‘Non-duality’ and ‘Reliance’ are the ‘regression refined principal components’ that influences ‘spirituality’ in ‘Indian Saints’.

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Abstract

Background: Quantifying spirituality is a tough ordeal and pretty intricate considering its multidimensional nature. Religion and culture are its top exponents. An evaluating tool must envisage them as core components. A tool to measure spirituality by incorporating Hindu philosophy was hard to find. Thus, we choose the commonly studied SAI (Spiritual Assessment Inventory) questionnaire and attempted to extract refined components with significant predicting potentials which can pave the path for spiritual assessment among Indian Saints.

Results: The legitimate KMO and Bartlett’s Test of significance of SAI for 1103 participants were .878 and 0.000; its Cronbach’s α was .810. Extracted Communalities for all 54 items of SAI ranged from .404 to .709. PCA (Principal Component Analysis) analysed 1097 participants that yielded 2 Principal Components (PCs) having a total of 7 variables; 3 for PC 1 and 4 for PC 2. The PCs thus derived explained 59.48% of the total variance of the participant’s spiritual score. The PCA for the two extracted components reported a Cronbach’s α value of .69, the KMO and Bartlett's Test of significance of .748 and 0.000, and a linear regression R² value at .605, F .000 and sig. f change .000. Standardized Beta for extracted component variables ranged from .10 to .28 with a significance value of .000. Both the PCs had corresponding Eigenvalues > 1. The corresponding Monte Carlo PCA test of parallel lines Eigenvalues was calculated to cross-check the PCA Eigen figure for their validity. The PCA Eigen figure was found tenable after cross-checking.

Conclusion: PC 1 with its 3 variables was named ‘Reliance’ and PC 2 with 4 variables were ‘Non-duality’ named. These two PCs accounted for to 59.48% of spirituality in Indian saints and demonstrated a strong positive prediction potential concerning spiritual scores (regression R² .605) in Indian Saints.

Introduction

The health paradigm has two protagonists: Spirit - Mind – Body and Body- Mind – Spirit. In eastern spiritualism, the ‘Spirit - Mind – Body’ paradigm is strongly prophesied. The first and the oldest component of the paradigm ‘Spirit or spirituality’ is a pretty complex issue. Its multidimensionality makes its empirical measurement harder. Nevertheless, it can be stated that spirituality is now seen as a universal human phenomenon with huge potential for overall individual and global wellbeing. India the ‘land of spirituality’ has constantly nurtured this concept since time immemorial. The local populace looks at the Saints as its propagators. But empirical documentation of this oldest domain among the mentioned saviours is far and few. One of the causes may be a lack of ‘religion and culture-sensitive tool’ to do so. In this research an admired and authenticated SAI (Spiritual Assessment Inventory) instrument was explored for its local relevance. It was then subjected to PCA (Principal Component Analysis) for extraction of prominent components that contributed to spiritual enrichment. Those contributors were scrutinised for their scientific assertion by a linear regression model for a closer
look at the role played by their constituting variables in influencing spirituality amongst studied participants.

**Methods**

Null hypothesis ($H_0$): All components and variables of SAI have equal contribution to spiritual development in Indian Saints.

The alternate hypothesis ($H_1$): There are select variables in SAI which can be grouped under fewer independent components which may significantly influence spiritual growth of Indian Saints.

Aim: The study aimed at quantifying spirituality by SAI and extracting valid ‘Principal Components ‘out of them.

Objectives:

1. To score spirituality in numeric
2. To extract evident components by PCA analysis
3. To analyse them for their reliability and contributing aptitude in spiritual development in Indian Saints by a regression model

Study design: Cross-sectional data from Indian Saints attending Ujjain Kumbha Mela (riverside religious and spiritual mass gathering) were collected by SAI and subjected to PCA (Principal Component Analysis).

