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Evaluating the Interpersonal Theory of Suicide and Measurement Invariance of the

Interpersonal Needs Questionnaire in Australian and Chinese Cultures

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General Abstract

The interpersonal theory of suicide is one of the most influential frameworks used to understand suicide. In order to examine the interpersonal theory in Chinese cultures, there is a need to develop and psychometrically evaluate a Chinese version of the Interpersonal Needs Questionnaire (INQ). This dissertation conducted two studies. *Study 1* aimed to translate the INQ into Chinese and examined its factorial structure and psychometric properties. A sample of 854 Chinese undergraduates was randomly split into two samples for performing exploratory factor analyses and confirmatory factor analyses (CFAs) to test the measurement models of the Chinese INQ. Structural equation models (SEMs) were performed to test the convergent, divergent and concurrent validity of the Chinese INQ. Results indicate that the 14-item Chinese INQ retained from the factor analyses reliably measured the two constructs with adequate internal consistency. Both constructs exhibited convergent associations (i.e., burdensomeness with self-esteem and belongingness with loneliness and social support) for the 10-item, 14-item, and 15-item Chinese INQ. Burdensomeness demonstrated concurrent associations with suicidal ideation for the 14-item, and 15-item Chinese INQ. These findings support the use of the 14-item and 15-item Chinese INQ in future research. *Study 2* aimed to establish measurement invariance for the INQ across two cultures and examine cross-cultural generalizability of the interpersonal theory. Using the undergraduate samples from Hong Kong (n = 427) and Australia (n = 469), a series of multigroup CFAs were conducted to examine measurement invariance. Multigroup SEMs and Wald tests were performed to compare the associations of the interpersonal factors with suicide ideation across cultures. *Study 2* established measurement invariance for the 15-item and 14-item INQ and provided support for the cross-cultural equivalence for the associations of the interpersonal factors with suicide ideation across Australian and Chinese cultures. Although cultural differences were found in the predictive effect of the two-way interaction

between the interpersonal factors on suicidal ideation, the findings generally support the

generalizability of the interpersonal theory across Western and Chinese cultures.

A Note on 'Thesis by Publication'

The Higher Degree Research programs of Macquarie University strongly encourage HDR candidates to complete their thesis via 'thesis by publication', which includes submitting chapters written with intent to be published as independent journal articles. This thesis consists of two studies presented as journal articles, and as such some degree of overlap and repetition is to be expected between publications discussing common topics. The components of this thesis appearing immediately before and after each publication are intended purely to contextualize the contributions of each article and help maintain the logical and narrative flow of the thesis as a whole.

Declaration of Originality

The works found within this thesis are original and have not been written by another person, nor submitted for a higher degree to any other university or institution.

Catie

Catie Chun Wan Lai

Statement of Candidate

I hereby confirm that all material contained in this project are my original authorship and ideas, except where the work of others has been acknowledged or referenced. I also confirm that the work has not been submitted for a higher degree to any other university or institution. The research project was approved by the Macquarie University Human Research Ethics Committee (Approval No. 5201800198).

Catie

Catie Chun Wan Lai

Acknowledgments

"No man is an island entire of itself; every man

is a piece of the continent, a part of the main;

if a clod be washed away by the sea, Europe

is the less, as well as if a promontory were, as

well as any manner of thy friends or of thine

own were; any man's death diminishes me,

because I am involved in mankind.

And therefore never send to know for whom

the bell tolls; it tolls for thee." - *John Donne (1624)*

Evaluating the Interpersonal Theory of Suicide and Measurement Invariance of the

Interpersonal Needs Questionnaire in Australian and Chinese Cultures

General Introduction

Globally, suicide is one of the leading causes of death. Figures released by World Health Organization (2017) show 800 000 deaths by suicide every year and an estimated twenty or more suicide attempts for each suicide. In Australia, suicide accounted for 1.8% of all deaths and contributed 10.5% of total years of potential life lost in 2016 (Australian Bureau of Statistics, 2016). In many parts of the world, including Australia and Hong Kong, suicide is the leading cause of death among individuals aged from 15 to 24 (Australian Institute of Health and Welfare, 2018; Committee on Prevention of Student Suicides, 2016; World Health Organization, 2017). Recently, the suicide rate of youth in Hong Kong has further increased (Committee on Prevention of Student Suicides, 2016), with suicide claiming two times more lives in 2016, compared with 2015. Given these findings, youth suicide has become a priority public health issue, making suicide and related behaviors one of the most important research priorities (World Health Organization, 2014).

Early Theories of Suicide

Different theoretical frameworks have been proposed to explain the causal processes linking risk factors and suicide (see Selby, Joiner, & Ribeiro, 2014). Examples of early theories of suicide include Durkheim's sociological theory (1897), Baumeister's escape theory (1990), Linehan's emotion dysregulation theory (1993), Beck's hopelessness theory (Beck, Steer, Kovacs, & Garrison, 1985; Beck, 1996), and Shneidman's psychache theory (1998). According to these theories, the cause of suicide or the factors promoting suicidal

behaviors range from societal structures, aversive self-awareness, emotional conflicts, feelings of hopelessness, to 'psychache' (psychological pain). Each of these theories has its strengths and weaknesses (for a comprehensive discussion, see Selby, Joiner, & Ribeiro, 2014). However, one common limitation of these theories is the failure to address why only some at-risk individuals displaying aversive self-awareness, high level of hopelessness, or emotion dysregulation (etc.) actually commit suicide while others do not.

Some authors suggest that the explanatory failure of these early theories results from the use of vague or inconsistent terms (Klonsky, May, & Saffer, 2016; Van Orden, Witte, Cukrowicz, Braithwaite, Selby, & Joiner, 2010). In those early theories, suicidal ideation and suicide attempts were commonly encompassed by an umbrella term (e.g., suicidal behavior) without meaningfully differentiating between various aspects of suicidal behavior (e.g., suicidal thoughts, plans for committing suicide, nonfatal attempts, and fatal suicide attempts). It is now generally accepted that these various aspects of suicidal behavior have different prevalence rates, correlates, causes, and consequences (for a review, see Klonsky, May, & Saffer, 2016). For example, a meta-analysis revealed a difference in pooled lifetime prevalence of suicidal ideation (3.9%) and suicide attempt (0.8%) in China (Cao, Zhong, Xiang, Ungvari, Lai, Chiu, & Caine, 2015). In addition, the oft-cited risk factors for suicide, such as hopelessness and emotion dysregulation, are the predictors of suicidal ideation only, but not suicide attempts (Klonsky, Saffer, & Bryan, 2017). Therefore, Klonsky and May (2014) propose that theories for suicide should be guided by an "ideation-to-action" framework, in which risk factors should be addressed specifically for suicide ideation, suicide attempts in those ideating, or both. Such a framework can help generate knowledge about the progression from suicidal ideation to suicide attempts and thus form a comprehensive theory of suicide.

Ideation-to-Action Theories of Suicide

To date, there are three commonly cited ideation-to-action theories of suicide. They are the interpersonal theory of suicide (Van Orden et al., 2010), the integrated motivational-volitional model (O'Connor, 2011; O'Connor & Kirtley, 2018), and the three-step theory (Klonsky & May, 2015). Each of these theories differ with respect to the motivations for suicide, but they all emphasize the significance of interpersonal needs (e.g., belongingness, connectedness, and perception of burden) on aspects of suicidal behaviors. For example, in O'Connor's model (O'Connor, 2011; O'Connor & Kirtley, 2018), belongingness and perception of burden are the moderators influencing the development of suicidal ideation or intent from feelings of defeat or humiliation. On the other hand, Klonsky and May's three-step theory (2015) proposes that the co-occurrence of pain and hopelessness leads to suicidal ideation. The pain refers to psychological or emotional pain caused by various sources, such as interpersonal conflicts (Klonsky & May, 2015), social isolation, perceived burdensomeness and low belongingness (Klonsky, May, & Saffer, 2016). Suicidal ideation escalates and becomes strong and active when pain exceeds connectedness to loved and valued ones.

Interpersonal Theory of Suicide

Interpersonal needs also play an essential role in the interpersonal theory of suicide. The interpersonal theory was first proposed by Joiner (2005) and further articulated by Van Orden and colleagues (2010). This theory suggests that the two interpersonal states (i.e., thwarted belongingness and perceived burdensomeness) are the proximal causes of passive suicidal ideation. Thwarted belongingness refers to a psychological state resulting from an unmet need for connectedness, which can be operationally defined as social isolation, loneliness, or low levels of perceived social support from others. Perceived burdensomeness

refers to a mental state resulting from an unmet need for social competence, which can be reflected by a perception that one is a burden on others or by a sense that others would be better off without the person. The transition from passive suicidal ideation to active suicidal desire is facilitated by hopelessness about the unchangeableness of these interpersonal states. However, an active suicidal desire is necessary but not sufficient for causing a lethal suicidal attempt. Instead, the simultaneous presence of the capability for suicide and active suicidal desire is required. Together these constitute a sufficient cause of a lethal suicidal attempt. The capability for suicide refers to a sense of fearlessness about death and an elevated tolerance for physical pain. This capability is gained by the habituation following repeated exposure to painful and provocative experiences. This capability, once developed, is not amenable to clinical interventions. In contrast, thwarted belongingness and perceived burdensomeness are amenable to change. Therefore, the two interpersonal factors (thwarted belongingness and perceived burdensomeness) are particularly useful for guiding suicide prevention.

Interpersonal Needs Questionnaire

Given the theoretical and practical significance of these interpersonal factors, Van Orden (2009) developed the Interpersonal Needs Questionnaire (INQ) comprising 25 items to assess an individual's extent of thwarted belongingness and perceived burdensomeness. This original INQ and some shorter versions, including an 18-item, 15-item, 12-item, and 10-item INQ, were employed by many studies to test the interpersonal theory (for reviews, see Chu et al., 2017; Ma, Batterham, Calear, & Han, 2016; Stewart, Eaddy, Horton, Hughes & Kennard, 2017). Although these INQs have been extensively used, only the 25-item and 15-item INQs have clear documentation for their development and psychometric evaluation in the literature (Hill, Rey, Marin, Sharp, Green, & Pettit, 2015; Van Orden et al., 2012). Other shorter versions have received far less attention. However, Hill and colleagues (2015) recently

psychometrically evaluated and compared all five versions of the INQ and reported that the

10-item and 15-item INQs have good psychometric properties.

Interpersonal Needs and Cultures

Despite progress in substantiating the psychometric properties of various versions of

the INQ, these evaluations have predominantly been conducted in the United States. While

valuable, there is nevertheless also a need to psychometrically evaluate the INQ in other

cultures (Van Orden, Cukrowicz, Witte, & Joiner, 2012). This may be especially so for

within non-Western cultures (e.g., Chinese cultures) because the impact of the interpersonal

factors (thwarted belongingness and perceived burdensomeness) may not automatically

generalize to non-Western cultures. One reason for this relates to cultural differences in self-

construal. Individuals in Chinese cultures tend to have a more interdependent self-construal,

relative to individuals in Western cultures who tend to have a more independent self-

construal (Lou & Li, 2017; Markus & Kitayama, 2010; Zhu, Zhang, Fan, & Han, 2007). This

means that identity tends to be interwoven with relationships in Chinese cultures, and thus

relational stress may have a bigger impact in Chinese cultures compared to Western cultures.

Similarly, self-construal also tends to affect individuals' need to belong. For example, Chang

(2015) found that people with higher interdependent self-construal showed a stronger need to

belong than those with more independent self-construals. Therefore, people in Chinese

cultures may have a greater need to belong, and so the influence of thwarted belongingness

may be more pronounced in Chinese cultures compared to Western cultures.

On the other hand, compared with individuals in Western cultures (e.g., North

American and European Canadian), individuals in non-Western cultures (e.g., Hong Kong

Chinese and Japanese) tend to perceive having lower relational mobility (Lou & Li, 2017;

Sato, Yuki, & Norasakkunkit, 2014). Relational mobility refers to individuals' amount of

opportunities to both voluntarily form new relationships and terminate old ones in a given culture or social context (Sato, Yuki, & Norasakkunkit, 2014; Schug, Yuki, & Maddux, 2010). Relative to people with independent self-construal (e.g., North American), people with interdependent self-construal (e.g., Chinese) tend to experience a heightened sensitivity to others' evaluations (Markus & Kitayama, 2010) and social rejection (Lou & Li, 2017; Sato, Yuki, & Norasakkunkit, 2014). Taken together the apparent cultural differences in self-construal, relational mobility, need to belong, and sensitivity to social rejection and others' evaluations, there are questions concerning the generalizability of the interpersonal theory and the INQ to non-Western cultures, and especially so for Chinese cultures.

The Current Dissertation

Given the recent increase in suicide in the Chinese populations (Cheng, Chen, Lee & Yip, 2017), there is a pressing need to develop a psychometrically adequate Chinese version of the INQ for testing the interpersonal theory of suicide and shed light on the mechanisms of suicidal behaviors in Chinese cultures. Accordingly, one purpose of this dissertation was to translate the INQ into Chinese and examine its factorial structure and psychometric properties. A second purpose was to establish measurement invariance across Australian and Chinese cultures for the INQ and examine the cross-cultural generalizability of the interpersonal theory of Suicide using a cross-culturally equivalent INQ.

This dissertation consists of two articles in a mini-thesis by publication. Article 1 aimed at translating the INQ into Chinese and examining its factorial structure and psychometric properties. We translated the INQ into Chinese and examined its factorial structure and psychometric properties. We also tested and compared the psychometric appropriateness of different versions of the Chinese INQ (i.e., 10-item, 14-item and 15-item). This article, entitled "Translation and validation of the Chinese versions of the Interpersonal

Needs Questionnaire" was submitted to *Psychological Assessment* and is currently under review.

Article 2 aimed at establishing measurement invariance across Chinese and Australian cultures for the INQ and examining the cross-cultural generalizability of the interpersonal theory of suicide using a cross-culturally equivalent INQ. We conducted a series of multigroup confirmatory factor analyses to examine measurement invariance across cultures. We also performed multigroup structural equation models and Wald tests to compare the associations of the interpersonal factors with suicide ideation across cultures. Additionally, we performed single-group structural equation models to individually examine the predictive effect of the two-way interaction between the interpersonal factors on suicidal ideation in Chinese and Australian cultures. This article, entitled "The cross-cultural generalizability of the Interpersonal Theory of Suicide and measurement invariance of the Interpersonal Needs Questionnaire" was submitted to *Assessment* and is currently under for review.

The reference lists of each article and each part of this dissertation were combined to form one reference list (presented after the discussion part of this dissertation).

Article 1:

Translation and Validation

of the Chinese Versions of the Interpersonal Needs Questionnaire

Abstract

The Interpersonal Needs Questionnaire (INQ) was developed to measure the two proximal causes of desire for suicide (i.e., thwarted belongingness and perceived burdensomeness), according to the interpersonal theory of suicide. Existing studies in Chinese cultures have not utilized a culturally validated INQ. This study aimed to translate the INQ into Chinese and examine its factorial structure and psychometric properties. This study also aimed to test and compare the psychometric appropriateness of different Chinese versions of the INQ (10-item and 15-item). A sample of 854 Chinese undergraduates was randomly split into two samples for performing exploratory factor analyses and confirmatory factor analyses to test the measurement models of the Chinese INQ. Structural equation models were performed to test the convergent, divergent and concurrent validity of the Chinese INQ. Results support that the 14-item Chinese INQ retained from the factor analyses reliably measured the two constructs with adequate internal consistency. Both constructs exhibited convergent associations (i.e., burdensomeness with self-esteem and belongingness with loneliness and social support) for the 10-item, 14-item, and 15-item Chinese INQ. Burdensomeness demonstrated concurrent associations with suicidal ideation for the 14-item, and 15-item Chinese INQ. Future research should consider using the 14-item and 15-item Chinese INQ.

Public Significance Statement

This study developed the 14-item Chinese INQ and supports its use as a brief measure of suicide risk in research settings among Chinese populations. This study also indicates the potential of the 14-item and 15-item INQ to be developed into cross-culturally equivalent measures and their utility in cross-cultural research.

Keywords: risk assessment, interpersonal theory, suicidal ideation, factorial structure, construct validity

Translation and Validation of the Chinese Versions of the Interpersonal

Needs Questionnaire

Suicide is a major public health issue worldwide, accounting for 800 000 deaths by

suicide every year (World Health Organization, 2017). This amounts to one person dying by

suicide every 40 seconds. Furthermore, for each suicide, there is an estimated twenty or more

suicide attempts (World Health Organization, 2017). Additionally, according to projections

by the World Health Organization (2013), suicide will remain a leading cause of death

worldwide through 2030. Suicide is also a widespread public health issue in Asian countries

(Snowdon, Chen, Zhong, & Yamauchi, 2018). In particular, there is a recent increase in

suicides among Chinese students in Hong Kong (Cheng, Chen, Lee & Yip, 2017). In Hong

Kong, for instance, suicides among college students in 2016 were almost two times higher

than in 2015 (Committee on Prevention of Student Suicides, 2016). The spate of suicides has

led to in-depth inquiry into the antecedents of suicide (Cheng at al., 2017).

There are numerous risk factors for suicide including demographic factors (e.g., age,

gender, and marital status), the presence of psychiatric disorders, certain personality traits,

insomnia (Hawton & Van Heeringen, 2009; May & Klonsky, 2016; Van Orden, Witte,

Cukrowicz, Braithwaite, Selby, & Joiner Jr, 2010; Quilty, Mainland, McBride, & Bagby,

2013). Most of these risk factors are contextualized in the interpersonal theory of suicide

(Christensen, Batterham, Mackinnon, Donker, & Soubelet, 2014; Van Orden et al., 2010). As

first articulated by Joiner (2005), the interpersonal theory of suicide proposes the etiology of

suicide by depicting the causal pathway of three constructs: thwarted belongingness,

perceived burdensomeness and acquired capability for suicide. Thwarted belongingness

refers to a psychological state resulting from an unmet need for connectedness, which can be

operationally defined as social isolation, loneliness, or low levels of perceived social support

from others. Perceived burdensomeness refers to a mental state resulting from an unmet need

for social competence, which can be reflected by a perception that one is a burden on others or by a sense that others would be better off without the person. The joint occurrence of the two interpersonal states (thwarted belongingness and perceived burdensomeness) causes passive suicidal ideation. Hopelessness about the unchangeableness of these states intensifies the passive suicidal ideation into becoming an active desire for suicide. The simultaneous presence of active suicidal desire and capability for suicide is then a sufficient cause of lethal suicidal attempt. The capability for suicide refers to a sense of fearlessness about death and elevated tolerance for physical pain. This capability is gained by the habituation following repeated exposure to painful and provocative experiences.

