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Author

Lee, Patricia C, Stewart, Donald E

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# Does a Socio-Ecological School Model Promote Resilience in Primary Schools?

PATRICIA C. LEE, PhD<sup>a</sup> DONALD E. STEWART, PhD<sup>b</sup>

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## ABSTRACT

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**BACKGROUND:** This research investigates the extent to which the holistic, multistrategy “health-promoting school” (HPS) model using a resilience intervention can lead to improved resilience among students.

**METHODS:** A quasi-experimental design using a study cohort selected from 20 primary schools in Queensland, Australia was employed. Ten intervention schools using HPS protocols, with training support, were compared with 10 control schools in student resilience scores and protective factors. Baseline data explored the interactive effect of protective factors on overall resilience scores. Postintervention analysis compared changes in protective factors and resilience, after implementing the HPS project.

**RESULTS:** Baseline data analysis indicated no significant differences in the mean scores of protective factors and resilience scores between intervention and control groups (except for school connection). After 18 months of implementation, a resurvey showed that the intervention group had significantly higher scores than the control group on students’ family connection, community connection, peer support, and their overall resilience.

**CONCLUSIONS:** Results showed that students in the HPS group had significantly higher scores on resilience than did students in the control group. A comprehensive, whole-school approach to building resilience that integrates students, staff, and community can strengthen important protective factors and build student resilience.

**Keywords:** health-promoting school; resilience; socio-ecological model; primary school students.

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Socio-ecological paradigms of health seek to explore the interrelationship between social systems or settings and human health. They suggest that a combination of intrapersonal characteristics, life experiences, and dimensions of settings determine a person’s capacities for coping in an increasingly complex and unpredictable world.<sup>1-4</sup> Resilience is a dynamic construct constantly changing in response to external and internal conditions. It has been described as the individual’s adaptation to manage or cope with significant adversity, risk, or stress, which may result in an increased capacity to respond to future adversity.<sup>5,6</sup> Fergus and Zimmerman<sup>7</sup> also describe resilience as the capacity to recover successfully from traumatic experiences and overcome the negative effects of

risk exposure. Other researchers suggest that personal resilience is a foundation for positive development throughout childhood and adolescence, and thought to be essential to promoting young people’s mental health and well-being.<sup>8-10</sup>

It is broadly agreed that an individual’s resilience is derived not only from innate characteristics but also from external circumstances.<sup>11</sup> Many researchers address the interactive effects between personality characteristics and various forms of social and cultural determinants. More positive personality characteristics such as easy temperament, capacity to respond flexibly, capacity to search for solutions, and effective decision making are associated with high resiliency.<sup>12</sup> On the other hand, reinforcing human capital,

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<sup>a</sup>Lecturer, (patricia.lee@griffith.edu.au), School of Public Health, Griffith University Gold Coast Campus, Parklands Drive, Southport, Queensland 4222, Australia.

<sup>b</sup>Professor, (donald.stewart@griffith.edu.au), School of Public Health, Griffith University South Bank Campus, 226 Grey Street, South Bank, Queensland 4101, Australia.

Address correspondence to: Patricia C. Lee, Lecturer, (patricia.lee@griffith.edu.au), School of Public Health, Griffith University Gold Coast Campus, Parklands Drive, Southport, Queensland 4222, Australia.

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social capital, and cultural determinants can also make a contribution to positive outcomes from challenging experiences.<sup>13-15</sup> Thus, an individual's innate strengths and acquired competencies operate interactively as an adaptive system. Socio-ecological models of resilience provide an inclusive and balanced understanding of the determinants of health by recognizing both the "risk factors" and the "protective factors."<sup>16</sup> Protective factors may moderate or reduce the negative effects of risk exposure. A complex interplay of these factors determines a person's capacity to respond adaptively to new situations, or adversity. Resilience is described as a developmental outcome that evolves from balancing risks and protective factors at both individual and setting levels.<sup>15-17</sup> Bissonette<sup>18</sup> refers to 3 categories of protective factors: (1) dispositional attributes such as autonomy; (2) familial characteristics such as positive styles of attachment and emotional support; and (3) external support factors such as positive environments. Morgan et al<sup>19</sup> suggest that the more diverse the mix of internal and external protective factors, and the greater the range of resources available to an individual, the more a younger person's ability to cope with adverse situations improves. Resilience building integrates various sociocultural models into a holistic framework encompassing organizational effectiveness and community development theory to enable healthy psychosocial development and promote young people's mental health and well-being.<sup>20-22</sup>

