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ORIGINAL ARTICLE

Reliability of the tools used to examine psychological distress, fear of COVID-19 and coping amongst migrants and non-migrants in Australia

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ABSTRACT: *Study tools examining psychological distress, fear of COVID-19 and coping amongst migrants and non-migrants in Australia are very limited. The aim of this research was to assess the psychometric properties and correlation of the English version of Kessler Psychological Distress Scale (K-10), Fear of COVID-19 Scale (FCSV-19S), and Brief Resilient Coping Scale (BRCS) tools during the COVID-19 pandemic situation in Australia. Data from a cross-sectional survey (n = 516) were utilized to examine reliability; 299 (57.9%) were migrants. High internal consistency, as evidenced by Cronbach's alpha, was found for the K-10 (0.92), FCV-19S (0.87) and BRCS (0.66) tools. The corresponding values for migrants and non-migrants were (0.92, 0.87, 0.67) and (0.92, 0.86, 0.63), respectively. Item-total correlations ranged 0.57-0.78 for K-10, 0.62–0.69 for FCV-19S, and 0.39–0.50 for BRCS tools. EFA retained a single factor for each tool with adequate factor loadings. The scoring of K-10 was significantly predicted by the scoring of FCV-19S (r = 0.284, P < 0.001) and BRCS tool (r = 0.132, P < 0.01). Therefore, these tools can be used reliably amongst both migrant and non-migrant population in Australia.*

KEY WORDS: *Australia, BRCS, COVID-19, FCV-19S, K-10, psychometrics, reliability.*

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INTRODUCTION

Since early March 2020, many Australians have been physically and psychologically impacted by the coronavirus 2019 pandemic (COVID-19). The State of Victoria was more affected than the other states in Australia (Stanton *et al.,* 2020). As of 5th October 2020, there were 27 149 confirmed cases and a total of 894 deaths from COVID-19 in the country, and of those, 20 220 (74.5%) cases and 806 (90.2%) deaths were recorded from Victoria (Australian Government Department of Health). This resulted mainly from the second wave of the pandemic, which severely affected Victoria unlike other states and has been declared a public health disaster. Consequently, this has not only led to enormous pressure on the economy but also accentuated psychological distress, fear and anxiety amongst Victorians (Hayward, 2020).

A recent study in Australia used the Kessler Psychological Distress Scale (K-10), Fear of COVID-19 Scale (FCSV-19S), and Brief Resilient Coping Scale (BRCS) to measure psychological distress, fear and coping strategies during the COVID-19 pandemic (Rahman *et al.,* 2020). The study, with good representation from the State of Victoria, found that perceived distress due to change in employment status or providing care to a known or suspected case of COVID-19 was associated with higher levels of fear, and high levels of fear were associated with higher levels of psychological distress (Rahman *et al.,* 2020). Conversely, people who were born in Australia had a lower level of fear during the pandemic period, and a recent visit to a healthcare provider was associated with better coping during the pandemic (Rahman *et al.,* 2020).

Tools to measure psychological distress, fear and coping strategies have been evaluated in earlier studies. K-10 has been extensively explored in different populations, contexts, and languages including in Australia (Enticott *et al.,* 2018; Furukawa *et al.,* 2003), but it has not been examined during a pandemic situation when the levels of distress are quite high in the general population. In addition, to the best of our knowledge, no study investigated the difference regarding the psychometric properties of the K-10 tool in migrant and non-migrant people in Australia previously.

FCSV-19S had only been recently developed to specifically assess the fear of COVID-19 using a seven-item scale. That tool underwent rigorous testing and reported a stable unidimensional structure with robust psychometric properties (Ahorsu *et al.,* 2020a). The tool was tested in other countries including New Zealand, Malaysia, Turkey, Bangladesh, amongst different study population and in a number of languages (Pang *et al.,* 2020; Sakib *et al.,* 2020; Satici *et al.,* 2020; Winter *et al.,* 2020). In the UK, FCV-19S was one of the many tools used to predict virus mitigating behaviour where an increased FCV-19S score was correlated with increased self-reported risk of contracting the virus, thereby predicted positive behaviour change (e.g. social distancing, improved hand hygiene) (Harper *et al.,* 2020). A study conducted in New Zealand also found that lockdown adherence was associated with scoring on FCV-19S (Winter *et al.,* 2020).

The BRCS was developed to assess the ability to cope with stress in a resilient way or bounce back or rebound after adversity or trauma (Sinclair & Wallston, 2004). It has been translated into different languages and adapted for different study groups, including frontline nurses during the COVID-19 pandemic in the Philippines and showed excellent reliability (Fung, 2020; Kocalevent *et al.,* 2017; Labrague & De los Santos, 2020; Limonero *et al.,* 2014). In addition, the BRCS was also used to assess resilience in patients with long-term conditions (e.g. Rheumatoid arthritis) in Spain (López-Pina *et al.,* 2016).

