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Article

A Systematic Review of Studies Using the Brief COPE: Religious Coping in Factor Analyses

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Abstract: Religion is generally recognized as a major resource for dealing with stressful events, but its relationship with secular coping strategies continues to be debated. The present article provides a systematic review of the way in which analyses of the sub-scale *turning to religion* of the widely used Brief COPE [1] instrument are presented in peer-reviewed research articles, in order to investigate how the wealth of data published using this instrument can inform how religious coping relates to other coping strategies. Of the 212 identified articles that included *turning to religion* in their analyses, 80 combined sub-scale scores to form higher-order coping factors, 38 of which based on exploratory factor analyses of their own datasets. When factor analyses had used individual items as indicators, religious coping was more likely to load together with maladaptive coping strategies, and more likely with adaptive coping strategies when analyses were conducted at sub-scale level. To a large extent, the variation in the results from exploratory factor analyses appears to be due to the diverse and often inappropriate factor analytic techniques used to determine the factor structure of the Brief COPE instrument. Reports from factor analyses of the Brief COPE therefore have very little value when trying to make general conclusions about the role of religious coping in relation to secular coping methods.

Keywords: coping; religion; religious coping; Brief COPE; systematic review

1. Introduction

By early adulthood, most people would have faced considerable stress at some point in their lives, and it is likely that they would have developed some behavior patterns that are intended to reduce the

impact of stressors [2]. Such responses to environmental stressors are referred to as *coping*, which has been the subject of extensive investigations in psychological research during the past 40 years [3]. Although the specifics of the coping responses naturally vary across individuals, researchers have attempted to group similar types of responses into categories of coping strategies. An influential distinction was proposed by Lazarus and Folkman [4] and contrasts problem-focused with emotion-focused response strategies. While the former aim to modify the relationship between the environment and the person through dealing directly with the source of the stress, the latter attempt to regulate emotional distress by altering one's own response to the stressor.

What constitutes the most appropriate higher-order structure of coping is still being debated [5,6], with researchers having put forward a number of alternative categorizations such as through the addition of avoidant coping [7,8] or dysfunctional coping [9]. At the lower-order level, in contrast, coping strategies are grouped into much more specific categories. Emotional support coping strategies, for example, could thus be defined as any set of responses emitted in the context of a stressful event that have the potential to mitigate the effects of stress by invoking the emotional support from other people, such as friends and family members. The variety of lower-order categories mentioned in the literature and used in empirical research is immense [6], and here the challenge is to determine which range of strategies and level of specificity allows for the most efficient assessment of people's use of coping responses. Coping is commonly assessed using self-report inventories, and questionnaire length is therefore a crucial practical consideration.

One frequently used coping questionnaire is the COPE [10], which, in its original format, assesses 13 lower-order strategies using four questions assigned to each of the following sub-scales: *active coping*, *planning*, *suppression of competing activities*, *restraint coping*, *seeking social support for instrumental reasons*, *seeking social support for emotional reasons*, *positive reinterpretation and growth*, *acceptance*, *turning to religion*, *focus on and venting of emotions*, *denial*, *behavioral disengagement*, and *mental disengagement*. The development of these sub-scales was conceptually driven, and the theoretical grouping of the items to their sub-scales was largely confirmed using principal-factors exploratory factor analysis. However, Carver *et al.* [10] did not provide detailed information about their factor analysis conducted in the development of the questionnaire, and the use of the Kaiser-Guttman criterion of selecting factors with eigenvalues above 1.0 may have overestimated the number of factors extracted [5,11]. When Carver *et al.* [10] conducted a second-order factor analysis using the total sub-scale scores as variables, a four-factor structure emerged. Other researchers have since reported a three-factor structure [9,12,13], or modified the questionnaire and proposed a five-factor structure [14]. It appears, therefore, that the structure of the COPE is considerably unstable, with results often highly dependent on the method of factor analysis employed [13].

Soon after the development of the COPE [10], Carver [1] published the Brief COPE, a shortened version of the COPE designed for use when participant response burden is a considering factor. This questionnaire asks 28 questions on a four-point Likert scale ("*I haven't been doing this at all*", "*I've been doing this a little bit*", "*I've been doing this a medium amount*", and "*I've been doing this a lot*"), where two items each form the following 14 sub-scales: *active coping*, *planning*, *positive reframing*, *acceptance*, *humor*, *turning to religion*, *using emotional support*, *using instrumental support*, *self-distraction*, *denial*, *venting*, *substance use*, *behavioral disengagement*, and *self-blame*. Carver [1]

developed this questionnaire based on a community sample of 168 participants who had been affected by a hurricane. Acknowledging the limitations from a factor analysis with a small sample size, Carver [1] nevertheless reported the factor structure obtained from item-level analyses. The only sub-scales that formed distinct factors were *substance use*, *turning to religion*, *humor*, and *behavioral disengagement*. The items from the remaining scales formed larger factors, but Carver [1] concluded that the structure approximated that of the full-length COPE questionnaire [10]. Rather than prescribing a rigid structure of the coping strategies assessed by the Brief COPE, Carver [1] recommended that researchers use the Brief COPE flexibly and creatively as suits, such as by suggesting the possibility of only selecting a sub-set of the sub-scales. Researchers using the Brief COPE therefore regularly refer to this recommendation to justify an exploratory analysis to determine empirically how the data from their sample is to be analyzed [15,16].

The use of the variety of different Brief COPE [1] factor structures used in published research studies is part of the investigation of the present article. Focus will be given to the sub-scale *turning to religion* (the two items "*I've been trying to find comfort in my religion or spiritual beliefs*" and "*I've been praying or meditating*"), since this sub-scale is reported to behave in very diverse fashions in factor analyses. Schottenbauer *et al.* [17], for example, reported that the *turning to religion* sub-scale loaded onto a factor together with the sub-scales *using emotional support* and *using instrumental support*, and Farley *et al.* [18] found that *turning to religion* formed a factor together with the sub-sales *positive reframing*, *acceptance*, and *humor*. Religious coping forming its own distinct factor [19,20], or lack of sufficiently high loadings onto any other factor [21,22] is also commonly reported.