The interpersonal theory of suicide is the first theory making specific predictions about the desire to die by suicide and the ability to act on that desire and has been extensively examined (for reviews, see Chu et al., 2017; Ma, Batterham, Calear, & Han, 2016; Stewart, Eaddy, Horton, Hughes & Kennard, 2017). Additionally, the theory's account of the distinct mechanisms of suicidal ideation and suicide attempts has important implications for suicide intervention. According to Joiner (2005), the capability for suicide, once developed, is not amenable to clinical interventions. However, thwarted belongingness and perceived burdensomeness are amenable to change. Therefore, suicide intervention should be applied prior to the acquirement of the capability for suicide. Identifying risk factors that are associated with thwarted belongingness and perceived burdensomeness is thus particularly useful for suicide prevention.

Many studies have found that the interpersonal constructs (thwarted belongingness and perceived burdensomeness) mediate the associations between the risk factors and suicide. For example, Hill and colleagues (2018) demonstrated that both thwarted belongingness and perceived burdensomeness mediated the relationship between depressive symptoms and suicidal ideation. Similarly, Hill and Pettit (2013) found that both thwarted belongingness

and perceived burdensomeness explained the mechanisms underlying the negative

association between suicidal ideation and basic psychological needs (i.e., relatedness,

competence, and autonomy). Additionally, Chu and colleagues (2016) demonstrated that

thwarted belongingness mediated the relationship between insomnia and suicidal ideation.

Therefore, a valid assessment of these interpersonal constructs provides a useful tool for

identifying individuals with high suicidal risks and provision of interventions in early stages.

Given the practical significance of the interpersonal constructs, Van Orden (2009)

developed the Interpersonal Needs Questionnaire (INQ) comprising 25 items to assess an

individual's extent of thwarted belongingness and perceived burdensomeness. The INQ has

been widely used since it was first published (for reviews, see Chu et al., 2017; Ma et al.,

2016; Stewart et al., 2017). For example, the 25-item INQ was used to examine the role of

emotion dysregulation in suicidal behavior (Anestis, Bagge, Tull, & Joiner, 2011).

Nevertheless, shorter versions of the INQ tend to be used, including an 18-item INQ

(Davidson, Wingate, Grant, Judah, & Mills, 2011; Wong, Koo, Tran, Chiu, & Mok, 2011), a

12-item INQ (Lamis & Lester, 2012), and a 10-item INQ (Bryan, Clemans, & Hernandez,

2012; Bryan, Morrow, Anestis, & Joiner, 2010).

Although the original INQ (25 items) and its shorter versions (the 18-item, 12-item,

and 10-item INQ) have been extensively used as the measure of thwarted belongingness and

perceived burdensomeness, information on the development of the shorter versions has been

scarce (Hill, Rey, Marin, Sharp, Green, & Pettit, 2015). As a result, Van Orden and

colleagues (2012) have performed a series of exploratory factor analyses (EFAs) and

confirmatory factor analyses (CFAs) to develop a refinement of the original INQ. Their

results suggested a 15-item INQ, with nine items representing thwarted belongingness and six

items representing perceived burdensomeness. Along with different shorter versions of the

INQ, the 15-item INQ has also been used in many studies. For example, the 15-item INQ has

been used to show the processes underlying the association between suicidal ideation and the basic psychological needs (Hill & Pettit, 2013).

Both Van Orden (2009) and Van Orden et al. (2012) provide an initial psychometric evaluation for the original INQ and its 15-item refinement. Using CFA, they demonstrated support for the two-factor structure for both the original INQ and its 15-item refinement. Using the original INQ and the 15-item INQ, Van Orden (2009) and Van Orden et al. (2012) demonstrated convergent, but not divergent, validity for thwarted belongingness. Regarding perceived burdensomeness, results partly supported both convergent and divergent validity for the original INQ and the 15-item INQ (Van Orden, 2009; Van Orden et al., 2012).

With respect to concurrent validity, the interpersonal theory of suicide proposes that the primary outcome of perceived burdensomeness and thwarted belongingness is suicidal ideation. Therefore, the concurrent validity of the INQ can be assessed by examining the concurrent associations of perceived burdensomeness and thwarted belongingness with suicidal ideation. There is extensive evidence for the concurrent validity of the original INQ and the 15-item INQ (Hill et al., 2015, Van Orden et al., 2012, You, Van Orden, & Conner, 2011; Van Orden, 2009; Van Orden et al., 2012). In summary, there is empirical support for both the factorial structure and construct validity of the original INQ and the 15-item INQ.

Although the INQ is a psychometrically adequate assessment for risk factors of suicide, most of the psychometric evaluations have been conducted in English-speaking countries. However, suicide is a global health problem and the authors of the INQ (Van Orden et al., 2012) also called for studies to examine the factorial structure and validity of the INQ in other ethnic populations. Since suicidal behaviors vary across cultures (Lester, 2012), assessments developed in a specific culture need to be translated and culturally adapted for application in other cultures (Fu, Liu, & Yip, 2007). The present study address the psychometric properties of the Chinese version of INQ. Given the recent increase in suicide

in the Chinese population (Cheng, Chen, Lee & Yip, 2017), a psychometrically adequate Chinese version of the INQ is necessary for testing the hypotheses posited by the interpersonal theory of suicide and shedding light on the mechanisms of suicidal behaviors in Chinese cultures. Although one previous study has translated the INQ into Chinese and demonstrated its concurrent validity (Zhang, Lester, Zhao, & Zhou, 2013), there has been no information on either the factorial structure or convergent and divergent validity of the Chinese version of the INQ. Additionally, this Chinese INQ was translated from the 18-item INQ (Zhang et al., 2013), instead of the empirically derived 15-item INQ (Van Orden et al., 2012). Therefore, there is a pressing need to develop a Chinese translation of the INQ and examine its psychometric properties.

The Current Study

The primary and secondary purposes of the present study were to translate the original INQ (25 items) into Chinese and examine its factorial structures and psychometric properties (i.e., reliability, convergent, divergent and concurrent validity). The factorial structures of the Chinese INQ were examined using both EFA and CFA. Although the 15-item INQ is an empirically derived refinement of the original INQ and has empirical evidence for its reliability and validity, a previous study validating the Slovene INQ (Podlogar, Žiberna, Poštuvan, & CR Kerr, 2017) showed that a two-factor structure with 12 items was a better fit. Therefore, we believed that performing the EFA with all 25 items of the original INQ would help develop a Chinese version of the INQ with the optimal psychometric properties for use in future research.

The tertiary purpose was to examine the factorial structures (model fit of CFA) and the psychometric properties of the 10-item and 15-item Chinese INQ because these two versions displayed good psychometric properties in English speaking populations and previous studies supported the use of these two versions for future research (Hill et al., 2015;

Van Orden et al., 2012). Additionally, most of the translations of the INQ are translated from the 15-item version (e.g., Hallensleben, Spangenberg, Kapusta, Forkmann, & Glaesmer, 2016; Silva, 2013). Knowledge about the psychometric adequacy of the Chinese version of the 10-item and 15-item INQ would help generalize findings in the Western cultures to the Chinese cultures.

Method

Participants and Study procedures

Participants were 854 undergraduates (male: $n = 458$, 53.8%; mean age = 20.02, SD = 1.66) at a university in Hong Kong. Ethical approval was obtained from the University Review Board. All participants provided written informed consent and were recruited through various methods including lecturers' invitation in class, researchers' invitation in workshop, and coaches' invitation in sport training sessions. The majority of the participants were born in Hong Kong and China (Hong Kong: 74.9%, China: 23.3%). Only one participant was excluded due to random responding on at least one item.

Measures

The Interpersonal Needs Questionnaire (Van Orden, 2009). The INQ is a 25-item measure of the interpersonal states (10 items for measuring thwarted belongingness and 15 items for measuring perceived burdensomeness). Items are presented with a 7-point Likert scale from 1 (not at all true for me) to 7 (very true for me). The English INQ has good internal consistency coefficients with Cronbach's $\alpha = .85$ for thwarted belongingness and $\alpha = .89$ for perceived burdensomeness (Van Orden et al., 2008). A standard procedure was applied for translation. The authors translated the Interpersonal Needs Questionnaire into Chinese. A professional translator then translated the Chinese translation back into English. The original English questionnaire was then compared to the back-translated English version item-by-item. Discrepancies were identified and adjustments to the Chinese translation were

made. Then, the authors administered the Chinese questionnaire to a small group of Chinese students, whose feedback was incorporated in the final Chinese translation. Reversed items were recoded, so that higher scores reflect higher levels of thwarted belongingness and perceived burdensomeness. Internal consistency of the INQ in this study is reported in the result section.

The 8-item UCLA Loneliness Scale (ULS-8; Hays & DiMatteo, 1987). The ULS-8 is a 8-item measure of loneliness. Items are presented with a 6-point Likert scale from 1 (strongly disagree) to 7 (strongly agree), with higher scores reflecting greater loneliness. Previous studies have indicated that the Chinese version of the ULS-8 exhibits good psychometric properties, including adequate internal consistency, convergent and divergent validity (e.g., Wu & Yao 2008). Internal consistency of the ULS-8 was good in this study (Cronbach's α = .84).

The Multidimensional Scale of Perceived Social Support (MSPSS; Zimet, Dahlem, Zimet, & Farley, 1988). The MSPSS is a 12-item measure of perceived social support from three sources: family, friends, and significant others (support from each source has 4 items). Items are presented with a 4-point Likert scale from 1 (strongly disagree) to 4 (strongly agree), with higher scores reflecting greater perceived social support. Previous studies have demonstrated that the Chinese MSPSS showed good psychometric properties, including adequate internal consistency, convergent and divergent validity (e.g., Zhou et al., 2015). A total score of perceived social support was obtained by summing the scores from all 12 items. Internal consistency of the MSPSS was excellent in this study (Cronbach's α = .90).

Rosenberg Self-Esteem Scale (RSE; Rosenberg, 1965, 1979). The RSE is a 10-item measure of self-esteem. Items are presented with a 4-point Likert scale from 1 (strongly disagree) to 4 (strongly agree). The 5 reversed items were recoded, so that higher scores reflect greater self-esteem. The Chinese version of RSE has been extensively used and

demonstrated to be a reliable and valid scale with Chinese populations (e.g., Zhao, Kong, & Wang, 2012). Internal consistency of the RSE was good in this study (Cronbach's α = .82).

The Scale for Suicide Ideation (SSI; Beck et al., 1979). The SSI is a 21-item measure of suicide ideation and prior suicidal behaviors. Items are presented with a 3-point Likert scale from 0 (a statement describing strong wish to live) to 2 (a statement describing no wish to live). Since items 20 and 21 assess prior suicidal behaviors, they were not used in this study. A total score of suicide ideation was obtained by summing the scores from items 1-19, with higher scores reflecting greater suicide ideation. The Chinese version of the SSI shows good reliability and convergent validity (Zhang & Brown, 2007). Internal consistency of the SSI was good in this study (Cronbach's α = .81).

Analytic Approach

The sample was randomly split into approximate halves to examine the factor structure of the Chinese INQ. The first half of the sample (n = 426) was used for a series of EFAs, and the second half (n = 427) was used for a series of CFAs. Prior to factor analysis, normality was assessed both visually and through the Shapiro-Wilk test using the SPSS software. The Shapiro-Wilk test was used because it is considered the most powerful test for symmetric short-tailed distributions, symmetric long-tailed distributions, and asymmetric distributions (Yap & Sim, 2011).

For the specification of the first EFA model, an EFA with the 25 INQ items as observed variables was conducted using Mplus Version 8 with maximum likelihood estimation robust (MLR) to non-normality and a geomin oblique rotation. MLR was used because item responses of the INQ were not normally distributed. A geomin oblique rotation was used because the factor indicators of the 25-item INQ showed substantial cross-loadings in published research (Van Orden et al., 2012). The number of factors to be retained was guided by theoretical interpretability and multiple criteria. The criteria were: an examination

of the scree plot, which involves retaining only those factors that fall above a steep drop off

point (Cattell, 1966); application of the Kaiser-Guttman criterion, which suggests retaining

factors with observed eigenvalues equal to or greater than 1.0 (Kaiser, 1960), and; parallel

analysis (Horn, 1965), which involves retaining factors with observed eigenvalues (i.e., the

eigenvalues from the actual data) exceeding the 95th percentile of randomly generated

eigenvalues (i.e., based on the distribution of eigenvalues extracted from simulative data)

(Glorfeld, 1995).

To examine the fit of the factor models, several global fit indices were considered.

There were the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), the root mean

square error of approximation (RMSEA), the standardized root mean square residual

(SRMR), and the chi-square. The chi-square statistic in the analyses with the MLR estimator

is the Yuan-Bentler scaled chi-square, which is adjusted for nonnormality. Good model fit is

indicated by RMSEA values of .06 or less, SRMR values of .08 or less (Hu & Bentler, 1999),

and CFI and TLI values close to .95 or greater (Brown, 2014). Values in the range of .08-.06

for RMSEA suggest reasonable fit (Brown, 2014). In the presence of good fit for other global

fit indices, values in the range of .90-.95 for CFI and TLI suggest acceptable fit (Brown,

2014).

Another EFA was performed after removing items that did not perform well. Item

deletion was guided by theory and an inspection of factor loadings. Poor factor indicators

were those that did not load onto the pre-specified factor (e.g., the items developed to

measure thwarted belongingness loaded onto perceived burdensomeness). Items with

inadequate loadings were items with low primary factor loadings and cross-loading items. A

primary loading of .40 or less is considered low primary loading (Floyd & Widaman, 1995).

Cross-loading items were items with a secondary factor loading of .30 or higher, or having a

small gap between the primary and secondary loading (i.e., the primary loading is not two

times greater than the secondary loading). This procedure was repeated until good fit was reached for each of the global fit indices.

A CFA was then conducted to examine the measurement model retained by the final EFA with the INQ items that were deemed to be the best indicators of the two factors (i.e., thwarted belongingness and perceived burdensomeness). Good factor indicators of perceived burdensomeness in the final EFA model were specified to only load onto perceived burdensomeness in the CFA, and similarly for thwarted belongingness. Additionally, two CFA were performed to test the measurement models of the 10-item and 15-item Chinese INQ. Refinements (e.g., setting a residual covariance) were guided by theory and modification indices to improve model fit until each of the measurement models for the INQ showed an adequate fit to the data. All CFA were performed with MLR as the estimator, using the second half of the sample ($n = 427$).

For examining internal consistency, Cronbach's alphas were generated for each factor (i.e., thwarted belongingness and perceived burdensomeness) of each of the measurement models, using the second half of the sample ($n = 427$). An alpha of .70 or more indicates good internal consistency (Nunnally & Bernstein, 1994).

For examining convergent validity, correlations between the interpersonal constructs and other theoretically related constructs were examined. For examining divergent validity, correlations between the interpersonal constructs and other theoretically unrelated constructs were examined. Thwarted belongingness is theoretically related to loneliness and social support, while perceived burdensomeness is theoretically related to self-esteem. Structural equation models (SEMs) with three variables (i.e., self-esteem, loneliness, and social support) regressed onto each of the INQ measurement models were conducted. Loneliness and social support were posited to relate to thwarted belongingness, whereas self-esteem was posited to relate to perceived burdensomeness (see the conceptual relationships as depicted in Figure 1).

For examining concurrent validity, SEMs with suicidal ideation regressed onto each of the

INQ measurement models were conducted. A total of six SEMs were run with MLR as the

estimator, using the second half of the sample ($n = 427$).

Figure 1. The conceptual relationships for examining convergent and divergent validity of
the INQ. The gray-shaded ovals were posited to be significantly related to give support to
convergent validity, so were the unshaded ovals; the gray-shaded ovals and unshaded ovals
were posited to be non-significantly related to give support to divergent validity.

Results

　　　　Descriptive statistics and interrelationship of the INQ items for the first half of the

sample are presented in Table 1. These data for the second half of the sample are similar and

therefore not presented here (they are available upon request). Values of kurtosis and

skewness suggested responses of the 25 INQ items were normally distributed, using the

cutoff critical values of 2.0 for skewness and 7.0 for kurtosis (West, Finch, & Curran, 1995).

However, the result of the Shapiro-Wilk test (i.e., $p = .00$ for all 25 INQ items) for both the

first half and the second half of the sample suggested responses of the 25 INQ items were not

normally distributed. Since the Shapiro-Wilk test is generally considered the most powerful

normality test, MLR was used as the estimator for all models.

