Brain Research Bulletin, Vol. 47, No. 5, pp. 507–516, 1998

0361-9230/99/$–see front matter

PII S0361-9230(98)00091-4

Motion sickness susceptibility questionnaire revised and its relationship to other forms of sickness

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[Received 1 May 1998; Accepted 31 May 1998]

ABSTRACT: The Reason and Brand Motion Sickness Susceptibility Questionnaire (MSSQ) has remained unchanged for a quarter of a century. The primary aims of this investigation were to improve the design of the MSSQ, simplify scoring, produce new adult reference norms, and analyse motion validity data. We also considered the relationship of sickness from other nonmotion causes to the MSSQ. Norms and percentiles for a sample of 148 subjects were almost identical to the original version of this instrument. Reliability of the whole scale gave a Cronbach's standardised item alpha of 0.86, the correlation between Part A (child) and Part B (adult) was $r = 0.65$ ($p < 0.001$), and test-retest reliability may be assumed to be better than 0.8. Predictive validity of the MSSQ for motion sickness tolerance using laboratory motion devices averaged $r = 0.45$. Correlation between MSSQ and other sources of nausea and vomiting in the last 12 months, excluding motion sickness itself, was $r = 0.3$ ($p < 0.001$), migraine was the most important contributor to this relationship. In patients ($n = 101$) undergoing chemotherapy, there were significant correlations between MSSQ and chemotherapy-induced nausea and vomiting. Migraine also appeared as a predictor of chemotherapy-induced sickness. It was concluded that the revised MSSQ can be used as a direct replacement of the original version. The relationship between motion sickness susceptibility and other causes of sickness, including migraine and chemotherapy, points to the involvement of the vestibular system in the response to nonmotion emetogenic stimuli. Alternatively, this relationship may reflect individual differences in excitability of the postulated final common emetic pathway. © 1999 Elsevier Science Inc.

KEY WORDS: Emesis, Motion sickness, Migraine, Chemotherapy, Vestibular.

INTRODUCTION

Because of their minimal cost and subject convenience, motion sickness susceptibility questionnaires, sometimes called motion history questionnaires, are useful instruments in the prediction of motion sickness due to a variety of provocative environments [13]. A number of ad-hoc questionnaires have been reported in the literature but, apart from the Pensacola Motion History Questionnaire [12], few have the research pedigree of the Reason and Brand Motion Sickness Susceptibility Questionnaire (MSSQ) [17,18].

However, the MSSQ has remained unchanged for over a quarter of a century and improvements are possible in its format and scoring methods. In addition, the reference norms that appear never to have been formally published, require reverification, and a body of controlled laboratory data are now available for reanalysis to enable an estimate of the MSSQ's predictive validity. Consequently the principal aims of this investigation were to redesign the MSSQ, produce new adult reference norms, and analyse validity data. Additional aims were to investigate the incidence of nausea and vomiting from other nonmotion causes, for which surprisingly few data are available, in the healthy as opposed to clinical population [19]. We also considered the relationship of sickness from other nonmotion causes to the MSSQ, which might be predicted on theoretical grounds [11].

MATERIALS AND METHODS

Questionnaires

Variants of the MSSQ were tested in small pilot studies. The best compromise in terms of length, ease of administration, and scoring was chosen to use in a larger scale study. An additional single-item motion sickness susceptibility question was added, together with items concerning exposure and susceptibility to cinerama/video/simulator sickness. The latter proved not to be useful and was deleted in the later version used (see Appendix).

Further items concerned sickness (nausea, vomiting) from other sources in the last 12 months, adapted from the highest scoring response categories of Rub et al. [19]. These were: Alcohol; Food Poisoning; Binge Eating; Migraine; Self-induced Vomiting; Food Allergy; Stress or Anxiety; Illness, e.g., viral; Females only, e.g., Pregnancy sickness; Any other(s) please write in.

For the chemotherapy patient sample (see below) an additional questionnaire concerned background information on chemotherapy regime, antiemetics, treatment course number, side-effect checklists, together with detailed questions about nausea, concerning frequency (5-point scale never to always), severity (5-point scale none to severe) and usual duration (hours), and vomiting concerning frequency (5-point scale never to always), and usual number of times vomiting per episode (number). These questions were repeated for three periods: Anticipatory Nausea and Vomiting, Nausea and Vomiting During Chemotherapy, and Delayed (up to 48 h after chemotherapy) Nausea and Vomiting.

