



Patient Self-Management in PAP Therapy



The possibilities of mobile apps and the effects on treatment success

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Prevalence of Sleep-Disordered Breathing (SDB)

Sleep-Disordered Breathing (SDB) is a widespread chronic illness associated with increased mortality and an enormous economic burden for society. (Bally S., 2016), (Arnaud C., 2009) Study results indicate that about four percent of adult men and two percent of adult women are affected by SDB. Based solely on an $AHI \geq 5$, the estimated prevalence is substantially higher at 24 percent of men and nine percent of women. (Young et al., 1993 and 2003) .



The latest epidemiological studies, however, estimate the prevalence of SDB significantly higher than previously assumed, at 49 percent of men and 23 percent of women. (Yetkin O., Kunter E., Gunen H., 2008), (Epidemiology, 2017), (Heinzer R. et al., 2015)

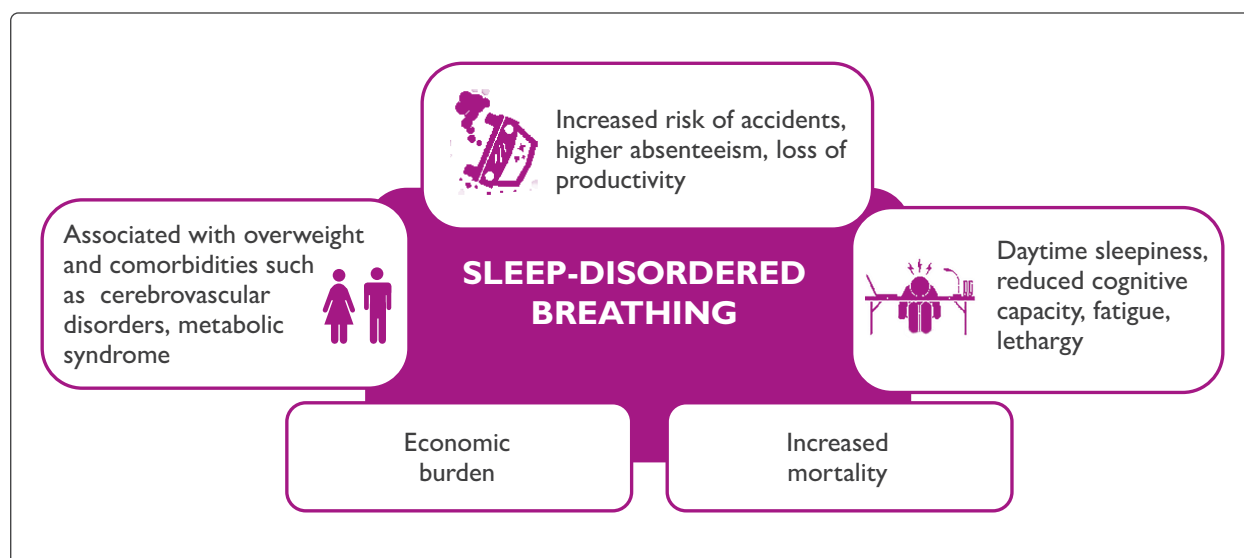


Figure 1: Effects of Sleep-Disordered Breathing

The greatest challenge: Patient acceptance and adherence

- PAP therapy is a demonstrably effective treatment for Sleep-Disordered Breathing. Diverse studies have proven the effectiveness of CPAP therapy, depending on the degree of compliance or with compliance of more than four hours per night. (Palm, Midgren, Theorell-Haglöw, Janson, & Lindberg, 2017), (Antic et al., 2011), (Billings M.E. et al., 2014), (Bouloukaki I. et al., 2017), (Kasai T., Narui K. et al., 2008), (Kingshott R.N. et al., 2000), (Peker Y. et al., 2016), (Abuzaid A.S. et al., 2017), (Weaver et al., 2007)

