2024 Standardization of Polysomnography Reports – A Consensus of the Brazilian Sleep Association

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Abstract

Introduction The absence of standardized reporting for sleep medicine exams across different laboratories can lead to misinterpretation, diagnostic inconsistencies, and suboptimal treatment strategies. This document seeks to establish guidelines for the development of sleep study reports, covering recordings from studies of types 1 to 4, and represents the official position of Associação Brasileira do Sono (ABS; Brazilian Sleep Association) on the standardization of polysomnography (PSG) and cardiorespiratory polygraphies.

Materials and Methods The recommendations for the items to be reported in PSG records were developed by means of a Delphi study, comprised of two voting rounds. In each round, participants had to vote regarding the appropriateness of items to be reported in type-1 to -4 sleep studies, rating them as *recommended*, *optional*, or *not recommended*. The consensus threshold was set at 66% in each voting round, or 75% for the combined responses of *recommended* and *optional*.

Results The panel was comprised of 29 experts. After 2 voting rounds and subsequent deliberations by the steering committee, 352 items were included in the final set of recommendations. Consensus was achieved for 339 items (96.3%), of which 145 (41.2%) were classified as *recommended*, 154 as *optional* (43.8%), 35 as *not recommended* (9.9%), and 5 as *not allowed* (1.4%). No consensus was reached for 13 items (3.7%). The items recommended in this consensus are detailed in the main text.

Conclusion These guidelines provide comprehensive recommendations for reporting diagnostic tests in sleep medicine.

Keywords
- Delphi
- diagnosis
- polysomnography
- sleep apnea

Introduction

Over the last decade, there has been increasing awareness about sleep disorders among both health practitioners and the general public. This has led to a significant rise in the demand for diagnostic sleep studies, including polysomnography (PSG – type-1 and -2 sleep studies) and polygraphy (type-3 and -4 sleep studies). The accurate interpretation of these diagnostic tools is crucial for the effective diagnosis and treatment of sleep disorders.

The interpretation of the results of a sleep study directly depends on the quality and clarity of the reports. However, the collection, presentation, summation and reporting of diagnostic data in sleep medicine is neither consistent nor standardized among sleep medicine centers,[1] and studies demonstrate that the way PSG results are reported can vary considerably.[2–4] Thus, previous discussions have focused on the need for standardized reporting practices in sleep medicine.[1,5,6]

The lack of standardized reporting practices across different laboratories may lead to misinterpretation, inconsistencies in diagnosis, and suboptimal therapeutical approaches. This might be especially problematic for non-specialist healthcare professionals, who might request a PSG, but may lack the technical knowledge to properly interpret the result. Among the biggest challenges are the variability in terminology (including nomenclature, scoring, and calculations) and inconstant reporting formats, which might either include imprecise parameters or omit important information.

Some proposals for the standardization of the reporting of the results from PSG and other diagnostic tools have already been published.[1,7] The most relevant of them is the third edition of the manual for the scoring of sleep and associated events, published by the American Academy of Sleep Medicine (AASM), published in 2023,[7] which defines and lists the information that should be reported as a result of a PSG and other diagnostic tests. However, there is a need to adapt reporting recommendations to local practices.[4] Additionally, these recommendations do not include reporting practices for consumer oriented portable sleep monitoring devices, which are undergoing an important technological improvement.

Thus, the aim of the present document is to provide guidelines for the production of reports for sleep studies of types 1 to 4 and to represent the official position of Associação Brasileira do Sono (ABS; Brazilian Sleep Association).

Materials and Methods

The recommendations and the resulting items to be reported in PSG records were achieved using the Delphi method, which is a reliable tool used for reaching consensus on topics through systematic input from a panel of specialists.[8–10] It has been increasingly used for the development of consensuses and guidelines on health-related topics, making it invaluable for healthcare decision-making and the standardization of clinical practices.[8–11] It is particularly useful in cases in which traditional evidence synthesis methods are not easily implemented due to lack of high-quality evidence, contradictory data, or a context requires input from experts.[11–13]

The Delphi method has evolved since its inception and now exists in multiple adapted forms,[8,13–16] but they are generally based on four core characteristics: anonymity, iteration, statistic response estimates, and controlled

feedback.[12,13,16] In brief, the method involves the selection of a group of experts on a topic based on objective criteria, who are invited to participate in iterative rounds of anonymous voting on predefined topics until consensus is reached. Between rounds, the panelists receive feedback on the collective results in respect of the items under consideration, allowing them to reassess their responses and refine their votes until consensus is reached. Delphi studies are increasingly being used in sleep medicine research to standardize clinical practice,[17–23] including previous consensuses conducted by the ABS.[24,25] This consensus was based on a modified Delphi methodology, following guidelines established by the Guidance on Conducting and Reporting Delphi Studies (CREDES)[25] and Enhancing the Quality and Transparency of Health Research (EQUATOR).[26] The subsections below detail the Delphi methodology used in this consensus.

Panel Selection

The participants in this consensus were organized into three levels of participation: The steering committee, the consulting committee, and the advisory committee. Together, these groups formed the panel of specialists, with their respective responsibilities as described below:

- *Steering committee* (GNP, RSS, LILM, and LOP): Responsible for the methodology and overall guidance of the project, including inviting participants, and managing their inputs, as well as defining the overall framework for the items to be voted on.
- *Consulting committee:* This committee consisted of the president and vice-president of ABS, as well as the president of Associação Brasileira de Medicina do Sono (ABMS; Brazilian Association of Sleep Medicine). Their role was to provide guidance on the development of the consensus and to endorse or change the consensus status reached at the end of each voting round.
- *Advisory committee:* This committee was made up by all of the members of the directory boards of the ABS, the ABMS, and (Associação Brasileira de Odontologia do Sono (ABROS; Brazilian Association of Sleep Dentistry), including their presidents, vice-presidents, treasurers, and secretaries, as well as by all the representatives of each council or department at the ABS and ABMS. They were responsible for both voting on the items initially listed by the steering committee, as well as for proposing new items to be voted on. As ABS is a multidisciplinary association, inviting members from all of its departments ensured the participation of the widest selection of professionals with an interest in the field, reinforcing the multidisciplinary nature of sleep medicine.

All the panelists signed an authorship form, agreeing to the terms of participation, including the need to participate in all voting rounds. Additionally, all participants were informed, and agreed, that the consensus represents a collective position that may not reflect the personal opinion of each individual participant, and that the group consensus will not be changed or revaluated based on individuals' opinions.

Delphi Surveys

The initial list of voting items was based on the "rules for reporting polysomnography" as outlined in the third edition of the AASM Manual for the Scoring of Sleep and Associated Events.[7] Taking this as a starting point, the steering committee added more items that addressed gaps not included in the manual.

The Delphi study was conducted over two rounds of voting. Both voting rounds were held using Google forms (Google LLC., Mountain View, CA, USA), and participation was restricted to online and asynchronous activities. Each panelist had one week to vote in each round. The panelists were not aware of each other and were instructed to share neither their participation nor answers until after the final voting round, to assure the anonymity of the process and prevent biases. The two voting rounds were structured as follows:

- *Round 1:* Once participants agreed to the authorship criteria and participation terms, all panelists were allowed to participate in voting round 1, which was organized into 5 sections. The first section contained items and questions related to the descriptive data of the participants, including sociodemographic and professional information (such as city and state, current academic affiliation, profession, highest academic title, and years of experience in sleep medicine). The following sections were devoted to items common to type-1 and -2 PSGs, type-3 and -4 sleep studies, and specific to type-3 sleep studies, and specific to type-4 sleep studies. At the end of each section, open fields were provided for the panelists to highlight unclear items in the first voting round, or to suggest new items for voting on in the following round. Once the first round was finished, each panelist automatically received a copy of their responses.
- *Round 2*: This round consisted of items for which consensus was not reached in the previous round, and new items suggested by the panelists in the previous round. For the items being revoted, the results of the previous voting round were disclosed, in addition to the comments and opinions of the panelists made in the round, so that each participant could reconsider their votes based on the opinions of others. Items from round 1 could be excluded, regardless of the voting results, in two cases: If they were deemed unclear, inapplicable, or misleading based on the comments of the panelists, or if their validity depended on the results achieved in a previous item (such as items related to disclosing the sensors used to score arousals in type-4 recording would be excluded if the reporting of arousals in type-4 recordings had been classified as not recommended in a previous round). For newly suggested items in round 2, this was the only time in which they were appraised.

During the voting rounds, each item was written and presented in a standardized way, simply composed of the name of each parameter to be listed in a PSG report. For most of the voting items, the panelists had to choose one of four possible alternatives:

- *Recommended:* Items that MUST be included in PSG reports. This option was chosen for items that the panelists deemed essential for the interpretation of a PSG record and its successful use in the diagnosis of sleep disorders.
- *Optional:* Items that MAY be included in PSG reports, but that are not mandatory. This option was chosen for items that, although considered to be accurate and informative, were not considered essential for the interpretation of a PSG record and its successful use in the diagnosis of sleep disorders.
- *Not recommended:* Items that MUST NOT be included in PSG records. Possible reasons for choosing this alternative include sleep-related metrics or parameters that are considered obsolete, unreliable, imprecise, or not suitable for a certain type of sleep study.
- *Don't know:* This option was chosen when the panelist was not confident or did not have sufficient information to give an opinion about a certain item.

As an exception, six items related to the reliability of estimating total sleep time, performing sleep staging, and detecting arousals in type-3 and -4 recordings were voted on using the following possible options:

- *Allowed:* These parameters may be reported in type-3 or -4 recordings, even though they are calculated indirectly (that is, by using metrics other than the electroencephalogram [EEG]).
- *Not allowed:* These parameters should not be reported in type-3 or -4 recordings, because indirect metrics, such as those lacking EEG data, do not provide reliable estimates.
- *Don't know:* This option was chosen when the panelist was not confident or did not have sufficient information to give an opinion about a certain item.

