

Psychometric Properties of the Gujarati Version of the Tampa Scale for Kinesiophobia in Chronic Neck Pain in Diamond Workers of South Gujarat Region

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Abstract

Background: The Tampa Scale for Kinesiophobia, an instrument for measuring fear of movement, has been confirmed as pain important predictor for the persistence of pain-related disability. The aim of this study to analyze the psychometric properties of Gujarati version Tampa Scale for Kinesiophobia (TSK-G) in chronic neck pain in diamond workers.

Methods: A total 300 subjects with chronic neck pain were included in this study according to inclusion criteria. After gaining cross cultural adaptations, reliability was assessed with Cronbach's alpha, inter and intra rater reliability, analyzed by intra- class correlation coefficient. And Neck disability index were used for construct validity and for face validity, this scale was given to more than 20 orthopedicians and physiotherapists.

Keywords: Kinesiophobia; Chronic Neck Pain; Psychometric Properties

Introduction

Kinesiophobia is a term used in physical therapy and medicine of rehabilitation, described by Miller, Kori and Todd in 1990. They described a fearful situation of people at the Ninth Annual Scientific Meeting of the American Pain Society by expressing fear of movement as "a patient has an excessive, irrational, and debilitating fear of physical movement and activity resulting from a feeling of vulnerability to painful injury or reinjury" [1,2]. The relationship between fear and pain was first described by Lethem, et al. 1982 in "the fear-avoidance model of exaggerated pain perception", in which fear and pain were both presented as associated with behavior through avoidance learning. Almost a decade later, Kori, et al. presented their thoughts about kinesiophobia [3,4].

It has been established that kinesiophobia plays a negative role in the outcome of the rehabilitation process which involves

increased physical fitness, improves functionality and betterment in performing social roles and participation [5-9].

Kinesiophobia had been widely assessed in various conditions including Parkinson's disease, fibromyalgia, spinal stenosis, and low back pain (LBP) [3,10,11]. Depending on the person's individual history, personality and genetics, they will develop a fear and therefore avoidance, of movement and physical activity [12].

According to cognitive-behavioral models, such as the fear-avoidance models, or the avoidance-endurance model of chronic pain, painful experiences will elicit a fear of movement/(re)injury in certain individuals, which often leads to behavioral avoidance and, in the long run, disuse, depression and increased disability. Other individuals will respond to pain with cognitions of minimization and/or thought suppression, and endurance behavior accompanied with low levels of pain-related fear and avoidance [12-16].

Detail kinesiophobic assessment is needed as till now kinesiophobia is being treated on the basis of mental issues rather personality disturbances [17,18].

Though limited evidences, the underlying constructs have been assessed from several years by various questionnaires amongst which the TAMPA scale for kinesiophobia(TSK-17) is the oldest gold standard existing measure developed in 1991 by Miller, *et al.* [2] The Tampa scale of kinesiophobia is self completed questionnaire and scores of this is ranging from 17 to 68 where the higher scores indicate increasing degree of kinesiophobia [19].

Each question is scored on a four-point Likert scale, with 1 indicating, strongly disagree and 4 indicating strongly agree. The scoring of four items is reversed (items 4, 8, 12, and 16). Total scores range from 17 to 68, with higher scores representing increased fear of movement.

TSK score was divided into two degrees indicating 'high kinesiophobia' and 'low kinesiophobia'. TSK score greater than 37 represents 'high kinesiophobia' while score lower than 37 represents 'low kinesiophobia' degrees [1].

The psychometric properties of the TSK have been tested in different languages [1,12,20-23] and for different pain disorders (e.g., CLBP [12,24] osteoarthritis [25], fibromyalgia [26] and neck pain [27].

The TSK models have been translated into various languages like German [28], Brazilian [29], Chinese [23], English [24], Finnish [30], Italian [22], Japanese [31], Norwegian [32], Persian [33], Spanish [21], Thai [34], Turkish [35], Arabic [36], Swedish [37], Brazilian – Portuguese [38], Dutch [39], Portuguese [40] their psychometric properties has been checked.

Diamond making industries are one of the widespread industries of Gujarat and Maharashtra. Approximately 3 lack workers alone in Surat city involved in it [41]. They are working in different sitting position like-without back support, back support and tailor sitting specific to the need of their work [42]. They are more prone for developing neck pain and back pain.