Methodology: SAI (a theistic selective instrument for the quantitative measure of spirituality and religion) was used for data collection from 1103 (10%) of Indian saints who attended the Kumbha Mela of 2016; the prestigious and holy riverside festival of faith, religion and spirituality held at the cultural city of Ujjain, Madhya Pradesh, India\textsuperscript{16-18}. Prior training of investigators to standardize the interviewing process, followed by conduction of a pilot survey and its SWOT analysis was conducted before the initiation of the final study. Five Akhads (clans) representing the three important Hindu lineages; Shiva, Vishnu and Neutral/ Sikhs were randomly selected from a total of 13 that participated in the mega event\textsuperscript{15}. Equality of participants from selected clans was ensured by systematic random sampling with a group interval of 10, and lineage proportionality was ensured by proportionate sampling method keeping representation of the clan lineage in mind. Thus 3 out of 7 Akhadas were selected from Shiva clans and1out of 4 each from Vishnu and Neutral clans. As the first step for sample estimation; 10% (205) participants from each select clan were chosen for study purpose thus yielding an initial sample figure of 205 x 5 = 1025 participants. Additional 10% (102) participants were added to this initial figure considering the approximate decadal increment in participant number over and above the last Mela figure. Thus, the final sample estimate was 1127 (1025 + 102) consenting participants/saints.
The spiritual score for individual participants was generated in accord with SAI guidelines. SAI tool consisting of 54 variables was scored on Likert Scale of 1 to 5, which recorded the responses ranging from ‘not at all true’ as ‘1’ to ‘very true’ as ‘5’\textsuperscript{15,16,18-20}. The select inventory was subjected to PCA suitability by conducting Reliability Statistics (Cronbach’s $\alpha$), Kaiser-Meyer-Olkin Measure for Sampling Adequacy, Bartlett's Test of Sphericity for hypothesis testing. Standard ‘Varimax rotation’ was adopted as the components proved to be nonlinear (independent/nonrelated) by ‘direct oblimin method’\textsuperscript{21,22}. The component extraction was done by fixing factor Communalities at $>0.4$, component initial Eigenvalues $>1$, and a factor loading of $>.45$ to suppress small coefficients. The validity of component Eigen value was confirmed by the corresponding MCA Test of Parallel Line fitness analysis\textsuperscript{23-27}.

Extracted components are presented as Scree plots, component plots in the rotated matrix, naming of components with factor loading, component reliability statistics in terms of Cronbach's $\alpha$ and item predictability by the linear regression model.

Data analysis was done by SPSS version 20 and Monte Carlo Analysis Test of Parallel Line for extracted components fitness analysis\textsuperscript{21}.

Results: We were able to collect data from 1103 participants. On screening for completeness of data, 1097 (99.45%) participants provided complete information on all 54 studied variables. SAI as an assessment tool was found to have a better unidimensional internal consistency reliability (Cronbach's $\alpha$ .81)\textsuperscript{23-25}. Exploratory Analysis in the form of ‘The Bartlett’s test’ and ‘Kaiser–Mayer Olkin measure’ was applied to the data for verifying the legitimacy of conducting PCA\textsuperscript{28-31}. Suitability for PCA analysis of the data set was affirmed by a meritorious KMO sampling adequacy value of .878 and Bartlett's Sphericity significance level at .000 which favoured the alternate hypothesis \textsuperscript{32-34}. The extracted Communalities value for all 54 variables ranged from .404 to .709, indicating their meaningful contribution in variances explained. In accord with the established standard, the recommended Communalities value of $>.40$ was employed to suppress small coefficients. All these analytical measures collectively enhanced fitment, validity, and reliability of study objective thereby rejecting the null hypothesis \textsuperscript{35-38}.

As an initial analysis, variables were subjected to Direct Oblimin Rotation in PCA and their component correlation matrix was analysed. None of the components suggested the presence of established co-relationship (value $<.30$) thereby suggesting the adoption of orthogonal rotation as the chosen method for component extraction. The commonly used Varimax Orthogonal Rotation was used for final analysis\textsuperscript{39,40}.

By running PCA with the above-mentioned model fitness criteria we were able to extract 3 components with 12 variables explaining 53.80% of the total variance. But when they were subjected to multilinear regression analysis 1 of the select 12 variables namely; variable(question) number 7 from instability
subsection of SAI, which says ‘there are times when I feel God is angry at me’; was found non-redundant (supplementary table number 1). This variable was subsequently dropped/excluded and PCA was redone keeping all other preconditions unaltered. The final result led to a 2 component PCA with 7 variables that explained 59.48% of the total variance. All those 7 components recorded an acceptable overall reliability scale (Cronbach’s α score of .695; with a range of .697 to .725).

As the development of spirituality is subjected to multiple domains with intradomain correlations it was unlikely that each extracted variable would record an individual $R^2 > .5$. Therefore, regression analysis was carried out under ‘unit assumption’ for the 7 extracted variables. It was observed that 7 of them together significantly influenced spirituality ($R^2 .605$).

