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ORIGINAL ARTICLE

Why is Self-Report of Sleep Position Sometimes Unreliable?

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ABSTRACT

This study examined whether the proportion of time spent on varying positions could account for the accuracy of self-perceived sleep position. The sample contained 26 healthy subjects, who were invited to sleep at a laboratory for two consecutive nights and in the next morning, were asked to answer some questions about their sleep, including self-perceived major sleep position and other sleep positions adopted. Their sleep was videotaped and was coded by two external judges. For both laboratory nights, subjects who correctly reported their major sleep position spent a larger proportion of their sleep time on the major body position, spent a smaller proportion of their sleep time on positions other than the major one, showed a larger discrepancy between the two proportions, and tended to rest their hands on their chest or stomach during sleep rather than put their hands aside their trunk than did subjects who incorrectly identified their major sleep position. These findings suggest that the misperception of one's sleep position can be attributed to the individual difference in the variability of sleep positions across the night. Although most subjects could correctly identify their major sleep position, the inaccuracy rate was high – that is, 23.1% for the first laboratory night and 42.3% for the second laboratory night. Furthermore, self-perceived and externally coded sleep positions were not significantly associated in the second night. The self-report method is far less expensive than the video-coding method but researchers should be cautious about its limitations and consistency with objective measures. Since the body posture during sleep is dynamic rather than static and sleepers may not be aware of their position shifts across the night, self-reported sleep position does not necessarily correspond to its objective counterpart, especially for those sleepers whose spend a similar proportion of time lying in different positions across the night. For clinical purposes, therefore, self-report of sleep position should be complemented by video records. Some specific body postures – such as resting hands on the chest and the nose pointing to one side – were demonstrated to be differentially correlated with supine and lateral sleep. Investigators may make use of these additional body postures to improve the accuracy of a reported sleep position.
Keywords: lateral position, prone position, self-reported position, sleep gesture, supine position

INTRODUCTION

The study of sleep position has important clinical implications in that different sleep positions have been repeatedly demonstrated to be associated with specific medical conditions. Sleep-disordered breathing, especially obstructive sleep apnea, is probably one of the most heavily investigated syndrome in connection with sleep position. Ample evidence has shown that supine position elevates the severity of sleep apnea as measured by apnea duration, apnea-hypopnea index, and oxygen desaturation index (e.g., Leppänen et al., 2016) whereas changing to lateral position (e.g., Pinna et al., 2015), making use of the mattress and pillow specially designed for prone sleeping (e.g., Bidarian-Moniri, Nilsson, Attia, & Ejnell, 2015; Bidarian-Moniri, Nilsson, Rasmusson, Attia, & Ejnell, 2015), or reducing supine sleep by utilizing a positional device (Heinzer et al., 2012; Jackson, Collins, Berlowitz, Howard, O'Donoghue, & Barnes, 2015) can

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significantly alleviate the condition.

A plausible reason for the beneficial effect of adjusting body posture on sleep apnea is that non-supine positions, such as the lateral one, can reduce passive airway collapsibility and improve the ability of the airway to stiffen and dilate (Joosten et al., 2015). Since the head position constitutes a critical factor that modulates airway collapse and apnea severity, placing a patient in supine position with the head rotated to one side seems to bring similar improvements (Safiruddin, Koutsourelakis, & Vries, 2015). It is important to note that while lateral and prone positions may be advisable for sleep apneics, they should be avoided for some other patients. For instance, sleeping on their affected side for patients with benign paroxysmal positional vertigo can exacerbate their condition (Li, Tian, Han, & Wang, 2013; Shigeno, Ogita, & Funabiki, 2012) and prone sleeping has been considered a risk factor for sudden unexpected death in epilepsy (Shmuely, Surges, Sander, & Thijs, 2016).