Studies examining the psychometric properties of K-10, FCV-19S, and BRCS in migrant and non-migrant population in Australia in the current pandemic are virtually non-existent. With a number of surveys being planned, and some underway, to assess the immediate and long-term impacts of COVID-19 on mental health status in a multicultural country like Australia, the present study aimed to assess the psychometric properties of the English version of K-10, FCV-19S, and BRCS during the COVID-19 pandemic in the State of Victoria, Australia. Furthermore, we examined any probable difference in the psychometric properties of those tools based on the migration status of the population, and whether there was any association between fear of COVID-19 and psychological distress as well as coping using those tools.

METHODS

Study type and settings

This analysis included data from a cross-sectional study that investigated factors associated with psychological distress, fear, and coping strategies during the COVID-19 pandemic in Australia (Rahman *et al.,* 2020). Participants were recruited from the general practice, allied healthcare, and community groups using online

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platform in June 2020. This paper restricted to data from Victoria only, which constituted majority of the study population (88%) in the original study (Rahman *et al.*, 2020).

Sample and data collection

Australian residents, who were aged 18 years and above, and had access to an online English language questionnaire, were invited to participate in this study. A total of 516 individuals from Victoria completed the anonymous online questionnaire. The questionnaire was pretested in a small sample and adjusted after approval from all the authors. More details on recruitment and methodology are available in the previous paper (Rahman *et al.*, 2020).

Study tool

Data were collected about socio-demographics, self-reported co-morbidities, risk factors, health services utilization, and psychological impact. Psychological impact during the COVID-19 pandemic was assessed using the Kessler Psychological Distress Scale (K-10) (Enticott *et al.*, 2018; Furukawa *et al.*, 2003), fear was assessed using the Fear of COVID-19 scale (FCV-19S) (Ahorsu *et al.*, 2020a), and coping strategies were assessed using the Brief Resilient Coping Scale (BRCS) (Sinclair & Wallston, 2004). K-10 has ten items and response to each item in the questionnaire was measured using a five-point Likert scale (1 = none, 2 = a little, 3 = sometimes, 4 = most of the time, 5 = all the time), with the total score ranging from 10 (lowest) to 50 (highest). The FCV-19S has seven items and the response to each item was also measured using a five-point Likert scale (1 = strongly disagree, 2 = somewhat disagree, 3 = neither agree nor disagree, 4 = somewhat agree, 5 = strongly agree), with the total score ranging from 7 (lowest) to 35 (highest). The BRCS has four items and responses were collected using again a five-point Likert scale (1 = does not describe me at all, 2 = does not describe me, 3 = neutral, 4 = describes me, 5 = describes me very well), with total score ranging from 4 (lowest) to 20 (highest). The three tools used in this study have been validated and widely used in other studies (Ahorsu *et al.*, 2020a; Kessler *et al.*, 2003; Sinclair & Wallston, 2004). Migration status was determined by the question, 'Were you born in Australia?' and the positive responses were considered as non-migrants (Australia born).

Data analyses

Data were analyzed using SPSS version 25 (IBM Corp., Armonk, NY, USA). Characteristics of the study participants were analyzed using descriptive statistics. Psychometric properties of the tools were assessed using item performance and internal consistency reliability. Item performance was assessed by exploring item means, standard deviations, standard errors, variance, skewness, range, and percentile distribution. Internal consistency reliability was assessed using item-total correlation and Cronbach's Alpha. Normal distribution of scores (with skewness of +1.0 and −1.0) indicated satisfactory item performance (Pascoe *et al.*, 2018). Variability was assessed using floor and ceiling effects where a cut-off score of >15% on the minimum and maximum score for each item indicated the presence of floor and ceiling effects (Pascoe *et al.*, 2018; Terwee *et al.*, 2007). Internal consistency reliability was considered satisfactory if Cronbach's Alpha had cut-off value of >0.7 and item–total correlations had cut-off value of >0.3 and <0.8 (Lindahl *et al.*, 2015). Exploratory factor analysis (EFA) was used to examine the dimensionality of each tool. To determine the suitability of the data for factor analysis, Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) and Bartlett's test of sphericity were used, where the KMO value of >0.60 and $P < 0.05$ indicated statistical significance, respectively (Cerny & Kaiser, 1977; Pallant, 2000). Items in each scale meeting the criterion of communalities exceeding the value of 0.3 were included in the principal component analysis (PCA). The Kaiser criteria of an eigenvalue > 1, the Cattell scree test, and the cumulative percentage of variance extracted indicated the number of factors to be extracted (Williams *et al.*, 2010). Psychometric properties were examined for each tool stratified by migration status. In addition, Pearson correlation tests and multiple linear regression were used to examine relationship with the impact of psychological distress, the fear of COVID-19 and coping/resilience, and the statistical significance was determined by the $P < 0.05$.

