Effects of telemonitoring on treatment of sleep-disordered breathing

Oct 2015

This report is a deep dive into sleep clinics in Finland and in the UK.

100%

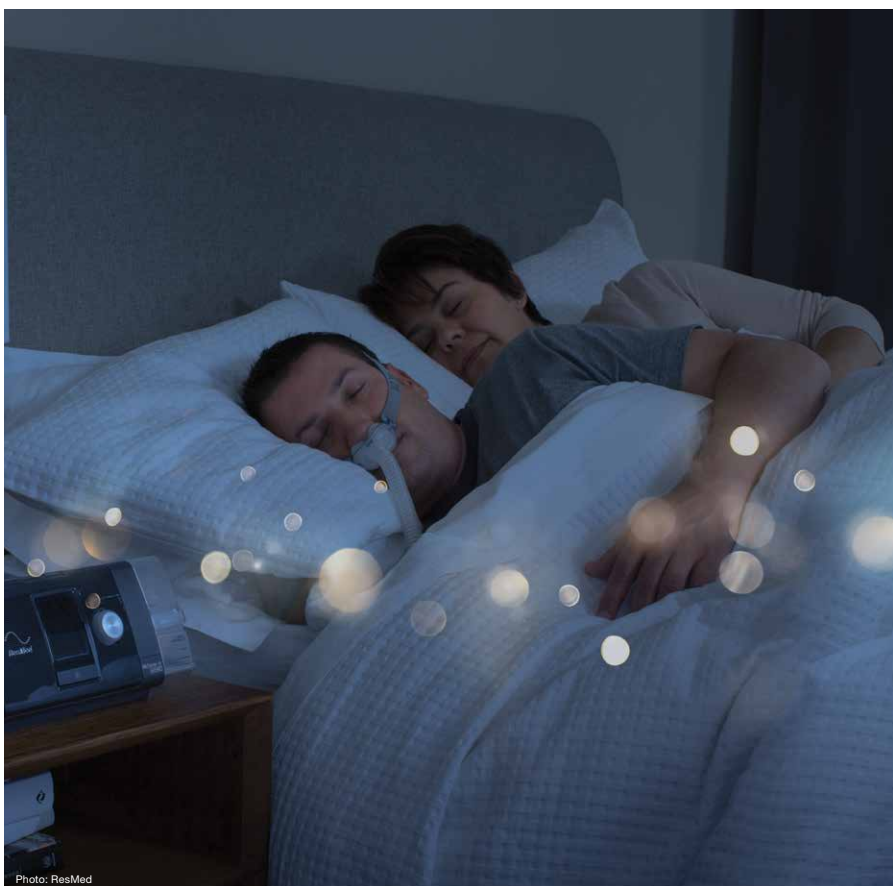Increase in capacity for new patients.

-90%

In number of early drop-outs.

Photo: ResMed

pwc

Contents

Executive summary

New solutions to treat sleep apnea are required

Sleep-disordered breathing is a very common but often overlooked medical condition. It is estimated that 26%[1] of adults between 30-70 suffer from some form of sleep-disordered breathing. Increased awareness and screening of selected risk groups of the condition is triggering a rapid increase in the number of patients. At the same time, resources allocated to sleep clinics are limited, resulting in an impossible equation for many clinics across Europe.

Introducing telemonitoring

The first clinics in Finland introduced telemonitoring in 2013, while several sleep clinics in the UK are now in the process of introducing telemonitoring to the patient pathway.

Finnish clinics needed to increase patient throughput while keeping within the limits of a fixed budget. The clinics identified a means of replacing physical visits to the clinic with telemonitoring and telephone interaction. Results from this indicate an up to 100% increase in capacity to treat new patients.

Clinics in the UK are still in the adoption phase but are already seeing positive benefits. Clinics report being able to interact with twice the number of patients in the same time period when using telemonitoring technology. At the same time they see huge benefits for the patients that no longer need to take a day off from work to travel to the clinic. Early indications from UK clinics using telemonitoring are lower drop-out rates.

Lessons from Finland and the UK applied to other European countries

Outdated reimbursement models requiring physical visits at clinics have been identified as one of the key barriers to the adoption of telemonitoring, in both Finland and the UK as well as across several European markets.

A way forward is to find a way to encourage virtual patient interaction in place of physical clinic visits. By using telemonitoring we note that sleep clinics can save resources and time while improving both quality and health outcomes and patient satisfaction.

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1. Peppard et al. Increased Prevalence of Sleep-Disordered Breathing in Adults. Am J Epidemiol. 2013 (5.17)

1.

Introduction

Sleep-disordered breathing prevalence in Europe

The number of patients diagnosed with sleep-disorded breathing is growing dramatically across Europe, putting a strain on sleep clinics which face the challenge to treat additional patients while caring for the patients already on treatment.

Sleep-disordered breathing encompasses a range of conditions characterised by abnormal breathing during sleep. Prevalence of sleep-disordered breathing is estimated at c. 26%[2] of the total adult population, indicating a massive number of c. 70 million potential patients suffering from sleep-disordered breathing in the EU28 area. It should be noted that a significantly higher prevalence is seen among obese and the male population in the older age groups.

The prevalence of mild to severe SDB was approximately 2-fold higher in older men than in younger men (37% vs. 18%, respectively); among overweight women, the prevalence was approximately 5-fold higher in older women than in younger women (20% vs. 4%, respectively). However, it is worth mentioning that far from all patients currently receive treatment.

The most common form of sleep-disordered breathing is obstructive sleep apnea and is thus the focus of this paper.

What is OSA?
Obstructive sleep apnea (OSA) occurs when the relaxation of the throat muscles obstructs airflow for more than 10 seconds at a time. The severity is usually measured as the Apnea-Hypopnea Index (AHI). The AHI is the number of apneas and/or hypopneas per hour of sleep (or study time).

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2. Peppard et al. Increased Prevalence of Sleep-Disordered Breathing in Adults. Am J Epidemiol. 2013 (5.17)

The person experiences apneas, hypopneas and flow limitation. **Apnea:** a cessation of airflow for ≥10 seconds. **Hypopnea:** a decrease in airflow lasting ≥10 seconds with a 30% oxygen reduction in airflow and with at least a 4% oxygen desaturation from baseline. **Flow limitation:** narrowing of the upper airway and an indication of an impending upper airway closure.

OSA syndrome causes daytime sleepiness, slow reflexes and poor concentration. Diabetes, high blood pressure, heart disease, stroke and weight gain are common long term impacts of untreated OSA.

Increased inflow of patients
There are several factors behind the recent increase of patient inflow at sleep clinics.

- Firstly, the awareness of the medical condition is increasing, both among general practitioners and the wider population.