In addition to the aforementioned medical conditions, there is growing evidence that non-left side sleeping positions for expectant mothers in late pregnancy, especially the supine one, may adversely affect fetal health, which in turn may result in stillbirth (Gordon et al., 2015; Owusu et al., 2013; Rådestad, Sormunen, Rudenhed, & Pettersson, 2016; Stacey et al., 2011). Moreover, it is now generally agreed that putting babies to sleep in the prone position increases the risk of sudden infant death syndrome (Dwyer & Ponsonby, 2009; Jeffery, Megevand, & Page, 1999; Mitchell, Thach, Thompson, & Williams, 1999). Some evidence also suggests that body position during sleep is related to sleep quality and dream experiences. According to Agargun, Boysan, and Hanoglu (2004), right-side sleepers are more likely to experience better sleep quality and the feelings of relief and safety in dreams and are less likely to suffer nightmares in comparison with left-side sleepers. Likewise, Yu's (2012, 2013) studies indicated that prone sleep, which creates pressure on the front of the body, may promote dreaming of sexual, erotomaniac, and persecutory material, such as themes involving "having a sexual relationship with a prominent person or celebrity," "being smothered, unable to breathe," and "being tied, unable to move." This effect cannot be properly accounted for by personality factors, which, similar to the findings reported by Kamau, Luber, and Kumar (2012), were shown to be weakly correlated with sleep position. In short, sleep position is a clinically significant issue in that it is associated not only with sleep-related disorders but also with other medical conditions and mental health factors.

Studies of sleep apnea are typically conducted in a sleep laboratory and assess sleep position using a body sensor or videotapes. On the other hand, studies of conditions or factors other than sleep-related disorders – such as pregnancy stillbirth, personality traits, and dream experiences – rely mostly on self-report measures of sleep position. There have been very few studies testing the accuracy of self-reported sleep position. Gordon, Grimmer, and Trott (2004) initially demonstrated that subjects' self-reports of their habitual sleep positions at home as well as their sleep positions on laboratory nights were highly congruent with their sleep positions determined by the videos recorded at the laboratory. This was also partly true in McIntyre et al.'s (2016) and Warland and Dorrian's (2014) studies, both of which involved videotaping pregnant women's sleep. In McIntyre et al.'s study, most subjects went to sleep spontaneously on their left side and accurately recalled their sleep onset position but incorrectly recalled their sleep position at waking. Warland and Dorrian instructed their subjects to sleep on their left side and follow through over the night. They found that self-reported and video-determined left-side sleep time were moderately correlated but there were large individual differences in reporting accuracy and in video-determined left-side sleep time. It is worth noting that their subjects spent an average of 59.60% of bedtime on their left side. This might suggest, instead of subjects' incompliance, that sleeping position is to some extent not under voluntary control. Somewhat inconsistent with McIntyre et al.'s findings, Russo and Bianchi's (2016) study found that apneic patients' self-report of sleep position was unreliable, even for the body position at the time of light-out – that is, sleep onset.

Very few attempts have been made to examine the

accuracy of retrospective sleep position and the findings are mixed as to whether people can accurately report their sleep position. Furthermore, no studies have explored why or how misreport of sleep position happens. Therefore, the study presented here was geared toward testing whether the characteristics of sleep positions and postures may cause misperception of sleep position. Previous studies focused primarily on the major position of the body trunk; they had not considered the specific postures of the head or limbs and the proportion of different body positions used by the same sleeper across the night. Sleepers do not necessarily maintain one position but most probably shift their body position for several times over a night's sleep. Warland and Dorrian observed large individual differences in reporting accuracy and in objective sleep time spent on the instructed position. In light of their observation, I hypothesized that the smaller the intra-individual difference between the time spent on the major sleep position and the time spent on other positions over the night, the more likely the sleepers are to misperceive their major sleep position. In addition to the ratio between varying sleep positions adopted by the sleepers, I hypothesized that certain body gestures associated with specific sleeping positions, such as crossing arms or legs while lying on the back, might provide a proprioceptive cue for better recognition of one's sleep position.

