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# High adherence to continuous positive airway pressure (CPAP) in patients with obstructive sleep apnea (OSA) in Belgium: a narrative review.

## Abstract

**Objectives:** Continuous positive airway pressure (CPAP) is the “gold standard” treatment for moderate-to-severe obstructive sleep apnea (OSA), but adherence is an important issue. The aim of this paper is to review Belgian data on CPAP users and their adherence over a period of 11 years (from 2008-2018).

**Methods:** Data delivered annually by the CPAP centers to the Belgian National Institute for Health Insurance (RIZIV/INAMI) were studied. Comments on these results were embedded in a narrative review.

**Results:** On January 1<sup>st</sup> 2008 27.266 Belgian patients were actively treated with CPAP, and at the end of 2018 this number increased to 121.605. In 2018, the short-term adherence ( $\leq 3$  months) to CPAP was at least twice as high compared to the United States: the CPAP termination rate in Belgium (mainly due to a stop of reimbursement because adherence  $< 4$  h / night) was estimated to be 12.4%, considerably lower than the 31.1% of patients on CPAP in the United States using the device  $< 4$  h.

**Conclusion:** We speculate that this good adherence might be attributed to a stringent Belgian diagnostic and treatment convention model. This model uses “gold standard” techniques (including in-hospital polysomnography), imposes a minimum capacity of medical doctors and paramedical collaborators, a strict follow-up of the patients, multidisciplinary care and proof of competency. Taking into account the increasing number of patients on CPAP, a change in the Belgian care strategy is under consideration focusing on more out-of-centre patient’s management; we propose a step-by step approach with careful monitoring of the impact of changing policy on adherence.

## **Introduction**

Obstructive sleep apnea (OSA) is characterized by repeated pharyngeal obstructions despite respiratory effort. OSA is often associated with symptoms, including loud snoring, witnessed apneas and excessive daytime sleepiness. Moreover, there is an association with cardiovascular disease and metabolic dysregulation. Subjects with moderate-to-severe OSA (defined as an apnea-hypopnea index (AHI = number of apneas and hypopneas / hour of sleep)  $\geq 15/h$ ) have a twofold risk of mortality [1]. However, increased cardiovascular risk has only been described in patients with either severe OSA or in OSA with hypersomnolence [2-4].

The “gold standard” treatment for moderate-to-severe OSA is continuous positive airway pressure (CPAP) [5].

## ***Diagnosis of OSA***

According to the American Academy of Sleep Medicine (AASM) guidelines, testing should be carried out after a comprehensive clinical sleep evaluation under supervision of a board-certified sleep physician. The “gold standard” test is polysomnography (PSG) conducted in an accredited sleep laboratory [6]. Polygraphy (PG) is an (often unattended) diagnostic study measuring different (cardio)respiratory signals without measuring sleep itself. The AASM allows the use of PG within strict conditions. The PG should be administered and interpreted by an accredited sleep center and is only recommended in “uncomplicated” patients defined by 1) absence of conditions that place the patient at increased risk of central apneas or hypoventilation (e.g. significant cardiopulmonary disorders, stroke, use of opioids, neuromuscular disorders, ...) or 2) a concern for significant non-respiratory sleep disorders (e.g. severe insomnia complaints, suspicion of hypersomnolence of central origin, ...).

The application of this guideline is variable in Europe: e.g. in Belgium, in-hospital PSG is the national standard for diagnosis while in Finland diagnosis using home PG is the national standard.