Socio-ecological models acknowledge the significance of a "place" (or setting) for health and well-being, at both individual and population levels. The "health-promoting school" (HPS) approach initiated by the World Health Organization (WHO) in the 1990s, which incorporates socio-ecological principles, is recognized globally as a key strategy to promote all aspects of health and well-being, including mental health and psychological resilience in children and young people.<sup>23</sup> The HPS approach integrates multilevel and comprehensive interventions addressing school environment, curriculum, management practices, policy making, and relevant social and cultural factors such as school ethos, communication across all participants in the setting, and community involvement to promote the health of children. The WHO supports a multilevel approach to mental health promotion that addresses strengthening individual resilience, strengthening social inclusion, and reducing structural barriers to mental health.<sup>24,25</sup> A range of multilevel strategies include linking curriculum developments and teaching approaches with health-promoting developments in the school ethos and environment, as well as enhancing access to services and fostering partnerships with the local community.<sup>26,27</sup> In terms of impact on social and emotional health, the HPS approach allows the school to

maximize protective factors within and outside the school setting to increase students' coping capacity and their mental health and well-being.<sup>6,27-29</sup> Many researchers indicate that the HPS approach builds social and organizational capital within the school setting and creates an environment that promotes teachers' health and has significant effects on building students' resilience.<sup>30-32</sup>

On the basis of this theoretical framework of socio-ecological models, HPS researchers suggest that the HPS approach, using multiple systematic interventions encompassing family, peer group, school, and community, can effectively address risk and protective factors within the school setting and benefit students' development of resilience.<sup>15,30,31</sup> However, limited evidence-based research has been published that identifies the potential interactive effects among multiple risk and protective factors, within and outside the school, on children's resilience building. This research aims to examine the extent to which a multistrategy, HPS-based intervention can maximize protective factors within and outside the school and help to improved resilience among students.

## METHODS

### Study Design and Participants

A quasi-experimental design was employed in this study to examine the effect of the HPS approach on changing students' resilience. The study sample with 20 State and Catholic schools in low socioeconomic areas in Queensland, Australia, was selected based on 2-stage cluster random sampling: school level and class level. The researchers determined 10 schools in northern region of Brisbane as the intervention group. The control schools located in southern region of Brisbane were matched with the intervention schools by school size, urban or rural location, State or Catholic Education, and socioeconomic status, using an index developed by government that allows a broad socioeconomic comparison of school catchment areas. A random selection at class level was then conducted in both intervention and control schools. The intervention group (10 schools) received multistrategy HPS interventions during the 18 months of the HPS project implementation,<sup>32</sup> whereas the control group did not receive any intervention. All participants were followed up over 2 ½ years. The participants in both groups consisted of students from grades 3, 5, and 7 (ages 8, 10, and 12) in the selected schools. The sample sizes for intervention and control groups were 1526 and 1232, respectively, at the beginning of the study (pretest phase). There were 828 students in intervention group and 449 in control group at the postintervention phase. The survey was conducted in class and the completed questionnaires were collected by teachers in the classrooms. Baseline

data were collected at the end of 2003 and follow-up data collection was completed in 2006. Teachers were informed about the study and given instructions on the survey procedures. Student participants were asked to provide consent from their parents and their voluntary participation and anonymity was carefully discussed at the beginning of both surveys.