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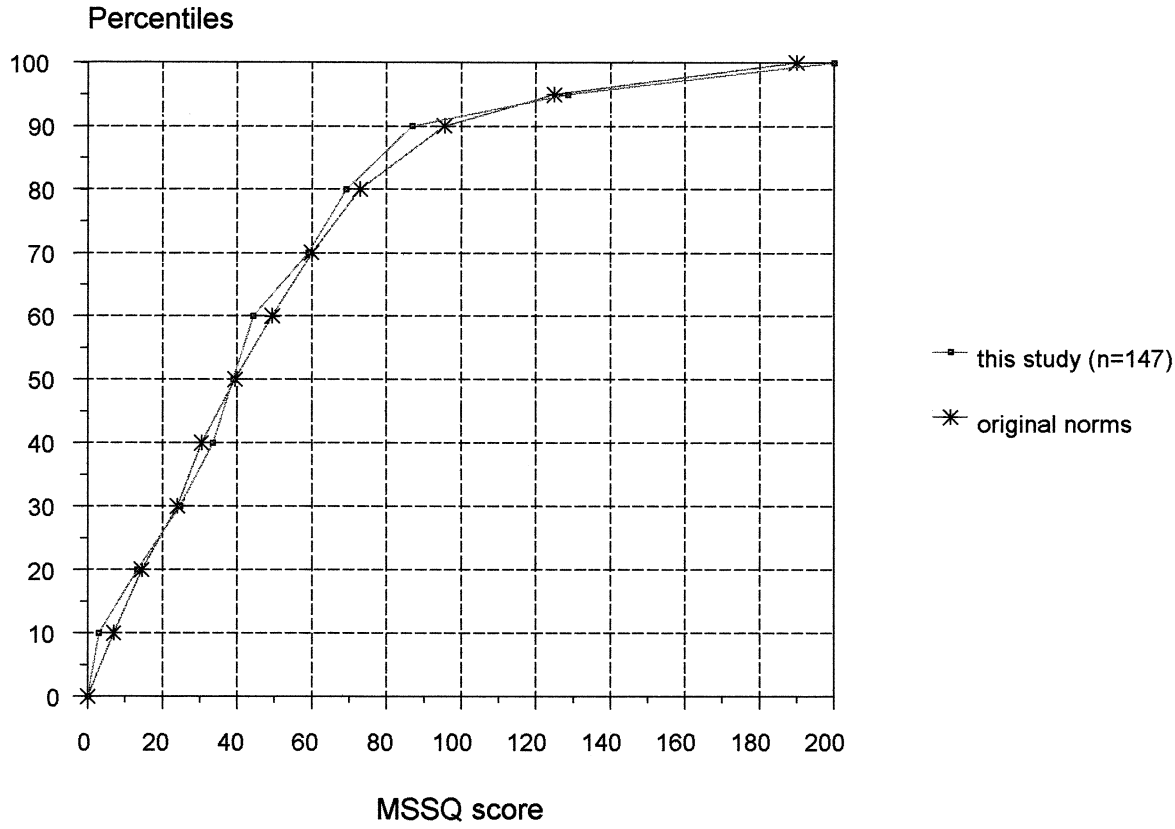

FIG. 1. Cumulative distribution (percentiles) of Motion Sickness Susceptibility Questionnaire scores for this study using the revised questionnaire and original unpublished norms. The two distributions were almost identical.

Samples

Subjects ($n = 147$) were male ($n = 70$) and female ($n = 77$) university students attending research methods classes, mean age was 26.6 years (SD = 7.3). The revised MSSQ was also used on a sample ($n = 101$) of male ($n = 35$) and female ($n = 66$) patients undergoing chemotherapy. The patients' mean age was 52.9 years (SD = 13.3), most were in the third to fourth course of treatment, undergoing British National Formulary (BNF) [2] Group 3 Cytotoxic Drugs (severe emetic, e.g., cisplatin, combinations, etc.) ($n = 70$) or BNF Group 2 ($n = 9$) or BNF Group 1 ($n = 22$), with standard antiemetic treatments as appropriate (e.g., $5HT_3$ antagonists + dexamethasone).

Scoring Methods

The "cinerama/video" items were not included because of their very low endorsement rate for nausea and vomiting. Questionnaires were scored according to three methods. The first method was the same as in the original papers of Reason and Brand [17,18], using their weighting scheme for extent of exposure to each mode of transport. The second, simplified method, did not use the exposure weighting but scored items from 0 = "Never" to 4 = "Always" (see MSSQ Revised, Appendix), the original correction for "Types experienced" was retained, as was the original formula. The third extremely simplified binary scoring method reduced the 0–4 scale to 0 = Never and 1 = "Rarely, sometimes, frequently or always," the original correction for "Types experienced" was again retained. The purpose of this latter binary scoring method was to determine whether or not the MSSQ scale items could be replaced with simple yes/no items without significant loss of information.

Validity Analysis

For the purpose of estimating the predictive validity of the MSSQ, data were analysed from a variety of recent studies [3,5–10,20,21]. The relationship between MSSQ and other sources of sickness was also treated as part of the validity analysis.

RESULTS

Single-Item Motion Sickness Susceptibility

Most responses were in the "not at all" (31%) and "slightly" (51%) categories, with fewer in the "moderately" (15%) and "very much so" (3%). The correlation between the single item and the full scale MSSQ was $r = 0.63$ ($p < 0.0001$).

Norms and Percentiles

The mean MSSQ score was 45.5 (SD = 37.6) with a positively skewed distribution. Percentiles are given in Fig. 1 and were very similar to the original unpublished percentiles. The mean subscores were significantly higher for Part A (child), 28.8 (SD = 23.3) than Part B (adult), 16.7 (SD = 17.5) ($t = 8.24$, $df = 146$, $p < 0.0001$, two-tailed). Female mean MSSQ, 51.8 (SD = 42.0),