- Secondly, screening of risk groups, such as patients with diabetes and cardiovascular diseases has increased in some countries and specific hospitals typically driven by individual doctors.
- Thirdly, the screening of selected professional groups, such as taxi or truck drivers, is increasing as the prevalence of OSA has been seen to increase the risk of motor vehicle accidents by up to 300%[3].
- Lastly, obesity levels are increasing which has a direct impact on the prevalence of OSA.

Resource constraints
An aging population is putting increased pressure on the European health care system. Sleep clinics are often forced to treat more and more patients with constant, or even decreasing, resources. New methods are needed to increase efficiency at sleep clinics while maintaining, or improving, treatment quality and outcomes.

Clinics in Finland and the UK are looking at telemonitoring as a solution
Sleep clinics in Finland and the UK were identified as front runners in telemonitored solutions to treat OSA. The primary focus of this report is to investigate how they have successfully been able to increase the number of patients treated while also improving the quality of treatment delivered.

PwC visited and analysed seven clinics in Finland and the UK in order to understand treatment pathway and utilisation of resources. **Our findings from these visits are presented in this report.**

We also visited more than 30 clinics in other European countries. We use findings from these studies to contrast and comment the findings in Finland and the UK.

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3. EU – "New Standards and Guidelines for Drivers with Obstructive Sleep Apnoea syndrome. Brussels, 2013"

Introduction to the patient pathway

OSA treatment follows the same basic steps in all studied countries. However, the detailed patient pathway differs greatly between clinics – even in the same country.

The treatment of OSA is normally initiated when the patient seeks care, either for symptoms directly related to OSA or symptoms related to diabetes, cardiovascular diseases etc. When OSA is suspected, a sleep study is performed to determine whether the patient is in fact suffering from the medical condition and to determine a suitable treatment method. The methods of conducting the sleep studies varies between different clinics.

When a patient is diagnosed with OSA a treatment method is prescribed. This report exclusively studies positive airway pressure therapy as this is the most commonly prescribed treatment. A non-obtrusive mask connected to a small machine that delivers a constant or automatically varying positive airway pressure (CPAP/APAP) to the sleeper is used.

This flow holds open the collapsible upper airway. Other treatment methods include oral appliance therapy, surgery and weight loss.

When a patient has been prescribed a CPAP/APAP device he or she visits the clinic for a treatment initiation appointment. Most clinics then schedule several follow up appointments during the first year to ensure that the patient is responding well to the treatment. The first weeks of treatment are identified by the clinics as the critical time when the pattern of adherence is established for the majority of patients. Clinics across Europe inform PwC that only 60-70% of patients stay on the treatment after the first 6 months, but reliable statistics are not available as many clinics do not systematically follow up their patients.

Basic treatment steps

Clinic variations

Patient seeks care
- Primary care
- Specialists

Sleep study
- At home or sleep lab
- Oximeter/ Polygraphy (PG)/ Polysomnography (PSG)

Diagnosis
- By doctor or nurse
- Thresholds and treatment method differs by country

CPAP/ APAP treatment initiation
- At clinic or home
- Individually or in groups
- One or several visits

Therapy review
- From no follow up to multiple follow up with PSG tests at clinic

Continuous treatment
- From no follow up to annual follow up with PSG tests at clinic

2.

Use of telemonitoring in Finland

The challenge: Increasing number of patients

Finnish clinics were faced with what they called "the impossible equation", an increasing patient inflow without a corresponding budget increase.

Three sleep clinics of varying size and stage of telemonitoring adoption were included in the study in Finland. The number of patient set-ups per clinic ranged from three hundred to almost one thousand patient set-ups with up to 10,000 patients on continuous treatment. However, in spite of large differences in size and geographic uptake area, all of the clinics faced very similar challenges.

The impossible equation
Prior to telemonitoring the Finnish clinics were all facing three very tough challenges.

- The demand for clinic resources was growing very rapidly, driven by both an increased inflow of new patients and by a growing number of patients already on treatment.
- Clinic budgets were kept constant despite the clinics treating more and more patients. One clinic had even had their budget decreased in the last year.
- Furthermore, the waiting time for patient set-ups in Finland should not exceed three months. Any violation of this leads to fines for the hospital

The clinics were forced to look for new solutions if they were to continue to provide high quality and timely care to their patients.

> *"It would be impossible for me to run the clinic without telemonitoring, we would be over-run with work."*

Increasing patient throughput

Waiting times for patient set-ups were growing rapidly as the Finnish clinics lacked the resources to treat all of the patients. At all of the three studied clinics nurse time was identified as the main bottle neck while the doctors, typically, had spare capacity and would be able to increase patient throughput. In the worst case, patients at one clinic were waiting up to 10 months to receive treatment. Extra nurses and evening clinics were used as a short term solution but at a very high cost. The primary motivation for using telemonitoring in the Finnish clinics was therefore to reduce waiting times for patients.

The clinics recognised that up to 70% of patients responded well to the treatment and had no reason to come to the clinic for a follow-up visit during the first month. However, the problem was that without telemonitoring there was no way of knowing which patient did not need to come to the clinic.

By introducing telemonitoring during the first 2-3 weeks of treatment the Finnish clinics were able to identify patients responding well to the treatment and thereby significantly reduce the need for follow up visits. Telemonitoring resulted in an increased capacity to treat new patients by up to 25%.

70%

of patients responded well to the treatment and had no reason to come to the clinic for a follow-up visit during the first month.

The solution: Introduction of telemonitoring

By introducing telemonitoring to the treatment pathway gradually, Finnish clinics were able to enjoy increased efficiency with very limited investment in time and money.

Gradual implementation of telemonitoring

Telemonitoring was gradually introduced at the studied clinics in Finland. A gradual introduction helped the clinics avoid large organizational and financial change. During the first phase a few nurses volunteered to try telemonitoring during patient set-ups (2-3 weeks) on a limited number of patients. At first, approximately half of all new patients were treated on the telemonitoring pathway. Patients selected for the traditional path included:

- Senior patients (above working age).
- Patients with an oxygen saturation below 90%.
- Other patients that the nurse deemed to need a physical check-up.

Once the clinics had an established workflow and patient pathway, they gradually started increasing the share of patients on telemonitoring. The clinic with the most experience of telemonitoring put 70% of all patients on the telemonitored pathway. And interestingly, they tend to use telemonitoring increasingly for the most complex patients, as they need the most care.

Currently, the clinics only use telemonitoring for the first 2-3 weeks of treatment. The clinics have started to look at the benefits from increasing the period of time using telemonitoring, but at the time of this study this has not been implemented by any clinic in Finland.

4. "The doctor is in – your smartphone"
PwC Sweden, 2015

"We rapidly realised that our most complex patients needed more care than others; they were the ones that would really benefit from telemonitoring."

Majority of patients are positive towards telemonitoring
Testimonials by clinic personnel indicate that patients are very positive towards telemonitoring in their treatment. This was also confirmed in a recent study[5] by PwC in Sweden. The study found that 74% of respondents were open to virtual monitoring if they were subject to a cardiovascular disease – and these respondents were answering a purely hypothetical question. Among patients that are already on telemonitoring, acceptance is even higher: 92% were satisfied or very satisfied in a French survey of OSA patients[6].

