POWER UP

EvidenceSynthesis

IMPACT OF SCHOOL PHYSICAL ACTIVITY-RELATED POLICIES AND INTERVENTIONS ON PHYSICAL ACTIVITY LEVELS, SEDENTARY BEHAVIOURS AND BODY WEIGHT

MAY 2015

OVERVIEW

Lack of adequate physical activity (PA) is a key determinant of childhood obesity in Canada (1). In the last several years, schools have emerged as an important location for addressing this issue given the large number of young people who regularly access this setting (2, 3). There is also growing awareness that implementation of school policies and environmental interventions have the potential to promote healthy PA habits in schools (2, 4). With these considerations in mind, this evidence synthesis examines the impact of school PA-related policies and interventions on student PA levels, sedentary behaviours, and body weight outcomes.

METHODS

Review of Evidence. This synthesis involved the collection of review articles obtained from four databases (Ovid Medline, PsycInfo, Ovid ERIC, and SPORTDiscus) and three grey literature resources (Yale Rudd Center for Food Policy & Obesity (5), Bridging the Gap (6) and Active Living Research (7)). Additional studies were also provided through a web search, review of references from key articles, researcher recommendations, and a review of PubMed-related references. To be included in this synthesis, reviews had to meet the following criteria: 1) French or English reviews published between January 2003 and March 2015; 2) systematic or comprehensive in nature, outlining explicit methods; 3) providing exposure of at least one PA-related policy or policy relevant intervention in the school setting; 4) policies/interventions targeting a school-aged population (K-12) and; 5) outcome measure relevant to PA levels, sedentary behaviours and/or body weight outcomes, including body mass index (BMI). The first level screening consisted of a review of article titles and abstracts. The second level screening consisted of a full review of remaining articles to ascertain relevance. One rapid review included in the second level screening reported on one systematic review only. For this reason, the systematic review (8) was retrieved and included in this analysis.

SYNTHESIS OF EVIDENCE

Characteristics of Reviews. Ten reviews met the inclusion criteria for this synthesis. Eight reviews evaluated outcomes relevant to PA levels, two evaluated outcomes relevant to sedentary behaviors, and six evaluated body weight outcomes. Included reviews were assessed for quality using the Assessing the Methodological Quality of Systematic Reviews (AMSTAR) criteria (9). According to the AMSTAR ranking proposed by Mikton et al. (10) and adopted by Melchiors et al. (11), six reviews (12-17) received a score between 0-4, indicating low quality, and four reviews (8, 18-20) received a score between 5-8, indicating moderate quality. Of the reviews included in this synthesis, Dobbins et al. (8) was deemed to be of the highest quality, receiving a score of 8.

IMPACT OF PA-RELATED POLICIES AND INTERVENTIONS ON PHYSICAL ACTIVITY LEVELS, SEDENTARY BEHAVIOURS AND BODY WEIGHT OUTCOMES

A synthesis of evidence pertaining to the impact of school PA-related policies and interventions on PA levels, sedentary behaviors, and body weight outcomes is provided below. For a summary of review findings and intervention characteristics, please see table two.

Impact on PA levels. Eight reviews examined the impact of school PA-related policies or interventions on outcomes relevant to PA levels (8, 12-17, 20). Taken together, the reviews suggest that such policies and interventions are a promising approach for increasing students' PA levels. With that said, the strength of evidence varied across reviews, based on factors such as the population sub-group under study and the specific PA-level outcomes measured. For example, Dobbins et al. (8) found that school-based PA interventions had a positive impact on children and adolescent's duration of moderate to vigorous physical activity (MVPA). However, findings rated to PA rates (% of participants physically active) were less promising (8). Specifically, the review found some evidence that children participating in school-based PA interventions were more likely to engage in MVPA during school hours, but concluded that such interventions were not effective in increasing PA rates of adolescents (8). Across reviews examining PA-related interventions, effective intervention characteristics often involved changes to physical education (PE) classes or the school curricula to promote PA, as well as an educational component (8, 15, 20).