### Instruments

The survey was designed to investigate student perceptions of their individual characteristics (also known as resilience variables) and protective resources drawn from family, peers, school, and the local community. The instrument in this study was a combined version of the California Healthy Kids Survey<sup>33</sup> and the Perception of Peer Support Scale.<sup>34</sup> The self-administered questionnaire used a 5-point rating scale, which included 2 major underlying constructs: student resilience and protective (sociocultural) factors. Student resilience was measured by 4 subscales as follows: empathy, communication and cooperation, self-efficacy, and problem solving, and the 5 components of protective factor scale included participants' feeling connected to adults at home (family connection), school (school connection) and in the community (community connection), peer support, and autonomy experience. Each subscale contained 4 to 13 questions. The validity and reliability of this instrument have been comprehensively tested.<sup>15,17</sup> High internal reliabilities for both the student overall resilience scale and the protective factor scale were achieved (Cronbach's  $\alpha = .84$  and  $.92$ , respectively). The results of a confirmatory factor analysis also confirmed a high level of consistency with previous studies (factor loading ranging from  $.62$  to  $.83$ ) for all the subscales under the constructs of resilience and protective factors.<sup>15,17,35</sup>

### Procedures

The HPS intervention for resilience building was introduced to the 10 intervention schools in August 2004, and data collection was completed by August 2006. The intervention schools were facilitated by the researchers to develop their own HPS priorities and intervention activities. The approach, which was consistently followed in all intervention schools, covered 4 main areas: constant communication and shared visions; staff empowerment; providing a structure that supports a culture of HPS; and support for school partnerships with families and communities.<sup>15</sup> The strategies commonly implemented in the intervention schools used the HPS framework to build supportive organizational structures in the school context, create a supportive school ethos and environment, build resilience in the school curriculum, undertake whole-school community engagement, strengthen family and school connections, and develop partnerships and

appropriate school-related services. The details of the common strategies and actions are summarized in Table 1. It was recognized that the selection of the parts of a project package, the curriculum materials, and interventions among the schools might be slightly different. Most importantly, the HPS framework placed an emphasis on the importance of needs-based health promotion project planning as well as developing the relevant curriculum. Apart from the common strategies, other intervention activities were developed around the issues or needs identified by the schools. The identified issues and interventions varied from school to school such as resilience building, anti-bullying, professional development in staff and parents in HPS principles and approaches, communication skills, extra curriculum development in music, drama, and sport, and building positive peer relationships. In each case, however, schools had to link the identified issues and local priorities with the building of resilience. Throughout the intervention period as part of the process evaluation, each school was regularly visited by project staff to ensure adherence to the HPS model; each school also submitted 6-monthly progress reports on their resilience projects identifying their achievements in each aspect of the HPS model; and every 6 months there was a combined training and information-sharing workshop attended by a selected number of students, staff, and parents from all the intervention schools.<sup>30</sup> The comprehensive HPS intervention was expected to increase students' resilience and enhance their individual adaptation ability (measured by several subscales of individual characteristics) through enhancing protective factors within and outside the school setting.

### Data Analyses

The data were analyzed using the SPSS/PASW and AMOS packages version 18.0 (IBM, Armonk, NY). The baseline data, involving both intervention and control groups, were first analyzed using descriptive statistics, *t* tests, and chi-square tests to compare the differences in demographic variables, social and cultural factors (also defined as protective factors including family connection, school connection, community connection, autonomy experience, and peer support), as well as students' overall resilience (outcome variable). Hierarchical multiple regression models were performed to examine the impact of the above-mentioned variables and grouping effect (receiving HPS intervention or not) on resilience. The outcome variable (students' resilience) was measured by overall individual characteristics combining a range of mental health wellness scales.

The *t* tests were used to examine the change in the comparison of the protective factors and resilience scores between intervention and control groups at baseline and postintervention. A mixed effect