## ***Treatment of OSA***

The effective level of CPAP pressure should be individually determined. According to the AASM, it is recommended to perform in-laboratory pressure titration. However, under strict conditions, titration at home can be performed by using positive pressure devices in auto-adjustment mode (APAP) [9].. Home APAP titration is only recommended in “uncomplicated” patients. Close follow-up by a trained sleep center staff during the titration period and initial treatment with CPAP is recommended [9]. Again, the application of this guideline is variable in Europe. Different sleep labs organize their approach of titration and follow-up by engaging home care providers (HCP's). Unfortunately, no

detailed European data are available with regard to this topic. In Belgium, in 2018, 19% of the centers engaged HCP's in the titration procedure, but their role was limited to transmission of the APAP data to the physician; in 25% HCP's were involved in the follow-up of therapy adherence in close collaboration with the center: motivating the patients, including monitoring adherence and regularly reporting these data to the center. The recent report by the Belgian Health Care Knowledge Centre (KCE) delivered some data from other European countries and demonstrated high variability [8]: in Germany, the HCP's are led by state-certified technical engineers with in some cases also medical doctors in their teams and their role is limited to transmission of the APAP-data to the physician; in France and the Netherlands, the vast majority of titrations are performed at home with HCP's involved [8].

### ***Aim of the present study***

CPAP therapy adherence is a crucial, important health outcome parameter [10-14]. The Belgian convention approach (see methods) is characterized by uniformity in diagnosis, treatment initiation and follow-up of patients. Within the convention system annual reports provide an opportunity to study CPAP adherence. Moreover, over the last years, some changes in the Belgian reimbursement rules were introduced and the impact of these changes on patient inclusion and CPAP adherence can be studied.

The aim of this paper is to review Belgian data over a period of 11 years (from 2008 -2018), especially focusing on CPAP adherence. In the discussion, a narrative review of relevant data is added to benchmark with the Belgian findings.

## Methods

### ***Diagnosis of OSA and CPAP-treatment in Belgium: the Belgian OSA convention system***

Reimbursement of CPAP in Belgium is performed by the Belgian National Institute for Health Insurance (RIZIV/INAMI) within a convention system based on an agreement with interested hospitals. In case of CPAP, the hospitals obtain a defined fee per day per patient in charge to cover the costs of treatment including materials, non-medical and medical costs.

To obtain reimbursement 1) an AHI threshold evaluated by in-hospital PSG and scored in a uniform way, and 2) in-hospital CPAP pressure titration are mandatory (although since 2018, home PG has been allowed in “uncomplicated” patients with an obstructive AHI (OAHl)  $\geq 30$ /h of sleep). CPAP prescription is only allowed by physicians accredited by the RIZIV/INAMI (pulmonologists, neurologists, internal medicine specialists or (neuro)psychiatrists) working in a hospital sleep laboratory recognized within the convention.

The convention system imposes multidisciplinary activity. Collaboration with an ENT specialist and a dentist (or orthodontic or stomatologist or maxillofacial surgeon), accredited by the RIZIV/INAMI, to deliver mandibular advancement device therapy instead of CPAP is obligatory. Moreover, a minimal presence of nurses and/or paramedics in the sleep lab (with a potential role in problem-solving, education and motivation of the patients) is mandatory. Furthermore, there is an obligation to collaborate with other care givers: psychologists who can help to educate and motivate the “more difficult” cases, but who can also treat co-existing insomnia; and dieticians and physicians engaged in treatment of obesity (endocrinologists, bariatric surgeons).

Proof of CPAP adherence is needed for continuation of reimbursement. Each application for prolongation of reimbursement has to report on the exact average number of hours use / night over the previous period. All centers have also to report annually the number of patients in follow-up (see figure 1). These data available for the period 2008-2018 enabled us to study the evolution in the number of patients and the number of new patients starting CPAP annually over more than a decade. Moreover, the separation in the reports between the number of new patients still actively treated and the number of them who terminated treatment during that year, enabled us to estimate the short-term adherence.