Creating a coherent patient pathway
Prior to telemonitoring the patient pathway at the Finnish clinics differed significantly, causing both in-equality in treatment quality and higher cost per treated patient. When introducing telemonitoring, the clinics were able to access best practices from other clinics which resulted in a more coherent patient pathway. On the following pages we will investigate the new patient pathway in greater detail.

Gradual introduction of telemonitoring

Stage 1: Selected patients for patient set-ups

- Less than 50% of patients.
- Patient results are reviewed after 2 weeks.
- Easy to implement.

Stage 2: Increase share of patients

- More than 80% of patients.
- Easy to increase portion of patients when a patient pathway is already established at the clinic.

Stage 3: Increase time on telemonitoring*

- Increase time on telemonitoring.
- Patient results are reviewed at determined points in time.
- Reduced need for follow up visits during the first year.

* To date, not seen implemented at studied clinics

5. "The doctor is in – your smartphone"
PwC Sweden, 2015

6. OpinionWay survey of 1012 French OSA patients being telemonitored. February 2014

The results: Improved capacity to treat patients

How Finnish sleep clinics increased the number of treated patients by 10-25% while being able to improve compliance and treatment quality.

50%

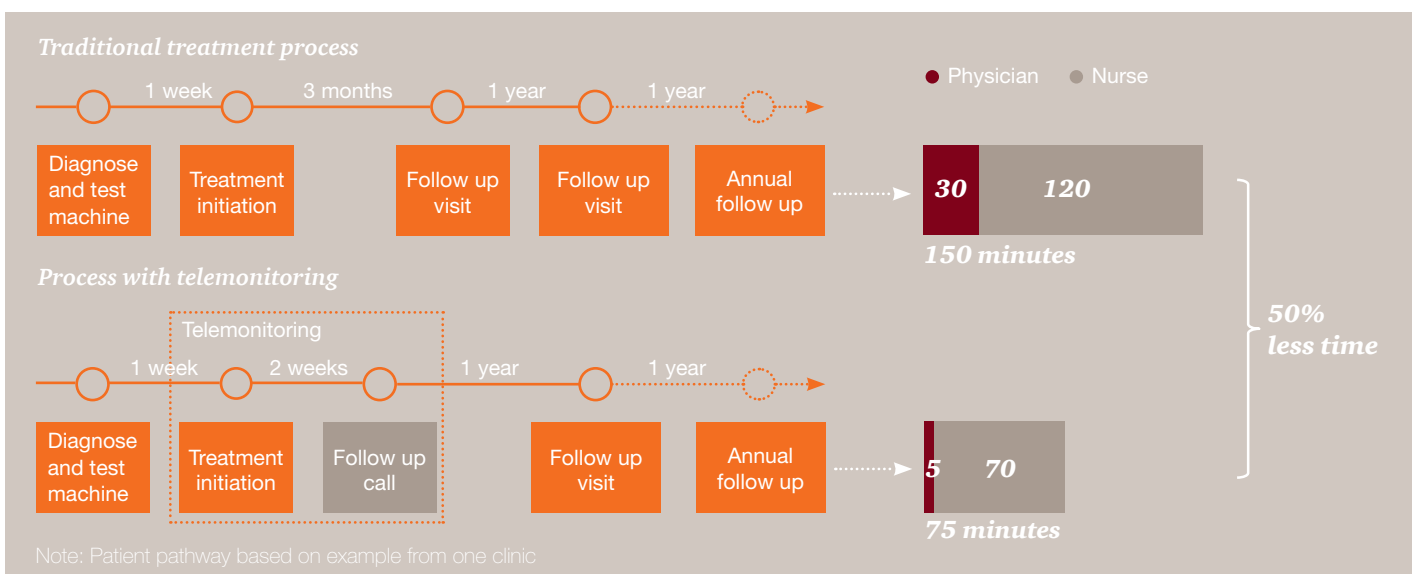less time needed to treat patients by using telemonitoring.

Telemonitoring during the first 2-3 weeks of treatment was identified as the best way to introduce telemonitoring into the patient pathway in Finland. It is during this time that both the risk of patients dropping out and the potential to save nurse time is the greatest.

75 minutes saved for every new patient treated
At treatment initiation all patients visit the clinic to receive a CPAP/APAP device. The patient is instructed on how to operate the device and the device is registered in an online database. When the patient goes home the clinic staff is able to see if and for how long the patient is using the device – from the very first night. The device also reports how well the patient is responding to the treatment.

During the first 2-3 weeks of treatment all patients are reviewed by the clinic, allowing the staff to intervene if a patient is for some reason using the device or not responding to treatment. At the end of the period, data from the device is coupled with qualitative information from the patient through a phone call.

With this procedure all three clinics were able to replace one or two physical clinic visits with telemonitoring and a phone call. This resulted in the clinics saving on average 75 minutes for every new patient treated. In addition the clinics could follow up on patients during the first critical week rather then months later.

Traditional treatment process

| 1 week | 3 months | 1 year | 1 year |

● Physician ● Nurse

Diagnose and test machine | Treatment initiation | Follow up visit | Follow up visit | Annual follow up

30 | 120

150 minutes

Process with telemonitoring

Telemonitoring

| 1 week | 2 weeks | 1 year | 1 year |

Diagnose and test machine | Treatment initiation | Follow up call | Follow up visit | Annual follow up

5 | 70

75 minutes

50% less time

Note: Patient pathway based on example from one clinic

Increasing the share of patients on telemonitoring

Stage 1: We saw that clinics chose c. 50% of patients for the telemonitoring pathway while the other half were treated on the traditional treatment pathway. This way, clinics using telemonitoring were able to treat a 10-16% greater number of new patients with unchanged nurse resources.[7]

Stage 2: We saw that the positive effects on the clinic increased as more and more patients were put on telemonitoring. The clinic that over time increased the share of telemonitored patients to 70% of patients saw a 25% increase in capacity to treat new patients compared to the situation prior to introducing telemonitoring.

Increase in capacity to treat new patients

| 10% | 16% | 25% |
| Clinic 1 | Clinic 2 | Clinic 3 |

Stage 1: c. 50% of patients on telemonitoring

Stage 2: c. 70% of patients on telemonitoring
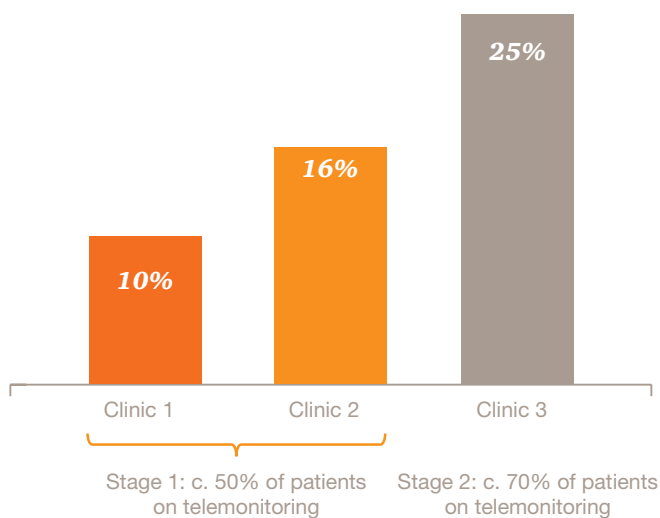
7. The variation between clinics is from how effective they were before telemonitoring.