Table 1. HPS Intervention Strategies and Actions

HPS Strategies	Implementation Activities
Constant communication and shared visions	<ul style="list-style-type: none"> <li>• A project committee was established in each intervention school.</li> <li>• Project committee members and principals met and communicated regularly, sharing a common vision/mission of the HPS project.</li> <li>• The committee members sought feedback from parents and all the partners with the school.</li> <li>• Principals and project committees regularly informed school members of project progress.</li> <li>• The project coordinating team provided guidance and monitored activities on a weekly basis.</li> </ul>
Staff empowerment	<ul style="list-style-type: none"> <li>• The intervention was implemented through 2 leadership teams. One team included the principal, school staff, and students, and the other team consisted of parents and community members, which was a supporting body of the school.</li> <li>• Both teams worked closely with the project committee in developing school plans and monitoring the implementation of the HPS.</li> <li>• School staff were provided with school-based professional development opportunities to build their skills in assisting with the HPS project.</li> <li>• Project committee members were encouraged to participate in the quarterly training workshops organized by the project coordinating team and to share experience with the members from other schools.</li> <li>• Resources such as HPS toolbox, mental health promotion packages, and resilience-related materials were provided.</li> </ul>
Providing a structure and resources that support a culture of HPS	<ul style="list-style-type: none"> <li>• A project-wide HPS network was established to support a health promotion culture.</li> <li>• Resources were provided to enhance a HPS culture. The culture was developed through changing school policy, refocusing curriculum on health promotion, student skills development in coping, problem solving, seeking help and support, and parent workshops in HPS.</li> <li>• The schools adopted various health promotion and resilience building curricula which were aligned with the HPS principles.</li> <li>• Regular training workshops were organized by the project coordinating team to facilitate a school-wide cultural change.</li> </ul>
Support for school partnership	<ul style="list-style-type: none"> <li>• The project coordinating team collaborates closely with school project committees to facilitate the implementation of their HPS programs and provided continual support.</li> <li>• Schools were connected with the local communities and various organizations such as local city council, local Departments of Health and Education, and NGOs, which provided the school with a range of support services and resources.</li> <li>• These partnerships contributed their efforts to strengthening the relationships between school, families, and communities and provided resources to promote student peer relationship and healthy environment, social interaction opportunities, and provided training for staff and parents.</li> </ul>

HPS, health-promoting school; NGOs, nongovernmental organizations.

model and analysis of variance (ANOVA) tests were performed to compare the differences in resilience scores in consideration of possible school variability due to various HPS strategies used or different time or effort spent on the HPS projects. The same hierarchical regression analysis was carried out in postintervention analysis to evaluate the contributions of protective factors to explaining students' resilience, particularly with the effect of HPS intervention on the resilience outcome. A structural equation model (SEM) using AMOS graphic tool was developed to further examine the theoretical constructs built to identify the possible interrelationships between HPS intervention, the protective factors, and student resilience outcome.

## RESULTS

### The Influences of Demographic Variables and Proactive Factors on Students' Resilience: Pretest

The chi-square tests and t test (age only) were used to compare the differences in the demographic data between the intervention and control groups. Table 2 presents demographic distributions in 2

groups. Distributions by sex and mean age were similar between these 2 groups, but the control group was slightly younger than the intervention group (mean difference = -0.12 year;  $p = .047$ ). However, the distributions of country of birth and main language spoken at home were different between the 2 groups ( $p < .001$ ). The results indicated that the control group had higher proportions of non-Australia born and non-English-speaking background students.

To evaluate the effect of the HPS approach on improving students' resilience, t tests were used to compare the baseline (pretest) data between intervention and control groups as well as the follow-up data. The results of baseline data analysis showed that only the school connection score of the control group was significantly higher than that of the intervention group ( $p = .001$ ). There were no significant differences in the mean scores of other protective factors (family connection, community connection, autonomy experience, and peer support) and resilience scores between the 2 groups, at the beginning of the study. Multiple regression modeling was used to analyze the relationships between the outcome variable

Table 2. Demographic Information of the Participants

Variable	Participants		$\chi^2$	p	
	Intervention, N (%)	Control, N (%)			
Sex	Male	735 (48.5%)	0.377	.539	
	Female	782 (51.5%)			
Age	Mean (SD)	10.05 (1.68)	10.17 (1.70)	T = -1.98	.047*
Country of birth	Australia	1364 (90.4%)	1013 (83.0%)	33.06	<.001***
	Others	145 (9.6%)	208 (17.0%)		
Main language spoken at home	English	1330 (88.1%)	955 (78.5%)	52.22	<.001***
	English and others	171 (11.3%)	232 (19.0%)		
	Others	9 (0.6%)	31 (2.5%)		

\*p < .05; \*\*\*p < .001.