Table 1 *Descriptive Statistics and Intercorrelations Among Interpersonal Needs Questionnaire Items for the First Sample (n = 426)*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1. TB1	-																								
2. TB2	.70	-																							
3. TB3	.67	.70	-																						
4. TB4	.61	.63	.74	-																					
5. TB5	.45	.52	.53	.52	-																				
6. TB6	.28	.26	.22	.27	.12*	-																			
7. TB7	.39	.38	.40	.43	.29	.30	-																		
8. TB8	.34	.36	.40	.42	.42	.23	.28	-																	
9. TB9	.45	.45	.44	.49	.34	.51	.48	.36	-																
10. TB10	.38	.38	.42	.40	.29	.27	.62	.35	.53	-															
11. PB1	.55	.48	.59	.59	.43	.13*	.44	.32	.33	.43	-														
12. PB2	.18	.13**	.10*	.10*	.04†	.28	.33	.11*	.26	.34	.19	-													
13. PB3	.14**	.15**	.12*	.16**	.08†	.35	.31	.15	.34	.37	.20	.65	-												
14. PB4	.39	.41	.47	.48	.41	.11**	.31	.31	.25	.33	.52	.10*	.11*	-											
15. PB5	.24	.28	.29	.28	.12*	.41	.42	.24	.39	.39	.31	.50	.60	.21	-										
16. PB6	.21	.19	.21	.22	.17	.34	.40	.23	.32	.34	.29	.59	.60	.17	.61	-									
17. PB7	.26	.26	.23	.22	.16	.44	.40	.21	.44	.42	.27	.40	.47	.22	.50	.48	-								
18. PB8	.32	.31	.30	.31	.21	.47	.54	.23	.48	.49	.35	.44	.57	.29	.62	.51	.75	-							
19. PB9	.30	.32	.34	.30	.19	.46	.56	.23	.48	.48	.33	.42	.52	.26	.57	.48	.68	.81	-						
20. PB10	.25	.19	.24	.24	.30	.09†	.24	.27	.25	.31	.33	.20	.16*	.31	.15*	.26	.22	.18	.15*	-					
21. PB11	.34	.34	.44	.39	.38	.26	.33	.41	.34	.39	.38	.24	.27	.47	.31	.25	.39	.42	.38	.41	-				
22. PB12	.37	.40	.45	.45	.42	.22	.32	.40	.35	.38	.42	.26	.28	.52	.25	.29	.32	.35	.34	.46	.57	-			
23. PB13	.35	.36	.37	.38	.40	.14*	.32	.40	.30	.30	.44	.26	.23	.44	.21	.26	.35	.29	.28	.45	.48	.65	-		
24. PB14	.20	.26	.26	.24	.17	.37	.44	.19	.48	.53	.25	.37	.50	.20	.50	.42	.58	.66	.65	.22	.35	.32	.25	-	
25. PB15	.34	.27	.31	.33	.31	.13	.26	.28	.29	.33	.35	.25	.17	.33	.16*	.26	.33	.26	.23	.65	.32	.42	.44	.28	-
Mean	2.76	2.60	2.70	2.54	3.25	2.48	3.14	3.07	2.66	2.91	2.90	3.42	2.86	3.30	2.66	3.21	2.38	2.33	2.39	3.32	2.73	2.82	2.80	2.11	3.42
variance	1.29	1.21	1.05	1.06	1.54	1.39	2.08	1.65	1.53	1.61	1.35	1.73	1.50	1.41	1.37	1.73	1.56	1.39	1.46	1.32	1.23	0.97	1.19	1.27	1.49
Skewness	1.15	1.27	1.03	1.17	0.90	0.96	0.44	0.71	0.67	0.48	0.85	0.17	0.76	0.49	0.75	0.38	1.02	0.94	0.95	0.30	0.77	0.69	0.69	1.02	0.51
Kurtosis	1.33	2.13	2.09	2.61	0.78	0.94	-0.37	0.57	0.02	-0.25	1.14	-0.64	0.62	0.55	0.62	-0.35	0.84	0.56	0.65	-0.02	0.95	0.90	0.68	0.73	0.22
n	426	425	424	425	425	426	426	425	425	425	425	426	426	424	424	426	426	424	426	425	426	426	426	423	425

Note. All unmarked correlations are significant at *p* < .001.

*p < .05, **p < .01, and †p > .05.

Exploratory Factor Analyses

An initial examination of factors with eigenvalues greater than one and the scree plot test suggested a four-factor solution. However, Kaiser's criterion has a tendency to overestimate the number of factors (Zwick & Velicer, 1986). Result of the parallel analysis (see Table 2) was used as a guide for selecting an appropriate number of factors to extract. This is because parallel analysis has been demonstrated to be more accurate than Kaiser's criterion and other commonly used criteria (Ledesma & Valero-Mora, 2007). Parallel analysis suggested a three-factor solution. Inspection of the factor structure and loadings revealed that the factors were not theoretically interpretable. Considering the small difference between the third observed eigenvalue (1.67) and the third 95th percentile parallel eigenvalue (1.34), a two-factor solution was extracted. The fit of the factor models are presented in Table 2. The two-factor model with 25 items did not fit well (Y-Bχ^2 (251) = 1074.410, RMSEA = .09 (90%CI = .08-.09), CFI = .81, TLI = .77, SRMR = .06).

The standardized estimated factor loadings are displayed in Table 3. The pattern of factor loadings was reviewed to identify poor factor indicators. Of the 10 items developed to represent thwarted belongingness, 6 items clearly loaded onto a "belongingness" factor. Of the 15 items developed to represent perceived burdensomeness, 8 items clearly loaded onto a "burdensomeness" factor. 7 items did not load onto the expected factor they were developed to represent and 4 items did not clearly load onto either factor. Therefore, a total of 11 items were eliminated to improve model fit. The remaining 14 items were analyzed with a second EFA. This analysis resulted in two factors with eigenvalues greater than one.

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Table 2 *Fit Statistics for Exploratory Factor Analysis/Confirmatory Factor Analysis Models*

	$\chi 2$	df	CFI	TLI	RMSEA (90% CI)	SRMR	Eigenvalue	Eigenvalue (PA)
"Good fit" indicated by:			≥.95	≥.95	≤.06	≤.08		
"Acceptable fit" indicated by:			≥.90	≥.90	≤.08			
Sample 1 (*n* = 426)								
Original model: 25 items								
1 factor	2148.246**	275	.57	.53	.13 (.122 - .131)	.12	9.518	1.532
2 factors	1074.410**	251	.81	.77	.09 (.082 - .093)	.06	3.205	1.436
3 factors	745.867**	228	.88	.84	.07 (.067 - .079)	.04	1.668	1.367
4 factors	535.214**	206	.92	.89	.06 (.055 - .068)	.03	1.058	1.340
Revised model: 14 items								
1 factor	1031.648**	77	.58	.50	.17 (.161 - .180)	.15	5.906	1.372
2 factors	279.826**	64	.91	.86	.09 (.078 - .100)	.05	2.743	1.292
3 factors	91.482**	52	.98	.97	.04 (.027 - .056)	.02	0.988	1.233

| | | | | | | | Internal consistency (α) | |
	$\chi 2$	df	CFI	TLI	RMSEA (90% CI)	SRMR	PB	TB
Sample 2 (*n* = 427)								
CFA: 14 items	299.088**	76	.90	.88	.08 (.073 - .093)	.06	.91	.86
One correlated error was set	233.994**	75	.93	.92	.07 (.060 - .081)	.05	-	-
Two correlated error were set	200.802**	74	.95	.93	.06 (.053 - .074)	.05	-	-
CFA: 15 items	464.523**	89	.84	.82	.10 (.091 - .108)	.10	.90	.86
One correlated error was set	414.348**	88	.86	.84	.09 (.084 - .010)	.11	-	-
Two correlated error were set	368.420**	87	.88	.86	.09 (.078 - .096)	.11	-	-
CFA: 10 items	233.443**	34	.85	.81	.12 (.103 - .132)	.08	.88	.79
One correlated error was set	178.658**	33	.89	.86	.10 (.087 - .117)	.07	-	-
Two correlated error were set	133.705**	32	.93	.90	.09 (.071 - .102)	.06	-	-

Note. Robust Maximum Likelihood estimation was used. $\chi 2$ = Yuan-Bentler scaled Chi-Square; CFI = comparative fit index; TLI = Tucker-Lewis Index; RMSEA = root mean square error of approximation; CI=confidence interval; SRMR= standardized root mean square residual. Eigenvalue (PA) = 95th percentile of eigenvalues from parallel analysis. α = Cronbach's alpha. TB = thwarted belongingness. PB = perceived burdensomeness. *p < .05 **p < .001.

Table 3 *Standardized Factor Loadings of Exploratory Factor Analysis for the Two-Factor Model (25 items) and the Revised Models (14 items)*

		25 items		14 items	
		Factor		Factor	
Item	Item content	Belong	Burden	Belong	Burden
Thwarted belongingness subscale item					
TB1	*I am close to other people*	**.750***	.002	**.764***	.025
TB2	*I feel that there are people I can turn to in times of need*	**.763***	.000	**.803***	.019
TB3	*other people care about me*	**.858***	-.047	**.880***	-.019
TB4	*I am fortunate to have many caring and supportive friends*	**.827***	-.033	**.815***	.000
TB5	*I feel like I belong*	**.695***	-.092	**.644***	-.048
TB6	I rarely interact with people who care about me	.065	**.502***	-	-
TB7	I often feel like an outsider in social gatherings	.314*	.463*	-	-
TB8	*I have at least one satisfying interaction every day*	**.498***	.070	**.445***	.093
TB9	I feel disconnected from other people	.372*	.405*	-	-
TB10	I feel unwelcome in most social situations	.336*	.437*	-	-
Perceived burdensomeness subscale item					
PB1	*I think I contribute to the well-being of the people in my life*	**.665***	.083	-	-
PB2	I feel like a burden on the people in my life	-.103	**.631***	-.117	**.625***
PB3	I think I make things worse for the people in my life	-.142*	**.755***	-.136*	**.748***
PB4	*I think I matter to the people in my life*	**.598***	.028	-	-
PB5	I think the people in my life wish they could be rid of me	.014	**.709***	.040	**.704***
PB6	I think I have failed the people in my life	-.006	**.649***	-.014	**.651***
PB7	I think I am a burden on society	-.024	**.791***	-.026	**.792***
PB8	The people in my life would be happier without me	.003	**.887***	.014	**.892***
PB9	The people in my life would be better off if I were gone	.022	**.835***	.046	**.830***
PB10	*I think I give back to society*	**.364***	.103	-	-
PB11	*I think people in my life would miss me if I went away*	.438*	.267*	-	-
PB12	*I think I am an asset to the people in my life*	**.532***	.183	-	-
PB13	*I think my ideas, skills, or energy make a difference*	**.494***	.146	-	-
PB14	I think my death would be a relief to the people in my life	.002	**.738***	.005	**.724***
PB15	*I think I contribute to my community*	**.393***	.157	-	-

Note. Loadings with asterisk are statistically significant (critical value > 1.96).
   Bolded loadings are twice as large as loadings on the other factor.
   Italicized items are reversed-scored. Van Orden (2009) did not mark PB4 as a reversed-scored item.
   However, this study considered PB4 as a reversed-scored item given its conceptual meaning.
   Belong = thwarted belongingness; Burden = perceived burdensomeness.

Parallel analysis also suggested a two-factor solution. This two-factor model with 14 items fit modestly well (Y-Bχ^2 (64) = 279.826, RMSEA = .09 (90%CI = .08-.10), CFI = .91, TLI = .86, SRMR = .05). All items loaded strongly onto the factor they were developed to represent (see Table 3). All secondary factor loadings were less than .15, indicating no cross-loading items. The "belongingness" factor was composed of 6 items and the "burdensomeness" factor was composed of 8 items.

Confirmatory Factor Analyses

The two-factor structure retained from the second EFA was next evaluated by CFA. For the specification of the initial CFA model, a measurement model was specified with two correlated factors composed of 14 items. Each item was only an indicator of its respective factor (i.e., either thwarted belongingness or perceived burdensomeness). Cross-loadings were fixed to 0. The first CFA indicated acceptable model fit according to CFI and SRMR (i.e., CFI = .90, SRMR = .06) and marginal model fit according to the TLI and RMSEA (i.e., RMSEA = .08 (90%CI = .07-.09) and TLI = .88). The modification indices were inspected to identify the source of misfit. The modification indices suggested that few pairs of factor indicators should covary. Each pair of factor indicators shared similar wording or content. Therefore, two additional CFA were conducted by using an iterative process wherein one correlated error was set for a pair of factor indicators at each model rerun, followed by reexamining the model fit, and repeating the process. A total of two correlated error were set through this process. The first pair of factor indicators was "I feel like a burden on the people in my life" and "I think I make things worse for the people in my life". The second pair of factor indicators was "I think the people in my life wish they could be rid of me" and "I think I am a burden on society". These factor indicators clearly loaded onto the burdensomeness factor.

The fit of each CFA model are presented in the bottom of Table 2. The final CFA model provided an adequate fit to the data (Y-Bχ^2 (74) = 200.802, RMSEA = .06 (90%CI = .05-.07), CFI = .95, TLI = .93, SRMR = .05). The standardized estimated factor loadings, covariances, residual covariances, and R-square values are displayed in Table 4. All items significantly loaded onto the specified latent variable and R-square values ranged from .24 to .74. Correlation between the perceived burdensomeness factor and the thwarted belongingness factor was moderate (covariance = .41). These results suggest the current model adequately measures both of the latent variables (i.e., thwarted belongingness and perceived burdensomeness). Furthermore, the results suggest that the items included in the model are reasonably good indicators of the two latent variables, and that these two latent variables are correlated yet distinct factors, supporting the appropriateness of the two-factor solution.

Table 4 *Standardized Estimated Factor Loadings, Covariances, Residual Covariances, R-Square Values of the CFA Models*

		15 items			14 items			10 items		
		Est	*SE*	R^2	Est	*SE*	R^2	Est	*SE*	R^2
Thwarted belongingness subscale item										
TB1	I am close to other people	.723	.030	.522	.726	.031	.527	.485	.053	.236
TB2	I feel that there are people I can turn to in times of need	.793	.028	.628	.787	.030	.619	-	-	-
TB3	other people care about me	.817	.022	.667	.843	.020	.711	-	-	-
TB4	I am fortunate to have many caring and supportive friends	.803	.028	.645	.821	.025	.674	.542	.054	.294
TB5	I feel like I belong	.639	.036	.408	.644	.036	.414	.458	.057	.210
TB6	I rarely interact with people who care about me	.434	.043	.188	-	-	-	-	-	-
TB7	I often feel like an outsider in social gatherings	.555	.043	.308	-	-	-	.750	.034	.563
TB8	I have at least one satisfying interaction every day	.503	.044	.253	.493	.043	.243	-	-	-
TB9	I feel disconnected from other people	.582	.043	.339	-	-	-	.798	.031	.637
TB10	I feel unwelcome in most social situations	-	-	-	-	-	-	-	-	-
Perceived burdensomeness subscale item										
PB1	I think I contribute to the well-being of the people in my life	-	-	-	-	-	-	-	-	-
PB2	I feel like a burden on the people in my life	-	-	-	.503	.044	.253	-	-	-
PB3	I think I make things worse for the people in my life	.629	.037	.395	.697	.033	.485	.615	.039	.378
PB4	I think I matter to the people in my life	-	-	-	-	-	-	-	-	-
PB5	I think the people in my life wish they could be rid of me	.649	.040	.421	.735	.034	.540	.676	.039	.456
PB6	I think I have failed the people in my life	-	-	-	.676	.036	.457	-	-	-
PB7	I think I am a burden on society	.793	.029	.629	.802	.028	.643	-	-	-
PB8	The people in my life would be happier without me	.890	.022	.791	.862	.024	.743	.873	.023	.762
PB9	The people in my life would be better off if I were gone	.875	.018	.766	.847	.019	.717	.890	.018	.792
PB10	I think I give back to society	-	-	-	-	-	-	-	-	-
PB11	I think people in my life would miss me if I went away	-	-	-	-	-	-	-	-	-
PB12	I think I am an asset to the people in my life	-	-	-	-	-	-	-	-	-
PB13	I think my ideas, skills, or energy make a difference	-	-	-	-	-	-	-	-	-
PB14	I think my death would be a relief to the people in my life	.679	.045	.462	.680	.043	.462	.667	.045	.445
PB15	I think I contribute to my community	-	-	-	-	-	-	-	-	-
Covariance/residual covariances										
	Belong with Burden	.500	.057	-	.408	.055	-	.718	.060	-
	PB2 with PB3	-	-	-	.432	.053	-	-	-	-
	PB5 with PB7	-	-	-	-.377	.058	-	-	-	-
	PB3 with PB5	.387	.060	-	-	-	-	.381	.061	-
	TB6 with TB9	.404	.058	-	-	-	-	-	-	-
	TB1 with TB4	-	-	-	-	-	-	.415	.058	-

Note. Belong = thwarted belongingness; Burden = perceived burdensomeness.

For the two CFA testing the factor structures of the 10-item and 15-item Chinese INQ, the fit of each model are also presented in the bottom of Table 2. Both initial CFA models for testing the 10-item and 15-item Chinese INQ did not fit well. Similar to the published results of the 10-item (Hill et al., 2015) and 15-item INQ (Van Orden et al.. 2012), the modification indices suggested that two pairs of factor indicators should covary due to shared content not accounted for by the respective latent variable. Two correlated error were set for both the 10-item and 15-item INQ through the same process for refining the CFA model for the 14-item INQ. These four pairs of factor indicators are specified in the bottom of Table 4. The final CFA model for the 10-item INQ fit modestly well (Y-Bχ^2 (32) = 133.705, RMSEA = .09 (90%CI = .07-.10), CFI = .93, TLI = .90, SRMR = .06). The final CFA model for the 15-item INQ indicated marginal model fit to the data (Y-Bχ^2 (87) = 368.420, RMSEA = .09 (90%CI = .08-.10), CFI = .88, TLI = .86, SRMR = .11). For both the 10-item and 15-item INQ, all items significantly loaded onto the specified latent variable. R-square values ranged from .21 to .79 for the 10-item INQ and ranged from .19 to .79 for the 15-item INQ. Correlation between the perceived burdensomeness factor and the thwarted belongingness factor was moderate (covariance = .50) for the 15-item INQ and strong (covariance = .72) for the 10-item INQ.

Internal Consistency

To examine the internal consistency of the two subscales (i.e., thwarted belongingness and perceived burdensomeness), Cronbach's coefficient alphas were generated for each subscale for the 10-item, 14-item and 15-item Chinese INQ (presented in the bottom of Table 2). For all three versions, the perceived burdensomeness and thwarted belongingness subscales demonstrated good internal consistency with alphas ranging from .79 to .91.

Convergent and Divergent Validity

Prior to the examination of convergent and divergent validity, the measurement model of each latent variable (i.e., self-esteem, loneliness and social support) was tested by CFA to assess the extent to which each of the latent variables was represented by its indicators. The fit of each CFA model are presented in Table 5. The measurement model with acceptable fit was considered as the final model of each latent variable and was used in the following SEMs for examining convergent and divergent validity and concurrent validity. Three SEMs were performed to examine convergent and divergent validity of the 10-item, 14-item, and 15-item Chinese INQ (see Figure 2 to Figure 4). The fit of each model are presented in the bottom of Table 5.