Further efficiency gains at Finnish clinics

Group patient set-ups and increased time on telemonitoring were both identified as further opportunities to increase efficiency at clinics in Finland.

Group patient set-ups
Group patient set-ups were shown to work very well in combination with telemonitoring in Finland. Two of the clinics introduced group patient set-ups at the same time as they introduced telemonitoring while the third clinic tried out group patient set-ups after using telemonitoring for about one year. Group sizes varied from 5-6 patients at two of the clinics to up to 12 patients at one clinic.

One of the biggest concerns with group patient set-ups was that some patients would fail to understand how to use the device and drop out of treatment as the symptoms continue. With telemonitoring it is possible for clinic staff to spot these patients and intervene, ensuring that they stay on the treatment. A recent study in Germany[8] confirms the decrease in drop-out for telemonitored patients.

Increasing time on telemonitoring
Extending the time on telemonitoring is seen as the next step by clinics in Finland. Similar to the current process, clinics could replace one to two follow up visits during the first year with a phone call. However, clinics have expressed a specific concern that needs to be addressed first:

- To succeed with increased use of telemonitoring, the clinics must develop a way to handle the large amount of patient data that would become available by extending the time patients are on telemonitoring. In effect, they need to find a way to use patient information as a means to interact with those who need help, while spending less time on those patients that are doing well.

Drop-out rates decreased from 10% to 6% for patients on telemonitoring.

-40%

APAP/CPAP
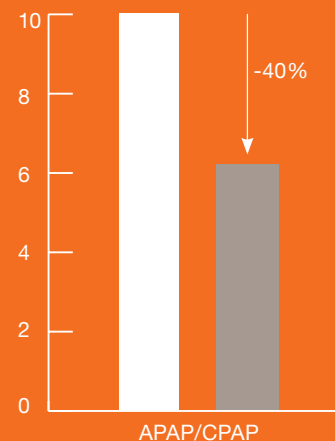
○ No telemonitoring
● With telemonitoring

Source: Telemonitoring solutions for a homecare provider in obstructive sleep apnea (OSA), PwC Case study, 2015

Efficiency gains remain the strongest driver for adopting telemonitoring in Finland. However, clinics note several other positive effects on the treatment.

Improved treatment quality and outcome

The driving force for the Finnish clinics has been improving treatment process efficiency to be able to treat all of the patients in need. However, all clinics recognise a long list of qualitative improvements attributable to the introduction of telemonitoring.

Improved overall health economics

When patients are being efficiently treated then the overall long term benefits to both the patient – and the payor – are higher. Also, the cost of NOT treating a patient is potentially very large. Several studies indicate for example 23-50% higher healthcare costs for patients prior to starting treatment.[8]

Spotting patients with problems early

The first 10 days of treatment are considered to be critical for the overall success of the treatment of OSA[9]. The majority of patient drop outs occur during this time. By using telemonitoring Finnish clinics were able to spot patients not responding to the treatment early on. By intervening and correcting the problem the clinics can ensure that more patients continue on the treatment. One clinic estimates a 90% reduction in early drop-out rates for patients on telemonitoring.

Reducing patient travel time

Sparsely populated areas are common in Finland and some patients require an entire day's travel back and forth to the nearest sleep clinic. Furthermore, some patients require ambulance transport to and from the clinic. By eliminating clinic visits, the clinic and hospital can also save significant ambulance resources.

Experience with external modems in the initial phase

When the clinics in Finland first started using telemonitoring there were no devices on the market that had built-in telemonitoring capabilities. A modem had to be attached to the device during patient set-ups. The modem was then returned by the patient through mail two weeks later. This set-up created some logistical issues having a limiting impact on the positive efficiency gains from telemonitoring.

One of the clinics is now in the transition phase to start using devices with integrated telemonitoring capabilities. Instead of attaching an external module they can now manage all telemonitoring activities from the clinic without patient effort. This has helped the clinic to further improve efficiency benefits from telemonitoring.

"We are still in the testing phase, but so far, out of 80 patients treated on telemonitoring only two have dropped out during the first months."

8. "What Are Obstructive Sleep Apnea Patients Being Treated for Prior to This Diagnosis?*" Smith et al, *Chest*, 2002
9. Lichuan, Ye, Pack Allan I, Maislin Greg, Dinges David, Hurley Sharon, McCloskey Susan, et al. 2012. "Predictors of continuous positive airway pressure use during the first week of treatment." Journal of sleep research 21 (4)

3.

Use of telemonitoring in the UK

The challenge: Constrained resources

UK clinics are under pressure to keep waiting times for patient set-ups below 18 weeks. Until now measures to meet this target have been mainly temporary. Telemonitoring is now being introduced as a means to permanently improve clinic capabilities.

Telemonitoring has only recently been adopted by sleep clinics in the UK and comparable results from long-term use is therefore not available on a broad basis. Four clinics in various stages of telemonitoring adoption were chosen for the in-depth study in the UK. Clinic experience from telemonitoring ranges from no practical experience to c. 6 months experience. The selected clinics were also of various sizes and locations with c. 200 to 1,200 patients per year.

UK clinics are under pressure to keep waiting times below 18 weeks. Also, they have only 6 weeks to diagnose the patient. All studied clinics are currently meeting these requirements; however, in many cases they have been forced to find short-term trade-offs to cope with the situation.

- Weekend and/or evening clinics
- Temporary extra staff.
- Reduced and/or delayed follow-up checks.

The clinics have started to recognise that the current situation is not sustainable in the long run. Even though the referral rate of new patients would remain constant, the number of patients on treatment would continue to grow and demand increased clinic resources. Furthermore, the temporary solutions put a strain on clinic staff, making it even more difficult to attract and retain qualified staff.

Improved efficiency and treatment quality

Clinics trying out telemonitoring in the UK are already seeing clear benefits. Efficiency and patient benefits are summarised as follows:

- Time saved through virtual patient interactions.
- Pro-actively managing early issues with therapy adherence, e.g. mask leak.
- Improved compliance.
- Travel time and expenses for patients.

In the following pages we will elaborate on the benefits and will in detail describe how the clinics introduced telemonitoring.