Of the eight reviews reporting on outcomes relevant to PA levels, two specifically examined the impact of U.S. public policies related to PA in the school setting. Robertson-Wilson et al. (13) reported on impacts related to three policy reforms: two Texas Senate Bills focused on increasing the number of daily minutes students spent in school-based PA and one safe routes to school legislation in California (13). Overall, the Robertson-Wilson et al. (13) review found that these PA-related policies were effective

in increasing youth PA levels. The Chriqui review (17), in contrast, examined two studies exploring the relationship between state PE requirements and youth fitness and PA levels, as well as findings from the Robertson-Wilson et al. review (13), reporting mixed results. One of the individual studies included in this review explored the relationship between student fitness levels and district-level compliance with a California law outlining minimum requirements for PE, concluding that students from policy-compliant districts were more likely to meet or exceed fitness standards (17, 21). The other study did not find an association between state PE requirements nationally and children's PA levels. However, this study did conclude that when implemented at the school level, school's PE requirements appeared to have a positive impact on children's PA, particularly for girls (17, 22). Ultimately, both reviews highlighted the need for further policy research and evaluation to more clearly understand the impacts of various policy levers in this area (13, 17).

Impact on Sedentary Behaviours. Two reviews examined outcomes relevant to sedentary behavior (8, 12). Beets et al. (12) explored the impact of after-school programs with a significant PA component and Dobbins et al. (8) examined the impact of school PA interventions. Taken together, review findings were limited and mixed. Beets et al. (12) found that after-school programs demonstrated effectiveness in reducing sedentary behaviors (i.e. television, computer, and video-game use) in one of four studies. Further, Dobbins et al. (8) found that school-based PA interventions were effective in reducing time spent watching television in 7 of 16 studies. Ultimately, Beets et al. (12) did not find evidence of impact for after-school programs with a PA component on sedentary behaviors. Dobbins et. al (8), however, concluded that school-based PA interventions can have a positive impact on television viewing, reducing time spent watching TV from 5 to 60 minutes less a day (8).

Impact on Body Weight Outcomes. Six reviews examined the impact of school PA-related policies or interventions on body weight outcomes (8, 12, 15, 17-19). Overall, findings across the reviews were mixed. For example, both Harris et al. (18) and Dobbins et al. (8), which focused predominately on higher income countries, concluded that PA interventions were not effective in reducing BMI. In contrast, Verstraeten et al. (20) found that PA-only and multi-component interventions (PA + diet) in low and middle income countries were effective in decreasing BMI in 8 of 10 studies. William et al. (19), in turn, found that PA policies alone were not sufficient in preventing or treating overweight or obesity in children, but do seem to have an effect when part of a comprehensive intervention program involving diet and PA.

In conclusion, a number of the reviews suggest that comprehensive, multi-component interventions and approaches may hold the most promise for addressing complex weight-related issues (8, 18-20). For example, Williams et al. (19) suggests that both PA and diet interventions may need to be located within a wider health promotion intervention program to be effective. Further, Harris et al. (18) hypothesizes

that using multiple interventions to target different aspects of obesity's casual pathway may have the greatest impact on body weight outcomes.

ADDITIONAL CONSIDERATIONS

The aim of this synthesis was to examine the impact of school PA-related policies and interventions on PA levels, sedentary behaviors, and body weight outcomes. With that said, some reviews also discussed policy implementation given the important role that factors such as cost, feasibility, and acceptability play in determining intervention success (23). For example, one study by Amis and colleagues (24), included in Chriqui's review (17), investigated the implementation process of three state-level school-oriented childhood obesity policies designed to increase PA levels and improve quality of PE, enacted between 2004 and 2007 in Mississippi and Tennessee. Overall, this study found that the policies faced significant barriers to implementation, including a value system that prioritizes standardized tests over physical education, a varsity sports system that negatively influences PA opportunities, resource constraints, and overloading of school administrators with new policies (17, 24).

Findings from the Chriqui et al. (17) review also illustrate the need to consider the wider policy context when examining policy outcomes. For instance, this review included two studies that examined the relationship between state PE and recess-related laws and youth obesity, reporting mixed results (17). While no association was found in one study, the other found that odds of youth obesity were higher in states with stronger laws related to PA. However, as Chriqui (17) outlines, this was likely due to the fact that states with larger youth obesity problems have stronger laws (17).

LIMITATIONS OF REVIEWS

It is important to note that the strength of evidence included in this synthesis was limited by a number of factors. First, while reviews concluded that PA policies and interventions can result in positive impacts, it was difficult to determine the specific characteristics that contribute to success. Further, few reviews included in this synthesis reported on outcomes relevant to sedentary behaviors. This may be due to limitations of the search strategy employed and the focus of this synthesis on reviews versus individual studies. Last, it is important to note that a number of reviews included in this synthesis received a low quality score using the AMSTAR ranking system (12-17). Considering this, conclusions from these reviews should be interpreted with caution.