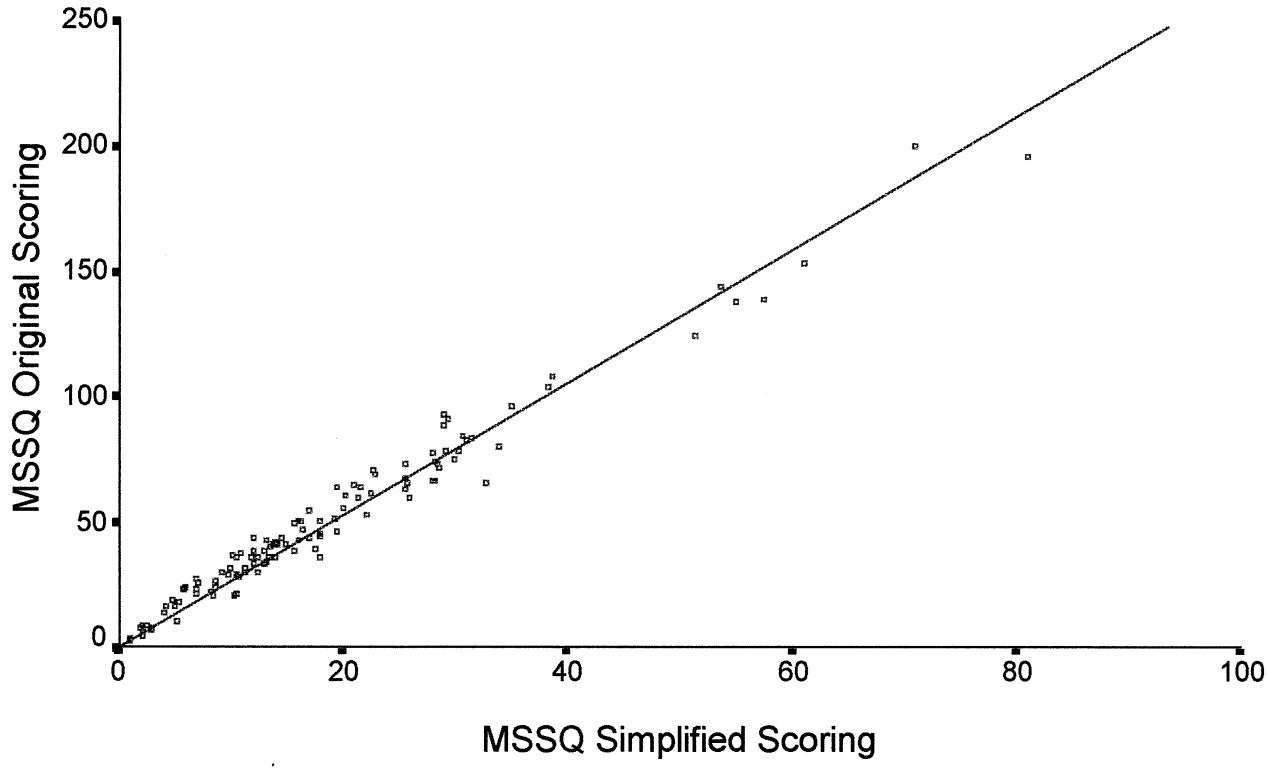

FIG. 2. Relationship between Motion Sickness Susceptibility Questionnaire simplified scoring and original scoring ($r = 0.989$). The original score can be derived as 2.64 times the simplified score.

was higher than male mean MSSQ, 38.5 (SD = 29.6) ($t = 2.2$, $df = 145$, $p < 0.05$, two-tailed).

Simplified Scoring

The relationship between the original MSSQ and simplified MSSQR scoring methods was linear, $r = 0.989$ ($p < 0.0001$) (see Fig. 2). The relationship between the original and extremely simplified binary scoring methods was also good, $r = 0.94$ ($p < 0.0001$). The best fit regression line of x (MSSQR) on y (MSSQ) was $y = 2.51x + 3.8$. Arguably, the line should go through the origin at zero, if this is forced then the slope becomes 2.64 and conversion of the revised scoring system score to original scores simply requires the multiplication of the revised score by 2.64.

Reliability

Analysis of the internal reliability of the whole scale gave a Cronbach's standardised item alpha (correlation) of 0.86, and a split-half reliability of 0.77. The correlation between Part A (child) and Part B (adult) was $r = 0.65$ ($p < 0.001$). Test-retest reliability for the whole questionnaire was not examined for a large sample, but may be assumed to be better than 0.8 [12,13].

Validity

Data were reanalysed from recent studies where MSSQ scores were available on subjects exposed to provocative motion under controlled laboratory conditions. The results are summarised in Table 1. Correlations of the MSSQ with objective measures of motion sickness tolerance using laboratory motion devices averaged around $r = 0.45$. See also Figs. 3 and 4.

Correlation between MSSQ in this sample of 147 subjects and other sources of nausea and vomiting in the last 12 months, excluding motion sickness itself, was $r = 0.3$ ($p < 0.001$) (questionnaire items drawn from Rub et al. [19]). Stepwise multiple regression to predict MSSQ scores produced as significant predictors: sickness in the last 12 months from migraine headaches, anxiety/stress, whereas dropped as nonsignificant were age, sex, alcohol sickness, food poisoning (Multiple $R = 0.3$, regression analysis of variance [ANOVA], $p < 0.001$). Logistic regression was employed to predict nausea and/or vomiting from migraine headaches, producing a 74% correct classification with predictors MSSQA (section A child) ($p = 0.002$) and sex (higher for females) ($p = 0.04$), dropped items were age, alcohol sickness, food poisoning. The difference for migraine versus nonmigraine sick on MSSQA is shown in Fig. 5.

The prevalence of chemotherapy-related nausea and vomiting in the patient sample is shown in Fig. 6. The extensive chemotherapy nausea and vomiting data were reduced by factor analysis prior to further analysis. First, a single summary factor "overall chemo-sickness" was forced (34% of variance). Second, an orthogonal rotated (varimax) with minimum eigenvalues >1 description produced three factors, Factor 1 (34% variance) loaded anticipatory nausea and vomiting together with nausea during treatment, all loadings >0.7; Factor 2 (24% variance) was exclusively delayed nausea and vomiting, all loadings >0.85; and Factor 3 (17% variance) consisted of during-treatment sickness, vomiting (loading 0.95), and, to a lesser extent, nausea (loading 0.45). Stepwise multiple regression employed all other variables, such as, age, sex, MSSQ, chemotherapy course, type, etc, as predictors for the overall chemo-sickness and more detailed che-

TABLE 1

VALIDITY OF THE MOTION SICKNESS SUSCEPTIBILITY QUESTIONNAIRE (MSSQ) IN PREDICTING TOLERANCE TO CONTROLLED EXPOSURE TO NAUSEOGENIC MOTION IN THE LABORATORY