Ethical consideration

Ethics approval was obtained from the Human Research Ethics Committee (HREC) at Federation University Australia (B20-036).

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RESULTS

Sample characteristics

Of the 516 Victorian residents considered for this analysis, mean age (±SD) was 41.1 ± 12.5 years, and 62% were females. More than half (57.9%) of the study population were migrants. Details of the descriptive data are presented in Table 1.

Data distribution

The total score distribution for the K-10, FCV-19S, and BRCS are presented in Table 2 and Fig. 1. Distribution of the total scores in each tool had skewness of <1.0 indicating normal distribution of data. The mean (±SD) was 19.4 ± 7.5 for the K-10 tool (score range of 10–50), 18.4 ± 6.5 for the FCV-19S tool (score range of 7–35), and 8.5 ± 2.6 for the BRCS tool (score range of 4–20).

Data variability

Variability was assessed by examining floor and ceiling effects, and >15% of scores were assigned to the lowest score across all items in the K-10 and BRCS, which indicated substantial floor effects. No ceiling effect was observed for any of the items in any of the tools except for item-1 (I am most afraid of COVID-19) and item-5 (When watching news and stories about COVID-19 on social media, I become nervous or anxious) in the FCV-19S. Those two items also did not show any floor effects in the FCV-19S. (Tables 3, 4, and 5) When stratified by migration status, findings remained the same except for item-2 (It makes me uncomfortable to think about COVID-19) in the FCV-19S, which did not show any floor effects but showed ceiling effects for migrants in Victoria.

Item performance and reliability

Tables 3, 4, and 5 show item performance and reliability for all three instruments. The mean value for all items ranged between 1.52 to 2.40 in the K-10, 1.92 to 3.41 in the FCV-19S, and 1.78 to 2.30 in the BRCS. The overall, as well as item specific Cronbach's alpha, showed high internal consistency reliability for K-10 (>0.7) and FCV-19S (>0.7). Findings did not change according to the migration status (Table 6). However, the Cronbach's alpha for the items in the BRCS ranged from 0.56 to 0.62, which was below the acceptable

TABLE 1 *Characteristics of the study participants*

Characteristics	Total, *n* (%)
Total study participants	516
Age (in years)	473
Mean (±SD)	41.1 (12.5)
Range	18 to 77
Age groups	473
18–29 years	94 (19.9)
30–59 years	343 (72.5)
60 years and above	36 (7.6)
Gender	516
Male	195 (37.8)
Female	320 (62.0)
Others	1 (0.2)
Living status	513
Live without family members (on your own/shared house/others)	115 (22.4)
Live with family members (partner and/or children)	398 (77.6)
Born in Australia	516
Yes	217 (42.1)
No	299 (57.9)
Completed level of education	515
Grade 1–12	71 (13.8)
Trade/Certificate/Diploma	84 (16.3)
Bachelor and above	360 (69.9)
Current employment condition (multiple responses)	516
Unemployed/Home duties	46 (8.9)
Jobs affected by COVID-19 (lost job/working hours reduced/afraid of job loss)	150 (29.1)
Have an income source (employed/Government benefits)	362 (70.2)
Perceived distress due to change of employment status	133
Moderate to a great deal	101 (75.9)
A little to none	32 (24.1)
Self-identification as a frontline or essential service worker	504
Yes	211 (41.9)
No	293 (58.1)
COVID-19 impacted financial situation	501
Yes	287 (57.3)
No	214 (42.7)
History of co-morbidities (multiple responses)	502
No	252 (50.2)
Psychiatric/Mental health problem	57 (11.4)
Other co-morbidities*	193 (38.4)
Smoking	387
Ever smoker (Daily/Non-daily/Ex)	49 (12.7)
Never smoker	338 (87.3)
Increased smoking over the last 4 weeks	49
Yes	19 (38.8)
No	30 (61.2)
Current alcohol drinking (last 4 weeks)	500
Yes	184 (36.8)
No	316 (61.2)
Increased alcohol drinking over the last 4 weeks	181

(*Continued*)

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TABLE 1 (Continued)

Characteristics	Total, *n* (%)
Yes	57 (31.5)
No	124 (68.5)
Caregiving to a family member/patient with history of COVID-19	471
Yes	57 (12.1)
No	414 (87.9)
History of COVID-19 exposure (multiple responses)	499
I have been tested negative for COVID-19 but self-isolating	91 (18.2)
I had recent overseas travel history and was in self-quarantine	6 (1.2)
No known exposure to COVID-19	402 (80.6)
Healthcare service utilization in the last 4 weeks	499
Visited healthcare providers in person	67 (13.4)
Telehealth consultation with healthcare providers/ National helpline	28 (5.6)
No	401 (80.4)
Healthcare service use to overcome COVID-19 related stress in the last 4 weeks	486
Yes	29 (6.0)
No	457 (94.0)

Total number of responses is mentioned for each variable.