Table 5 *Fit Statistics for Confirmatory Factor Analysis Models and Structural Equation Models*

	χ^2	df	CFI	TLI	RMSEA (90% CI)	SRMR	α
"Good fit" indicated by:			≥.95	≥.95	≤.06	≤.08	>.70
"Acceptable fit" indicated by:			≥.90	≥.90	≤.08		
Sample 2 (*n* = 427)							
Self-Esteem	159.239**	35	.88	.85	.09 (.077 - .106)	.06	.82
One correlated error was set	113.063**	34	.92	.90	.07 (.059 - .089)	.05	-
Loneliness	242.933**	20	.76	.66	.16 (.144 - .180)	.06	.84
One correlated error was set	105.116**	19	.91	.86	.10 (.084 - .123)	.06	-
Two correlated error were set	71.680**	18	.94	.91	.08 (.064 - .104)	.04	-
Social Support	125.727**	51	.96	.95	.06 (.046 - .072)	.04	.90
Suicidal ideation	-	-	-	-	-	-	.81
Structural equation models: 15 items							
Convergent and divergent validity	1898.074**	927	.89	.88	.05 (.046 - .053)	.07	-
Concurrent validity	393.805**	100	.88	.86	.08 (.074 - .092)	.10	-
Structural equation models: 14 items							
Convergent and divergent validity	1615.786**	884	.91	.91	.04 (.041 - .047)	.05	-
Concurrent validity	234.882**	86	.94	.92	.06 (.054 - .073)	.05	-
Structural equation models: 10 items							
Convergent and divergent validity	1386.544**	722	.91	.90	.05 (.043 - .050)	.06	-
Concurrent validity	153.264**	40	.92	.89	.08 (.068 - .095)	.06	-

Note. Robust Maximum Likelihood estimation was used. χ^2 = Yuan-Bentler scaled Chi-Square; CFI = comparative fit index; TLI = Tucker-Lewis Index; RMSEA = root mean square error of approximation; CI=confidence interval; SRMR= standardized root mean square residual. α = Cronbach's alpha. *$p < .05$ **$p < .001$.

Standardized coefficients for the regressions of self-esteem, loneliness and social support on thwarted belongingness and perceived burdensomeness appear in Figure 2 to Figure 4. Results supported convergent validity for thwarted belongingness and perceived burdensomeness of the 10-item, 14-item, and 15-item Chinese INQ. As expected, perceived burdensomeness was significantly and negatively associated with self-esteem. On the other hand, thwarted belongingness was significantly and positively associated with loneliness as well as negatively associated with social support. However, the results did not support divergent validity for thwarted belongingness since thwarted belongingness was associated with its conceptually dissimilar construct (i.e., self-esteem). Similarly, the results did not support divergent validity for perceived burdensomeness of the 14-item and 15-item Chinese INQ since perceived burdensomeness was significantly associated with its conceptually dissimilar constructs (i.e., loneliness and social support). On the other hand, the results supported divergent validity for perceived burdensomeness of the 10-item Chinese INQ because perceived burdensomeness was not significantly associated with loneliness and social support.

Figure 2. A structural equation model to examine convergent and divergent validity of the INQ (15 items). *p* < .05 and **p* < .01.

Figure 3. A structural equation model to examine convergent and divergent validity of the INQ (14 items). *p* < .05 and **p* < .01.

Figure 4. A structural equation model to examine convergent and divergent validity of the INQ (10 items). *p < .05 and **p < .01.

Concurrent Validity

For examining concurrent validity, three SEMs were performed for the 10-item, 14-item, and 15-item Chinese INQ (see Figure 5 to Figure 7). The fit of each model are presented in the bottom of Table 5. Standardized coefficients for the regressions of suicide ideation on thwarted belongingness and perceived burdensomeness appear in Figure 5 to Figure 7. Perceived burdensomeness was a significant independent predictor of concurrent suicidal ideation for the 14-item and 15-item Chinese INQ. The SEMs accounted for 9.7% (14-item) and 10.2% (15-item) of the variance in suicidal ideation scores. In the SEM for the 10-item Chinese INQ, both thwarted belongingness and perceived burdensomeness did not significantly predict concurrent suicidal ideation.

Figure 5. A structural equation model to examine concurrent validity of the INQ (15 items). *p* < .05 and **p* < .01.

Figure 6. A structural equation model to examine concurrent validity of the INQ (14 items). *p* < .05 and **p* < .01.

Figure 7. A structural equation model to examine concurrent validity of the INQ (10 items).
*p < .05 and ***p* < .01.

Discussion

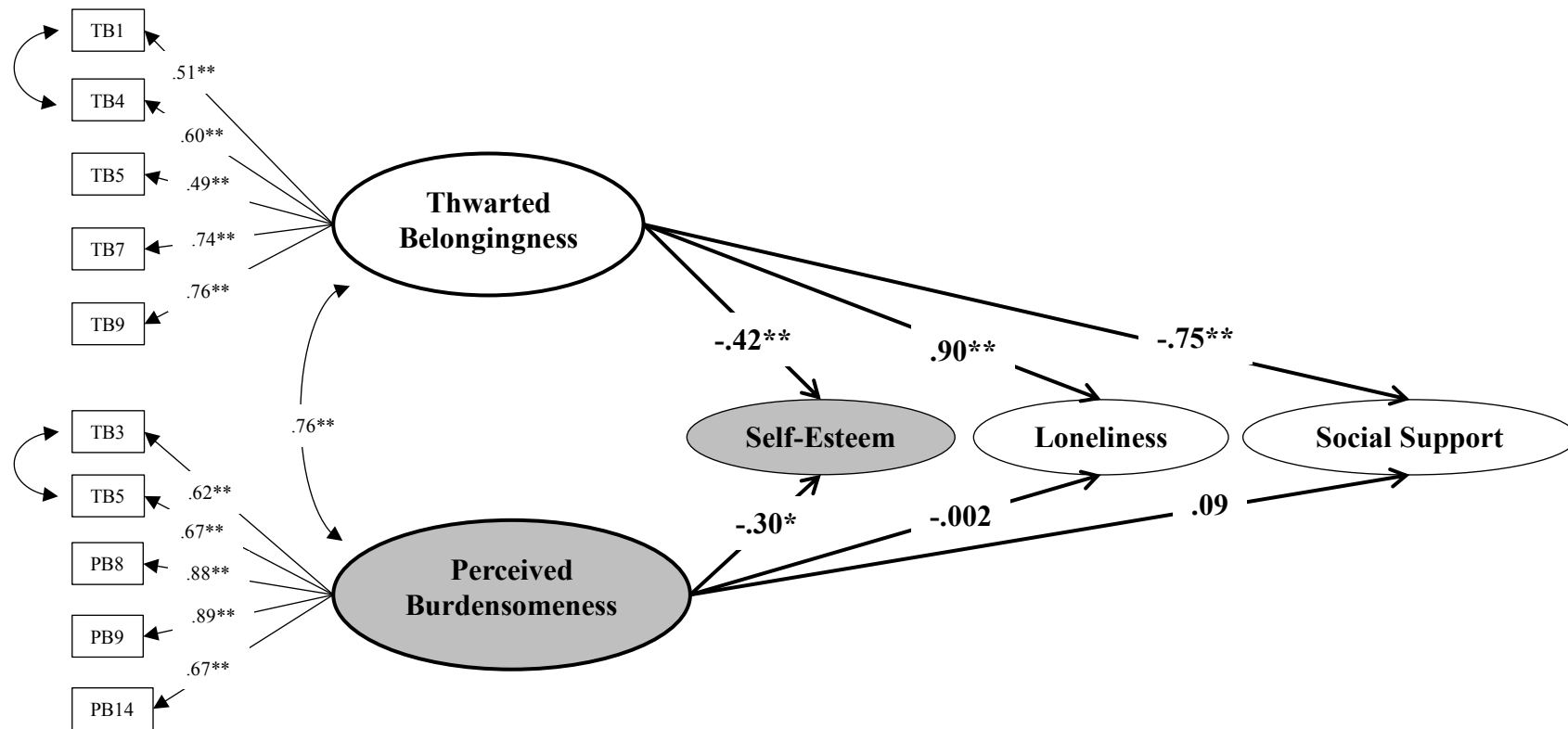The primary purposes of the present study were to translate the original INQ (25

items) into Chinese and examine its factorial structures. This study examined the

measurement model of the Chinese translation of the original INQ with EFA and CFA.

Results from the EFA and CFA support the two-factor structure for the Chinese version of

the INQ. These results are important because they extend findings from Western cultures to

Chinese cultures, and provide further support for previous research indicating that thwarted

belongingness and perceived burdensomeness are related, but distinct constructs. However,

consistent with previous findings (Van Orden et al., 2012), the 25-item INQ had poor model

fit and problems with cross-loading items. Therefore, the EFA was performed to develop an

abbreviated Chinese INQ. The EFA generated a measurement model with six indicators of

thwarted belongingness and eight indicators of perceived burdensomeness. This 14-item

version was supported by CFA and met all criteria for good fit, indicating that this 14-item

model provides an adequate representation of the latent structure of the Chinese INQ.

Furthermore, all 14 items significantly loaded onto their respective constructs, suggesting that

these 14 items are relatively good indicators. The results of CFA established evidence of

structural validity for the 14-item Chinese INQ. Importantly, as noted earlier, researchers

tended to use the shortened versions of the INQ. Therefore, an additional strength of this 14-

item Chinese INQ is its brevity, which may allow researchers and clinicians to assess risk for

suicide without increasing burden on respondents.

The secondary purpose was to evaluate the psychometric properties of the 14-item

Chinese INQ. Our findings supported the reliability and validity of the 14-item Chinese INQ.

As expected, both thwarted belongingness and perceived burdensomeness demonstrated good

internal consistency. Consistent with previous studies (e.g., Van Orden et al., 2012), evidence

for convergent validity was found for both thwarted belongingness and perceived

burdensomeness. However, this study found no support for divergent validity for thwarted

belongingness and perceived burdensomeness because these two interpersonal factors affect a

wide range of psychological experiences and behaviors making them related to most of the

psychological constructs (Van Orden et al., 2012). Although such results are consistent with

previous studies, future research is needed to identify constructs that are unrelated to

thwarted belongingness and perceived burdensomeness in order to further examine divergent

validity for these two interpersonal factors. For example, previous research has demonstrated

that religious coping behaviors were associated with thwarted belongingness but not

perceived burdensomeness (Khazem, Law, Green, & Anestis, 2015). Therefore, religious

coping behaviors can be used to demonstrate divergent validity for perceived

burdensomeness in future research.

Nevertheless, as hypothesized, concurrent validity was supported for perceived burdensomeness but not thwarted belongingness. Although this finding is consistent with many studies in western cultures (e.g., Hill & Pettit, 2012; Lamis & Lester, 2012; Monteith et al., 2013; Van Orden et al., 2008; Wong et al., 2011), further research is needed for studying the possible cultural inadequacy or inaccuracy of the concept of thwarted belongingness (O'Keefe et al., 2014). The INQ addresses belongingness in a general manner, rather than in relation to a valued social group, such as peer, family, community, or other meaningful groups. Previous study on Asian American adolescents' suicide attempts provides indirect support for the importance of assessing belongingness within the context of a valued social group (Wong & Maffini, 2011). Wong and Maffini (2011) found that family relationship was a protective factor against suicide attempts while peer and school relationships acted as the risk factors. Measuring belongingness in a general manner may therefore cancel out the effect of belongingness to different social groups and result in a non-significant association with suicidal ideation. Consequently, although the current study did not support the concurrent validity for thwarted belongingness, future research should further examine the concurrent validity by measuring belongingness to different social groups. Nevertheless, this study supported the utility of the 14-item Chinese INQ for use in future research by providing initial evidence for the reliability and validity of the 14-item Chinese INQ.

The tertiary purpose of the present study was to examine the factor structures and the psychometric properties of the 10-item and 15-item Chinese INQ. Regarding factorial validity (indicated by model fit), the 10-item INQ met most criteria for acceptable fit whereas the 15-item INQ demonstrated close to acceptable fit. Reliability and convergent validity were supported for both the 10-item and 15-item Chinese INQ. Concurrent validity was supported for the 15-item Chinese INQ only. Future research is needed to further investigate the ability of the 10-item Chinese INQ in detecting suicide ideation among Chinese

populations. Despite the marginal model fit of the 15-item Chinese INQ, this study provides support for its reliability, convergent and concurrent validity.

This study also resulted in a 14-item Chinese INQ that can potentially be validate in Western cultures and developed into a cross-culturally equivalent measure for thwarted belongingness and perceived burdensomeness. However, several considerations should be taken when interpreting the results of this study here. First, reliability and validity for the 14-item Chinese INQ was supported in college student samples. Thus, future research is needed to test the psychometric adequacy of the 14-item Chinese INQ in other samples (e.g., with different ranges of age, socioeconomic status, and clinical severity). However, given the recent sharp increase in suicide among Chinese college students, there is a pressing need for identifying the antecedents of suicide that are particular relevant to Chinese college students. This study addresses this by developing a brief, reliable and valid assessment (i.e., the 14-item Chinese INQ) for future research in understanding suicide among Chinese college students. Second, although using the Chinese student samples allows us to produce knowledge about the psychometric adequacy of different versions of the Chinese INQ, future research using participants from both Chinese and Western cultures is needed to examine the cross-culturally equivalency for the INQ. Knowledge about measurement invariance among the INQ in different languages (e.g., English and Chinese) is imperative for generalizing the interpersonal theory of suicide from Western cultures to Chinese cultures. Nevertheless, this study provides preliminary support to future research examining the measurement invariance across cultures for the 14-item and 15-item INQ. This information can help researchers to identify psychometrically sound version(s) of the INQ to develop into cross-culturally equivalent measure(s) for thwarted belongingness and perceived burdensomeness.

In conclusion, this study advances the literature in several important ways. First, this study is the first study (to our knowledge) to develop a Chinese version of the INQ with

evidence for its reliability and validity. Second, this study is also the first study (to our knowledge) to empirically derive a shorten version of the Chinese INQ (i.e., the 14-item INQ) from the original INQ. Third, this study provides initial support for the psychometric adequacy of the Chinese 15-item INQ. The findings of this study represent the essential first step for using the interpersonal theory of suicide to understand suicide among Chinese populations. Additionally, the brevity of the 14-item INQ allows researchers and clinicians to assess risk for suicide without increasing burden on respondents. Furthermore, this study indicates the potential of the 14-item and 15-item INQ to be developed into cross-culturally equivalent measures and their utility in cross-cultural research.

Article 2:

The Cross-Cultural Generalizability of the Interpersonal Theory of Suicide

and Measurement Invariance of the Interpersonal Needs Questionnaire

Abstract

Although previous research has used the interpersonal theory of suicide to understand suicide in Chinese cultures, the cross-cultural generalizability of the interpersonal theory has yet to be determined. The Interpersonal Needs Questionnaire (INQ) has been widely used to test the interpersonal theory and assesses the two hypothesized causes of suicidal ideation (i.e., thwarted belongingness and perceived burdensomeness). Evaluating the cross-cultural measurement invariance of the INQ is an essential step for establishing generalizability of the interpersonal theory. This study aimed to establish measurement invariance across Chinese and Australian cultures for the 15-item and 14-item INQ. This study also aimed to examine the cross-cultural generalizability of a proposition of the interpersonal theory using a cross-culturally equivalent INQ. Using the samples from Hong Kong ($n = 427$) and Australia ($n = 469$), a series of multigroup confirmatory factor analyses were conducted to examine measurement invariance. Multigroup structural equation models and Wald tests were also performed to compare the associations of the interpersonal factors with suicidal ideation across cultures. Results indicate that the 15-item and 14-item INQ are cross-culturally equivalent measures, with a few differences in item intercepts. Results also provided support for the cross-cultural equivalence for the associations of the interpersonal factors with suicide ideation across Australian and Chinese cultures. Although cultural differences were found in the predictive effect of the two-way interaction between the interpersonal factors on suicidal ideation, the findings generally support the generalizability of the interpersonal theory across Australian and Chinese cultures.

Public Significance Statement

This study established measurement invariance across Chinese and Australian cultures for the 15-item and 14-item INQ and enables future use of them as psychometrically sound measures for cross-cultural research. This study also provided substantial support for cross-cultural

generalizability of the interpersonal theory of suicide and sets the stage for using research

findings in Western cultures to inform directions in future research and suicide prevention in

Chinese cultures.

Keywords: risk assessment, interpersonal theory, suicidal ideation, cross-cultural

equivalence, interaction

The Cross-Cultural Generalizability of the Interpersonal Theory of Suicide

and Measurement Invariance of the Interpersonal Needs Questionnaire

Suicide is one of the leading global causes of death and takes the lives of nearly 800,000 individuals each year (World Health Organization, 2017). Among youth, suicide is the leading cause of death in many parts of the world, including Australia and Hong Kong (Australian Institute of Health and Welfare, 2018; Committee on Prevention of Student Suicides, 2016; World Health Organization, 2017). Although studies on suicide and related behaviours have been one of the most important research priorities globally (World Health Organization, 2014), projections by the World Health Organization (2013) indicate that suicide will continue to be the leading cause of death worldwide through until at least 2030. The suicide rate of Hong Kong Chinese youth, for example, has doubled in one year, from 2015 to 2016 (Cheng, Chen, Lee & Yip, 2017; Committee on Prevention of Student Suicides, 2016). These figures emphasize a critical need to address the causes of suicide (Cheng at al., 2017) and identify best practices for suicide assessment, prevention, and intervention (Committee on Prevention of Student Suicides, 2016; World Health Organization, 2014).

Utilisation of theoretical frameworks is imperative for advancing progress in the prevention of suicide to allow the systematic organization of findings (related to risk and protective factors) and inform specific directions in suicide prevention and future research (Chu et al., 2017; Ma, Batterham, Calear, & Han, 2016; Stewart, Eaddy, Horton, Hughes & Kennard, 2017). One influential framework is the interpersonal theory of suicide, first proposed by Joiner (2005) and further articulated by Van Orden and colleagues (2010). The interpersonal theory of suicide proposes that passive suicidal ideation is caused by the joint occurrence of two interpersonal factors: thwarted belongingness and perceived burdensomeness. Thwarted belongingness refers to a psychological state resulting from an unmet need for connectedness, which can be operationally defined as social isolation,

loneliness, or low levels of perceived social support from others. Perceived burdensomeness refers to a mental state resulting from an unmet need for social competence, which can be reflected by a perception that one is a burden on others or by a sense that others would be better off without the person. Passive suicidal ideation becomes an active desire for suicide when the person feels hopeless about the immutability of these two interpersonal factors. However, a lethal suicidal attempt requires the coexistence of both an active suicidal desire and acquired capability for suicide. The capability for suicide refers to a sense of fearlessness about death and elevated tolerance for physical pain. This capability is gained by the habituation following repeated exposure to painful and provocative experiences.