Estimating Consensus

At the end of each voting round, consensus was calculated. The consensus threshold was established at 66%, meaning that a recommendation was confirmed when a particular option received at least 2/3 of the weighted responses for each item. The votes were weighted according to the participants' professional background. The votes of physicians were weighed as 5 for all items except for those related to bruxism, while the votes of dentists were weighted as 5 specifically for those items related to bruxism.

At the end of the voting rounds, items for which consensus was not reached at the 66% threshold, but for which the combined responses of *recommended* and *optional* was higher than 75% percent were given the consensus of *optional*. The rationale being that although no consensus was reached, these cases were clearly considered as well-understood and reliable items, as the option *don't know* and *not recommended* accounted for less than one quarter of the total weighted responses. Finally, all the voting items and their consensus status were reviewed at a meeting of the steering and the consulting committee. The steering committee had the right to change the consensus status of any item, or to determine a recommendation for items for which no consensus had been reached during the voting rounds. They also had the right to propose new items, provided that an absolute consensus was reached among the members of the steering and the consulting committee.

Limits and Definitions of the Voting Items

The Delphi round focused solely on listing which variables and parameters should be listed in the reports of sleep studies. This consensus did not aim to provide guidance or include voting items related to the following cases:

- *Montage and data acquisition*: Technical aspects about how sleep studies are set up and how data are acquired (such as the number and position of electrodes, sample rate and filters, etc.) were not included, and no recommendations were provided in this matter. For these items, we fully endorse the last edition of the AASM scoring manual.[7]
- *Scoring rules for sleep-related events:* Although we provide recommendations for which sleep-related events should be reported, we do not detail how they should be scored or calculated. For this purpose, we fully endorse the last edition of the AASM scoring manual.[7]
- *Other diagnostic sleep tools:* This consensus focuses specifically on type-1 to -4 sleep studies. Any other diagnostic tools used in sleep medicine are not covered by these recommendations (such as multiple sleep latency test, actigraphy, etc.).
- *Sleep studies performed for non-diagnostic purposes:* Specific setups used for either research interests or to determine treatment approaches are not included in the current consensus. Therefore, parameters for reporting variables related to split-night PSGs or other forms of CPAP titration are not encompassed in this document.
- *Consumer sleep technology*: Diagnostic tools are becoming increasingly common and may be confused with medical grade devices (especially with type-4 sleep studies).[22] However, this document focuses only on the use of sleep studies requested by healthcare professionals and performed under adequate professional oversight.

Results

Panel of Specialists

The panel included 29 specialists (out of the 36 invited). Of these, 17 (58.6%) were physicians, 4 (13.8%) were dentists, 3 (10.3%) were physiotherapists, 2 (6.9%) were speech therapists, and 3 were from other professional backgrounds (biology, biomedicine, and nutrition – 3.4% each). Most of the panelists were from the state of São Paulo ($n = 22$; 75.9%), 2 (6.9%) were from Rio de Janeiro, and 3 other states had 1 panelist each (Minas Gerais, Paraná, and Pernambuco – 3.4% each). Two panelists were practicing abroad (Canada and the United Kingdom). Most of the panelists held a PhD title ($n = 24$; 82.8%), while the remaining had a master's degree as their highest academic qualification. All panelists had at least 10 years of experience in sleep medicine, with most of them having more than 20 years of experience ($n = 17$; 58.6%).

Delphi Results

In voting round 1, 297 items were evaluated (including 6 items using the "allowed/not allowed" responses). Of these, consensus was reached for 140 items (47.1%), of which 109 were considered as *recommended* (36.7%), 7 were considered as *optional* (2.4%), 21 were considered as *not recommended* (7.1%), and 3 were considered as *not allowed* (1.0%). The items considered as *not recommended* were all determined automatically due to their dependency on items considered as *not allowed* (rather than determined by consensus during the voting rounds). One item was considered as not applicable based on the inputs from the panelists and was therefore excluded (0.3%).

In voting round 2, 193 items were evaluated, 156 (80.8%) of which were items that had not reached consensus in round 1, and 37 (19.2%) were new items included based on the panelists' comments and suggestions. Among these 193 items, consensus was reached for 99 (51.3%), of which 29 were considered as *recommended* (15.0%), 58 as *optional* (30.1%), 10 as *not recommended* (5.2%), and 2 were considered as *not allowed* (1.0%). The items considered as *not recommended* were all determined automatically due to their dependency on items considered as *not allowed* (rather than being determined by consensus during the voting rounds). A total of 94 items (48.7%) failed to reach consensus by the end of voting round 2.

After the voting rounds, the steering committee met, and the results of the voting rounds were reviewed. As a result of the steering committee's deliberation, some recommendation statuses were changed, and new items were proposed. An *optional* status was granted to 79 items that had not reached consensus during the voting rounds (by using the criterion of assigning *optional* for items in which *recommended* and *optional* corresponded to more than 75% of the weighted votes). Thirty-two items had their recommendation status changed following the deliberation of the steering committee. The most important of these items include downgrades from *recommended* to *optional* for five items related to bruxism, downgrades of respiratory effort-related sleep arousals (RERAs) and related variables from *recommended* to *optional*, establishing the number of desaturations and indoleamine 2, 3-dioxygenase (IDO) $\geq$ 4% as *optional* and $\geq$ 3% as *recommended* in all cases, and downgrading most cardiovascular events in type-4 recordings to *not recommended*. Finally, 20 new items were proposed, mainly to address gaps in areas not covered during the voting rounds.

In total, considering both voting rounds and the post-voting deliberations by the steering committee, 353 items were considered. The consensus was reached for 341 items (96.6%), of which 116 (32.9%) were considered as *recommended*, 178 as *optional* (50.4%), 42 as *not recommended* (11.9%), and 5 were considered as *not allowed* (1.4%). No consensus was reached for 12 items (3.7%).

Recommendations

The following sections present the items classified as *recommended*, *optional*, and *not recommended,* for reports of type-1 to -4 sleep studies. These sections are written in a standardized way to systematically present the material. Recommended items are referred to as "shall be reported," optional items are referred to as "may be reported," and not recommended items are referred to as "shall not be reported."

Each section highlights the most important items, with the complete list of items voted on displayed in separate tables, including their final recommendation status, the stage at which agreement was achieved, and the agreement rate (►**Tables 1**–**17**). Items that failed to reach consensus and those excluded are included in ►**Table 18**.

Table 1 Patient and exam characteristics - types 1 to 4.

#	Item	Status	Consensus reached on	Agreement rate
1.1	Date of the exam	Recommended	Voting - round 2	100.0%
1.2	Patient name	Recommended	Voting - round 2	100.0%
1.3	Age	Recommended	Voting - round 2	100.0%
1.4	Date of birth	Optional	Recommended + Optional > 75% criterion	100.0%
1.5	Sex	Recommended	Voting - round 2	94.6%
1.6	Height	Recommended	Voting - round 2	81.5%
1.7	Weight	Recommended	Voting - round 2	87.0%
1.8	Body Mass Index	Recommended	Voting - round 2	75.0%
1.9	Clinical complaint	Optional	Recommended + Optional > 75% criterion	100.0%
1.10	Diagnostic hypothesis	Optional	Recommended + Optional > 75% criterion	93.5%
1.11	Use of medications before or during the exam	Recommended	Voting - round 2	79.3%
1.12	Complications during the exam	Recommended	Voting - round 2	93.5%
1.13	Need to repeat the exam	Recommended	Voting - round 2	68.5%

Type-1 to -4 Sleep Studies – Patient and General Recording Characteristics

This section refers to items of general interest for any type of sleep study related to patient characteristics and how the exam was conducted (►**Table 1**).

Basic descriptive information (date of the exam, name, sex, age) and anthropometric information (heigh, weight and body mass index) shall be reported (RECOMMENDED – items 1.1–1.8). Intercurrences during the exam, medication use and the need to repeat the test (due to inconclusive results or technical errors) shall be reported (RECOMMENDED – items 1.11–1.13), while the patients' symptoms or complaints leading to the exam and the diagnostic hypothesis may be reported (OPTIONAL – items 1.9 and 1.10).

Common Items to Type-1 and -2 PSG

Montage, Technical Aspects, and Sleep Staging – Types 1 and 2

All devices, sensors, electrodes and other equipment used in the exam, including their positioning, shall be reported (RECOMMENDED – item 2.1). The manual or guidelines used for sleep staging shall be reported (RECOMMENDED – items 2.2). The brand and model of the equipment and the software used for data acquisition and analyses may be reported (OPTIONAL – items 2.3–2.5).

Regarding the involved personnel, the name of the physician responsible for the PSG report (that is, the person signing it and legally responsible for it) shall be reported (RECOMMENDED – items 2.9), while the other professionals involved in the exam (sleep technicians, sleep technologists, and physician responsible for the sleep laboratory) may be reported (OPTIONAL – items 2.6–2.8).

Regarding sleep staging and related events, lights on and lights off time, total recording time, total sleep time, sleep latency, rapid eye movement (REM) sleep latency, wake after sleep onset (WASO), and the duration and percentage of each sleep stage shall be reported (RECOMMENDED – items 2.10–2.21), while artifact time may be reported (OPTIONAL – item 2.21).

The list of items related to the montage of type-1 and -2 sleep studies, related technical aspects, and sleep staging, along with their final recommendation status and agreement rates are shown in ►**Table 2**.

