soll noch jemanden einschieben, und der soll so schnell wie möglich da sein dann kann ich da eben einen suchen was in der Bemerkung steht was der schnellste ist zum Beispiel. Oder falls erst jemand um 10 ausgefallen ist, dann schau ich dass die die von weiter herkommen eine Möglichkeit haben her zu kommen.

Dann ruf ich denjenigen an, und der Patient sagt ja dann wird der Termin übernommen. Mit einmal klicken und verschieben und dann springt der da rüber. Dann hab ich ihn da drinnen. Ich muss halt immer dann schauen, wenn das nur eine kleine Lücke ist, dann muss ich ja die Zeit ändern. Weil wenn nur wenig frei ist dann muss ich den halt mal kleiner machen damit der da rein passt weil sonst nimmt der das nicht.

INT: Ah ok, also da gibts eine Sperre sozusagen?

B: Ja weil der hat dazwischen nicht Platz und was Platz hat das kann ich dann speichern. Man kann nicht doppelt buchen.

Es schreibt zum Beispiel auch her Patient hat schon einen Termin wenn jemand schon wo einen Termin hat kann ja sein dass der Patient selber anruft und möchte einen Termin, und dann nochmal von seinem Arzt ob das nicht früher geht dass wir den nicht doppelt drinnen haben. Und dann ists auch leider so dass dann ein Termin ja nicht genutzt wird. Weil das wissen die ja oft nicht dass sie eigentlich schon einen gehabt haben.

INT: Das heißt wenn ich versuche einen Patienten einzutragen der in einem Monat schon einen Termin hat bekomme ich einen Hinweis?

B: Ja genau, und dann schau ich halt ob es die selbe Untersuchung ist oder was anderes. Und sonst mach ich den nochmal drauf aufmerksam und dann sagt er mir eh ob ich den löschen soll.

Und man kann dann auch noch Daten vom letzten Termin die Daten kopieren damit ich nicht nochmal alles eingeben muss. Da kann ich dann noch was ändern, aber die grunddaten sind da.

Und ab und zu, kann es auch sein

dass weil wir so viel telefonieren, jemand versucht den gleichen Termin wie ich einzugeben dann kann man wenn man dran denkt den reservieren dann kann da keiner mehr reinspringen. Weil sonst wenn da einer schneller war als ich, dann schreibt es mir dann beim speichern her Termin ist schon vergeben und dann hat der Patient aber schon aufgelegt und dann hüpft es in die nächste Zeile runter.

INT: Kommt das oft vor bei euch?

B: Nein.

INT: Wie viele Leute seid ihr in der Terminverwaltung?

B: Sekretariat sind wir (zählt, Anm. 9)

Also im MR die machen schon ab und Zu im Terminkalender selber was. Aber wir gehen da schon her und haken jeden einzelnen ab in der Tagesansicht, aber die machen das nicht. Die drucken das aus, die nehmen das nicht über den Computer. Ich weiß aber nicht warum das so ist, aber für uns ist das aber so einfacher. Weil wenn ich da hergeh' und da reinschreibe dass der Patient ein paar Minuten später kommt ich muss ihnen dass ja dann am Gerät sagen, dann ist das für sie schon auch praktisch wenn sie auch noch mal reinschauen.

INT: Aber wenn sie das in der Früh schon ausgedruckt haben dann ist das schwierig!

B: Ja genau, am Vortag am Abend drucken wir ihnen das aus für den nächsten Tag. Und natürlich wenn irgendwelche Patienten eingeschoben werden, das ist jetzt wirklich was dringendes der liegt im Krankenhaus und braucht die Untersuchung, dann sehen die das ja nicht. Weil die haben die Liste ja noch. Das heißt wir müssen ihnen alles so übers Telefon sagen obwohls eigentlich so einfacher wäre. Aber keine Ahnung warum sie das so machen. Auch wenn wir da sitzen weil dann seh ich gleich ah der ist heute schon ausgefallen und der ist schon da.

(Dumme Frage zu Farben)

Nein, das ist die Untersuchungsfarbe aber da dieser kleine weiße Balken wenn der nicht gelb wird dann heißt dass das der nicht gekommen ist. Kann natürlich auch vergessen worden sein, ich schau dann nochmal durch ob der wirklich nciht da war. Aber normalerweise aber wenn der Patient kommt dann geh ich her und such ihn da und mach den Termin auf und kopier mir die Nummer damit ich es dann im Patienteninformationssystem noch einfügen kann und kontrollieren kann ob das die richtige Nummer ist oder eine neue. Und dann bin ich ja eh automatisch da drinnen und kann da auf gekommen klicken.

Und es gibt Ärzte, ab und zu ist da ein roter Balken, dann sind das Ärzte die einen Zugang haben zu unserem Terminkalender. Das nutzen nicht so viele, vielleicht zwei oder drei höchstens. Und dann kann der in unseren Terminkalender einsteigen und schauen wies mit den Terminen steht. Ich habs noch nie genau gesehen wie das ausseht, aber alles was wir hier markieren kann der/die Arzt/Ärztin gar nicht eintragen sondern wirklich nur in die weißen (leeren) kann der eintragen.

INT: Weiß der wie das eingeteilt wird bei euch? Weil zum Beispiel Knie geblockt war am Vormittag.

B: Nein das weiß er glaub ich gar nicht, durch dass das der da ja gar nicht rein kann in den Farben. In das weiße können wir ja eintragen was wir wollen. Aber das weiß ich leider nicht ob die das wissen. Und weißt eh für so Akuttermine muss er sowieso anrufen. Der kann auch nichts kürzen, das kann er

nicht machen aber wir tun das viel. Der kann nur Standard mit 15 Minuten eintragen.

INT: Werdet ihr da irgendwie benachrichtigt?

B: Nein ich seh es halt da (im Kalender) wie wenn eine Kollegin einträgt. Und halt da das rote da.

INT: Gibts damit Probleme?

B: Nein das passt weil der ja auch wirklich nur die weißen kriegt. Wir schauen da schon dass wir da immer Blöcke zusammen kriegen. Alles kriegt man eh nie genau hin aber bissi gestaffelt sind sie schon drinnen.

INT: Wie läuft das ab wenn ein Patient aufgenommen wird?

B: Meistens hat der eine Überweisung dabei, e-card, dann gibts einen Termin dazu und dann schreiben wir das auch dazu falls sie eine Bewilligung brauchen dann bekommen sie die Überweisung wieder mit. Da schreiben wir halt oft dazu wegen Vorbefunden was dazu. Überweisung im Kasten zum Beispiel falls der die schon abgegeben hat.

INT: Weil ich es gerade seh, es gibt so ein Hakerl für "gekommen" falls jemand erschienen ist und wofür ist das Hakerl fertig?

B: Das nehmen wir nicht. Der ist ja für mich sozusagen fertig sobald wir ihn aufnehmen dann kommt der ja nicht mehr zu mir her. Ich glaub dass das fertig wäre wenn der am Gerät fertig ist, aber bei mir ist der ja fertig sobald er aufgenommen ist. Also quasi mit gekommen schon fertig, das wäre wohl hinten zum anklicken.

INT: Ihr habt hier keine Verbindung mit dem Patienteninformationssystem?

B: Es ist schon ein bisschen Verbunden für die Patientenvorschläge. Ich such mir oft jemanden mit Geburtsdatum weil es halt einfacher ist dann krieg ich schon weniger Vorschläge oder wenns ein schwieriger Name ist.

INT: Aber das geht halt nur in die eine Richtung sozusagen, weil ihr ja die Telefonnummer kopiert.

B: Genau. Also es geht nicht wenn ich jetzt eine neue Nummer eingebe, speichert es das nicht ins Patienteninformationssystem, aber umgekehrt schon.

INT: Das wäre ja eigentlich praktisch wenn das so wäre?

B: Ja sicher. Auf der anderen Seite ists halt so, wenn der erst in zwei Monaten einen Termin hat kann es ja sowieso sein dass sich die Nummer noch geändert hat also wir kontrollieren das sowieso jedes mal wenn sie da sind und die Adresse alles noch einmal.

Im Terminkalender ists ja nur wichtig dass wir die Telefonnummer drinnen haben falls wir eine Wartung oder was haben und verschieben müssen. Weil sonst müsste man wieder extra nachschauen.

INT: Wie viel vom Tag nimmt die Terminverwaltung in Anspruch?

B: Eigentlich die ganze Zeit. Ja. So das Hauptding. Man merkt dann auch es ist fast eine ganze Woche oder zumindest drei Tage vollgefüllt nach einem Tag, das geht so schnell.

INT: Fällt dir etwas ein was in den letzen Wochen und Monaten war, was ganz furchtbar lästig war?

B: Was ich letztes mal draufgekommen bin, hier (demonstriert UI-Bug, Hitbox zu klein etc.). Aber sonst eigentlich, sicher ists ab und zu manchmal lästig. (Bug mit Geburtsdatum etc.)

INT: Und vom technischen Aspekt mal weg, überhaupt bei euch? Unter Kollegen Problemen?

B: Nein, das passt meistens gut auch mit der Dauer da gibts keine gröberen Probleme.

Die Radiologie druckt auch einen Zettel mit Patienten aus und streicht lieber durch. Weiß nicht warum.

INT: Wie gehts dir mit dem UI? Vergleich mit anderen Kalendersystemen?

B: Wenn man weiß wies geht, passt es. Auf den ersten Moment nicht übersichtlich. Aber für jemanden der geübt ist, passt es gut.

INT: Eingabe ineffizient?

B: Nein, passt gut. So wie bei normalen Computerprogrammen, man kann etwas ausschneiden und einfügen wie wenn ich wo anders was ausschneide oder einfüge. Das ist nicht anders.

Interview III

INT: Wie funktioniert das wenn ich einen Termin haben möchte?

B: Entweder telefonisch, da gibts den Unterschied dass wir Handy und Festnetz haben. Wenn ich in der Ordination bin nehm ich das Festnetz auch, hebe also bei beiden ab.

B: Um 18:00 sollte eigentlich der letzte Patient fertig sein, geht sich manchmal nicht ganz aus. Aber da sind wir sehr strikt bei der Termineinhaltung. Kommt natürlich auch immer auf die handelnden Personen an. Wobei die Gynäkologie etwas anders ist als andere Bereiche das ist alles so routinemäßig.

INT: Hat Wahlarzt ja/nein einen Einfluss?

B: Schon. Da gibt es Termine die entweder 20 oder 40 Minuten sind. Da bringst du halt dann in einer Stunde 3 Patienten unter oder zwei eben.

INT: Und richtet sich das nach Untersuchung?

B: Ja, da gehts strikt nach Untersuchung.

INT: Und was verwendet ihr da für ein Kalendersystem?

B: Das heißt ich glaub Office Cloud... (Webkalender System)

INT: Nicht integriert mit Patientenakte?

B: Nein. Aber dort sind 4 Ärzte, und ich kann mir jeden einzeln anschauen, ich kann aber auch alle vier anschauen. Und da haben wir die Unterscheidung, da hat jeder Arzt eine eigene Farbe.

INT: Also keine Farben für Untersuchung sondern Farbe nach Arzt.

B: Genau.

INT: Die Ärzte machen das aber alle gleich, 20 und 40 Minuten und selbe Puffer?

B: Termine gleich, aber Puffer nicht weil immer abwechselnd da.

INT: Wie viele Leute arbeiten dort in der Terminverwaltung?

B: Vier. Wobei die nie gleichzeitig dort sind, immer nur eine.

INT: Wie viel Prozent eines Arbeitstags macht Terminverwaltung aus?

B: Wesentlich weniger als die Hälfte der Zeit. In beiden Ordinationen. In der gynäkologischen mehr als hier.

INT: Wie ist das dort mit Patienten die nicht erscheinen?

B: Rufen wir an nach einer Zeit wenn sie nicht erscheinen.

INT: Also während der Termin läuft sozusagen ruft ihr an als Kontrolle.

B: Genau.

INT: Auch dort keine Erinnerungen für Patienten? Keine SMS keine Emails?

B: Nein. Nichts.

Und es gibt auch keine, da haben wir uns das eben überlegt, dass wir sagen dass sich der Patient selber den Termin vergeben kann, aber da haben wir ebene auch gesagt, nein, das machen wir nicht, damit wir nicht den persönlichen Kontakt verlieren.

B: Ok. Und da kennt man auch schon seine Leute, die kommt eine halbe Stunde später.

INT: Gibt es viele Patienten die versuchen einen Termin per Email auszumachen?