Strengths of the interpersonal theory of suicide include its provision of testable and falsifiable hypotheses and account of the distinct mechanisms of suicidal ideation and suicide attempts (Stewart et al., 2017). The interpersonal theory of suicide also contextualizes relevant risk factors for suicide, such as the presence of psychiatric disorders and certain personality traits (Christensen, Batterham, Mackinnon, Donker, & Soubelet, 2014; Van Orden, Witte, Cukrowicz, Braithwaite, Selby, & Joiner, 2010). Thus, the interpersonal theory provides a potential framework for explaining the mechanisms underlying the associations between various risk factors and suicidal behaviors (Stewart et al., 2017). For example, Hill and colleagues (2018) recently demonstrated that the relationship between depressive symptoms and suicidal ideation were mediated by thwarted belongingness and perceived burdensomeness. The interpersonal theory also overcomes the failure to differentiate between risk factors for suicidal ideation and suicide attempts, which is the limitation of many existing theories and studies of suicide (Rogers, & Joiner, 2017). In addition, the interpersonal theory has improved the assessment and treatment of suicide (Chu et al., 2017).

Based on the interpersonal theory, Van Orden (2009) developed the Interpersonal Needs Questionnaire (INQ), which is composed of 25 items (10 items for measuring thwarted

belongingness and 15 items for measuring perceived burdensomeness). This original INQ and some shorter versions of the INQ, including an 18-item, a 15-item, a 12-item, and a 10-item INQ, were employed by previous studies to assess an individual's extent of thwarted belongingness and perceived burdensomeness (Chu et al., 2017; Hill, Rey, Marin, Sharp, Green, & Pettit, 2015). Of these five versions, the 15-item INQ has been most widely used (for a review, see Chu et al., 2017), because it is the refinement of the original 25-item INQ developed and psychometrically evaluated by the original authors (Van Orden, Cukrowicz, Witte, & Joiner, 2012). In addition, this 15-item INQ has been translated into many languages, including Spanish (Silva, 2013), German (Hallensleben, Spangenberg, Kapusta, Forkmann, & Glaesmer, 2016), Portuguese (Campos & Holden, 2016), Slovene (Podlogar, Žiberna, Poštuvan, & CR Kerr, 2017), Korean (Suh et al., 2017), and Chinese (Lai & Boag, under review) for examining the interpersonal theory in different cultures.

Despite a growing body of research testing the interpersonal theory, over eighty percent of the existing research has been conducted with samples derived from the United States (US) or Canada (for a review, see Chu et al., 2017). As is commonly recognized, theories developed in Western cultures (individualistic cultures) may not automatically generalize to non-Western cultures (collectivistic cultures) due to cross-cultural differences. For example, numerous differences have been reported regarding differences between Western cultures, such as Australia, which are typically 'individualistic' and non-Western cultures, such as China, that are typically collectivistic (Markus & Kitayama, 2010). These cultural differences may considerably influence individuals' intra- and interpersonal experience, and thus may be highly relevant to the key components of the interpersonal theory, including perceptions of burden and expectations of social connection (c.f., thwarted belongingness) (Suh et al., 2017; Zhang, Lester, Zhao, & Zhou, 2013). For example, previous studies have shown that the foundational self-schema of individuals in Chinese, collectivistic

contexts tends to be interdependent with others, compared to individuals within Western, individualistic contexts who tend to have a more independent self-construal (Lou & Li, 2017; Markus & Kitayama, 2010; Zhu, Zhang, Fan, & Han, 2007). As such, relative to people with independent self-construal (e.g., North American or European Canadian), people with interdependent self-construal (e.g., Chinese) may tend to experience a heightened sensitivity to others' evaluations and social rejection (Lou & Li, 2017; Markus & Kitayama, 2010).

Self-construal also tends to influence individuals' need to belong. For example, Chang (2015) found that people with higher interdependent self-construal showed a stronger need to belong. Therefore, people in Chinese cultures (collectivistic cultures) may experience greater perceptions of burden and have greater needs to belong. Consequently, thwarted belongingness and perceived burdensomeness may have different impacts upon suicide-ideation in Chinese cultures (collectivistic cultures), compared to Western cultures (individualistic cultures). Furthermore, self-construal (independence and interdependence) appears to influence the psychological meanings and consequences for obligations in a particular situation, relationships with significant others, and intergroup processes (Markus & Kitayama, 2010). Hence, the interpersonal factors (i.e., thwarted belongingness and perceived burdensomeness) may function differently across cultures and may be associated with suicide to various extents. Consequently, prior to using the interpersonal theory to understand suicidal behaviors in non-Western cultures, it is necessary to explore the applicability of the interpersonal theory in other contexts such as Chinese cultures.

Although research testing the interpersonal theory has been conducted in some collectivistic (East Asian) cultures such as South Korea (Chu, Hom, Rogers, Ringer, Hames, Suh, & Joiner, 2016) and China (Zhang et al., 2013), these studies have not included a cultural comparison group. Therefore, these studies are limited in their ability to examine the cross-cultural comparability (cross-cultural generalizability) of the interpersonal theory

(Stewart et al., 2017). To date, only one study has directly examined the interpersonal theory's comparability across American and South Korean cultures. Shu et al. (2017) used the chi-square difference test to compare the fit of the constrained model (equal gamma (ζ) paths from the interpersonal factors to suicide risk across cultures) to the freely estimated model (freely estimated gamma (ζ) paths from the interpersonal factors to suicide risk in both cultures). This study showed that there were no significant differences in the strength of the effects of the interpersonal factors on suicide risk across South Korea and the US. Such finding provides preliminary support to the generalizability of the interpersonal theory across Western individualist and North East Asian collectivist cultures.

Although this preliminary support for the generalizability of the interpersonal theory is promising, further investigation is nevertheless warranted because Shu et al. (2017) did not examine measurement invariance across cultures for the INQ. Measurement invariance is a prerequisite for comparing differences between culturally different groups (Milfont, & Fischer, 2010), because individuals from different cultures may respond to the items of a measure in a dissimilar manner. Differences or similarities between groups could thus be artifacts of assessments when measurement invariance is not established (Chen, 2008). For example, a previous simulation study has demonstrated that lack of measurement invariance can produce artificial differences in means across cultural groups and artificial interaction effects in predictive relationships (Chen, 2008). Therefore, measurement invariance must be established for any measure of interest, prior to assessing generalizability across cultures.

Measurement invariance can be established by performing a series of multigroup confirmatory factor analyses (CFAs), following the stepwise approach discussed in Milfont and Fischer (2010). The three common types of invariance tested for establishing measurement invariance are configural, metric, and scalar invariance. Configural invariance is assessed by constraining the factorial structure to be equal across groups. Satisfying

configural invariance suggests the same conceptualizations of a construct across groups.

Metric invariance is assessed by constraining all factor loadings to be equal across groups.

Factor loadings represent the strengths of the relations between items (of a scale) and a

construct (measured by a scale). Satisfying metric invariance suggests that items are

responded to in the same manner across groups. Scalar invariance is assessed by constraining

the intercepts of items to be equal across groups. Satisfying scalar invariance suggests that

individuals from different groups obtain comparable scores on a construct if they have the

same scores on items. Configural invariance is a prerequisite for examining metric

invariance, while metric invariance must be established before examining scalar invariance.

Therefore, the model used to test for configural invariance is the baseline model for

subsequent comparison. Satisfying these three types of invariance permits appropriate

comparisons of relationships between variables and latent means across cultures (Hirschfeld

& Von Brachel, 2014; Milfont & Fischer, 2010). However, to our knowledge, no studies to

date have examined measurement invariance across cultures for the INQ. Consequently, no

studies have comprehensively examined the generalizability of the interpersonal theory

across cultures or have been able to make meaningful comparisons between culturally

different groups (e.g., Western individualistic and Chinese collectivistic cultures).

Therefore, there is a pressing need to develop a cross-culturally equivalent INQ to

help generalize the interpersonal theory to Chinese cultures and advance progress in the

universal prevention of suicide. Although the 15-item INQ has potential to be developed into

a cross-culturally equivalent measure, a previous study has demonstrated only marginal

model fit for the factor structure of the 15-item INQ in a Chinese culture (Lai & Boag, under

review). In contrast, another shorter version of the Chinese INQ (14-item) exhibited adequate

model fit and sound psychometric properties in that same study (Lai & Boag, under review).

Therefore, the present study sought to establish measurement invariance for both the 14-item

and 15-item INQ in order to evaluate the generalizability of the interpersonal theory of suicide across Chinese and Australian cultures.

The Current Study

The overarching purpose of the present study was to establish measurement invariance for both the 14-item and 15-item INQ in order to evaluate the generalizability of the interpersonal theory of suicide across Chinese and Australian cultures. This purpose can be fulfilled by achieving two sub-goals.

The first sub-goal was to establish measurement invariance across Australian and Chinese cultures for the14-item and 15-item INQ. This goal can be achieved by taking three corresponding steps: 1) examining whether the measurement model of the 14-item INQ would fit the Australian student sample well, 2) evaluating the psychometric properties (i.e., reliability, convergent and divergent validity) of the English version of the 14-item INQ, and 3) examining whether the 15-item and 14-item INQ would be measurement invariant across the student samples from Australia and Hong Kong.

The second sub-goal was to examine the cross-cultural equivalence for the associations of the interpersonal factors (thwarted belongingness and perceived burdensomeness) with suicide ideation across the Australian and Hong Kong samples. To achieve this, this study tested the invariance of the structural path coefficients between the interpersonal factors and suicide ideation across the Australian and Hong Kong samples.

Related to the second sub-goal, this study also examined the predictive effect of the interaction between thwarted belongingness and perceived burdensomeness on suicide ideation. Although the predictive effect of the interaction is one of the key propositions of the interpersonal theory (Van Orden et al., 2010) and was supported by previous studies (for a meta-analysis, see Chu et al., 2017), null findings were also reported in some previous studies (e.g., Hill et al., 2015; Suh et al., 2017). Specifically, Suh and colleagues (2017)

demonstrated that the predictive effect of the interaction was significant in an American sample but not significant in a Korean sample. Suh and colleagues (2017) suggested that culture (i.e., collectivistic vs. individualistic cultures) may be one of the factors contributing to the mixed result. Therefore, this study also examined the predictive effect of the interaction in Chinese and Australian cultures to provide further evidence for the potential effect of culture.

Method

Participants and Study Procedures

Participants were university students in Hong Kong and Australia. The Hong Kong sample was the second half of a randomly split sample used in a previous study (Lai & Boag, under review). The Hong Kong sample consisted of 427 (male: $n = 246$, 57.7%; mean age = 20.07, SD = 1.69) undergraduates at a university in Hong Kong. Ethical approval was obtained from the University Review Board. All participants provided written informed consent and were recruited through various methods including lecturers' invitation in class, researchers' invitation in workshop, and coaches' invitation in sport training sessions. Participation was on a voluntary basis. The majority of the participants were born in Hong Kong and China (Hong Kong: 78.4%, China: 20.5%).

The Australian sample consisted of 469 (male: $n = 102$, 21.7%; mean age = 19.42, SD = 3.25) undergraduates at a university in Australia. Ethical approval was obtained from the University Human Research Ethics Committee. All participants were recruited through an advertisement posted on the online participant pool, SONA. All participants received course credit for participation. The majority of the participants were born in Australia (Australia: 98.7%, New Zealand: 1.3%).

Measures

The original English versions of all measures were used in the Australian sample. The

Chinese versions of all measures were used in the Hong Kong sample.

The Interpersonal Needs Questionnaire (Van Orden, 2009). The INQ is a 25-item

measure of the interpersonal constructs (10 items for measuring thwarted belongingness and

15 items for measuring perceived burdensomeness). Each of the 15-item and 14-item

versions was derived from these 25 items in previous studies (Lai & Boag, under review; Van

Orden et al., 2012). Items are presented with a 7-point Likert scale from 1 (not at all true for

me) to 7 (very true for me). Previous studies have indicated that the English versions of INQ

(25-item and 15-item) exhibit good psychometric properties, including adequate internal

consistency, convergent and divergent validity as well as concurrent and predictive validity

(Van Orden, 2009; Van Orden et al., 2012). The Chinese versions of INQ (15-item and 14-

item) have previously been translated and demonstrated to be reliable and valid (Lai & Boag,

under review). Reversed items were recoded, so that higher scores reflect higher levels of

thwarted belongingness and perceived burdensomeness. Internal consistency of the Chinese

INQ was good in this study, with values of Cronbach's α greater than .85 for both

interpersonal constructs of the 15-item and 14-item versions. Internal consistency of the

English INQ is reported in the result section.

The 8-item UCLA Loneliness Scale (ULS-8; Hays & DiMatteo, 1987). The ULS-8

is an 8-item measure of loneliness. Items are presented with a 6-point Likert scale from 1

(strongly disagree) to 7 (strongly agree), with higher scores reflecting greater loneliness.

Previous studies have indicated that the English and Chinese versions of the ULS-8 exhibit

good psychometric properties (e.g., Hays & DiMatteo, 1987; Wu & Yao 2008). Internal

consistency of the ULS-8 was good in this study ($\alpha_{English}$ = .89; $\alpha_{Chinese}$ = .84).

The Multidimensional Scale of Perceived Social Support (MSPSS; Zimet, Dahlem, Zimet, & Farley, 1988). The MSPSS is a 12-item measure of perceived social support from three sources: family, friends, and significant others. Support from each source has 4 items. Items are presented with a 4-point Likert scale from 1 (strongly disagree) to 4 (strongly agree), with higher scores reflecting greater perceived social support. Zimet et al. (1988) provided support for the psychometric adequacy for the original English MSPSS. Previous studies have showed that the Chinese MSPSS demonstrated good psychometric properties, including adequate internal consistency, and convergent and divergent validity (e.g., Zhou et al., 2015). A total score of perceived social support was obtained by summing the scores from all 12 items. Internal consistency of the MSPSS was excellent in this study ($\alpha_{English} = .92$; $\alpha_{Chinese} = .90$).

Rosenberg Self-Esteem Scale (RSE; Rosenberg, 1965, 1979). The RSE is a 10-item measure of self-esteem. Items are presented with a 4-point Likert scale from 1 (strongly disagree) to 4 (strongly agree). The 5 reversed items were recoded, so that higher scores reflect greater self-esteem. The English and Chinese versions of RSE has been extensively used and demonstrated to be a reliable and valid scale (e.g., Alessandri, Vecchione, Eisenberg, & Laguna, 2015; Zhao, Kong, & Wang, 2012). Internal consistency of the RSE was good in this study ($\alpha_{English} = .91$; $\alpha_{Chinese} = .82$).

The Scale for Suicide Ideation (SSI; Beck et al., 1979). The SSI is a 21-item measure of suicide ideation and prior suicidal behaviors. Items are presented with a 3-point Likert scale from 0 (a statement describing strong wish to live) to 2 (a statement describing no wish to live). Since items 20 and 21 assess prior suicidal behaviors, they were not used in this study. A total score of suicide ideation was obtained by summing the scores from items 1-19, with higher scores reflecting greater suicide ideation. The English and Chinese versions

of the SSI show good reliability and validity (Beck, Steer, & Ranieri, 1988; Zhang & Brown, 2007). Internal consistency of the SSI was good in this study ($\alpha_{English}$ = .88; $\alpha_{Chinese}$ = .81).

Analytic Approach

Normality was assessed both visually and through the Shapiro-Wilk test using SPSS software. All other analyses of this study were conducted in Mplus Version 8 with maximum likelihood estimation robust (MLR) to non-normality because item responses of the INQ were not normally distributed.

To examine the measurement model of the English 14-item INQ, a single-group CFA was conducted with the Australia sample. Refinements (e.g., setting a residual covariance) were guided by theory and modification indices to improve model fit until the measurement model showed an adequate fit to the data. The resultant measurement model was used in the subsequent analyses to test the 14-item INQ's validity and measurement invariance as well as the structural invariance and the two-way interaction effect of the interpersonal factors on suicide ideation.

To examine the fit of the factor models, several global fit indices were considered. They were the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), the root mean square error of approximation (RMSEA), the standardized root mean square residual (SRMR), and the chi-square. The chi-square statistic in the analyses with the MLR estimator is the Yuan-Bentler scaled chi-square, which is adjusted for nonnormality. Good model fit is indicated by RMSEA values of .06 or less, SRMR values of .08 or less (Hu & Bentler, 1999), and CFI and TLI values close to .95 or greater (Brown, 2014). Values in the range of .08-.06 for RMSEA suggest reasonable fit (Brown, 2014). In the presence of good fit for other global fit indices, values in the range of .90-.95 for CFI and TLI suggest acceptable fit (Brown, 2014).

To examine internal consistency, Cronbach's alphas were generated for each factor (i.e., thwarted belongingness and perceived burdensomeness) of the English 15-item and 14-item INQ, using the Australian sample. An alpha of .70 or more indicates good internal consistency (Nunnally & Bernstein, 1994).

To examine convergent and divergent validity, a single-group structural equation model (SEM) with three variables (i.e., self-esteem, loneliness, and social support) regressed onto the measurement model of the English 14-item INQ was conducted, using the Australian sample. Loneliness and social support are theoretically related to thwarted belongingness, whereas self-esteem is theoretically related to perceived burdensomeness. Significant associations (i.e., thwarted belongingness ↔ loneliness, thwarted belongingness ↔ social support, and perceived burdensomeness ↔ self-esteem) provides support for convergent validity. On the other hand, non-significant associations (i.e., perceived burdensomeness ↔ loneliness, perceived burdensomeness ↔ social support, and thwarted belongingness ↔ self-esteem) provides support for divergent validity. The measurement model of each latent variable (i.e., self-esteem, loneliness and social support) was tested by single-group CFA to assess the extent to which each of the latent variables was represented by its indicators. The measurement model with acceptable fit was considered as the final model of each latent variable and was used in the single-group SEM for examining convergent and divergent validity.