Arousals – Types 1 and 2

The total number of arousals and arousal index shall be reported (RECOMMENDED – items 3.1 and 3.2). The number of arousals and arousal index stratified by sleep stages (REM and NREM) may be reported (OPTIONAL – items 3.3–3.6). The list of items related to arousals, along with their final recommendation status and agreement rates is shown in ►**Table 3**.

Movement Events – Types 1 and 2

The number of periodic lower limb movements shall be reported (RECOMMENDED – item 4.1). The number of periodic upper limb movements and of lower and upper limb movements combined may be reported (OPTIONAL – items 4.2 and 4.3), provided that upper limb electromyography (EMG) electrodes are used (most likely at the flexor digitorum superficialis [FDS] muscles). In the absence of upper limb EMG electrodes, the term "periodic limb movement" may be used with no need to specify lower or upper limbs. The number of periodic limb movements associated with arousals shall be reported (RECOMMENDED – item 4.4). The index of total periodic limb movements and the index of periodic limb movement associated with arousals shall be reported (RECOMMENDED – items 4.6 and 4.7). The number and index of periodic limb movements associated with respiratory events may be reported (OPTIONAL – items 4.5 and 4.8). Items related to the reporting of periodic limb movements during wakefulness were voted on, but no consensus was reached.

The presence of REM sleep without atonia (RWA) shall be reported (RECOMMENDED – item 4.9), as this is the main polysomnographic feature of REM sleep behavior disorders. In the case of no observable RWA, the absence of such events should be reported in the PSG report, so it can be clearly understood that it was searched for and not found (rather than not evaluated). The RWA index may be reported (OPTIONAL – item 4.10), and if reported, information shall be provided about how it was calculated, as there is no current consensus on the best method to do this in the literature. The report of other movement events is optional (OPTIONAL - items 4.11–4.14).

The list of items related to movement events along with their final recommendation status and agreement rates are shown in ►**Table 4**. Items for which no consensus was reached are shown in ►**Table 18**.

Bruxism Events – Types 1 and 2

Bruxism events are only observable if appropriate EMG electrodes are used, usually to analyze masseter activity. These are not mandatory features of a regular PSG. Therefore, if these electrodes are absent, none of the items in the bruxism section apply.

A total of 48 items related to bruxism were voted on, covering a complex combination of bruxism events with other PSG events. First, the total number of bruxism events was voted on for six different conditions: the total number of events regardless of any associated feature, associated with arousals, associated with respiratory events, associated with movement, per sleep stage and per body position. For each condition, the corresponding index was also voted on. Then, these 12 voting items were repeated for different types of bruxism events (tonic, phasic, and mixed).

After the second round of voting, four items reached consensus to be considered as recommended parameters (total number of bruxism episodes, total number of bruxism events associated with respiratory events, the bruxism index, and the bruxism index associated with respiratory events). However, the advisory committee decided to downgrade these items to *optional* due to the non-mandatory nature of masseter EMG electrodes in PSG, and the lack of technical specifications on how to score these parameters.

Table 2 Sleep exam and staging assembly - types 1 and 2.

#	Item	Status	Consensus reached on	Agreement rate
2.1	Description of the items composing the exam	Recommended	Voting - round 1	82.6%
2.2	Manual/guidelines used for sleep staging and event scoring	Recommended	Voting - round 1	82.6%
2.3	Polygraph brand and model	Optional	Recommended + Optional > 75% criterion	94.6%
2.4	Brand and model of other equipment	Optional	Voting - round 1	66.3%
2.5	Software used for exam acquisition and analysis	Optional	Recommended + Optional > 75% criterion	88.0%
2.6	Name of the sleep technician responsible for the exam	Optional	Voting - round 2	81.5%
2.7	Name of the sleep technologists responsible for analyzing the exam	Optional	Recommended + Optional > 75% criterion	77.2%
2.8	Name of the professional responsible for the laboratory	Optional	Recommended + Optional > 75% criterion	87.0%
2.9	Name of the physician responsible for issuing the report	Recommended	Voting - round 1	100.0%
2.10	Video Recording Information	Recommended	Voting - round 2	69.6%
2.11	“Lights out” time	Recommended	Voting - round 1	100.0%
2.12	“Lights on” time	Recommended	Voting - round 1	93.5%
2.13	Total recording time	Recommended	Voting - round 1	100.0%
2.14	Total sleep time	Recommended	Voting - round 1	100.0%
2.15	Sleep latency	Recommended	Voting - round 1	100.0%
2.16	Rapid eye movement sleep latency	Recommended	Voting - round 1	100.0%
2.17	Wakefulness after sleep onset	Recommended	Voting - round 1	89.1%
2.18	Sleep efficiency	Recommended	Voting - round 1	100.0%
2.19	Time in each sleep stage (in minutes)	Recommended	Voting - round 1	81.5%
2.20	Percentage of total sleep time at each sleep stage	Recommended	Voting - round 1	100.0%
2.21	Artifacts time	Optional	Voting - round 2	81.5%
2.22	Explicit mention of automated data analysis (if applicable)	Recommended	Steering committee	Not available

Table 3 Arousals - types 1 and 2.

#	Item	Status	Consensus reached on	Agreement rate
3.1	Number of arousals	Recommended	Voting - round 1	98.9%
3.2	Arousal Index	Recommended	Voting - round 1	100.0%
3.3	Number of non-rapid eye movement (NREM) sleep arousals	Optional	Voting - round 2	75.0%
3.4	NREM sleep arousals index	Optional	Voting - round 2	75.0%
3.5	Number REM sleep arousals	Optional	Voting - round 2	76.1%
3.6	Rapid eye movement sleep arousal index	Optional	Voting - round 2	81.5%

Table 4 Motion events - types 1 and 2.

#	Item	Status	Consensus reached on	Agreement rate
4.1	Number of periodic lower limb movements	Recommended	Voting - round 1	97.8%
4.2	Number of periodic upper limb movements	Optional	Voting - round 2	77.2%
4.3	Number of periodic lower and upper limb movements	Optional	Recommended + Optional > 75% criterion	98.9%
4.4	Number of periodic limb movements associated with arousals	Recommended	Voting - round 1	100.0%
4.5	Number of periodic limb movements associated with respiratory events	Optional	Recommended + Optional > 75% criterion	92.4%
4.6	Index of periodic limb movements	Recommended	Voting - round 1	93.5%
4.7	Index of periodic limb movements associated with arousals	Recommended	Voting - round 1	82.6%
4.8	Index of periodic limb movements associated with respiratory events	Optional	Recommended + Optional > 75% criterion	92.4%
4.9	Rapid eye movement (REM) sleep without atonia	Recommended	Voting - round 1	69.6%
4.10	REM sleep without atonia index	Optional	Recommended + Optional > 75% criterion	93.5%
4.11	Presence of rhythmic movement disorder	Optional	Recommended + Optional > 75% criterion	98.9%
4.12	Presence of alternating leg muscle activation	Optional	Voting - round 2	66.3%
4.13	Presence of hypnagogic tremors of the feet	Optional	Recommended + Optional > 75% criterion	93.5%
4.14	Presence of excessive fragmentary myoclonus	Optional	Voting - round 2	69.6%

Abbreviation: REM, rapid eye movement.

Therefore, all bruxism-related variables may be reported (OPTIONAL – items 5.1–5.48). The list of items related to bruxism events along with their final recommendation status and agreement rates are shown in ►**Table 5**.

Respiratory Events – Types 1 and 2

The four main indexes related to the severity of sleep-disordered breathing shall be reported for type-1 and -2 PSG – apnea-hypopnea index (AHI), respiratory disturbance index (RDI), respiratory event index (REI), and oxygen desaturation index (ODI) (RECOMMENDED – ►**Table 6**).

The number of total, obstructive, central, and mixed apneas shall be reported (RECOMMENDED – items 7.2–7.5), and their stratification per sleep stages and body position may be reported (OPTIONAL – items 7.18–7.20 and 7.31–7.33). For hypopneas, the total number of hypopneas shall be reported (RECOMMENDED – item 7.6), while their stratification per type (obstructive or mixed), sleep stages, and body position may be reported (OPTIONAL – items 7.7–7.8, 7.21–7.23, and 7.34–7.37). The combined number of apneas and hypopneas shall be reported (RECOMMENDED – items 7.12). The duration of respiratory events may be reported (OPTIONAL – items 7.44–7.51).

Regarding disease severity indexes, additionally to the four main indexes mentioned above, the apnea index, the hypopnea index, and the AHI, and the AHI per body position shall be reported (RECOMMENDED – items 7.10–7.13, and 7.40).

Regarding desaturation events, the number of desaturations at $\geq$ 3% and its respective ODI shall be reported (RECOMMENDED – items 7.52 and 7.58), while the number of desaturations at $\geq$ 4% and its respective ODI may be reported (OPTION – items 7.53 and 7.59. The stratification of the number of desaturations and their indexes per sleep stage and per body positions may be reported (OPTIONAL – items 7.18–7.26, and 7.31–7.42). Maximum, mean, and minimum spO_2 levels, and the amount of sleep time with spO_2 below 90% shall be reported (RECOMMENDED – items 7.64–7.67).

The occurrence of hypoventilation, Cheyne-Stokes breathing, and snoring shall be reported (RECOMMENDED – items 7. 70, 7.71, and 7.75). Derivative parameters, including the duration or number of events related to Cheyne-Stokes breathing, or the intensity, duration, or index of snoring may be reported (OPTIONAL – items 7.72–7.78). Hypoxic burden may be reported (OPTIONAL – item 7.79).

The list of items related to respiratory events along with their final recommendation status and agreement rates is shown in ►**Table 7**.