The reviews included in this synthesis also noted a number of limitations. For example, reviews outlined limitations regarding the search strategy employed (i.e. exclusion of grey literature or publications based on language) and issues related to the quality and design of included studies (8, 13-16, 18-20). Examples of other limitations noted include a failure to apply a quality assessment tool (13), limited studies

pertaining to specific population groups (15), lack of information on adverse effects and cost effectiveness of interventions (20), and issues related to the use of BMI as an indicator to measure intervention effectiveness (8, 18). Finally, a potential limitation of this evidence synthesis is that the search strategy may not have been comprehensive enough to capture all of the literature relevant to interventions of interest. As a result, there is potential that relevant reviews were excluded from this synthesis.

FUTURE RESEARCH

The reviews included in this synthesis outlined a number of research areas warranting further attention. For instance, a number of reviews highlighted the need for increased research and evaluation on policy implementation and impact (13, 14, 17, 19). This is particularly relevant to the Canadian context, given the limited number of studies that took place within a Canadian setting. Reviews also called for studies with improved methodological rigor, longer study periods and better follow-up, as well as research into long-term intervention impacts (8, 12, 15, 19). In addition, reviews called for further research on specific population settings and sub-groups (8, 20). Dobbins et al. (8), for example, indicated a need for research examining differences according to gender, age and ethnicity, as well as the impact of strategies that take into account these differences.

CONCLUSIONS

This synthesis of evidence indicates that school PA-related policies and interventions can be effective in increasing student PA levels, though additional research and evaluation is required, particularly at the public policy level. Evidence pertaining to the impact of school PA-related policies and interventions was limited for sedentary behaviours and mixed for BMI and weight outcomes. With that said, a number of reviews hypothesize that broad, multi-component interventions may hold promise for promoting healthy weights.

Table 1. Characteristics of reviews evaluating the impact of school PA-related policies or intervention on PA levels, sedentary behaviours, and/or weight outcomes

Author	Years	Study design	Number of studies	Types of studies included	Location of Studies	Relevant Outcomes	AMSTAR ranking
Beets et al. 2009 (12)	1980-February 2008	Meta-Analysis	11 interventions, 13 studies	Randomized control trial Non-randomized pre-test/post-test design with control Non-randomized pre-test/post-test design without control	U.S (11); Australia (1); Spain (1);	PA levels; Sedentary Behaviours; Weight outcomes	3/11
Chriqui, 2013 (17)	January 1st 2012 – March 1, 2013	Review	27; 12 focused on school-based PE and PA-related Policies	Not reported on in the review	U.S (27)	PA levels; Weight outcomes	1/11
Dobbins et al., 2013 (8)	1985-October 2011	Systematic Review	44	Randomized Controlled Trials	US (24); Australia (5); Belgium (3); China (2); Greece (1); Canada (1); India (1); Portugal (1); Mexico (1); Belgium (2); UK (1); Switzerland (1); Spain (1); Netherlands (1)	PA levels; Sedentary Behaviours; Weight outcomes	8/11

Author	Years	Study design	Number of studies	Types of studies included	Location of Studies	Relevant Outcomes	AMSTAR ranking
Harris et al., 2009 (18)	Up to September 2008	Meta-Analysis	18 from 23 articles	Randomized Controlled Trials Controlled Trials	US (12) Canada (3) Chile (1) Sweden (1) Australia (1)	Weight outcomes	6/11
Hoehner et al., 2008 (15)	1980-2006	Systematic Review	19; 5 involved PA in the school setting	Not reported on in the review	Of school-based interventions: Brazil (1); Chile (2); U.S/Mexico Boarder (2)	PA levels	3/11
Kriemler, 2011 (16)	2007-2010	Review of Reviews and Systematic Update	4 reviews + 20 studies	Comprehensive Systematic reviews Randomized Controlled Trials Controlled Trials	Of the individual studies included: USA (3); Canada (2); Europe (12); Australia (1); Brazil (1); Iran (1)	PA levels	4/11
Matson-Koffman, 2005 (14)	Before 1990 and from 1990-2003	Site-Specific Literature Review	65; 10 involved PA in the school setting	Not reported on in the review	U.S (10)	PA levels	3/11