METHOD

The sample contained 26 healthy volunteers, 8 (30.8%) men and 18 (69.2%) women. The mean age was 20.65 years old (SD = 1.263, range = 19 – 23). They were invited to sleep at a laboratory for two consecutive nights. They were allowed to sleep as much as they wanted and in the next morning, were asked to rate their sleep quality on a 11-point scale (0 = *very bad*, 10 = *very good*) and answer some other questions about their sleep, such as the frequency of waking up during sleep, self-perceived primary sleep position, and other sleep positions adopted. Their sleep was videotaped and all 52 (26 subjects x 2 nights) video records were coded by two external judges. The definitions of all sleep positions and postures were clarified between the two external judges before coding. All codes are listed in Table 1; each position or posture should last for at least 30 seconds to receive a code (except changing position). Each code had been tested to obtain a full agreement between three trained judges before this study. The footage of each subject's sleep was divided into 30-second epochs, each of which received one code for sleep position and three or more codes for head, arm, and leg postures. This was in accord with the American Academy of Sleep and Medicine's (AASM; Iber, Ancoli-Israel, Chesson, & Quan, 2007) scoring standards. In cases of ambiguous sleep posture, the judges were permitted to discuss to reach a consensus. Each subject's major sleep position was determined by the largest proportion of sleep time spent on a sleep position. For instance, Subject 1 spent 4.84, 4.08, and 0.00 hours on the supine, lateral, and prone positions on the first laboratory, respectively; his major sleep position was classified as supine. Subjects were instructed to regularize their sleep-wake schedules one week prior to the first laboratory night. It was surmised that approximately 85% of sleepers could correctly identify their sleep position. The primary statistical test used in the present study was Fisher's exact test; the alpha level was set at .05. The required sample size calculated using G*Power 3 (Faul, Erdfelder, Lang, & Buchner, 2007) was 26.

RESULTS

On the first laboratory night, 9 and 17 subjects reported having slept mainly in the supine and lateral positions, respectively; no subjects reported lying on the abdomen to be their major sleep position. Of the 26 subjects, 20 (76.9%) claimed to use the same major sleep position across the two laboratory nights. The self-perceived sleep positions for the two laboratory nights were significantly associated, Fisher's exact test, p = .011, with a very large effect size, Phi = .566, p = .004. The major sleep position rated by external judges was even more stable, all 15 objectively judged supine sleepers on the first night being also classified as supine sleepers on the second night, Fisher's exact test, p = .002, Phi = .640, p

Table 1. Coding System for Sleep Position and Posture

Sleep position	Description
Supine	Lying on the back
Prone	Lying on the stomach
Right lateral	Left shoulder lifting
Left lateral	Right shoulder lifting
Right lateral (fetus)	Lying on the subject's right side with the legs curled up at least 90 degrees
Left lateral (fetus)	Lying on the subject's left side with the legs curled up at least 90 degrees
Undefined	Staying in an ambiguous, unobservable, or undefinable sleep position
Head posture	
Face up	Nose tip pointing to the ceiling
Face down	Nose tip pointing to the pillow or mattress
Right lateral	Nose tip pointing to the wall on the subject's right side
Left lateral	Nose tip pointing to the wall on the subject's left side
Undefined	Ambiguous, unobservable, or undefinable head position
Arm posture	
Crossing	Crossing arms
On the chest or stomach	Resting hand(s) on the chest or stomach
Embracing	Hand(s) or arm(s) embracing the bed sheet, duvet, or pillow
Covering eyes	Hand(s) or arm(s) covering eye(s)
Fists	Holding fist(s)
Above shoulders	Any one of the hands putting above the shoulder
Bending	Arms bending and putting beside the body
Straightening	Arms straightening and putting beside the body
Undefined	Ambiguous, unobservable, or undefinable arm posture
Leg posture	
Supine and crossing	Lying on the back, crossing legs
Lateral and one leg on top of another	Lying in the lateral position, putting one leg precisely on top of another
Raising knees	Raising knee(s) or bending leg(s)
Straightening	Straightening leg(s)
Undefined	Ambiguous, unobservable, or undefinable leg posture
Other	
Mummy	Wrapping the body and head tight in the bed sheet
Changing position	Changing from one position to another

Table 2. Association between Perceived and Coded Major Sleep Positions on Night 1