*Cardiac diseases/Stroke/Hypertension/Hyperlipidaemia/Diabetes/Cancer/Long-term respiratory illness.

level of >0.7, but the item-total correlations had the value ranging from 0.39 to 0.50, which indicated satisfactory reliability (>0.3 and <0.8). Migration status did not indicate any difference as well (Tables 5 and 6).

TABLE 2 *Performance of the K-10, FCV-19S, and BRCS tools*

Statistics	K-10 $N = 485$	FCV-19S $N = 486$	BRCS $N = 486$
Median	18.0	18.0	8.0
Mean	19.4	18.4	8.5
Minimum	10	7	4
Maximum	45	35	18
Standard deviation (SD)	7.45	6.51	2.60
Standard error (SE) mean	0.34	0.30	0.12
Variance	55.5	42.4	6.8
Skewness	0.8	0.1	0.4
Kurtosis	0.03	−0.81	0.21
Percentiles			
25th	14.0	13.0	7.0
50th	18.0	18.0	8.0
75th	24.0	23.0	10.0

Total number of responses is mentioned for each variable.

Kessler Psychological Distress Scale (K-10): The lowest possible score was 10 and the highest possible score was 50; increase of score indicated increased levels of distress; Fear of COVID-19 Scale (FCV-19S): The lowest possible score was 7 and the highest possible score was 35; increase of score indicated increased levels of fear due to COVID-19; Brief Resilient Coping Scale (BRCS): The lowest possible score was 4 and the highest possible score was 20; increase of score indicated increased levels of resilience.

Dimensionality

EFA showed the KMO value of 0.93 in the entire K-10, and the value for all the items had a range of 0.64–0.83, with significant results ($P < 0.001$) in Bartlett's test of sphericity. A single factor was extracted, which explained 59.9% of the total variance in that tool. For the FCV-19S, the KMO value was 0.87 in the entire tool, and the value for all the items had a range of 0.71–0.78, with significant results ($P < 0.001$) in Bartlett's test of sphericity. A single factor was extracted, which explained 57.1% of the total variance in that tool. For the BRCS, the KMO value was 0.70 in the entire tool, and the value for all the items had a range of 0.65–0.76, with significant results ($P < 0.001$) in Bartlett's test of sphericity. A single factor was extracted, which explained 50.1% of the total variance in that tool. Individual analyses of each tool according to migration status also extracted a single factor. Such unidimensional findings for each tool demonstrated that all items in each tool fit into a single theoretical construct, naming psychological distress by the K-10, fear of COVID-19 by the FCV-19S and coping/resilience by the BRCS. Importantly, the findings were the same irrespective of migration status of the participants.

Validity

The validity of none of these three tools was assessed in this study. Factor analyses along with theoretical underpinning were used to establish construct validity. Content validity had already been confirmed in earlier studies for the widely used K-10 (Kessler *et al.,* 2002), the newly developed FCV-19S (Ahorsu *et al.,* 2020a), and the BRCS (Sinclair & Wallston, 2004).

Correlation within the tools

The scoring of K-10 showed a statistically significant positive linear relationship with the scoring of FCV-19S ($r = 0.284$, $P < 0.001$) and BRCS ($r = 0.132$, $P < 0.01$). However, the scoring of FCV-19S and those of BRCS showed non-significant negative linear relationship ($r = -0.057$, $P > 0.05$). Multiple linear regression showed that the scoring of K-10 was significantly predicted by the scoring of FCV-19S ($r = 0.294$,