Cardiac Events – Type-1 and -2 PSG

Average, minimal, and maximal heart rate shall be reported (RECOMMENDED – items 8.1 and 8.2), and their stratification per sleep stage or during wake time may be reported (RECOMMENDED – items 8.3 and 8.4). All major

Table 5 Bruxism events – types 1 and 2.

#	Item	Status	Consensus reached on	Agreement rate
5.1	Total number of bruxism episodes	Optional	Steering committee	Not available
5.2	Total number of bruxism episodes associated with arousals	Optional	Steering committee	Not available
5.3	Total number of bruxism episodes associated with respiratory events	Optional	Recommended + Optional > 75% criterion	95.5%
5.4	Total number of bruxism-associated episodes of movement	Optional	Voting - round 2	68.2%
5.5	Total number of bruxism episodes per sleep stage	Optional	Recommended + Optional > 75% criterion	93.2%
5.6	Total number of bruxism episodes by position	Optional	Voting - round 2	68.2%
5.7	Bruxism index	Optional	Steering committee	Not available
5.8	Bruxism index associated with arousals	Optional	Steering committee	Not available
5.9	Bruxism index associated with respiratory events	Optional	Steering committee	Not available
5.10	Bruxism Index associated with movement	Optional	Recommended + Optional > 75% criterion	95.5%
5.11	Bruxism index by sleep stages	Optional	Steering committee	Not available
5.12	Bruxism index by position	Optional	Voting - round 2	68.2%
5.13	Total number of tonic episodes of bruxism	Optional	Voting - round 2	75.0%
5.14	Total number of tonic episodes of bruxism associated with arousals	Optional	Voting - round 2	81.8%
5.15	Total number of tonic episodes of bruxism associated with respiratory events	Optional	Recommended + Optional > 75% criterion	95.5%
5.16	Total number of tonic episodes of bruxism associated with movements	Optional	Voting - round 2	79.5%
5.17	Total number of tonic episodes of bruxism per sleep stage	Optional	Voting - round 2	77.3%
5.18	Total number of tonic bruxism episodes by position	Optional	Voting - round 2	81.8%
5.19	Tonic bruxism index	Optional	Recommended + Optional > 75% criterion	95.5%
5.20	Tonic bruxism index associated with arousals	Optional	Voting - round 2	72.7%
5.21	Tonic bruxism index associated with respiratory events	Optional	Voting - round 2	68.2%
5.22	Tonic bruxism index associated with movement	Optional	Recommended + Optional > 75% criterion	95.5%
5.23	Tonic bruxism index by sleep stages	Optional	Steering committee	Not available
5.24	Tonic bruxism index by position	Optional	Voting - round 2	81.8%
5.25	Total number of phasic episodes of bruxism	Optional	Voting - round 2	72.7%
5.26	Total number of phasic episodes of bruxism associated with arousals	Optional	Recommended + Optional > 75% criterion	95.5%
5.27	Total number of phasic episodes of bruxism associated with respiratory events	Optional	Voting - round 2	79.5%
5.28	Total number of phasic episodes of bruxism associated with movements	Optional	Voting - round 2	79.5%
5.29	Total number of phasic episodes of bruxism per sleep stage	Optional	Voting - round 2	81.8%
5.30	Total number of fascist episodes of bruxism by position	Optional	Voting - round 2	81.8%
5.31	Phasic bruxism index	Optional		95.5%

(*Continued*)

Table 5 (*Continued*)

#	Item	Status	Consensus reached on	Agreement rate
			Recommended + Optional > 75% criterion	
5.32	Phasic bruxism index associated with arousals	Optional	Recommended + Optional > 75% criterion	95.5%
5.33	Phasic bruxism index associated with respiratory events	Optional	Recommended + Optional > 75% criterion	95.5%
5.34	Phasic bruxism index associated with movement	Optional	Recommended + Optional > 75% criterion	95.5%
5.35	Phasic bruxism index by sleep stages	Optional	Steering committee	Not available
5.36	Phasic bruxism index by position	Optional	Voting - round 2	81.8%
5.37	Total number of mixed episodes of bruxism	Optional	Voting - round 2	77.3%
5.38	Total number of mixed episodes of bruxism associated with arousals	Optional	Voting - round 2	81.8%
5.39	Total number of mixed episodes of bruxism associated with respiratory events	Optional	Voting - round 2	81.8%
5.40	Total number of mixed episodes of bruxism associated with movements	Optional	Voting - round 2	81.8%
5.41	Total number of mixed bruxism episodes by sleep stage	Optional	Voting - round 2	81.8%
5.42	Total number of mixed bruxism episodes by position	Optional	Voting - round 2	81.8%
5.43	Mixed bruxism index	Optional	Recommended + Optional > 75% criterion	95.5%
5.44	Mixed bruxism index associated with arousals	Optional	Voting - round 2	72.7%
5.45	Mixed bruxism Index associated with respiratory events	Optional	Recommended + Optional > 75% criterion	95.5%
5.46	Mixed bruxism index associated with movement	Optional	Recommended + Optional > 75% criterion	95.5%
5.47	Mixed bruxism index by sleep stages	Optional	Steering committee	Not available
5.48	Mixed bruxism index by position	Optional	Voting - round 2	79.5%

Table 6 Recommendation of sleep-disordered breathing severity parameters by record type.

	AHI	RDI	REI	IDO
Type 1	Recommended	Recommended	Recommended	Recommended
Type 2	Recommended	Recommended	Recommended	Recommended
Type 3	Not recommended	Not recommended	Recommended	Recommended
Type 4	Not recommended	Not recommended	Not recommended	Recommended

Abbreviations: AHI, apnea-hypopnea index; IDR, respiratory disturbance index; ODI, oxygen desaturation index; REI, respiratory event index.

cardiovascular events observable in a PSG shall be reported (RECOMMENDED – items 8.4–8.11). In the case of no observable cardiovascular events, the absence of such events should be reported in the PSG report, so it can be clearly understood that such events were searched for and not found (rather than not evaluated). The list of items related to cardiac events along with their final recommendation status and agreement rates is shown in ►**Table 8**.

Conclusions and Graphic Reports – Types 1 and 2

Text description of the main diagnostic findings, EEG and electrocardiogram (ECG) abnormalities, behavioral observations, and sleep architecture shall be reported (RECOMMENDED – items 9.2–9.5). If EEG and ECG abnormalities or behavioral manifestations are not found, the absence of such abnormalities or observations shall be properly stated.

Graphic reports containing data about the sleep architecture, body position, spO_2, heart rate and respiratory events

Table 7 Respiratory events – types 1 and 2.

#	Item	Status	Consensus reached on	Agreement rate
7.1	Criteria for scoring hypopneas	Recommended	Voting - round 1	81.5%
7.2	Number of total apneas	Recommended	Steering committee	N/A
7.3	Number of obstructive apneas	Recommended	Voting - round 1	100.0%
7.4	Number of mixed apneas	Recommended	Voting - round 1	100.0%
7.5	Number of central apneas	Recommended	Voting - Round 1	100.0%
7.6	Number of hypopneas	Recommended	Voting - round 1	100.0%
7.7	Number of obstructive hypopneas	Optional	Voting - round 2	67.4%
7.8	Number of central hypopneas	Optional	Voting - round 2	67.4%
7.9	Number of apneas + hypopneas	Recommended	Voting - round 1	88.0%
7.10	Apnea index	Recommended	Voting - round 1	82.6%
7.11	Hypopnea index	Recommended	Voting - round 1	82.6%
7.12	Apnea-hypopnea index (AHI)	Recommended	Voting - round 1	100.0%
7.13	Obstructive apnea + hypopneas index	Optional	Steering committee	IN
7.14	Centra apnea + hypopneas index	Optional	Recommended + Optional > 75% criterion	98.9%
7.15	Number of arousals associated with respiratory effort (RERA)	Optional	Steering committee	IN
7.16	Index of arousals associated with respiratory effort	Optional	Steering committee	IN
7.17	Respiratory disorder index (RDI)	Optional	Steering committee	IN
7.18	Number of obstructive apneas per sleep stage	Optional	Recommended + Optional > 75% criterion	100.0%
7.19	Number of mixed apneas per sleep stage	Optional	Voting - round 2	68.5%
7.20	Number of central apneas per sleep stage	Optional	Recommended + Optional > 75% criterion	100.0%
7.21	Number of hypopneas per sleep stage	Optional	Recommended + Optional > 75% criterion	100.0%
7.22	Number of obstructive hypopneas by sleep stage	Optional	Voting - round 2	78.3%
7.23	Number of central hypopneas per sleep stage	Optional	Voting - round 2	85.9%
7.24	Number of Apneas + hypopneas by sleep stage	Optional	Recommended + Optional > 75% criterion	100.0%
7.25	Apnea index by sleep stage	Optional	Recommended + Optional > 75% criterion	94.6%
7.26	Hypopnea index by sleep stage	Optional	Recommended + Optional > 75% criterion	94.6%
7.27	Apnea + hypopnea index by sleep stage	Optional	Steering Committee	N/A
7.28	Obstructive apnea + hypopnea index by sleep stage	Optional	Recommended + Optional > 75% criterion	94.6%
7.29	Central apnea + hypopnea index by sleep stage	Optional	Recommended + Optional > 75% criterion	94.6%
7.30	Respiratory disturbance index by sleep stage	Optional	Voting - round 2	70.7%
7.31	Number of obstructive apneas by position	Optional	Voting - round 2	67.4%
7.32	Number of mixed apneas per position	Optional	Voting - round 2	75.0%
7.33	Number of central apneas per position	Optional	Voting - round 2	76.1%

(*Continued*)

Table 7 (*Continued*)