Religion and spirituality as a resource for coping has only recently received increasingly more attention [3]. While the benefits of religious involvement for both mental and physical health are well documented [23-25], its function as a resource for coping is still less well known. In a meta-analytic review of studies to investigate gender differences in coping, Tamres *et al.* [26] noted that religion could neither be clearly defined as problem- nor emotion-focused coping. Some researchers interpreted low factor loadings of religion with other coping strategies as indicating that it is a unique and independent strategy [27,28]. However, the concerns raised about commonly employed factor analytic methods with the COPE questionnaire [5,13] also apply to the Brief COPE and might help explain the highly variable reports of the position of religious coping in relation to other coping strategies.

Thus, the present study serves the following purposes: A systematic review of empirical studies will investigate how the religion sub-scale of the Brief COPE [1] is commonly analyzed. Studies will be identified that used factor structures that are based on previous research and those that conducted a factor analysis on their own dataset. Hereby, differences in methods of factor analyses used in the latter studies could reveal the reason for the variety of different reports of the behavior of the *turning to religion* sub-scale in relation to the factor structure of the remaining secular coping strategies. So far, no study has systematically explored the use of religious coping within the Brief COPE instrument, from which a pattern of the role of religious coping might emerge.

2. Method

In order to investigate how the *turning to religion* sub-scale of the Brief COPE [1] inventory is generally used in published research studies, a comprehensive literature search was conducted. Using

the databases *PsychInfo*, *Scopus*, *PubMed*, *Medline*, and *Google Scholar*, peer-reviewed journal articles were identified that had referred to Carver [1] in their reference list and that were published until and including 2009. Access to the articles was obtained through the university library system of the author of the present article, through the inter-library loan service, or by requesting reprints directly from the authors of the concerning articles.

In total, 463 articles were identified and obtained in the manner described above. Only studies that had collected empirical data using the Brief COPE were considered for further analyses, of which there were 399. Review articles and commentaries were thus excluded. Given that the focus of the present study was on religious coping, studies that did not collect data of the *turning to religion* sub-scale or used substantially modified items were discarded, reducing the number of articles to 290. Further 78 studies were excluded as they that did not provide enough information about which items in the Brief COPE were used or in which manner the scores were calculated. The information extracted from the remaining 212 articles was the manner in which the religion sub-scales was used, such as whether scores from the religion items were presented individually or as a sub-scale total, or whether the items contributed to a score that was calculated by summation of item scores from a number of different coping strategies. In the latter case, it was determined whether the calculation of scores was based on the findings from previous research or whether it was based on the relevant study's own exploratory factor analysis. If a factor analysis was conducted, the main factor analytic method used was identified, as well as how *turning to religion* loaded to the proposed factor structure. Although principal components analysis (PCA) is technically not considered as a type of factor analysis, for ease of presentation of the present results, references to the term *factor analysis* also include PCA.

3. Results

Of the 212 empirical studies that had used the Brief COPE [1] and fit the criteria mentioned above, more than half (N = 125) had used scores from the individual sub-scales. Four studies presented analyses using scores from individual items [29-32], and three studies used total scores [33-35]. The number of studies that had used scores calculated based on a factor structure was 80, of which 38 studies had conducted an exploratory factor analysis on their own dataset.

3.1. Studies that conducted their own exploratory factor analysis

Tables 1 and 2 show a summary of the studies that conducted their own exploratory factor analysis at item and sub-scale level, respectively. The majority of studies explicitly stated whether they had conducted their analyses at item level or by treating sub-scale totals as indicators. No study mentioned having conducted a higher-order factor analysis to test for a lower-order factor structure and how these lower-order factors are correlated with higher-order factors [36]. With 14 theoretical sub-scales, such a model would have been very complex, requiring such a large sample size that it is unlikely that researchers would have attempted this type of analysis. Instead, many authors referred to the term high-order factor analysis and explained it as conducting a factor analysis at sub-scale level, as used by Carver *et al.* [10] in the development of the COPE questionnaire. Thus, when authors simply stated that they had conducted a higher-order factor analysis without providing more detail, it was assumed that this referred to using sub-scales as indicators, although the more appropriate technical term for this

analysis would have been *individual extension analysis* [37]. It is highly likely that this assumption was warranted, since the reported factor loadings in those cases were always reported for sub-scales only, and never for individual items.

The summary of results from item-level factor analyses are grouped separately in Table 1, depending on whether studies reported that the two religious coping items loaded together with items from other sub-scales, formed an independent factor, or whether they failed to load. In cases where two separate papers reported on different aspects of the same dataset, the study was included in the table that provided the most amount of detail about its methods. This concerned the studies by Brain *et al.* [19] and Henderson *et al.* [38], as well as Radat *et al.* [15] and Lucas *et al.* [39], where the results from Henderson *et al.* and Lucas *et al.* are not shown.

As shown in Table 1, only one study reported that the *turning to religion* items did not fit onto the proposed factor structure [22]. Five studies [16,40-43] reported that items from the religious coping sub-scale loaded together with items from other sub-scales. For four of these studies, both *turning to religion* items loaded onto the same factor, whereas in Zelikovsky *et al.* [16] only one item loaded with another factor, while the other item was excluded due to a factor loading below 0.40. All five studies conducted a PCA. Three of these [16,40,41] used an orthogonal (varimax) rotation, one [42] an oblique (direct oblimin) rotation, and one study [43] did not specify the rotation method. Apart from the study by Lee and Liu [41], who had a sample size of 406 using university undergraduate students, the sample sizes of the other four studies were very similar, ranging from 104 to 154. According to the commonly stated rule of thumb of five participants per indicator [44], this could be considered insufficient to marginal for a 28-item questionnaire.