	Coded supine	Coded lateral	Total
Perceived supine	9 (60%)	0 (0%)	9 (34.6%)
Perceived lateral	6 (40%)	11 (100%)	17 (65.4%)
Total	15 (100%)	11 (100%)	26 (100%)

= .001. All 26 subjects were observed to have adopted both supine and lateral positions on both laboratory nights although 5 and 6 subjects reported in the first and second laboratory nights, respectively, having adopted only one sleep position. The average frequency of shifting sleep position for the first laboratory night was 13.69 (*SD* = 9.068, range = 2-42), that for the second laboratory night being 13.65 (*SD* = 7.955, range = 2-36). Similarly, 4 subjects were observed to have slept in the prone position over the two laboratory nights, the duration of their prone sleep ranging between 21 minutes and 128 minutes. All these 4 subjects did not recognize that they had slept on the abdomen during the laboratory nights.

The percentage of subjects who could correctly identify their sleep positions (76.9%) was significantly larger than that of subjects who could not (23.1%) on the first laboratory night, binominal test = .009, Cohen's *h* = 1.136. However, the former (57.7%) was not significantly larger than the latter (42.3%) on the second night, binominal test = .557, Cohen's *h* = 0.309. The major sleep

position perceived by the subjects was significantly associated with the major sleep position coded by the external judges on the first night, Fisher's exact test, p = .002, Phi = .623, p = .001, Kappa = .559, p = .001. All 11 subjects who slept mostly in the lateral position correctly identified their own sleep position in the next morning (see Table 2). However, such an association was not significant on the second night, Fisher's exact test, p = .322, Phi = .183, p = .352, Kappa = .154, p = .352. Almost half of the subjects who slept on their back for most of the night perceived their major sleep position to be lateral (see Table 3). On the first night, 2 of the 6 subjects who incorrectly reported their major sleep position claimed that they had not slept in other positions; on the second night, 4 of the 11 subjects who misperceived their major sleep position made the same claim.

Within the subsample of major supine sleepers on the first laboratory night, subjects who correctly perceived their sleep position spent a significantly larger proportion of their sleep time on the supine position, z = 2.828, p = .003 (Mann-Whitney U test), Cohen's d = 2.293; spent a significantly smaller proportion of their sleep time on the

Table 3. Association between Perceived and Coded Major Sleep Positions on Night 2

	Coded supine	Coded lateral	Total
Perceived supine	11 (55%)	2 (33.3%)	13 (50%)
Perceived lateral	9 (45%)	4 (66.7%)	13 (50%)
Total	20 (100%)	6 (100%)	26 (100%)

Table 4. Durations (Minutes) and Prevalence Rates (Percentages) of Sleep Positions and Postures for Night 1

