



HOME SENSING:

*Tracking Adherence and Changes
in Activities of Daily Living*

Mental Health and Home Sensing: *Identifying Changes in Activities of Daily Living*



People with mental health challenges, such as bi-polar disorder, major depressive disorder, and PTSD, often display changes in their activities of daily living during exacerbations of their conditions. By identifying changes in activity patterns early on, one can intervene early enough to reduce the severity of and consequences from exacerbation of the condition.

Examples of pattern changes:

Sleep Patterns

A mattress sensor is placed on the person's bed to track times he or she spends in or out of bed. The sensor also tracks the number of times the person rolls over in bed, to identify restlessness. When a patient with bipolar disorder begins spending less time in bed during the nighttime, it can be an indication that they are experiencing some symptoms of mania¹. For a person with major depressive disorder, longer sleep periods and more frequent sleep periods during the night and day can be an indication that the level of depression is worsening. For a person with PTSD, an increase in restlessness in bed can be an indication of worsening insomnia due to anxiety produced by PTSD.

Motion Patterns

Motion sensors are placed around the corners of the living room, kitchen, and bathroom to track motion in the patient's home. When a patient with bi-polar disorder begins to have increased motion, such as pacing detected in the living room, it can be an indication of restlessness, often experienced during a manic episode of the illness. When a person is spending many hours in their living room chair or on the couch with a very limited amount of motion, it can be an indication of excessive sleeping, indicative of an increase in depression level. If a decrease in length of time in the bathroom is sensed, it can mean the person is no longer engaged in personal hygiene. A drop in appetite might be picked up when there is a lack of movement detected in the kitchen. All of these indicate a drop in activities of daily living, which can be a sign of a decline in a person's mental wellbeing.

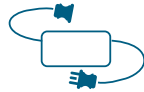
¹ Bressert, S. (2016). Manic Episode Symptoms. Psych Central. Retrieved on May 18, 2017, from <https://psychcentral.com/disorders/manic-episode/>

Using the Care Innovations® Health Harmony Home Sensing solution, sensors installed in the home can track activities and identify changes in patterns that may indicate that a problem is arising for the patient. These changes will trigger an alert that notifies a monitoring clinician to reach out to the patient to further evaluate him or her for an exacerbation.

For more information about **Health Harmony Home Sensing**,
please visit www.careinnovations.com/home-sensing/ or call us at **800-450-0970**.



COPD and Home Sensing: Tracking Adherence and Changes in Activities of Daily Living



Patients with COPD can experience a rapid decline in respiratory health if they veer from their medical therapies or medication regime. In addition, if a patient is feeling unwell, one could see a decline in Activities of Daily Living. In a recent study, researchers found that ambient sensor data are good predictors of a change in functional status². Therefore, using sensors to track activity in the home and adherence to medical therapies is very helpful to clinicians in managing patients with COPD.

Examples of home sensing for COPD patients:

Passive Motion Sensors

Passive motion sensors are placed in strategic areas of the living spaces in order to pick up the patient's level of motion in the home. When a patient is having more difficulty with breathing, the patient will frequently sleep upright in a chair in the living room, instead of the normal behavior of sleeping in bed. This type of change in behavior will trigger an alert to the monitoring clinician who can contact the patient and further assess the situation.

Device Adherence

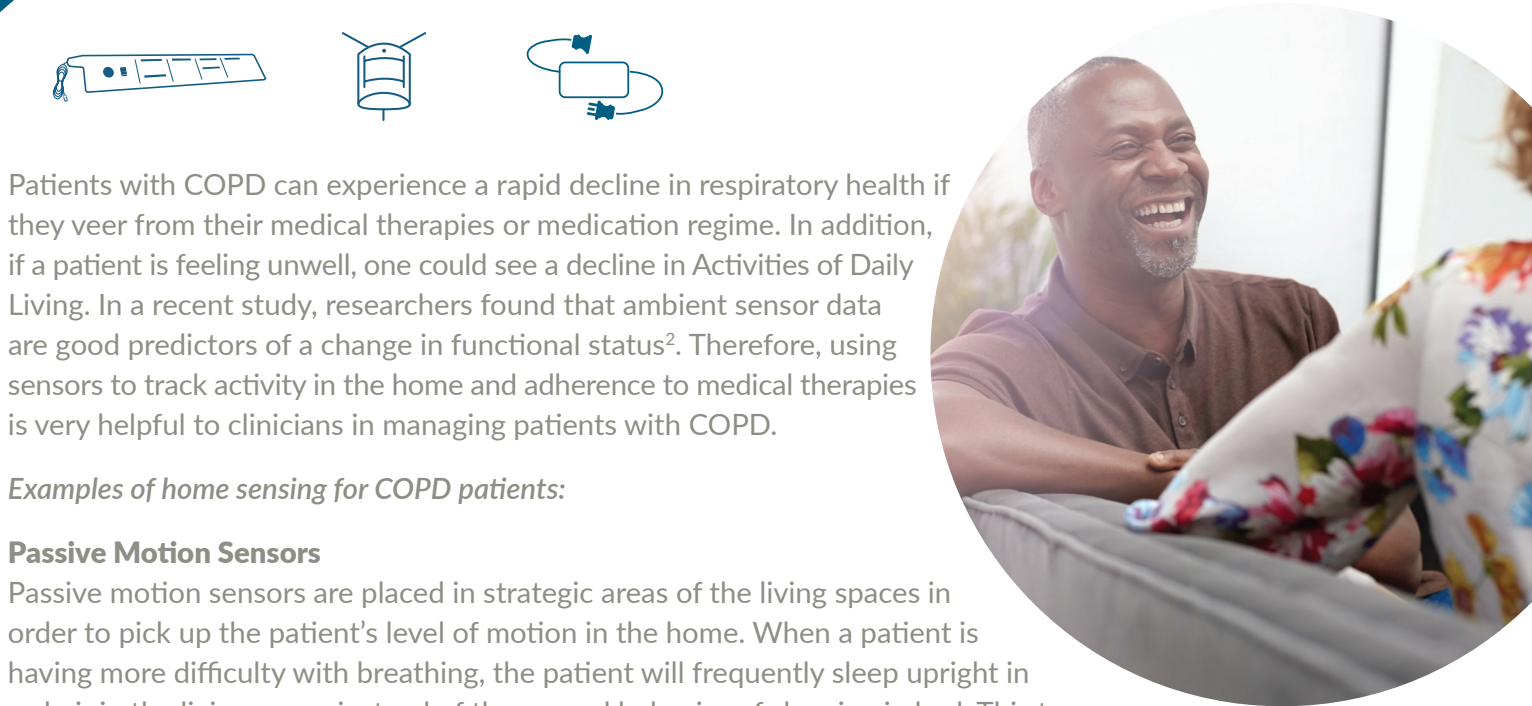
The use of home oxygen is frequently prescribed for a patient with advancing COPD. Tracking the frequency and duration of home oxygen usage can be accomplished by placing an on/off switch detector on the power supply for the flow meter. The indicator can track usage of the oxygen both in frequency and length of time. If the patient has a dramatic increase in usage of oxygen, it is likely an indicator of an increase in shortness of breath—a clear symptom of COPD exacerbation.