Prior to measurement invariance analysis, the measurement model of the English 15-item INQ was tested by single-group CFA, using the Australian sample. The measurement models of the Chinese 15-item and 14-item INQ were tested in a previous study (Lai & Boag, under review). To examine measurement invariance, a series of increasingly restrictive multigroup CFAs were conducted with both Australian and Hong Kong samples. Following the stepwise approach discussed in Milfont and Fischer (2010), three models were tested for

examining configural, metric, and scalar invariance. The model testing metric invariance was

nested in the model testing configural invariance. The model testing scalar invariance was

nested in the model testing metric invariance. A total of six models were tested for the 15-

item and 14-item INQ. For model specification, configural invariance was assessed by

constraining the factorial structure to be identical across groups. Metric invariance was

assessed by constraining all factor loadings to be equal across groups. Scalar invariance was

assessed by constraining the intercepts of all items to be equal across groups.

To compare the fit of the models, the fit of the model with identical factor structure

served as the basis for comparison to the fit of the model with equal factor loadings.

Similarly, the fit of the model with equal factor loadings served as the basis for comparison to

the fit of the model with equal intercepts of items. Configural invariance was supported by

demonstrating acceptable model fit (according to the global fit indices listed above) for the

model with identical factor structure. Metric and scalar invariance was tested by evaluating

change in CFI (ΔCFI), RMSEA (ΔRMSEA), and SRMR (ΔSRMR) during model

comparisons. Change in Satorra-Bentler chi-square (ΔS-Bχ^2) is not considered to be the

criterion for evaluating change in fit due to the sensitivity of chi-square to large sample sizes

(Oishi, 2007). A ΔCFI value smaller than or equal to .01, a ΔRMSEA value smaller

than .015, and a ΔSRMR value smaller than .03 indicate the more restrictive model fits the

data as well as the less restrictive one (Chen, 2007; Meade, Johnson, & Braddy, 2008) and

support metric and scalar invariance (Cheung & Rensvold, 2002).

Partial invariance was examined when full metric or scalar invariance could not be

established. Partial invariance was examined through an iterative process. First, mis-specified

items (i.e., items with differential item functioning across cultures) were identified, guiding

by modification indices. Second, one item with highest value of modification indices was set

freely estimated each time. Third, partial invariance was examined. This procedure was repeated until the criterions of invariance (listed above) were reached.

Prior to examining invariance of structural path coefficients, four single-group SEMs with suicide ideation regressed onto the interpersonal constructs were conducted for the 15-item and 14-item INQ and for each sample (using the measurement models resulted from the final single-group CFAs).

To examine structural invariance across the Australian and Hong Kong samples, two multigroup SEMs with suicide ideation regressed onto the interpersonal constructs were conducted for the 15-item and 14-item INQ (using the measurement models resulted from the final multigroup CFAs). Four Wald tests were then performed to compare the structural path coefficients of the Australian and Hong Kong samples.

To examine the predictive effect of the two-way interaction between the interpersonal constructs on suicide ideation, an interaction variable was created (i.e., TB x PB). This interaction variable was then added to the four single-group SEMs tested above. Four additional single-group SEMs were conducted for the 15-item and 14-item INQ and for each sample (using the measurement models resulted from the final single-group CFAs).

Result

Descriptive Statistics

Descriptive statistics and interrelationship of the INQ items for the Australian and Hong Kong samples are presented in Table 1. The result of the Shapiro-Wilk test (i.e., p = .00) suggested responses of all 17 INQ items were not normally distributed for both the Australian and Hong Kong samples.

Table 1 *Descriptive Statistics and Intercorrelations Among Interpersonal Needs Questionnaire Items for the Hong Kong and Australian Samples*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. TB1	-	.67	.68	.67	.56	.46	.47	.47	.54	.24	.29	.31	.32	.36	.33	.37	.34
2. TB2	.62	-	.75	.64	.57	.51	.50	.53	.55	.37	.39	.45	.43	.46	.48	.47	.42
3. TB3	.59	.66	-	.68	.57	.51	.45	.53	.54	.35	.42	.50	.47	.49	.51	.51	.43
4. TB4	.57	.62	.73	-	.60	.45	.50	.46	.58	.27	.31	.38	.35	.33	.38	.43	.32
5. TB5	.49	.51	.51	.52	-	.44	.56	.54	.62	.46	.47	.48	.56	.50	.51	.53	.41
6. TB6	.22	.36	.33	.32	.22	-	.40	.44	.45	.36	.38	.39	.43	.48	.45	.43	.38
7. TB7	.39	.42	.39	.37	.33	.35	-	.36	.65	.44	.44	.45	.49	.43	.47	.50	.39
8. TB8	.41	.32	.40	.39	.42	.25	.26	-	.54	.40	.44	.41	.48	.53	.53	.49	.47
9. TB9	.37	.45	.38	.44	.33	.55	.58	.35	-	.49	.50	.49	.56	.49	.52	.54	.43
10. PB1	.10†	.18**	.10†	.09†	.17**	.28	.26	.19	.32	-	.81	.65	.69	.61	.62	.61	.51
11. PB2	.14*	.23	.18**	.17**	.16**	.37	.30	.26	.39	.62	-	.67	.76	.67	.68	.67	.58
12. PB3	.18**	.26	.26	.28	.19	.38	.40	.25	.50	.48	.64	-	.75	.67	.71	.72	.59
13. PB4	.21	.25	.23	.20	.25	.36	.39	.23	.42	.50	.60	.59	-	.70	.71	.70	.56
14. PB5	.22	.25	.20	.22	.20	.45	.46	.27	.47	.33	.52	.44	.49	-	.78	.76	.67
15. PB6	.22	.35	.27	.27	.21	.49	.52	.28	.55	.42	.57	.58	.55	.72	-	.87	.71
16. PB7	.25	.33	.33	.35	.22	.45	.58	.28	.58	.36	.51	.60	.53	.69	.78	-	.73
17. PB8	.16**	.25	.20	.21	.16**	.37	.37	.17**	.43	.34	.48	.47	.44	.57	.59	.58	-
Mean (HK)	2.77	2.67	2.78	2.71	3.31	2.64	3.25	3.14	2.78	3.64	2.95	2.79	3.24	2.56	2.52	2.49	2.25
Variance (HK)	1.00	1.10	1.06	1.17	1.28	1.47	1.89	1.57	1.47	1.57	1.24	1.26	1.44	1.69	1.41	1.36	1.25
n (HK)	427	427	426	426	425	427	425	426	426	427	425	427	427	427	426	427	427
Mean (AU)	2.79	2.32	2.26	2.50	3.02	2.63	3.46	2.49	3.37	3.18	2.74	2.27	2.75	2.19	2.15	2.08	1.84
Variance (AU)	2.13	1.95	1.45	2.08	1.92	2.23	3.09	1.80	2.83	2.36	2.24	1.79	2.56	1.96	1.74	1.85	1.66
n (AU)	469	469	469	469	469	469	469	469	469	469	469	469	469	469	469	469	469

Note. Correlations for the Hong Kong sample are below the diagonal, and correlations for the Australian sample are above the diagonal.

HK = Hong Kong; AU = Australian.

All unmarked correlations are significant at *p* < .001.

p < .05, **p* < .01, and †*p* > .05.

Table 2 *Fit Statistics for Single-group/Multigroup Confirmatory Factor Analysis Models and Single-group Structural Equation Models*

Description	$\chi2$	df	CFI	TLI	RMSEA (90% CI)	SRMR	PB	TB
					Goodness-of-fit indices		**Internal consistency (α)**	
"Good fit" indicated by:			≥.95	≥.95	≤.06	≤.08		
"Acceptable fit" indicated by:			≥.90	≥.90	≤.08			
CFA: 14 items INQ	443.943**	76	.89	.87	.10 (.093 - .111)	.07	.94	.90
One correlated error was set	317.394**	75	.93	.92	.08 (.074 - .093)	.06	-	-
Two correlated error were set	279.782**	74	.94	.93	.08 (.068 - .087)	.06	-	-
CFA: 15 items INQ	334.240**	89	.93	.92	.08 (.068 - .085)	.06	.93	.91
One correlated error was set	288.680**	88	.94	.93	.07 (.061 - .079)	.06	-	-
Two correlated error were set	267.408**	87	.95	.94	.07 (.058 - .076)	.05	-	-
SEM (validity): 14 items INQ	1942.595**	885	.92	.92	.05 (.047 - .054)	.06	-	-

Description	$\chi2$	df	CFI	TLI	RMSEA (90% CI)	SRMR	Contrast	ΔCFI	ΔRMSEA	ΔSRMR
					Goodness-of-fit indices			**Comparison of nested models**		
"Good fit" indicated by:			≥.95	≥.95	≤.06	≤.08		≤.01	<.015	<.03
"Acceptable fit" indicated by:			≥.90	≥.90	≤.08					
1. Configural invariance: 14 items	476.343**	146	.943	.929	.071 (.064 - .078)	.055	-	-	-	-
2. Metric invariance: 14 items	528.200**	158	.936	.927	.072 (.066 - .079)	.066	2 vs. 1	.007	.001	.011
3. Scalar invariance: 14 items	636.782**	170	.920	.914	.078 (.072 - .085)	.068	3 vs. 2	.016	.006	.002
Partial scalar invariance: 14 items										
3a. One freely estimated item	559.734**	169	.926	.920	.075 (.069 - .082)	.069	3a vs. 2	.010	.003	.003
4. Configural invariance: 15 items	625.543**	172	.922	.905	.077 (.070 - .083)	.082	-	-	-	-
5. Metric invariance: 15 items	666.301**	185	.918	.906	.076 (.070 - .082)	.085	5 vs. 4	.004	.001	.003
6. Scalar invariance: 15 items	883.896**	198	.882	.875	.088 (.082 - .094)	.094	6 vs. 5	.036	.012	.009
Partial scalar invariance: 15 items										
6a. One freely estimated item	798.378**	197	.897	.890	.083 (.077 - .089)	.088	6a vs. 5	.021	.007	.003
6b. Two freely estimated items	767.750**	196	.902	.895	.081 (.075 - .087)	.086	6b vs. 5	.016	.005	.001
6c. Three freely estimated items	731.115**	195	.908	.901	.078 (.072 - .084)	.087	6c vs. 5	.010	.002	.002

Note. Robust Maximum Likelihood estimation was used. $\chi2$ = Satorra-Bentler Chi-Square; CFI = comparative fit index; TLI = Tucker-Lewis Index; RMSEA = root mean square error of approximation; CI=confidence interval; SRMR= standardized root mean square residual. α = Cronbach's alpha. TB = thwarted belongingness. PB = perceived burdensomeness. Validity = Convergent and divergent validity. *p < .05 **p < .001.

Factor Structure of the English 14-item INQ

The measurement model of the English 14-item INQ was evaluated by single-group CFA, using the Australian sample. The fit statistics are presented in Table 2. The first CFA did not fit well according to the indices used to evaluate model fit. Two correlated error were set (specified in the bottom of Table 3). The final CFA model demonstrated acceptable to good fit (Y-Bχ^2 (74) = 279.782, RMSEA = .08 (90%CI = .07-.09), CFI = .94, TLI = .93, SRMR = .06). All items significantly loaded onto the specified latent factor (p = .00). The standardized loadings were high (.64 to .88). R-square values ranged from .41 to .77. Correlation between the perceived burdensomeness factor and the thwarted belongingness factor was strong (covariance = .64, p = .00).

Reliability and Validity of the English 14-item INQ

The reliability of the two subscales (i.e., thwarted belongingness and perceived burdensomeness) was indicated by Cronbach's alphas. The perceived burdensomeness and thwarted belongingness subscales demonstrated excellent internal consistency (α perceived burdensomeness = .94; α thwarted belongingness = .90). The convergent and divergent validity was evaluated by single-group SEM (see Figure 1 for standardized coefficients). The fit statistics are presented in Table 2. Convergent validity was supported for both thwarted belongingness and perceived burdensomeness by the significant associations (thwarted belongingness ↔ loneliness, thwarted belongingness ↔ social support, and perceived burdensomeness ↔ self-esteem). However, divergent validity was not supported for both interpersonal factors because both interpersonal factors were significantly related to the theoretically unrelated constructs (perceived burdensomeness ↔ loneliness, perceived burdensomeness ↔ social support, and thwarted belongingness ↔ self-esteem).

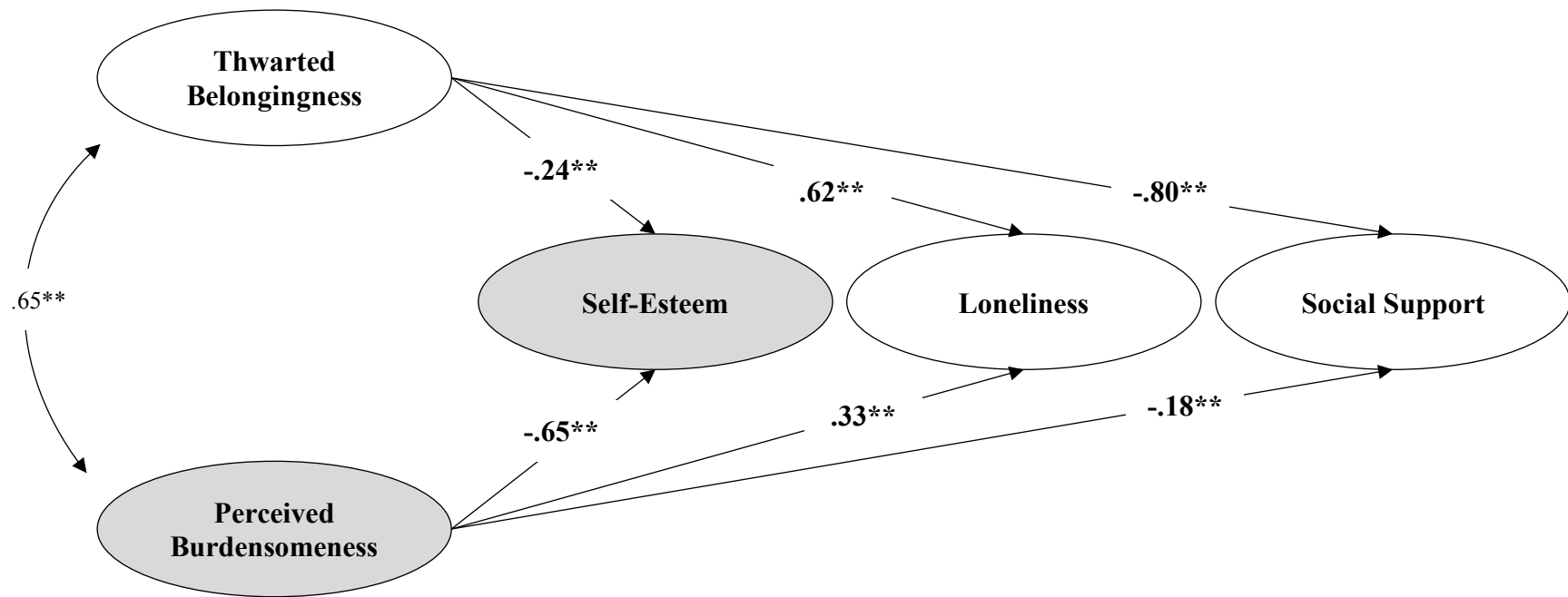*Figure 1.* A structural equation model to examine convergent and divergent validity of the 14-item INQ, using the Australian sample. The gray-shaded ovals were posited to be significantly related to give support to convergent validity, so were the unshaded ovals; the gray-shaded ovals and unshaded ovals were posited to be non-significantly related to give support to divergent validity. *p* < .05 and **p* < .01.

Measurement Invariant of the INQ across Australia and Hong Kong Samples

Measurement invariance was evaluated by a series of increasingly restrictive multigroup CFAs. The measurement model of the English 15-item INQ used for measurement invariance analysis had two residual covariances and demonstrated acceptable to good fit (see Table 2) and excellent reliability ($\alpha_{\text{perceived burdensomeness}} = .93$; $\alpha_{\text{thwarted belongingness}} = .91$). The fit statistics for the models testing measurement invariance are presented in the bottom of Table 2. The configural models of the 15-item and 14-item INQ demonstrated acceptable fit, providing support to their configural invariance. A decrease in fit statistics resulted by setting equal factor loadings, for both the 15-item and 14-item INQ. However, the change in fit statistics (i.e., ΔCFI < .01, ΔRMSEA < .015, and ΔSRMR < .03) indicated that the metric models fit the data as well as the configural models, for both the 15-item and 14-item INQ. In contrast, setting equal intercepts significantly decreased fit statistics, with ΔCFI = .036 for the 15-item INQ and ΔCFI = .016 for the 14-item INQ. Therefore, full scalar invariance was not supported for both the 15-item and 14-item INQ.

For the 15-item INQ, partial scalar invariance was tested by releasing the constraints of three items' intercepts (i.e., "other people care about me", "I have at least one satisfying interaction every day", and "I feel disconnected from other people"). As a result, the CFI's decline narrowed (ΔCFI = .01) and indicated that the assumption of partial scalar invariance held for the 15-item INQ. However, the partial scalar model of the 15-item INQ demonstrated a SRMR greater than .08 (SRMR = .087), therefore indicating possible misspecification. For the 14-item INQ, partial scalar invariance was tested by releasing the constraint of one item's intercepts (i.e., "I am close to other people"). This resulted in a ΔCFI of .01 and indicated that partial scalar invariance was established for the 14-item INQ. The partial scalar model of the 14-item INQ demonstrated acceptable to good fit. The standardized estimated factor loadings, covariances, residual covariances, and R-square

values are displayed in Table 3. For both 15-item and 14-item INQ, all items significantly

loaded onto the specified latent variable. Correlation between the perceived burdensomeness

factor and the thwarted belongingness factor was moderate, ranging from .41 to .68.