Ten of the studies [15,19,20,45-51] that conducted item-level analyses reported that the two items from the *turning to religion* sub-scale formed their own separate factor (Table 1). Three of these studies [20,49,50] used a sample of university students, but overall, the range was very broad, and included diverse participants groups, such as emergency workers [45], edentulous patients with complete dentures [48], or genetic counselors [51]. PCA was the stated method of choice for four of the ten studies [15,19,46,50]. Three studies [20,45,48] only stated that they had conducted a factor analysis without further specification, two used a principal axis factoring technique [47,51], and one stated that they had used a robust weighted least squares technique with a polychoric correlation matrix [49]. Compared to the five studies that had reported that religion loaded onto a factor with other coping strategies, the ten studies that found religion to form a separate factor used considerably larger sample sizes, ranging from 132 [46] to 1534 [15], with a mean of 587.80.

Table 2 shows the summaries of the studies that had conducted exploratory factor analyses using the sub-scale total scores as indicators. As with the item-level analyses, the samples were very diverse, and the sample sizes varied from 71 [52] to 1289 [17], with a mean of 288.70. Twelve studies [17,18,52-61] reported that the *turning to religion* sub-scale loaded to a factor with at least one other sub-scale, three studies [62-64] reported that the *turning to religion* sub-scale formed its own separate factor, and five studies [21,65-68] reported that the religion sub-scale did not have a sufficiently high loading with any other factor. As with the item-level analyses (Table 1), PCA was the most frequently used technique, with 9 of the 20 studies [18,52-54,56,57,62,64,66] explicitly stating this method. Of the ten studies that mentioned the rotation method used, nine [18,21,52-55,61,62,67] stated varimax, and one stated that they had used an oblique rotation [68]. Nine studies [17,21,58-60,63,65,67,68] only

stated that they had used a factor analysis or exploratory factor analysis, and two studies had used a principal axis factor analysis [55,61]. Compared to item-level analyses, where the median number of extracted factors was six, the median number of factors extracted in studies using sub-scale level exploratory factor analyses was three. In the calculation of the median, the two-factor solution by Kershaw *et al.* [58] was not included, as they reported that the religion sub-scale loaded differently, depending on whether data from caregivers or care recipients were considered.

3.2. Studies that did not conduct their own exploratory factor analysis

The studies that used factor structures based on theoretical considerations or factor structures based on previous research are listed in Table 3. As with Tables 1 and 2, when at least two studies reported results based on the same dataset, only summaries are shown for the study that provided the most detail. Summaries for the following eight studies are therefore not listed in Table 3: Cooper *et al.* [69-71], Gillen [72], Gore-Felton *et al.* [73], Gow *et al.* [74], Pence *et al.* [75], and Piazza-Waggoner *et al.* [76]. Compared to the studies that had conducted their own exploratory factor analyses, those that based their factor structure on previous research tended to have smaller samples sizes. Of the 34 studies listed in Table 3, 14 studies had a sample size of less than 100 [77-90]. Some of the studies had more than 300 participants [91-93], where a factor analysis would have been supported by a sufficiently large sample size.

With a median number of two factors, studies that used a pre-existing factor structure tended to use a factor structure at the lower end of the numbers reported from exploratory factor analyses (Tables 1 and 2). Seven of the 34 studies listed in Table 3 [79,80,85,92,94-96] referred to Carver *et al.* [10] to justify the use of their factor structure, and two [89,92] to Carver [1]. Four studies [88,91,97,98] provided some general theoretical or practical considerations, and eight studies [81,93,99-104] did not provide any justification or reference. The remaining studies referred to a variety of studies using either the COPE or Brief COPE questionnaire. Atkinson *et al.* [77] referred to Lunsford *et al.* [105], although Lunsford *et al.* themselves used the separate Brief COPE sub-scale scores. Some studies referred to the theoretical considerations from other researchers, such as Cartwright *et al.* [106] referring to Schnider *et al.* [98].

3.3. Overview of findings

Table 4 provides a summary of the factor loading pattern of the Brief COPE *turning to religion* items, presented separately by results from exploratory factor analyses at item level (Table 1), sub-scale level (Table 2), and, for comparative purposes, of the studies that used factor structures based on previous research (Table 3). Artinian *et al.* [94], for example, reported that the *turning to religion* sub-scale loaded together with the sub-scales *active coping*, *planning*, *positive reframing*, *acceptance*, *humor*, *emotional support*, *instrumental support*, *self-distraction*, and *venting*. The entry "1" was therefore made under the respective columns in Table 4. Entries were made in this fashion for all studies shown in Tables 1 to 3. For item-level analyses, split-loading was possible, such as reported by Lee and Liu [41] and Zelikovsky *et al.* [16]. In the case of Lee and Liu [41], the two items from the *turning to religion* sub-scale loaded together with only one item each from *humor* and *venting*, and therefore "0.5" was entered for *humor* and *venting*. Zelikovsky *et al.* [16] reported that only one of the

items from the *turning to religion* sub-scale loaded onto a factor, and therefore the entry was "0.5" when it loaded with two items from another sub-scale (*behavioral disengagement*, *denial*, *substance use*, and *self-blame*) or "0.25" when it loaded with only one item from another sub-scale (*humor* and *venting*). Data for Kershaw *et al.* [58] are not shown in Table 4, since *turning to religion* loaded onto a different factor depending on whether the exploratory factor analysis was conducted for caregivers or care recipients.

The percentage of cases that *turning to religion* loaded with another coping strategy was then calculated. For sub-scale-level analyses, for example, *turning to religion* loaded together with *active coping* in seven of eleven studies (64%). Comparing the results between item and sub-scale levels, some interesting differences emerge. For item-level analyses, *turning to religion* appeared to load more often with the strategies *venting*, *behavioral disengagement*, *denial*, *substance use*, and *self-blame*, whereas for sub-scale level analyses, *turning to religion* tended to load together with *active coping*, *planning*, *positive reframing*, *acceptance*, *humor*, *emotional support*, *instrumental support*, and *self-distraction*. The loading pattern for studies using factor structures based on previous studies was similar to those from the sub-scale factor analyses. The most obvious exception was *humor*, which was used in a factor together with *turning to religion* in 71% of the studies that based their factor structure on previous research, when only 15% of item-level analyses and 18% of sub-scale-level analyses reported that religious coping loaded together with *humor*.