B: Ja, viele nicht, aber es gibt ein paar. Ich mag das überhaupt nicht, mich geht das an, ich finde das komisch das stehen dann so viele Fragen drinnen die kann ich dann manchmal per Email gar nicht alle beantworten und will ich auch nicht beantworten. Weil alles was geschrieben dort steht, die Leute nageln einen fest. Und das ist irrsinnig mühsam, und wahrscheinlich ist das auch speziell das Klientel in einer Wahlarzt Gynäkologie-Praxis.

Wenn ein Patient eine Anfrage für einen Termin mittels Email schickt und der hat die Telefonnummer dabei, ruf ich ihn an. Bzw. schreib ihm zurück er soll mich anrufen. Ich mach keine Terminvorschläge am Papier, beziehungsweise per Email. Weil wir eben zu viert sind die die Termine vergeben, je nachdem wer in der Ordination jetzt, das heißt wir können alle vier auf das zugreifen jetzt macht die Kollegin den Termin aus, weiß aber nicht dass ich den Termin vorgeschlagen hab per Email. Darum machen wir das nicht.

Interview IV

B: Also wir machen das so, ich frag sie immer ganz genau, ich löchere sie ganz genau was sie haben (auf der Überweisung) und ich schau auch immer dass sie/er (der/die Arzt/Ärztin, Anm.) Abwechslung hat.

INT: Das ist ja auch ganz unterschiedlich manche machen das ja gerne geblockt?

B: Ja. Also ich hab hier das Labor.

INT: Der Kalender ist immer in 15 Minuten eingeteilt?

B: Eigentlich sind es 30 Minuten. Also ich mach immer da (eine Notiz in MedXpert) schreib das da rein. Weil oft vergessen die Leute das und rufen an.

INT: Und dann kann man da suchen, das ist leichter als im Kalender.

B: Genau.

INT: Und das ist ja dann quasi doppelt?

B: Ja.

INT: Aber das ist nicht so aufwendig?

B: Überhaupt nicht. Sobald die anrufen schreib ich es auch immer rein.

INT: Gibt es da so Puffer?

B: Ja, ich habe da (am Rand des Kalenderblatts, Anm.) so ein Zeichen, so ein Kringel und dann weiß ich dass da noch Termine frei sind für akute Sachen zum Beispiel Gastroskopie. Und wenn dann am Mittwoch für Donnerstag noch niemand drinnen ist und jemand anruft für eine Echokardiografie dann bekommt es der.

INT: Kommt es oft vor dass Patienten nicht kommen?

B: Kommt vor. Aber wir sind normalerweise nicht böse weil eh andere Patienten da sind. Natürlich ist es und lieber sie rufen an und sagen ab, aber wenn jetzt einer nicht kommt und sagt sie/er hat es gestern leider verschwitzt sind wir nicht böse. Wir haben keine Strafen. Natürlich kommt der dann aber nicht gleich wieder dran am nächsten Tag, kann den ja nicht reinschieben.

INT: Ok, also ihr habt eine Warteliste?

B: Ja, da stehen die Leute drauf die gerade anwesend sind. (Im Wartezimmer, Anm.)

INT: Wie lang gehen die Termine ca. in die Zukunft?

B: Das kommt drauf an, das war jetzt einer der braucht eine jährliche Kontrolle. Da ists weiter in der Zukunft, aber für eine normale internistische Untersuchung so ca. drei Monate. Aber wenn was akutes ist, jederzeit. Also wenn jemand Beschwerden hat kann jederzeit zu mir kommen ich schieb die ein. Dann haben wir das abkommen mit den Kollegen vom XY (Arzt/Ärztin, Anm.), die rufen an, das vorher war eine Kollegin, die sagen es war grad ein Patient bei ihr dem gehts nicht gut, ist nicht ganz akut den hab ich für nächste Woche eingetragen. Ich halte dann immer Termine frei die ich dann jetzt nicht mehr vergebe, die sind jetzt für sie/ihn (Arzt/Ärztin, Anm.) wenn sie/er jetzt rauskommt und sagt sie/er braucht noch einen Termin oder halt Kollegen die anrufen. Wenn Patienten herinnen stehen, die kommen alle dran. Das sowieso. Und sonst, ich versuch einfach möglichst heraus zu bekommen was da los ist und wie akut das ist.

Die Kollegen wissen, wenn es dringend ist lieber selber anrufen. Und sonst wird jemand da hinten dran gehängt. (An den Ende des Tages, Anm.)

INT: Und habt ihr so über den Tag verteilt noch Puffer eingeplant?

B: Wir haben immer Mittagspuffer, also über Mittag. Heute ist zwar nur der kurze Tag da ist der XY (Arzt/Ärztin, Anm.) bis um drei da. Aber sonst haben wir immer Mittag Puffer.

INT: Das ist dann eine Stunde ungefähr (der Puffer, Anm.)?

B: 15) und dann gehts erst weiter um halb zwei.

INT: So zwischendurch aber mal 15 Minuten habt ihr keine Puffer?

B: Wir haben nur Mittag einen großen Puffer, sie/er legt keinen Wert auf Mittagspause. Wenn hat er halt frei oder sonst machen wir durch.

INT: Und von den Längen her geht sich das gut aus? Ist das Erfahrungssache?

B: Das ist natürlich Erfahrungssache, am Anfang hat er/sie länger gebraucht.

INT: Haha, ja da ist es natürlich auch Erfahrungssache aber ich meine jetzt von der Planung her?

B: Jaja, das ist Erfahrungssache. Sie/Er hat mich einfach auch auf seine Arbeitsweise eingeschult. Sie/Er braucht so und so lang, sie/er möchte so und so viel Zeit haben. Also ich glaub, es ist speziell auf XY (Arzt/Ärztin, Anm.). Ist wahrscheinlich bei jedem Arzt anders.

INT: Aber das funktioniert gut? Ist selten so dass jemand doppelt so lang braucht?

B: Das funktioniert gut, ja. Selten so lang. Außer sie/er hat einen interessanten Bauern hinten der über Bienen spricht,

und sie/er spricht auch gern über Bienen, dann kann es sein da weiß ich die reden über ganz andere Sachen.

B: Dann gibt es noch so Sachen, da hab ich erfahren dass ein Kongress da ist. Jetzt muss ich alle verschieben.

INT: Und zum verschieben muss man den Namen nachschauen, da eingeben und den Patienten öffnen zum anrufen?

B: Genau.

INT: Und in der Ordination sieht man noch einmal die Warteliste? (aus MedXPert)

B: Ja genau, und manchmal schreib ich da (als Notiz zum Patienten) noch was dazu, zum Beispiel dass sie/er die Überweisung drinnen hat oder so.

INT: Ganz generell, gibt es irgendwas in letzter Zeit was Terminverwaltung betrifft was ganz gut oder ganz schlecht gelaufen ist?

B: Ahm... Also nein. Eigentlich nicht. Das läuft immer so dahin, und alle Beteiligten sind alle halbwegs glücklich damit.

INT: Von daher gibt es auch keinen Plan da irgendwas zu ändern daran?

B: Nein, der Plan ist es vielleicht doch vielleicht drauf zu verzichten. Es gibt ja auch die Terminverwaltung direkt mit der Kartei (MedXpert, Anm.), sei angeblich schneller. Auf der anderen Seite, ich mag das eigentlich ganz gerne. Ich mags auch ganz gerne, bei meinem Schwager, der ist Zahnarzt da gibts nur das Computer und da schaut die dann rein und sieht da ist kein Termin und sagt sie hat erst wieder im September. Und dann dann merkt man immer wie die Leute schauen, na das stimmt wahrscheinlich nicht. Und bei mir, die Leute sehen das, ich sag schau her hier ich hab da noch eine kleine Lücke da kann ich sie reingeben. Also für die Kommunikation ist es nicht schlecht, wir spielen halt mit offenen Karten weil so (zeigt auf die potentielle Computerlösung, Anm.) kann ich sagen also September und dann denkt sie/er sich (der Patient, Anm.) ja wahrscheinlich bin ich zu wenig wichtig und dann kann ich hier sagen schauens, ich versuchs wirklich. Und dann sagen die Leute, boa, ihr Buch ist ganz voll und sie nehmen mich trotzdem noch dran, also das hat wirklich das hat irgendwie glaubwürdiger ist es. Und jetzt sind wir schon so lange dabei auch.

INT: Ganz allgemein, wie viel Zeit von einem Arbeitstag nimmt die Terminverwaltung und -planung ein?

B: Ahm, ich mach jetzt im Moment gar nichts. Weil du da bist. Ja? Aber eigentlich müsst ich da die Abrechnung machen und die Post nebenbei, also es ist sicher am Vormittag die Hälfte meiner Arbeitszeit.

INT: Und am Nachmittag?

B: Am Nachmittag ist Schluss, wenn ich raus geh um halb eins ist das Telefon aus. Da ist dann eine Kollegin von uns die die schreibt Befunde und nimmt die Leute an.

INT: Und die Leute die da sind, und gleich im Anschluss einen Termin ausmachen wollen?

B: Die rufen am nächsten Tag an, oder der/die XY (Arzt/Ärztin, Anm.) kommt vor und schaut mit der YZ (Nachmittagsangestellte, Anm.) ob was frei ist weil er/sie ja meine Zeichen schon kennt da. Aber an sich, ihm/ihr ist es lieber sie machen sich es mit mir aus. Dann rufen sie halt am nächsten Tag an.

INT: Gut, vielen Dank dann hab ich alles glaub ich.

Interview V

INT: Ihr habt da einen Papierkalender und noch zusätzlich einen am Computer.

B: Ja genau, das liegt aber daran dass ich den schon so gewöhnt bin. (Den Papierkalender, Anm.) Ich mach das schon seit über 40 Jahren so und ich hab da einfach, ich seh das, das ist ein Blick und ich weiß was da drinnen ist. Und ich gewöhne mich so schwer an die kleinen Wörter. Ich schreib mir da sehr viele Sache dazu, die da drinnen (PC, Anm.) keinen Platz haben und du blätterst um und hast da sofort alles auf einen Blick was für mich wichtig ist und relevant ist. Das ist halt doppelte Arbeit, aber das ist reine Gewohnheitssache, das muss ich auch dazusagen.

INT: Also zum Buch kann man sagen dass der Vorteil ist dass zum Beispiel Nummern oder Bemerkungen dabei sind die man dann gleich sieht auf den ersten Blick.

B: Genau, ich mach mir da zum Beispiel sehr viele Notizen warum ein Patient da ist und dann sieht man das gleich auf den ersten Blick. Das ist ein Vorteil vom Buch.

INT: Das kann man wahrscheinlich da (PC, Anm.) auch irgendwo hinschreiben, aber es ist halt mühsam weil man dann halt zuerst drauf klicken muss damit man das sieht oder?

B: Naja, man kann da schon hinschauen, aber schau mal, so klein ist der Terminkalender. Und das ist für mich, das ist nicht gut. Ich seh da nichts was da los ist, ich muss da bei jedem anklicken was da dazugeschrieben ist, was da geplant ist. Und das ist irgendwie einfach nicht übersichtlich. Ich finde, es würde gehören dass wirklich der ganze Bildschirm voll ist. Weil so ist das für mich nicht wirklich übersichtlich. Die Schrift ist immer so klein. Ich finde das schlecht so. Aber das ist bei mir auch reine Gewohnheitssache, das geb ich ganz offen und ehrlich zu.

INT: Nein, das ist sehr interessant das machen viele. Absolut keine Seltenheit. Ein Drittel haben sicher einen Terminkalender.

B: Das ist einfach gemütlicher, ich schreib alles mit Bleistift da kannst du es jederzeit ausradieren. Und dann kann man auch ändern vorziehen oder verschieben.

Zum Beispiel diese Farben da drinnen, das heißt der ist dringend, und wenn du dann irgendwo ein Loch hast dann ziehst du den einfach vor, das heißt der wird dann eingeschoben. Das ist recht praktisch.

INT: Und die Farben da (PC, Anm.) sind die nach Untersuchungsart?

B: Ja, auch. Wir haben zum Beispiel da herüben, das schwarze heißt der Patient ist noch nicht da. Wenn er dann ankommt dann wird er grün und kommt er in die Warteliste. Da ist die Warteliste für die Gastroskopien und dass ist die Warteliste für die Befunde und Briefe.

INT: (Dumme Frage zur Überschrift)

B: (Antwort auf dumme Frage.)

Das ist dann die Liste für Telefonauskünfte.