Reference	*n*	Age (y) mean (SD) or range	MSSQ mean (SD)	Motion Stimulus (exposure time to produce moderate nausea)	MSSQ × Motion Tolerance Correlation r_p
[20]	24	18–50	49.8 (35.1)	Cross-coupled Coriolis	−0.42
[3]*	91	23.3 (5.0)	55.1 (30.0)	Cross-coupled Coriolis	−0.31
[21]	18	24.3 (7.5)	52.7 (31.5)	Cross-coupled Coriolis	−0.58
[7]*	20	23.5 (2.5)	71.8 (45.1)	Cross-coupled Coriolis	−0.14
[5]	12	24.5 (6.7)	68.9 (52.0)	Vertical Translational Oscillation *z*-axis 0.30Hz	−0.72 eyes open −0.67 eyes closed
[8]	40	25.7 (6.6)	64.3 (40.8)	Vertical Translational Oscillation *z*-axis 0.35 Hz	−0.45
[6,10]	24	25.4 (6.8)	47.8 (36.1)	Horizontal Translational Oscillation *x*-axis 0.205 Hz	−0.42
[8,9,10]	64	25.2 (6.6)	57.4 (39.7)	Horizontal Translational Oscillation *x*-axis 0.35 Hz	−0.43
[6,9]	24	24.5 (6.6)	45.9 (35.5)	Horizontal Translational Oscillation *x*-axis 0.50 Hz	−0.47
[10]	12	24.8 (4.1)	41.9 (38.1)	Horizontal Translational Oscillation *y*-axis 0.205 Hz	−0.44

* Golding [3] correlation of MSSQ with Motion Tolerance rose to mean $r = -0.36$ when reanalysed after partitioning the data into the four constituent experiments; Golding and Stott [7] study was on airsick aircrew referred for motion sickness desensitisation treatment, which may have reduced the relationship with MSSQ.

motherapy sickness factors. Overall, chemo-sickness was predicted by higher MSSQ part A (child) and by more severe chemotherapy drug (BNF cytotoxic classification, see Materials and Methods) (Multiple $R = 0.36$; adjusted $R^2 = 0.11$; ANOVA regression, $F(2,97) = 8.6$, $p < 0.005$). For brevity, the multiple regression analyses to predict Factors 1, 2, and 3 are summarised in Table 2. MSSQ, migraine, sex, antiemetic type, and course of treatment, in various combinations, were all significant predictors of chemotherapy related nausea and vomiting (see Table 2).

DISCUSSION

The principal aims of this investigation were to redesign the MSSQ, produce new adult reference norms, analyse the validity

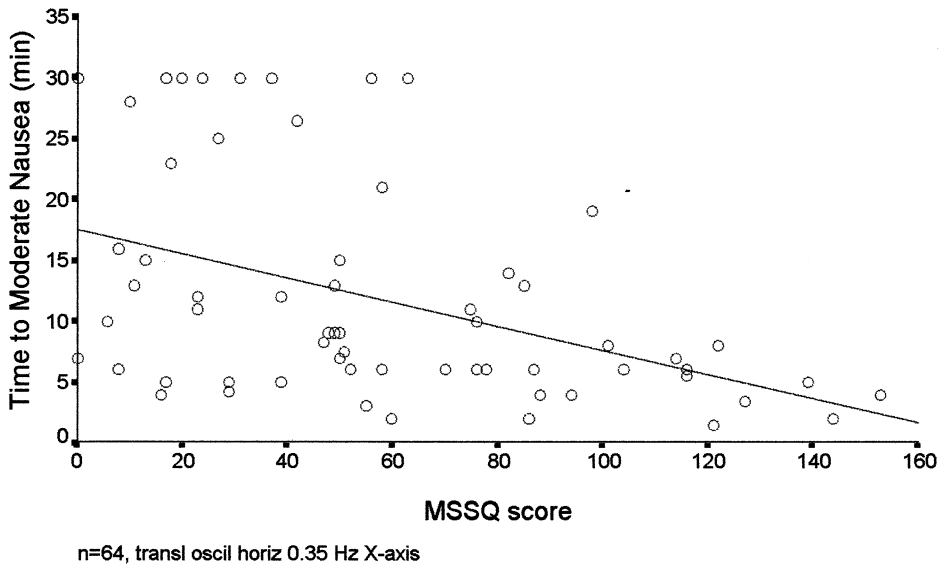

FIG. 3. Relationship ($r = -0.43$) between Motion Sickness Susceptibility Questionnaire (MSSQ) score and exposure time to achieve moderate nausea for 64 subjects undergoing horizontal translational oscillation at 0.35 Hz 3.6 ms^{-2} through the X-axis of the head and body. Note that whereas a high MSSQ score is a good predictor of high susceptibility to the motion challenge, a low MSSQ score is not such a good predictor of low susceptibility.