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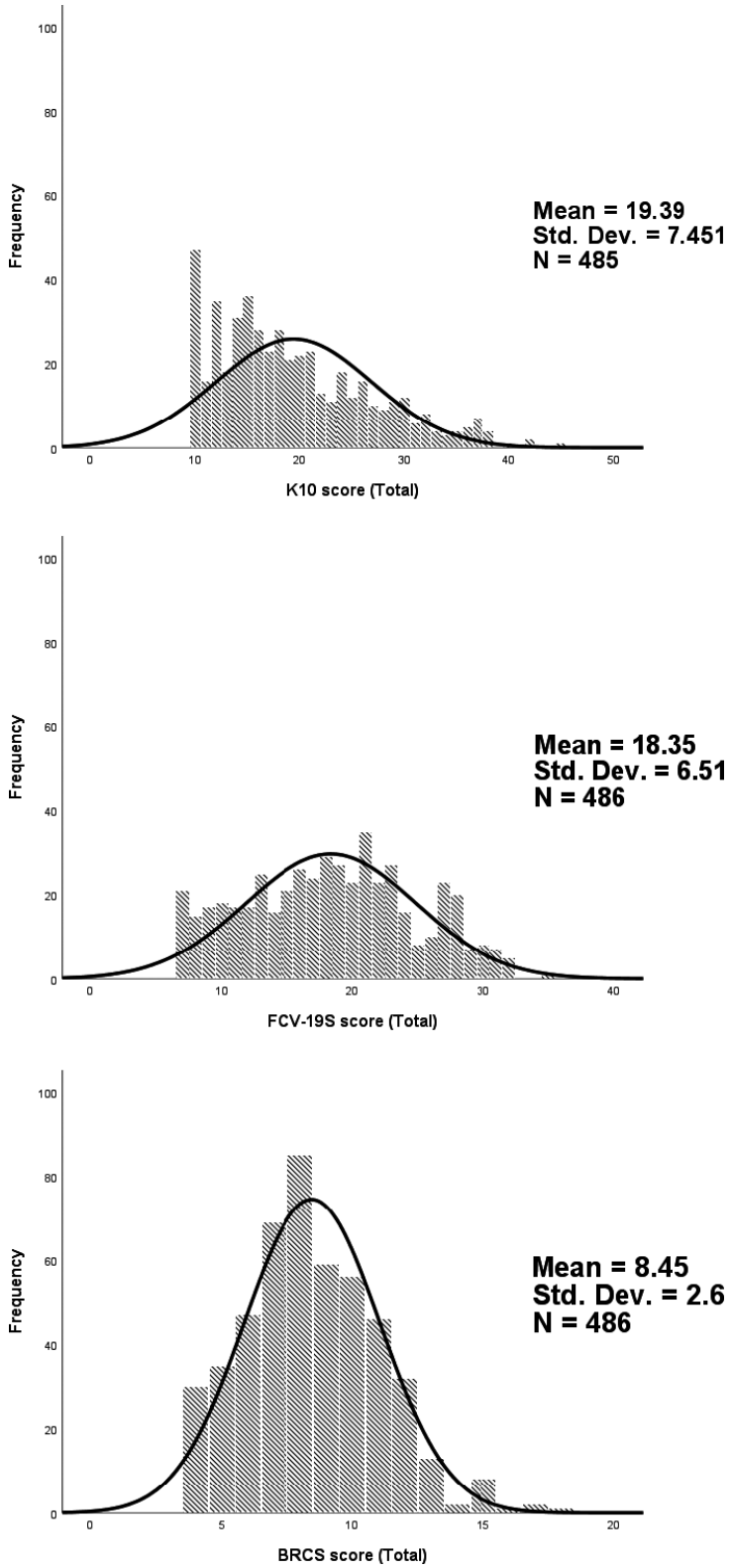

FIGURE 1 Distribution of scores on total scale of K-10, FCV-19S, and BRCS scale. (N *represents total number of responses for each category, mean/standard deviation represents the values derived from total score of all items included in the entire scale).*

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TABLE 3 *Item performance and reliability estimates of the K-10 tool* (N = *485*)

Item no	Item content	Mean	SD	Missing %	Floor (% with lowest score)	Ceiling (% with highest score)	Corrected Item–total correlation	Cronbach's Alpha if item deleted
1	About how often did you feel tired out for no good reason?	2.40	1.129	6.00	28.90	2.90	0.57	0.92
2	About how often did you feel nervous?	2.40	1.025	6.00	23.30	1.60	0.69	0.92
3	About how often did you feel so nervous that nothing could calm you down?	1.52	0.817	6.20	66.10	2.30	0.73	0.91
4	About how often did you feel hopeless?	1.84	0.970	6.00	47.80	0.80	0.76	0.91
5	About how often did you feel restless or fidgety?	2.12	0.998	6.00	33.00	1.00	0.73	0.91
6	About how often did you feel so restless you could not sit still?	1.55	0.813	6.00	62.50	0.20	0.69	0.92
7	About how often did you feel so depressed?	2.05	1.012	6.20	36.40	1.90	0.78	0.91
8	About how often did you feel that everything was an effort?	2.21	1.101	6.20	32.90	2.30	0.68	0.92
9	About how often did you feel so sad that nothing could cheer you up?	1.66	0.875	6.20	55.60	0.40	0.77	0.91
10	About how often did you feel worthless?	1.64	0.942	6.00	60.60	1.00	0.72	0.91

Total Cronbach's Alpha: 0.92.