Until 2017 CPAP was reimbursed in case of an AHI  $\geq 20$ /h (using the AASM 1999 scoring guidelines) and a sleep fragmentation index  $\geq 30$ /h [15]. From 2017 on the cut-off value for reimbursement changed to an OAHl (number of obstructive apneas, mixed apneas and obstructive hypopneas)  $\geq 15$ /h (using the AASM 2012 scoring guidelines) [16]. Moreover, until 2017, patients needed to use CPAP for a mean of at least 3 h / night (based on the time counters of the CPAP device ) and adherence should be attested after 6 months (and thereafter annually). From 2017 on minimal adherence was

at least 4 hours and in 2018 proof of adherence was made even more stringent: a first evaluation needed to be performed within 3 months instead of 6 months and adherence data needed to be accompanied by an outprint of the CPAP device data. We studied the possible impact of these changes on patient inclusion and CPAP adherence.

***Comments on the results were embedded in a narrative review***

This review is based on references found in the 2020 Belgian KCE report and supplemented with a systematic review on CPAP adherence published in 2016 [8,17]. To benchmark the Belgian “real world” data to similar data from other West-European countries, North-America and Australia/New-Zealand we conducted a PubMed search between Jan 2016 and Dec 2020 using the combined search terms “CPAP and adherence”. This search yielded 474 articles, but after reading the titles, and if necessary the abstracts, only 1 paper on “real world” adherence was found[18].

## **Results**

### ***Evolution of the number of CPAP treated patients in Belgium***

In 2018, 67 centers were accredited by the RIZIV/INAMI: an equivalent of 1 center per 87.906 Belgian inhabitants aged 30-70 years [19]. In table 1 we show data on the capacity and the growth based on the number of new patients starting CPAP per center and bundled at regional and provincial levels. The capacity of the centers increased significantly, and this was true for all three Belgian regions: in 2008 68% of the centers started less than 100 new CPAP treatments and no center started more than 500. In 2018 only 6% started less than 100 new patients and 18% started more than 500. Consequently, increasingly more patients are treated with CPAP. This is illustrated in figure 2. On January 1<sup>st</sup> 2008 27.266 Belgian patients were actively treated with CPAP, and at the end of 2018 (over a period of 11 years) this number increased to 121.605. Taking into account the total Belgian population between 30 and 70 years, 121.605 represents 2.1% [19].

### ***CPAP adherence and impact of change in reimbursement rules***

Figure 3 shows the proportion of patients that terminated treatment per year. From 2008 to 2012, a significant number of patients per year changed from center: in the centers where patients left, they were considered as patients that stopped CPAP treatment, which was not reality. In order to counteract this bias we only comment on the years from 2013 on. The percentage of patients already treated before the current year that terminated during the specific year dropped from 8.2 in 2013 to 7.2% in 2016; and, the percentage of new started patients that terminated CPAP in the same (starting) year remained stable: 8.1 in 2013 and 8.0% in 2016. As presented in figure 3 there were regional differences demonstrating a considerable higher percentage of patients that stopped CPAP in the Brussels region.

In 2017 reimbursement rules changed and patients needed to use the device for a mean of at least 4 hours / night instead of 3. The percentage of patients that terminated CPAP treatment increased by 12.2%, mainly caused by an increase in patients who were treated since longer time; in 2018 no further increase was noted. Also the percentage of new patients who terminated CPAP increased in 2017 and increased further in 2018.

In Belgium, as represented in figure 3 and 4, the percentage of new CPAP patients who started CPAP in 2018 and terminated CPAP during the same year was 9.3%, but this number is potentially an underestimation because in case patients started treatment after October 1<sup>st</sup>, an evaluation after 3 months was often not carried out within the same year. Taking this into account the termination rate can be calculated as being 12.4% (figure 4). Moreover, according to the convention rules, non-adherent patients who want to continue CPAP can get a second chance with an additional

assessment 3 months later. If we hypothesize that all non-adherent patients terminated treatment at this second time-point, only evaluation of patients who started in the first half year could be taken into account and the termination rate in that case would be 18.6% (figure 4). But vice versa, 18.6% is an extreme overestimation of the CPAP termination rate because 1) in real life only part of non-adherent patients want or will be allowed to continue the convention after the first 3 month-assessment and 2) patients adherent at 3 months can terminate some months later within the same year. Consequently, the “real world” termination rate in Belgium in new started patients within 3 months will be between 12.4% and 18.6%, and most probably closer to 12.4%.



