Validity of a scale of neighbourhood informal social control relevant to pre-schoolers' physical activity: A cross-sectional study

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ABSTRACT

Childhood physical activity (PA) is important for health across the lifespan. Time pre-schoolers spend outdoors, which has been associated with more PA, is likely influenced by parents' perception of neighbourhood informal social control relevant to pre-schoolers' PA, defined as the willingness of neighbours to intervene to ensure social order and a safe community environment for young children's active play. To advance measurement of this construct, we assessed factorial and construct validities of the PA-related neighbourhood informal social control scale for parents of pre-schoolers (PANISC-PP). In 2013–2014, Hong Kong primary caregivers (n=394) of 3–5 year-old children completed a socio-demographic questionnaire, the preliminary version of the PANISC-PP, and self-report measures of theoretical neighbourhood correlates of PA-related neighbourhood informal social control (perceived signs of physical and social disorder, community cohesion, perceived stranger danger, risk of unintentional injury and traffic safety). The fit of the data to an a priori measurement model of the PANISC-PP was examined using confirmatory factor analyses. As the a priori model showed inadequate fit to the data, the factor structure was re-specified based on theoretical considerations. The final measurement models of the PANISC-PP showed acceptable fit to the data and consisted of three correlated latent factors: "General informal supervision", "Civic engagement for the creation of a better neighbourhood environment" and "Educating and assisting neighbourhood children". The internal reliability of the subscales was good (Cronbach's α values 0.82–0.89). Generalised additive mixed models indicated that all subscales were positively associated with community cohesion and scores on the subscale "Educating and assisting neighbourhood children" were related in the expected direction to all indicators of traffic and personal safety, supporting construct validity of the PANISC-PP. This study suggests that the PANISC-PP is a reliable and valid instrument for assessing parents' perceived neighbourhood informal social control related to pre-schoolers' PA.

1. Introduction

Encouraging adequate levels of physical activity (PA) in pre-schoolers is important for health in childhood and across the life-span (Adamo et al., 2014; Carson et al., 2016; Innella, Breitenstein, Hamilton, Reed, & McNaughton, 2016; Telama et al., 2014). Unfortunately, the prevalence of pre-schoolers meeting the current guideline of three hours of PA per day (Pate & O'Neill, 2012) is typically low worldwide, ranging from as little as 5% to around 50% (Cardon & De Bourdeaudhuij, 2008; Hinkley, Salmon, Okely, Crawford, & Hesketh, 2012; Pate et al., 2015; Pujadas Botey, Bayrampour, Carson, Vinturache, & Tough, 2015).

As posited by social ecological (Stokols, 1996) and social cognitive theories (Bandura, 2004), PA behaviour is influenced by interacting individual, social and environmental factors. Environmental factors are particularly important for pre-schoolers as more time spent outdoors has been shown to be associated with more PA (Cerin et al., 2016; Hinkley, Crawford, Salmon, Okely, & Hesketh, 2008; Hinkley, Salmon, Okely, Crawford, & Hesketh, 2012; Sallis et al., 1993). Due to their low level of autonomy, pre-schoolers' time outdoors is dependent on parents' safety perceptions of the environment, especially the immediate neighbourhood environment where most young children are likely to play (Cerin et al., 2016). In fact, parental perceptions that the neighbourhood was unsafe has been associated

with their preschool children not being allowed to play outdoors (O'Connor et al., 2014a) and being less active (Datar, Nicosia, & Shier, 2013).

Parental perceptions of neighbourhood safety do not necessarily reflect objectively measured safety (Carver, Timperio, & Crawford, 2008; Gielen et al., 2004; Kimbro & Schachter, 2011; Soltero, Cerin, Lee, & O'Connor, 2016). They can be influenced by other factors, such as the perceived level of collective efficacy within the neighbourhood (Sampson, Morenoff, & Earls, 1999), which has been shown to be associated with mothers' fear of their children playing outdoors (Kimbro & Schachter, 2011). Collective efficacy for children is task specific and related to adults' shared expectations and mutual engagement in the active support and social control of children (Sampson et al., 1999). It is a combination of child-centred mutual trust and community solidarity (i.e., social cohesion) and willingness to intervene to ensure the maintenance of social order and safety in the community (i.e., informal social control; ISC) (Sampson, Raudenbush, & Earls, 1997). Child-centred ISC encompasses informal processes such as educating children about safety, stopping and preventing hazardous behaviours or situations, and assisting children in need. Parents are more likely to allow their children to play outdoors if residents of the community share mutual health-related goals (e.g., importance of being physically active) and there is a high level of child-centred neighbourhood ISC that help shape a healthy social environment by reducing the incidence of undesired events, such as neighbourhood safety concerns (McNeill, Kreuter, & Subramanian, 2006). In fact, a recent study on parents of Latino preschool-age children found child-centred neighbourhood ISC to be positively associated with parenting practices encouraging participation in PA and with having outdoor toys available to children for play (O'Connor et al., 2014b). While the importance of neighbourhood ISC for engagement in PA has been previously highlighted in theoretical papers (McNeill et al., 2006) as well as empirical studies on school-age children and adolescents (Duke, Borowsky, & Pettingell, 2012; Foster, Villanueva, Wood, Christian, & Giles-Corti, 2014), findings on young, preschool-age children are lacking.