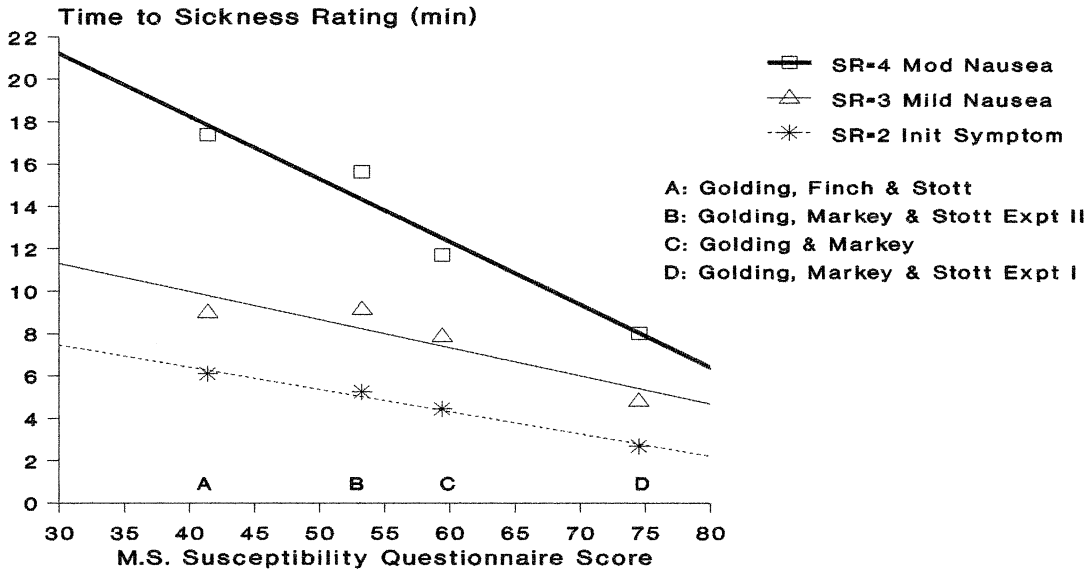

FIG. 4. Mean times to achieve sickness ratings stages (SR = 2 initial symptoms, SR = 3 mild nausea, SR = 4 moderate nausea) are plotted against mean Motion Sickness Susceptibility Questionnaire scores (MSSQ percentile score) (adapted from Golding et al. [9]). Time data are for 0.35 Hz horizontal translation oscillation through the head-body X-axis at acceleration 3.6 $m.s^{-2}$ (peak).

data both in terms of motion and nonmotion emetogenic stimuli. The revised version of the MSSQ was well received by subjects in mass testing situations and few difficulties were encountered by subjects in completing the questionnaire. This appeared to be an improvement because the experience of the author has been that many subjects have not found the original Reason and Brand [17,18] version of the MSSQ easy to complete without guidance and explanation. It is a truism that when respondents have difficulties with a questionnaire there is a greater chance of errors or nonresponse, and the redesigned MSSQ greatly reduces this problem.

The simplified scoring system produced a score that almost perfectly correlated with the original complicated method of scoring, which required look-up tables for weighting each subitem

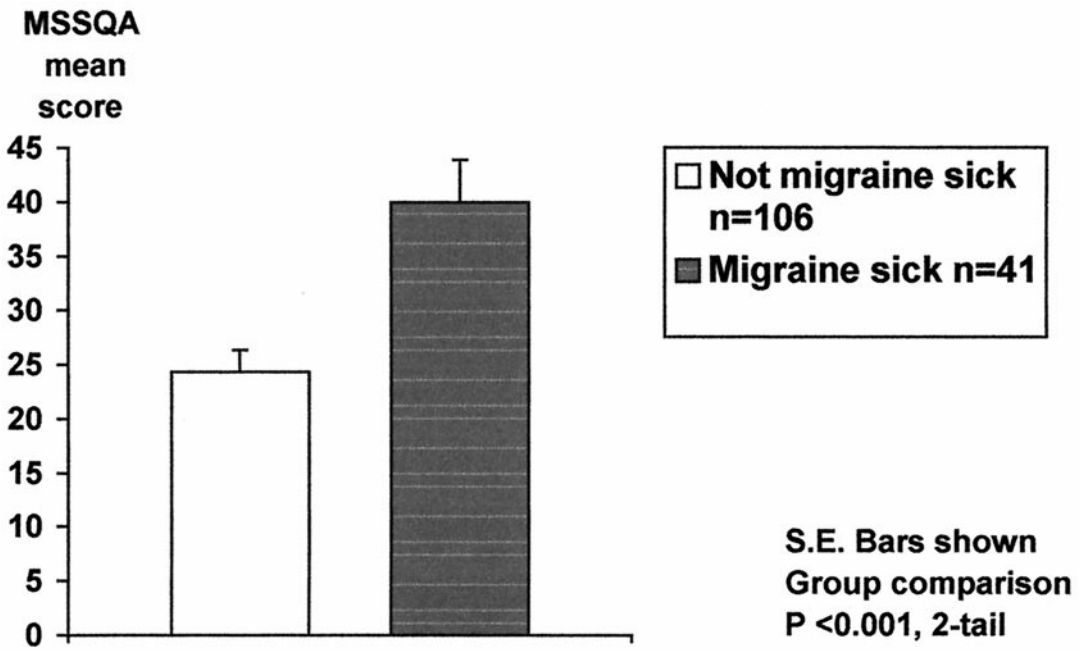

FIG. 5. Mean Motion Sickness Susceptibility Questionnaire-A (section A scores childhood) scores are shown for those who experienced sickness (nausea and/or vomiting) from migraine in the last 12 months versus subjects who did not.