The solution: Clinics experimenting with telemonitoring

All studied UK clinics which had begun to try out telemonitoring had developed a clinic specific approach and patient pathway. This differs from Finland where a coherent pathway was established at the clinics with telemonitoring.

The clinic approach to introducing telemonitoring to the treatment process differs greatly between clinics in the UK. We identified two distinct approaches:

- Varying experimental approaches
- Service-wide approach

Several clinics had chosen an experimental approach whereby they selected a small portion of patients to try telemonitoring. In contrast, one clinic had introduced telemonitoring into the mainstream treatment pathway, putting all patients on telemonitoring.

UK clinics also differed compared with Finnish clinics in terms of telemonitoring duration. While the Finnish clinics introduced telemonitoring by using it only for the first 2-3 weeks, and are now reviewing telemonitoring as a viable longer-term solution, the UK clinics are planning to keep patients on telemonitoring for the first 3-24 months of treatment.

Experimental approach

Two of the studied clinics adopted an experimental approach to introducing telemonitoring to selected patients only. Patients were selected mainly based on the following criteria:

- Medical condition requiring more follow-up.
- Long travel distance for patient.

For these clinics, the use of telemonitoring is mainly motivated by improving treatment quality for a selected few patients. Efficiency gains remained limited as the share of patients on telemonitoring remained very low, as little as eight patients so far in one of the clinics.

An experimental approach has a limited impact on clinic operation and overall service delivery. The existing patient pathway is kept unchanged for other patients and only a small portion of the staff need training in new methods. It is then, possible for the clinics to scale up the portion of patients on telemonitoring in a controlled manner. From our interviews is seems very likely that the share of patients on telemonitoring will increase, as the clinics express satisfaction with the trials so far.

Service-wide approach

One of the clinics chose to do a service wide introduction of telemonitoring. The clinic changed the patient pathway for all patients to include telemonitoring. Compared with the experimental approach, benefits of this approach include eliminating the need for two parallel patient pathways. The service-wide approach also enables the clinic to reap efficiency benefits from day one. The clinic was able to reduce a 30 minute physical follow up visit to a 10-15 minute virtual follow up (through phone or even Skype).

The results: Improving clinic efficiency

Several benefits of telemonitoring were identified at the sleep clinics in the UK, with increased clinic efficiency comprising a strong benefit. Other benefits include improved treatment quality, as well as patient convenience and comfort.

40%

of our time slots for follow-up are wasted due to rescheduling and "DNAs".

Despite only being in a trial phase, the clinics had identified several clear benefits from using telemonitoring to treat OSA syndrome. Four main benefits are illustrated and discussed below.

More efficient follow-up

One of the main challenges for the UK sleep clinics was to keep up with the need to execute follow-up on patients, both at the beginning of treatment and in annual follow-ups. Follow-up appointments were constantly being delayed, jeopardising the quality of treatment. Clinics found that telemonitoring improved the efficiency of follow-up visits in two ways:

- Reduced required nurse time by calling patients instead of physical visits at the clinic.
- Reduce the share of "do not attends" (DNAs).

Improved efficiency – time spend on physical vs virtual visit

30 minutes — Physical visit

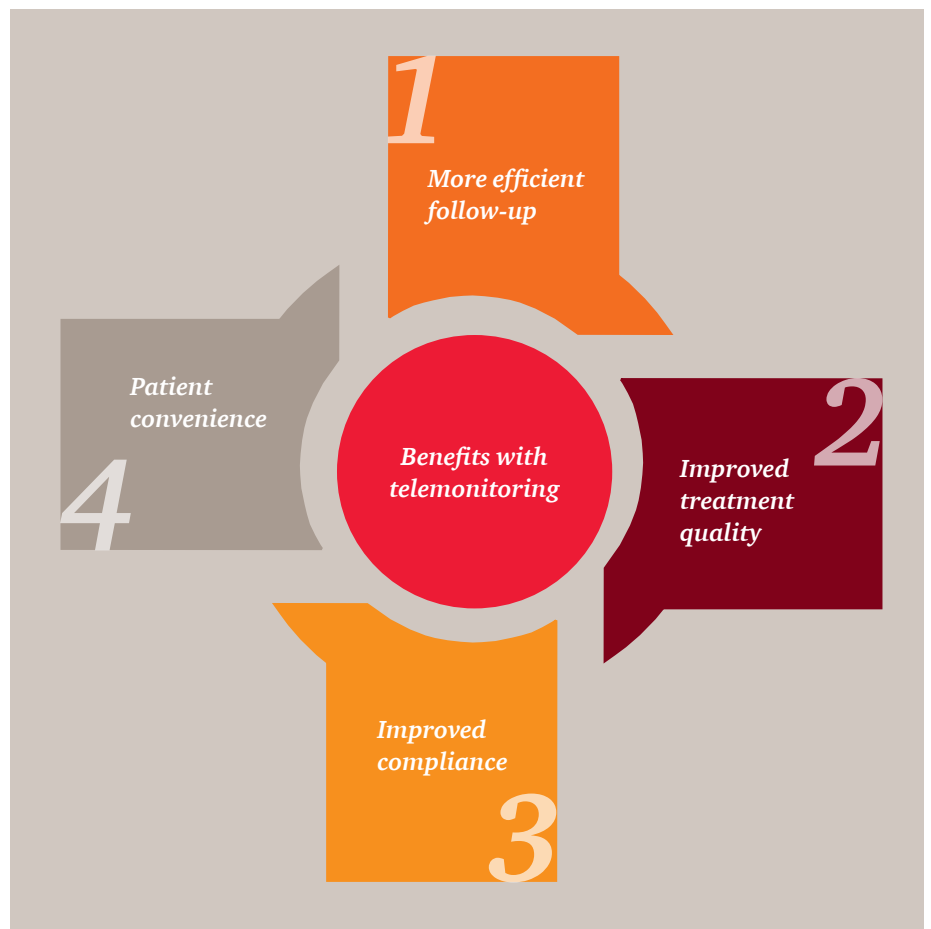**15 minutes** — Virtual visit with telemonitoring and phone/Skype.
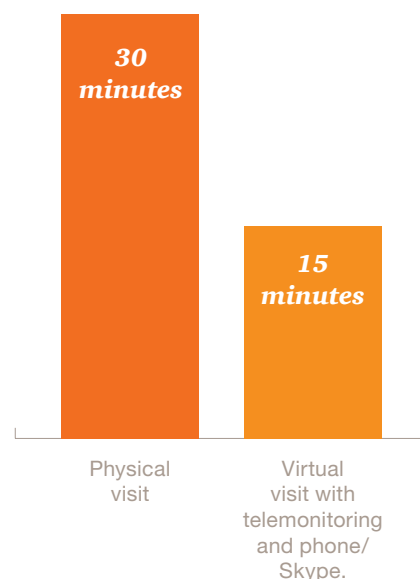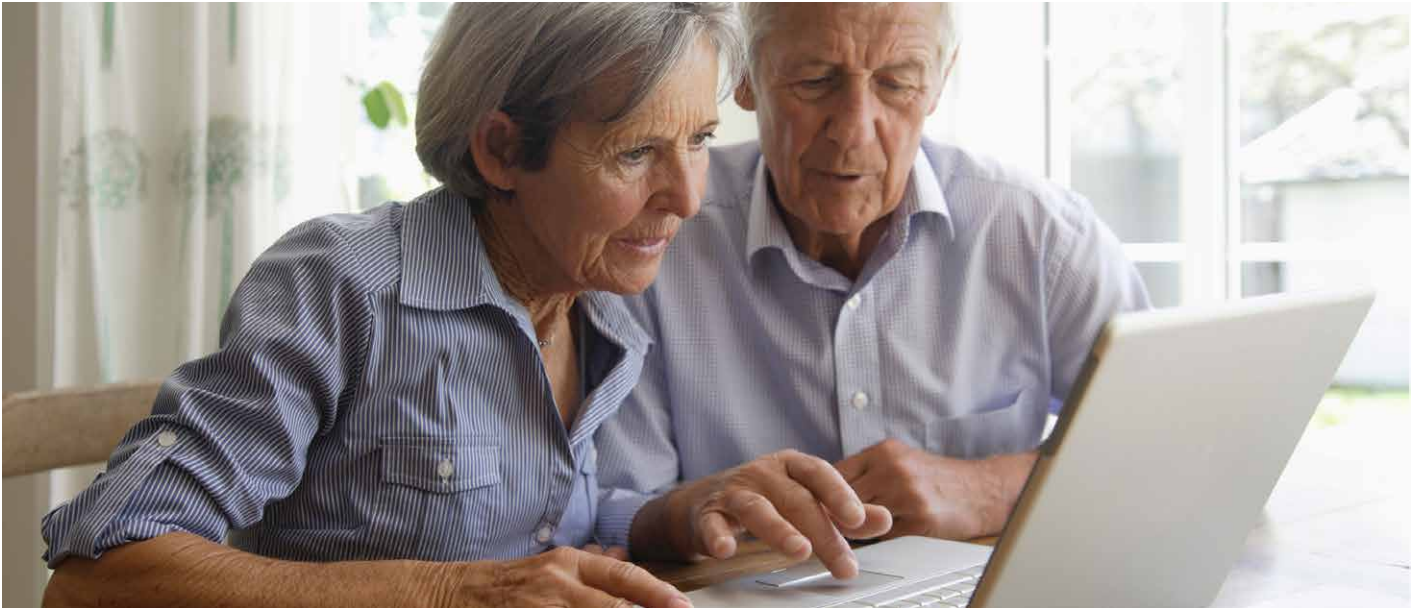
"With telemonitoring, we can interact with two patients in the same amount of time."