Die haben auch alle Farben, zum Beispiel die gelben die sind fertig, die roten das heißt dass ich die noch anrufen muss, das muss ich heute noch machen dass es dringender ist. Und die pinken, das heißt dass die Roswitha die eintragen muss und dann wieder gehen. Also wir haben viele Farben.

Das ist toll. Am Anfang haben wir uns furchtbar schwer getan dass du dir das einfach merkst, aber das geht alles automatisch jetzt. Ich schreib das rein, braucht der/die Doktor/Doktorin nicht reingehen, sie/er liest das und damit brauch ich ihn nicht sehen wir machen das aus der Entfernung und das ganze ist erledigt ohne dass man sich sozusagen gegenseitig Zeit weg nimmt.

INT: Also das mit den Farben ist eine gute Sache wenn man sich mal dran gewohnt hat.

B: Voll.

INT: Termine bei euch mit den Patienten sind hauptsächlich per Telefon, oder wenn sie halt da sind dass sie sich einen Folgetermin ausmachen.

B: Genau. ganz richtig.

INT: Also schriftlich macht ihr eigentlich nicht.

B: Per Mail? Nein, nicht gerne. Wir machens schon per Mail auch, aber ich mach das meistens so dass ich mir die Telefonnummer hol vom Patienten und ihn dann anruf persönlich weil Mailtermine die sind immer sehr... Du brauchst ja sowieso Daten, wenn ich die Kartei anleg dann brauchst du ja sowieso Daten.

Das ist auch persönlicher, du kannst Fragen stellen um welche Untersuchung es geht. Wenn jetzt jemand anruft und fragt er braucht eine Margen/Darm Untersuchung was versteht er drunter. Braucht er eine Koloskopie, braucht er eine Gastroskopie oder wie auch immer.

INT: Wie ist das mit der Länge der Termine? Ist das etwas was du nach Gespür machst? Oder ist das fix nach Untersuchung?

B: Nein, wir haben ein fixes Programm, und zwar macht der/dir Doktor/Doktorin pro Stunde immer drei Patienten mehr macht sie/er nicht. Und in diesen wird ganz frei eingeteilt. Wir haben zum Beispiel in der Stunde drei Patienten, immer drei und in dieser Stunde sind verschiedene Untersuchung, zum Beispiel eine kardiale Abklärung, ein Belastungs-EKG dann gibt es eine Gesundenuntersuchung oder eine Schilddrüsenuntersuchung. Da wird immer eine halbe Stunde eingeplant, außer ich hätte jemanden ganz akut dringenden. Dann muss ich das aber mit der/dem Frau/Herrn Doktor abklären. Wenn das einer von einem Hausarzt ist ein Patient, dann bekommt sie/er das eingeschoben in der Früh oder wenn natürlich ein akuter Patient herkommt dann kommt der auch dran. Wenn einer starke Beschwerden hat dann nimmt man den natürlich dran.

INT: Ihr habt keine fixen Zeiträume unter der Woche wo ihr sagt ihr macht die und die Untersuchung?

B: 00. Zwischendurch gibt es Belastungs-EKGs, die bespricht der/die Doktorin dann.

Am Donnerstag, gibt es immer zwei Termine und der dritte Termin ist dann eine Gastroskopie. Das heißt wir machen jede Stunde eine Gastroskopie und zwei zusätzliche Untersuchungen.

INT: Das heißt so ganz grob gibt es schon eine Planung wann welche Untersuchung statt finden soll?

B: Ja, natürlich. Natürlich.

INT: Habt ihr geplante Pufferzonen drinnen am Tag, wo ihr sagt am Vormittag 15 Minuten nichts geplant falls sich etwas nicht ausgeht oder am Nachmittag?

B: Nein, nein nein. Das wollte die/der Doktor/in nicht. Weil wenn dann keiner da ist und es kommt akut keiner und

es ist nichts zu tun dass mag die/der Doktor/in nicht.

INT: Mittagspause?

B: Haben wir schon, da sind wir aber sehr flexibel muss ich sagen. Wir machen meistens zwischen 12 und 13 Mittagspause. Je nachdem wenn dann am Vormittag was akutes kommt, machen wir halt später Mittagspause wir sind da sehr flexibel.

INT: Erinnerungen?

B: Ich ruf alle am Vortag an. Entweder ich erreich sie, oder ich spreche ihnen auf den Anrufbeantworter. Weil mit dem SMS das hat irgendwie nicht so funktioniert, da haben dann viel nicht drauf reagiert und so erreich ich sie und dann sagen oft welche nein ich brauch den Termin nicht mehr. Oder nein das ist schon vorbei. Dann weiß ich wenigstens der kommt nicht und dann ruf ich jemanden an von der dringend Liste, und dann kommt jemand von denen dran.

INT: Ist das etwas was gut ankommt bei den Patienten?

B: Ja, sehr sogar. Muss ich ganz ehrlich sagen. Die warten teilweise schon drauf dass ich anrufe. Manche sagen auch wirklich oft das ist schon so lang her dass ich das ausgemacht hab das brauch ich nicht mehr. Und dann kommen halt die Leute von der Dringend-Liste. Das hat sich sehr amortisiert muss ich ganz ehrlich sagen.

INT: Wieder daran anknüpfend, kommt das oft vor dass Leute einfach nicht erscheinen?

B: Ja. Also nach dem System wie wir das jetzt machen geht das irrsinnig gut. Aber eine Zeit am Anfang wie wir gekommen sind, passiert es oft dass zwei bis drei direkt hintereinander nicht kommen das geht nicht. Da sitzt du dann fast eine halbe Stunde Stunde da und hast nichts zu tun und die anderen warten drei Monate auf einen Termin, das geht so nicht. Und so haben wir dann besprochen, ok wir rufen so die Patienten vorher an.

INT: Also kann man sagen zu früher, mit jetzt ist das eine deutliche Verbesserung.

B: Ja, natürlich.

INT: Wie viele kann man sagen kommen nicht pro Woche ca. ohne Abmeldung?

B: Es ist schwierig, manche wenn du sie anrufst und auf den Anrufbeantworter sprichst, die kommen trotzdem nicht. Sagen wir im Monat zwei.

INT: Wieviele Leute seid ihr insgesamt, mit Terminplanung?

B: Nur ich.

INT: Wieviel Zeit vom Arbeitstag nimmt Terminplanung ein?

B: Die Hälfte ungefähr, es ist so unterschiedlich. Nach Feiertagen mehr, ich würde sagen so um die 40% würde ich sagen.

INT: Gibt es irgendetwas dass schlecht oder gut gelaufen ist in letzter Zeit?

B: Nein eigentlich nicht. Ich finde einfach dass ist bei uns irrsinnig gut organisiert, das läuft gut. Wenn die Leute Termine haben sind die Wartezeiten sehr kurz. Da sitzt du nicht eine Stunde draußen, das gibt es nicht. Der/Die Herr/Frau Doktor legt da wert drauf. Deswegen ist auch relativ lang auf die Termine zu warten, aber wenn man dann einen hat dann hat man den fix und dann sitzt man dann nicht drei Stunden dort und muss wieder warten. Sehr gut funktioniert das.

Das wird ständig wieder darüber geredet, was müssen wir ändern was müssen wir besser machen, aber ich finde das System so wie wir es haben funktioniert hervorragend.

INT: Ist das auch für die praktisch und gut zum arbeiten?

B: Ich find das System so in Ordnung, man kann da gut damit arbeiten.

Das einzige was vielleicht ist, wenn man jemandem sagen muss er muss drei Monate warten, das ist irrsinnig schwierig rüberzubringen. Aber sie sehen dann ja auch dass alles voll ist, und dass ich nicht schwindle.

Aber ich finde die Arbeit ganz in Ordnung.

INT: Gibt es Pläne für die Zukunft?

B: Der/Die Doktor/in ist immer schwer am überlegen, da gibt es so ein telefonisches System wo man sich selbst den Termin eintragen kann. Aber es ist hat immer irrsinnig schwierig bei uns dadurch dass wir so viele verschiedene Untersuchungen machen. Und wenn sich die Leute selber eintragen, dann kommt es vor dass wir am Vormittag fünfzehn Herzuntersuchungen haben, das geht nicht.

Bei uns ist einfach die ganze Arbeit so unterschiedlich. Breit gefächert unser Bereich den wir dann machen.

INT: Habt ihr in den einzelnen Untersuchungsräumen auch einen Bildschirm und sieht das?

B: Ja genau, jeder sieht das. Ob das jetzt der/die Herr/Frau Doktor/in ist oder die XY vorne beim EKG jeder sieht genau das gleiche und hat das selbe Programm mit den gleichen Listen und jeder kann das überschauen.

Interview VI

INT: Was passiert wenn bei euch ein Patient einen Termin braucht?

B: Also grundsätzlich ist es so, dass man fragt ob er schon mal da war. Falls ja, dann nach dem Namen fragen oder nach dem Geburtstag. Dann fragt man welche Art von Untersuchung er oder sie braucht.

INT: Habt ihr gewisse Zeiträume in der Woche reserviert für gewisse Untersuchungen?

B: Eigentlich nicht. Nein. Wir machen alles zu jeder Zeit. Es gibt Personen die das trennen. Aber bei uns läuft das alles durcheinander. Wir haben zwar verschiedene Spalten, Ordination eins, zwei und drei. Aber da ist es quer durch, das sieht man eh. Das ist eigentlich komplett gemischt.

INT: Wie funktioniert das mit der Dauer der Termine? Ist das etwas was ihr nach Gefühl entscheidet?

B: Es ist ein bisschen eingeteilt. Nach Farben zum Beispiel, gelb ist die technische Arbeit, rot ist Schmerzpatient, grau ist normal Kontrolle. Grün sind neue Patienten. Violett sind Wurzelbehandlungen.

Und dann geht es nach der Dauer. Das machen wir hier vorne.

INT: Funktioniert das?

B: Ich glaub dass wir das gut einteilen, die Patienten müssen selten lang warten.

INT: Gibt es etwas was schlecht dran ist? Wo man sich jeden Tag denkt das ist blöd da muss man fünfmal klicken?

B: Nein, Ich denk vom Computer her geht das gut. Manche Patienten höchstens die mich kränken teilweise wenn sie einen Termin sofort haben müssen wo

ich aber sehe der war jetzt seit fünf Jahren nicht mehr da.

Also so für euch intern hat es nie Probleme gegeben?

B: Nein. Es ist natürlich schwierig wenn man da immer alleine sitzt, egal ob Telefon, Rechnung oder Termin, Leute da stehen und warten bis man fertig ist. Aber es geht eigentlich gut, weil das Telefon gleich einmal aufs Band umschaltet.

Wenn es um eine Arbeit geht, mache ich eigentlich gleich alle Folgetermine auf einmal aus. Also damit ich dann nicht irgendwie in Zeitdruck komm, weil ich dann eigentlich nächste Woche nichts mehr frei hab. Dann kann ich mir das gut aussuchen.

INT: Schickt ihr Erinnerungen an Patienten?

B: Wir schicken am Vortag die SMS aus.

INT: Ok. Also das habt ihr. Kommt das gut an?

B: Das kommt eigentlich gut an. Aber es ist halt schon so, dass sich schon sehr viele Patienten auf die SMS verlassen. Nur auf die SMS verlassen.

Also Terminliste für den Tag drucken wir am Vortag aus.

INT: Weil?

B: Naja wir haben vier Zetteln und ich kontrollier die Karteien am Vortag schon. Und dann schreib ich gleich dazu, bei der Mundhygiene welche Röntgen zu machen sind.

Wir hängen die Zetteln drinnen auf, in jeder Ordination. Und der Chef sieht das gleich. Auch wenn die Leute reinkommen, dann seh ich gleich wer das ist. Sonst bräuchte man im Endeffekt fast zwei Bildschirme. Wo ich dann auf einem immer meinen Kalender sehe. So weiß ich halt als nächstes kommt der und der und das ist praktisch wenn man das eigentlich da immer liegen hat. Natürlich wäre das von Vorteil wenn ich einen zweiten Bildschirm hätte, und einen nur für den Terminkalender.

INT: Das heißt, wenns einen zweiten Bildschirm gäbe und die Möglichkeit das da darzustellen wäre das auch eine Lösung?

B: Ja, das wäre aber für drinnen dann auch und das geht ja fast nicht. Und ich muss es am Vortag ausdrucken.

INT: Das SMS schicken macht ihr manuell?

B: Ja, da muss ich irrsinnig aufpassen dass ich das richtig auswähle das Datum weil automatisch immer drei Tage ausgewählt sind und ich will es aber nur für einen Tag, also für den nächsten. Und da haben wir dann irrsinnige Probleme wenn ich das falsch auswähle weil dann glauben alle die haben morgen einen Termin, und dann laufen die Telefone heiß.