4. Discussion

4.1. General discussion

The present study provided a systematic review of the way in which religious coping is assessed in peer-reviewed research studies using the Brief COPE [1] inventory. Encouraged by the recommendations of the inventory's author, researchers often conduct a factor analysis on their dataset to determine the way in which the scores from the 14 coping sub-scales are to be calculated for their sample. The present review analyzed 16 studies that had conducted an exploratory factor analysis at item level and 20 studies that reported results from analyses conducted at sub-scale level. The most commonly used method in both cases was PCA, and the diversity of the sample population of the individual studies was comparable. The most striking difference in the results between the two types of approaches to exploratory factor analysis was that, when the analyses were conducted at sub-scale level, *turning to religion* more commonly loaded onto a factor with strategies such as *active coping* and *positive reframing*, or strategies sometimes referred to as *adaptive* [83], as opposed to item-level analyses, where religious coping was more likely to load with *maladaptive* strategies, such as *behavioral disengagement* or *denial* (Table 4). In 10 of 16 cases, religion formed its own factor for item-level analyses (Table 1), compared to only 3 of 20 cases for sub-scale-level analyses (Table 2). Factor analyses at sub-scale level were more likely to report a lack of factor loading for religious coping, with 5 out of 20 cases, compared to 1 out of 16 factor analyses at item level, although Zelikovsky *et al.* [16] reported that one of the religious coping items did not load, either.

Table 1. Summary of studies identified in the systematic review that had conducted an item-level factor analysis on their own dataset. Listed are the type of sample, the sample size, the method of factor analysis used, and whether items had been excluded from the factor analysis. The number of factors extracted is also listed for each study. Unless otherwise stated in the notes, an English language version of the Brief COPE [1] was used.

Author	Sample	Sample Size	Method of exploratory factor analysis	Excluded items prior to factor analysis	Number of factors extracted	Notes
Religious coping loading together with items from other sub-scales:						
Hastings *et al.* [40]	Parents of children with autism	135	Principal components analysis with varimax rotation	None	4	
Lee and Liu [41]	University undergraduate students	406	Principal components analysis with varimax rotation	Two items each from the sub-scales *instrumental support* and *self-blame*	2	
Liu and Iwamoto [42]	University students	154	Principal components analysis with direct oblimin rotation	Two items from the sub-scale *substance use*	2	
Paukert *et al.* [43]	Heart failure patients	104	Principal components analysis	None	3	
Zelikovsky *et al.* [16]	Parents of children with end-stage renal disease	144	Principal components analysis with varimax rotation	None	2	
Religious coping items forming separate factor:						
Brain *et al.* [19]	Young women with breast cancer	1286	Principal components analysis	Two items, not mentioned which ones	7	

Table 1. *Cont.*

Cicognani *et al.* [45]	Emergency workers	764	Factor analysis	Two items each from the sub-scales *behavioral disengagement*, *denial*, and *substance use*	7	
Fillion *et al.* [46]	Women undergoing radiation therapy for breast cancer	132	Principal components analysis with oblique rotation	None	8	Added items and modified items slightly
Fletcher *et al.* [47]	Relatives of newly diagnosed breast cancer patients	624	Principal axis factor analysis with promax rotation	Two items each from the sub-scales *planning*, *humor*, *behavioral disengagement*, *substance use* and *self-blame*	3	
Heydecke *et al.* [48]	Edentulous patients with complete dentures	249	Factor analysis with oblique rotation	None	6	
Miyazaki *et al.* [49]	International university students	555	Robust weighted least squares with polychoric correlation matrix with promax rotation	None	7	
Perczek *et al.* [20]	University undergraduate students	148	Factor analysis with oblique rotation	None	12	Conducted factor analysis with items from both Spanish and English versions together
Radat *et al.* [15]	Adult migraine sufferers from the general population	1534	Principal components analysis with varimax rotation of the correlation matrix	None	6	French language version

Table 1. *Cont.*

Ribeiro and Rodrigues [50]	University undergraduate students	364	Principal components analysis with oblique rotation	None	8	Portuguese language version
Udipi *et al.* [51]	Genetic counselors	222	Principal axis factor analysis with varimax rotation	None	8	Some minor modifications to items
Religious coping items not loading onto a factor:						
Welbourne *et al.* [22]	Nurses	190	Principal component factor analysis with varimax rotation	None	3	Religion items not loading onto a factor, with loading <0.40

Table 2. Summary of studies identified in the systematic review that had conducted a sub-scale-level factor analysis on their own dataset. Listed are the type of sample, the sample size, the method of factor analysis used, and whether items had been excluded from the factor analysis. The number of factors extracted is also listed for each study. Unless otherwise stated in the notes, an English language version of the Brief COPE [1] was used.

Author	**Sample**	**Sample Size**	**Method of exploratory factor analysis**	**Excluded sub-scales prior to factor analysis**	**Number of factors extracted**	**Notes**
Religious coping loading together with items from other sub-scales:						
Aitken and Crawford [52]	Project managers	71	Principal components analysis with varimax rotation	None	2	The sub-scales *instrumental support* and *self-blame* loaded onto both factors
Bean *et al.* [53]	Patients with heart failure	100	Principal components analysis with varimax rotation	None	2	
Bellizzi and Blank [54]	Breast cancer survivors	224	Principal components analysis with varimax rotation	None	2	