The above-reported results are presented in the following sequences. The 7 extracted variables along with their respective domains are presented in table number 1. The higher mean scores, narrow standard deviation and acceptable component/factor loading of $>.4$ lend initial support in favour of their selection as dominant players.

**Table Number 1**

| Variables | Mean | Std. Deviation | Participants |
|-----------|------|----------------|--------------|
| I work harder to restore divine  connect on a difficult time (RA2**) | 3.26 | 1.15 | 1097 |
| my trust in God stays mostly un-wavered may come what (RA7**) | 3.09 | 1.43 | 1097 |
| I am able to come to sense and work on restoring our relationship on fractious occasions (RA3**) | 3.28 | 1.10 | 1097 |
| On the feeling of betrayal by Almighty, my effort in relationship-repair stays un-dampened (RA5**) | 3.38 | 1.08 | 1097 |
| God recognizes my strong spiritual ability (G2**) | 3.40 | .98 | 1097 |
| My experience of God’s response has a great impact on me (A5**) | 3.46 | .93 | 1097 |
| My needs are more important to God than most others(G3**) | 3.21 | 1.13 | 1097 |

*RA: Realistic acceptance, A: Awareness, and G: Grandiosity.**These numbers represent the item under the above-mentioned subcategories.

Table number 2 demonstrates individual and cumulative variance (59.48%), explained by the two extracted PCs. This figure lies within the standard acceptable range of 40%to 60% . The corresponding Eigenvalues of the components at 2.537 and 1.627 are well above the customary cut-off value of $1.43,44$. The initial PCA Eigen values were cross-checked against their corresponding Eigen values generated by Monte Carlo PCA for the parallel line. The selected 2 PCs were found tangible/retainable after cross-checking. (Supplementary table number 1).

**Table Number 2**
Individual and Cumulative variance of studied components along with their Eigen values

| Component | Initial Eigenvalues | Extraction Sums of Squared Loadings | Rotation Sums of Squared Loadings |
|-----------|---------------------|-------------------------------------|----------------------------------|
|           | Total               | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1         | 2.537               | 36.23        | 36.23        | 2.537 | 36.23        | 36.23        | 2.206 | 31.51        | 31.51        |
| 2         | 1.627               | 23.24        | 59.48        | 1.627 | 23.24        | 59.48        | 1.958 | 27.96        | 59.48        |
| 3         | .659                | 9.41         | 68.89        |       |              |              |       |              |              |
| 4         | .620                | 8.85         | 77.74        |       |              |              |       |              |              |
| 5         | .544                | 7.76         | 85.51        |       |              |              |       |              |              |
| 6         | .535                | 7.64         | 93.15        |       |              |              |       |              |              |
| 7         | .479                | 6.84         | 100.00       |       |              |              |       |              |              |

*Extraction Method: Principal Component Analysis

The Scree plot, it's interpolation line and Eigen values of principal components are presented in figure number 1. The two components above the elbow were the final detainees for further exploration.

Figure number 2 depicts the rotated factor loading for the selected 2 PCs both at origin and in spike centroid axis. Both of them presents the ‘inter-component independency’ and ‘intra-component dependency’ of select factors thereby justifying component nonlinearity. It is seen that A5, G2 and G3 loaded under Component 1 and RA2, RA7, RA3 and RA5 loaded under component 2 (figure number 2).

The two extracted core components were named ‘Nonduality’ and ‘Reliance’ considering the nature of variables which loaded under them. All of them had good component loading scores (> .5) thereby indicating strong intra-component correlation. Table number 3 presents the details in this regard.

**Table number 3**

The naming of extracted Component along with factor loading

| Principal Components | Variables                                                                 | Component loading |
|----------------------|---------------------------------------------------------------------------|-------------------|
| PC 1 Reliance        | A5 (My experience of God’s response has a great impact on me)              | 0.787             |
|                      | G2 (God recognizes my strong spiritual ability)                            | 0.784             |
|                      | G3 (My needs are more important to God than most others)                   | 0.772             |
| PC 2 Nonduality      | RA2 (I work harder to restore divine connect on difficult time)            | 0.803             |
|                      | RA7 (My trust in God stays mostly un-wavered may come what)               | 0.767             |
|                      | RA3 (I am able to come to sense and work on restoring our relationship on fractious occasions) | 0.716             |
|                      | RA5 (On the feeling of betrayal by Almighty my effort in relationship-repair stays un-dampened) | 0.657             |

* Exraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization
Next, the reliability score of SAI questionnaire along with the extracted components was estimated by Cronbach $\alpha$. All of them had good estimates which also renders supports the study hypothesis ($H_1$). The reliability score (Cronbach's Alpha) for the final PCA model along with extracted components is presented in table number 4.