INT: Findest du SMS gut?

B: Es ist zwar nett für die Patienten, aber für mich macht es sehr viel Arbeit. Weil oft mach ich das so zwischendurch und wenn ich dann einen Fehler mach dann ist das Malheur komplett. Aber das geht derweil nicht anders.

INT: Kommt es oft vor dass Patienten nicht auftauchen? Oder ist das eher selten?

B: Ja schon, also ich würde sagen so einer am Tag. Aber das kreuzen wir dann an. Aber das fällt fast nicht auf, außer bei den ganz den großen Sachen.

INT: Wie viel Zeit von einem Arbeitstag geht für Terminverwaltung drauf?

B: Am Vormittag 100%, am Nachmittag eigentlich auch fast nur.

INT: Gibt es irgendwas was schlecht läuft?

B: Nein eigentlich nicht, das passt. Außer mit der SMS-Verwaltung.

INT: Seid zufrieden? Keine Änderungswünsche?

B: Nein, wir haben eigentlich alles was wir brauchen.

INT: Bei euch haben prinzipiell alle Patienten immer einen Termin?

B: Nein, wir sind da relativ streng. Der/Die Frau/Herr Doktor sagt das zwar oft kommen sie halt einfach vorbei, aber die Annika und ich sind da sehr streng. Und das ist auch wichtig dass wenn man zwei Assisteninnen an der Rezeption hat dass die relativ gleich sind. Wir sind da sehr streng mit den Patienten und die wissen das auch.

INT: Habt ihr da auch Puffer eingeplant?

B: Ja, da haben die Annika und ich ein eigenes Kürzel, das möchte ich jetzt nicht sagen welches, und wir wissen dann schon wo wir die Patienten hinschreiben können.

INT: Das System an und für sich kann das nicht, aber ihr tragt einfach einen bestimmten Termin ein der dann eben ein Puffer ist.

B: Genau. Ich geb einfach irgendwas ein was wir beide wissen und da teilen wir ungefähr 20 Min oder eine halbe Stunde ein. Und wir machen das aber schon im Vorhinein. Nächste Woche am Donnerstag ist unser letzter Arbeitstag weil am Freitag machen wir einen Ordinationsausflug und da ist der Chef nicht da und da teilen wir schon eine Stunde vorher nichts ein damit wir da Pufferzeiten.

INT: Und wenn man da eine Woche in die Zukunft schauen würde, dann sieht man da schon die Puffer eingetragen. Das sieht man da schon.

B: Ja, genau. Jeder der Zeit hat von uns trägt mal ein paar Puffer ein. Oder auch vor Weihnachtstagen oder Feiertagen tragen wir gerne Puffer ein, weil da haben uns die Patienten besonders gerne.

INT: Wie weit geht eure Terminplanung in die Zukunft?

B: Also mit den nächsten Füllungsterminen sind wir zwei Monate im Vorhinein, aber Mundhygiene ist jedes halbes Jahr, da haben wir schon September Termine.

INT: Aber so richtig voll wird der Kalender wann?

B: Zwei Monate, genau. Gute zwei Monate sind wir immer ausgebucht.

INT: Was sind die Vorteile vom Zettel gegenüber dem Bildschirm?

B: Weil wir das immer schon so gemacht haben. Normalerweise braucht man es eh nicht für uns heraußen, aber wir haben uns das so angewöhnt dass immer da der Zettel liegt. Ich hake das da immer ab und seh auch gleich dass da Röntgen gemacht gehören. Das ist vielleicht der einzige Vorteil, aber das könnte man im Computer nachschauen. Aber man siehts halt da gleich auf der ersten Blick.

INT: Das Blatt hat also sozusagen ein Plus an Übersichtlichkeit? Auf den ersten Blick.

B: Genau. Ist halt gut weil wenn jemand die Röntgen macht, der kommt nur vor und kann da selbst schauen und sich die Patienten selbst holen.

INT: Terminvereinbarung hauptsächlich per Telefon?

B: Hauptsächlich per Telefon und per Mail, aber lieber Telefon weil Mail ist sehr sehr umständlich für uns. Der schreibt mir nachher dann erst drei Wochen später zurück und dann muss ich alle Termine reservieren und ich muss immer hin und her hüpfen das ist sehr zeitaufwendig. Aber das ist bei uns gottseidank nur vereinzeln.

INT: Dass Patienten das selber machen können ist nicht geplant?

B: Nein. Die Patienten können ja nicht wissen was wie lang dauert.

INT: Alle Untersuchungen durchgemischt? Keine Blöcke?

B: Nein. Bei uns ist immer der ganze Tag ganz gemischt.

Interview VII

INT: Prinzipiell verwendet ihr den Kalender von MedXPert und habt keinen Papierkalender nebenbei parallel?

B: Nein haben wir nicht, was ich immer habe ist ein Schmierzettel für mich wo ich mir das aufschreibe was kalendermäßig schon drinnen ist, weil wir haben ja fixe Terminvergabe am Vortag oder heute telefonisch, wir haben natürlich Akutpatienten speziell in der Früh oder jetzt wo wir aufsperren (Nachmittag, Anm.) und da kannst du nicht immer nur Termine verwenden das geht bei einem praktischen Arzt nicht.

INT: Wie ist da das Verhältnis terminisiert zu nicht terminisiert?

B: Mittlerweile haben wir schon sehr viele terminisierte Patienten, würde schon sagen jetzt 3/4 mit Termin sind. Teilweise aber am selben Tag ausgemacht. Aber es gibt auch Tage wo die Hälfte einfach da steht. Man kann auch nicht sagen der Montag ist stark oder der Freitag ist stark, das ist einmal drei Wochen so und dann ist es wieder ganz anders. Deswegen hab ich auch da meinen Schmierzettel mit weil wenn dieses Ding ausfällt, dann steh ich schlecht da.

INT: Kommt das oft vor?

B: Jetzt gottseidank nicht mehr so oft. Momentan läuft es ganz gut. Wir haben immer mal wieder ein Problemchen, wo das e-card-System nicht funktioniert oder so da ist einfach gewährleistet dass der Betrieb weiterlauft und die/der Frau/Herr Doktor nicht ins Stocken kommt und weiterarbeiten kann weil ihre Zeit ist kostbar und die verwendet sie/er dann lieber für die Patienten.

INT: Auf dem Zettel sind sozusagen die Patienten die heute geplant sind?

B: Ja, und auch die die angerufen haben und auch was mit der Kinderordination passiert. Zur Zeit haben wir auch viele mit Scharlach, das heißt natürlich muss ich dann schauen dass ich die separiere. Wir haben auch Chemo-patienten die bei uns sind, oder auch Patienten mit hohem Fieber die kann man nicht eine Stunde warten lassen. Hauptsache es entstehen keine Leerläufe.

INT: Macht ihr das so dass ihr gewisse Zeiträume in der Woche habt wo ihr nur eine spezielle Untersuchung macht, oder macht ihr jeden Tag alles?

B: Prinzipiell haben wir jeden Tag eine Mischung, das einzige was wir wirklich mit mehr Zeit und längerfristig einplanen sind Vorsorgeuntersuchungen.

INT: Sind die dann immer an einem gewissen Tag?

B: Ja, am Dienstag Vormittag haben wir zwei und am Donnerstag Nachmittag haben wir zwei. Aber wenn der Patient

da nicht kann und sagt ich kann da nur Montag, dann sind wir da relativ flexibel. Langfristige Termine haben wir schon die sich auf zwei, drei Monate ausweiten. Aber die sind einmal im Jahr werden die bezahlt von der Kasse. Mutter-Kind-Pass Untersuchungen schauen wir auch, weil ja dann eben diese Akutfälle kommen, dass wir die erst nach neun machen. Oder Führerschein, dass wir die an den Rand legen.

INT: Also in der Früh mal eine Stunde für akute Patienten frei lassen?

B: Ja genau, also eine halbe Stunde auf jeden Fall aber besser ist eine Stunde. Ich hab auch immer dazwischen Löcher.

INT: Plant ihr fixe Puffer ein?

B: Ja plane ich schon ein, allerdings wir haben Tage wo es trotzdem nicht funktioniert. Es sind ja nur zehn Minuten geplant, das ist ein Mini-Richtwert und wenn ein Patient nicht da ist der eine halbe Stunde braucht dann ist das- also ich sag immer alles was unter 40 Minuten Wartezeit ist, das taugt mir. Drüber ist natürlich ein Schmarrn, aber innerhalb einer Viertelstunde ist fast nicht machbar.

INT: Wenn ihr die Termine plant, können wir das ansehen? Die haben ja eine gewisse Länge. Ist das etwas dass ihr nach Gespür macht weil ihr wisst wie lang das dauert oder habt ihr euch das fix ausgemacht?

B: Nein, das haben wir uns schon fix ausgemacht. Vorsorge nehmen wir prinzipiell eine halbe Stunde, weil wenn der jetzt um halb vier kommt und war gestern schon nüchtern zur Blutabnahme da, dann reicht eine halbe Stunde. Oder bei Mutter-Kind-Pass, weil bis das Kind ausgezogen ist, und dann haben die Mama's Fragen. Führerschein ist 20 Minuten weil den Patienten kennt man ja auch überhaupt nicht, oder wenn ein Patient von vornherein sagt, ich habe eine Problem ich muss den Befunde besprechen, dann hört man eh schon heraus, das wird mehr Zeit brauchen. Ganz oft sagen sie es selber, dann trag ich auch mehr Zeit. Manche sagen es selber, bei manchen spürst du es.

Wir haben ein Telefonsystem, das leuchtet hier auf und dann siehst du schon den Befund und da tu ich dazwischen schon ein bisschen überlegen und wenn ich sehe dass da was ernstes ist dann plane ich von Haus aus mehr Zeit ein oder leg ihn an den Rand. Und wenn ich sehen, ok, der Befund ist total harmlos dann bieten wir auch an dass wir der/dem Frau/Herrn Doktor einfach Nachrichten hinterlassen und sie/er ruft dann nach der Ordination zurück, weil ja wir vom Gesetz her nicht befugt sind Auskunft zu geben, auch wenn wir genau wissen das ist in Ordnung, wir dürfen es einfach nicht sagen. Und das macht die/der Frau/Herr Doktor ganz viel telefonisch, weil sie/er sagt, wenn da jeder da ist dann braucht jeder 10 Minuten und per Telefon sind es drei Minuten.

INT: Also ihr habt eine Warteliste, wer gerade in der Ordination ist und die auch drinnen im Untersuchungsraum hängt wo die Patienten dann in der Reihenfolge wie sie drankommen drin stehen?

B: Genau. Das ist auch dann der nächste der hineingeschickt wird, da hab ich dann alle drauf.

INT: Wie viele Leute seid ihr hier in der Terminverwaltung?

B: Wir sind immer zu zweit, sonst geht es eigentlich gar nicht.

INT: Wie viel Zeit von eurem Arbeitstag geht für Terminverwaltung drauf?

B: Schon relativ viel, summa summarum, kommt natürlich drauf an wie viel Tele-

fon ist. Aber 50

INT: Wie viele Patienten habt ihr so pro Tag?

B: Die die hineingehen sind ca. 20-40, die behandelt werden mit Rezepten das sind schon um die 100. Im Schnitt plus-minus wenns ganz hart auf hart kommt mit Befund und Rezepten, das können schon 150 werden. Es ist immer so wenn die Ordination aus ist, dann schalten wir das Telefon aus und dann läuft das Band dass sie/er notfalls am Handy erreichbar ist. Und einer (von den Ordinationshilfen, Anm.) geht dann heim. Einer bleibt da bist alles fertig ist. Also wenn das Telefon nicht mehr ist, dann schafft es einer. Man kann es einfach überhaupt nicht planen. So ein Akutpatient, und alles ist durcheinander.

INT: Wie oft kommt es vor dass Patienten nicht erscheinen zu Terminen die ihr vereinbart habt?

B: Relative selten. Also heute ist uns ein Gesundenuntersuchungstermin ausgefallen, das ist wirklich ganz ganz selten, weil wir diese langen Termine, die rufen wir eine Woche vorher nochmal an und fragen ob das eh noch ok ist. Und zum Beispiel die Donnerstag Nachmittag Leute die kommen am Mittwoch in der Früh zum Blutabnehmen, da weiß ich dann schon ah der hat eh seinen Termin fix. Aber im Großen und Ganzen kommt das sehr selten vor. Es funktioniert besser als in Zeiten ohne Erinnerung, was schon auch gedauert hat. Aber fad wird uns nie und 99% ists voll peinlich dass sie vergessen haben. Die Patienten sind eigentlich sehr dankbar und gewissenhaft und funktioniert wirklich sehr gut mittlerweile.