## Discussion

At the end of 2018, the number of Belgian patients actively treated with CPAP was 3.5 times higher compared to 2008 and their short-term adherence ( $\leq 3$  months) to CPAP was at least twice as high compared to the United States. We will speculate on possible reasons for that.

### *Increase in the number of patients treated with CPAP over the years*

At the end of 2018, 121.605 patients representing 2.1% of the total Belgian population between 30 and 70 years were actively treated with CPAP. This number appears huge, but a recent publication estimated that 15.7% of the Belgian adults between 30-70 years suffers from moderate-to-severe OSA, regardless of symptoms, while in a recent population-based study in the Lausanne region, performed in the age category of 40-80 years, the prevalence of moderate-to-severe OSA was 23.4% in women and 49.7% in men [20,21].

Given the steadily rising number of CPAP users, the high number of CPAP users in 2018 (figure 2), and the observation that this number is still far below the estimated prevalence of moderate-to-severe OSA (cfr supra), concerns were raised about potential future health-economic implications. This was the reason why the RIZIV/INAMI requested a KCE evaluation [8].

OSA is undoubtedly a problem of public health, but the prevalence numbers from the studies mentioned above result in an overrating of the problem [22]. There is more and more evidence that CPAP treatment should not be AHI driven: indeed, the metric AHI is controversial and under debate. In the recent epidemiological study by Heinzer, the number of patients with  $AHI \geq 15$  was 4 times higher than the somnolent patients with  $AHI \geq 5$  (12.5% in men and 5.9% in women) [21,23]. This means: if the AHI would be the diagnostic test and sleepiness the indicator of true disease, the test would be characterized by a high sensitivity and low specificity with a lot of false positives. Moreover, so far, RCT's on hard-outcome cardiovascular parameters (myocardial infarction, stroke, death, ...) showed no benefit of CPAP [11,12,24]. There are different explanations for these "disappointing" results. First, the association between OSA and cardiovascular risk may vary with the patients' phenotype. For example, such association has been reported to be higher in younger subjects and in those with excessive daytime sleepiness [1,25]. However, (severely) somnolent patients were excluded in these RTC's. Moreover, in the largest RCT so far, patients with pronounced hypoxemia were also excluded, while there is evidence that hypoxic burden, rather than AHI, predicts cardiovascular mortality [12,26]. Second, adherence to CPAP (in these not severely somnolent) study populations was poor, potentially reducing the benefit on cardiovascular outcomes. Meta-analyses of the RCT's revealed that patients using the device  $\geq 4$  h/night demonstrated cardiovascular benefit, especially related to stroke [14,27].

Consequently, the guideline of the US Preventive Services Task Force not to screen in asymptomatic adults, although simple unobtrusive tools are available today, makes sense except, probably, for resistant hypertension and atrial fibrillation [28-30]. Recently, in this context, a multicomponent grading system of OSA severity, including a combination of AHI > 15, symptoms and possible end-organ impact has been proposed [31].

More research related to cardio(vascular) and cerebrovascular risk profiling (phenotyping) is needed. Further studies focusing on patient's reported outcomes and comorbidities based on alternative metrics (e.g. hypoxic burden, potentially easier to measure) and using methodologic approaches through detailed meta-analyses or artificial intelligence analysis of real big data may help. In the mean time we should not throw the AHI in the trash: there is convincing evidence based on a meta-analysis demonstrating that severe OSA is an independent predictor for cardiovascular and all cause mortality in long term cohort studies [32]. Moreover, a number of the studies included in this meta-analysis provide indication of a significant protective effect of CPAP therapy [33-35]. Data from existing meta-analyses emphasizing the importance of adherence to obtain any cardiovascular benefit merits special attention [14,27].