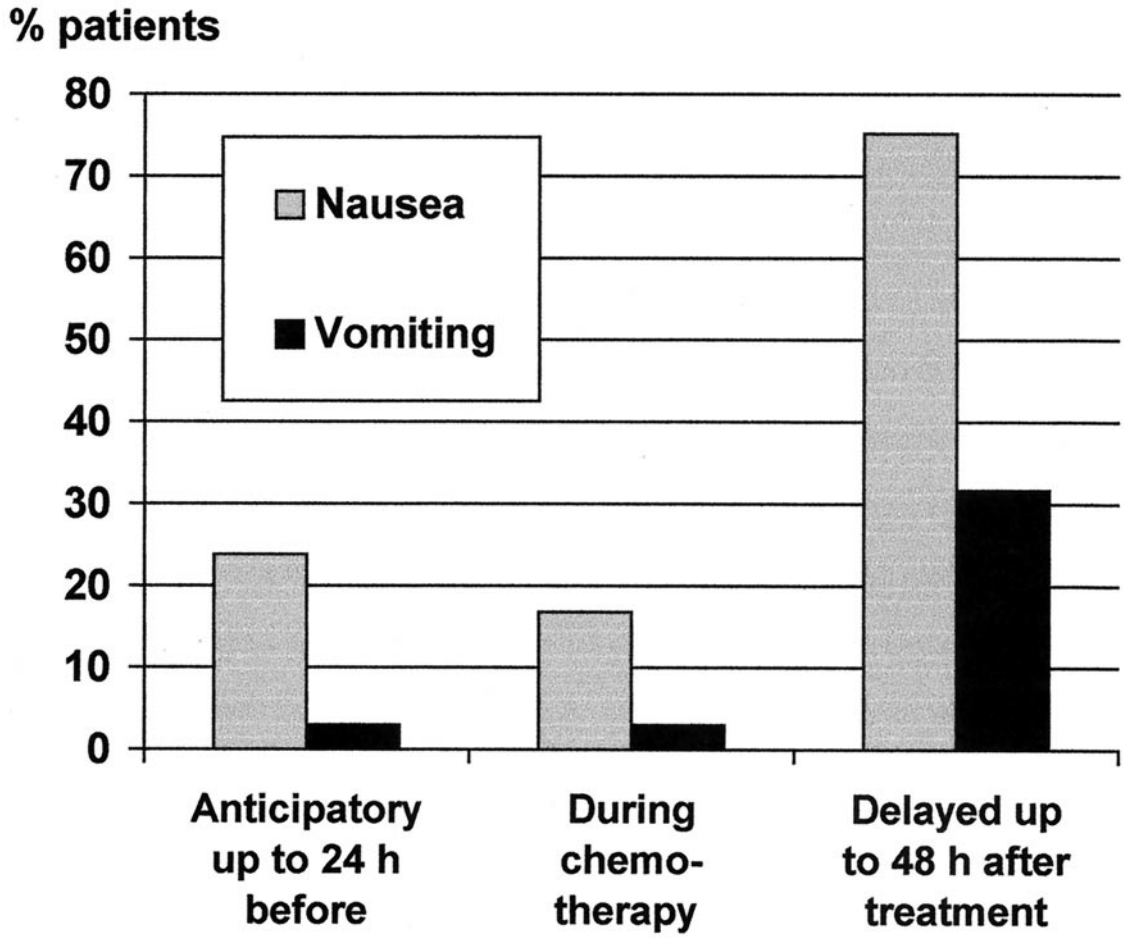

FIG. 6. Prevalence and type of nausea and vomiting are shown in patients undergoing chemotherapy ($n = 101$). The predictors of this chemotherapy-related sickness include Motion Sickness Susceptibility Questionnaire (see Table 2 and text).

TABLE 2

PREDICTORS OF FACTORS DESCRIBING CHEMOTHERAPY-RELATED NAUSEA AND VOMITING IN A SAMPLE OF PATIENTS UNDERGOING CHEMOTHERAPY TREATMENT ($N = 101$) (THREE-FACTOR ORTHOGONAL SOLUTION OF CHEMOTHERAPY SICKNESS VARIABLES, 75% OF TOTAL VARIANCE)

Chemotherapy Sickness Factor	Sickness Variance (%)	Predictor(s)	Multiple R	Adjusted R^2	ANOVA p
Anticipatory nausea and anticipatory vomiting, nausea during treatment	34	Type of antiemetic*	0.3	0.09	0.01
Delayed nausea and delayed vomiting	24	Higher MSSQ (part A child) Migraine, Course of treatments (earlier)	0.43	0.16	0.0005
Vomiting and nausea during treatment	17	Sex (female), Higher MSSQ (part A child)	0.33	0.10	0.005

MSSQ, Motion Sickness Susceptibility Questionnaire.

Summary of stepwise multiple regression is shown to predict each chemotherapy related sickness factor.

* Type of antiemetic indicates more sickness with $5HT_3$ antagonists and combinations, e.g., granisetron + dexamethasone than with less potent antiemetics such as domperidone. However, type of antiemetic was collinear with the category of cytotoxic variable, i.e., this relationship is equivalent to increased prevalence of sickness with use of British National Formulary [2] Category 3 (more emetogenic) cytotoxic drugs.

[18], and it is recommended that this simplified method be used for convenience. The new adult reference norms seemed virtually identical to the original unpublished norms and the internal reliability of the revised MSSQ was high. Thus, the revised MSSQ may be used as a direct replacement of the original version with numerically compatible scores.

The predictive validity of the MSSQ was estimated by analysis of recent motion studies, the majority of correlations were around $r = 0.45$. Correlations between laboratory measures of motion sickness and general susceptibility to motion sickness, e.g., as measured by the MSSQ, are frequently observed to be low [3,18]. The reasons for this probably include limitations imposed by the reliability of the motion challenge (around $r = 0.8–0.9$), and uncertainties in questionnaire responses, where individuals may have had very different histories of motion exposure, as well as the multifactorial nature of motion sickness susceptibility itself. Thus, at least three processes are thought to be at work: initial sensitivity to motion, rate of natural adaptation, and the ability to retain such protective adaptation in the longer term [18]. Moreover, the correlations between various types of motion challenges are not high [14], implying differential sensitivity in individuals to different types of motion, e.g., the correlation between motion susceptibility between translational versus angular (coriolis) motion may be as low as $r = 0.3–0.4$ [4]. From the practical point of view, the MSSQ is good at predicting who will be motion sensitive, but less efficient at identifying motion-resistant individuals (e.g., see Fig. 3). Apart from its utility as a general research tool, it can be employed to enable subject group comparisons between experiments and thus explain differences in findings due to subject sample characteristics (e.g., see Fig. 4). Such considerations also become of importance when considering whether, for example, a subject sample undergoing motion testing to evaluate the efficacy of a novel antimotion sickness drug is representative of the normal population.