INT: Termine macht ihr eher per Telefon aus oder Folgetermine vor Ort?

B: Ja genau, manchmal stehen Leute da und dann sag ich ihnen heute ists ruhig kommen sie gleich und wenn es recht zugeht dann fahren sie vorher einkaufen, aber 80% ist Telefon. Es gibt Tage da schepperts und ich rede und ich sehe es hängen schon wieder 5 in der Schleife. Wir hatten diese Woche schon wieder einen Tag wo es ein bisschen ruhiger war, aber du hast dann eh so viel Papierkram dass du da etwas nacharbeiten kannst. Aber es ist mittlerweile schon ganz gut eingespielt.

INT: Habt ihr Pläne für die nähere Zukunft dass ihr am System etwas ändert oder ist das ganz gut?

B: Eigentlich ist es schon ganz gut zugeschneidert auf uns, das einzige was jetzt leider nicht mehr gibt ist wo man über das Internet ein SMS verschicken hat können an den Patienten als Erinnerung, z.B. Ihre Zeckenimpfung ist fällig oder Ihre Hepatitis Impfung ist fällig oder es läuft gerade eine Aktion in der Apotheke und das gibt es jetzt leider nicht mehr und da haben wir überlegt ob wir das über unseren Internetanbieter eben wieder installieren lassen, kostet ein Vermögen, über 900 Euro und das Telefonsystem ist auch sehr teuer, wo man da eben sieht wer anruft und es fällt uns einfach zwei mal in der Woche regelmäßig aus. Und das war jetzt die Entscheidung, nehmen wir es nicht (Das SMS System, Anm.) weil wenn uns das jetzt auch ständig ausfällt dann haben wir nichts davon. Und deswegen haben wir uns entschieden dass ich das jetzt eben selber eintippe. Ist mir egal, weil so viele sind das nicht und ob ich das dort oder da eingebe.

Interview VIII

INT: Was bedeuten die unterschiedlichen Farben?

B: Frauen werden bei uns blau gekennze-

ichnet Männer werden rot gekennzeichnet, und dann weiß man ah der kommt in den 1er Raum außer es ist nur eine Besprechung zum Beispiel, dann wird sie genau so rot. Also das ist bei uns die farbliche Kennzeichnung wer in welchem Raum ist.

Wenn jemand da ist, dann wird er rosa gemacht. Diejenige die auf dem anderen PC sitzt, auch die/der Frau/Herr Doktor weiß dann ah der Patient ist da.

Wenn mehrere rote hintereinander kommen, ist das auch nicht so das Problem.

INT: Ich habe das richtige verstanden, ihr habt für Männer und Frauen eine Farbkodierung damit man das auf den groben Blick gleich einmal hat.

B: Ja genau.

INT: Macht ihr alle Termine immer gleich lang? Weil ich da unten einen längeren gesehen habe.

B: Ja, das sind zum Beispiel Operationstermine. Die brauchen länger und werden anders gekennzeichnet.

INT: Ist das so, weil das Raster auf der Seite in 15 Minuten ist (und die Termine auch alle, Anm.), dass die wirklich alle nur 15 Minuten brauchen?

B: Ja man weiß dann zum Beispiel schon, (Untersuchungsdetails, Anm.) und da weiß man dann schon das ist in 5 Minuten erledigt und da weiß man dann schon, da ist zum Beispiel eine Frau eingeschoben, die Farben sind eh zum Beispiel grün damit man weiß das ist für die XY wichtig.

INT: Also ihr seid hier zu zweit?

B: Ja genau, eine läuft und eine macht Termine. Einfach auch damit jede alles kann. 75% auf jede Fälle ist Terminverwaltung vorne. Entweder Patientenaufnahme oder Terminverwaltung.

INT: Termine macht ihr hauptsächlich telefonisch aus oder wenn ein Patient da ist?

B: Es sind... ja, oder eben ganz wenige mit Email. Aber das sind so wenige dass man das eigentlich vernachlässigen kann.

INT: Was ist für euch am angenehmsten? Oder am unpraktischsten?

B: Du, das ist... wir kriegen fast keine Email von dem her weil die Patienten selber anrufen.

INT: Vergebt ihr für alles Termine oder gibt es auch Sachen wo man einfach vorbeikommen kann?

B: Wir haben einen Patienten der immer kommt und sich nicht erziehen lässt. Prinzipiell braucht jeder einen Termin, die akut sind und Schmerzen haben die kommen natürlich sofort ohne Termin her. Das ist ein Akuttermin.

INT: Habt ihr Pufferzonen eingeplant in eurem Tag? So am Vormittag 15 Minuten oder am Nachmittag?

B: 00 geht es dann weiter. Aber Pufferzonen in dem Sinn sind nicht gut weil erstens ist es unwirtschaftlich und es kommt immer drauf an wie man zusammenarbeiten kann. Die/Der XY (Arzt/Ärztin, Anm.) arbeitet gut, genau und schnell und das ist ein Traum weil man wirklich gut mit ihr/ihm zusammenarbeiten kann von der Zeit her. Sie/Er sieht ok, es sind schon ein paar Patienten mehr, aber, sicher es kann passieren dass wir ein bisschen Wartezeit haben, aber das hält sich alles in Grenzen bei ihr/ihm.

Pufferzone ist in dem Sinn, da hat zum Beispiel abgesagt. Und die ist krank, und du hast eigentlich keine Zeit mehr dass du dir jemand anderen

herbestellst. Es kann dir auch passieren dass dann wirklich ein Loch drinnen ist und wenn du dann Pufferzone auch noch hast dann ist das unwirtschaftlich.

INT: Also man kann sagen das funktioniert bei euch so gut dass man eigentlich keine Pufferzonen braucht.

B: Ja, es wäre was anderes wenn wieder die/der Doktor/in zur Vertretung da wäre da wären Pufferzonen manchmal nicht so schlecht.

INT: OK, also das ist natürlich von den handelnden Personen abhängig.

B: Ja.

INT: Schickt ihr Erinnerungen aus?

B: Ja ein Email ein mal im Jahr für Vorsorgeuntersuchungen.

Nein. Das machen wir nicht. Bei uns ist das so, die Erinnerungsschreiben kriegen die einmal im Jahr. SMS machen wir nicht.

INT: Passiert es oft dass Patienten nicht erscheinen?

B: Es ist selten. Das kann täglich sein, es kann sein dass jeden dritten Tag einmal, aber es sind jetzt nicht so viele. Natürlich ist es ungut, viele sagen dann nein ich hab den Termin übersehen oder stehen eine Woche vorher da. Aber ich weiß nicht ob sich der Aufwand lohnt dass man da jedem ein SMS schreibt.

(Gespräch über Automatisierung)

INT: Wie viele Leute seid ihr prinzipiell?

B: Wir sind zu dritt angestellt, und sind immer zu zweit da besetzt.

INT: Gibt es irgendwas wo man sagen kann das war besonders schlecht oder besonders gut? Oder alle zufrieden?

B: Nein im Grunde genommen läuft das total gut bei uns, natürlich gibt es immer wieder Sachen wo man sich denkt da könnte man etwas verbessern. Wir haben jetzt zum Beispiel, vorher war es so dass wir immer nur einen Patienten hineingenommen haben jetzt ist es so nachdem wir hinten Computer haben plus Ultraschall, jetzt wird das alles doppelt belegt. Wir haben natürlich jetzt umgestellt dadurch dass wir jetzt eine neue Chefin haben und ja. Man kommt immer wieder drauf das könnte man besser machen, einfach im Tun kommt man drauf, aber im Grunde genommen läuft das sehr gut.

B: 1 so?

B: Ja genau, wenn das zum Beispiel so strichliert ist dann weiß man die ist gerade da. (Termin des Patienten, Anm.) Wer als nächstes drein kommt, das heißt jetzt nicht weil der da rosa ist sondern dann obliegt das derjenigen die den Assistenzbereich hat weil man einfach von der Aufteilung wer wo wann und wies vom organisatorischen Ablauf am geschicktesten ist.

INT: Das heißt die Reihenfolge in der Patienten drankommen hat nicht unbedingt mit dem Termin zu tun oder wer als erster da ist sondern wie es sich praktisch ausgeht?

B: Genau. Wie man einfach von der Raumaufteilung am besten zusammen kommt. Oder man muss da zum Beispiel Kathetherharn machen oder so so so.

INT: Ihr verwendet nur den Kalender? Keinen Papierkalender nebenbei?

B: Nein wir haben nur den.

INT: Gibt es irgendetwas an dem, dass euch stört oder was man verbessern könnte? Oder etwas dass mühsam ist oder unpraktisch?

B: Wir haben viele Kürzel drinnen, (Tastenkürzel, Anm.) wo man nicht ausschreiben muss. Ich würde sagen wir sind da voll super organisiert.

INT: Vielen Dank.

Interview IX

INT: Termine werden bei euch hauptsächlich telefonisch ausgemacht?

B: Hauptsächlich telefonisch, oder auch größtenteils persönlich hier bei uns. Weil es gibt manche Untersuchungen bei uns wo man etwas abholen kann deswegen machen wir das gleich hier.

INT: Aber so per Email das kommt nicht oft vor?

B: Dadurch dass das Telefon dauernd läutet und jemanden andauernd dahaben wir schaffen das nicht parallel die Emails zu beantworten. Die Termine sind nicht mit dem Emailprogramm verbunden sondern extern im Ärzteprogramm (Innomed, Anm.) deswegen nimmt das viel Zeit in Anspruch Emails zu beantworten, einen Termin zu vereinbaren und dann warten ob der Termin auch bestätigt werden kann. Am Telefon sagen die Leute gleich ob sie Zeit haben. Daher eher nur telefonisch oder persönlich. So funktioniert das bei uns.

INT: Ist es bei euch so dass ihr gewisse Untersuchungen zu einem gewissen Zeitpunkt in der Woche macht? Oder macht ihr immer alles?

B: Es ist je nach Plan. Es hängt von uns von der Anzahl an Geräten ab die wir zu Verfügung haben, und es sollten nicht mehrere selbe Untersuchungen hintereinander sein damit die Geräte gereinigt werden können. Also eine gewisse Zeit muss man einrechnen damit die Maschinen gereinigt werden können. Daher müssen wir es schaffen dass wir es ein Bisschen abwechseln oder etwas dazwischen dazutun was mit den Geräten nichts zu tun hat. Deswegen kannst du auch hier sehen wir haben heute Koloskopie, dann haben wir Magenspiegelung und in der Zwischenzeit wurde schon gereinigt.

B: Es gibt Patienten die ein bisschen länger brauchen, und dadurch dass wir zur Zeit sehr viele Einschübe haben verkürzen wir manchmal einzelne Termine. (Im Programm, Anm.) Aber sonst bleibt die Reihe so wie sie ist. Wir tun so gut wie nie jemanden vorziehen wenn jetzt gerade mehrere da sind. Auch wenn ein Patient zum Beispiel früher gekommen ist (zeigt Reihenfolge her). Weil dann komme ich aus der Reihe.

INT: Es gibt sozusagen 4 Spalten für einen Tag?

B: Ja, die erste Spalte sind alle Patienten die heute einen Termin bei uns haben, die nächste Spalte sind alle Patienten die heute bei uns angerufen haben. Aus welchem Grund auch immer, wir gehen gleich in die Kartei und schreiben an warum und dass ein Patient angerufen hat oder vergeben einen Termin. In der dritten Spalte machen wir alle die persönlich da waren zu einer Terminvereinbarung. Und diese vierte Spalte ist die für Befunde, also was wir an Labor und Befunde haben.

INT: Wie lang dauert es wenn ein Patient anruft bis der Termin eingetragen ist und vereinbart?

B: Es ist verschieden. Es gibt Patienten mit Sprachproblemen, da werden wir ein paar Minuten länger brauchen. (Spricht über Stammdaten, nicht Terminrelevant)

INT: Habt ihr Puffer eingeplant?

B: Also Timeout haben wir und Mittagspause und da sind welche für Akuttermine.

Das ist jeden Tag so eingeplant. Das schaut immer so aus dass wir immer Mittagspause und Timeout haben und die Akuttermine sozusagen. Wenn jemand dann kommt oder länger braucht, damit wir nicht so in Zeitverzug kommen.