### ***CPAP adherence and impact of change in reimbursement rules***

The main intention of this paper was to compare Belgian data on adherence with other adherence data.

In 2016 a systematic review on CPAP adherence in RCT publications was published [17]. Short-term data (<6 months) revealed a mean CPAP use of 4.3 hours. Three years later a big data study on CPAP adherence in the United States was published by Cistulli et al. [18]. The primary outcome of this study was the adherence after 3 months in 2.621.182 patients: the mean+/-SD use of CPAP was 5.1+/-2.5 h / night. Consequently, this largest analysis of objective CPAP usage ever undertaken, demonstrated that adherence based on "real world" data appears higher than is generally acknowledged.

Figure 4 shows the comparison between the United States and the Belgian 2018 data. In the United States 31.1% of the patients used the CPAP for less than 4 h / night 3 months after CPAP initiation. Unfortunately, although all Belgian centers were obliged to report the exact average nightly use each time they asked for a prolongation of reimbursement, the Belgian RIZIV/INAMI did not collect these data in a national database. This is the reason why we cannot perform a detailed comparison with the "Cistulli publication". But, based on the dropout percentages of the new CPAP patients in the yearly reports, we can estimate that the "real world" termination rate in Belgium in new started patients ~ non-adherence < 4 hours within 3 months is between 12.4 and 18.6%, and most probably closer to 12.4% which is considerable lower than the 31.1% in the United States.

We are aware that this comparison between CPAP termination rate and proportion of patients in the US that used CPAP >4 hours/night has several limitations. However, we are convinced that the CPAP termination rate in Belgium is mainly due to a cessation of reimbursement with adherence <4 because on this very short time base of 3 months only a very small amount will be cured (e.g. after bariatric surgery) or changed to MRA. The comparison with the United States is possibly influenced by differences in socioeconomic status and access to care. We could not analyze the Belgian data with regard to socioeconomic status, because these data were not available. However, we have regional data (Wallonia, Brussels, Flanders), figure 3. The highest termination rate in new started patients was observed in the Brussels region, a region with an 21.8% lower average income per capita in comparison to the whole Belgian population [19]. Nevertheless, the highest termination rate (14.7% in 2014) in Brussels in new started patients (figure 3) is still lower than the 31.1% value of the “Cistulli publication”.

Besides, the good adherence data in Belgium, especially the absence of an obvious increase in termination rate of the new patients over the years (figure 3) underlines that there is no overshooting in starting-up CPAP and can be considered to be related to the expertise of the physicians within the Belgian convention centers or at least to the current organization of care.

In 2017, the Belgian data revealed a temporary increase in the termination rate of patients being treated since longer time; in 2018 no further increase was observed. This temporary increase is most probably related to the increase in the adherence cut-off. By increasing the adherence cut-off from 3 to 4 hours a night, we possibly denied treatment in part of the patients who, albeit having a lower adherence, do have a sufficient usage to feel better. Weaver et al demonstrated that the impact on daytime sleepiness is more obvious with a higher adherence, while a use between 2-4 hours a night already resulted in improvement of sleepiness in some patients [10]. Unfortunately, we are not able to check this: for reasons already mentioned above, we do not have data on the amount of the patients who were obliged to stop CPAP treatment due to a usage between 3 and 4 hours/night. The percentage of new patients who terminated CPAP also increased in 2017 and increased further in 2018. Is this a reflection of overshooting in CPAP prescription, or is this a reflection of offering patients the opportunity to feel better with CPAP (but at the end not fulfilling the 4 h cut-off adherence as discussed above): an open question?

In the present review, the following aspects were not addressed and could be considered limitations. The data are based on yearly reports delivered by the centers themselves and these could be prone to minor mistakes.