Table 3 *Standardized Estimated Factor Loadings, Covariances, Residual Covariances, R-Square Values of the Multigroup Confirmatory Factor Analysis Models for Testing Scalar Invariance*

| | | 15 items | | | | | | 14 items | | | | | |
| | | Australian sample | | | Hong Kong sample | | | Australian sample | | | Hong Kong sample | | |
		Est	SE	R^2	Est	SE	R^2	Est	SE	R^2	Est	SE	R^2
	Thwarted belongingness subscale item												
TB1	I am close to other people	.74	.03	.54	.73	.03	.53	.75	.03	.56	.75	.03	.56
TB2	I feel that there are people I can turn to in times of need	.80	.02	.64	.78	.03	.60	.82	.02	.67	.79	.03	.62
TB3	other people care about me	.83	.02	.69	.77	.03	.59	.88	.02	.77	.83	.02	.68
TB4	I am fortunate to have many caring and supportive friends	.80	.02	.63	.79	.03	.62	.78	.03	.60	.80	.02	.64
TB5	I feel like I belong	.76	.03	.57	.65	.03	.43	.71	.03	.51	.65	.03	.42
TB6	I rarely interact with people who care about me	.59	.04	.35	.50	.03	.25	-	-	-	-	-	-
TB7	I often feel like an outsider in social gatherings	.61	.03	.37	.56	.03	.31	-	-	-	-	-	-
TB8	I have at least one satisfying interaction every day	.67	.03	.45	.51	.03	.26	.65	.03	.43	.52	.03	.27
TB9	I feel disconnected from other people	.71	.03	.50	.65	.03	.43	-	-	-	-	-	-
	Perceived burdensomeness subscale item												
PB1	I feel like a burden on the people in my life	-	-	-	-	-	-	.69	.03	.48	.59	.03	.35
PB2	I think I make things worse for the people in my life	.71	.03	.50	.69	.02	.47	.76	.03	.58	.73	.02	.54
PB3	I think the people in my life wish they could be rid of me	.78	.03	.60	.70	.03	.49	.83	.02	.68	.76	.02	.58
PB4	I think I have failed the people in my life	-	-	-	-	-	-	.81	.02	.66	.74	.02	.55
PB5	I think I am a burden on society	.85	.02	.72	.77	.03	.60	.86	.02	.74	.77	.03	.59
PB6	The people in my life would be happier without me	.93	.01	.86	.87	.02	.76	.89	.02	.80	.83	.03	.69
PB7	The people in my life would be better off if I were gone	.92	.02	.86	.88	.02	.77	.89	.02	.78	.83	.02	.69
PB8	I think my death would be a relief to the people in my life	.77	.03	.60	.70	.03	.49	.76	.03	.58	.68	.03	.47
	Covariance/residual covariances												
	Belong with Burden	.68	.04	-	.53	.06	-	.65	.04	-	.41	.06	-
	PB1 with PB2	-	-	-	-	-	-	.56	.05	-	.41	.06	-
	PB2 with PB3	-	-	-	.38	.06	-	-	-	-	-	-	-
	PB3 with PB5	-	-	-	-	-	-	-	-	-	-.39	.06	-
	PB6 with PB7	-	-	-	-	-	-	.41	.10	-	-	-	-
	TB1 with TB2	.10	.06	-	.15	.07	-	.08	.07	-	.14	.08	-
	TB2 with TB3	.29	.07	-	-	-	-	-	-	-	-	-	-
	TB6 with TB9	-	-	-	.39	.06	-	-	-	-	-	-	-
	TB7 with TB9	.36	.05	-	-	-	-	-	-	-	-	-	-

Note. Belong = thwarted belongingness; Burden = perceived burdensomeness.
    All estimates are based on the multigroup CFA models for testing scalar invariance (i.e., Models 3a and 6c in Table 2).

Associations of the Interpersonal Factors with Suicide Ideation

For the 15-item and 14-item INQ, the associations of thwarted belongingness and perceived burdensomeness with suicide ideation were separately evaluated by single-group SEMs, using the Australian and Hong Kong samples. The fit statistics of the four single-group SEMs are presented in Table 4. Standardized coefficients for the structural paths appear in Figure 2. Perceived burdensomeness was significantly and positively associated with suicide ideation for both versions of INQ in both samples. However, thwarted belongingness was significantly and positively associated with suicide ideation in the Australian sample only (for both versions of INQ). The SEMs accounted for 35.8% (14-item, Australia), 9.7% (14-item, Hong Kong), 35.9% (15-item, Australia) and 10.2% (15-item, Hong Kong) of the variance in suicidal ideation scores.
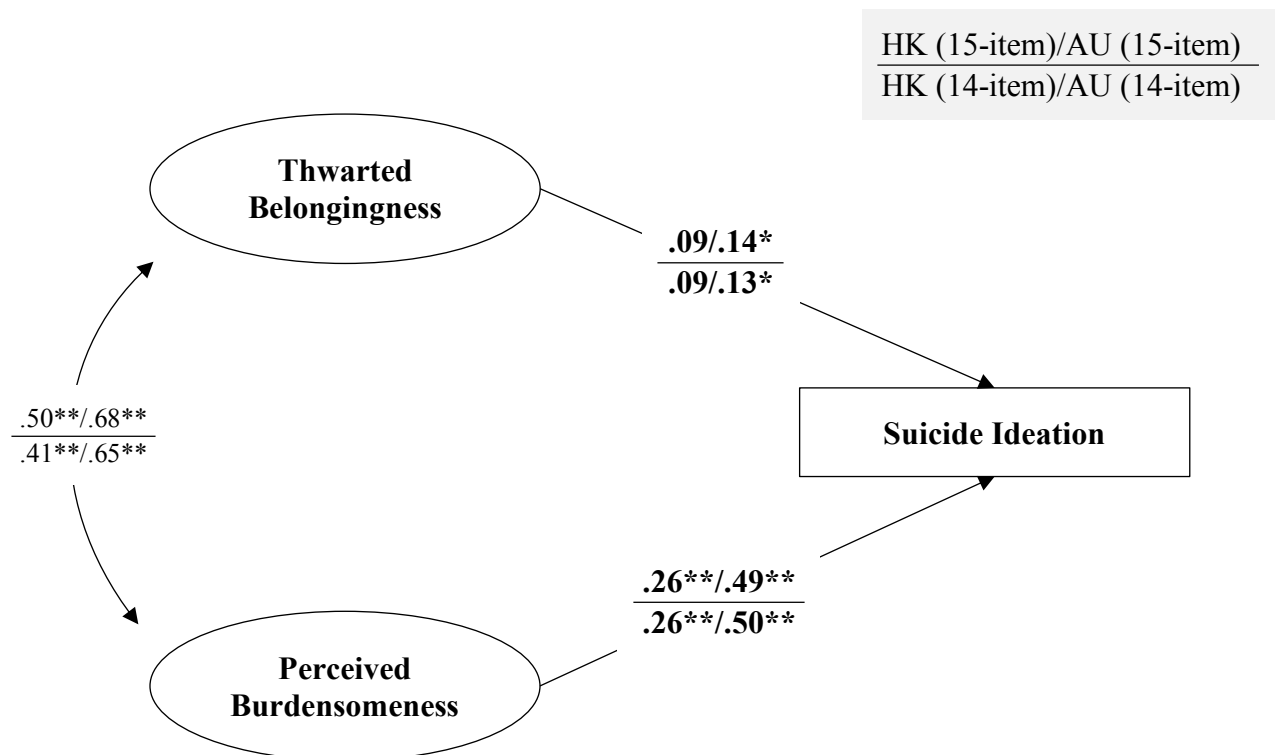

Figure 2. The standardized estimates for the four single-group structural equation models to individually examine the associations between suicide ideation and the interpersonal factors in the Australian and Hong Kong samples. HK = Hong Kong. AU = Australian. *p* < .05 and **p* < .01.

Table 4 *Fit Statistics for Single-group/Multigroup Structural Equation Models*

Description	χ^2	*df*	CFI	TLI	RMSEA (90% CI)	SRMR
"Good fit" indicated by:			≥.95	≥.95	≤.06	≤.08
"Acceptable fit" indicated by:			≥.90	≥.90	≤.08	
Structural path coefficients between the interpersonal factors and suicide ideation						
Australian sample: 14 items INQ	317.899**	86	.94	.92	.08 (.067 - .085)	.06
Australian sample: 15 items INQ	306.629**	100	.94	.93	.07 (.058 - .075)	.05
Hong Kong sample: 14 items INQ	234.882**	86	.94	.92	.06 (.054 - .073)	.05
Hong Kong sample: 15 items INQ	393.805**	100	.88	.86	.08 (.074 - .092)	.10
Structural invariance for the path coefficients between the interpersonal factors and suicide ideation						
14 items INQ	669.356**	193	.92	.92	.07 (.068 - .080)	.07
15 items INQ	796.025**	221	.91	.90	.08 (.071 - .082)	.08

Note. Robust Maximum Likelihood estimation was used.
χ^2 = Satorra-Bentler Chi-Square; CFI = comparative fit index;
TLI = Tucker-Lewis Index; RMSEA = root mean square error of approximation;
CI=confidence interval; SRMR= standardized root mean square residual.
p < .05 **p* < .001.

Equivalence of the Associations across Australia and Hong Kong

Equivalent associations of the interpersonal factors with suicide ideation were evaluated by multigroup SEMs with the Wald test function. The fit statistics of the two multigroup SEMs are presented in Table 4. Standardized coefficients for the structural paths appear in Figure 3. Results supported the equivalence of the associations across Australia and Hong Kong, for both versions of the INQ. For the associations between thwarted belongingness and suicide ideation, the Wald tests were not significant, (14-item INQ: $\chi^2(1) = .03$, $p = .86$; 15-item INQ: $\chi^2(1) = .06$, $p = .81$) indicating that Australian students ($\beta_{\text{14-item}} = .13$; $\beta_{\text{15-item}} = .14$) and Hong Kong students ($\beta_{\text{14-item}} = .09$; $\beta_{\text{15-item}} = .10$) did not differ in the associations. Similar results were shown in the associations between perceived burdensomeness and suicide ideation. The Wald tests were not significant, (14-item INQ: $\chi^2(1) = 3.46$, $p = .06$; 15-item INQ: $\chi^2(1) = 3.19$, $p = .07$) indicating that Australian students ($\beta_{\text{14-item}} = .51$; $\beta_{\text{15-item}} = .49$) and Hong Kong students ($\beta_{\text{14-item}} = .26$; $\beta_{\text{15-item}} = .26$) did not show different association patterns.
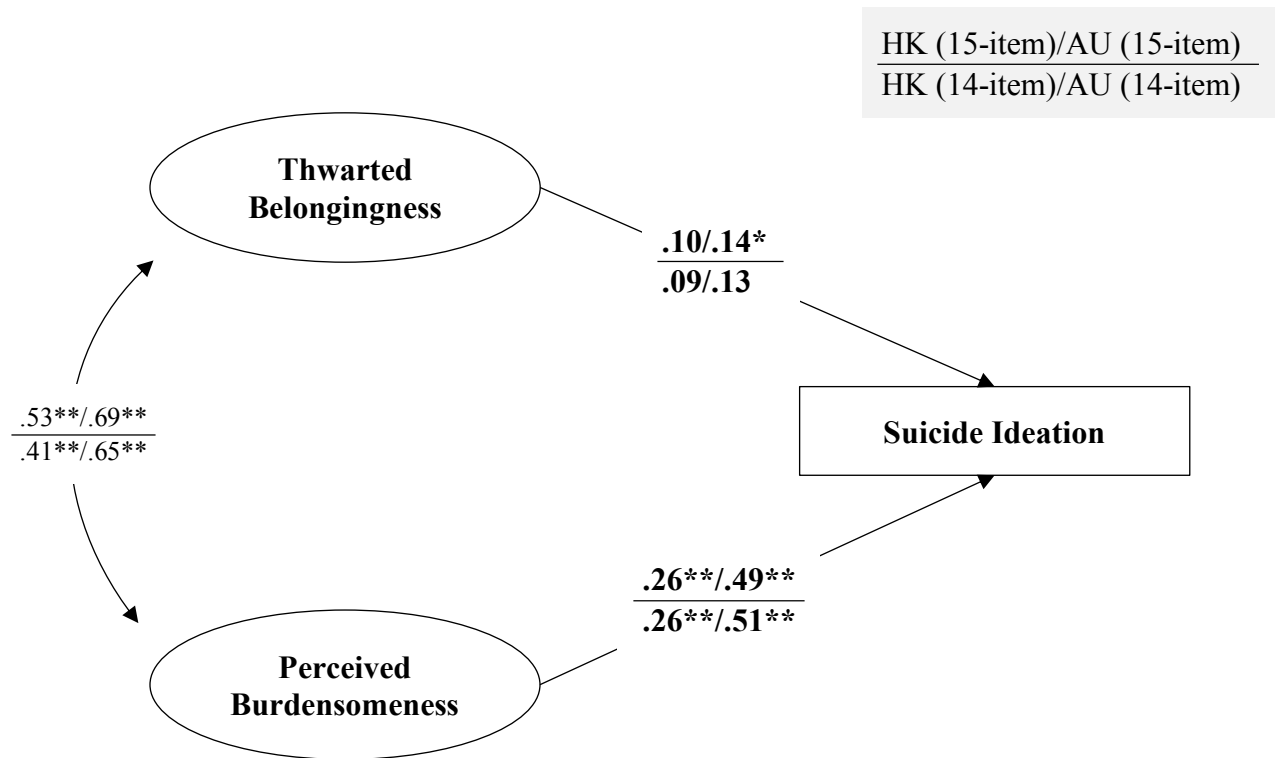
Figure 3. The standardized estimates for the two multigroup structural equation models to examine structural invariance across the Australian and Hong Kong samples. HK = Hong Kong. AU = Australian. *$p < .05$ and **$p < .01$

Two-way Interactions of the Interpersonal Factors

The two-way interactions between thwarted belongingness and perceived burdensomeness were individually evaluated by single-group SEMs with an interaction variable, using the Australian and Hong Kong samples. Standardized coefficients for the structural paths appear in Figure 4. The interaction was significant in the Australian sample only ($\beta_{14\text{-item}} = .39$, $p = .00$; $\beta_{15\text{-item}} = .41$, $p = .00$). The graphical representation of the significant interactions is presented in Figure 5. The data points of the interactions were plotted on the graphs with the latent scores of thwarted belongingness ranging from -3 *SD* to +3 *SD*. High and low burdensomeness correspond to1 *SD* above and 1 *SD* below the zero

mean of perceived burdensomeness, respectively. The results were similar for the 15-item

and 14-item INQ. Either interpersonal factor moderated the association of the other

interpersonal factor with suicidal ideation. Specifically, among students with higher

perceived burdensomeness, the association between thwarted belongingness and suicide

ideation became more positive when thwarted belongingness increased. Among students with

lower perceived burdensomeness, the association between thwarted belongingness and

suicide ideation became more positive when thwarted belongingness decreased. Therefore,

individuals with high levels of both interpersonal factors are at great risk for suicide ideation.

The interaction variable accounted for an additional 6.9% (14-item, Australia) and 7.3% (15-

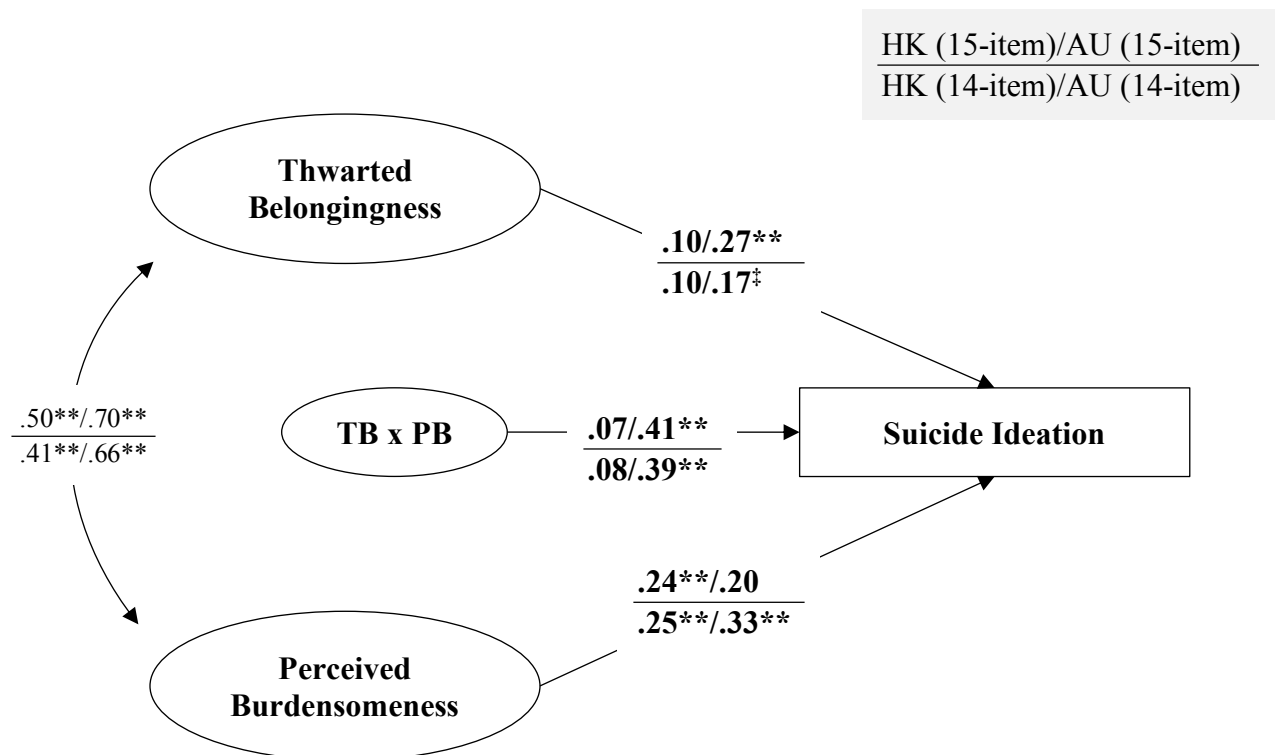item, Australia) of the variance in suicidal ideation scores.

