A good laugh and a long sleep : insights from prospective and ambulatory assessments about the importance of positive affect and sleep in mental health

Valorisation, clinical implications and future directions

Exploration of the use of ESM-I in **chapters 6-8** (i.e. the use of therapeutic interventions based on electronic ESM) is just one example of the opportunities offered by the advent of rapidly developing electronic ambulatory techniques. These ambulatory techniques also include a plethora of wearable electronic sensors in the form of wristbands, smart watches, pendants or smart clothing.

Among the possible research and therapeutic applications of this new technology is the integration of several ambulatory procedures such as: (i) ESM, (ii) actigraphy (i.e. the registry of diurnal/nocturnal physical activity), (iii) monitoring of physiological variables (e.g. temperature, heart rate, hormone levels), (iv) luxometry (i.e. the monitoring of light input) and (v) registry of geographic location. This integration may provide unprecedented data richness, fostering exciting new routes of discovery leading to the unravelling of pathogenic mechanisms on a micro-level (part I of this thesis) and the development of new, more effective treatment applications (part II of this thesis). By assimilating the information from these diverse high-resolution information channels, we may be able to reach a more complete representation of an individual's emotional, behavioural and physiological state within the context of his or her daily life. That is, we may go from a black-and-white static photo of a patients' state (i.e. single-point retrospective questionnaires administered in the doctor's office) to a full-colour movie (i.e. continuous, prospective ambulatory assessment integrating multiple psychological and physiological channels). With this increased resolution and detail, new options emerge. These conceivably include the detailed moment-to-moment monitoring of treatment responses, or state monitoring combined with the development of individual relapse logarithms. Recently, a first effort has been undertaken to integrate ambulatory assessments of mood and behaviour (i.e. ESM) with that of physical activity (i.e. motion sensing); however, it remains until now primarily on a conceptual level [1-3].

Within somatic medicine, ambulant monitoring of blood pressure or blood sugar levels represents a routine clinical process. As of today, this situation is very different for the psychiatric context: the ambulant monitoring of mood states, behaviour or physical activity is hardly ever used outside the research context. The research presented in this thesis, especially in **chapter 2** (prospective monitoring of perceived sleep quality vs. retrospective assessment of sleep quality) and **chapters 6-8** (ESM as potential therapeutic application), may help to incorporate ESM and other related ambulatory assessments as a routine part of (mental health) clinical practice. While concerns could arise about the feasibility and compliance of patients when incorporating these techniques in everyday clinical life, the results presented **chapter 6** to **8** as well as by Kramer and colleagues [4], and other related research [5-7] provide evidence refuting these concerns. Ambulatory assessments (even the

8-week intensive self-monitoring of affective states and behaviour in patients with mild to moderate depression), were well-accepted and compliance rates were high [chapter 7, 4]. Moreover, the high popularity of apps on iOS and Android platforms providing software for self-monitoring (ranging from food intake, sleeping and activity patterns to the integration of medical records) argue in favour of a bright future for ambulatory assessments in mental health care routine. However, the implementation of ambulatory assessment techniques may be impeded by clinicians working within this sector. As noted by Trull and Ebner-Priemer [7] and by the researchers associated with the RCT presented in **chapters 6-8** (personal communication), there seems to be a stronger resistance against the incorporation of ambulatory assessments in clinical routine by the clinicians themselves. This resistance should be taken seriously and the mechanisms behind such barriers should be explored and represent an important area of future research.

The apparent resistance of clinicians to the incorporation of ambulatory assessments may be related to some obvious drawbacks associated with the development of novel monitoring methods. The newly developed techniques, including a large spectrum of activity monitors and tracking sensors, seem to lead to a different form of being, also referred to 'quantified self' or 'self-logging'. With it, a number of essential, yet unresolved problems arise. First of all, there is the issue of privacy. What happens to the data collected by the patient? Who is owner of the data and who is authorized to access it? Is it the patient's general practitioner, his/her mental health care professional, or merely the patient? How long are the data going to be stored? Furthermore, security of data storage can be a serious problem. With an increasing amount of channels collecting personal data which is possibly stored at various places, it becomes very vulnerable to cyber criminality such as online hacking. These and other related concerns should be carefully addressed through sound empirical methods before ESM and ESM-I, combined with other forms of ambulatory assessments, are adapted as a regular part of clinical routine.

By integrating the insights of part one ('measuring') and part two ('intervening') of the present thesis, several recommendations can be provided to guide and inform future research. The model of micro-mechanisms potentially underlying depression in part 1 (Figure 1), showed the apparent importance of endogenous rhythms, sleep-wake related processes, and PA, warranting future interventions precisely targeting these processes. Therefore, subsequent interventions should be aimed at stabilizing endogenous rhythms, enhancing sleep quality, and enhancing the experience of positive affect. In recent years, considerable progress has been made in chronotherapeutic approaches with the underlying goal of normalizing circadian rhythms and, by extension, enhancing sleep quality. In 2005, a consensus has been reached by the

Committee on chronotherapeutics considering treatment options [8]. Here, light and stepped wake therapy, either in isolation, combined and/or augmented with pharmacological treatments (i.e. SSRI's), are recommended as first-line treatments for major depression [8].

Furthermore, given the apparent importance of PA, psychological treatments which have been traditionally focused on reducing negative affectivity rather than increasing positivity, should shift their focus on the restoration of the PA system 'to get the individual going'. A number of promising treatments are currently in development, such as behavioural activation approaches [9]. When utilizing ESM to target the PA system (demonstrated in part 2 of this thesis), providing feedback about experienced PA and thereby increasing PA may not be as straight-forward as previously thought. However, by increasing expertise about PA-related mechanisms underlying depression, increasingly targeted and person-tailored interventions can be developed. In concrete terms, it may be more efficient to give person-specific feedback and recommendations on exactly *how* to adapt behaviour, instead of merely providing passive, data-driven feedback about experienced PA.

On a practical level, chronobiological as well as behavioural activation interventions are *par excellence* suited to be delivered by, or in combination with, ambulatory assessment approaches, integrating psychological (i.e. mood, symptoms, context), behavioural (i.e. inside/outside, passive/active activities, sleep patterns), and physiological (i.e. heart rate, temperature, light input, hormones such as cortisol or melatonin) variables. Here, it is crucial to not only meticulously brief the patient, but also sufficiently consider potential clinician's concerns. By doing so, 'a good laugh and a long sleep', could indeed be the best cures in a doctor's book.

References

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