Table Number4
Reliability Statistics for SAI and extracted components

| Components         | Cronbach's $\alpha$ | Standardized Cronbach's $\alpha$ | No. of Items |
|--------------------|----------------------|----------------------------------|--------------|
| (Reliance)         | .69                  | .70                              | 7            |
| (non-duality)      | .72                  | .73                              | 4            |

As a final step linear regression analysis was carried out to find the predictive power of extracted variables. Recognizing the multi-domain nature of spirituality, we opted for the concept of unit assumption for regression analysis. Here we assumed all extracted variables as one ‘unit variable’ and subjected it to the regression model. The regression model generated a favourable $R^2$ value at .605 and The ANOVA supported linear regression model validity with $F$ at 238.23, and sig, 0.000. The linear regression findings are presented in table number 4.

Table number 5
Linear Regression Model Summary

| Model | R      | R Square | Adjusted R Square | Std. Error of the Estimate | R Square Change | F Change | df1 | df2 | Sig. F Change |
|-------|--------|----------|-------------------|---------------------------|-----------------|----------|-----|-----|--------------|
| 1     | .778*  | .605     | .602              | 9.93926                   | .605            | 238.239  | 7   | 1089| .000         |

a. Predictors: (Constant), A5, RA2, G3, RA5, RA7, G2, RA3; b. Dependent Variable: Spiritual Score
To establish the contribution of each selected variable to the above all spiritual scores in study participants, their ‘standardized $\beta$’ was calculated. The ‘standardized $\beta$’ for all extracted variables were found to have high statistical significance (.000). These details are presented in table number 5.

Table number 6
Coefficient Table
| Model  | Unstandardized Coefficients | Standardized Coefficients | T   | Sig. | 95.0% Confidence Interval for B | Correlations |
|-------|-----------------------------|---------------------------|-----|-----|--------------------------------|--------------|
|       | Bstd| Error | Beta |      | Lower Bound | Upper Bound | Zero-order | Partial | Part |
| 1 (Constant) | 100.549 | 1.581 | 63.595 | 0.000 | 97.446 | 103.651 |  | | |
| RA2   | 1.965 | 0.318 | .144 | 6.173 | 0.000 | 1.341 | 2.590 | .369 | .184 | .118 |
| RA3   | 2.681 | 0.328 | .188 | 8.161 | 0.000 | 2.036 | 3.325 | .496 | .240 | .155 |
| RA5   | 2.137 | 0.322 | .147 | 6.637 | 0.000 | 1.505 | 2.769 | .456 | .197 | .126 |
| RA7   | 1.197 | 0.248 | .109 | 4.824 | 0.000 | .710 | 1.684 | .344 | .145 | .092 |
| G2    | 3.535 | 0.368 | .220 | 9.602 | 0.000 | 2.812 | 4.257 | .529 | .279 | .183 |
| G3    | 2.409 | 0.306 | .173 | 7.862 | 0.000 | 1.808 | 3.010 | .444 | .232 | .150 |
| A5    | 4.862 | 0.385 | .288 | 12.620 | 0.000 | 4.106 | 5.618 | .558 | .357 | .240 |

a. Dependent Variable: Spiritual Score

**Discussion**

The teachings from Hindu culture are a protagonist of Spirit – Mind – Body paradigm. Spirituality is considered as the essence of healthful living. All available scriptures are in tune with this concept. In one hand Hindu spirituality has always thrived on the concept of ‘non-duality’; a strong sense of connecting with the creator by realistic acceptance of his creation, and in the other; a sense of surrender to the supreme by ‘Reliance’. Both these components cement the all-inclusive ‘transcendental’ approach in achieving spiritual growth.

To explore this concept data from an exertive descriptive study involving 1097 participants was subjected to dimensional reduction and core component extraction by Principal Component Analysis. The study sample met all the prerequisites considered conducive for running an effective PCA; i.e. testing sample adequacy by KMO, hypothesis testing by Bartlett’s test of Sphericity and Eigen values for component selection $23^{-25}$, $28^{-31}$ & $35^{-38}$, $43^{-44}$.