The diamond work needs most skillful and precise movements gained by flexing body and neck on diamond table for cutting, shining and shaping of the diamonds which leads constrain fixed sitting posture [38]. By this means disabilities of neck are different than other occupations.

Statement of problem

There is theoretical strong background showing the relation between pain and kinesiophobia and also showing correlation with disability. Many studies have been done which shows good psychometric properties of the Tampa scale of kinesiophobia in different languages for neck pain [21-24,30-40], but to the best of our knowledge there is scarcity of literature which determines the psychometric properties of the Gujarati version of the Tampa scale for kinesiophobia in chronic neck pain.

Purpose of the Study

To evaluate the psychometric property of the Gujarati version of the TampaScale for Kinesiophobia in chronic neck pain in diamond workers.

Aim of Study

To analysis the psychometric properties of the Gujarati version of the TampaScale for Kinesiophobia(TSK -G) in chronic neck pain in diamond workers of south Gujarat region.

Methodology

Study design

Reliability and Validity study.

Population

Diamond workers with chronic neck pain of south Gujarat region.

Sampling technique

Purposive sampling based on inclusion and exclusion criteria.

Sample size

300 [43-44].

Study duration

Six month.

Sources of data collection

Diamond factories of South Gujarat region.

Inclusion criteria

- Diamond workers who are male in gender [45]
- Age 30 to 60 years [42]
- Working more than 5 years, at least 8 months per year and working 6 hours per day [33]
- Experiencing neck pain (respondent reported any pain or stiffness in area bounded by the occiput superiorly and seventh cervical vertebra inferiorly, with or without radiating symptoms) of any mechanism [33,44]

- Duration of pain More than 3 months (chronic neck pain) [33].

Exclusion criteria

- History of neck surgery [43]
- Fracture around neck region [33]
- Any neck injury in last 6 weeks [43]
- Neurological disorders due to cervical spine injuries [43]
- Severe myelopathy [33]
- Relevant co morbidities such as cancer, infectious disease, heart attack, or clinically recognizable cognitive impairment were excluded from the study [33]
- Those who are not willing to participate.

Procedure

The process of translation is carried out according to Beaton's guidelines [46,47].

Step 1

Translation into Gujarati: The TSK chronic neck pain was translated from English into Gujarati followed by the essential steps recommended. The steps are: conceptualized on Newmark's concept of "communicative translation" for gaining dynamic equivalence between the source and target texts. "Communicative translation attempts to produce in its readers an effect as close as possible to that obtained on the readers of the original" [48]. Two native Gujarati speakers, one of whom was a linguist and another one a health care professional, who knew English as a second language independently translated the text. Finally, both translations were compared for effects equivalent, and a single version was agreed upon.

Step 2

Back translation into English: The agreed Gujarati version was back translated into English by two bilingual translators with English as a first language for taking into account cultural adaptation, that is, the localization process. After comparing both versions they agreed for single version.

Step 3

Review Committee: For checking of final version for semantic and idiomatic equivalence acceptable for dynamic equivalence bilingual committee consisting clinicians and translators reviewed the text and ended with the final approval.

Step 4

Test of the prefinal version: as a lack of direct contact with original author was piloted with 30 subjects by testing what was meant by each item and response chosen in order to verify whether the formulation of the item was clear or not. The expert committee re-evaluated all the findings and the back translation of the scale was approved [35].



Figure 1

The present study was initiated, where a total of 300 subjects were included who were found to be in a category of chronic neck pain and who were found to be satisfying all the inclusion criteria. A detailed explanation regarding the complete procedure was done for each subject and as a formality towards their willingness to be a part of this study, they were asked to sign a written consent.

Intra rater and inter rater reliability and face validity were been determined by 4 physiotherapists and given to the subjects for filling it by own.

Raters were recruited from the S.S. Agrawal Institute of Physiotherapy and Medical Care Education who are studying in Bachelor’s of Physiotherapy.

All the subjects were received information about The Tampa Scale for Kinesiophobia as well as about procedure of testing by filling an informed consent form.

For interater reliability on day one, rater one (R1) had given Tampa Scale to the subjects to be filled on their own. Along with the Tampa Scale, another scale named by Neck Disability Index (NDI) was also given by another rater to be filled by them on the day of assessment.