Figure 4. The standardized estimates for the four single-group structural equation models to individually examine the associations between suicide ideation and the interpersonal factors and the interaction between the interpersonal factors in the Australian and Hong Kong samples. TB = thwarted belongingness. PB = perceived burdensomeness. HK = Hong Kong. AU = Australian. *$p < .05$, **$p < .01$, and ‡$p = .052$.

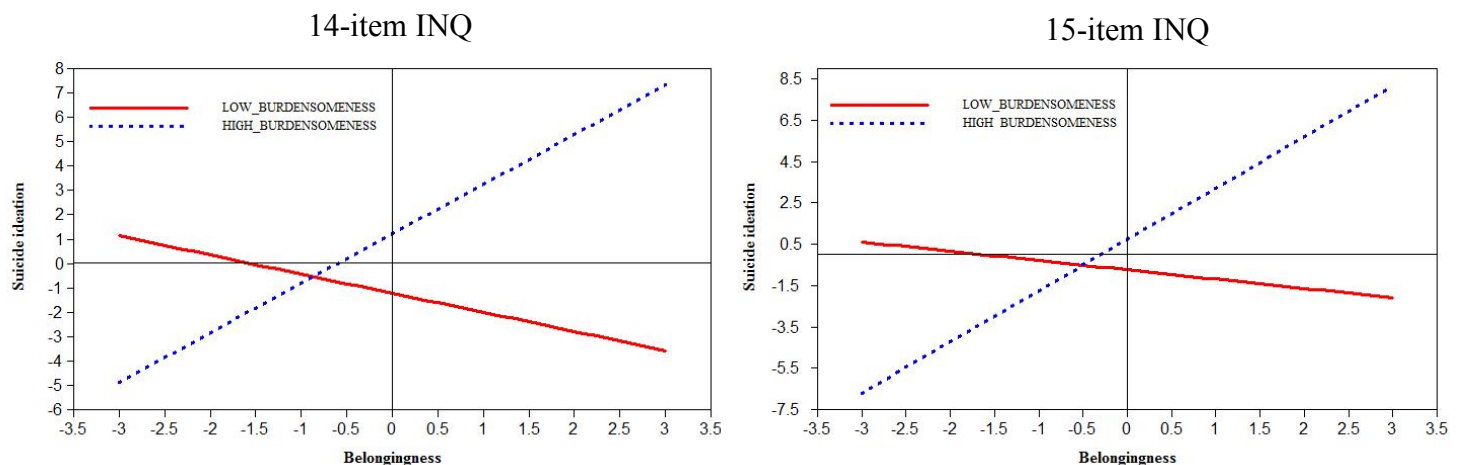14-item INQ   15-item INQ

Figure 5. Interactions between the interpersonal factors on suicide ideation in the Australian sample. The effect of thwarted belongingness was evaluated at low (1 *SD* below the mean) and high (1 *SD* above the mean) levels of perceived burdensomeness. Belongingness = thwarted belongingness. Burdensomeness = perceived burdensomeness.

Discussions

The overarching purpose of the present study was to investigate the cross-cultural generalizability of the interpersonal theory of suicide in order to demonstrate the potential utility of the interpersonal theory of suicide across cultures. Examination of the cross-cultural generalizability of a theory requires a cross-culturally equivalent measure for the variables of interest. Following this notion, this study investigated the measurement invariance of the 15-item and 14-item INQ across the student samples from Australia and Hong Kong. Single-group analyses supported the two-factor structure, reliability, and validity of the English version of the 14-item INQ. Multigroup analyses supported configural and metric invariance across cultures for both 15-item and 14-item INQ. In other words, both versions of the INQ showed the same pattern of factor structure and factor loadings across cultures. However, both versions of INQ did not perform well under examinations of scalar invariance across cultures. After releasing the constraints of one item for the 14-item INQ and three items for the 15-item INQ, partial invariance was support for both versions of INQ. These findings

indicated that the item intercepts of the 15-item and 14-item INQ were comparable with few differences. Taken together, results from this study suggest that although there are a few differences in item intercepts, the 15-item and 14-item INQ are generally cross-culturally equivalent measures for assessing the interpersonal factors across Western cultures, such as Australian, and Chinese culture.

The examination of measurement invariance across cultures is a considerable strength of this study. This study provides initial evidence of the culturally invariant factor structure and factor loadings of the 15-item and 14-item INQ. This study also established partial scalar invariance for both versions of INQ and identified the specific items with differential item functioning across Australian and Chinese cultures. These findings thus provide an empirically supported measure for assessing and interpreting cultural similarities, or differences, in the interpersonal factors and their associations with other variables. This is a major contribution to progress in suicide-related research because it enables meaningful cross-cultural comparison of the theoretically derived risk factors for suicidal ideation. Nevertheless, the 15-item INQ had three items with differential item functioning and demonstrated only marginal model fit. A suggested solution for future cross-cultural research is to consider dropping the noninvariant items and use the invariant items only (for details, see Sass, 2011). However, the 14-item INQ had only one item with differential item functioning. The adequate model fit shows support for scalar invariance and indicates the minimal level of item bias for all but one item of the 14-item INQ across Australian and Chinese cultures. Since the gap in the standardized loadings of that item was not substantial (.004), the item may exhibit only slightly different functions across the two cultures.

Another important finding of this study is the demonstration of cross-cultural equivalence for the associations of the interpersonal factors (thwarted belongingness and perceived burdensomeness) with suicide ideation across the Australian and Hong Kong

samples. Specifically, this study did not find significant cultural differences in the associations. As discussed earlier, cross-cultural generalizability of the interpersonal theory should be demonstrated (rather than assumed) due to potential cultural differences in self-construal, need to belong, and sensitivity to social rejection and others' evaluations (Lou & Li, 2017; Markus & Kitayama, 2010). Therefore, this finding provides empirical support for the applicability of the interpersonal theory for suicide research in Chinese cultures. In addition, this finding is in line with the previous study examining the cross-cultural generalizability across South Korean and a Western culture (Shu et al., 2017). Taken together, these findings support the applicability of the interpersonal theory in North East Asian cultures, such as Chinese, South Korean and potentially other collectivist cultures. Furthermore, the findings of this study provide a strong foundation for using the research findings of the interpersonal theory in Western cultures to inform specific directions in suicide prevention and research in Chinese cultures. Given the recent increase in the suicide rate of Hong Kong Chinese youth (Cheng, Chen, Lee & Yip, 2017; Committee on Prevention of Student Suicides, 2016), this finding provides valuable evidences for advancing progress in the prevention of suicide among Hong Kong Chinese youth.

Another noteworthy finding of this study is that the two-way interaction between the interpersonal factors was significantly associated with suicidal ideation in the Australian sample, but not in the Hong Kong sample. The finding with the Australian sample is consistent with the interpersonal theory (Van Orden et al., 2010) and previous findings in Western cultures (for a review, see Chu et al., 2017). However, the finding from the Hong Kong sample appears to contradict the interpersonal theory in that the effect of either interpersonal factor on suicidal ideation did not significantly depend on the level of the other interpersonal factor. As such, the interpersonal factors do not appear to have an interaction effect on predicting suicide ideation in the Hong Kong sample. This finding is in line with the

cultural differences reported between South Korean and American samples (Suh et al., 2017).

More specifically, Suh and colleagues (2017) also demonstrated that the predictive effect of

the interaction was significant in a Western individualistic culture but not significant in an

East Asian collectivistic culture. Further examination of these differences is theoretically and

practically important because it enhances the specificity of how the interpersonal factors and

suicidal ideation are associated in different cultures and provides a more culturally specific

direction for suicide research, prevention and intervention. Both replication and extension of

this research is thus warranted.

A key advantage of this study resides in its practical implications. Given that the 15-

item and 14-item INQ are measurement invariant across at least Western and Chinese

cultures, they can be utilized to assess the interpersonal factors and examine the interpersonal

theory in Chinese populations and cross-cultural research. As such, research findings of the

interpersonal theory in Western cultures may help inform directions in future research and

suicide prevention in Chinese cultures. Due to the 14-item INQ's brevity and strong

psychometric properties, it can be used as a reliable and valid measure to assess suicide risk

without imposing too much burden on participants, administers, researchers, and clinicians.

Future research evaluating the use of 15-item and 14-item INQ in clinical settings and

developing clinical cutoff scores would further inform the practical use of the 15-item and

14-item INQ.

Another major strength of this study is the inclusion of a cultural comparison group.

A recent review indicated that the lack of cultural comparison group in previous studies (e.g.,

Zhang et al., 2013) has prevented these studies from identifying cultural differences in risk

factors and mechanisms of suicide ideation (Stewart et al., 2017). Therefore, with the

inclusion of a cultural comparison group, this study demonstrated not only the significant

associations between the interpersonal factors and suicide ideation, but also the cross-cultural

equivalence of the associations across Chinese and Australian cultures. Furthermore, this study is the first study to use a culturally equivalent INQ to examine cross-cultural generalizability of the interpersonal theory.

However, this study is not without limitations, including the cross-sectional design and an imbalanced ratio of the Australian participants' gender, with over 75% of the Australian sample of this study being female. Despite this, a previous study has demonstrated measurement invariance across gender for the INQ, using an American sample (Freedenthal, Lamis, Osman, Kahlo, & Gutierrez, 2011). As such, the imbalance in ratio of gender should not have unduly influenced the findings of this study. Nevertheless, future studies may seek to examine measurement invariance across gender in non-Western cultures. Investigation of such invariance may shed light on whether the difference between male and female reflects the real differences in the interpersonal factors in non-Western cultures. Lastly, this study examined measurement invariance using the CFA approach. Future studies may use other approaches, such as item response theory (Oishi, 2007), to further establish measurement invariance for the INQ.

In conclusion, this study established measurement invariance across Chinese and Australian cultures for the 15-item and 14-item INQ. These findings enable future use of the 15-item and 14-item INQ as psychometrically sound measures for cross-cultural research. To our knowledge, this is the first study to use a culturally equivalent INQ to examine cross-cultural generalizability of the interpersonal theory across Chinese and a Western culture. Therefore, this study provided important support for the cross-cultural generalizability of a proposition of the interpersonal theory of suicide (i.e., the interpersonal factors predict suicide ideation). In addition, this study further identified cultural differences relevant to the interpersonal theory with respect to the predictive effect of the interaction between the interpersonal factors. In general, the findings of this study set the stage for using research

findings in Western cultures (individualistic cultures) to inform directions in future research

and suicide prevention in non-Western cultures (collectivistic cultures).

General Discussion

The broad purpose of this dissertation was to contribute to the cross-cultural research of suicide with a focus on generalizability of the interpersonal theory and measurement invariance for relevant assessments of suicide. More specifically, the aims of this dissertation were threefold: 1) translate the INQ into Chinese and examine its factorial structure and psychometric properties; 2) establish measurement invariance across Chinese and Australian cultures for the INQ; 3) use a cross-culturally equivalent INQ to examine cross-cultural generalizability of the interpersonal theory of suicide.

Key Findings and Contributions from Article 1

The first study generated two versions of Chinese INQ (i.e., 15-item and 14-item) and provided evidence for their psychometric adequacy. This study performed EFAs to empirically derive the 14-item INQ from the original INQ (25-item) and performed CFAs to evaluate the factorial validity (indicated by model fit) of the 15-item and 14-item Chinese INQ. Although the 15-item Chinese INQ only demonstrated close to acceptable fit, the 14-item Chinese INQ met all criteria for good fit. These findings provided strong support for the factorial validity of the 14-item INQ and some support for the factorial validity of the 15-item INQ in Chinese cultures. Furthermore, both the 15-item and 14-item Chinese INQ demonstrated excellent reliability.

This study also performed SEMs to examine the convergent and divergent validity and concurrent validity for the 15-item and 14-item Chinese INQ. The results were similar for both versions of Chinese INQ. Consistent with previous findings in Western cultures (e.g., Van Orden et al., 2012), the convergent validity was supported. Although there was no support for divergent validity, these results are consistent with previous studies in Western cultures (Van Orden et al., 2012), suggesting that the interpersonal factors are also related to

a wide range of psychological constructs in Chinese cultures. Furthermore, as reported by many studies in Western cultures (e.g., Hill & Pettit, 2012; Lamis & Lester, 2012; Monteith et al., 2013; Van Orden et al., 2008; Wong et al., 2011), concurrent validity was supported for perceived burdensomeness but not thwarted belongingness. These results are theoretically important because they provide support for the15-item Chinese INQ's reliability and validity. Given that the 15-item INQ is the most widely used version in Western cultures (for a review, see Chu et al., 2017), evidence for the psychometric adequacy of the 15-item INQ in Chinese cultures provides a foundation then for generalizing findings from Western cultures to Chinese ones.

To our knowledge, this study was the first to examine and support the psychometric adequacy of the15-item Chinese INQ. The finding will hopefully facilitate future research on the interpersonal theory of suicide in Chinese cultures. A further practical contribution of this study is its generation of the brief and psychometrically sound 14-item Chinese INQ, which allows researchers and clinicians to assess risk for suicide with minimal burden on respondents and administers. Overall, these findings represent an essential first step for using the interpersonal theory of suicide to understand suicide among Chinese populations. Additionally, these findings provide a solid foundation for the subsequent examination of measurement invariance for the INQ and cross-cultural generalizability of the interpersonal theory across Chinese and Western cultures.

Key Findings and Contributions from Article 2

The second study established measurement invariance for the 15-item and 14-item INQ across Australian and Chinese cultures, provided support for the cross-cultural equivalence for the associations of the interpersonal factors with suicide ideation across Australian and Chinese cultures, and provided further evidence for the cultural differences in

the predictive effect of the two-way interaction between the interpersonal factors on suicidal ideation (i.e., significant interaction in Australian culture and non-significant interaction in Chinese culture).

This study performed multigroup CFAs to evaluate configural, metric, and scalar invariance. For both versions of the INQ, there was strong support for configural and metric invariance, as well as partial support for scalar invariance. These findings indicate that the 15-item and 14-item INQ are generally cross-culturally equivalent measures for assessing the interpersonal factors across Chinese and Australian cultures, despite a few differences in item intercepts of the items. This study also performed multigroup SEMs with the Wald test function to examine the cross-cultural equivalence for the associations between the interpersonal factors and suicidal ideation. There was no significant cultural difference found in the associations. These findings show substantial evidence for cross-cultural generalizability of the proposition, that the interpersonal factors predict suicide ideation, across Chinese and Australian cultures.

Therefore, a major contribution of this study here is the provision of an empirically supported measure (the INQ) for assessing and interpreting cultural similarities, or differences, in the interpersonal factors and their associations with other variables across Chinese cultures and Western cultures (e.g., Australian). As such, this study enables meaningful cross-cultural comparison of the theoretically derived risk factors for suicidal ideation across Chinese and Western cultures. Another important contribution is the empirical support for using research findings of the interpersonal theory in Western cultures, with due caution, to inform specific directions in suicide prevention and future research in Chinese cultures. As such, this study could potentially advance progress in the prevention of suicide for Chinese populations (and for Hong Kong Chinese youth in particular).

Additionally, this study performed single-group SEMs to individually investigate the predictive effect of the interaction between the interpersonal factors on suicidal ideation in Chinese and Australian cultures. In addition to the main effect of the interpersonal factors, the interaction between the interpersonal factors significantly predicted suicidal ideation in the Australian sample. However, the predictive effect was not significant in the Hong Kong sample and this finding appears to contradict the interpersonal theory. More specifically, the effect of either interpersonal factor on suicidal ideation did not significantly depend on the level of the other interpersonal factor. As such, the interpersonal factors do not appear to have an interaction effect on predicting suicide ideation in the Hong Kong sample.

These results are consistent with the cultural differences reported between South Korean and American samples (Suh et al., 2017) and provide further evidence for the cultural differences between East Asian and Western cultures. Given that the predictive effect of the interaction has been predominantly examined in Western cultures (for a review, see Chu et al., 2017), this study represents a valuable addition to the scarce literature on the predictive effect of the interaction in East Asian cultures. This study also provides preliminary support for future research to investigate the specific role of culture in the predictive effect of the interaction.

Synthesis and General Contributions

Overall, this dissertation extended the existing suicide literature by being the first study to: 1) generate two brief, reliable and valid versions of Chinese INQ; 2) rigorously examine and establish measurement invariance for those two versions of INQ, and 3) use the culturally equivalent INQ to examine and support cross-cultural generalizability of the interpersonal theory (across Chinese and Australian cultures). Furthermore, the findings of this dissertation provide a platform for: 1) using the interpersonal theory of suicide to

understand suicide among Chinese populations, and 2) using research findings of the interpersonal theory in Western cultures to inform directions in future research and suicide prevention in Chinese and probably other East Asian cultures.

Limitations and Future Research

As with all research, the studies of this dissertation are not without limitations. First, the cross-sectional design prevents any definitive conclusion about the hypothesized causal effect of the interpersonal factors on suicidal ideation. However, the current findings represent a substantial foundation for future longitudinal research in Chinese and potentially other East Asian cultures. Second, this dissertation employed university student samples only. Thus, future research is needed for generalizing the current findings to other samples with different ranges of age, socioeconomic status, and clinical severity. However, given that youth suicide is a priority public health issue worldwide (World Health Organization, 2014), the findings of this dissertation address this important issue by providing valuable information about the potential mechanisms of suicidal behaviors among Australian and Chinese youths. Related to this point, future research evaluating the use of 15-item and 14-item INQ in clinical settings and developing clinical cutoff scores would further inform the practical use of the 15-item and 14-item INQ. Lastly, this dissertation examined measurement invariance using the CFA approach. Future studies may use other approaches, such as item response theory (Oishi, 2007), to further establish measurement invariance for the INQ.

Conclusion

In conclusion, this dissertation contributes to suicide research and prevention in two important ways. First, this dissertation generated the 14-item and 15-item Chinese INQ and provided evidence for their reliability, validity and measurement invariance across Chinese

and Australian cultures. These findings enable future use of the 15-item and 14-item INQ as brief and psychometrically sound measures for assessing suicide risk in Chinese populations and cross-cultural research. Second, using the culturally equivalent INQ to examine cross-cultural generalizability, this dissertation provides substantial support for the cross-cultural generalizability of the interpersonal theory of suicide across Chinese and Australian cultures. These findings provide a strong foundation for using research findings in Western cultures to inform directions in future research and suicide prevention in Chinese and potentially other East Asian cultures.

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