When introducing telemonitoring, clinics were able to replace physical visits with remote reading of patient data. One clinic noted that they could double the number of slots for follow-ups with the new method.

Furthermore, the capacity at UK clinics was strained as up to 40% of planned follow-up time slots were wasted due to patients not attending or rescheduling at the last minute. Initial trials of telemonitoring showed that the portion of wasted timeslots was minimised when the clinic staff reached out to the patient.

A study in Derby found that the use of telemonitoring could reduce the number of physical visits by a patient from an average of 4.5 for the traditional pathway, to only 2.3 for monitored patients. And, the DNAs frequency dropped to zero.[10]

1
More efficient follow-up

2
Improved treatment quality

3
Improved compliance

4
Patient convenience

Benefits with telemonitoring

10. "An evaluation of the benefits of a telemedicine service for CPAP follow up" Fillingham R C, Clinical Measurement Department, Royal Derby Hospital 2014

Improved treatment quality
Identifying and helping patients with issues is seen as an important measure of treatment quality. If a patient is not responding well to the treatment, there is a high risk that he or she will drop out. One clinic had started to systematically use telemonitoring to identify and reach out to patients with issues, thereby significantly increasing the quality of treatment.

Furthermore, the same clinic has noted that the number of patients calling to book an additional follow-up visit has decreased. By reacting to non-compliant patients and doing virtual patient interactions, the clinic was able to free up time slots that were previously required for extra follow-up visits.

A German study provides additional underpinning evidence to the trends seen in the UK clinics – namely: a significantly increased compliance for telemonitored patients compared to traditional patients.[11]

Target patients:
compliance improvement
Professional drivers were identified as a large patient group with a need for certified compliance. Despite frequent clinic visits to ensure compliance for this target group, clinics cannot have fully updated information as to how the patient is responding to the treatment. Telemonitoring provides reliable and continuous data on compliance for this group of patients.

Patient convenience
Patient convenience is recognised as one of the major benefits from telemonitoring in the UK. A physical visit is troublesome for patients in two distinct ways:

- Direct travel expenses (fuel and parking).
- Have to take time off from work to travel to and from the clinic.

Some patients also require ambulance transport to the clinic. Cost of ambulance transport is often not part of the clinic budget but significant savings can be made at a hospital level.

11. "Telemonitoring solutions for a homecare provider in obstructive sleep apnea (OSA), PwC Case study, 2015

Overview of patient compliance without and with telemonitoring and intervention
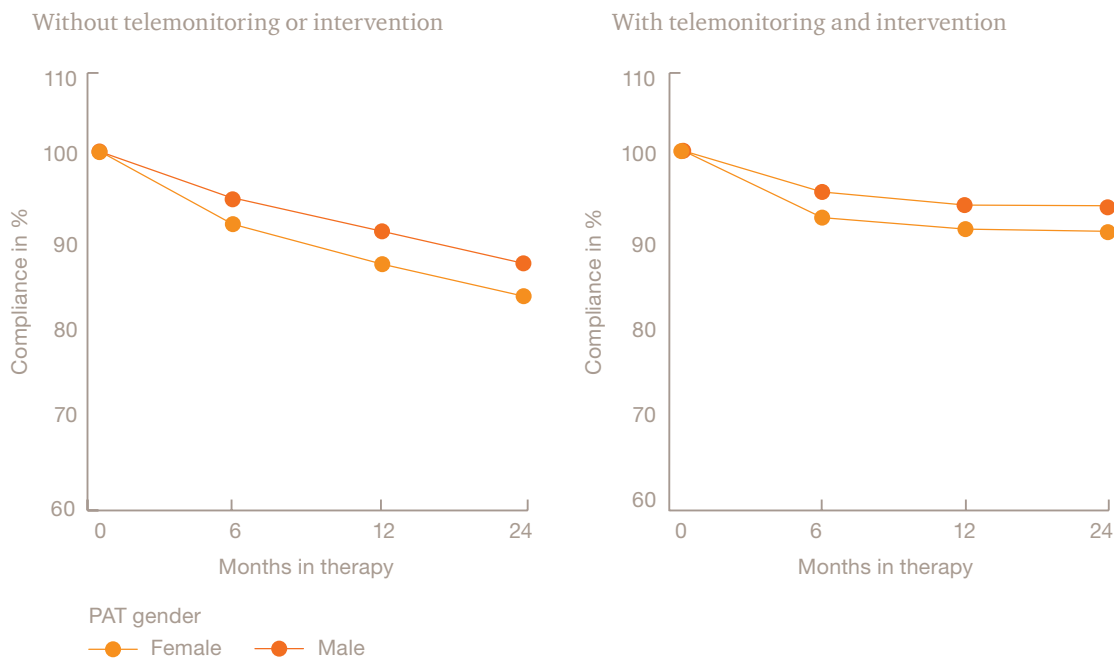
Without telemonitoring or intervention