Medication Adherence

A simple motion detector is placed with line of sight to a medication box. Medication adherence can be tracked by the expected pattern of motion in front of the medication dispenser or box. If there is no motion when expected, there is an indication that the patient has not taken medications and the monitoring clinician can reach out to the patient to reinforce the importance of medication adherence.

² Robben, S., Englebienne G. & Krose, B. Delta Features from Ambient Sensor Data are Good Predictors of Change in Functional Health. (2016). IEEE J Biomed Health Inform. 2016 Jul 22

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Obstructive Sleep Apnea (OSA) and Home Sensing: Tracking Adherence



Although Continuous Positive Airway Pressure (CPAP) is considered to be the primary treatment modality for OSA, long-term adherence to CPAP is challenging because up to 50% of patients will discontinue CPAP therapy in the first week and 12-25% will discontinue CPAP use in 3 years³. Tracking a patient's adherence to CPAP is critical, as payers will not reimburse for the therapy if the provider cannot prove that the machine is being used for at least 4 hours per night.

The most frequent reasons people stop using a CPAP machine are related to:

- CPAP device factors (e.g. operational knowledge of device);
- CPAP mask interface factors (e.g. appropriate fitting);
- patient side effects (e.g. rhinorrhea/congestion, air leaks, dryness, pressure intolerance);
- and/or timely feedback (from the respiratory therapist and physician).

The challenge is knowing when a patient has stopped using the CPAP so that a clinician can intervene, help the patient solve the problem, and then motivate the patient to continue CPAP therapy. With home sensing, adherence of CPAP can be easily tracked.

Appliance sensors can be placed on power sources, such as electrical outlets. These sensors monitor and record electrically powered equipment usage, like the CPAP machine. When the sensors do not detect expected usage, an alert is sent to a clinician manager who can then reach out to the patient and intervene. In addition to identifying lack of usage, the home sensing platform can be used as documentation of CPAP adherence and submitted as supportive documentation for billing.

³ Engleman, H.M. & Wild, M.R. Improving CPAP use by Patients with the Sleep Apnoea/Hypopnoea Syndrome (SAHS). (2003). Sleep Med Rev. Feb; 7(1):81-99.

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Peritoneal Dialysis at Home and Home Sensing: Tracking Adherence



Many patients with serious renal disease can perform peritoneal dialysis (PD) at home, rather than having to go into a clinic or hospital for dialysis treatments. The PD treatments are critical in managing kidney failure, improving quality of life, and preventing emergency department visits and hospital admissions. Providers of home dialysis treatments are required to demonstrate patient compliance with treatments to meet various quality measures. Because of the clinical importance of patients using equipment properly to conduct their treatments, patients are put through a rigorous training program by the provider and followed closely. Tools in managing these patients remotely have proven to be crucial in both effectiveness and efficiencies of managing this type of patient population.

Patients conducting their dialysis treatments at home use an automated peritoneal dialysis machine, often called a cyclor. These cyclors are designed to fill the peritoneal cavity with fresh solution and then drain the solution and waste out of the body. Because the average treatment time is 8-9 hours, patients often conduct their treatments at night.

One of the tools available to assist in managing this type of patient population remotely is home sensing. In a model where home sensing is implemented, the cyclor machine can easily be plugged into an appliance sensor which is then plugged into power. Besides the patient plugging the sensor in, there is no other participation required from the patient which makes the model extremely easy to implement and manage from a logistics perspective. The power usage of the cyclor can be monitored remotely and associated software can notify clinicians of missed treatments. Not only is this data important in providing clinicians with actionable data to improve compliance, it is also useful for documentation that can be submitted for billing purposes.



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