TABLE 4 *Item performance and reliability estimates of the FCV-19S tool* (N = *486*)

Item no	Item content	Mean	SD	Missing %	Floor (% with lowest score)	Ceiling (% with highest score)	Corrected Item–total correlation	Cronbach's Alpha if item deleted
1	I am most afraid of COVID-19	3.41	1.199	5.8	9.90	17.50	0.62	0.86
2	It makes me uncomfortable to think about COVID-19	3.16	1.292	5.8	15.60	13.40	0.68	0.85
3	My hands become clammy when I think about COVID-19	1.92	1.172	5.8	53.90	3.10	0.65	0.86
4	I am afraid of losing my life because of COVID-19	2.68	1.380	5.8	30.50	10.50	0.62	0.86
5	When watching news and stories about COVID-19 on social media, I become nervous or anxious	3.33	1.279	5.8	14.20	16.00	0.68	0.85
6	I cannot sleep because I'm worrying about getting COVID-19	1.90	1.132	5.8	54.90	1.00	0.65	0.86
7	My heart races or palpitates when I think about getting COVID-19	1.95	1.167	5.8	53.10	1.60	0.69	0.85

Total Cronbach's Alpha: 0.87.

$P < 0.001$) and BRCS ($r = 0.150$, $P < 0.01$) [$F(2, 482) = 32.39$, $P < 0.001$; $R^2 = 0.103$]. Therefore, with an increased of fear of COVID-19, psychological distress increased, and so did coping/resilience.

DISCUSSION

Findings of this study suggested that the English version of the K-10 and FCV-19S were reliable to examine psychological distress and fear; BRCS had suboptimal reliability to assess coping during a crisis period like the current COVID-19 pandemic in a multicultural setting like Australia. As far as we know, this is the first study in Australia to examine performance of these tools in migrant and non-migrant population separately. We found that the tools performed equally irrespective of migration status in Australian population.

Several studies have utilized the K-10 previously to examine psychological distress amongst the Australian population, however, studies analysing psychometric

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properties of the tool in similar pandemic/crisis are non-existent. The K-10 was used in a study during the Equine Influenza outbreak in Australia in 2007, which reported higher psychological distress (34%) compared with the national average of 12% (Taylor *et al.,* 2008). The instrument was widely used in the National Survey of Mental Health and Wellbeing in 2007 conducted by the Australian Bureau of Statistics as well as other population health surveys in Victoria, New South Wales, South Australia, and Western Australia (Australian Bureau of Statistics, 2008; Taylor *et al.,* 2008). K-10 showed no age-related bias in detecting psychological distress (O'Connor & Parslow, 2010), and also demonstrated validity for measuring psychological distress amongst middle-aged and older Indigenous people in Australia (McNamara *et al.,* 2014). While K-10 measures non-specific psychological distress, a previous study demonstrated that it could predict Diagnostic and Statistical Manual of Mental Disorders (DSM–IV) in the previous 12 months amongst the Australian general population and recommended use of K-10 in settings where comprehensive assessment of mental health was not feasible (Sunderland *et al.,* 2011). However, a review examining the validity of K-10 amongst culturally diverse populations identified very limited evidence on conceptual and linguistic equivalence of the translated/adapted version of the tool (Stolk *et al.,* 2014). Our study indicated that the original English version K-10 could be used for multicultural community settings such as Australia, as it did not indicate any difference in performance based on migration status, particularly during the COVID-19 pandemic.

K-10 showed high internal consistency/reliability in this study, which was consistent with previous studies. In this study, Cronbach's alpha was 0.92, which was similar to a previous value of 0.93 for Indigenous and 0.89 for non-Indigenous population in Australia (McNamara *et al.,* 2014). A previous study from Victoria, Australia amongst intravenous drug users also showed high internal consistency with a value of 0.84 and in the same study, it showed that the tool could detect 78% of cases and 74% of non-cases based on DSM-IV diagnoses of mental illness (Hides *et al.,* 2007). The English language version of K-10 showed satisfactory performance in an earlier study from Canada (Cronbach's alpha 0.88) (Sampasa-Kanyinga *et al.,* 2018). Satisfactory performance of the items included in K-10, as calculated through item-total correlations, for migrants (0.55–0.77) and non-migrants (0.60–0.80) in this study could also be comparable with previously tested values for the Indigenous (0.57–0.83) and non-Indigenous (0.51–0.75) people in Australia (McNamara *et al.,* 2014). The variability of K-10 with the floor effects in this study indicated that people with the lowest possible score could not be distinguished from one another, which potentially reduced sensitivity and responsiveness (Rodrigues Sde *et al.,* 2013; Terwee *et al.,* 2007). Uni-dimensionality of the tool, as detected in this study in general and by migration status, was also comparable to the findings of a previous study in Australia (McNamara *et al.,* 2014). Therefore, such consistent findings of reliability demonstrated that the English version of K-10 can be used to screen psychological distress in the general population in Australia.