To examine the potential effects of parent-perceived neighbourhood ISC on their PA-related parenting practices and the PA level of their preschool-age children, appropriate validated measures are needed. Until recently, measures specifically tailored to preschool-age children's PA participation were not available. Coulton and colleagues (1995) and Cerin et al. (2015) respectively developed scales of child-centred neighbourhood ISC for parents of U.S. and Latino preschool-age children. However, these scales were constructed with the aim of assessing social processes primarily focused on the enhancement of neighbourhood safety for young children in general rather than with respect to their PA participation. Virtually all items included in these two instruments describe processes pertaining to neighbourhood traffic safety and safety from crime. However, as noted by a recent qualitative study on Chinese parents of preschool-age children (Anonymous, 2014), child-centred neighbourhood ISC relevant to children's PA can potentially target factors other than traffic and crime safety. These, for example, include instructing children how to avoid injuries and conflicts with other children while playing outdoors, teaching children PA-related skills, and participation in civic actions for the creation and enhancement of neighbourhood spaces and facilities appropriate for young children.

To address the need for an instrument of child-centred PA-related neighbourhood ISC for parents of young children, a preliminary version of a scale (thereafter, PA-related neighbourhood ISC for parents of pre-schoolers or PANISC-PP) was recently developed based on formative qualitative research and expert input to ensure content validity (Suen, Cerin, & Mellecker, 2014). Although the PANISC-PP was developed in a Hong Kong Chinese setting, 13 of its 20 items were identical or comparable to those included in the measure of child-centred neighbourhood ISC developed for a U.S. Latino population

(Cerin et al., 2015). The remaining seven items covered aspects of ISC that were more specifically related to PA (improving PA skills and avoiding unintentional injuries) and described practices that are typically used in most cultures (i.e., they were not Chinese-culture specific). This makes the PANISC-PP potentially applicable to other populations of parents of preschool-age children. Although the scale showed good test-retest reliability and acceptable levels of internal consistency (Suen et al., 2014), further validation work was necessary as its factorial and construct validities had not been examined. Hence, the aim of this study was to assess the factorial and construct validities of the PANISC-PP (Suen et al., 2014). Mirroring a previous study on Latino parents (Cerin et al., 2015), construct validity assessment was based on an examination of the associations of dimensions of the PANISC-PP with perceived neighbourhood attributes hypothesised to be positively [community cohesion (Sampson et al., 1999) and traffic safety (Inclán, Hijar, & Tovar, 2005)] or negatively [signs of physical and social disorder (Cradock, Kawachi, Colditz, Gortmaker, & Buka, 2009), stranger danger (Sampson et al., 1999) and risk of unintentional injury (Carver et al., 2008; Suen et al., 2014)] related to child-centred neighbourhood ISC relevant to engagement in PA.

2. Materials and methods

2.1. Participants and procedures

A convenience sample of 394 Chinese-speaking primary caregivers of 3–5 year old children was recruited from kindergartens, preschool playgroup centres and Maternal Care and Health Clinics (MCHC) of the Department of Health of the Hong Kong Special Administrative Region (SAR) in 2013 and 2014. Recruitment locations were stratified by administrative-area-level income (monthly domestic household income > HK$ 24,500 representing medium-to-high income and ≤HK$ 24,500 representing low-to-medium income) and population density (> 9000 residents/km^2 representing high density and ≤9000 residents/ km^2 low density areas) because these two characteristics might influence the type and levels of parents' perception of PA-related ISC and their children's PA (O'Connor et al., 2014b; Cohen, Finch, Bower, & Sastry, 2006; Suen, Cerin, & Wu, 2015a).

Participants were included in the study if they identified themselves as being a primary caregiver of at least one 3–5 year-old Chinese-speaking child living in Hong Kong. Exclusionary criteria were parents/ primary caregivers of children with a disease affecting their PA behaviour or cognitive functioning, and those who were unable to read and write in Chinese. All eligible participants provided written informed consent. They were asked to complete a socio-demographic questionnaire, the preliminary version of the PANISC-PP, and self-report measures of perceived signs of physical and social disorder, community cohesion, perceived stranger danger, risk of unintentional injury and traffic safety. Additionally, participants' census administrative areas of residence (named Tertiary Planning Units or TPUs) were recorded for analytical purposes (see Data analysis plan). The characteristics of the sample can be found in Table 1. Participants represented 96 TPUs (~4 participants per TPU).

2.2. Measures

Child-centred PA-related neighbourhood ISC was measured using a 20-item scale developed for Hong Kong Chinese-speaking parents/ caregivers of preschool-age children (PANISC-PP) (Suen et al., 2014), with items grouped into three *a priori* determined subscales: "Personal Involvement and general informal supervision" (5 items; e.g., supervise the neighbourhood children at all times), "Civic engagement for the creation of a better neighbourhood environment" (7 items; e.g., organize meetings with the police and other organizations to promote safety) and "Educating and assisting neighbourhood children" (8 items; e.g., make sure the neighbourhood children do not play in dangerous

Table 1

Participants' characteristics (N=394).