This was followed by filling the Tampa scale to the same subject by rater two (R2) on day three and by rater three (R3) on fifth day to same subjects. The rater one (R1) had on fifth day to subjects. The rater one (R1) had again given the Tampa scale to the same subject on fifteenth day for intra rater reliability.

Demographic characteristics and assessment of the participants were taken before filling scale.

Data analysis

Data analysis is done using the SPSS software version 23.0.

Results are considered significant at $p < 0.05$ and confidence interval of 95%. Data analysis is done by:

- Intra class correlation coefficient for inter rater and intra rater reliability which is regarded as a key indicator of reliability.
- Bland -Altman limits of agreement analysis for assessing the agreement between rater’s scores.
- Standard error of measurement (SEM) to calculate the variability in measurement of same individual. The true measurement can be calculated as $1.96 * SEM$.
- Smallest real difference (SRD) is the smallest change that can be interpreted as a real difference. It is calculated as $SRD = 1.96 * 2 * SEM$.

Results

In this study sample size was 30.

Variable	Mean	SD
Age	40.47	7.430
NDI	16.58	5.225
NPRS	6.29	0.915
Pain duration	34.38	46.935
Working hours	9.65	6.443

Table 1: Demographic data.

Table 1 shows demographic information of participants that are Age (years), NDI (out of 50), NPRS (out of 10), Pain duration (months), Working hours(per day 8 to 9 hours) of 300 subjects.

49 % right side and 51% left side involvement - the side of pain involved in subjects with neck pain with frequency and percentage from total 300 subjects.

Inter rater reliability

	N	Minimum	Maximum	Mean	SD
Rater 1	300	38.907	39.907	39.37	6.193
Rater 2	300	38.907	39.907	38.91	5.925
Rater 3	300	38.907	39.907	39.19	5.945

Table 2: Mean and SD of Tampa Scale of Kinesiophobia (TSK-G).

Table 2 shows mean and standard deviation with minimum and maximum of TSK-G scores of all.

SEM value of variability between three raters. Variability in measurements between rater 1 and rater 2, rater 2 and rater 3, rater 3 and rater 1 are 0.624, 0.979 and 0.842 which are very small that indicate the measurement are very reliable.

The true SEM value for variation in measurement between rater 1 and rater 2 ($0.624 * 1.96$) suggests that any individual value lies within the range of 1.22 of Tampa scale of kinesiophobia measured value.

SRD values for variation in measurement of three rater 1.72, 2.71, and 2.32.

	Three raters (R ₁ , R ₂ , R ₃)
SD	6.021
ICC (2,3)	0.897
CI (upper)	0.916
CI (lower)	0.875
SEM	0.620
SRD	1.71

Table 3: Total score of inter rater measurements.

Table 3 shows mean value of all variables i.e. SD, ICC, SEM and SRD of three raters.

Intrarater reliability

	Day 1 - Day 15
ICC	0.697
CI (Upper)	0.758
CI (Lower)	0.619
Cronbach alpha	0.708
SEM	2.11
SRD	5.84

Table 4: ICC with CI and Cronbach alpha.

Table 4 shows ICC of day 1 and day 15 that is 0.697 which shows excellent intra rater reliability of Tampa Scale for Kinesiophobia and Cronbach alpha is 0.708. True SEM value between occasions is 2.11 which suggest that any individual lies within the range of 4.13 value of Tampa Scale for Kinesiophobia. The value of smallest real difference (SRD) value of variation between the two occasion ($1.96 * 2SEM = 5.84$) is claimed to be capable of representing the “real” change.

Validity

	Mean	N	SD	SEM
TSK -G	37.7483	298	7.73991	0.44836
NDI	16.5168	298	5.17714	0.29990

Table 5: Comparison between TSK-G and NDI.

Table 5 shows the Tampa score is 37.74 +/- 7.7399 and NDI score is 16.5168.

Validity is used to test whether the scale measures what it has to measure. For that we have used repeated measurement of Anova which shows the f value = 1.006 and p value = 0.364 $p > 0.05$ which is not significant which means there is no significant difference between the readings of raters. Therefore scale is valid.

T-test shows $p = 0.000$ which shows that there is a significant difference between the Tampa and NDI scale.