Sleep position	Supine sleepers (N = 15)	Lateral sleepers (N = 11)	Entire sample (N = 26)
Supine	348.9 (100.0%)	163.4 (100.0%)	270.4 (100.0%)
Prone	0.0 (0.0%)	13.5 (18.2%)	5.7 (7.7%)
Right lateral	64.0 (73.3%)	130.9 (100.0%)	92.3 (84.6%)
Left lateral	78.9 (86.7%)	163.9 (100.0%)	114.8 (92.3%)
Right lateral (fetus)	0.2 (6.7%)	11.6 (36.7%)	5.0 (19.2%)
Left lateral (fetus)	6.2 (13.3%)	16.5 (54.5%)	10.6 (30.8%)
Undefined	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)
Head posture			
Face up	301.1 (100.0%)	127.3 (100.0%)	227.6 (100.0%)
Face down	0.0 (0.0%)	8.6 (27.3%)	3.7 (11.5%)
Right lateral	72.0 (73.3%)	152.9 (100.0%)	106.2 (84.6%)
Left lateral	125.1 (100.0%)	208.7 (100.0%)	160.5 (100.0%)
Undefined	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)
Arm posture			
Crossing	11.3 (33.3%)	1.0 (18.2%)	7.0 (26.9%)
On the chest or stomach	271.5 (100.0%)	182.5 (100.0%)	233.9 (100.0%)
Embracing	25.1 (26.7%)	16.6 (27.3%)	21.5 (26.9%)
Covering eyes	1.6 (6.7%)	0.0 (0.0%)	0.9 (3.8%)
Fists	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)
Above shoulders	79.9 (86.7%)	117.6 (90.9%)	95.9 (88.5%)
Bending	119.2 (100.0%)	258.0 (100.0%)	177.9 (100.0%)
Straightening	70.7 (100.0%)	43.0 (81.8%)	59.0 (92.3%)
Undefined	0.1 (6.7%)	4.5 (9.1%)	1.9 (7.7%)
Leg posture			
Supine and crossing	24.2 (46.7%)	3.4 (18.2%)	15.4 (34.6%)
Lateral and one leg on top of another	151.7 (100.0%)	257.8 (100.0%)	196.6 (100.0%)
Raising knees	108.0 (100.0%)	35.0 (100.0%)	77.0 (100.0%)
Straightening	233.6 (100.0%)	226.4 (100.0%)	230.6 (100.0%)
Undefined	0.0 (0.0%)	6.9 (18.2%)	2.9 (7.7%)
Other			
Mummy	0.0 (0.0%)	7.0 (18.2%)	2.9 (7.7%)
Changing position (frequency)	10.3 (100.0%)	18.2 (100.0%)	13.7 (100.0%)

lateral position, $z = 2.828$, $p = .003$, Cohen's $d = -2.293$; showed a significantly larger difference in the proportion of sleep time between the supine and lateral positions than did the subjects who incorrectly identified their major sleep position as lateral, $z = 2.828$, $p = .003$, Cohen's $d = 2.294$. In addition, the former rested their hands on their chest or stomach for a significantly longer time during sleep than did the latter, $z = 2.003$, $p = .050$, Cohen's $d = 1.197$. No other sleep posture effects on the self-report accuracy were observed. Likewise, the accuracy of perceiving one's supine sleep was not affected by sex, Fisher's exact test, $p = 1.000$; the total number of sleeping hours, $z = 0.354$, $p = .776$; self-rated sleep quality, $z = .480$, $p = .689$; the frequency of waking up during the night, $z = .241$, $p = .864$; and the average length of each waking during the night, $z = .237$, $p = .864$.

The findings for the second laboratory night were largely reminiscent of those for the first laboratory night. Specifically, the 11 supine sleepers who correctly recognized their sleep position in the next morning showed a higher ratio of supine sleep, $z = 1.785$, $p = .080$, Cohen's $d = 0.668$; a lower ratio of lateral sleep, $z = 2.849$, $p = .003$, Cohen's $d = -1.756$; a larger difference in the ratio between supine and lateral sleep than did the sleepers who misperceived their sleep position, $z = 2.393$, $p = .016$, Cohen's $d = 1.387$. Likewise, the former spent a longer duration of hands resting on the chest or stomach, $z = 2.736$, $p = .004$, Cohen's $d = 1.378$; and a shorter duration of arms resting beside the body trunk than did the latter, $z = 2.925$, $p = .002$, Cohen's $d = -1.475$. There were no significant sex, sleep-length, and sleep-quality effects on the accuracy of self-reported sleep position, Fisher's exact test and Mann-Whitney U tests, all p values > .05.

Table 5. Durations (Minutes) and Prevalence Rates (Percentages) of Sleep Positions and Postures for Night 2