Characteristics: Statistic	(N=394)
Child's gender: frequency (%)	
Male	226 (57.4%)
Female	168 (42.5%)
Child's age in years: Mean(SD)	4.2 (0.7)
Caregivers' age, years: Mean(SD)	37.2 (6.0)
Caregivers' gender: frequency (%)	
Male	80 (20.3%)
Female	314 (79.7%)
Caregivers' relationship with child: frequency (%)	
Mother	306 (77.7%)
Father	79 (20.1%)
Others (female or male relative)	9 (2.2%)
Caregivers' education attainment: frequency (%)	
Up to lower secondary education	157 (39.8%)
Higher secondary education	47 (11.9%)
Associate degree or higher diploma	42 (10.7%)
Undergraduate degree	116 (29.4%)
Postgraduate degree	32 (8.2%)
Household monthly income (HK$): frequency (%)	
< $15,000	73 (18.5%)
$15,000–$25000	90 (22.8%)
$25,000–$40,000	75 (19.1%)
> $40,000	156 (39.6%)
Area-level household income: frequency (%)	
Low-middle (≤HK$ 24,500)	278 (70.6%)
Middle-high (> HK$ 24,500)	116 (29.4%)
Area-level population density: frequency (%)	
Low (≤9000 residents/km²)	271 (68.8%)
High (≤9000 residents/km²)	123 (31.2%)

areas). Each item was rated on a 5-point Likert scale ranging from strongly disagree (1) to strongly agree (5). In a previous study, these subscales showed substantial to excellent levels of test-retest reliability [intra-class correlations (ICCs) ranged from 0.61 to 0.81] and acceptable to excellent levels of internal consistency (Cronbach's alphas ranged from 0.74 to 0.90) (Suen et al., 2014).

Community cohesion was measured using a validated Chinese version (Suen, Cerin, Huang, & Mellecker, 2015b) of a 7-item scale developed by Martinez et al. (2002). The scale included items tapping feelings of membership, trust, mutual influence and social and emotional ties among neighbours. Responses were given on a 5-point Likert scale. The Chinese version of the scale showed substantial levels of test-retest reliability (ICC: 0.60–0.80) and acceptable levels of internal consistency (Cronbach's > 0.70) (Anonymous, 2015b). *Perceived signs of physical and social disorder,* including descriptors of neighbourhood conditions that are relevant to caregivers of young children, were gauged with a 16-item scale developed for a Hong Kong Chinese population, with responses given on a 5-point frequency scale ranging from 'never' (1) to 'frequently' (5). In a validity study, the scale showed substantial levels of test-retest reliability (ICC = 0.60) and excellent internal consistency (Cronbach's α = 0.88–0.91) (Suen et al., 2015b). A Chinese validated version of a 4-item scale used in the Neighborhood Impact on Kids Study (www.nikproject.org/index.htm) was employed to assess *perceived stranger danger* (Suen et al., 2015b). Items were rated on a 4-point Likert scale. Cronbach α for the Chinese version of the scale ranged from 0.87 to 0.90, while test-retest reliability was substantial (ICC = 0.69). *Perceived traffic hazards* and *risk of unintentional injury* were measured with 5-item scales developed for Hong Kong Chinese parents of preschool-age children (Suen et al., 2015b). The test-retest reliability of these two scales ranged from moderate to substantial, while their internal consistency ranged from 0.71 to 0.73 for the traffic hazards scale, and from 0.78 to 0.86 for the risk of unintentional injury scale (Suen et al., 2015b). Respondents rated each item on a 4-point Likert scale. *Socio-demographic characteristics* of the respondent (age, sex, educational attainment, household income and relationship with child) and their preschool-age child (age and sex) were assessed using a questionnaire.

2.3. Data analysis plan

Descriptive statistics (mean, SD, median, interquartile range and skewness) were computed for each item of the PANISC-PP (Table 2). The validity of a measurement model of the PANISC-PP was examined using Confirmatory Factor Analysis (CFA). The *a priori* measurement model (Fig. 1) was specified based on the results of a formative study (Suen et al., 2014) suggesting that the PANISC-PP consisted of three

Table 2

Descriptive statistics of items included in the original version of the PA-related Neighbourhood Informal Social Control scale for Parents of Pre-schoolers (PANISC-PP).