Component (factor)	% of variance	Cumulative %
1	12.776	12.776
2	9.451	22.227
3	9.407	31.635
4	9.290	40.924
5	8.973	49.897
6	8.701	58.598
7	8.152	66.751

Table 6: Total variance explained.

Table 6 shows total variance explained in which total cumulative% is 66.7 of the total 17 items.

Table 6 column 1 shows component factors of scale for factorial validity. In factorial validity, the goal of exploratory factor analysis is to establish the underlying constructs, or factors, that explain

the variation and covariation among multiple observed variables (Briggs and Cheek, 1986; Brown, 2006). Like confirmatory factor analysis, exploratory factor analysis is based on the common factor model which describes each measured variable as a linear function of two things: (a) common variance, and (b) unique variance (Brown, 2006; Thurstone, 1947). Common variance refers to the variance in a measured variable that is explained by a factor, whereas unique variance refers to systematic and random error variance in the measured variable (Floyd and Widaman, 1995).

Face validity

For face validity, this scale was given to more than 20 orthopedicians and physiotherapists and about 80 to 85% were agreed with the questionnaire of Gujarati version of the Tampa Scale for Kinesiophobia (TSK-17).

Results

The result shows the ICC value 0.897 of inter reliability with confidence interval of (0.875 - 0.916) which indicates high internal consistency between raters and the SEM value is 0.620 and SRD is 1.71 and for intra rater ICC is 0.697 with confidence interval of (0.619 - 0.758) which indicates moderate to high internal consistency and SEM value is 2.11 and SRD is 5.84. Factorial validity shows that KMO that was 0.684. Cumulative of all 17 items was more than 0.5, Dimension factor would use 7 factors with 66.75% of variance. This study shows that about 66.75% of the population is having kinesiophobia.

Discussion

Understanding Chronic Neck Pain with its relationship of functional ability in population such as diamond workers of south Gujarat region to rule out fear of movement i.e. Kinesiophobia and to analyze Psychometric properties of Gujarati version of Tampa Scale for Kinesiophobia is fundamental for successful rehabilitation (TSK-G). Diamond making industries are one of the widespread industries of Gujarat and Maharashtra. Approximately 3 lack workers alone in Surat city involved in this business [41].

Neck pain problem is second most in diamond workers as worker is involving in diamond work with constantly require bending their head on the diamond table which, increased the static loading of neck muscle. Donald and Adams; noted that leaning back also has a disadvantage, many computer users slumps against their backrest, locking in their pelvis and causing them to lose the natu-

ral curve of their low back and neck pain [49]. "Fear of pain and what we do about it may be more disabling than pain itself". It is advantageous to treat neck pain before going to worsening and hampering lifestyles of diamond workers.

The TSK questionnaire assesses fear of movement/re-injury and has invariance across different clinical conditions and patient populations [50].

This study hypothesized whether the Gujarati version of the Tampa Scale for Kinesiophobia (TSK-G) is reliable and valid for ruling out fear of movement i.e. is Kinesiophobia in population of Diamond workers with Chronic Neck Pain by scale was provided for filling it up by three raters for inter rater reliability, and after 15th day for intra rater reliability and for construct validity TSK-G was compared with NDI and also face validity was done by providing this scale to more than 20 orthopedicians and physiotherapists.

On the basis of inclusion and exclusion criteria 300 subjects were included from different diamond industries from south Gujarat region which is sufficient for performing and analyzing psychometric properties of the scale [33,43,44].

All the demographic data which are mentioned above were similarly in the study done by Askary- Ashtiani., *et al.* [33] and Waltom D [44] which stated that with similarity of all criteria shows statistically significant value for performing study to analyze hypothesis.

The mean value of onset of neck pain is 34.39 months with minimum value of 4 month and maximum value is 240 months shows that chronically participants are suffering from neck pain which might cause kinesiophobia.

Furthermore in this study mean and SD of TSK -G for all three raters are ; The mean and SD of TSK -G are 39.37 and 6.193 for rater one (R1), for rater two 38.91 and 5.925 and for rater two (R2) and for rater three (R3) 39.19 and 5.945, with the minimum and maximum value of TSK -G are 38.907 and 39.907 of all three raters. Moreover the mean of SD for all three raters is 6.021. All the data which are mentioned above were similarly in the study done by Askary- Ashtiani., *et al.* the mean, SD are 44.7 and 7.8 [33] and by French J., *et al.* the mean, SD are 42.9 and 9.1 [24]. These values were also within range previously reported patients with LBP and neck pain [24,33]. This clearly correlates and signifies moderate to severe kinesiophobic conditions of subjects [45,51].