Sleep position	Supine sleepers (N = 20)	Lateral sleepers (N = 6)	Entire sample (N = 26)
Supine	302.9 (100.0%)	144.8 (100.0%)	266.4 (100.0%)
Prone	3.4 (10.0%)	21.3 (16.7%)	7.5 (11.5%)
Right lateral	82.5 (85.0%)	190.4 (100.0%)	107.4 (88.5%)
Left lateral	64.6 (90.0%)	125.8 (100.0%)	78.8 (92.3%)
Right lateral (fetus)	15.5 (15.0%)	0.0 (0.0%)	11.9 (11.5%)
Left lateral (fetus)	29.7 (35.0%)	18.5 (16.7%)	27.1 (30.8%)
Undefined	0.6 (5.0%)	0.0 (0.0%)	0.5 (3.8%)
Head posture			
Face up	244.5 (100.0%)	102.8 (100.0%)	211.8 (100.0%)
Face down	1.8 (5.0%)	0.0 (0.0%)	1.3 (3.8%)
Right lateral	89.1 (90.0%)	187.6 (100.0%)	111.8 (92.3%)
Left lateral	164.0 (100.0%)	210.5 (100.0%)	174.7 (100.0%)
Undefined	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)
Arm posture			
Crossing	13.6 (30.0%)	0.0 (0.0%)	10.4 (23.1%)
On the chest or stomach	300.6 (100.0%)	242.7 (100.0%)	287.3 (100.0%)
Embracing	17.5 (20.0%)	0.0 (0.0%)	13.4 (15.4%)
Covering eyes	1.9 (15.0%)	0.0 (0.0%)	1.5 (11.5%)
Fists	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)
Above shoulders	47.4 (80.0%)	37.8 (66.7%)	45.2 (76.9%)
Bending	97.9 (90.0%)	182.9 (83.3%)	117.5 (88.5%)
Straightening	36.3 (65.0%)	33.8 (66.7%)	35.7 (65.4%)
Undefined	35.5 (45.0%)	41.0 (50.0%)	36.8(46.2%)
Leg posture			
Supine and crossing	30.6 (35.0%)	4.9 (33.3%)	24.7 (34.6%)
Lateral and one leg on top of another	190.3 (100.0%)	273.9 (100.0%)	209.6 (100.0%)
Raising knees	72.5 (80.0%)	39.8 (50.0%)	64.9 (73.1%)
Straightening	238.3 (100.0%)	204.8 (100.0%)	230.6 (100.0%)
Undefined	0.9 (10.0%)	0.0 (0.0%)	0.7 (7.7%)
Other			
Mummy	0.4 (5.0%)	11.1 (16.7%)	2.9 (7.7%)
Changing position (frequency)	14.1 (100.0%)	12.5 (100.0%)	13.7 (100.0%)

Tables 4 and 5 present the average durations and prevalence rates of all coded body postures on the first and second laboratory nights. All 26 subjects were observed to have slept on their back, faced up, and placed their hands on their chest or stomach on both nights. Nevertheless, major supine sleepers spent a significantly longer time lying on their back than did major lateral sleepers (Night 1: $z = 3.867$, $p < .001$, Cohen's $d = 1.995$; Night 2: $z = 2.770$, $p = .003$, Cohen's $d = 1.142$). On both laboratory nights, furthermore, the duration of supine sleep exhibited a medium-to-large correlation coefficient with the durations of facing up ($r_s = .864$, $p < .001$; $r_s = .694$, $p < .001$), raising knees ($r_s = .625$, $p < .001$; $r_s = .733$, $p < .001$), straightening legs ($r_s = .512$, $p = .008$; $r_s = .619$, $p < .001$), and resting hands on the chest or stomach ($r_s = .712$, $p < .001$; $r_s = .453$, $p = .02$). On the other hand, the duration of lateral sleep had a medium-to-large correlation coefficient with the durations of the head facing to the right side ($r_s = .723$, $p < .001$; $r_s = .636$, $p < .001$), putting one leg precisely on top of another ($r_s = .870$, $p < .001$; $r_s = .491$, $p = .011$), and bending arms aside the body ($r_s = .891$, $p < .001$; $r_s = .436$, $p = .026$).

DISCUSSION

The study presented here investigated whether the individual difference in the proportion of time spent on varying positions could explain the accuracy of self-perceived sleep position. The overall results lend support to this conjecture in that the smaller the difference between the time spent on the major position and that on other positions, the more likely the subjects were to misperceive their major position. The current study replicated Gordon et al.'s (2004) previous finding of night-to-night consistency in sleep position; both subjectively reported and externally judged sleep positions were stable across the two laboratory nights. Most subjects could accurately report their major sleep position and the major sleep position perceived by the subjects was significantly associated with the major sleep position coded by external judges in the first laboratory night. In the second laboratory night, however, the percentage of subjects who could correctly identify their sleep positions was not significantly larger than that of subjects who could not and the association between self-reported and externally coded sleep positions was not significant.