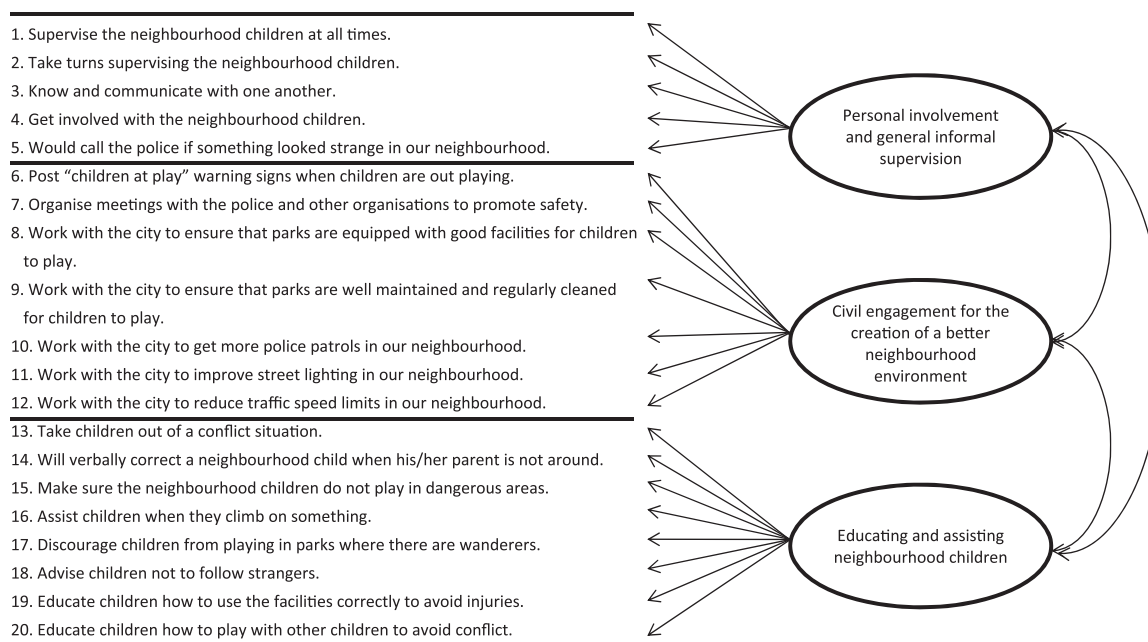| Items	People in my neighbourhood...	M (SD)	Skew
1	...supervise the neighbourhood children at all times.	2.72 (0.88)	0.03
2	...take turns supervising the neighbourhood children.	2.57 (0.82)	0.01
3	...know and communicate with one another.	3.56 (0.73)	-0.70
4	...get involved with the neighbourhood children.	3.29 (0.85)	-0.31
5	...would call the police if something looked strange in our neighbourhood.	3.86 (0.60)	-0.21
6	...post "children at play" warning signs when children are out playing.	2.79 (0.99)	0.28
7	...organise meetings with the police and other organisations to promote safety.	3.17 (0.79)	-0.28
8	...work with the city to ensure that parks are equipped with good facilities for children to play.	3.54 (0.81)	-0.39
9	...work with the city to ensure that parks are well maintained and regularly cleaned for children to play.	3.60 (0.81)	-0.47
10	...work with the city to get more police patrols in our neighbourhood.	3.36 (0.79)	-0.19
11	...work with the city to improve street lighting in our neighbourhood.	3.45 (0.73)	-0.40
12	...work with the city to reduce traffic speed limits in our neighbourhood.	3.35 (0.77)	-0.17
13	...take children out of a conflict situation.	3.41 (0.77)	-0.25
14	...will verbally correct a neighbourhood child when his/her parent is not around.	3.48 (0.74)	-0.81
15	...make sure the neighbourhood children do not play in dangerous areas.	3.91 (0.70)	-0.75
16	...assist children when they climb on something.	3.75 (0.77)	-0.71
17	...discourage children from playing in parks where there are wanderers.	3.77 (0.79)	-0.36
18	...advise children not to follow strangers.	4.17 (0.71)	-0.81
19	...educate children how to use the facilities correctly to avoid injuries.	3.98 (0.70)	-0.65
20	...educate children how to play with other children to avoid conflict.	3.98 (0.71)	-0.82

Note. M = mean; SD = standard deviation.

1. Supervise the neighbourhood children at all times.

2. Take turns supervising the neighbourhood children.

3. Know and communicate with one another.

4. Get involved with the neighbourhood children.

5. Would call the police if something looked strange in our neighbourhood.

6. Post "children at play" warning signs when children are out playing.

7. Organise meetings with the police and other organisations to promote safety.

8. Work with the city to ensure that parks are equipped with good facilities for children to play.

9. Work with the city to ensure that parks are well maintained and regularly cleaned for children to play.

10. Work with the city to get more police patrols in our neighbourhood.

11. Work with the city to improve street lighting in our neighbourhood.

12. Work with the city to reduce traffic speed limits in our neighbourhood.

13. Take children out of a conflict situation.

14. Will verbally correct a neighbourhood child when his/her parent is not around.

15. Make sure the neighbourhood children do not play in dangerous areas.

16. Assist children when they climb on something.

17. Discourage children from playing in parks where there are wanderers.

18. Advise children not to follow strangers.

19. Educate children how to use the facilities correctly to avoid injuries.

20. Educate children how to play with other children to avoid conflict.

Personal involvement and general informal supervision

Civil engagement for the creation of a better neighbourhood environment

Educating and assisting neighbourhood children

Fig. 1. *A priori* measurement model of the PA-related Neighbourhood Informal Social Control Scale for Parents of Pre-schoolers.

correlated latent factors: "Personal involvement and general informal supervision", "Civic engagement for creation of better neighbourhood environment" and "Educating and assisting neighbourhood children". Specifically, items were grouped into these three factors based on an analysis of their content by a panel of experts (Suen et al., 2014) and an analysis of previous instruments of child-centred neighbourhood ISC (Cerin et al., 2015; Coulton, Korbin & Su, 1996). Seven items that described concrete organised group actions promoting specific changes in the neighbourhood environment to enhance the level of safety and the provision of appropriate places for play for young children were hypothesised to measure the latent factor of "Civic engagement for the creation of better neighbourhood environment" (Cerin et al., 2015; Suen et al., 2014) (see Fig. 1). Eight items describing actions that neighbours would undertake to educate and assist neighbourhood children regarding safe and disciplined active play outdoors were hypothesised to load on the latent factor "Educating and assisting neighbourhood children" (Coulton et al., 1996; Suen et al., 2014). The remaining five items describing passive supervision of children and broader, non-specific interactions with neighbours were made to load on the latent factor "Personal involvement and general informal supervision" (Cerin et al., 2015; Coulton et al., 1996; Suen et al., 2014). These factors were hypothesised to be positively correlated (Cerin et al., 2015; Suen et al., 2014).