Since 2017 the convention system enabled reimbursement of mandibular advancement devices (MAD) in case of  $OAHI \geq 15$ . The number of patients actively treated with MAD was 857 in 2017 and 2450 in 2018 or respectively 0.8% and 2% of the total number of patients treated for  $OAHI \geq 15$ . Because these numbers are very low, we did not comment on the possible impact on new patients or CPAP adherence, but this has to be evaluated in the future.

Since 2018, APAP titration at home followed by proof of disease control using PG at home was allowed in case of  $OAHI \geq 30/h$  in “uncomplicated” patients. This new approach was performed in less than one quarter of the centers. Although the reasons for such a low usage remain speculative, problems related to a prompt (re-)organization of the sleep lab, including the acquisition of PG’s, surely play a role. Because we only have data with regard to one (first) year, we decided not to evaluate the possible impact.

Only data on short-term adherence are shown, no long-term data. A detailed analysis of the Belgian data based on the yearly report related to long-term adherence is impossible: the data in the “already treated” columns (figure 1) are averaging adherence of patients that started treatment over several different years (~continuous inflow of new patients). Nevertheless, as represented in figure 3, each year the percentage of patients in Belgium already treated before the current year that terminated CPAP use that year is lower than the termination rate in new patients. This observation is proof that adherence to CPAP does not erode over time. Based on older Belgian CPAP convention data, Sucena showed in a monocentric study an improvement in adherence over a period of 11 years by an average of 8 min/night each year of continuing therapy and the difference in adherence became significant from the third year of treatment onwards, provided they did not quit [36]. The percentage who abandoned treatment over a period of 5 years was 22.7% in total, and this was the case for 14.3, 3.2, 1.9, 1.3 and 1.9% after 1, 2, 3, 4 and 5 yrs, respectively. They demonstrated that the reason to stop was death or cure (e.g. by weight loss, bariatric surgery, ...) in at least 70%.

Recently, the RIZIV/INAMI questioned the traditional hospital-centred model driven by PSG, for diagnosis and treatment of OSA. The KCE report, published in July 2020, clearly advises a more out-of-centre approach [8]. Unfortunately, in their report the aspect adherence was not well addressed. We assume that high (short-term) adherence in the present Belgian situation is due to the bundled approach of in-hospital polysomnography for diagnosis of OSA and for proof of CPAP efficiency as well as medical and paramedical infrastructure, multidisciplinary care and proof of competency to diagnose, treat and follow up patients. However, it could be argued that these bundled components have different weights towards outcome. E.g. home PSG or PG could replace in-hospital PSG for diagnosis or for assessment of CPAP efficacy, with or without impact on adherence and the same is through for transmitting care to less trained primary care or nurses instead of sleep specialists. There

are no data available focusing on adherence analyzing the relative importance of the components of care separately. Yet, we want to emphasize three points.

First, a shift towards a diagnostic home PG and expanding home PG could be a solution for the (probable) underdiagnosis of OSA in the community. However home PG is not only less sensitive than PSG in detection of OSA (and a false negative test could result in harm to the patient due to denial of a beneficial therapy), the specificity is also not 100%. According to the recent publication of the AASM, specificity of PG (type 3 monitoring) to diagnose OSA (AHI on PSG  $\geq 15/h$ ) in a population highly suspected of OSA ranged between 25 and 97% with a false positive rate between 1.1 and 27% [6]. Indeed, scoring of respiratory events during nocturnal unstable sleep-wake periods with accompanying unstable breathing may overestimate the PG-AHI. False positive diagnosis of OSA on PG, which will be especially the case in subjects with insomnia or underlying periodic limb movements, will result in useless CPAP treatment with accompanying non-adherence (and denial of beneficial therapy again).