Table 2. *Cont.*

Ebert *et al.* [55]	University undergraduate students	202	Principal factor analysis with varimax rotation	None	2	
Farley *et al.* [18]	Rural population in USA	288	Principal components analysis with varimax rotation	None	4	
Jacobson [56]	Employee assistance professionals	325	Principal components analysis	None	3	
Kellezi *et al.* [57]	Kosovo Albanians who experienced extreme events in war	127	Principal components analysis	None	1	Albanian language version; forced a one-factor solution and excluded items that did not load
Kershaw *et al.* [58]	Patients with breast cancer and their caregivers	189	Exploratory factor analysis	*Instrumental support* and *self-blame*	2	For family caregivers, loaded with *humor*, *self-distraction*, *venting*, *behavioral disengagement*, *denial*, and *substance use*. For patients, with *active coping*, *planning*, *positive reframing*, *acceptance*, and *emotional support*
Liu *et al.* [59]	Renal transplant recipients	160	Factor analysis	*Substance use*	2	
Mugavero *et al.* [60]	Patients infected with HIV	611	Exploratory factor analysis	*Planning*, *humor*, *instrumental support*, *self-distraction*, *venting*, and *substance use*	2	Not mentioned whether the sub-scales were excluded before the exploratory factor analysis or as a result of it

Table 2. *Cont.*

Schottenbauer *et al.* [17]	Participants responding to an internet survey	1289	Exploratory factor analysis	None	3	Religion was later dropped due to overlap with other measures
Steinhardt and Dolbier [61]	University undergraduate students	114	Principal axis factor analysis with varimax rotation	None	4	Loaded with *positive reframing* and *substance use* (negatively scored)
Religious coping sub-scale forming separate factor:						
Saroglou and Anciaux [62]	Convenience sample of adults	256	Principal components analysis with varimax rotation	None	5	French language version; with high cross-loading of *behavioral disengagement* and negatively scored *humor*
Weininger *et al.* [63]	Physicians	212	Factor analysis	Added two items about political activity	4	Not entirely clear whether conducted at item or sub-scale level
Wood and Rutterford [64]	People recovering from brain injury	131	Principal components analysis using the correlation matrix	None	5	
Religious coping sub-scale not loading onto a factor:						
Kershaw *et al.* [65]	Prostate cancer patients and spouses	121	Exploratory factor analysis	None	2	Religion sub-scale not loading onto a factor, with loading <0.40, or having factor loading of >0.40 on two factors (not specified)
Lawrence and Fauerbach [21]	Adult burn survivors requiring hospitalization	158	Exploratory factor analysis with least square extraction method and varimax rotation	*Instrumental support*, *substance use*, and *self-blame*	2	Religion sub-scale not loading onto a factor, with loading <0.30

Table 2. *Cont.*

Myaskovsky *et al.* [66]	Adult lung transplant candidates	114	Principal components analysis	None	5	Although not explicitly stated, appears that *religion* did not load
Ng and Leung [67]	Dental practice patients	1000	Factor analysis with varimax rotation	None	3	Although not explicitly stated, appears that *religion* did not load
Yang *et al.* [68]	Women diagnosed with breast cancer	82	Exploratory factor analysis with oblique rotation	*Self-blame*	2	Religion sub-scale not loading onto a factor, with loading <0.30

Table 3. Summary of studies identified in the systematic review that had used a factor structure of the Brief COPE [1] that was based on previous research. Listed are the type of sample, the sample size, the justification provided for using the factor structure, and whether sub-scales had been excluded from the study. The number of factors extracted is also listed for each study. Unless otherwise stated in the notes, an English language version of the Brief COPE was used.

Author	Sample	Sample Size	Justification of factor structure	Excluded sub-scales	Number of factors	Notes
Artinian *et al.* [94]	Patients in cardiac rehabilitation program	112	Carver *et al.* [10]	None	2	
Atkinson *et al.* [77]	Adults with HIV infection	34	Lunsford *et al.* [105]	None	2	Lunsford *et al.* [63] used scores from individual sub-scales
Cartwright *et al.* [106]	Individuals with alopecia recruited from internet support groups	214	Schnider *et al.* [98]	None	3	
Cooper *et al.* [107]	Family caregivers of patients with Alzheimer's disease	126	Coolidge *et al.* [9]	None	3	

Table 3. *Cont.*

David and Knight [91]	Adults self-identified as gay	383	Consistent with previous use, but no reference provided	None	2	Conducted confirmatory factor analysis
Gillen [78]	Stroke survivors	16	Meyer [83]	None	2	
Glass *et al.* [108]	Hurricane survivors	228	Schnider *et al.* [98]	None	2	
Gore-Felton *et al.* [97]	HIV positive and AIDS patients	122	Theoretical considerations, although not much information provided	*Humor*, *instrumental support*, *self-distraction*, *venting*, *behavioral disengagement*, *substance use*, *self-blame*	2	
Gow *et al.* [92]	Male apprentices	326	Carver *et al.* [10]; Carver [1]	None	3	
Hart *et al.* [99]	HIV positive and AIDS patients	105	No justification or reference provided	*Instrumental support* and *self-blame*	2	Mentioned that the other factor consisted of *active coping* and *planning*, but did not mention about the remaining sub-scales
Hastings and Brown [79]	Staff members working at a school for children with developmental disabilities	55	Carver *et al.* [10]		2	
Hirsch *et al.* [109]	Pharmacy students	213	Meyer [83]	No information	2	
Ironson and Kremer [100]	Individuals with HIV	147	No justification or reference provided	*Humor*, *instrumental support*, *venting*, and *self-blame*	2	
Kinsinger *et al.* [101]	Men receiving treatment for prostate cancer	250	No justification or reference provided	Some sub-scales excluded, but not mentioned which ones	2	