CFAs were based on the Maximum Likelihood Estimation method (robust estimation) (Yuan & Bentler, 2000). Analyses were conducted on residualised within-administrative-area (within-TPU) responses to items (i.e., scores on items from which TPU-level variance was partialled out) to address the presence of clustering effects at the TPU level that, in turn, would invalidate the standard errors of the factor loadings (Cerin, 2011; Cerin et al., 2010). No evidence of residual variance at the recruitment-site (kindergarten/playgroup or MCHC) level was found after accounting for TPU-level variance. Jöreskog and Sörbom's iterative model-generating approach was used to re-specify the models including an inspection of standardised factor loadings, standardised residual covariances, univariate Langrage multiplier tests, Wald tests, multivariate outliers, and theoretical considerations (Jöreskog & Sörbom, 1993). The global goodness-of-fit of the models was tested by the comparative fit index (CFI), the root mean

square error of approximation (RMSEA), and the standardized root mean squared residual (SRMR). CFI value ≥0.95, RMSEA value ≤0.06 and SRMR value ≤0.08 were indicative of good model fit. We treated CFI values ≥0.90 as indicative of acceptable levels of model fit as they are strongly influenced by the magnitude of correlations between variables, if the other two fit indices met Hu and Bentler's stricter criteria (Hu & Bentler, 1995). The Satorra-Bentler scaled χ^2 test was also reported as it is robust to non-normally distributed data (Satorra & Bentler, 2001). The local fit of the models was examined with the following parameters: standardised factor loadings, standardised residual covariances, univariate Langrage multiplier tests and Wald tests. EQS 6.2 was used to conduct CFA.
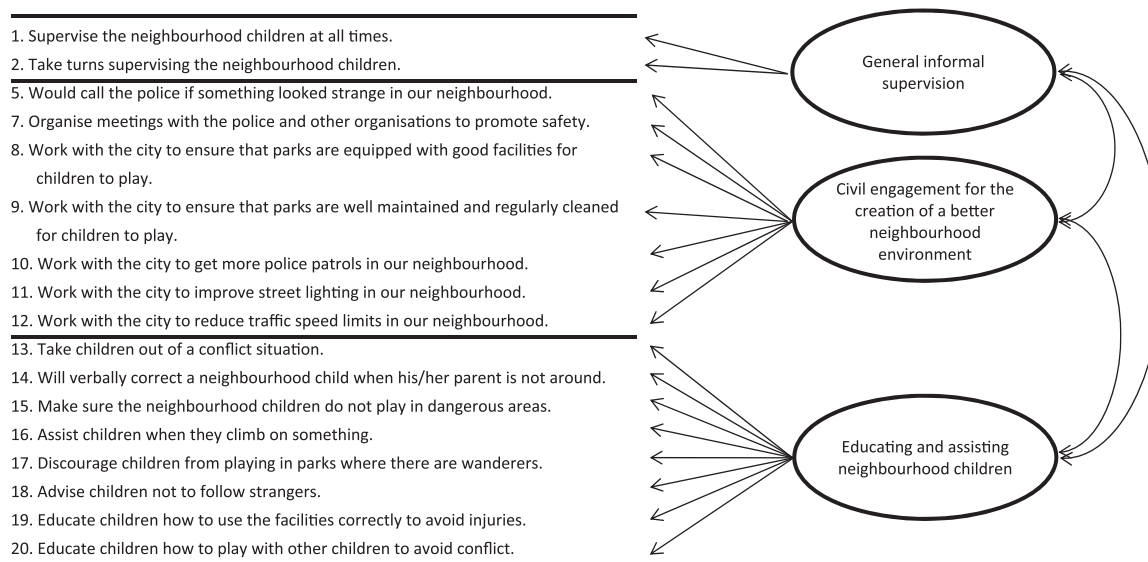
After a final measurement model of the PANISC-PP was established, Cronbach's α coefficients, corrected item-scale correlations and mean inter-item correlation were computed to estimate the internal consistency of the subscales. Mean inter-item correlations with values ranging from 0.15 to 0.50 indicate an adequate level of internal consistency (Clark & Watson, 1995).

To assess construct validity of the PANISC-PP, we estimated the associations of each subscale (defined as per final measurement model) with environmental correlates hypothesised to be associated with aspects of PA-related ISC. Generalised additive mixed models were used to estimate the associations adjusted for socio-demographic confounders (e.g., respondent's age, sex, educational attainment and household income). These models could account for the possibility of curvilinear relationships, non-normality of response distributions, and administrative-area-level clustering (Cerin, 2011; Cerin et al., 2014; Wood, 2006).

3. Results

Table 2 shows the descriptive statistics of the PANISC-PP items. The *a priori* factor structure of the PANISC-PP showed poor fit to the data, with none of the fit indices meeting the pre-established criteria [Satorra-Bentler scaled χ^2 (167) = 553, p < .001; CFI = 0.833; SRMR = 0.101; RMSEA = 0.077, 95% CI$_{RMSEA}$ = 0.070, 0.084]. After considering standardised residual covariances and Lagrange multiplier tests, the measurement model was re-specified as depicted in Fig. 2.

Fig. 2. Final measurement model of the PA-related Neighbourhood Informal Social Control Scale for Parents of Pre-schoolers.