- Longer usage times of more than six hours per night are associated with significantly improved symptoms, better cognitive function and notably reduced blood pressure. (Weaver T.E., 2007), (Barbé F., 2010)
- The therapy, however, is not without side effects. Consequently, even patients with severe cases of Obstructive Sleep Apnea Syndrome (OSAS) show suboptimal acceptance of and adherence to therapy. (Engleman H.M., Wild M.R., 2003), (Weaver T.E., Mancini C., Maislin G., 2012), (McEvoy R.D., Antic N.A., Heeley E., 2016)
- Approximately 46 to 83 percent of OSAS patients use their devices regularly for more than four hours per night. (Engleman H.M., Wild M.R., 2003), (Weaver T.E. et al., 2008), (Orth M. et al., 2006)

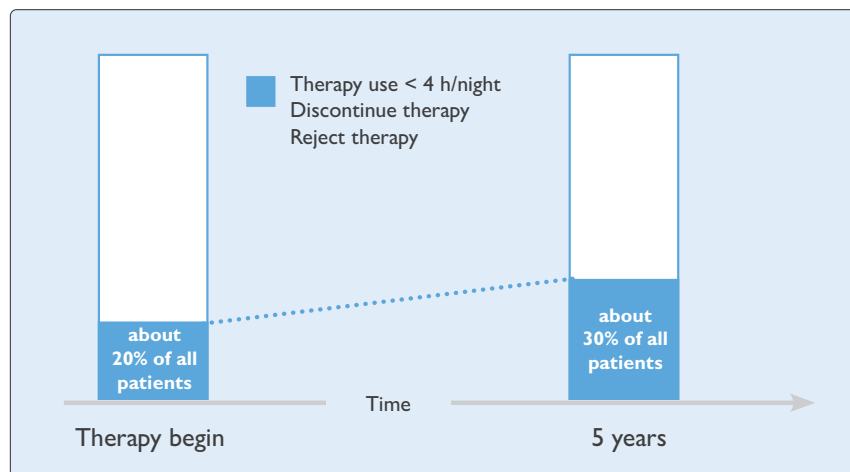


Figure 2: Increasing proportion of non-compliant patients over time. Engleman H.M., Wild M.R., 2003

- Furthermore, even with good CPAP adherence of more than four hours nightly and a low AHI, up to 40 percent of OSAS patients still suffer from daytime sleepiness, which, in turn, can have a negative effect on therapy adherence. (Antic, 2011)

Multiple factors affect therapy adherence

Comorbidities: Critical factors are subjective perceptions of daytime symptoms (sleepiness as measured by Epworth Sleepiness Scale) combined with the severity of SDB. (Engleman H.M., 1996), (Orth et al., 2006) Others include the existence of depression (Borel J.C. et al., 2013), a high BMI (Marques S. et al., 2017) or other comorbidities such as hypertension and diabetes. (Nakamura H. et al., 2016), (Marques S. et al., 2017).

Technological progress: Significant improvement in CPAP compliance has been reported (Rotenberg B.W., Murariu D., Pang K.P., 2016) and attributed to technological progress in the development of devices (more comfort functions) and masks (better wearing comfort).