Table 3. *Cont.*

Knoll *et al.* [95]	Cataract patients	110	Carver *et al.* [10]	*Self-distraction*, *behavioral disengagement*, and *substance use*	4	German language version; conducted a confirmatory factor analysis
Kristiansen *et al.* [80]	Elite wrestlers	82	Carver *et al.* [10]; Hastings and Brown [79]	*Positive reframing*	2	Norwegian language version
Krzemien [96]	Women between 60 to 95 years of age	212	Carver *et al.* [10]	None	3	Spanish language version
Lethborg *et al.* [102]	Oncology clinic patients	100	No justification or reference provided	None	2	
Lord and Robertson [81]	Patients at assisted conception units	50	No justification reference provided	None	2	
McIlvane *et al.* [82]	Individuals recently diagnosed with mild cognitive impairment and their care partners	75	Cooper *et al.* [69], Coolidge *et al.* [9]	None	3	
Meyer [83]	Psychiatric ward inpatients	70	Carver *et al.* [112]	None	2	
Moscardino *et al.* [110]	Adolescent school children who experiences the Beslan terrorist attacks	171	Feaster and Szapocznik [113]	None	3	Conducted confirmatory factor analysis
O'Brien *et al.* [84]	Adolescents considered high risk of developing psychosis	16	The selected strategies were encouraged during the treatment group	*Venting*, *denial*, *behavioral disengagement*, *substance use*, and *self-blame*	1	
O'Connor *et al.* [85]	End-stage renal disease patient	73	Carver *et al.* [10]	*Denial*, *venting*, *substance use*, *behavioral disengagement*, and *self-blame*	3	

Table 3. *Cont.*

Piazza-Waggoner *et al.* [86]	Patients at a university-based pediatric clinic	64	Spirito [114]	None	2	
Richards *et al.* [103]	Polymorphic light eruption patients	145	No justification or reference provided	None	2	
Rosenberger *et al.* [87]	Patients undergoing knee arthroscopic surgery	81	Stephens *et al.* [115]	*Instrumental support* and *self-blame*	2	Also used individual sub-scale data
Schnider *et al.* [98]	University students	123	Theoretical considerations	None	3	
Schwartz *et al.* [104]	Urban minority participants diagnosed with chlamydia or gonorrhoea	259	No justification or reference provided	*Positive reframing*, *acceptance*, *humor*, *self-distraction*, *venting*, and *substance use*	2	
Steinhardt *et al.* [88]	African Americans with Type 2 diabestes	16	Theoretical considerations	None	2	
Straughan and Buckenham [89]	Outpatients diagnosed with bipolar disorder	48	Carver [1]	None	2	
Tuncay *et al.* [111]	Patients with Type 1 and 2 diabetes	161	Tuna [116]	None	2	Turkish language version
Wichianson *et al.* [90]	College students	95	Meyer [83]	None	2	
Yeung and Fung [93]	Participants sampled for telephone survey	351	No justification or reference provided	*Acceptance* and *denial*	2	Only used one item from each sub-scale, except for *instrumental support*, where one was added; conducted in Hong Kong, with no mention of language used

Table 4. Summary of factor loading of *turning to religion* with the other 13 sub-scales from the Brief COPE [1], presented separately for studies that conducted exploratory factor analyses at item level, those that conducted factor analyses at sub-scale level, and those that used factor structures based on previous research or theoretical considerations. Note that Steinhardt and Dolbier [61] reported that *turning to religion* loaded together with the negatively scored sub-scale *substance use*, but no entry was made in that case.

Author	*Active coping*	*Planning*	*Pos. re-framing*	*Accept-ance*	*Humor*	*Emo. support*	*Instru. support*	*Self-distract.*	*Venting*	*Behav. dis-engage.*	*Denial*	*Sub-stance use*	*Self-blame*
Item-level analyses:													
Hastings *et al.* [40]											1		
Lee and Liu [41]	1	1	1	1	0.5	1			0.5				
Liu and Iwamoto [42]										1	1		1
Paukert *et al.* [43]												1	
Zelikovsky *et al.* [16]					0.25				0.25	0.5	0.5	0.5	0.5
Frequency:	20%	20%	20%	20%	15%	20%	0%	0%	15%	30%	50%	30%	30%
Sub-scale-level analyses:													
Aitken and Crawford [52]	1	1	1	1			1						1
Bean *et al.* [53]	1	1	1	1		1	1						
Bellizzi and Blank [54]	1	1	1	1		1	1	1	1				
Ebert *et al.* [55]	1	1	1	1		1	1						
Farley *et al.* [18]			1	1	1								
Jacobson [56]	1	1	1			1	1						
Kellezi *et al.* [57]			1		1								1
Liu *et al.* [59]	1	1	1	1		1	1	1					
Mugavero *et al.* [60]	1		1	1		1							
Schottenbauer *et al.* [17]						1	1						

Table 4. *Cont.*

Steinhardt and Dolbier [61]			1										
Frequency:	64%	55%	91%	64%	18%	64%	64%	18%	9%	0%	0%	0%	18%
Studies using structures based on previous research:													
Artinian *et al.* [94]	1	1	1	1	1	1	1	1	1				
Atkinson *et al.* [77]	1	1	1	1	1	1	1						
Cartwright *et al.* [106]	1	1					1						
Cooper *et al.* [107]			1	1	1	1							
David and Knight [91]	1	1	1	1	1	1	1						
Gillen [78]	1	1	1	1	1	1	1						
Glass *et al.* [108]	1	1	1	1	1	1	1		1				
Gore-Felton *et al.* [97]			1	1		1					1		
Gow *et al.* [92]			1	1	1	1					1		
Hart *et al.* [99]				1		1					1		
Hastings and Brown [79]	1	1	1	1	1	1	1						
Hirsch *et al.* [109]	1	1	1	1	1	1	1						
Ironson and Kremer [100]	1	1	1	1		1							
Kinsinger *et al.* [101]	1	1			1	1			1				
Knoll *et al.* [95]						1	1						
Kristiansen *et al.* [80]	1	1		1	1	1	1						
Krzemien [96]								1			1	1	1
Lethborg *et al.* [102]	1	1	1	1	1	1	1						