Specifically, items 3, 4 and 6 were omitted from the model as they were substantially loading on all three latent factors and, thus, did not gauge a specific aspect on child-centred PA-related neighbourhood ISC. Item 6 ("would call the police if something look strange in our neighbourhood") was made to load on the latent factor of "Civic engagement for the creation of a better neighbourhood environment" rather than its originally assigned factor of "Personal involvement and general informal supervision" (Table 3). This change was theoretically justifiable because item 6 described a form of engagement with a government organisation (police) as did all other items loading on the Civic engagement factor. Finally, items 8 and 9 were allowed to have correlated error terms as they measured a similar construct – namely, the improvement of the quality of parks. The final measurement model of the PANISC-PP, consisting of three correlated latent factors (Fig. 2 and Table 3), demonstrated acceptable fit to the data with two indices meeting Hu and Bentler's (1995) stricter criteria of model fit [Satorra-Bentler scaled χ^2 (115) = 248, p < .001; SRMR = 0.066; RMSEA = 0.054, 95% CI_{RMSEA} = 0.045, 0.063], and the other index (CFI = 0.932) meeting the less stringent criterion.

Given that the items representing the factors "Civic engagement for the creation of a better neighbourhood environment" and "Educating and assisting neighbourhood children" did not significantly change, their name was retained. However, the factor "Personal involvement and general informal supervision" was renamed into "General informal supervision" to reflect the changes in the list of items representing the latent factor. All standardised factor loadings were statistically significant at a probability level of < 0.001 and their absolute value greater than 0.35. The corrected item-scale correlations were 0.81 for the subscale of "General informal supervision", ranged from 0.32 to 0.79 for "Civic engagement for the creation of a better neighbourhood environment" and from 0.34 to 0.68 for "Educating and assisting neighbourhood children" (Table 3). The correlation among the three latent factors was positive and small-to-moderate in size (Table 3).

The internal reliabilities of the subscales were good, with Cronbach's α values of 0.89 for "General informal supervision", 0.87 for "Civic engagement for the creation of a better neighbourhood environment", and 0.82 for "Educating and assisting neighbourhood children". The average inter-item correlations of the three subscales were 0.81 for "General informal supervision", 0.48 for "Civic engagement for the creation of a better neighbourhood environment" (range: 0.20–0.77) and 0.36 for "Educating and assisting neighbourhood children" (range: 0.17–0.71), demonstrating a good level of internal consistency.

After adjusting for socio-demographic characteristics, all three subscales of the PANISC-PP showed strong positive associations with community cohesion (Table 4). "Educating and assisting neighbourhood children" was the only subscale associated, in the expected direction, with all other perceived neighbourhood environmental attributes. "General informal supervision" and "Civic engagement for the creation of a better neighbourhood environment" were respectively negatively related to perceived traffic hazards and signs of physical and social disorder (Table 4).

4. Discussion

The purpose of this study was to assess the factorial and construct validities of the PANISC-PP, the only measure of PA-related neighbourhood ISC for parents of preschool-age children currently available. As noted earlier, although the PANISC-PP was originally developed in a Chinese setting, its items describe practices that are not overtly specific to the Chinese culture and may be applicable to other populations of parents of young children. It is, thus, hoped that the PANISC-PP will facilitate future investigations about the role of neighbourhood ISC in pre-schoolers' PA. In fact, despite the importance of the neighbourhood social environment for children's PA and other health behaviours being well documented (Carter & Dubois, 2010; Cohen et al., 2006; Duke et al., 2012; Foster et al., 2014; Stone, Faulkner, Mitra, & Buliung, 2012), the effect of neighbourhood ISC on preschool-age children's PA remains understudied. A lack of appropriate measures of child-centred neighbourhood ISC specifically focused on children's outdoor play and PA might have been one of the contributing factors to the dearth of research in this field.

This study and earlier formative work (Suen et al., 2014) suggest that the PANISC-PP is a reliable instrument consisting of three correlated latent factors, including: "General informal supervision", "Civic engagement for the creation of a better neighbourhood environment" and "Educating and assisting neighbourhood children". A non-PA-specific scale of neighbourhood ISC recently developed for Latino parents of preschool-age children displayed a somewhat similar factorial structure with a latent factor tapping organised civic actions for the enhancement of neighbourhood safety and pedestrian infrastructure, and another factor assessing supervision and safety-related education of, and provision of assistance to, children (Cerin et al., 2015). The fact that the responses on the PANISC-PP items gauging children's education, supervision and assistance were underlain by two weakly correlated latent factors ("General informal supervision" and

Table 3

Final measurement model of the Physical Activity-related Neighbourhood Informal Social Control Scale For Parents of Pre-schoolers (PANISC-PP) (N=394).

Item No.	Item description	CISC	General informal supervision	Civic engagement for the creation of a better neighbourhood environment	Educating & assisting neighbourhood children
	People in my neighbourhood …		Standardized loading	Standardized loading	Standardized loading
1	…supervise the neighbourhood children at all times.	0.81	0.90	–	–
2	…take turns supervising the neighbourhood children.	0.81	0.90	–	–
5	…would call the police if something looked strange in our neighbourhood.	0.32	–	0.36	–
7	…organise meetings with the police and other organisations to promote safety.	0.58	–	0.63	–
8	…work with the city to ensure that parks are equipped with good facilities for children to play.	0.69	–	0.67	–
9	…work with the city to ensure that parks are well maintained and regularly cleaned for children to play.	0.74	–	0.74	–
10	…work with the city to get more police patrols in our neighbourhood.	0.79	–	0.87	–
11	…work with the city to improve street lighting in our neighbourhood.	0.74	–	0.80	–
12	…work with the city to reduce traffic speed limits in our neighbourhood.	0.66	–	0.75	–
13	…take children out of a conflict situation.	0.36	–	–	0.38
14	…will verbally correct a neighbourhood child when his/her parent is not around.	0.34	–	–	0.35
15	…make sure the neighbourhood children do not play in dangerous areas.	0.65	–	–	0.69
16	…assist children when they climb on something.	0.60	–	–	0.60
17	…discourage children from playing in parks where there are wanderers.	0.39	–	–	0.40
18	…advise children not to follow strangers.	0.65	–	–	0.76
19	…educate children how to use the facilities correctly to avoid injuries.	0.68	–	–	0.83
20	…educate children how to play with other children to avoid conflict.	0.64	–	–	0.78