This exercise yielded 2 core components consisting of a total of 7 variables, which cumulatively explained a high percentage (59.48%) of variance in spiritual score$^{36,38}$. As a next step, the extracted core components were named keeping their constituent variables in mind. The 2$^{nd}$ component explaining 23.24% of the spiritual score was named ‘Nonduality’. It had 4 variables all of which were from RA subscale and pointed at a strong desire and sustained effort to stay associated with divinity or God (Fig. 2 and table number 3).

The ‘distinction and definition’ ambush between spirituality and religiousness is a topic of grand eternal debate. While some consider spirituality as a subset or superset of religiousness (Zinnbauer and Pargament religiousness$^{2005}$; Zinnbauer et al. 1999), others opine religiousness as the most popular form of spiritual life that drives one to transcend the material sphere$^{45^{-47}}$. Though there are many definition difficulties, one thing that emerges as the front runner (core component) is the desire to
transcendence i.e. going beyond or above one's “physical self”\textsuperscript{[48-50]}. This can happen through a combination of personal and as well as a religious domain which we have coined as 'nonduality'\textsuperscript{[51,52]}. Nonduality identifies one as the part of the cosmos and prompts one to dissolve all personal boundaries to embrace the divine creation. This inclusiveness is fundamental to transcendental reform. Indian saints are in constant pursuit to spiritual transcendence by leading a dedicated religious life as seekers of truth through four major practices, namely; devotion, karma, body energy management and constant seeking for knowledge. This dynamic character of spirituality prompted many to consider it's multidimensional nature and even some name it as the 'sixth domain of personality'\textsuperscript{[53]}. Researchers also have identified positive spiritual and religious coping behaviors\textsuperscript{[53]}. Positive religious coping strategies are based on solid, trustful and safe relation with God which has confirmed beneficial health impacts\textsuperscript{[54-57]}. Transcendence can assume different directions: self-improvement of oneself, deepening relations with others, building the sense of unity with nature or attachment to and trust in the Divine Being. Miller and Thoresen along with Hill et al. also observed that spiritual coping with stress can be defined as an attempt to overcome the stressor based on what is transcendental approach\textsuperscript{[58,59]}. The 1\textsuperscript{st} component explained 36.23% of the variance in the spiritual score. It was named ‘Reliance ‘and had 3 variables loading together that explains the significance of divine influence in the day to day functioning of Indian saints (Fig 2 and Table number 3). Studies have identified the significance of maintaining solid relationships with God/the Supreme Power, based on the sense of presence, love and trust (the religious domain)\textsuperscript{[58]}. Thus ‘Trust & Acceptance’, opens up another rich area of inquiry. Here accepting what is, integrating the new status of affairs, making sense of them coherently, demonstrating flexibility and resilience, and moving forward with a trusting attitude are identified as major influencers in meeting one's needs in spiritual spear\textsuperscript{[59]}. Finally, the core variables contributing to the extracted factors were subjected to multilinear regression analysis. The MLR model was found sustainable with R at .778, R\textsuperscript{2} at .605 and adjusted R\textsuperscript{2} at .602 with a sig. F at .000. Standardized $\beta$ coefficient for influencing variables was estimated to evaluate the impact of a unit change in each of them with the corresponding changes on the total spiritual score. It was observed that per unit change in predictor variables there were highly significant changes (.000) in the spiritual score of participants. For example, a unit change in A5 (divine influence in day-to-day activities) can lead to a corresponding increase in the spiritual score by 28 points. Similarly; per unit change in G2(devotional spiritual quest or surrender to almighty), RA3(relationship restoration), G3(divine favour), RA5 (repair of relationship), RA2 (trust) AND RA7(divine connect) the corresponding increase in spiritual score will be by a margin of 22, 18, 17, 14 and 10 points respectively (table number 5). So, the present analysis renders empirical support to the age-old hypothesis; that transcendental reform is dependent on nurturing a ‘non-dual' and ‘reliance' conduct. The instrument SAI has 6 scales and 54
variables out of which the major contributors to spirituality in Indian saints were concentrated to 2 components consisting of 7 variables that were derived from 3 subscales.

Strengths and Limitations

This study has several important strengths. The most important being it's a large and representative sample size of 1103 participants all belonging to one religion. The percentage of missing data was merely 0.5% (6 cases). All variables (54) had High (> .4) extracted communalities and sampling adequacy (KMO .878). Fitment of extracted components to MLR model further rendered strength and support to the study. Other strong areas were conduction of a pilot survey to access feasibility issues, 2 weeks training workshop of team members before initiation of the study to ensure uniformity in information retrieval, and immediate SWOT (Strength, Weakness Opportunities and Threat) analysis based on feedback from the day's ‘on-field activities’ to maintain high morale of research staffs and ensure good quality data.