Table 4. *Cont.*

Lord and Robertson [81]	1	1	1	1	1	1	1						
McIlvane *et al.* [82]			1	1	1	1							
Meyer [83]	1	1	1	1	1	1	1						
Moscardino *et al.* [110]						1	1						
O'Brien *et al.* [84]	1	1	1	1	1	1	1	1					
O'Connor *et al.* [85]	1	1	1	1	1	1	1						
Piazza-Waggoner *et al.* [86]	1	1	1	1	1	1	1		1				
Richards *et al.* [103]	1	1	1	1	1	1	1						
Rosenberger *et al.* [87]	1	1	1	1	1	1			1				
Schnider *et al.* [98]	1	1					1						
Schwartz *et al.* [104]	1	1				1	1						
Steinhardt *et al.* [88]	1	1	1	1		1	1						
Straughan and Buckenham [89]	1	1	1	1	1	1	1	1	1				
Tuncay *et al.* [111]	1	1	1	1	1	1	1						
Wichianson *et al.* [90]	1	1	1	1	1	1	1						
Yeung and Fung [93]					1	1		1	1	1		1	1
Frequency:	74%	74%	71%	76%	71%	91%	71%	15%	21%	3%	12%	6%	6%

These results indicate that the methods of factor analysis can have substantial consequences on the conclusions that researchers derive about the role of religious coping in relation to other strategies. The use of the Kaiser-Guttman criterion is known to lead to an inflated number of factors extracted [5,11], although it is impossible to determine to what extent the studies reviewed in the present article have relied in this criterion, since most have indicated the simultaneous use of additional criteria, such as the scree plot or interpretability of the factor solution. Only one of the studies reviewed had used an analysis that is technically appropriate for this type of data: Miyazaki *et al.* [49] used a robust weighted least squares method with a polychoric correlation matrix. Commonly used techniques, including PCA, are based on the assumption that the data are continuous, which is violated when data are collected using a Likert scale, as is the case with the Brief COPE [1]. When data are ordinal, researchers are instead advised to use an asymptotically distribution free method, such as the weighted least squares [117] or robust weighted least squares method [118].

The use of inappropriate factor analytical techniques in psychological research has been heavily criticized by Bernstein and Teng [37], and may be explainable by researchers' tendency to unquestioning reliance on standard statistical packages without consideration of the assumptions required for using the various estimation methods. Using PCA for non-continuous data tends to inflate the number of extracted factors, even when the scree plot criterion is used in addition to the Kaiser-Guttman criterion [37]. The practice of combining items to form mini-scales, such as with the sub-scale-level analyses of the Brief COPE (Table 2), results in variables that are starting to approximate continuous variables more closely. As can be seen in the results of the present review, sub-scale-level analyses extracted a median number of three factors, as opposed to six factors from item-level analyses, which may reflect the increased likelihood of extraction of spurious factors when the latter technique is used. Perhaps some of the loadings of *turning to religion* with maladaptive coping strategies at item-level analysis may also be the result of this effect: If participants in a sample do not endorse *turning to religion* or *substance use*, data from these sub-scales are highly skewed, as for example reported by Kallasmaa and Pulver [119] when using the COPE [10] questionnaire. In that case, when using a PCA with ordinal-level data, it could be possible that these two strategies load together [43] not because of their similarity in content, but simply because of their similarity in response level [37]. Given that religious affiliation is well known to be negatively correlated with use of drugs and alcohol [120], this might be a feasible alternative explanation rather than concluding that these two strategies are genuinely related.

The factor structures used by studies that had not conducted exploratory factor analyses more closely resemble those proposed from sub-scale-level analyses rather than item-level analyses (Table 4). The most striking deviation pertains to the *humor* sub-scale, which was included into a factor with *turning to religion* 71% of the time, whereas the item-level and sub-scale-level analyses reported common loadings only 15% and 18% of the time, respectively. With a median number of two factors, studies not conducting exploratory factor analyses tended towards choosing factor structures that were even broader than those that typically emerged from sub-scale-level analyses, where the median number of factors was three. A common way to analyse Brief COPE scores was to combine the scores from the first eight sub-scales into one score (*i.e.*, *active coping*, *planning*, *positive reframing*, *acceptance*, *humor*, *turning to religion*, *emotional support*, and *instrumental support*) and the remaining sub-scales into another (Tables 4). Of the 34 studies listed in Table 3, 12 had used this

approach [77-79,81,83,85,90,91,102,103]. Four of these twelve studies [81,91,102,103] mentioned general theoretical considerations or did not provide any justification or reference. When references were provided, these were frequently to Carver *et al.* [10], although not always to argue for the use of a four-factor structure, as Carver *et al.* [10] had proposed for the COPE based on results from their factor analyses. Instead, this reference was sometimes used to justify a two-factor structure, such as *adaptive versus problematic coping* [94] or *adaptive versus maladaptive coping* [79], which is most likely based on theoretical comments that Carver *et al.* [10] had made about the supposed adaptiveness of some of the coping strategies. Atkinson *et al.* [77] referred to Lunsford *et al.* [105], although Lunsford *et al.* themselves had used the individual sub-scales separately. Hastings and Brown [79] and O'Connor *et al.* [85] referred to Carver *et al.* [10], and Gillen [78], Hirsch *et al.* [109] and Wichianson *et al.* [90] referred to Meyer [83], while Meyer himself had referred to Carver *et al.* [112]. Studies that did not publish results from exploratory factor analyses of their own dataset (Table 3) therefore did not appear to have been influenced very much by the factor analytical results from studies using the Brief COPE—or at least the ones that met the criterion of the present review that *turning to religion* be included.

As can be seen in Table 4, the use of factor structures that used the *adaptive versus maladaptive* distinction or similar appears to be the dominant approach in studies that did not conduct factor analyses on their own dataset. This distinction, however, has frequently been criticized [4,121,122] with the argument that the effectiveness of the specific coping strategies is context-dependent. With religious coping, variations in effectiveness are also acknowledged by distinguishing between positive or negative religious coping [123,124], where the former involves activities, such as seeking of spiritual support, religious purification and forgiveness, while the latter includes spiritual discontent or punishing God reappraisals. The studies reviewed in the present article do not reveal any clear factor loading pattern for religious coping (Table 4), which may certainly be explainable by variations in the extent of positive *versus* negative religious coping in different samples.