(students' resilience scores) and the demographic and sociocultural (protective) factors. Both intervention and control groups were included in the analysis. The model could explain only 1.7% of total variance of students' resilience level ( $R^2 = .017$ ). That is, demographic variables alone were not sufficient to predict students' resilience score. Only sex and age showed statistical significance (both  $p < .05$ ) in the demographic data analysis. As sex and age had significant effects ( $p < .05$ ) on the students' resilience score in the preliminary regression analysis and the distributions in country of birth and language spoken at home were different between intervention and control groups, they were considered as potential confounders. In further analyses involving social and cultural factors, hierarchical multiple regression modeling was used to control for the potential confounders (Table 3). After controlling for the demographic variables (sex, age, country of birth, and language), all the independent variables (protective factors) made significant contributions (significance level  $p < .05$ ) to explaining the student resilience score (outcome variable). The final model could explain 55.9% of the variance in students' resilience score. Family connection, school connection, community connection, autonomy experience, and peer support made strongly significant contributions (all p values < .001) to explaining the students' resilience. Each of these variables was positively associated with the dependent variable. For example, students reporting a higher sense of family connectedness seemed to have a higher resilience score. Grouping effect (intervention or control groups) did not make a significant contribution to predict student resilience at preintervention stage. The results indicated that all the social and cultural factors (which we had defined as protective factors and which included family connection, school connection, community connection, autonomy experience, and peer support in this study) were significant predictors for the student resilience score. Also, their interaction had a positive impact on students' overall resilience score across all respondents.

#### Influences of HPS Interventions: Post-Test

After implementing the HPS project for 18 months, the intervention and control groups were surveyed again to find out the effect of the HPS intervention on the protective factors and students' overall resilience scores. The t test results (Table 4) showed that HPS interventions had significantly changed the difference in students' resilience between intervention and control groups ( $p = .001$ ). In terms of the influence of HPS on the other protective factors, HPS had posed significant effects on family connection, community connection, and peer support ( $p < .001$  and  $p = .011$ , respectively). However, the mean scores of school connection and autonomy experience between the 2 groups after the HPS interventions were not significantly different. In comparison with the baseline results, the scores of 4 protective variables (family connection, school connection, community connection, and autonomy experience) in the intervention group at postintervention stage became greater than those in the control group.

To examine the potential school variability in resilience scores, a mixed effect model and ANOVA tests were conducted to measure the differences among the HPS schools at the post-test. The result of mixed effect model showed that less than 0.001% ( $p > .50$ ) of the total variance could be attributed to the differences between the intervention schools, but almost 100% of the total variance was due to the differences between students. The result of ANOVA test confirmed that the differences in resilience scores between all the HPS schools at post-test stage were not significant ( $F = .37$ ,  $p = .77$ ). Hierarchical multiple regression modeling was employed to examine the overall contribution of the protective factors with the effect of HPS intervention on student resilience. After controlling for the demographic variables, as shown in Table 5, the final model could explain 57.0% ( $R^2 = .57$ ) of variance in students' resilience score. HPS intervention (grouping effect), family connection, school connection, autonomy experience, and peer support were significant predictors in explaining students' resilience

Table 3. Hierarchical Multiple Regression: Factors Relating to Student's Resilience (Baseline;  $R^2 = .559$ )

	B	SE	Beta	t	p	95.0% CI for B	
						Lower	Upper
Sex	-0.032	0.084	-0.005	-0.381	.703	-0.197	0.133
Age	-0.073	0.025	-0.041	-2.875	.004**	-0.122	-0.023
Country of birth	-0.139	0.139	-0.015	-1.005	.315	-0.411	0.133
Language at home	0.145	0.127	0.018	1.134	.257	-0.105	0.395
Group	-0.057	0.042	-0.019	-1.347	.178	-0.140	0.026
Family connection	0.459	0.079	0.098	5.814	<.001***	0.304	0.614
School connection	0.413	0.063	0.112	6.533	<.001***	0.289	0.537
Community connection	0.365	0.073	0.083	5.020	<.001***	0.223	0.508
Autonomy experience	1.191	0.062	0.337	19.131	<.001***	1.069	1.313
Peer support	1.209	0.060	0.336	20.124	<.001***	1.091	1.327
Constant	7.176	0.434		16.516	<.001	6.324	8.028

\*\*p < .01; \*\*\*p < .001.