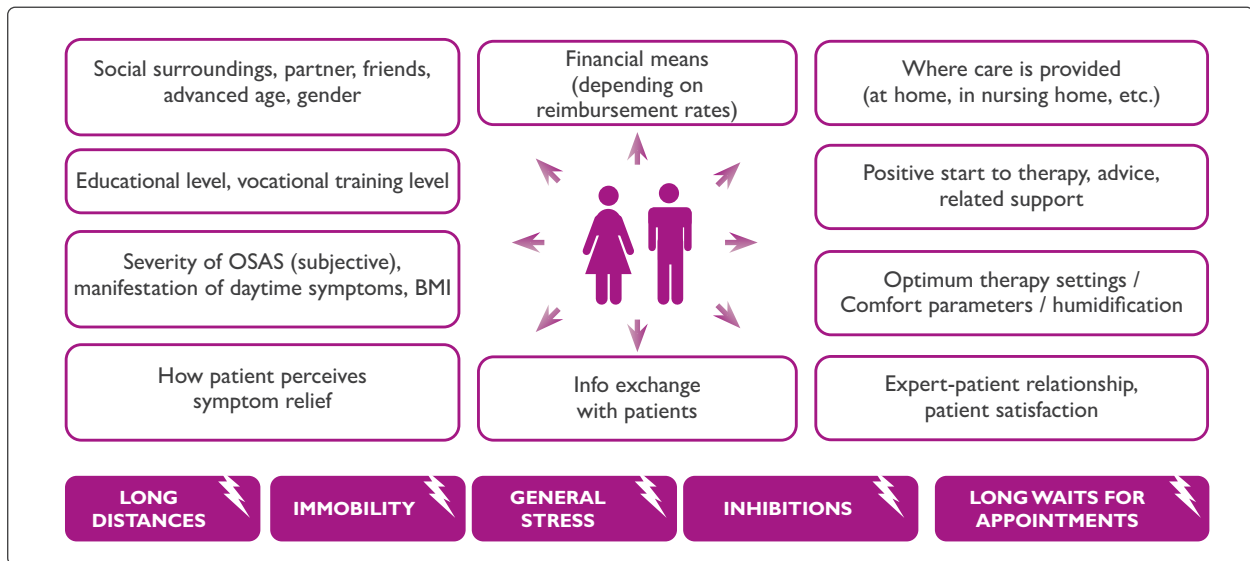


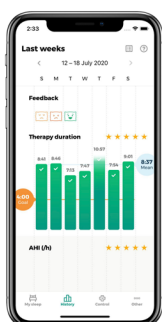
Figure 3: Factors and barriers to therapy adherence from the patient's surroundings (Kanfer F.H., 2006) (Berger et al., 2007)

Long-term adherence supported by early intervention

Low therapy adherence after one month is generally a good predictor of low adherence at 12 months (Chai-Coetzer C.L. et al., 2014). Therefore, it is very important to provide comprehensive patient care in the first weeks after therapy begins. Long-term compliance can be achieved when such intense care includes giving patients information about their disorder and devices, encouraging them to develop skill and competence, and supporting them with problem-solving during the initial days and weeks. Providing this type of patient care in cases of chronic diseases like SDB, however, is possible to a limited extent. Therapy adherence can be improved only with enormous investments in time, work and resources. For example, repeated intense conversations in which patients are told about the benefits of PAP usage generally increase the patient's satisfaction with information flow and level of care and positively affect therapy adherence. (Hoy C.J., 1999), (Lewis K.E., 2004).

Providing comprehensive care in times of a pandemic is that much more challenging because sleep therapy patients can have only limited or no personal contact with their caregivers. That situation underscores the need for additional communication channels and smoothes the way for app-supported treatment strategies with prisma APP.

prisma APP – the Löwenstein app for a good night



Patients who become actively engaged in their therapy and regularly receive information and support as needed exhibit significantly higher therapy compliance. An always available mobile application like prisma APP from Löwenstein Medical is a low-cost alternative to personal contact. The app can positively affect motivation by regularly showing the patient his therapy progress and engaging him in treatment. (Isetta V. et al., 2017), (Fox N. et al., 2012), (Shaugnessy G.F. et al., 2019), (Marques S. et al., 2017), (Engleman H.M., 2018).

The preliminary results of a controlled randomized study with the prisma APP show much higher adherence in the group that voluntarily used the

prisma APP as a supplement to treatment (332 min +/-159 min) than the control group with standard therapy (219 min +/-190 min), (Franke et al., 2020).*

The prisma APP is not a replacement for the interaction between expert and patient, but it can be additional support. If patients are to use their devices long-term, they need continuous guidance and information to keep them motivated throughout the therapy period. Patients have shown ready acceptance of app-supported treatment, which works reliably and contributes to sustained improvement of sleep quality.