It is interesting to note that five of the 11 lateral sleepers on the first night changed their major sleep position to supine whereas the 15 supine sleepers on the first night retained the same position on the second night. Since a substantial proportion of the sample adopted the same sleep position over the two nights, the consistency in externally rated sleep position was high. The similar also applied to the self-perceived sleep position – that is, most subjects perceived that their sleep positions remained unchanged across the two nights. However, four of the five lateral sleepers on the first night were unware of the fact that they had shifted their major sleep position to supine on the second night. Accordingly, the non-significant association between self-reported and externally coded sleep positions on the second night was at least partly caused by the reduced accuracy of self-perceived position.

In addition to the frequent misreports of major sleep position, subjects appeared to be oblivious about many other characteristics of their sleep and the nonstationary nature of body posture during sleep. Subjects in this study shifted their body position during sleep with an average frequency of 13.7 times a night. This incidence rate can be compared favorably to the average of 13 body position changes reported by Dzvonik et al. (1986) and the average of 11 body position shifts reported by Gordon et al. (2004). Approximately 21% subjects thought that they slept in only one position through the night but they were observed to have shifted between the supine and lateral positions on both laboratory nights. Similarly, around 15% subjects were observed to have slept in the prone position during the laboratory nights but none of them recognized this fact. It is also noteworthy that some subjects who incorrectly reported their major sleep position claimed that they had never slept in other positions. It seems that actual position shifts occur far more frequently than sleepers subjectively perceive and that people tend to see their body position during sleep to be static rather than dynamic.

Previous studies have not explored why some people

fail to recognize their own sleep position. In filling this gap, the present study showed that the misperception of one's sleep position can be attributed to the individual difference in the variability of their sleep positions across the night. For both laboratory nights, subjects who correctly reported their major sleep position were distinguished by the larger proportion of their sleep time spent on the major body position, the smaller proportion of their sleep time spent on positions other than the major one, and the larger discrepancy between the two proportions. Additionally, they tended to rest their hands on their chest or stomach during sleep rather than put their hands beside their trunk. This suggests that resting hands on the chest or abdomen, whether the sleeper is aware of this posture, increases the chance for the sleeper's recognition of his or her supine position.

The present coding system is intended to be exhaustive such that the postures of all main body parts can be captured. As indicated by the differential correlation patterns between the supine and lateral positions, the supine position is often characterized by the nose tip pointing to the ceiling, raising knees, straightening legs, and putting hands on the chest or abdomen. In contrast, the lateral position is signified by the nose tip pointing to the wall, putting one leg precisely on top of another, and bending arms beside the body trunk. Accordingly, investigators can make use of these additional body postures to improve the accuracy of a reported sleep position. To this end, the position of the head is particularly useful for two reasons. First, sleepers typically align their head with their body trunk. Second, the head is very rarely covered by bedding or other body parts to the extent that its position cannot be observed.

The self-report method can provide a convenient tool for sleep position research. As indicated by the present results and Gordon et al.'s (2004) previous findings, self-report of sleep position has good test-retest reliability and is to some extent associated with externally rated sleep position. Nonetheless, this method can provide nothing more than the primary position that subjects believe to have slept in. A self-reported sleep position is not necessarily in accord with its objective counterpart, especially for an individual who spends relatively similar lengths of time on various sleep positions in a single night. Accordingly, researchers may strategically separate frequent position shifters from sleepers staying in one position for a longer period. In addition, they may verify sleepers' position with the body gestures akin to a specific sleep position. In view of the present evidence that subjects were unaware of the dynamic nature of sleep position and the multitude of body gestures during sleep, it is recommended that for clinical purposes, a self-report of sleep position should be complemented by home-video recording or laboratory results.

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