The finding that high MSSQ scores were significantly associated with sickness susceptibility to migraine headaches was consistent with the observation that motion sensitivity with bouts of motion sickness occurs in approximately two thirds of patients with migraine [1]. The reasons for this association are obscure but recently it has been suggested that, in part, there may be a (genetic) link caused by ". . . defective (calcium) ion channels shared by the brain and inner ear leading to reversible hair cell depolarization, producing vestibular symptoms . . . headache might just be a secondary phenomenon . . ." [1].

The significant relationship observed between higher MSSQ scores and greater chemotherapy-induced nausea and vomiting in the patient sample replicated the findings of Morrow [16]. However, it is noteworthy that the revised MSSQ has the sensitivity and power to identify such associations at the $p < 0.0005$ level using a sample of 100, whereas the Morrow [16] study could only identify such an association at the less significant $p < 0.05$ level, using a much larger sample of 500. This suggests that apart from other advantages, such as clarity for the respondent and availability of reference norms for the experimenter, the revised MSSQ represents a major improvement in terms of power and sensitivity over ad-hoc motion sickness questionnaires.

In conclusion, the results of this study indicated that the revised MSSQ represents an improvement in terms of ease of completion by subjects and reduced scoring effort by experimenters. It can be used with confidence in place of the original version. The relationship between motion sickness susceptibility and other causes of sickness, including migraine and chemotherapy, may point to the involvement of the vestibular system in the response to nonmotion emetogenic stimuli [15]. Alternatively, this relationship may simply reflect individual differences in excitability of the postulated final common emetic pathway [11].

ACKNOWLEDGEMENTS

Ethical approval for the survey of chemotherapy patients was given by the East London and the City Health Authority Ethics Committee. The assistance of Martha Chekenya in collecting some of the data relating to chemotherapy is acknowledged. Some of this study was presented at the Motion Sickness Meeting at Marbella, 1997, and the partial assistance of a Wellcome Trust research travel grant in this connection is acknowledged.

REFERENCES

1. Baloh, R. W. Advances in neuro-otology. Curr. Opin. Neurol. 11:1–3; 1998.
2. British National Formulary. Number 29. London: British Medical Association and Royal Pharmaceutical Society of Great Britain; 1995.
3. Golding, J. F. Assessment of a simple laboratory rotating chair motion challenge: Reference norms, reliability, response to hyoscine and relationship with motion sickness susceptibility. INM Tech Memo 3/89. Gosport, UK: Institute of Naval Medicine; 1989.
4. Golding, J. F. The effect of motion direction on motion sickness induced by low frequency linear oscillation with subjects seated upright. Proceedings of the UK Informal Group meeting on Human Response to Vibration, Army Personnel Research Establishment, Farnborough UK, 1993.
5. Golding, J. F.; Kerguelen, M. A comparison of the nauseogenic potential of low-frequency vertical versus horizontal linear oscillation. Aviat. Space Environ. Med. 63:491–497; 1992.
6. Golding, J. F.; Markey, H. M. Effect of frequency of horizontal linear oscillation on motion sickness and somatogravic illusion. Aviat. Space Environ. Med. 67:121–126; 1996.
7. Golding, J. F.; Stott, J. R. R. Effect of sickness severity on habituation to repeated motion challenges in aircrew referred for airsickness treatment. Aviat. Space Environ. Med. 66:625–630; 1995.
8. Golding, J. F.; Markey, H. M.; Stott, J. R. R. The effects of motion direction, body axis, and posture on motion sickness induced by low frequency linear oscillation. Aviat. Space Environ. Med. 66:1046–1051; 1995.
9. Golding, J. F.; Finch, M. I.; Stott, J. R. R. Frequency effect of 0.35–1.0 Hz horizontal translational oscillation on motion sickness and the somatogravic illusion. Aviat. Space Environ. Med. 68:396–402; 1997.
10. Golding, J. F.; Finch, M. I.; Stott, J. R. R. Y versus X axis comparison of nauseogenicity of horizontal translational oscillation. Unpublished data; 1996.
11. Hasegawa, S.; Takeda, N.; Morita, M.; Horii, A.; Koizuka, I.; Kubo, T.; Matsunaga, T. Vestibular, central and gastral triggering of emesis: A study on individual susceptibility in rats. Acta Otolaryngol. 112: 927–931; 1992.
12. Kennedy, R. S.; Dunlap, P.; Fowlkes, J. E. Prediction of motion sickness susceptibility. In: Crampton, G. H., ed., Motion and space sickness. Boca Raton, FL: CRC Press Inc.; 1990:179–215.
13. Kennedy, R. S.; Fowlkes, J. E.; Berbaum, K. S.; Lilienthal, M. G. Use of a motion sickness history questionnaire for prediction of simulator sickness. Aviat. Space Environ. Med. 63:588–593; 1992.
14. Lentz, J. M. Laboratory tests of motion sickness susceptibility. In: Motion sickness: Mechanisms, prediction, prevention and treatment. AGARD Conference Proceedings No. 372; 1984:29-1–29-9.
15. Money, K. E.; Cheung, B. S. Another function of the inner ear: Facilitation of the emetic response to poisons. Aviat. Space Environ. Med. 54:208–211; 1983.
16. Morrow, G. R. The effect of a susceptibility to motion sickness on the side effects of cancer chemotherapy. Cancer 55:2766–2770; 1985.
17. Reason, J. T. Relations between motion sickness susceptibility, the spiral after-effect and loudness estimation. Br. J. Psychol. 59:385–393; 1968.
18. Reason, J. T.; Brand, J. J. Motion sickness. London: Academic Press; 1975.
19. Rub, R.; Andrews, P. L. R.; Whitehead, S. A. Vomiting: Incidence, causes, ageing and sex. In: Bianchi, A. L.; Grelot, L.; Miller, A. D.;