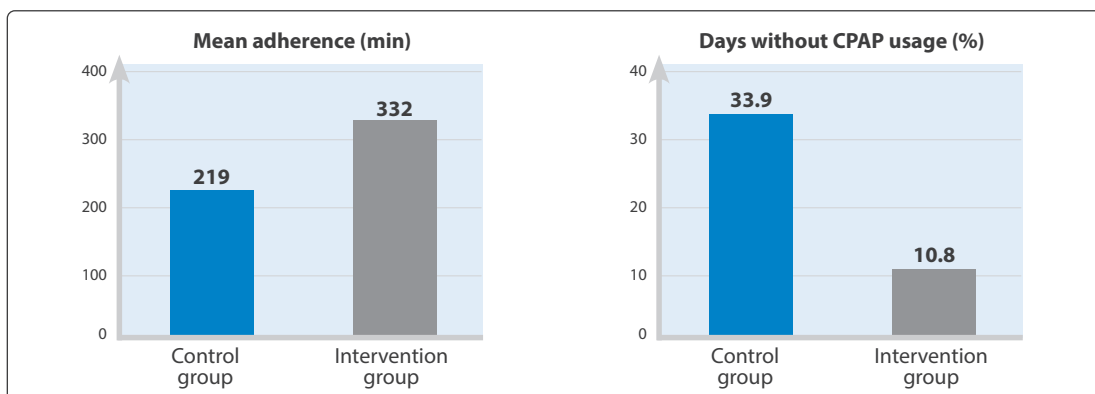


Figure 4: CPAP adherence within 12 weeks of follow-up, preliminary analysis n= 38 patients

prisma APP for patients:

Communication as information guide and aid to self-help

Patients generally rely on apps for positive reinforcement of therapy success in which their behavior plays a critical role and confirmation of the proper functioning of the device. In the self-management approach, persons affected by sleep apnea are activated and trained to practice sleep-promoting behavior. The supporting pillars of app-based communication with the prisma APP are:

- Brief daily summaries of therapy results and goal achievement
- Detailed weekly reports on relevant therapy parameters
- Setting reasonable, measurable and authentic goals
- Automated, sensible interim goals with regular progress checks and results monitoring
- Patient's personal observation of symptoms and physiological processes based on data and analyses with recommendations for action
- Regular, personalized feedback on therapy success and goal attainment sent to patient (Kuna S.T. et al., 2011), (Hibbard J.H., 2004), (Berger A., 2007)
- Option to exchange data with the doctor or caregiver (for example, before a visit to doctor or a telephone call)
- Recommendation to contact the doctor on the basis of data (e.g., persistent elevated AHI, or many side effects or other therapy problems).

In addition to the information about therapy, such as mean pressure level, mask air-tightness, AHI and therapy use, other parameters like estimated deep sleep time are transmitted for the overall evaluation of sleep quality.*

If a problem arises, the patient's responses to four fundamental questions in the standard therapy check could lead to an automatic recommendation for an intervention or to the suggestion that the patient contact an expert. The point of the intervention is to build up patient knowledge and competence so he can help himself in the first instance. The app serves as a contemporary supplement to the traditional instructions for use on paper with:

- Brief usage videos on handling humidifiers, devices and masks
- Tips on mask corrections
- Hygiene recommendations
- Therapy tips on comfort parameters
- Additional recommendations on making contact and arranging appointments with experts

For the experts: focus on essentials and look toward future potential

Experts are not replaced by Web-based communication with prisma APP; they are freed up to use their time more effectively. Patients' frequently asked questions are automatically filtered by prisma APP and answered with short explanatory videos or offers.

Then interventions by experts could be initiated early for patients who cannot be successfully treated independently or who have particularly serious problems. These patient groups are encouraged to contact experts. According to Isetta et al., distance learning (teleconsultation and telephone contact) has already proven to be an effective way to transfer knowledge as an alternative to a face-to-face meeting. (Isetta et al., 2014). An intervention based on data and reports from the patient could even go so far as to refer the patient to the sleep lab again.

The app is responsible for processing large amounts of data, identifying patients with serious problems and intervening at an early stage. Depending on the seriousness of the reported problem, prisma APP and prisma CLOUD prioritize patients for a targeted intervention.

By means of Web and app-based communication channels between experts and patients such as prisma APP and prisma CLOUD, experts and service providers – depending on the healthcare system – are given the infrastructure to convey to patients new information about therapy and appropriate accessories.