Students' resilience score is measured by a total individual characteristics score: a combination of communication and cooperation, self-esteem, empathy, help-seeking, goal and inspiration. Each subscale contains 2-4 questions to measure the construct.

Table 4. Differences in the Scores of the External Factors and the Outcome Variable (Students' Resilience Levels) Between Intervention and Control Groups: Postintervention

Variable	HPS Intervention						t	p
	Intervention			Control				
	N	Mean	SD	N	Mean	SD		
Family connection	797	4.475	0.621	438	4.316	0.704	3.96	<.001***
School connection	801	4.044	0.889	429	4.034	0.834	0.19	.849
Community connection	807	4.566	0.636	431	4.412	0.727	3.70	<.001***
Autonomy experience	795	3.634	0.868	429	3.579	0.982	0.97	.331
Peer support	765	4.008	0.852	416	3.874	0.881	2.55	.011*
Student's resilience (individual total)	740	20.791	3.022	398	20.097	3.431	3.39	.001**

\*p < .05; \*\*p < .01; \*\*\*p < .001.

score. However, community connection did not make significant contribution in explaining the change in students' resilience ( $p = .053$ ). Figure 1 depicts the hypothesized SEM to test the theoretical constructs and their relationships. The result of AMOS analysis suggested that the HPS intervention had not only a significant direct effect but also significant indirect effects (through the change in the protective factors) on student resilience in the model. Student resilience regressed onto the HPS intervention and the protective factors, except community connection. This result was consistent with the regression analysis. The model also indicated a similar result to *t* test findings that family connection, community connection, and peer support were significantly associated with HPS intervention. The nonsignificant associations between HPS and the other 2 protective factors (school connection and autonomy experience) were likely to be influenced by the prior baseline differences between the intervention and control groups. The model as a whole clearly supports the study hypothesis that the HPS intervention had a positive effect on the change in students' resilience through enhancing the mixed effect of the protective factors.

## DISCUSSION

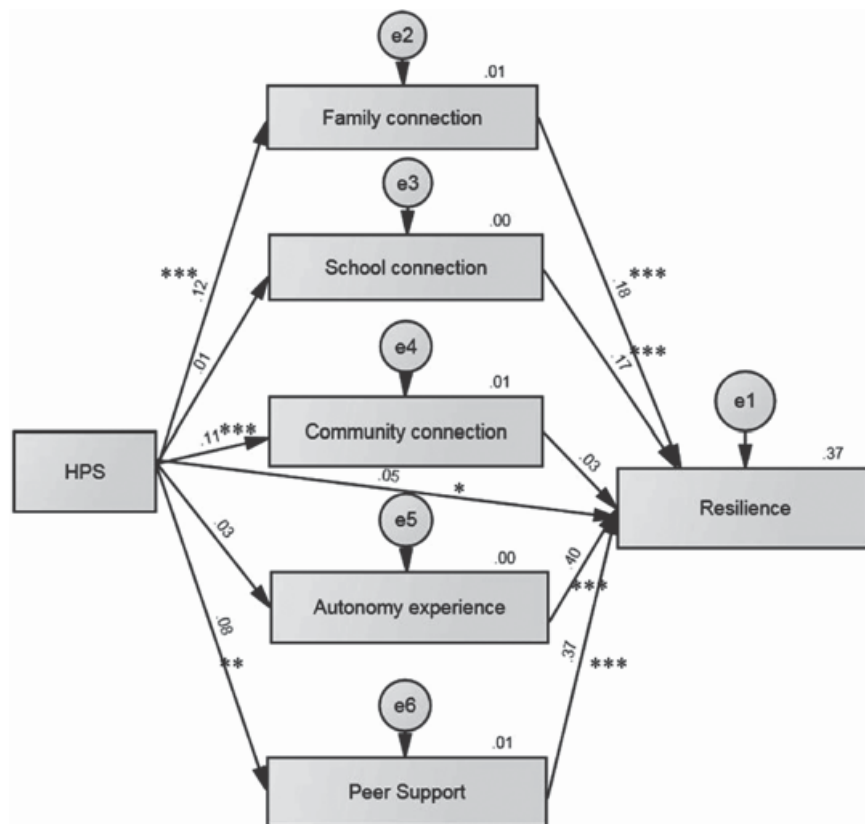
The statistical analyses reconfirmed the value of a socio-ecological model of resilience and the importance of external social and cultural factors in shaping students' resilience. The results from the baseline data analyses indicated that social and cultural factors (including family connection, school connection, community connection, autonomy experience, and peer support) were significantly associated with students' resilience and the combined effect of these protective factors can explain about 56% of the variance in students' resilience. All of these protective factors had positive relationships with students' resilience and together they could effectively predict the change in resilience score. These results were consistent with most socio-ecological models of resilience that identify protective factors (such as adult support at family, school and community, peer support, and positive environment) as having the capacity to improve young people's resilience and their potential ability to cope with adversities and buffer their life risks.<sup>6,18,19,30,31</sup> The results also proved the effectiveness of the HPS intervention with an emphasis on building HPS culture and network, strengthening