With telemonitoring and intervention

PAT gender
— Female   — Male

Source: Telemonitoring solutions for a homecare provider in obstructive sleep apnea (OSA), PwC Case study, 2015

Patient interaction matters

Frequent and high quality patient interactions are seen as very important by clinic staff treating OSA patients. However, the interviewed physicians do not see physical visits as a guarantee to achieve this. Virtual interactions utilising modern technology, such as telemonitoring, can be used to reach the same, or even better, results.

Case study

Wrightington, Wigan and Leigh NHS Foundation Trust Hospital

In 2014 the sleep clinic at Wrightington, Wigan and Leigh NHS Foundation Trust Hospital was running at maximum capacity treating over 500 new patients per year. The clinic hoped to improve efficiency by introducing ResMed Air Solutions, a telemonitoring solution by the company ResMed.

One hospital within the NHS network, Wrightington, Wigan and Leigh NHS Foundation Trust Hospital, provides healthcare services to a population of over 300,000 patients in North-West England. The Sleep and Respiratory clinic within the hospital is staffed by four clinicians and one consultant working across sleep and respiratory wards. The clinic was established in 2009 and now supports over 2,000 patients setting up over 500 new patients per year.

Identifying the problem
Prior to October 2014, the clinic was experiencing major capacity issues and faced the prospect of exceeding its commitment to treat diagnosed patients within 18 weeks of referral. At the same

time, the therapy review period – the follow-up visits – was being stretched. One of the clinics senior clinicians, Claire Goulden, recognised that the traditional pathway would not be viable long term without some changes. Goulden says, "there was no scope for extra staff to cope with rapidly increasing demand whilst being able to cost-effectively maintain the traditional level of patient care".

Goulden then learnt about AirView™, part of ResMed Air Solutions, and was interested in the opportunity to increase efficiency in their care pathway. After completion of NHS IT & Information Governance approvals, the activation of ResMed Air Solutions commenced.

With telemonitoring the sleep clinic was able to increase the number of patient set-ups, patient satisfaction while boosting the quality of care.

Maximising capacity
Goulden says "by using AirView, the care team was soon able to quickly identify those patients who were non-compliant or experiencing problems". Using Air-View enabled the care team to increase new patient set-up slots by 25% and follow-up slots by 14%, whilst reducing unnecessary out-patient appointments and therefore appointments where the patient does not attend.

Increasing efficiency and patient satisfaction
Previously when patients reported issues, the patient would be inconvenienced by having to return their device to the clinic or for those patients unable to travel, two clinical staff, (due to safety precautions), would have to drive to the patient's home. Goulden says "with ResMed Air Solutions in place, the care team could remotely check the device

status using AirView's 'Remote Assist' feature and if required update therapy settings without leaving the clinic".

Boosting quality of care
The time savings realised by using ResMed Air Solutions has allowed Goulden and the team to spend more time on more complex patients, such as those with Central Sleep Apnoea (CSA) and Cheyne-Stokes Respiration (CSR) that can also be identified via AirView. Goulden says, "by implementing ResMed Air Solutions we will be able to replace the current six month follow up visit, typically 30 minutes in duration, for all patients with a targeted consultation for only the patients that require it. This will lead to further significant clinician time savings".

Claire Goulden – Wrightington, Wigan and Leigh NHS Foundation Trust Hospital

Increase in available time slots
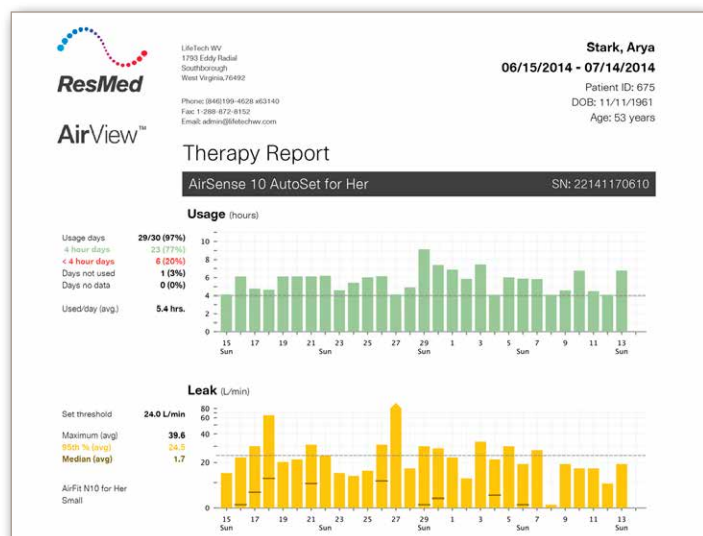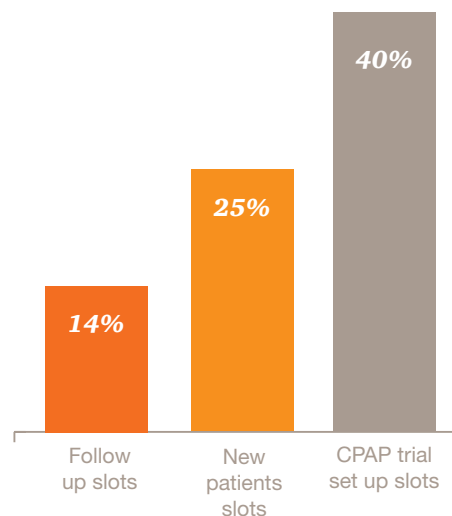
"By using AirView, the care team was soon able to quickly identify those patients who were non-compliant or experiencing problems."

4.

Outlook and conclusions

Deep dive into clinics

Countries studied

Brief overview of selected European countries

Studies by PwC indicate that findings from Finnish and UK clinics can be used to understand the state of OSA treatment across the European continent.

PwC European sleep studies
PwC has conducted studies on the treatment of OSA in eight countries across Europe, including Finland and the UK. The studies show that other European sleep clinics face similar issues to the clinics in Finland and the UK.

- Resources for sleep clinics are limited.
- Reimbursement models are often outdated, promoting inefficiencies at the clinics.
- The demand for sleep clinic services is growing as awareness of OSA is increasing.