Tamres *et al.* [26] noted that religious coping could neither be assigned to problem- nor emotion-focused coping, and the results from the present review echo this statement. For example, religious coping was found to load equally often with problem-focused strategies, such as *active coping*, than with emotion-focused strategies, such as *emotional support* (Table 4). One reason suggested to explain such unclear findings is that religious coping might be a unique strategy [27,28], independent of other means of coping. Given the methodological concerns identified above about the use of PCA with ordinal data, reports of religious coping loading as a separate factor do not provide a strong argument for this possibility. Confirmatory factor analyses are a more robust way to investigate the factor structure of religious coping, and of the studies reviewed in the present article, only three used this approach. David and Knight [91] reported acceptable fit indices when religious coping was grouped together with adaptive coping strategies (Table 4), while Knoll *et al.* [95] and Moscardino *et al.* [110] reported acceptable fit indices when *turning to religion* was in the same factor as *instrumental* and *emotional support*. A recent study by Krägeloh *et al.* [125] conducted a series of exploratory and confirmatory factor analyses to compare alternative factor solutions for the Brief COPE [1], and found that, for participants with lower levels of religiosity and spirituality, the best model was when *turning to religion* was grouped with maladaptive coping strategies. For participants with higher levels of religiosity and spirituality, the best model was when religious coping was grouped with problem-

focused strategies, followed by emotional coping strategies, and lastly by maladaptive strategies. These findings show that characteristics of the sample can directly affect the way the *turning to religion* is grouped with secular coping strategies.

The extent to which religious coping may overlap with other strategies or whether it may provide unique coping strategies has been debated in recent research studies. Zwingmann *et al.* [126] presented data that suggested that the effects of religious coping on psychosocial adjustment in breast cancer patients were fully mediated by non-religious coping strategies, and Pérez *et al.* [127] found that spiritual striving and depressive symptoms was mediated by acceptance. Burker *et al.* [128], on the other hand, reported findings that religious coping strategies do not appear to be functionally redundant when predicting stress in lung transplant candidates, as did Schottenbauer *et al.* [17] in a large survey of respondents self-identifying as Christian. Other evidence for the unique contribution of religious coping strategies comes from Jermann *et al.* [129], who investigated the effects of mindfulness on depressive symptoms. Mindfulness, which is also a technique central to Buddhism [130], was associated with reduced depressive symptoms, in addition to its indirect effects via other types of coping strategies. Clearly more research is needed to determine if, or which aspect of, religious coping may play a unique and independent function in dealing with stress, and to what extent this may interact with the characteristics of the individual and type of stressful situation.

4.2. Limitations and conclusions

The present study outlined the wide range in which *turning to religion* sub-scale of the Brief COPE [1] is commonly reported to align with other coping strategies. When factor analyses had been conducted using individual items as indicators, religious coping was more likely to load together with maladaptive coping strategies, and more likely with adaptive coping strategies when analyses were conducted at sub-scale level. To a large extent, this range in findings is likely to be due to the diverse and often inappropriate factor analytic techniques used to determine the factor structure of the Brief COPE instrument, therefore unfortunately also affecting the conclusions researchers frequently make about the role of religious coping. PCAs are known to yield unstable factor solutions, especially when used with ordinal-level data [5,11], and conclusions made from such analyses therefore lack validity. While sub-scale-level analyses are more robust, findings were still very variable, with three studies [62-64] reporting that *turning to religion* formed a separate factor and five studies [21,65-68] reporting lack of sufficiently high factor loadings for religious coping (Table 2). The use of general or uni-dimensional religious coping measures to inform about the role of religion in coping with stress has been criticized [17,131], and in the Brief COPE [1], the scope that the religious coping sub-scale can assess is even further limited by the fact it was reduced to two items, compared to the four items in the COPE. As the development of Brief COPE [1] has not followed recommended guidelines for developing short forms [132], the unstable factor structure of the instrument is not surprising, and it is therefore also uncertain to what extent sub-scale level analyses may be appropriate without prior formal psychometric testing [133]. Because of its brevity, the Brief COPE remains a very popular instrument. However, the present review highlighted how reports from exploratory factor analyses of the Brief COPE have very little value when trying to make general conclusions about the role of religious coping in relation to secular coping methods. Such theoretical questions will need to be

investigated by using coping instruments that more specifically and comprehensively assess the nature of religious coping, such as the RCOPE [123].

Several limitations of the present study need to be acknowledged, as they leave unaddressed some potential alternative explanations. Firstly, the only criterion used for inclusion of articles in the present review was completeness of information about the use of the Brief COPE [1] and particularly the *turning to religion* sub-scale. As outlined in the methods section above, 78 studies could therefore not be analyzed. No *a priori* criterion of methodological rigour was applied, and therefore the range in findings could also be a reflection of the range in methodological rigor of the reviewed studies. Secondly, the range in the target populations varied enormously across the reviewed studies. As Krägeloh *et al.* [125] showed, this diversity may also be a contributing factor to the wide range of reports about the role of religious coping in relation to other coping mechanisms. Finally, to contain the already large scope of the present review, no analyses were shown how the outcomes from exploratory factor analyses differed for studies that used the situational and those that used the dispositional version of the questionnaire. In the dispositional version, Likert-scale descriptors are worded in terms of participants' usual tendency to use a particular coping strategy (e.g. "I usually don't do this at all") instead of referring to specific events that they are being asked to recall (e.g. "I've been doing this a lot"). Of the 36 studies shown in Tables 1 and 2, eight studies used the dispositional version [16,18,50,52,55,61,62,67], and the results were equally varied as those of the remaining studies that used the situational version. To a large extent, any differences would be confounded by differences in sample characteristics, since the situational version tends to be administered to participants who have or are currently encountering specific stressors, while the dispositional version tends to be administered to target populations with no specific common stressor, such as convenience samples [62] or university students [50,55,61]. Further research is therefore necessary to explore whether responses to religious coping questionnaires framed in a dispositional format may result in different factor solutions than those in situational formats.

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