INT: Wie ist das mit der Dauer von Terminen? Wonach richtet sich das? Nach Untersuchung? Ist das fix?

B: Wir haben verschiedene Taktiken sozusagen ausprobiert, und dann sind wir irgendwann mal draufgekommen dass wir bestimmte Untersuchungen mindestens Zeit brauchen. Also Gespräch zum Beispiel für Gastroskopie so 10 Minuten, Darmspiegelung 20 Minuten vielleicht. Es ist auch so, dass wenn wir Patienten schon kennen und wissen der braucht etwas extra dann verlängern wir den Termin. Wir verkürzen eher nicht, sondern verlängern. Aber das wissen wir schon wenn wir in die Kartei hineinschauen.

INT: Also es gibt so eine Grunddauer, und manchmal werden Termine länger eingetragen?

B: Genau, genau.

INT: Funktioniert das gut? Also ist das meistens richtig?

B: Das funktioniert gut. Es gibt natürlich Ausnahmen. Es kann nicht ohne, aber meistens funktioniert es ganz normal. Super.

INT: Wie viele Patienten habt ihr pro Tag?

B: Zwischen 25 und 35. Die zu uns kommen zu einer Untersuchung.

INT: Wie weit in die Zukunft vergebt ihr Termine?

B: Nun gut, für ein Vorgespräche schauen wir dass wir so schnell wie möglich einen Termin vergeben, also in der nächsten Woche. Und ja, es gibt Patienten die gleich eine Untersuchung brauchen oder akut sind, dann schauen wir dass wir gleich die Akuttermine so wie ich vorher gesagt habe vergeben.

INT: Aber wenn etwas nicht akut ist? Also wie weit seid ihr mit euren Terminen in der Zukunft?

B: Ungefähr zwei bis drei Wochen. Drei Wochen ca.

INT: Wie viel von eurem Arbeitstag nimmt Terminverwaltung und -planung ein? Im Verhältnis zu anderer Arbeit?

B: Haha. Wir machen alles parallel. Zum Beispiel die Jasmin hat heute Abrechnung gemacht, jetzt macht sie Befunde was noch fehlt und sobal ein Anruf kommt lassen wir sowieso alles stehen und machen den Patienten das hat auch Vorrang.

INT: Aber kann man so sagen 50% ungefähr?

B: Ich glaube mehr, oder, Jasmin?

B: Wenn ich den ganzen Tag nur herunten bin, ist Terminvereinbarung 70

B: Ja, weil wir teilen uns zum Beispiel alles. Wer oben die Untersuchungen macht und wer unten ist.

INT: Sendet ihr Erinnerungen an Patienten?

B: Nein. Wir schreiben den Termin auf, wir sagen den Termin. Wir haben Formulare und oben steht riesig Datum und Uhrzeit drauf und ohne diesen Zettel können die sich nicht vorbereiten und das ist immer vor Augen.

INT: Kommt es oft vor dass Patienten nicht erscheinen?

B: Bei schönem Wetter, ja. Na wirklich, im Sommer wenn es schön ist dann kommen sie einfach nicht mehr.

INT: Rufen auch nicht mehr vorher an und sagen ab?

B: Ich muss schon sagen, es gibt Patienten die sich gar nicht mehr melden und es gibt auch Patienten die anrufen und sagen das und das hab ich, oder die ins Krankenhaus verlegt worden sind oder die sagen ich weiß nicht wann ich kann aber ich melde mich wieder.

INT: Ist das ein Problem für euch das Patienten nicht kommen, weil dann etwas leer steht bei euch?

B: Es kommt darauf an, wenn zum Beispiel eine halbe Stunde eingeplant haben wo der ohne Vorwarnung nicht mehr kommt und der nächste ist noch nicht da dann sitzen wir eine halbe Stunde herum sozusagen, tun wir eh nie, aber ähm Patient ist nicht da, und uns fehlt diese Zeit.

INT: Aber das ist selten.

B: Selten ja, also bei Kleinigkeiten wo es nicht so auffällt passiert das. Aber bei den großen Sachen eher selten.

INT: Passiert das oft dass ihr Patienten verschieben müsst weil ihr merkt es geht sich nicht aus weil ihr voll seid?

B: Von uns aus passiert das so gut wie nie, dass wir verschieben. Also wenn jemand ausfällt, dann rufen wie zum Beispiel den letzten (am Tag, Anm.) an und fragen können sie vielleicht etwas früher kommen. Weil wenn die so lange Hungern müssen, die freuen sich eh wenn sie früher kommen können.

INT: Also es gibt dann auch noch so eine Ansicht für eine Woche oder für ein Monat?

B: Ja, und man kann hier auf die Patientin klicken und nach vor und zurück.

INT: Gibts irgendetwas, dass in letzter Zeit besonders gut oder besonders schlecht gelaufen ist? Oder irgendwelche Probleme?

B: Es ist immer irgendetwas, man kann das nicht voraussehen. Bei der Darmspiegelung gibt es manchmal Patienten wo wir uns schon denken oh da werden wir länger brauchen. Manchmal gibt es Sachen wo man denkt es wird lange dauern und die sind nach ein paar Minuten fertig. Es gibt so und so.

INT: Alles in allem funktioniert das aber gut?

B: Es gibt auch von sich aus schwierige Patienten. Haha.

B: Ganz schlecht ist es wenn wir Vertretung sind für einen Kollegen.

B: Dann ist wirklich sehr viel los wenn jemand Urlaub hat. Haha.

INT: Weil ich gehört habe dass ihr laufen am Prozess arbeitet?

B: Wir tun das laufend anpassen in Teambesprechungen, und reden. Sobald wir merken es passt etwas nicht oder wenn es Vorschläge gibt, dann setzen wir uns zusammen und schauen die ganze Ordination.

INT: Und hat sich dadurch etwas geändert wo man sagen kann das ist besser geworden als es früher war?

B: (Zeigt auf Headset) Das Hörgerät haben wir bekommen.

B: Früher bin ich immer gebogen dagesessen, da brauchst du eine Physiotherapie. Man braucht beide Hände frei.

INT: Und der Kalender ist bei euch direkt mit der Patientenkartei verknüpft?

B: Ja genau, da kann man direkt auch über den Patienten suchen nach Terminen. UNd dann holen wir die Kartei direkt heraus.

INT: Und oben in den Untersuchungsräumen, habt ihr die selben Listen?

B: Jeder Raum sieht so aus, am Computer.

INT: Also die/der Frau/Herr Doktor hat oben den selben Kalender und kann nachsehen wer als nächster kommt.

B: Ja, sie/er schaut immer vorher die Kartei an, damit sie/er vorbereitet ist auf einen Patienten. Zum Beispiel die Vorgeschichte, damit sie/er Bescheid weiß und damit sie/er weiß was sie/er machen soll. Oder wenn einer oft da war will sie/er wissen was der schon für eine Therapie gehabt hat.

INT: Gibt es Pläne für die Zukunft?

B: Urlaub.

INT: Auf die Terminverwaltung bezogen?

B: Wie gesagt, wir passen immer wieder etwas an. Irgendwelche Vorschläge, da muss man nicht warten wir machen das in der Teambesprechung. Dann treffen wir eine Entscheidung.

INT: Wie viele Leute seid ihr insgesamt?

B: Vier Assistenz, und die/der Frau/Herr Doktor.

INT: Ihr vier macht alles? Und wechselt ab?

B: Wir wechseln uns ab, ja. Die Jasmin zum Beispiel kann am besten unten.

Interview X

INT: Wieviele Patienten habt ihr pro Tag ungefähr?

B: Zwischen 70 und 80 meistens. Bis jetzt waren es 16, also das ist nichts. (09:00, Anm.)

INT: Wozu gibt es zwei verschiedene Kalender?

B: Das sind die Privatpatienten und das sind die anderen.

INT: Macht ihr viele Termine?

B: Nein, nur für die Vorsorgeuntersuchungen eigentlich. Die anderen kommen einfach so.

INT: Gibt es gewisse Zeitfenster wo ihr bestimmte Untersuchungen macht?

B: Ja, am Mittwoch haben wir Blutabnahme-Tag für die Vorsorgeuntersuchungen zum Beispiel, ich mein, man kann zwar einen anderen Tag auch haben.

INT: Kommt es oft vor dass Leute nicht kommen?

B: Nein. Meistens rufen sie vorher an wenn sie nicht kommen.

INT: Ihr sendet keine Erinnerungen im Vorhinein?

B: Nein.

INT: Würdet ihr sagen dass das gut bei euch funktioniert?

B: Ja.

INT: Also gibt es keine Bestrebungen dass man mehr terminisiert?

B: Nein. Weil wenn man noch mehr Termine ausmacht und dann kommt jemand nicht, dann bringt das nichts.

INT: Ihr habt hier die Warteliste (MedX-Pert, Anm.) und da werden die Leute eingereiht und in der Reihenfolge kommen sie dann auch dran?

B: Ja genau. Rezeptpatienten werden natürlich nicht für den/die Arzt/Ärztin eingereiht.

INT: Ihr seid hier zu dritt in der Ordination?

B: Zu dritt, ja.

INT: Gibt es irgendetwas was besonders gut oder schlecht gelaufen ist?

B: Nein, eigentlich auch nicht.

Appendix B

Use Case Diagrams

A complete list of use cases along with descriptions can be found in table 5.1.

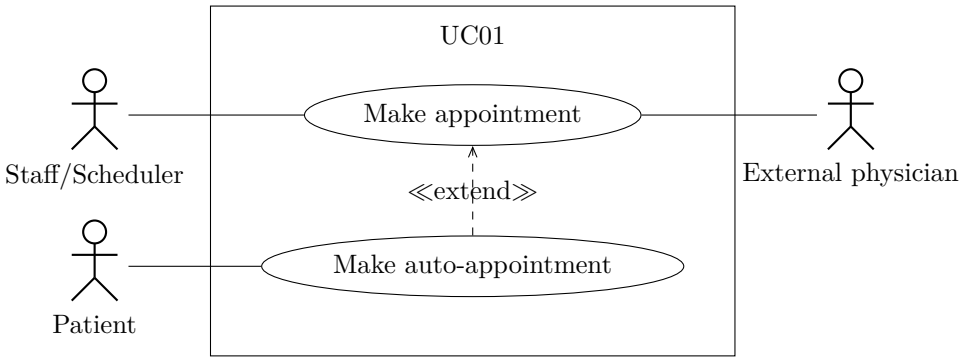

Figure B.1: Make appointment (UC01)

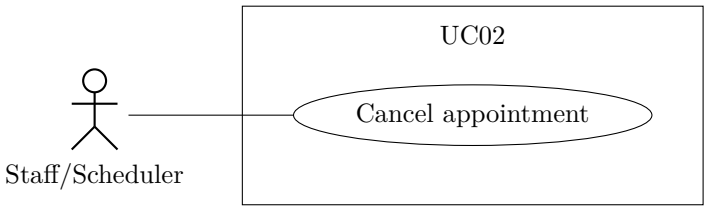

Figure B.2: Cancel appointment (UC02)

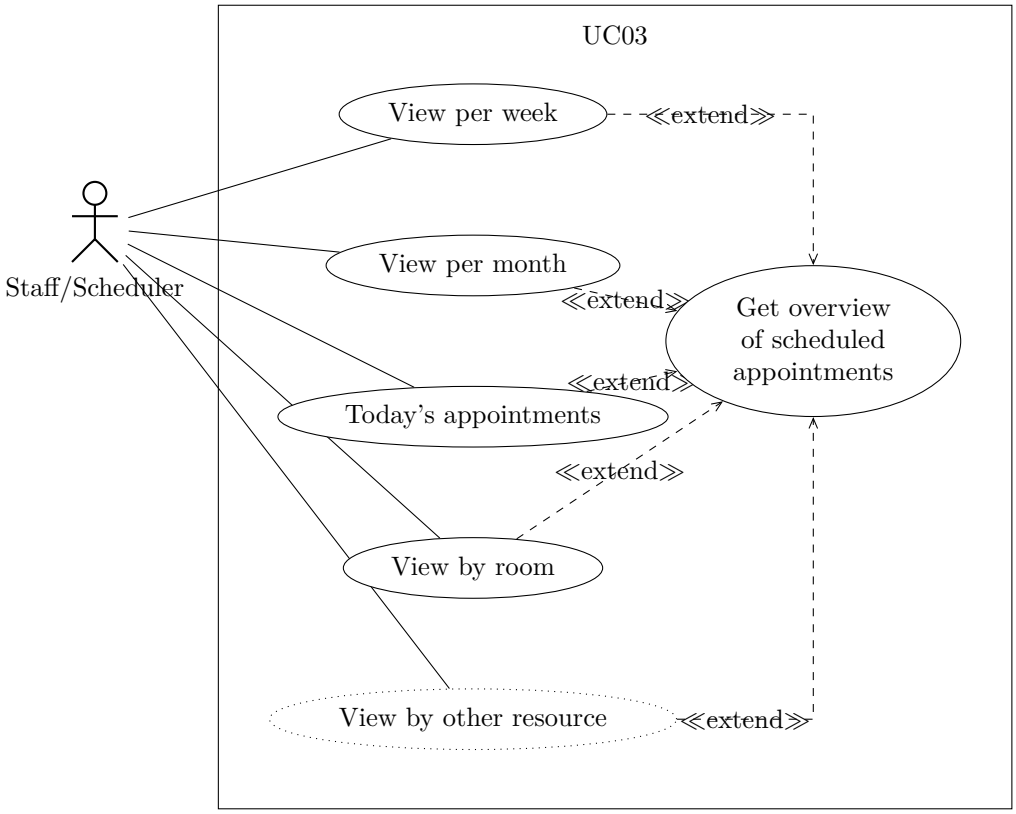

Figure B.3: Get schedule overview (UC03)