These issues have caused many clinics in the studied countries to consider telemonitoring as part of a solution to the situation. However, adoption takes time and to-date telemonitoring is not widely used in the studied countries. It is our hope that this report will help clinics and decision makers to see the benefits of telemonitoring in the treatment of OSA.

A comparison of selected countries shows similar drivers and barriers to telemonitoring.

Country	State of sleep treatment	Drivers for telemonitoring	Barriers to adoption
UK	• Lack of capacity to treat new and existing patients. Temporary measures employed. • Hospitals are financially penalised if they fail to meet the 6 week time limit from referral to diagnosis, or the 18 weeks time limit from referral to treatment.	• Maintain clinical standards while increasing capacity with constant resources. • Improve patient convenience.	• Reimbursement model for some clinics. • Difficulties in changing patient pathway to fit telemonitoring.
Finland	• Growing waiting times. • Hospitals are fined for over three month waiting times.	• Reduce waiting times. • Improve capacity for new and existing patients within existing budget.	• Clinics are awarded fixed budgets regardless of the number of patients treated.
Sweden	• Growing waiting times for treatment. • Over one year waiting time at some clinics.	• Reduce waiting times. • Improve capacity for new and existing patients within existing budget.	• Difficulties in changing patient pathway to fit telemonitoring. • Reimbursement for physical visits in some regions.
Norway	• Growing waiting times for treatment.	• Reduce waiting times. • Increase number of treated patients.	• Reimbursement model. • Physical visits receive much higher reimbursements than virtual follow-up visits.
Poland	• Very low portion of population on treatment – due to lack of awareness and low priority. • Limited follow-up done today due to reimbursement model.	• Cost efficient method for follow-ups. • Clinic concerned about compliance.	• Reimbursement model. • Clinics are only reimbursed for diagnosis.
Belgium	• Cost of treatment is exploding. • Partially due to outdated reimbursement models.	• Government is looking to cut costs. • Telemonitoring is seen as a way to go forward.	• Reimbursement requires physical control visits. • Patient data privacy concerns.
Germany	• Majority of treatments are funded by insurance companies. • Cost of treatment is a major issue.	• Way to lower cost per patient. • Insurers demanding proof of compliance.	• Focus on absolute cost.
Czech Republic	• Very low share of population on treatment.	• Patient convenience.	• Reimbursement model not suitable for telemonitoring.

Succeeding with telemonitoring

Despite evident benefits from telemonitoring, any widespread adoption across Europe is still absent. Overcoming outdated reimbursement models and resistance to change is key going forward.

As has become evident in reviewing sleep clinics in Finland and the UK, telemonitoring can greatly improve clinic efficiency while contributing to better quality treatment and patient comfort. But why is the adoption rate of telemonitoring remaining at a low level across Europe?

The reasons have been identified in this study:

- Stagnant clinic reimbursement models.
- Resistance to change.

Successfully overcoming outdated clinic reimbursement models

Clinic and hospital reimbursement models differ greatly, both between countries and for clinics within the same country. Some clinics have a variable compensation based on for example patient visits, new patients treated and/or number of patients in treatment while other clinics have a fixed budget, regardless of how many patients are treated.

However, what is common for most clinics is that the reimbursement models were set-up before efficient telemonitoring solutions were introduced for OSA

treatment. Variable reimbursement is often based on what clinics do (e.g., seeing a patient at the clinic), rather than how patients are doing (e.g., patient is responding well to the treatment), while fixed reimbursement does not take treatment quality into account to any degree. Some clinics even experience a negative financial impact from introducing telemonitoring as only physical clinic visits are reimbursed.

We propose that decision-makers at all levels should take a patient perspective, instead of a clinic perspective, when setting reimbursement levels. Instead of demanding specific actions, sleep clinics should be steered towards providing efficient and high quality care for their patients. More patients could be treated with a high quality level and at a similar or lower cost if this approach was be taken.

Case 1: New reimbursement models

One clinic in the UK was receiving only 30% of the compensation for remotely monitoring and calling the patient than they would receive by physically dealing with the patient at the clinic. With these conditions, it would have been financially unviable to introduce telemonitoring and substitute a clinic visit with remote monitoring and phone calls.

However, the clinic was determined to introduce telemonitoring in order to both improve treatment quality and clinic efficiency. The clinic staff took the discussion to the regional NHS trust, and by showing the clear benefits from telemonitoring, the parties were able to come to a conclusion. The compensation discount was set at c. 65% of a physical visit. In effect, the clinic receives 65% of the revenue, and spends 50% of the time compared to a physical visit, leading to an overall positive financial effect for the clinic.

This made it possible for the clinic to adopt telemonitoring into the treatment process. Three physical visits during the first year of treatment could be replaced by remote monitoring and phone calls, effectively decreasing the nurse time required for each new patient treated by up to 60%. At the same time, the Trust was also able to significantly reduce the cost per patient.

Overcoming resistance to change

Resistance to change is a common barrier as regards all types of technological innovation. Many clinics that had not yet started with telemonitoring expressed concerns over telemonitoring with the two following worries often coming to the fore:

- "We fear telemonitoring will add to our workload – where would we find the time to use all that new information?"
- "We're unsure as to the data provided by telemonitoring. Does it give me all the data I need on my patients?"

However, clinics that have implemented telemonitoring are able to counter these worries: The workload actually decreases, as telemonitoring enables the clinic to have fewer physical visits while increasing patient interactions. And the data provided by telemonitoring – often complemented by a phone call – is deemed fully satisfactory by the interviewed clinics.

Clinics can overcome this resistance by gradually introducing telemonitoring in small steps, as clinics in both Finland and the UK have done. This approach minimises the sudden changes that have to be made in the patient pathway, while enabling the clinic to experience the benefits first-hand. Furthermore, we suggest that clinics that are interested in introducing telemonitoring learn from other clinics by studying established patient pathways incorporating telemonitoring.

PwC and this research

The research

This report is based on knowledge gathered first hand at a number of sleep clinics across eight countries in Europe. The studies have been sponsored by ResMed, a global leading provider of sleep and respiratory care solutions.

PwC

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PwC reports on eHealth

- "The doctor is in – your smartphone" *2015*

- "Telemonitoring solutions for a homecare provider in obstructive sleep apnea (OSA)", PwC Case study, *2015*

- "Global health´s new entrants: Meeting the world's consumer" *2015*

- "Emerging mHealth: Paths for rowth" *2014*

- "The global mHealth market opportunity and sustainable reimbursement models" *2013*

- "Touching lives through mobile health" *2012*

- "Moving towards good practice in the reimbursement of CIED telemonitoring" *2012*
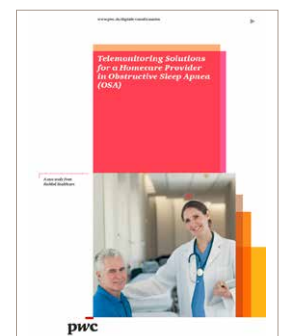
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