* see White Paper: "Sleep Quality under CPAP/APAP Therapy links compliance, leakage, AHI and therapeutic success" at www.loewensteinmedical.com

How prisma APP supports therapy adherence

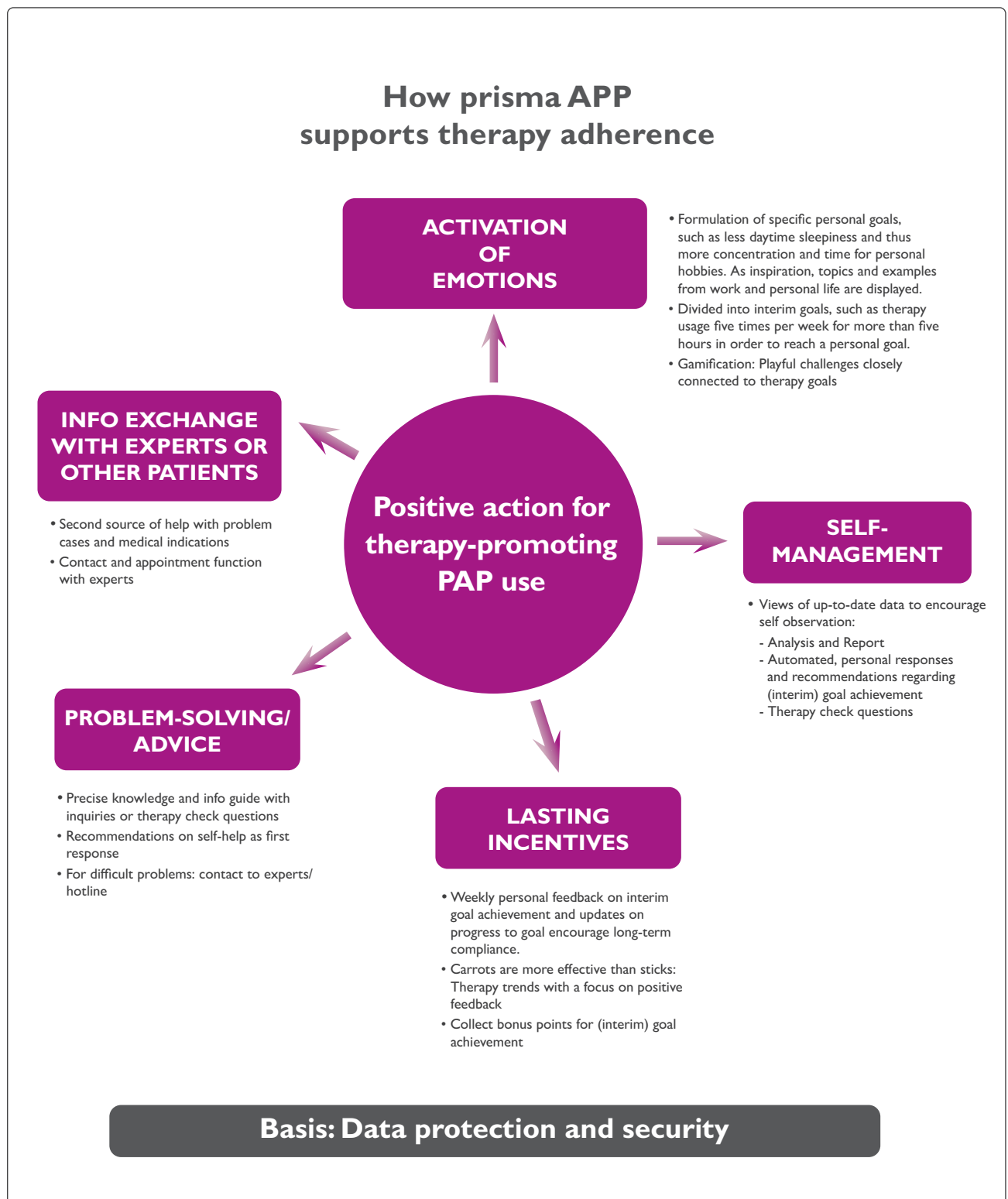
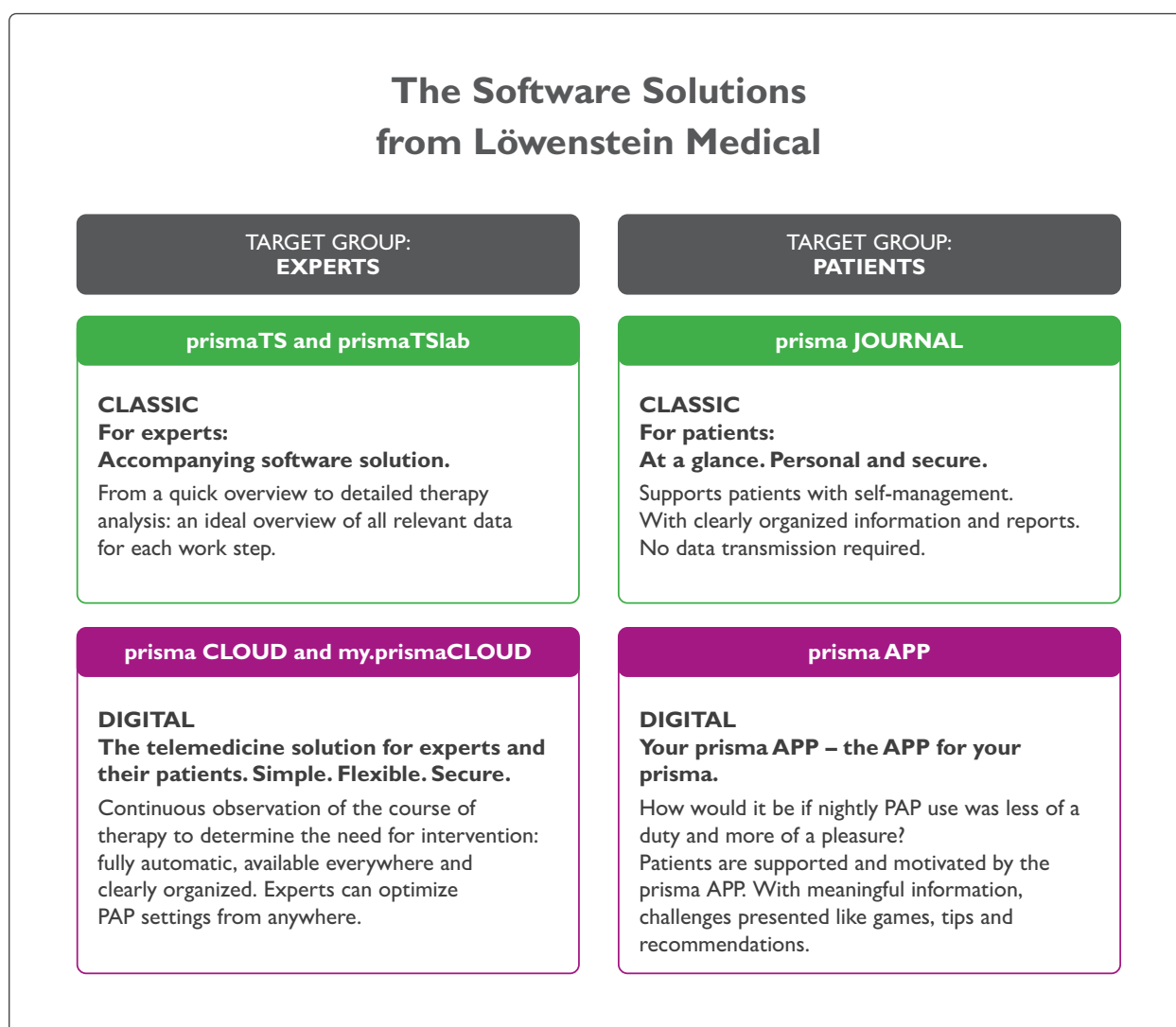


Figure 5: Support of therapy adherence in a Web-based application

Summary

The focus is on a cost-effective, barrier-free system for everyday patient use in which relevant parameters (e.g., deep sleep indicator*) are compiled in a comprehensive evaluation of sleep quality.

App-based communication with prisma APP cannot replace the trusting expert-patient relationship. However, it can serve as a low-cost, resource-conserving alternative that helps the patient to help himself, builds confidence in therapy, increases motivation long term, and eliminates side effects and problems by means of early intervention. prisma APP offers the patient complete and secure access to relevant therapy data and functions as a guide and resource for all related support questions. With game-like challenges, the prisma APP can give the patient holistic support and lighten the expert's workload.



* see White Paper: "Sleep Quality under CPAP/APAP Therapy links compliance, leakage, AHI and therapeutic success" at www.loewensteinmedical.com

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