#	Item	Status	Consensus reached on	Agreement rate
7.34	Number of hypopneas per position	Optional	Voting - round 2	69.6%
7.35	Number of obstructive hypopneas by position	Optional	Voting - round 1	66.3%
7.36	Number of central hypopneas by position	Optional	Voting - round 1	79.3%
7.37	Number of apneas + hypopneas by position	Optional	Recommended + Optional > 75% criterion	100.0%
7.38	Apnea index by position	Optional	Recommended + Optional > 75% criterion	100.0%
7.39	Hypopnea index by position	Optional	Recommended + Optional > 75% criterion	100.0%
7.40	Apnea + hypopnea index by position	Recommended	Voting - round 1	80.4%
7.41	Obstructive apnea + hypopneas index by position	Optional	Recommended + Optional > 75% criterion	100.0%
7.42	Central apnea + hypopneas index by position	Optional	Recommended + Optional > 75% criterion	89.1%
7.43	Respiratory disturbance index by position	Optional	Recommended + Optional > 75% criterion	94.6%
7.44	Mean duration of obstructive apneas	Optional	Voting - round 2	68.5%
7.45	Maximum duration of obstructive apneas	Optional	Recommended + Optional > 75% criterion	100.0%
7.46	Average duration of mixed apneas	Optional	Voting - round 1	67.4%
7.47	Maximum duration of mixed apneas	Optional	Voting - round 1	66.3%
7.48	Average duration of central apneas	Optional	Voting - round 2	69.6%
7.49	Maximum duration of central apneas	Optional	Recommended + Optional > 75% criterion	100.0%
7.50	Average duration of hypopneas	Optional	Voting - round 2	69.6%
7.51	Maximum duration of hypopneas	Optional	Voting - round 2	68.5%
7.52	Number of oxyhemoglobin desaturations $\geq$ 3%	Recommended	Voting - round 2	76.1%
7.53	Number of oxyhemoglobin desaturations $\geq$ 4%	Optional	Steering committee	N/A
7.54	Number of oxyhemoglobin desaturation $\geq$ 3% in REM sleep	Optional	Steering committee	N/A
7.55	Number of oxyhemoglobin desaturation $\geq$ 4% in REM sleep	Optional	Steering committee	N/A
7.56	Number of oxyhemoglobin desaturation $\geq$ 3% in NREM sleep	Optional	Steering committee	N/A
7.57	Number of oxyhemoglobin desaturation $\geq$ 4% in NREM sleep	Optional	Steering committee	N/A
7.58	Oxyhemoglobin desaturation index (ODI) $\geq$ 3%	Recommended	Voting – round 1	77.2%
7.59	Oxyhemoglobin desaturation index (ODI) $\geq$ 4%	Optional	Steering committee	N/A
7.60	Oxyhemoglobin desaturation index (ODI) $\geq$ 3% in REM sleep	Optional	Steering committee	N/A
7.61	Oxyhemoglobin desaturation index (ODI) $\geq$ 4% in REM sleep	Optional	Recommended + Optional > 75% criterion	93.5%
7.62	Oxyhemoglobin desaturation index (ODI) $\geq$ 3% in NREM sleep	Optional	Recommended + Optional > 75% criterion	100.0%

Table 7 (*Continued*)

#	Item	Status	Consensus reached on	Agreement rate
7.63	Oxyhemoglobin desaturation index (ODI) $\geq$ 4% in NREM sleep	Optional	Recommended + Optional > 75% criterion	93.5%
7.64	Maximum oxyhemoglobin saturation value	Recommended	Voting - round 1	66.3%
7.65	Mean value of oxyhemoglobin saturation	Recommended	Voting - round 1	98.9%
7.66	Minimum value of oxyhemoglobin saturation	Recommended	Voting - round 1	97.8%
7.67	Oxyhemoglobin saturation time below 90%	Recommended	Voting - round 1	100.0%
7.68	Oxyhemoglobin saturation time below 80%	Optional	Steering committee	N/A
7.69	Oxyhemoglobin saturation time below 70%	Optional	Recommended + Optional > 75% criterion	94.6%
7.70	Occurrence of hypoventilation during diagnostic study in adults	Optional	Steering committee	N/A
7.71	Occurrence of Cheyne-Stokes respiration	Recommended	Voting - round 1	93.5%
7.72	Absolute duration of Cheyne-Stokes respiration	Optional	Voting - round 2	68.5%
7.73	Relative duration of Cheyne-Stokes respiration	Optional	Voting - round 2	70.7%
7.74	Number of Cheyne-Stokes breathing events	Optional	Recommended + Optional > 75% criterion	94.6%
7.75	Occurrence of snoring in adults	Recommended	Voting - round 1	88.0%
7.76	Intensity of snoring	Optional	Voting - round 2	72.8%
7.77	Snoring time	Optional	Voting - round 2	82.6%
7.78	Snoring index	Optional	Voting - round 2	90.2%
7.79	Hypoxic burden	Optional	Voting - round 2	76.1%
7.80	Presence of hypoxemia during sleep (SpO2 $\leq$ 88% for 5 minutes)	Optional	Recommended + Optional > 75% criterion	93.5%

Abbreviations: IN; N/A, not available; NREM, non-rapid eye movement; REM, rapid eye movement.

shall be reported (RECOMMENDED – items 9.6–9.10). Graphic reports for snoring or movement events and snoring, and samples of epochs from each sleep stage may be reported (OPTIONAL – items 9.11–9.13). The list of items related to conclusion remarks and graphic reports along with their final recommendation status and agreement rates, is shown in ►**Table 9**.

Items Common to Type-3 and -4 Sleep Studies

Montage, Technical Aspects and General Recording Parameters – Types 3 and 4

The items that compose the exam shall be reported (RECOMMENDED – item 10.1). These include all devices, sensors, electrodes, and other equipment, including their positioning. The manual or guidelines used to define and score events shall be reported (RECOMMENDED – item 10.2). The brand and model of the equipment and its approval or clearance by relevant health regulatory authorities (such as the Food and Drug Administration [FDA], in the United States, or Agência de Vigilância Sanitária [ANVISA], in Brazil) shall be reported (RECOMMENDED – items 10.3 and 10.4). This is an important matter, especially in the case of type-4 devices, as some have been marketed directly to the consumers, therefore bypassing regulation by health agencies.

The use of automated sleep scoring techniques must be explicitly mentioned, if used (RECOMMENDED – item 10.8). The name of the physician responsible for the emission of the PSG report (that is, the one signing it and legally entitled for it) shall be reported (RECOMMENDED – item 10.9).

Regarding overall recording parameters, the time in which the recording started and ended, the total recording time and the total monitoring time shall be reported (RECOMMENDED – items 10.10–10.14).

The list of items related to the montage of type-3 and -4 sleep studies, technical aspects, and sleep staging, along with their final recommendation status and agreement rates, is disclosed in ►**Table 10**.

Conclusions and Graphic Reports – Types 3 and 4

A textual description of the main diagnostic findings, including ECG abnormalities, shall be reported (RECOMMENDED –

Table 8 Cardiac events – types 1 and 2.

#	Item	Status	Consensus reached on	Agreement rate
8.1	Average heart rate during sleep	Recommended	Voting - round 1	94.6%
8.2	Higher and lower heart rate during sleep	Recommended	Voting - round 1	71.7%
8.3	Higher and lower heart rate during recording	Optional	Recommended + Optional > 75% criterion	98.9%
8.4	Higher, average, and lower heart rate during each sleep stage	Optional	Voting - round 1	76.1%
8.5	Occurrence of bradycardia during sleep	Recommended	Voting - round 1	87.0%
8.6	Occurrence of asystole	Recommended	Voting - round 1	92.4%
8.7	Occurrence of sinus tachycardia during sleep	Recommended	Voting - round 1	81.5%
8.8	Occurrence of narrow complex tachycardia	Recommended	Voting - round 1	68.5%
8.9	Occurrence of wide complex tachycardia: report highest heart rate observed	Recommended	Voting - round 1	69.6%
8.10	Occurrence of atrial fibrillation: reporting mean heart rate	Recommended	Voting - round 1	87.0%
8.11	Occurrence of other arrhythmias	Recommended	Voting - round 1	87.0%

Table 9 Conclusions and graphical reports – types 1 and 2.

#	Item	Status	Consensus reached on	Agreement rate
9.1	Diagnostic findings - textual description	Recommended	Voting - round 1	94.6%
9.2	EEG abnormalities - textual description	Recommended	Voting - round 1	94.6%
9.3	ECG abnormalities - textual description	Recommended	Voting - round 1	100.0%
9.4	Behavioral observations - textual description	Recommended	Voting - round 1	100.0%
9.5	Sleep architecture - textual description	Recommended	Voting - round 1	78.3%
9.6	Hypnogram	Recommended	Voting - round 1	100.0%
9.7	Position chart	Recommended	Voting - round 1	97.8%
9.9	Oxyhemoglobin saturation chart	Recommended	Voting - round 1	100.0%
9.9	Heart rate graph	Recommended	Voting - round 1	98.9%
9.10	Respiratory event graph	Recommended	Voting - round 1	100.0%
9.11	Snoring chart	Optional	Recommended + Optional > 75% criterion	94.6%
9.12	Movement event graph	Optional	Recommended + Optional > 75% criterion	89.1%
9.13	Examples of epochs of each stage	Optional	Voting - round 1	83.7%

Abbreviations: ECG, electrocardiogram; EEG, electroencephalogram.

items 11.1–11.2). If no ECG abnormalities or behavioral manifestations are found, the absence of such abnormalities or observations shall be properly stated. Graphic reports containing data about body position, spO_2, heart rate, snoring, and respiratory events shall be reported (RECOMMENDED – items 11.4–11.8). Hypnograms shall not be reported (NOT RECOMMENDED – item 11.3). Hypnograms are not recommended, as sleep scoring estimates were considered as not allowed in both type-3 and -4 sleep studies.