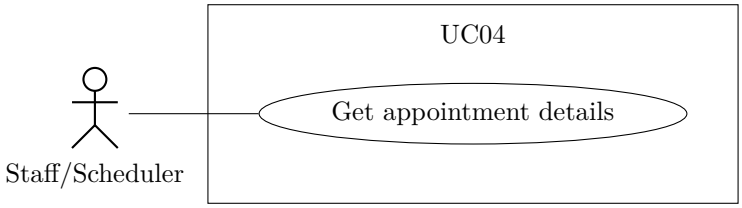

Figure B.4: Get appointment details (UC04)

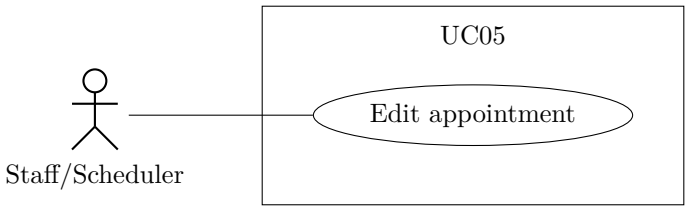

Figure B.5: Edit appointment (UC05)

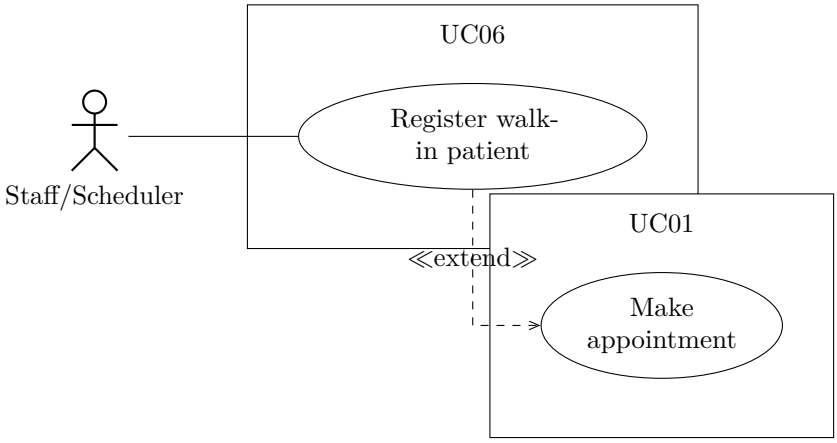

Figure B.6: Register walk-in patient (UC06)

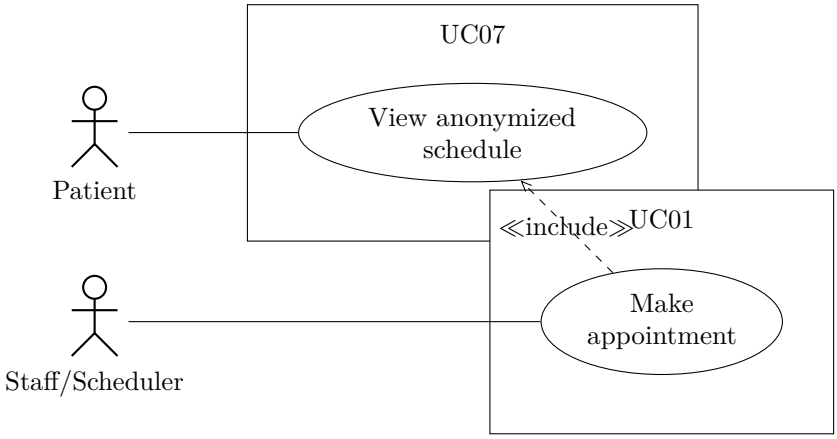

Figure B.7: Make an appointment using the anonymized calendar view (UC07)

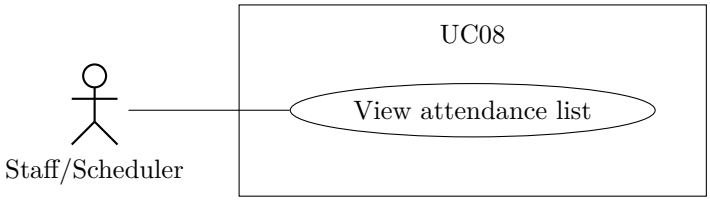

Figure B.8: View attendance list (UC08)

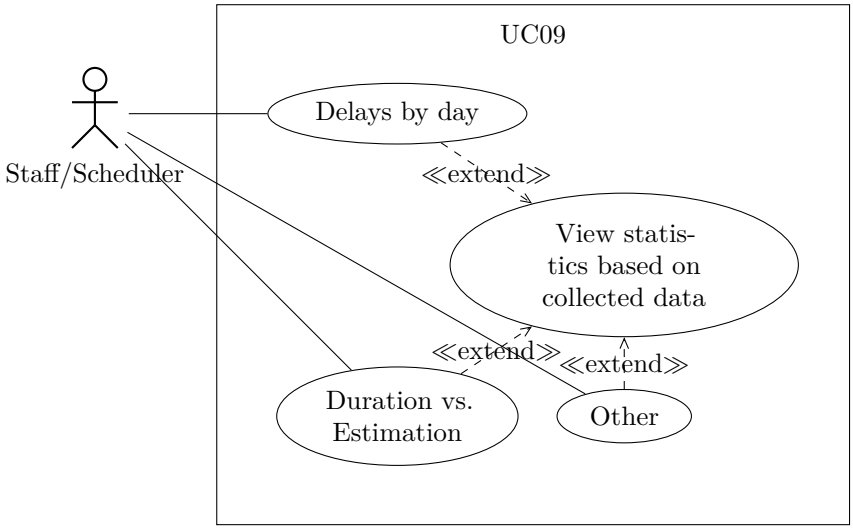

Figure B.9: View statistics (UC09)

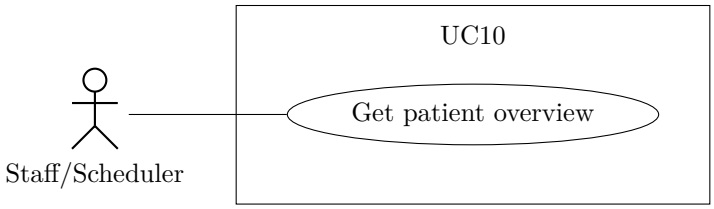

Figure B.10: Get patient overview (UC10)

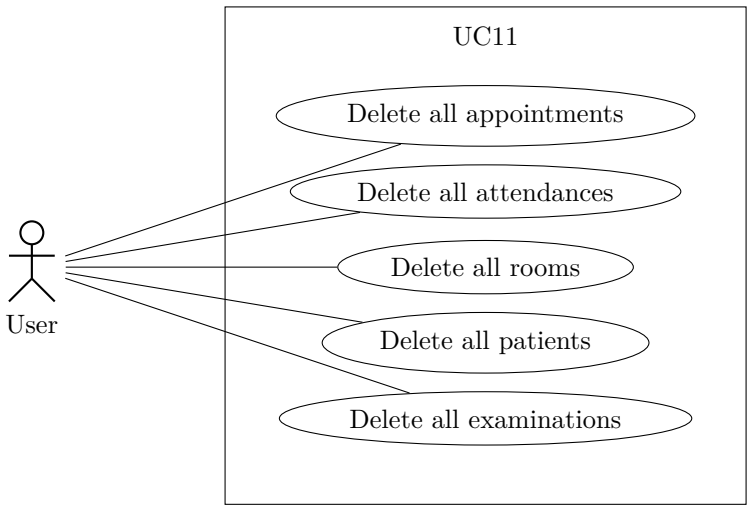

Figure B.11: Delete all data (UC11)

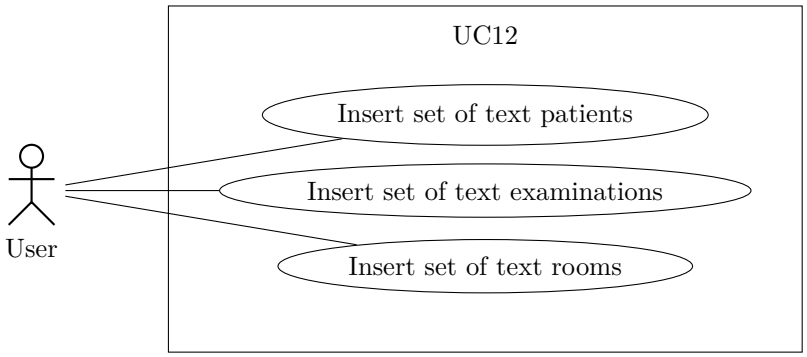

Figure B.12: Insert test data sets (UC12)

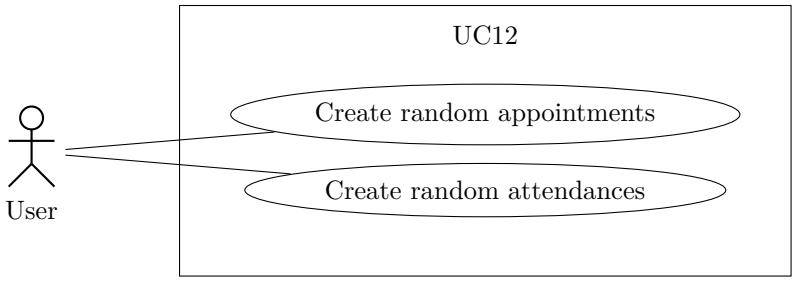

Figure B.13: Create random appointment data (UC13)

Activity Diagrams

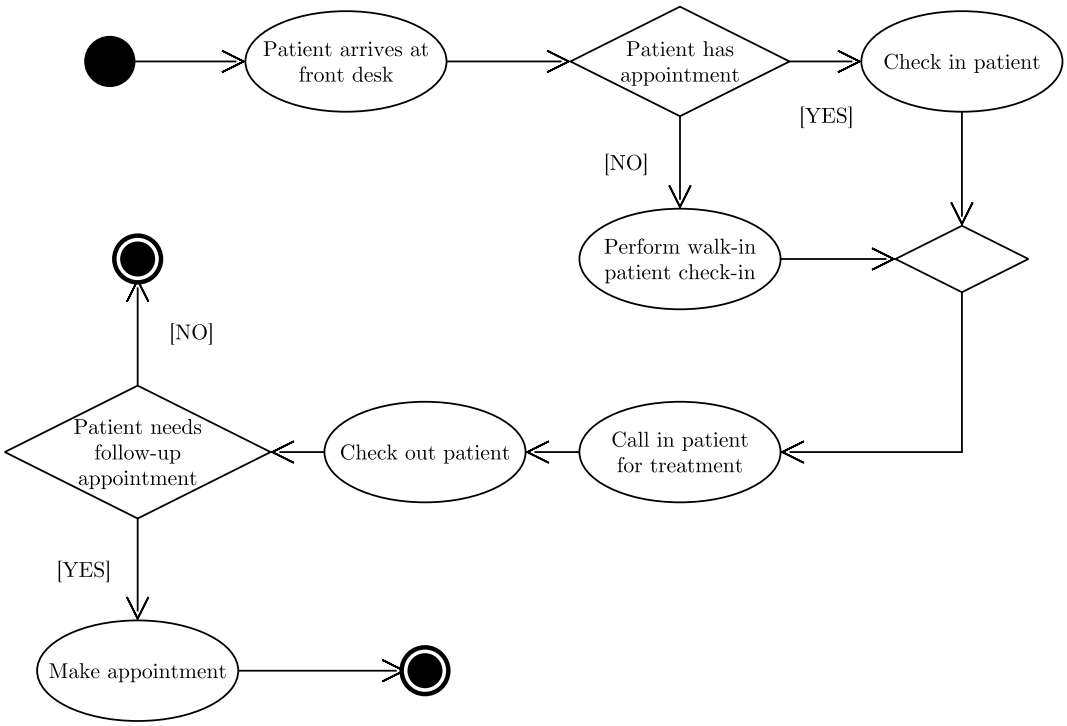

Figure B.14: Attending patient (AC01)