Secondly the comment on the rather relative relevance of AHI as parameter of severity of OSA described in the first part of the discussion, opens the discussion whether full control of AHI as parameter of CPAP efficacy should remain the primary goal and further questions whether a full PSG in order to check efficacy is still defensible. In a lot of patients titration based on a combination of clinical improvement (improvement of somnolence or other neurocognitive parameters and snoring) and surrogate AHI-parameters for PSG-AHI on the memory card of the CPAP-device represents another possible approach. In that case telemonitoring and clinical expertise play an important role. A final check with a home PG modality able to measure oxygen and oxygen desaturations related to obstructive events remains important taking into account the presumed impact of hypoxic burden on cardiovascular comorbidities [22,26]. In case of failure of CPAP efficacy, ePSG valuation in order to detect other sleep disorders than OSA should remain the gold standard.

Thirdly, increased complexity in detecting the patient groups that would truly benefit from CPAP represents an argument in favor of concentrating diagnosis and care in specialized centers. We found 2 RCT's comparing management performed by sleep physicians to primary care physicians with focus on adherence [37,38]. Both studies compared the approach of sleep specialists with primary care centers consisting of both a primary care physician and nurses. Both physicians and nurses had to follow an education programme delivered by the sleep centre lasting for more than 5 days. Only in the study of Sanchez-de-la-Torre adherence was the primary outcome parameter [38]. The patients were selected based on an AHI  $\geq 30$  with hypersomnolence and/or high cardiovascular risk; and, CPAP titration was performed in the sleep centre. After six months, the adherence was similar on both arms. They concluded that follow-up by trained primary care centres (primary physicians and nurses) in patients with a clear-cut diagnosis of severe OSA and titrated in the sleep center can be

considered. In a second study (Chai-Coetzer et al.) the primary care centers diagnosed the patients, performed CPAP titration and follow-up by using a questionnaire and oximetry plus APAP; sleep specialists could decide whether additional diagnostic PSG and or in-hospital titration were necessary. After six months, the adherence appeared similar in both arms. However, based on the number of patients still using CPAP, the mean use was 4.8+/-2.1 h in the primary care versus 5.4+/-0.3 in the sleep center group ( $p=0.11$ ), but there was a drop out of 30,1% in the primary care arm compared to 13.5% in the sleep center group. This latter study is very important as it underlines that expertise remains mandatory. When combining both studies, the data are in favor of a sleep center based approach with a possibility to delegate follow-up to trained primary care centers after diagnosis and CPAP titration in the sleep center..

In summary: the good adherence data in the existing Belgian convention system are of relevance to the organization of care for OSA in Belgium, especially in the light of the recent report of the Belgian KCE on the subject; and the decisions that could be derived from these recommendations that may change the current care model.

Based on the KCE report, an increase in out-of-centre patient's management for OSA diagnosis and treatment is certainly defensible in some patient subgroups. However, the impact on adherence should be carefully monitored. Therefore, we advise to perform step-by-step changes taking into account the expertise of sleep centers (expertise built up over years) and to meticulously study the impact of changes of adherence on a national level in a national database.

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Figure 1. Annual report to be sent by each center to the Belgian national health insurance

Table 1. Activity of the different centres in Belgium, expressed as the number of new patients starting CPAP-treatment in 2008 versus 2018, bundled per region and province

Legend: Blanco field represent not yet active or termination of activity (the latter was mainly the result of a merge of hospitals)

Figure 2. Number of CPAP patients treated, and yearly increase in CPAP users actively treated compared to the previous year

Figure 3. Percentage of CPAP users that terminated CPAP treatment

Legend: Of note: in 2008 – 2012 a large number of patients per year changed between centers: in the centers where patients left they were considered as CPAP terminators, which was not reality. In order to counteract this bias we will only comment on the years 2013-2018.

Figure 4. CPAP adherence within the 3 months in 2.657.983 patients (adapted from Cistulli et al.\* [18]) and benchmarking with Belgian data

Legend: \* we adapted the numbers of Cistulli et al. by adding the 1.4% of patients that were excluded because of a use of CPAP < 1 h in the first 3 months.