The list of items related to conclusions and graphic reports, along with their final recommendation status and agreement rates, is shown in ►**Table 11**.

Type-3 Sleep Studies

Before voting for the items to be reported in type-3 reports, the panelists were asked to assess the reliability of type-3 sleep studies for estimating total sleep time, performing sleep staging and detecting arousals (►**Table 12**).

Table 10 Exam setup, technical aspects and registration parameters – types 3 and 4.

#	Item	Status	Consensus reached on	Agreement rate
10.1	Description of the items that compose the exam	Recommended	Voting - round 1	88.0%
10.2	Manual/guidelines used for event scoring	Recommended	Steering committee	N/A
10.3	Device brand and model	Recommended	Voting - round 1	71.7%
10.4	Approval of the device by regulatory agencies (ANVISA, FDA, etc.).	Recommended	Voting - round 2	78.3%
10.5	Make and model of other equipment used (if applicable)	Optional	Voting - round 2	78.3%
10.6	Software used for exam acquisition and analysis	Optional	Recommended + Optional > 75% criterion	100.0%
10.7	Name of the sleep technologist responsible for analyzing the exam (in case of manual analysis)	Optional	Recommended + Optional > 75% criterion	77.2%
10.8	Explicit mention of automated data analysis (if applicable)	Recommended	Voting - round 2	88.0%
10.9	Name of the professional responsible for the laboratory	Optional	Recommended + Optional > 75% criterion	98.9%
10.10	Name of the physician responsible for issuing the report	Recommended	Voting - round 1	94.6%
10.11	Registration start time	Recommended	Voting - round 1	94.6%
10.12	Registration end time	Recommended	Voting - round 1	94.6%
10.13	Total registration time	Recommended	Voting - round 1	94.6%
10.14	Monitoring time (registration time minus time on artifacts)	Recommended	Voting - round 1	94.6%

Abbreviations: ANVISA, Agência de Vigilância Santiária; FDA, Food and Drug Administration; N/A, not available.

Table 11 Conclusions and graphical reports – types 3 and 4.

#	Item	Status	Consensus reached on	Agreement rate
11.1	Diagnostic findings - textual description	Recommended	Voting - Round 1	94.6%
11.2	ECG abnormalities - textual description (for type 3)	Recommended	Voting - Round 1	83.7%
11.3	Hypnogram (where applicable)	Not recommended	Conditional response	N/A
11.4	Position chart (where applicable)	Recommended	Voting - round 1	91.3%
11.5	Oxyhemoglobin saturation chart	Recommended	Voting - round 1	94.6%
11.6	Heart rate chart	Recommended	Voting - round 1	93.5%
11.7	Snoring chart	Recommended	Voting - round 2	70.7%
11.8	Respiratory event chart	Recommended	Voting - round 1	94.6%

Abbreviation: ECG, electrocardiogram.

No consensus was achieved regarding the reliability of type-3 studies for estimating total sleep time. Therefore, all items conditioned to this definition were automatically defined as *no consensus*. The performance of sleep staging and the detection of arousals in type-3 studies were both considered NOT ALLOWED. Therefore, all items conditioned to these aspects were automatically considered as *not recommended*.

Overall Recording Parameters – Type 3

As no consensus was reached for the reliability of estimating total sleep time by type-3 studies, all items conditioned to this definition were automatically defined as "no consensus." This includes variables related to reporting total sleep time, sleep latency, WASO and sleep efficiency.

As both performance of sleep staging and detection of arousals were considered as not allowed, all items conditioned to these definitions shall not be reported (NOT RECOMMENDED – items 13.1 to 13.7). This includes reporting REM sleep latency, and the time spent in each stage. Artifact time may be reported (OPTIONAL – item 13. 8). The list of items related to overall recording parameters of type-3

Table 12 Estimates of total sleep time, sleep staging, and awakening detection – types 3 and 4.

	Type 3			Type 4		
	Status	**Consensus reached on**	**Agreement rate**	**Status**	**Consensus reached on**	**Agreement rate**
Estimate total sleep time	No consensus	Not available	Not available	Not allowed	Voting - round 2	73.9%
Perform sleep staging	Not allowed	Voting - round 1	79.3%	Not allowed	Voting - round 1	85.9%
Detect arousals	Not allowed	Voting - round 2	80.4%	Not allowed	Voting - round 1	71.7%

studies, along with their final recommendation status and agreement rates, is shown in ►**Table 13**.

Respiratory Events – Type 3

As the detection of arousals was considered as *not allowed* for type-3 studies, AHI or RDI shall not be reported (NOT RECOMMENDED – ►**Table 6**). The REI and ODI are the only appropriate disease severity parameters that shall be reported (RECOMMENDED – ►**Table 6**).

The number of total, obstructive, central, and mixed apneas, the number of total and obstructive hypopneas, and the combined number of apneas and hypopneas shall be reported (RECOMMENDED – items 14.1–14.7).

Regarding desaturation events, the number of desaturations at $\geq$ 3% and its respective ODI levels and their respective ODI shall be reported (RECOMMENDED – items 14.18 and 14.20), while the number of desaturations at $\geq$ 4% and its respective ODI levels and their respective ODI may be reported (OPTIONAL – items 14.19 and 14.21). Mean and minimum spO_2 levels and the time with spO_2 below 90% shall be reported (RECOMMENDED – items 14.27–14.29).

The occurrence of Cheyne-Stokes breathing and snoring shall be reported (RECOMMENDED – items 14.33 and 14.37). Derivative parameters, including the duration or number of events related to Cheyne-Stokes breathing, or intensity, duration or index of snoring may be reported (OPTIONAL – items 14.34–14.41). Hypoxic burden may be reported (OPTIONAL – 14.42).

The list of items related to respiratory events, along with their final recommendation status and agreement rates, is shown in ►**Table 14**.

Cardiac Events – Type 3

Average heart rate during the recording shall be reported (RECOMMENDED – item 15.1), while minimal and maximal heart rate may be reported (OPTIONAL – item 15.2). Bradycardia shall be reported (RECOMMENDED – item 15.4), while other major observable cardiovascular events shall not be reported (NOT RECOMMENDED – items 15.5–15.9), due to the lack of proper ECG recording. The list of items related to cardiac events, along with their final recommendation status and agreement rates, is shown in ►**Table 15**.

Type-4 Sleep Studies

Before voting for the items to be included in type-3 reports, the panelists were asked to assess the reliability of type-3

Table 13 General recording parameters – type 3.

#	Item	Status	Consensus reached on	Agreement rate
13.1	Methods (sensors and calculations) used for sleep staging	Not recommended	Conditional response	N/A
13.2	Reference to studies comparing the methods implemented for sleep staging in relation to PSG type 1 2.	Not recommended	Conditional response	N/A
13.3	Methods (sensors and calculations) used for arousal estimation	Not recommended	Conditional response	N/A
13.4	Reference to studies comparing the methods implemented for the detection of arousals in relation to PSG type 1 or 2.	Not recommended	Conditional response	N/A
13.5	REM sleep latency (where applicable)	Not recommended	Conditional response	N/A
13.6	Time in each sleep stage (in minutes) (where applicable)	Not recommended	Conditional response	N/A
13.7	Percentage of total sleep time at each sleep stage (where applicable)	Not recommended	Conditional response	N/A
13.8	Artifacts time	Optional	Voting - Round 2	88.0%

Abbreviations: N/A, not available; PSG, polysomnography; REM, rapid eye movement.

Table 14 Respiratory events – type 3.

#	Item	Status	Consensus reached on	Agreement rate
14.1	Criteria for scoring hypopneas	Recommended	Voting - round 1	82.6%
14.2	Number of total apneas	Recommended	Steering committee	N/A
14.3	Number of obstructive apneas	Recommended	Voting - round 1	93.5%
14.4	Number of mixed apneas	Recommended	Voting - round 1	87.0%
14.5	Number of central apneas	Recommended	Voting - round 1	87.0%
14.6	Number of hypopneas	Recommended	Voting - round 1	93.5%
14.7	Number of obstructive hypopneas	Optional	Steering committee	N/A
14.8	Number of central hypopneas	Optional	Recommended + Optional > 75% criterion	94.6%
14.9	Number of apneas + hypopneas	Recommended	Voting - round 1	93.5%
14.10	Average duration of hypopneas	Optional	Recommended + Optional > 75% criterion	98.9%
14.11	Maximum duration of hypopneas	Optional	Recommended + Optional > 75% criterion	100.0%
14.12	Mean duration of obstructive apneas	Optional	Recommended + Optional > 75% criterion	100.0%
14.13	Maximum duration of obstructive apneas	Optional	Recommended + Optional > 75% criterion	100.0%
14.14	Average duration of mixed apneas	Optional	Voting - round 2	69.6%
14.15	Maximum duration of mixed apneas	Optional	Recommended + Optional > 75% criterion	100.0%
14.16	Average duration of central apneas	Optional	Recommended + Optional > 75% criterion	100.0%
14.17	Maximum duration of central apneas	Optional	Recommended + Optional > 75% criterion	100.0%
14.18	Number of oxyhemoglobin desaturations $\geq$ 3%	Recommended	Voting - round 1	76.1%
14.19	Number of oxyhemoglobin desaturations $\geq$ 4%	Optional	Steering committee	N/A
14.20	Oxyhemoglobin desaturation index (ODI) $\geq$ 3%	Recommended	Voting - round 1	77.2%
14.21	Oxyhemoglobin desaturation index (ODI) $\geq$ 4%	Optional	Steering committee	N/A
14.22	Oxyhemoglobin desaturation index (ODI) $\geq$ 3% in REM sleep	Not recommended	Conditional response	N/A
14.23	Oxyhemoglobin desaturation index (ODI) $\geq$ 4% in REM sleep	Not recommended	Conditional response	N/A
14.24	Oxyhemoglobin desaturation index (ODI) $\geq$ 3% in NREM sleep	Not recommended	Conditional response	N/A
14.25	Oxyhemoglobin desaturation index (ODI) $\geq$ 4% in NREM sleep	Not recommended	Conditional response	N/A
14.26	Maximum oxyhemoglobin saturation value	Optional	Recommended + Optional > 75% criterion	94.6%
14.27	Mean value of oxyhemoglobin saturation	Recommended	Voting - round 1	82.6%
14.28	Minimum value of oxyhemoglobin saturation	Recommended	Voting - round 1	88.0%