Reliability

Inter rater reliability

In statistics, inter -rater reliability is the degree of agreement among raters.

In this study, aimed at measuring the psychometric properties of Tampa scale for kinesiophobia (TSK-G): inter and intra rater reliability by analyze ICC (Intra class correlation coefficient) value. ICC is measured on a scale of 0 to 1 in which 1 represent perfect reliability with no measurement error whereas 0 indicate poor reliability and no correlations between raters. And ICC of 0.80 or higher indicates excellent correlation and good reliability. Value of 0.60 to 0.80 indicated adequate correlation and moderate reliability and value of ICC of 0.40 to 0.60 indicates poor correlation and weak reliability [52].

The result been gained for Inter rater reliability ICC (1, 2) for rater one (R1) and two (R2) is 0.863 at confidence interval (0.828 to 0.90) which shows excellent correlation and good reliability between rater one (R1) and two (R2). ICC value of rater two (R2) and three (R3) is 0.835 which indicate almost good reliability and excellent correlation at confidence interval (0.793 to 0.869). ICC value of rater three(R3) and one (R1) is 0.861 at confidence interval (0.825 to 0.889) indicate good reliability and excellent correlation between rater 3 and 1. In addition we found the mean of ICC is 0.897 at confidence interval (0.875-0.916) for all three raters which shows high inter rater reliability. Furthermore, these values were within range higher indicates excellent correlation and good reliability [52]. The testing of reliability was done within preferred interval of 48 hours to minimize chances of bias in memory of subjects and our result show the high agreement between measurements recorded on 2 occasions during 48-hour period [33]. The Cronbach's alpha of the study is 0.897 which suggest high internal consistency of the TSK -G.

The previous study established inter rater reliability by calculating a Pearson's product moment (PPM) correlation, which merely measures the strength of an association between two variables and not the agreement between them (Bland and Altman, 1986) our study addressed these limitation, by calculating the SEM and SRD and extended upon these previous finding, by showing that the English version of the TSK demonstrates excellent inter rater reliability in sample of CLBP subjects.

SEM (standard error of measurement) and SRD (smallest real difference)

SD (Standard deviation) and ICC are taken from reliability testing procedure from different raters. SEM value of variability between three raters: Variability in measurements between rater one (R1) and rater two (R2), rater two (R2) and rater (R3), rater three (R3) and rater one (R1) are 0.624 and 0.979 and 0.842. which are very small that indicate the measurement are very reliable. But variability in measurement between rater 3 and rater 1 shows adequate reliable as the SEM score is 0.842. The true SEM value for variation in measurement between rater 1 and rater 2 (0.624×1.96) suggests that any individual value lies within the range of 1.22 of TSK -G measured value. The mean value of SEM for all three raters is 0.620. Once again these values were within ranged previously reported for patients with back pain [51,53]. The values of SRD variation in measurement of three rater 1.72, 2.71, 2.32 for TSK -G and the mean value for all three rater is 1.71, which is comparable with results previously reported [51].

Bland Altman limits of agreement

In this study, SEM value is from corresponding variability in measurements of three raters, the finding of Bland Altman limits of agreement showed good inter rater agreement between rater one (R1) and rater two (R2) (limits of agreement = 8.6874 to -7.7607), rater two (R2) and rater three (R3) (limits of agreement = 8.457 to -9.0307) and rater three (R3) and rater one (R1) (limits of agreement = 8.1463 to -8.4997). Certain subjects are beyond the limits of agreement between all raters and in two occasions which shows value of brief TSK only 6.7% of subjects out of 100 % are shows different reading due to barrier of environment, mood of patients and time taken by raters to check reliability. But it doesn't affect the consistency of scale. In Previous study, Polish version of TSK has done Bland Altman for intrarater reliability (limits of agreement = 10.79 to -9.810) which shows there is a good limits of agreement [54].

Furthermore in this study the individual item correlation between rater 1, rater 2 and rater 3 by Pearson's rank correlation coefficient. Almost all items show highly correlation between all three rater which indicate good item correlation of TSK - G. All the correlation which are mentioned above were similarly in the study done by Wong S [23].