Limitation: The tool used was not culture and religion-specific thereby leading to some information bias because of comprehending issues. The scope for respondent bias cannot be overruled as the tool used respondents’ repose for scoring the variables.

Conclusion: Spirituality in Indian saints is mainly transcendental where one tries to rise above one's physical being. The main factors responsible to achieve this are conceptualized in ‘nonduality’ and ‘reliance’. Nondual relationship demolishes one's physical existence and drives one closer to the divine whereas reliance on divinity or God paves the path to transcendence. These components and their constituent variables should be kept in mind while designing a socio-cultural evaluation tool of spirituality from the Indian context.

Declarations

Conflict of interest: The author declares ‘no conflict of interest’.

Ethical permission: The study had ethical clearance from IEC. Via IEC Ref. No. 52/2016

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References
1. Büssing, A., Michalsen, A, Khalsa, S.B.S., Telles, S., Sherman, K.J. Effects of yoga on mental and physical health: A short summary of reviews. Evidence-Based Complementary and Alternative Medicine. 2012, 1-7.

2. Emerson, D., Sharma, R., Chaudhry, S., Turner, J. (2009). Trauma sensitive yoga: Principles, practice, and research. International Journal of Yoga Therapy, 19, 123-128.

3. Sharon Cumbie. The Integration of Mind-Body-Soul and the Practice of Humanistic. Nursing Holistic nursing practice. 2001. 15(3):56-62.

4. Cecilia Chan, Petula Sik Ying Ho, Esther Chow. A body-mind-spirit model in health: an Eastern approach. Social Work in Health Care. 2001. 34(3-4):261-82.

5. Stephanie A. Hooker, Kevin S. Masters & Kate B. Carey. Multidimensional Assessment of Religiousness/Spirituality and Health Behaviors in College Students. The International Journal for the Psychology of Religion, 2014. 24:3, 228-240

6. Koenig, Harold G. MD. Concerns about Measuring “Spirituality” in Research. The Journal of Nervous and Mental Disease: 2008 ; 196; 5: 349-355

7. Aldwin, Carolyn M.; Park, Crystal L.; Jeong, Yu-Jin; Nath, Ritwik. Differing pathways between religiousness, spirituality, and health: A self-regulation perspective. Psychology of Religion and Spirituality. 2014; 6; 1:9-21.

8. Marcelo Saad, Roberta de Medeiros and Amanda Cristina Mosini. Are We Ready for a True Biopsychosocial—Spiritual Model? The Many Meanings of “Spiritual”. Medicines. 2017, 4, 79:1-6

9. David R. Hodge. Spirituality and Religion among the General Public: Implications for Social Work Discourse. Social Work, 2015. 60, 3: 219–22

10. McClintock CH, Lau E and Miller L. Phenotypic Dimensions of Spirituality: Implications for Mental Health in China, India, and the United States. Psychol. 2016.7:1600. doi: 10.3389/fpsyg.2016.01600. Accessed on 23.11.2019.

11. Chattopadhyay S. Religion, spirituality, health and medicine: Why should Indian physicians care?. J Postgrad Med 2007;53:262-6

12. Kashi Komala R. A. and Ganesh L.S. Spirituality in Health Care Organisations. Journal of the Indian Academy of Applied Psychology, 2006. 32, 2: 119-126.

13. Pandav CS, Kumar R. Spiritual health: Need for its mainstreaming in health-care delivery in India. Indian J Public Health 2018;62:251-2.

14. Dipak Shukla, Kaustubhi Shukla. Healthcare Transition and Spiritual Health. Journal of The Association of Physicians of India. 2016, 64.6:66-67

15. Mishra, B., Baghel, A.S., Paliwal, D. et al. Study of Spiritual Health Determinants in Indian Saints (Sadhus) at Ujjain Kumbh Mela (Simhast) 2016 J Relig Health. 2019. 1-25. https://doi.org/10.1007/s10943-019-00764-3. Accessed on 23.11.2019

16. Hall, T. and K. Edwards. “The Spiritual Assessment Inventory: A Theistic Model and Measure for Assessing Spiritual Development.” Journal for the Scientific Study of Religion 41 (2002): 341-357.
17. David, N. Roy. Public health perspectives from the biggest human mass gathering on earth: Kumbh Mela, India. International Journal of Infectious Diseases. 2016; 47: 42–45

18. Suresh Dwivedi and Mudera P. Cariappa. Mass-gathering Events: The Public Health Challenge of the Kumbh Mela 2013. 2015; 30, 6: 621-624

19. Dhar N, Chaturvedi S K, Nandan D. Spiritual health scale 2011: Defining and measuring 4th dimension of health. Indian J Community Med. 2011;36:275-82

20. Stéfanie Monod et al. Instruments Measuring Spirituality in Clinical Research: A Systematic Review. J Gen Intern Med. 26, 11:1345–57.