(*Continued*)

Table 14 (*Continued*)

#	Item	Status	Consensus reached on	Agreement rate
14.29	Oxyhemoglobin saturation time below 90%	Recommended	Voting - round 1	94.6%
14.30	Oxyhemoglobin saturation time below 80%	Optional	Steering committee	N/A
14.31	Oxyhemoglobin saturation time below 70%	Optional	Optional	Optional
14.32	Occurrence of hypoventilation during diagnostic study in adults	Not recommended	Optional	Optional
14.33	Occurrence of Cheyne-Stokes respiration	Recommended	Voting - round 1	91.3%
14.34	Absolute duration of Cheyne-Stokes respiration	Optional	Recommended + Optional > 75% criterion	94.6%
14.35	Relative duration of Cheyne-Stokes respiration	Optional	Recommended + Optional > 75% criterion	87.0%
14.36	Number of Cheyne-Stokes breathing events	Optional	Recommended + Optional > 75% criterion	94.6%
14.37	Occurrence of snoring in adults	Recommended	Voting - round 1	83.7%
14.38	Intensity of snoring	Optional	Recommended + Optional > 75% criterion	100.0%
14.39	Snoring time	Optional	Recommended + Optional > 75% criterion	94.6%
14.40	Snoring index	Optional	Voting - round 2	75.0%
14.41	Hypoxic burden	Optional	Recommended + Optional > 75% criterion	89.1%
14.42	Presence of hypoxemia during sleep (SpO2 $\leq$ 88% for 5 minutes)	Optional	Recommended + Optional > 75% criterion	88.0%

Abbreviations: N/A, not available; NREM, non-rapid eye movement; REM, rapid eye movement.

Table 15 Cardiac events – type 3.

#	Item	Status	Consensus reached on	Agreement rate
15.1	Average heart rate during sleep	Recommended	Voting - round 2	71.7%
15.2	Higher and lower heart rate during recording	Optional	Recommended + Optional > 75% criterion	100.0%
15.3	Higher, average, and lower heart rate during each sleep stage	Not recommended	Conditional response	N/A
15.4	Occurrence of bradycardia	Recommended	Voting - round 2	89.1%
15.5	Occurrence of asystole	Not recommended	Steering committee	N/A
15.6	Occurrence of sinus tachycardia	Not recommended	Steering committee	N/A
15.7	Occurrence of narrow complex tachycardia	Not recommended	Steering committee	N/A
15.8	Occurrence of wide complex tachycardia: report highest heart rate observed	Not recommended	Steering committee	N/A
15.9	Occurrence of atrial fibrillation: reporting mean heart rate	Not recommended	Steering committee	N/A

Abbreviation: N/A, not available.

sleep studies to estimate total sleep time, perform sleep staging and detect arousals (►**Table 12**). These three features were considered NOT ALLOWED for type-4 studies. Therefore, all items conditioned to these were automatically considered as *not recommended*.

Sleep Staging – Type 4

As estimating total sleep type, performing sleep staging, and detecting arousals were considered as not allowed, all items conditioned to these definitions shall not be reported (NOT RECOMMENDED – items 16.1–16.13). Artifact time may be

Table 16 General logging parameters – type 3.

#	Item	Status	Consensus reached on	Agreement rate
16.1	Methods (sensors and calculations) used for indirect sleep estimation (as opposed to wakefulness)	Not recommended	Conditional response	N/A
16.2	Reference to studies that compare the methods implemented for sleep estimation in relation to actigraphy, PSG type 1 or 2	Not recommended	Conditional response	N/A
16.3	Methods (sensors and calculations used for sleep staging	Not recommended	Conditional response	N/A
16.4	Reference to studies comparing the methods implemented for sleep staging in relation to PSG type 1 or 2	Not recommended	Conditional response	N/A
16.5	Methods (sensors and calculations) used for arousal estimation	Not recommended	Conditional response	N/A
16.6	Reference to studies comparing the methods implemented for the detection of arousals in relation to PSG type 1 or 2	Not recommended	Conditional response	N/A
16.7	Total sleep time (when applicable)	Not recommended	Conditional response	N/A
16.8	Sleep latency (where applicable)	Not recommended	Conditional response	N/A
16.9	R-stage latency (where applicable)	Not recommended	Conditional response	N/A
16.10	Wakefulness after sleep onset (when applicable)	Not recommended	Conditional response	N/A
16.11	Sleep efficiency (where applicable)	Not recommended	Conditional response	N/A
16.12	Time in each sleep stage (in minutes) (where applicable)	Not recommended	Conditional response	N/A
16.13	Percentage of total sleep time at each sleep stage (where applicable)	Not recommended	Conditional response	N/A
16.14	Artifacts time	Optional	Recommended + Optional > 75% criterion	85.9%

Abbreviations: N/A, not available; PSG, polysomnography.

reported (OPTIONAL – item 16.14). The list of items related to overall recording parameters of type-4 studies, along with their final recommendation status and agreement rates, is shown in ►**Table 16**.

Respiratory Events – Type 4

As the direct detection of obstructive respiratory events are not possible in type-4 studies, AHI, RDI, or REI shall not be reported (NOT RECOMMENDED – ►**Table 6**). The ODI is the only appropriate disease severity parameter and shall be reported (RECOMMENDED – ►**Table 6**).

Regarding desaturation events, the number of desaturations at $\geq$ 3% and their respective ODI shall be reported (RECOMMENDED – items 17.2 and 17.4), while the number of desaturations at $\geq$ 4%, and its respective ODI levels and their respective ODI may be reported (OPTIONAL – items 17.3 and 17.5). Mean and minimum spO_2 levels and the time with spO_2 below 90% shall be reported (RECOMMENDED – items 17.11–17.13). The occurrence of snoring may be reported (OPTIONAL – item 17.17), and derivative parameters or the intensity, duration, or index of snoring may be reported (OPTIONAL – items 17.17–17.19). Hypoxic burden may be reported (OPTIONAL – 17.20). The list of items related to respiratory events, along with their final recommendation status and agreement rates, is shown in ►**Table 17**.

Discussion

The current guidelines aim to standardize the reporting of results from the most important diagnostic tools in sleep medicine. Given the existing lack of uniform standards in this regard, and the limited implementation of those that do exist, we hope that this material will contribute to standardizing the practice of sleep medicine. This would certainly assist physicians and other health professionals (especially those not primarily specialized in sleep medicine) to understand the information collected during a sleep study, therefore increasing the accuracy of diagnoses and result in more appropriate treatment.

Some considerations about the parameters of this study should be made clear, to ensure its proper implementation. First, this guideline refers specifically to type-1 to -4 sleep studies. Therefore, no other diagnostic test is covered (such as MSLT, actigraphy), and the results presented here might not apply to them. Secondly, sleep studies performed with objectives that are not purely diagnostic (such as split-night studies and other forms of continuous positive airway

Table 17 Respiratory events – type 4.

#	Item	Status	Consensus reached on	Agreement rate
17.1	Criteria for scoring desaturations	Recommended	Voting - round 1	89.1%
17.2	Number of oxyhemoglobin desaturations ≥3%	Recommended	Voting - round 1	77.2%
17.3	Number of oxyhemoglobin desaturations ≥4%	Optional	Steering committee	N/A
17.4	Oxyhemoglobin desaturation index (ODI) ≥ 3%	Recommended	Voting - round 1	77.2%
17.5	Oxyhemoglobin desaturation index (ODI) ≥ 4%	Optional	Steering committee	N/A
17.6	Oxyhemoglobin desaturation index (ODI) ≥ 3% in REM sleep	Not recommended	Conditional response	N/A
17.7	Oxyhemoglobin desaturation index (ODI) ≥ 4% in REM sleep	Not recommended	Conditional response	N/A
17.8	Oxyhemoglobin desaturation index (ODI) ≥ 3% in NREM sleep	Not recommended	Conditional response	N/A
17.9	Oxyhemoglobin desaturation index (ODI) ≥ 4% in NREM sleep	Not recommended	Conditional response	N/A
17.10	Maximum oxyhemoglobin saturation value	Optional	Recommended + Optional > 75% criterion	89.1%
17.11	Mean value of oxyhemoglobin saturation	Recommended	Voting - round 1	89.1%
17.12	Minimum value of oxyhemoglobin saturation	Recommended	Voting - round 1	93.5%
17.13	Oxyhemoglobin saturation time below 90%	Recommended	Voting - round 1	94.6%
17.14	Oxyhemoglobin saturation time below 80%	Optional	Steering committee	N/A
17.15	Oxyhemoglobin saturation time below 70%	Optional	Steering committee	N/A
17.16	Occurrence of snoring in adults	Optional	Steering committee	N/A
17.17	Intensity of snoring	Optional	Recommended + Optional > 75% criterion	77.2%
17.18	Snoring time	Optional	Recommended + Optional > 75% criterion	88.0%
17.19	Snoring index	Optional	Voting - Round 2	71.7%
17.20	Hypoxic burden	Optional	Recommended + Optional > 75% criterion	83.7%
17.21	Presence of hypoxemia during sleep (SpO2 ≤ 88% for 5 minutes)	Optional	Recommended + Optional > 75% criterion	88.0%

Abbreviations: N/A, not available; NREM, non-rapid eye movement; REM, rapid eye movement.

pressure [CPAP] titration studies) are not covered. Third, the guidelines do not define how sleep-related parameters should be detected, analyzed, or calculated. For questions on this regard, we suggest following standard practices of data acquisition and analysis, most of which are contained in the AASM scoring manual.[7] The current guidelines endorse the definitions of the AASM manual regarding the montage and other technical information of sleep studies.