Notes. CISC = corrected item-scale correlation. Correlation between latent factors: "General informal supervision" and "Civic engagement for the creation of a better neighbourhood environment" = 0.33; "General informal supervision" and "Educating and assisting neighbourhood children" = 0.27; "Civic engagement for the creation of a better neighbourhood environment" and "Educating and assisting neighbourhood children" = 0.50; Correlations between error terms: Items 8 and 9 = 0.55. All factor loadings statistically significant at p < .001.

Table 4

Associations of scores on the Physical Activity-related Neighbourhood Informal Social Control scale for Parents of Pre-schoolers (PANISC-PP) with self-reported neighbourhood characteristics in Hong Kong Chinese parents of preschoolers (N=394).

Neighbourhood characteristic (theoretical range of scale)	M (SD)	Cronbach α	PANISC-PP subscale		
			General informal supervision [M = 2.64; SD = 0.82]	Civic engagement for the creation of a better neighbourhood environment [M = 3.47; SD = 0.58]	Educating & assisting neighbourhood children [M = 3.79; SD = 0.51]
			b (95% CI)	b (95% CI)	b (95% CI)
Community cohesion (1-5)	3.51 (0.51)	0.78	0.64 (0.50, 0.77)***	0.34 (0.25, 0.45)***	0.37 (0.28, 0.46)***
Perceived signs of physical and social disorder (1-5)	1.89 (0.65)	0.91	-0.01 (-0.13, 0.11)	-0.09 (-0.18, -0.02)*	-0.09 (-0.17, -0.02)*
Perceived stranger danger (1-4)	2.78 (0.78)	0.91	-0.01 (-0.11, 0.10)	-0.05 (-0.12, 0.03)	-0.06 (-0.13, -0.01)*
Perceived risk of unintentional injury (1-4)	2.48 (0.82)	0.87	-0.07 (-0.17, 0.03)	-0.02 (-0.09, 0.05)	-0.13 (-0.20, -0.05)**
Traffic hazards (1-4)	2.45 (0.52)	0.72	-0.16 (-0.31, -0.02)*	-0.02 (-0.13, 0.08)	-0.11 (-0.21, -0.02)*

Notes. Models adjusted for socio-demographic covariates (participant's age, gender educational attainment, household income, child's gender and age). Generalised additive mixed models with Gaussian variance and identity link functions were used, accounting for clustering at the census-administrative-unit (Tertiary Planning Unit) level. Regression coefficients are interpreted as the difference in the outcome followed by a 1 unit increase in the correlate. No curvilinearity in associations was found.

* $p < .05$.
** $p < .01$.
*** $p < .001$.

"Educating and assisting neighbourhood children") rather than a single factor may be due to the PANISC-PP being a measure of ISC focused on PA-related rather than general neighbourhood safety. Five of the eight items of the PANISC-PP loading on the factor "Educating and assisting neighbourhood children" make explicit reference to play or PA, all of them refer to active behaviours (talking, education and advising) rather than passive supervision, and six of them refer to specific threats that children may encounter while playing in the neighbourhood (e.g., strangers, injuries, personal conflicts). In contrast, the two items loading on the factor "General informal supervision" make no specific reference to either PA/play or concrete sources of threat and are more in line with the items pertaining to generic safety included in the corresponding child-centred neighbourhood ISC subscale for Latino parents (Cerin et al., 2015).

The provision of education and assistance to preschool-age children playing outdoors was the dimension of ISC most frequently endorsed by the respondents. The opposite was true for general informal supervision. A comparable pattern of findings was observed in Latino parents whereby two supervision-related items similar to those included in the PANISC-PP were amongst the least frequently endorsed by parents (Cerin et al., 2015). Parents may prefer to personally supervise their young children while playing outdoors as opposed to relying on neighbours. While outdoors, children are likely to play with other children and interact with adult neighbours (usually parents of other children). These social events offer ample opportunities for adult neighbours to provide safety-related advice, education and assistance to participating children. Consequently, it is not surprising that items describing such practices scored high amongst Latino as well as Chinese parents of preschool-age children.

Two items originally hypothesised to assess "Personal involvement and general informal supervision" ("*know and communicate with one another*" and "*get involved with the neighbourhood children*") were omitted from the PANISC-PP as they significantly loaded on all latent factors. These items were also deemed more likely to measure neighbourhood social cohesion than ISC, the former being underpinned by the strength of social relations, connectedness, sense of trust and belonging among neighbours (Bruhn, 2009). In contrast, ISC refers to the informal mechanisms by which residents of a neighbourhood achieve public order (Sampson et al., 1997), which are activated via relational networks present in socially cohesive communities (Bellair,

1997). Sampson et al. (1999) also suggested that whether residents are willing to intervene for the common good or not depends on the levels of trust and solidarity in the community. The fact that the two items omitted from the PANISC-PP loaded on all latent factors can be explained by social cohesion being deemed to affect the whole construct of ISC (Sampson et al., 1999). This supposition is supported by the present study which, similarly to what was observed among Latino parents (Cerin et al., 2015), found robust positive associations between community cohesion and all three subscales of PA-related neighbourhood ISC. This finding, together with the other significant associations among aspects of PA-related ISC and neighbourhood safety observed in this study, speak in favour of the construct validity of the PANISC-PP.