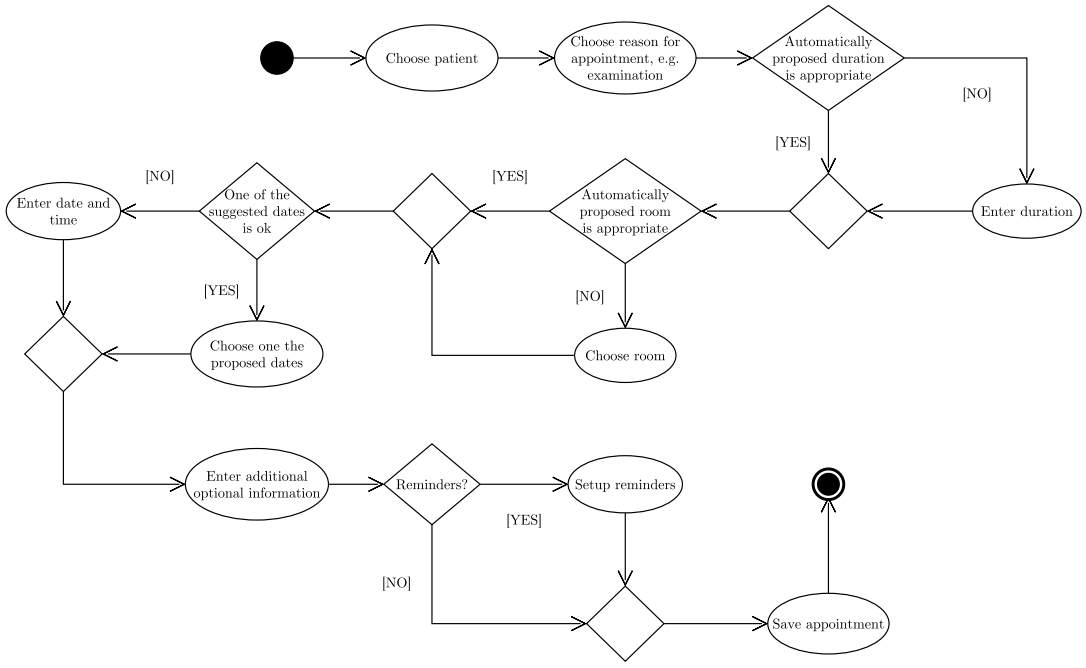

Figure B.15: Make appointment (AC02)

Sequence Diagrams

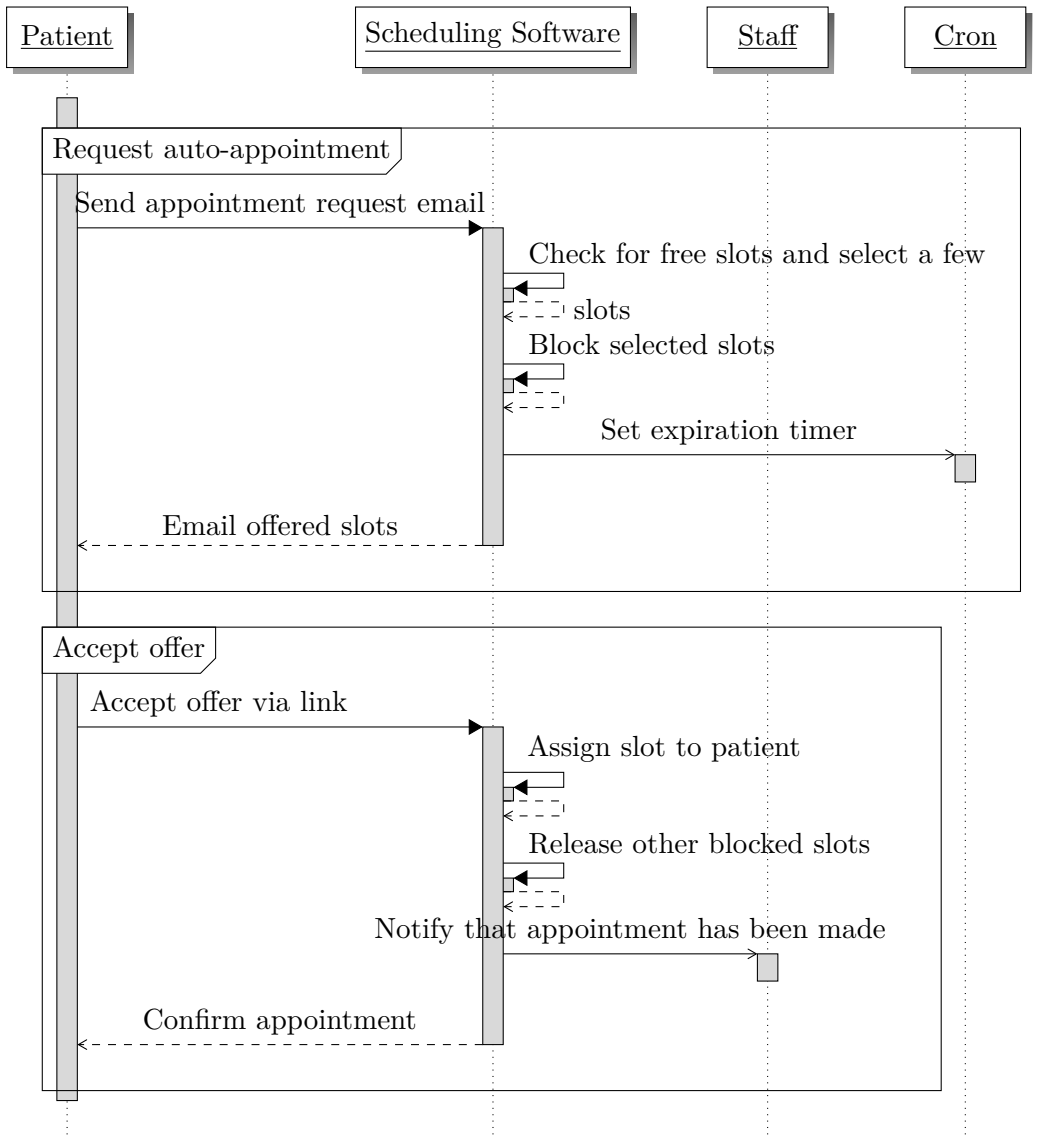

Figure B.16: Automatic appointment scheduling (SQ01)

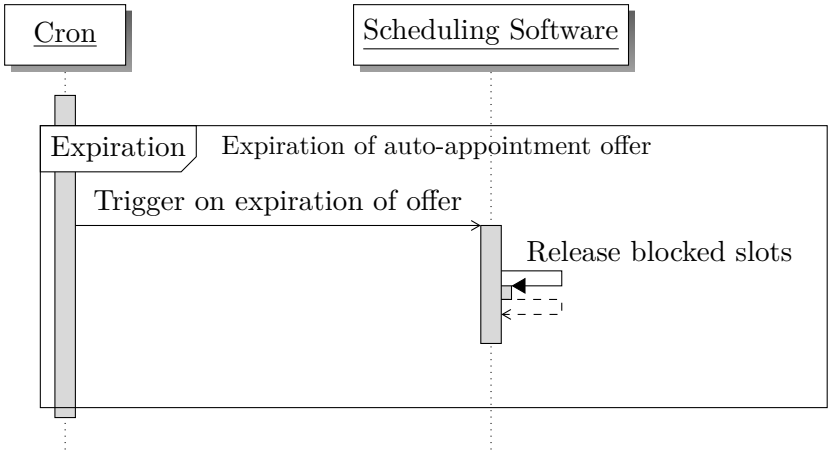

Figure B.17: Expiration of offered appointments (SQ02)

Entity Relationship Diagrams

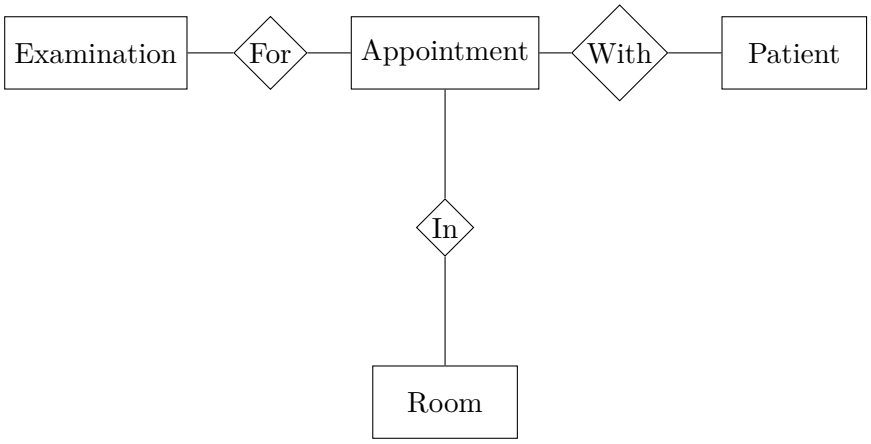

Figure B.18: ERD showing an approach on generic resource handling. (ERD01)

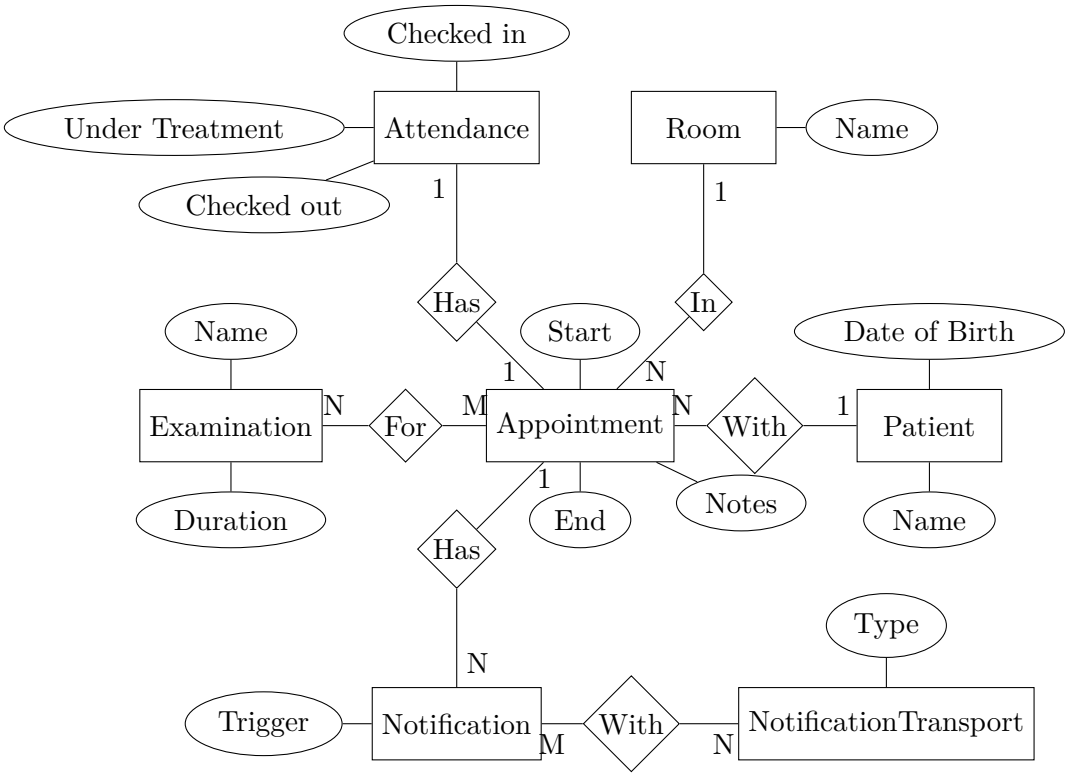

Figure B.19: Possible data model with cardinalities and basic attributes. (ERD02)