21. Nadi MA, Ghahremani N. The relationship between dimensions of religiosity/spirituality with mental health and hope for future between staff of public hospitals in Shiraz. J Edu Health Promot. 2014;3:20.

22. Springer Nature Singapore Pte Ltd. 2018 E. Mooi et al., Market Research, Springer Texts in Business and Economics, DOI 10.1007/978-981-10-5218-7_8 Principal Component and Factor Analysis 8 Page 265.

23. Hamilton, L.C. 2013. Statistics with Stata, Version 12. Belmont, CA: Cengage (seven previous editions, 1990–2009; Chinese translations of 2006 and 2009 editions by Zhigang Guo, and 2013 edition by Xiwei Wu and colleagues; Arabic translation of 2013 edition by Ramadan El-Faitouri). Statistics with Stata, version 12. Lawrence C. Hamilton, University of New Hampshire, Durham. Department of Publisher Brooks/Cole, Cengage. 2013.

24. Mohsen Tavakol and Reg Dennick. Making Sense of Cronbach's Alpha. International Journal of Medical Education. 2011; 2:53-55.

25. Taber, K.S. The Use of Cronbach's Alpha When Developing and Reporting Research Instruments. Res Sci Educ. 2018; 48: 6: 1273–1296.

26. Jain S. & Angural V. Use Of Cronbach's Alpha In Dental Research. Med. Res. Chron. 2017; 4, 3: 285-291.

27. Cerny, C.A., & Kaiser, H.F. A study of a measure of sampling adequacy for factor-analytic correlation matrices. Multivariate Behavioral Research. 1977; 12,1: 43-47.

28. Kaiser, H. An index of factor simplicity. Psychometrika. 1974; 39: 31–36.

29. J. G. Wenham R., Barkshire M., and Prutton R. H. Roberts; An examination of the use of principal component analysis and target factor analysis for the determination of Auger depth profiles in two magnetic multilayer metal systems—Cu/Co and Co/Pt† Surface and interface analysis. 1995; 23,13: 858-872.

30. Ellison, C. W. (1983). Spiritual well-being: Conceptualization and measurement. Journal of Psychology and Theology, 11,4: 330-340

31. Ellison, L. A review of The Spiritual Well-Being Scale. NewsNotes, 2006. 44,1.

32. Klara Malinakova et al; The Spiritual Well-Being Scale: Psychometric Evaluation of the Shortened Version in Czech Adolescents. J Relig Health. 2017; 56:697–705.
33. Braeken, Johan, van Assen, Marcel A. L. M. Braeken, J., & van Assen, M. A. L. M. An empirical Kaiser criterion. *Psychological Methods*, 2017; 22, 3: 450–466.

34. Roberta de Oliveira Santos et al. Principal Component Analysis and Factor Analysis: differences and similarities in Nutritional Epidemiology application. *Rev Bras Epidemiol.*, 2019; 22, 7: 1-14.

35. Cerny, C.A., & Kaiser, H.F. A study of a measure of sampling adequacy for factor-analytic correlation matrices. *Multivariate Behavioral Research*, 1977; 12, 1: 43-47.

36. Liew Lee Chan, Noraini Idris. Validity and Reliability of The Instrument Using Exploratory Factor Analysis and Cronbach's alpha. *International Journal of Academic Research in Business and Social Sciences*. 2017; 7, 10: 400–410.

37. Citation: Ekşi, H., & Kardaş, S. Spiritual well-being: Scale development and validation. *Spiritual Psychology and Counselling*. 2017; 2: 73–88.

38. Eric L. Scott, Albert A. Agresti and George Fitchett. Factor Analysis of the 'Spiritual Well-Being Scale' and Its Clinical Utility with Psychiatric Inpatients. *Journal for the Scientific Study of Religion*, 37, 2: 314-321.

39. Noor Ul Hadi, Naziruddin Abdullah, Ilham Sentosa. An Easy Approach to Exploratory Factor Analysis: Marketing Perspective. *Journal of Educational and Social Research*. 2016; 6, 1: 215-223.