It is noteworthy that "Educating and assisting neighbourhood children" was the only subscale of the PANISC-PP to be significantly associated in the expected direction with all neighbourhood safety measures included in this study. This mirrors previous findings in Latino parents among whom items measuring supervision, education and assistance of children were positively associated with perceived neighbourhood traffic safety and negatively related to traffic hazards, stranger danger and signs of physical and social disorder (Cerin et al., 2015). Actively educating and assisting neighbourhood children in avoiding potential threats while playing outdoors may be more appropriate and effective informal mechanisms for addressing a wide range of day-to-day safety concerns than general passive supervision. In fact, "General informal supervision" was weakly associated with only one aspect of safety – namely, traffic hazards. As noted earlier, this form of ISC may be too passive and non-specific to have a substantial impact on parental perceptions of safety related to young children's participation in PA.

A substantial number of items of the PANISC-PP loaded on the latent factor of "Civic engagement for the creation of a better neighbourhood environment". This group of items describe civic actions residents would engage in to improve the condition and safety of places for children's PA through collective activities or agents of formal social control (police and local government). With the exception of the measure developed for Latino parents (Cerin et al., 2015), this type of activities was not included in previous ISC scales which, instead, focused on general supervision and assistance of neighbourhood children (Coulton et al., 1996; Franzini et al., 2009; Grafova, 2008). Civic engagement represents a mixture of informal and formal

social control that may be employed when individual, child-focused actions (education, supervision and assistance) are not sufficient to address substantial community-level safety concerns (e.g., widespread crime), and changes to formal aspects of community regulations (laws and policies) or management are required. The presence of safety concerns may sometimes trigger civil engagement among neighbours and thus result in attenuated associations with neighbourhood safety (Taylor, 1995). This may explain why signs of physical and social disorder were the only perceived neighbourhood-safety characteristic associated with "Civic engagement for the creation of a better neighbourhood environment". A recent study on Latino parents of pre-school-age children also found fewer associations (although not with signs of physical and social disorder) between this dimension of neighbourhood ISC and perceived aspects of neighbourhood safety (Cerin et al., 2015). Similarly, another study on 129 African-American mothers of preschool-age children did not find sufficient evidence of an association between perceived crime and a subscale of social embeddedness including items related to neighbourhood informal social control (e.g., exchange child care; greeting neighbours) (Martinez, 2000).

4.1. Strengths and limitations

One of the main strengths of this study pertains to the fact that the development of the measure was based on the opinion provided by parents / caregivers of preschool-age children in relation to their children's participation in PA. Such a strategy enhanced the specificity of the measure of neighbourhood ISC, leading to the development of an instrument appropriate for studying neighbourhood social influences on preschool-age children's PA. Participants were recruited from neighbourhoods stratified by household income and population density to maximise variability in neighbourhood characteristics that may impact on children's PA and ISC (Cohen et al., 2006; O'Connor et al., 2014b; Sampson et al., 1999; Suen et al., 2015a). Such a variance-maximising strategy is likely to yield more robust estimates of associations (Cerin et al., 2014). The study design and several measures of correlates of ISC were comparable to those of a recent study on U.S. Latino parents of preschool-age children, making it possible to somewhat examine the generalizability of findings across geographical regions and cultures.

Our study has also limitations. First, the majority of the participants were mothers of preschool-age children. Further studies could be conducted to examine the generalizability of the factorial structure to fathers and other significant caregivers. Secondly, the perception and level of PA-related ISC may vary across geographical locations and cultures. It would be necessary to cross-validate the measure in other samples of parents. However, the fact that the observed findings in a Hong Kong Chinese sample were similar to those observed in a sample of Latino parents living in the U.S. indicates that suitably translated/adapted versions of the PANISC-PP are likely to be appropriate for use with other populations of parents of young children. This scale was developed and validated using convenience samples of parents and, thus, may not capture all aspects of PA-related neighbourhood ISC that a fully representative sample of parents would have identified. Yet, these concerns are alleviated by the fact that the findings were similar to those observed in a different culture and the study aimed to recruit parents from socio-economically and environmentally diverse communities. Finally, this study did not examine the criterion validity of the PANISC-PP (associations with pre-schoolers' PA), a limitation that needs to be addressed in future research.

5. Conclusion

We have assessed the factorial and construct validities of the PANISC-PP, a measure of PA-related neighbourhood ISC appropriate for parents of preschool-age children. The scale consists of three subscales, including: "General informal supervision", "Civic engagement for the creation of a better neighbourhood environment" and "Educating and assisting neighbourhood children". This study suggests that the PANISC-PP has good factorial and construct validity, though cross-validation of the measure in other samples of parents is required. Further studies will need to examine the associations of the PANISC-PP subscales with outdoor play opportunities, PA-related parenting practices and children's PA, optimally accounting for parents' PA levels which are a major determinant of young children's PA (Ziviani et al. 2006). Such information will contribute to determining the criterion validity of the scale and further assessing its construct validity.

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