The FCV-19S demonstrated reliability of its use amongst the migrants and non-migrants in Victoria, Australia. We found high internal consistencies as demonstrated by alpha value of 0.87 for migrants and 0.86 for non-migrants, which was similar to the findings from the original study in Iran (0.82) (Ahorsu *et al.,* 2020a), studies from New Zealand (0.86) (Winter *et al.,* 2020) and the USA (0.91) (Perz *et al.,* 2020). Findings of higher floor effects in our study were explained partially in a previous study, where the authors explained that participants tend to respond more to 'strongly disagree' for items 3, 6, and 7 which were related to somatic responses (Winter *et al.,* 2020). Further potential explanations for lower scoring in the instrument was mentioned in the original study (Rahman *et al.,* 2020). Uni-dimensionality of the tool was also supported by evidence from earlier studies (Ahorsu *et al.,* 2020a; Chang *et al.,* 2020a; Perz *et al.,* 2020; Winter *et al.,* 2020). On the other hand, two factors pertaining to emotional fear reactions and symptomatic expressions of fear have also been reported in literature (Tzur Bitan *et al.,* 2020), which has been criticized for not using confirmatory factor analysis and lack of clarity on theoretical assumptions (Pakpour *et al.,* 2020a; Pakpour *et al.,* 2020b).Within the current period of COVID-19 pandemic, the English version of the FCV-19S had already been translated in a number of languages including Arabic (Alyami *et al.,* 2020), Bangla (Sakib *et al.,* 2020), Greek (Tsipropoulou *et al.,* 2020), Hebrew (Tzur Bitan *et al.,* 2020), Italian (Soraci *et al.,* 2020), Japanese (Masuyama *et al.,* 2020), Malay (Pang *et al.,* 2020), Spanish (Martínez-Lorca *et al.,* 2020), and Urdu (Mahmood *et al.,* 2020), all of which showed consistently satisfactory internal validity. While the instrument was validated across different populations and languages, there was no existing evidence regarding its performance in cross-cultural settings (Chang *et al.,* 2020a). Our study showed no difference in the performance of the FCV-19S across migrant and non-migrant

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TABLE 5 *Item performance and reliability estimates of the BRCS tool* (N = *486*)

Item no	Item content	Mean	SD	Missing %	Floor (% with lowest score)	Ceiling (% with highest score)	Corrected Item–total correlation	Cronbach's Alpha if item deleted
1	I look for creative ways to alter difficult situations	2.30	1.028	5.8	20.40	5.10	0.39	0.62
2	Regardless of what happens to me, I believe I can control my reaction to it	2.17	0.985	5.8	24.90	3.10	0.40	0.62
3	I believe I can grow in positive ways by dealing with difficult situations	1.78	0.784	5.8	39.70	0.80	0.50	0.56
4	I actively look for ways to replace the losses I encounter in life	2.19	0.891	5.8	22.80	0.80	0.48	0.56

Total Cronbach's Alpha: 0.66.

TABLE 6 *Item performance and reliability estimates of the K-10, FCV-19S, and BRCS tools according to the migration status (born/not born in Australia) in Australia*

Tools and statistics	Non-migrants	Migrants
K-10	(*N* = 201)	(*N* = 280)
Cronbach's alpha (total scale)	0.92	0.92
Cronbach's Alpha if item deleted (range)	0.91–0.92	0.91–0.92
Corrected item-total correlation (range)	0.60–0.80	0.55–0.77
Mean (range)	1.58–2.64	1.48–2.30
FCV-19S	(*N* = 204)	(*N* = 282)
Cronbach's alpha (total scale)	0.86	0.87
Cronbach's Alpha if item deleted (range)	0.83–0.86	0.84–0.85
Corrected item-total correlation (range)	0.57–0.74	0.59–0.70
Mean (range)	1.56–3.08	2.02–3.64
BRCS	(*N* = 204)	(*N* = 282)
Cronbach's alpha (total scale)	0.63	0.67
Cronbach's Alpha if item deleted (range)	0.52–0.62	0.56–0.65
Corrected item-total correlation (range)	0.34–0.50	0.39–0.53
Mean (range)	1.74–2.53	1.80–2.14

population in Victoria demonstrating that it can be used in multicultural settings elsewhere as well.