40. James Dean Brown. Choosing the Right Type of Rotation in PCA and EFA. *Shiken: JALT Testing & Evaluation SIG Newsletter*. 2009; 13, 3: 20 – 25.

41. Revelle, W. *An introduction to psychometric theory with applications in R*. Retrieved from [http://www.personality-project.org/r/book](http://www.personality-project.org/r/book).

42. Hon, Carol K.H., Chan, Albert P.C., & Yam, Michael C.H. () Determining safety climate factors in the repair, maintenance, minor alteration, and addition sector of Hong Kong. *Journal of Construction Engineering and Management*, 2013; 139, 5: 519-528.

43. Ande, D. “Determining factors affecting the performance of Indian mutual funds”, PhD Thesis, SVKM's NMIMS University. 2008; chapter 8, 147-166.

44. J. Kevin Ford. and Robert C. Maccallum. The Application of Exploratory Factor Analysis in Applied Psychology: A Critical Review and Analysis. *Psychology* 1986. 39: 291-314.

45. Shiken: *JALT Testing & Evaluation SIG Newsletter*, 2001; 5, 1: 15 – 19.

46. Zinnbauer, B. J., & Pargament, K. I. Religiousness and Spirituality. In R. F. Paloutzian & C. L. Park (Eds.), *Handbook of the psychology of religion and spirituality*. Guilford Press. 2005. 21–42.

47. Brian J. Zinnbauer Kenneth I. Pargament Allie B. Scott. The Emerging Meanings of Religiousness and Spirituality: Problems and Prospects. *Journal of Personality* 1999; 67:6, 889-919.

48. Socha P., Duchowyrozwójeńcowieka, *WydawnictwoUniwersytetuJagiellońskiego*, Kraków. 2000.

49. Bernard Chiu, George H Freeman, M MA Salamaand Aaron Fenster. Prostate segmentation algorithm using dyadic wavelet transform and discrete dynamic contour. *Physics in Medicine & Biology* 2004; 49, 21: 43-49.
50. Martsolf, D., & Mickey, J. The concept of spirituality in nursing theories: Differing world-views and extent of focus. Journal of Advanced Nursing, 1998; 27: 294–303.

51. Convention: A Philosophical Study. David Lewis. Blackwell Publishers. 108 Cowley Road. Oxford 0X4, IJF, UK.

52. Peter C Hill et al. Conceptualizing Religion and Spirituality: Points of Commonality, Points of Departure. Journal for the Theory of Social Behaviour. 2000; 30:1, 51-77.

53. Diana Fisher. “Everybody thinking differently”: K–12 is a leverage point. System Dynamics Review. 2011; 27, 4: 394-41.

54. Pargament, K. I. The psychology of religion and coping: Theory, research, practice. Guilford Press. 370 Seventh Avenue Suite. 1200, NY.

55. Pargament, K. I., Koenig, H. G., Tarakeshwar, N. and Hahn, J. ‘Religious coping methods as predictors of psychological, physical and spiritual outcomes among medically ill elderly patients: A two-year longitudinal study’, Journal of Health Psychology. 2004; 9; 6: 713 – 30.

56. Pargament, K. I. and Raiya, H. A. ‘A decade of research on the psychology of religion and coping: Things we assumed and lessons we learned’, Psyche and Logos, 2007; 28,2: 742 – 66.

57. Pargament, K. I., Feuille, M. and Burdzy, D. ‘The brief RCOPE: Current psychometric status of a short measure of religious coping’, Religions, 2011; 2, 1: 51 – 76.

58. Pargament, K. I., Smith, B.W., Koenig, H. G. and Perez, L. ‘Patterns of positive and negative religious coping with major life stressors’, Journal for the Scientific Study of Religion, 1998;37,4, 710 – 24.

59. Edyta Charzyn’ska. Multidimensional Approach Toward Spiritual Coping: Construction and Validation of the Spiritual Coping Questionnaire (SCQ). J Relig Health 2015; 54:1629–1646.

**Figures**
Figure 1

Scree plot with Eigen value and interpolation line for extracted components

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Scree plot with Eigen value and interpolation line for extracted components

Figure number 2

Component rotation of 2 PCs at Origin and Centroid locations demonstrating their nonlinear nature and intra group correlations
Figure 2

Component rotation of 2 PCs at Origin and Centroid locations demonstrating their nonlinear nature and intragroup correlations

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