Table 5. Hierarchical Multiple Regression: Factors Relating to Students' Resilience (Postintervention;  $R^2 = .570$ )

	B	SE	Beta	t	p	95.0% CI for B	
						Lower	Upper
Sex	0.283	0.132	0.044	2.15	.032*	0.025	0.542
Age	-0.132	0.038	-0.072	-3.474	.001**	-0.206	-0.057
Country of birth	0.122	0.424	0.019	0.288	0.773	-0.710	0.955
Language at home	0.237	0.508	0.03	0.468	0.64	-0.759	1.233
HPS (group)	0.427	0.142	0.064	3.001	.003**	0.148	0.706
Family connection	0.697	0.124	0.143	5.614	<.001***	0.454	0.941
School connection	0.462	0.097	0.126	4.757	<.001***	0.271	0.652
Community connection	0.229	0.118	0.048	1.937	0.053	-0.003	0.461
Autonomy experience	1.907	0.093	0.313	11.826	<.001***	0.915	1.279
Peer support	1.129	0.091	0.306	12.343	<.001***	0.949	1.308
Constant	6.819	0.778		8.76	<.001	5.292	8.347

\*p < .05; \*\*p < .01; \*\*\*p < .001.

Figure 1. Hypothetical Model Predicting Students' Resilience as a Function of HPS Intervention and the Protective Factors ( $R^2 = .37$ )



partnerships with parents and communities, and student skills development.

The effect of the HPS intervention could be seen from the follow-up data analyses. The multistrategy HPS approach implemented in the intervention schools had significantly changed the differences in students' resilience and a majority of the protective factors between intervention and control groups. The nonsignificant differences in school connection and

student autonomy could be due to the higher scores in the control group at preintervention stage, particularly in school connection scores (control > intervention,  $p = .001$ ). This was noteworthy, as it indicated that interventions to promote resilience need to lay greater stress on these 2 factors in the future. Some potential confounding factors such as demographic variables could have significantly impacted on the relationship between HPS intervention and student's



resilience,<sup>6,17,29</sup> so they needed to be carefully addressed. In this study, however, the confounding factors did not seem to have a significant impact on the relationship. Although the controls tended to be younger, more overseas born, and non-English speaking at home than the intervention group due to sampling error, these variables did not confound the comparisons of the protective factors and resilience scores. If the uneven distributions of the demographic variables had impacted on the results, the intervention group should appear with higher levels of all the measured variables at preintervention stage. However, the resilience scores and the levels of all the protective factors were not significantly different between controls and interventions (except controls were significantly higher in school connection) at baseline. In addition, the majority of these variables showed increases in intervention group and significantly higher than the controls at postintervention stage. As all the demographic variables were controlled for in the regression modeling process, the confounding effects from the above-mentioned variables in determining the association between the protective factors and student's resilience could be ruled out.