It is important to note that diagnostic sleep medicine is constantly evolving,[26] which may affect the way in which sleep disorders are evaluated and diagnosed. New devices and tools are being developed and made available at a rapid pace, and it is natural that some of them will be incorporated into the list of diagnostic tools used by healthcare professionals. Consumer-sleep technologies are also becoming increasingly prevalent, with improvements in their accuracy for a range of applications such as sleep staging[27] and the diagnosis of sleep disorders (particularly sleep disordered-breathing).[26] Finally, automatic detection tools and the use of artificial intelligence and machine learning are becoming increasingly common, especially for portable sleep monitoring.[28,29] Although the currently available technologies are

Table 18 Deleted and non-consensus items.

Domain	Item	Status	Consensus reached on
Movement events - types 1 and 2	Number of periodic lower limb movements during wakefulness	No consensus	Voting - Round 2
Movement events - types 1 and 2	Number of periodic upper limb movements during wakefulness	No consensus	Voting - Round 2
Movement events - types 1 and 2	Number of periodic lower and upper limb movements during wakefulness	No consensus	Voting - Round 2
Movement events - types 1 and 2	Index of periodic limb movements during wakefulness	No consensus	Voting - Round 2
General recording parameters - types 3 and 4	Manual used for sleep staging	Deleted Item - Inaccurate Writing	Voting - Round 1
General recording parameters - type 3	Sleep (as opposed to wakefulness, for determination of total sleep time, sleep latency, and sleep efficiency)	No consensus	Conditional response
General recording parameters - type 3	Methods (sensors and calculations) used for indirect sleep estimation (as opposed to wakefulness)	No consensus	Conditional response
General recording parameters - type 3	Reference to studies that compare the methods implemented for sleep estimation in relation to actigraphy, PSG type I or II.	No consensus	Conditional response
General recording parameters - type 3	Total sleep time (when applicable)	No consensus	Conditional response
General recording parameters - type 3	Sleep latency (where applicable)	No consensus	Conditional response
General recording parameters - type 3	Wakefulness after sleep onset (when applicable)	No consensus	Conditional response
General recording parameters - type 3	Sleep efficiency (where applicable)	No consensus	Conditional response
Respiratory events - type 3	Occurrence of hypoventilation during diagnostic study in adults	No consensus	Voting - Round 2
Cardiac events - type 3	Higher and lower heart rate during sleep	No consensus	Conditional response

not yet reliable enough for indirect quantification of total sleep time, performance of sleep staging, and detection of arousals, it is possible that their accuracy will increase with new technological developments in the near future. Thus, while these guidelines address today's needs, they may require constant updates as technology evolves.

As the present document represents the official position of the Brazilian Sleep Association on the preparation of reports for PSG and sleep studies, we expect it to be implemented consistently across the country. By promoting the standardization of reporting practices in sleep medicine, we hope to enhance the overall quality of diagnostic and therapeutic practices through clearer communication among health professionals and between them and their patients.

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References

1 Lastra AC, Ingram D, Park J, et al. Moving toward standardization: physician reporting of sleep studies. J Clin Sleep Med 2023;19 (03):595–603
2 Kishi TT, Andersen ML, Luciano YM, Kakazu VA, Tufik S, Pires GN. Methods for REM Sleep Density Analysis: A Scoping Review. Clocks Sleep 2023;5(04):793–805
3 Arnardottir ES, Isleifsson B, Agustsson JS, et al. How to measure snoring? A comparison of the microphone, cannula and piezoelectric sensor. J Sleep Res 2016;25(02):158–168
4 Arnardottir ES, Verbraecken J, Gonçalves M, et al; The National Representatives as Study Collaborators. Variability in recording and scoring of respiratory events during sleep in Europe: a need for uniform standards. J Sleep Res 2016;25(02):144–157

5 Roehrs TA, Carskadon MA. Standardization of method: essential to sleep science. Sleep 1998;21(05):445

6 Midelet A, Borel JC, Tamisier R, et al. Apnea-hypopnea index supplied by CPAP devices: time for standardization? Sleep Med 2021;81:120–122

7 Troester MM, Quan SF, Berry RB, et al. The AASM manual for the scoring of sleep and associated events: Rules, terminoloy and technical specifications. Version 3. Darien, IL, USA: American Academy of Sleep Medicine; 2023

8 Diamond IR, Grant RC, Feldman BM, et al. Defining consensus: a systematic review recommends methodologic criteria for reporting of Delphi studies. J Clin Epidemiol 2014;67(04): 401–409

9 Jünger S, Payne SA, Brine J, Radbruch L, Brearley SG. Guidance on Conducting and REporting DElphi Studies (CREDES) in palliative care: Recommendations based on a methodological systematic review. Palliat Med 2017;31(08):684–706

10 McPherson S, Reese C, Wendler MC. Methodology Update: Delphi Studies. Nurs Res 2018;67(05):404–410

11 Barrett D, Heale R. What are Delphi studies? Evid Based Nurs 2020;23(03):68–69

12 Humphrey-Murto S, Wood TJ, Gonsalves C, Mascioli K, Varpio L. The Delphi Method. Acad Med 2020;95(01):168

13 Niederberger M, Spranger J. Delphi Technique in Health Sciences: A Map. Front Public Health 2020;8:457

14 Spranger J, Homberg A, Sonnberger M, Niederberger M. Reporting guidelines for Delphi techniques in health sciences: A methodological review. Z Evid Fortbild Qual Gesundhwes 2022;172:1–11

15 Boulkedid R, Abdoul H, Loustau M, Sibony O, Alberti C. Using and reporting the Delphi method for selecting healthcare quality indicators: a systematic review. PLoS One 2011;6(06): e20476

16 Nasa P, Jain R, Juneja D. Delphi methodology in healthcare research: How to decide its appropriateness. World J Methodol 2021;11(04):116–129

17 Allavena C, Bastides F, Moroy A, et al. The screening and management of sleep disturbances in people living with HIV: Delphi consensus. J Sleep Res 2024;33(03):e14070

18 Berezin L, Nagappa M, Wong J, et al. Identification of Sleep Medicine and Anesthesia Core Topics for Anesthesia Residency: A Modified Delphi Technique Survey. Anesth Analg 2021;132(05): 1223–1230

19 Boerner KE, Coulombe JA, Corkum P. Core competencies for health professionals' training in pediatric behavioral sleep care: a Delphi study. Behav Sleep Med 2015;13(04):265–284

20 Murphie P, Little S, Paton R, McKinstry B, Pinnock H. Defining the Core Components of a Clinical Review of People Using Continuous Positive Airway Pressure Therapy to Treat Obstructive Sleep Apnea: An International e-Delphi Study. J Clin Sleep Med 2018; 14(10):1679–1687

21 Pearson L, Parker S, Mansell W. The development of a theoretically derived measure exploring extreme appraisals of sleep in bipolar disorder: a Delphi study with professionals. Behav Cogn Psychother 2020;48(04):395–407

22 Pires GN, Arnardóttir ES, Bailly S, McNicholas WT. Guidelines for the development, performance evaluation and validation of new sleep technologies (DEVSleepTech guidelines) - a protocol for a Delphi consensus study. J Sleep Res 2024;33(05):e14163

23 Steier JS, Bogan RK, Cano-Pumarega IM, et al. Recommendations for clinical management of excessive daytime sleepiness in obstructive sleep apnoea - A Delphi consensus study. Sleep Med 2023;112:104–115

24 Drager LF, Assis M, Bacelar AFR, et al. 2023 Guidelines on the Diagnosis and Treatment of Insomnia in Adults - Brazilian Sleep Association. Sleep Sci 2023;16(2, Suppl 2)507–549

25 Studart-Pereira LM, Bianchini EMG, Assis M, et al; Consensus Group on Sleep-focused Speech-Language-Hearing Sciences. Brazilian Consensus on Sleep-Focused Speech-Language-Hearing Sciences - 2023 Brazilian Sleep Association. Sleep Sci 2023;16 (Suppl 2):489–506

26 Pires GN, Arnardóttir ES, Islind AS, Leppänen T, McNicholas WT. Consumer sleep technology for the screening of obstructive sleep apnea and snoring: current status and a protocol for a systematic review and meta-analysis of diagnostic test accuracy. J Sleep Res 2023;32(04):e13819

27 Melo MC, da Silva Vallim JR, Garbuio S, et al. Validation of a sleep staging classification model for healthy adults based on two combinations of a single-channel EEG headband and wrist actigraphy. J Clin Sleep Med 2024;20(06):983–990

28 Goldstein CA, Berry RB, Kent DT, et al. Artificial intelligence in sleep medicine: an American Academy of Sleep Medicine position statement. J Clin Sleep Med 2020;16(04):605–607

29 Goldstein CA, Berry RB, Kent DT, et al. Artificial intelligence in sleep medicine: background and implications for clinicians. J Clin Sleep Med 2020;16(04):609–618