Intrarater reliability

Intra rater reliability is the degree of agreement among repeated administration of a diagnostic test performed by single rater.

the present study indicates ICC of day 1 and day 15 that is 0.697 which shows moderate intra rater reliability of TSK-G and Cronbach's alpha is 0.708 and the Persian version, the higher version and the original English version of TSK have also been shown to possess good inter rater reliability in back and neck pain [24,33,44].

SEM (standard error of measurement) and SRD (smallest real difference)

The SEM value is 2.11 that is value between occasions which suggest that any individual lies within range of 4.13 value of TSK -G. Moreover we found SRD value is 5.84 that is value between occasions which claimed to be capable of representing the "real" change". In the previous study by Woby R., *et al.* A shorten version of TSK the value of the tsk-17 SEM is 3.16 and SRD is about -1.19 [53]. In this study there is much more difference of the SRD value because of some limitation of administering scale or subject's mood even environmental barrier affect the scoring of the scale.

ICC value of Intrarater reliability of day 1 and day 15 was compared with the Persian (<0.80), original English (0.69 to 0.80) and Chinese versions (0.81). This shows Gujarati version of TSK-17 is have adequate correlation and moderate Intrarater reliability which is more of similar to the original English version TSK-17.

Bland Altman limits of agreement

In present study, the finding of Bland Altman limits of agreement showed good intra rater agreement between rater. Similarly results of Bland Altman limits of agreement between two occasion by rater 1 at day 1 and day 15 showed good agreement (limits of agreement = 14.4397 to -11.727) In Previous study by Misterska E., *et al.* Polish version of TSK has done Bland Altman for Intrarater reliability (limits of agreement = 10.79 to -9.810) which shows there is a good limits of agreement [54].

In addition the result shows individual item correlation between rater 1, rater 2 and rater 3 by Pearson rank correlation coefficient. Almost all items show highly correlation between all three rater which indicate good item good item correlation of Tampa Scale for Kinesiophobia.

Item total correlation based on Pearson's rank correlation coefficient of all items of the TSK-G of interrater and Intrarater shows excellent correlation between the items.

The present result indicate that the Gujarati version of the TSK has good psychometric properties in Gujarati -speaking chronic

neck pain in diamond workers of south Gujarati region. The reliability estimates ranged from satisfactory to excellent for both inter rater and adequate to moderate for intra rater reliability. TSK - G scores are positively related to self- reports of clinical pain, disability and negative effect.

Validity

Construct validity of the Tampa scale for Kinesiophobia

Factorial validity

Factorial validity shows that KMO that was=0.684.

With the help of factorial analysis, 7 different factors related to mainly activity avoidance and somatic focus was found. Detail domains are fear of movement, harm, reinjury, disability, pain related beliefs and pain related fear. Cumulative of all 17 items was more than 0.5; Dimension factor would use 7 factors with 66.75% of variance. This study shows that about 66.75% of the population is having kinesiophobia.

Face validity

For face validity, this scale was given to more than 20 orthopedicians and physiotherapists and about 70 to 85% were agreed with the questionnaire of Gujarati version of the Tampa Scale for Kinesiophobia (TSK-17).

The result of this study have shown that the Gujarati version of TSK-17 have acceptable intra-rater and inter-rater reliability and construct validity and face validity to measure Kinesiophobia in Gujarati - speaking subjects with chronic neck pain.

Limitations of Study

- Whether the results are generalized to patients with acute or sub acute Neck pain in diamond worker is unknown.
- The 2 databases were similar in terms of symptom duration, but differed in pain intensity and age.

Conclusion

The results suggest that the Gujarati version of the TSK-17 the reliable and valid scale for diamond workers of the south Gujarat region for ruling out the kinesiophobia.

Future Recommendation

- The study was done on chronic neck pain people, so further study can be done on different population such as acute or sub acute neck pain individuals.

- The study was done to see psychometric properties of the Tampa scale for Kinesiophobia in Gujarati language for diamond workers. In future, this scale will be used as outcome measures for same populations to see effects of any exercises on fear of movement.
- The convergent and concurrent validity can be evaluated to improve psychometric properties of the Gujarati version (TSK-G) of the scale.

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