Apart from the demographic variables, another issue that could have impacted on the resilience outcome was the unmeasured variability in intervention activities implemented among the HPS schools. To address this issue, a mixed effect model was carried out to examine the effect of school variability. Because the results indicated that the school variance was little, we could conclude that all the intervention schools as a whole had attained an improvement in resilience score, which also reflected the importance of implementing the 4 common areas of HPS strategies as detailed in Table 1. The processes described as part of the monitoring and evaluation that took part over the life of the project<sup>32</sup> helped to ensure that variability in terms of implementation of core components of the HPS model was minimized.

Both hierarchical multiple regression and SEM results in postintervention data analyses confirmed that the HPS intervention had significant effects (including direct effects and indirect effects through the change in the protective factors) on students' resilience. These results not only reflected the results from previous studies<sup>29-31</sup> which found that the multistrategy HPS approach made a significant contribution to promoting students' resilience and improving various protective factors, but they also took the analysis a step forward. They helped to identify the significant influence of the interrelationship among a variety of protective factors on students' resilience.

#### Limitations

As many participants moved to high schools (grade 7 students) or transferred to other schools during the

study period and the control schools did not receive any intervention, a large number of student subjects were lost to follow-up, particularly in the control group. This problem might have resulted in a potential bias and weakened the statistical power.

The baseline data analyses indicated that the 2 groups had no significant differences in the social and cultural factors except school connection when the study began. As the recruited samples for intervention and control groups were matched by school size, location, and socioeconomic status, and the interventions were not introduced to any of the participating schools, the mean scores were expected to be similar. The difference in school connection scores at preintervention stage could be due to uneven distributions in demographic variables. This sampling error was possibly a random effect, which did not impact on the results. This study required all intervention schools to participate in training and reporting how they implemented the 4 major areas of intervention and other various strategies developed by different HPS schools to tackle their identified issues or needs during the project, but it did not record any differences in emphasis and effort relating to implementation. It was thus limited in terms of discovering how much the individual strategies might have effects on different protective factors and even the overall resilience.

In summary, the results indicated that HPS posed positive effects for the intervention group not only in terms of overall resilience building but also in enhancing most of the protective factors. This finding suggested that the implementation of the HPS approach, bringing about some positive changes in organizational structure, school ethos and environment, curriculum, school-family connections, and school-community relationships, might be associated with a significant improvement in students' resilience and coping capacity. As suggested in previous studies,<sup>6,25,26</sup> the HPS approach maximizes protective factors within and outside the school setting and increases students' coping capacity and resilience. A future study can explore which specific strategies make contributions to the change in different protective factors and student's resilience. It is also necessary to adjust the study design so as to retain a prospective study sample, for example, recruiting grades 2, 4, 6, instead of 3, 5, 7, to reduce attrition rate over a period of time. Furthermore, strategies will be needed to motivate the participation of control group participants.

#### IMPLICATIONS FOR SCHOOL HEALTH

This research used a holistic HPS approach, founded on socio-ecological principles, to investigate how we could strengthen and support resilience as an important protective factor for young people. The

data indicated that the socio-ecological HPS model could indeed promote resilience in primary schools. Moreover, it could help researchers to take into account innate intrapersonal characteristics as well as external circumstances including life experiences and dimensions of settings.

All those involved in the school community, including parents, students, teachers, administrators, and policy makers, in recognizing that school structures and relationships play a vital role in strengthening and sustaining resilience, must ensure that school-based resilience initiatives are appropriately planned and supported. The research reported above indicates that a socio-ecological approach to building resilience that truly engages the whole-school community requires a plan that sets goals and objectives, that integrates curriculum, school policies, procedures, and external resources, and that is managed and evaluated.

Building resilience in the school setting can become a critical issue for teachers and educational administrators with the mounting evidence that school structures and relationships play a vital role in strengthening and sustaining this important protective factor. Planning and initiating a HPS that is dedicated to promoting resilience in all its activities require a commitment of effort and resources; however, if primary schools can promote resilience at this early age, the benefits in terms of lifelong social-emotional well-being or improved mental health will be substantial.

#### Human Subjects Approval Statement

Ethics approval for this research project was obtained from the University's Human Research Ethics Committee, Education Queensland Ethics Committee, and Catholic Education Ethics Committee (ethics approval number: QUT Ref No 3058H) before the data collection commenced.

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