King, G. L., eds Mechanisms and control of emesis. Colloque INSERM/John Libbey Eurotext Ltd., vol. 223:363–364; 1992.
20. Stott, J. R. R.; Barnes, G. R.; Wright, R. J. Ruddock, C. J. S. The effect on motion sickness and oculomotor function of GR 38032F, a 5-HT_3-receptor antagonist with anti-emetic properties. Br. J. Clin. Pharmacol. 27:147–157; 1989.
21. Stott, J. R. R.; Golding, J. F. The effect of a selective muscarinic receptor antagonist on motion sickness, skin conductance and heart rate in humans. J Physiol. 476:47P; 1994.

APPENDIX: MOTION SICKNESS SUSCEPTIBILITY QUESTIONNAIRE (MSSQ) REVISED AND SIMPLIFIED HAND-SCORING METHOD.

MSSQ (REVISED) SIMPLIFIED SCORING METHOD BY HAND

For Section A (Child)

In Q5 score the number of types of transportation experienced at least once (i.e., maximum is 9).
Total the sickness scores for each mode of transportation in Q6 and in Q7 (use the 0–4 number score key at bottom).

$$\text{MSSQA} = \frac{2.64 \times (\text{total sickness score child}) \times 9}{(\text{number of types experienced as a child})}$$

NB. Where a subject has not experienced any forms of transport a division by zero error occurs. It is not possible to estimate this subject's motion sickness susceptibility in the absence of any relevant motion exposure.

For Section B (Adult)

Repeat as for section A above but using the data from section B, i.e., Q8, Q9, Q10 respectively.

$$\text{MSSQB} = \frac{2.64 \times (\text{total sickness score adult}) \times 9}{(\text{number of types experienced as an adult})}$$

Raw Score

$$\text{MSSQ raw score} = \text{MSSQA} + \text{MSSQB}$$

Percentile Score

See Fig. 1 for percentile conversions.

MOTION SICKNESS SUSCEPTIBILITY QUESTIONNAIRE

This questionnaire is designed to find out how susceptible to motion sickness you are and what sorts of motion are most effective in causing that sickness. Sickness here means feeling queasy or nauseated or actually vomiting.
After some background questions, the questionnaire consists of two sections:
Section A is concerned with your **childhood** experiences of travel and motion sickness, that is, before the age of 12 years.
Section B is concerned with your experiences of travel and motion sickness **over the last 10 years**.
The correct way to answer each question is explained in the body of the questionnaire. It is important that you answer every question.
Thank you for your help.

Background Questions

1. Please State Your Age _____ Years

2. Please State Your Sex (tick box) Male [ ] 1 Female [ ] 2

3. Please State Your Current Occupation _____

4. Do you regard yourself as susceptible to motion sickness? (tick box)

Not at all [ ] 0 Slightly [ ] 1 Moderately [ ] 2 Very much so [ ] 3

Section A: **Your CHILDHOOD Experience Only** (before 12 years of age)

For each of the following types of transport or entertainment please indicate:

5. As a **Child (before age 12),** how often you **Travelled or Experienced** (tick boxes):

	Never	1 to 4 trips	5 to 10 trips	11 or more trips
Cars				
Buses or Coaches				
Trains				
Aircraft				
Small Boats				
Ships, e.g. Channel Ferries				
Swings				
Roundabouts: playgrounds				
Big Dippers, Funfair Rides				
	0	1	2	3

6. As a **Child (before age 12),** how often you **Felt Sick or Nauseated** (tick boxes):

	Never	Rarely	Sometimes	Frequently	Always
Cars					
Buses or Coaches					
Trains					
Aircraft					
Small Boats					
Ships, e.g. Channel Ferries					
Swings					
Roundabouts: playgrounds					
Big Dippers, Funfair Rides					
	0	1	2	3	4

7. As a **Child (before age 12),** how often you **Vomited** (tick boxes):

	Never	Rarely	Sometimes	Frequently	Always
Cars					
Buses or Coaches					
Trains					
Aircraft					
Small Boats					
Ships, e.g. Channel Ferries					
Swings					
Roundabouts: playgrounds					
Big Dippers, Funfair Rides					
	0	1	2	3	4

Section B: **Your Experience over the Last 10 Years (approximately).**

For each of the following types of transport or entertainment please indicate:

8. Over the **last 10 years,** how often you **Travelled** or **Experienced** (tick boxes):

	Never	1 to 4 trips	5 to 10 trips	11 or more trips
Cars				
Buses or Coaches				
Trains				
Aircraft				
Small Boats				
Ships, e.g. Channel Ferries				
Swings				
Roundabouts: playgrounds				
Big Dippers, Funfair Rides				
	0	1	2	3

9. Over the **last 10 years,** how often you **Felt Sick** or **Nauseated** (tick boxes):

	Never	Rarely	Sometimes	Frequently	Always
Cars					
Buses or Coaches					
Trains					
Aircraft					
Small Boats					
Ships, e.g. Channel Ferries					
Swings					
Roundabouts: playgrounds					
Big Dippers, Funfair Rides					
	0	1	2	3	4

10. Over the **last 10 years,** how often you **Vomited** (tick boxes):

	Never	Rarely	Sometimes	Frequently	Always
Cars					
Buses or Coaches					
Trains					
Aircraft					
Small Boats					
Ships, e.g. Channel Ferries					
Swings					
Roundabouts: playgrounds					
Big Dippers, Funfair Rides					
	0	1	2	3	4