The BRCS showed moderate internal consistency reliability in this study, which is also supported by previous evidence. The BRCS, developed by Sinclair et al. (Sinclair & Wallston, 2004) showed 0.69 as the value of Cronbach's alpha in the original study, which was similar to what we found in this study for the migrants (0.67). However, the value was slightly lower for the non-migrants (0.63) population in our study. Evidence from Spanish sample showed higher value (0.83) when the Spanish version of the tool was tested for elder people (mean age 72 years) (Tomás *et al.,* 2012), but showed lower value (0.68) when tested for younger people (mean age 20 years) (Limonero *et al.,* 2014). Although the alpha value was slightly lower than the acceptable value, the inter-item correlation range in our study supported the internal consistency of the BRCS. In our study, we found that the instrument was unidimensional, which was supported by earlier studies (Cosco *et al.,* 2016; Kocalevent *et al.,* 2017). It had been evidenced as a valid and reliable tool for measurement of resilience in people with stable mental illnesses (Mayordomo *et al.,* 2020). Due to the brief nature of the BRCS, a previous study mentioned it could be used to identify individuals who would be targeted for testing effectiveness of an intervention designed to enhance resilient coping skills and also emphasized the need to examine the effectiveness of the BRCS in longitudinal studies (Ahern *et al.,* 2006).

Scoring for the psychological distress measured by the K-10, fear of COVID-19 measured by the FCV-19S and coping/resilience measured by the BRCS were positively correlated in this study. Studies exploring such correlation are non-existent to date. Previous evidence demonstrated that higher scores in the FCV-19S were associated with higher scores in the Hospital Anxiety and Depression Scale (HADS) and Perceived Vulnerability to Disease Scale (PVDS) (Ahorsu *et al.,* 2020a). The scoring was also found to be moderately correlated with the scoring of the Generalized Anxiety Disorder-7 (GAD-7) scale (Perz *et al.,* 2020). Our study demonstrated that the three instruments can be used concurrently to identify individuals at higher risk of developing mental illness, so that early interventions can be targeted for those vulnerable populations. In addition, there was a lack of other relevant instruments to examine the criterion-related validity of the three tools assessed in the present study. Instruments on assessing the COVID-19 preventive behaviours had

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been developed in previous studies; association between COVID-19 preventive behaviours and psychological distress had already been established (Ahorsu *et al.*, 2020b; Chang *et al.*, 2020a; Chang *et al.*, 2020b; Lin *et al.*, 2020). Therefore, those three tools were good candidates for criterion-related validity.

Limitations of this study include selective sample from the State of Victoria only, which limits external validity to the entire Australian population. However, multiculturalism in Victoria exhibits almost similar statistics for other Australian states (except for Tasmania) and hence, can be safely stated as a proxy representation of the country as a whole (Australian Bureau of Statistics, 2020). The cross-sectional study design limited our ability to comment on temporal relationship between fear and distress. Other limitations of the primary study were mentioned previously (Rahman *et al.*, 2020), although the aim of the present study was different. The strength of this study, however, was to examine the reliability of the three instruments for the very first time amongst the migrant and non-migrant population in Australia and during the current crisis period of COVID-19. Future research can focus on different psychometric testing (e.g. confirmatory factor analysis or Rasch analysis) to verify the uni-dimensionality findings of the three tools reported in the present study.

CONCLUSION

This study demonstrated that the English versions of K-10, FCV-19S, and BRCS have robust psychometric properties to measure psychological distress, fear of COVID-19 and coping amongst Australian population. Each instrument was structured to measure a single factor and there was no difference in performance amongst migrants and non-migrants. Future studies in a multicultural setting with representative samples are warranted to verify the replicability of the findings.

RELEVANCE FOR CLINICAL PRACTICE

The English versions of FCV-19S can be used to identify the vulnerable groups of individuals having higher risk of fear during the pandemic period of COVID-19. The English versions of K-10 and BRCS can be used in clinical settings to screen the individuals at higher risk of having psychological distress and to measure the extent of coping respectively during such crisis period and beyond. Our findings confirm that all these three tools can be used for both migrants and non-migrants, which is particularly important for a multicultural setting like Australia.

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ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by Human Research Ethics Committee at Federation University Australia (B20-036). Each study participant read the consent form along with plain language summary and ticked their consent in the online form prior to accessing the study questionnaire. Data were collected anonymously, therefore, no identifying information was collected from the study participants and only the group data were presented in the publication.

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