Author	Years	Study design	Number of studies	Types of studies included	Location of Studies	Relevant Outcomes	AMSTAR ranking
Robertson-Wilson, 2012 (13)	2000-2011	Systematic review	13	Not reported on in the review	U.S (13)	PA levels	1/11
Verstraeten, 2012 (20)	January 1990- July 2011	Systematic Review	25 studies, 29 publications	Randomized Controlled Trials Controlled Trials	Brazil (6); Mexico (2); Chile (4); South Africa (1); China (5); Hungary (1); Iran (1); Russia (1); Thailand (1); CNMI (1); Trinidad and Tobago (1); India (1)	PA levels; Weight outcomes	7/11
Williams et al., 2013 (19)	2003-2012	Systematic review and meta-analysis	21 studies, 23 articles	Cohort Controlled before-and-after Cross-sectional Randomized controlled trial	United States (n=16); Australia (n=1); Canada (n=1); Italy (n=1); Mexico (n=1); United Kingdom (n=1)	Weight outcomes	7/11

Table 2. Overview of findings of reviews evaluating the impact of school PA-related policies or intervention on PA levels, sedentary behaviours, and/or weight outcomes

Author	Policy / Intervention Description	Physical Activity Levels	Sedentary Behaviours	BMI or Weight-Related	Conclusions
Beets et al. 2009 (12)	-After-school programs in the school setting. -Focused on increase of and/or gave information related to physical activity as sole strategy or one of several strategies. -4 studies employed a combined dietary and physical activity intervention.	-3 of 6 studies reporting on PA outcomes demonstrated positive effects, with an overall effect size of 0.44 [5% CI=0.28-0.60]. -PA defined as measures related to: reports of bodily movement related to MPA, VPA, total MVPA, and activity counts from accelerometers, as well as daily steps counts and self-reported measures of PA involvement.	-1 of 4 studies investigating sedentary activities demonstrated effectiveness in reducing sedentary behaviors [0.20 (CI=-0.04-0.44)]. -Measures for sedentary activities related to television, computer and video-game use.	-1 of 10 studies reporting body composition-related outcomes demonstrated reductions in BMI, body weight, or skinfold thickness [0.07 (CI=0.03-0.12)] -Measures of body composition included BMI, % body fat, waist circumference, fat mass, fat-free mass and skinfold thickness.	-This review concluded that, while the evidence is limited, after-school programs that contain a physical activity component may be effective in improving activity levels and body composition. -The specific components of a successful after-school program remain unclear.
Chriqui, 2013 (17)	Obesity prevention policy strategies at the U.S state, local, and/or district level. Examples of policies related to PA in the school setting include minimum PE time requirements.	-Mixed results: 1 study examining minimum time requirements for PE reported a positive impact on PA levels, one found no association. -2 studies in Robertson Wilson et al. (13) review found state DPA laws had a positive impact on time spent in MVPA.	N/R	-2 studies examined the relationship between PE and recess-related laws on youth obesity, reporting mixed results.	-This review concluded that findings related to the impact of school-based PA policies on PA level and BMI were mixed.

Author	Policy / Intervention Description	Physical Activity Levels	Sedentary Behaviours	BMI or Weight-Related	Conclusions
Dobbins et al., 2013 (8)	-School-based Physical Activity Interventions -Interventions included in the review targeted school curriculum (related to PE classes and whole curriculum), teacher training, educational materials, changes to the format of the school day, and accessibility to exercise equipment.	-Results were mixed for physical activity rates (% of participants physically active): 2 of 5 studies reported statistically positive effects on physical activity rates, while three did not. -Physical activity duration (minutes engaged in physical activity): 12 of 17 reported statistically positive effects among grade school children. -Among grade school and secondary school children, 1 did not report a statistically significant effect and 1 reported a statistically significant effect in the control group. -1 of 3 studies evaluating impact on adolescent girls reported a statistically significant positive effect.	-7 of 16 studies exploring time spent watching TV reported statistically significant positive effect.	- 8 of the 32 studies reported statistically significant positive effects on BMI in favor of the intervention. -One study reported a statistically significant effect in favor of the control group.	-This review concluded that school-based PA interventions can have a positive impact on duration of physical activity and television viewing. -School-based PA interventions were generally found to have little effect on physical activity rates or BMI. -The review found some evidence that school-based interventions led to an improvement in the proportion of children who engaged in MVPA during school hours. The review concluded that PA interventions were not effective in increasing PA rates among adolescents. -A combination of printed educational materials and changes to the school curriculum that promote physical activity resulted in positive effects.

Author	Policy / Intervention Description	Physical Activity Levels	Sedentary Behaviours	BMI or Weight-Related	Conclusions
Harris et al., 2009 (18)	-Physical activity interventions: 3 studies consisted of exercise only interventions and 15 had a co-intervention (i.e. classroom education, health education, family involvement).	N/R	N/R	-The meta-analysis was conducted in 15 out of 18 studies. -Body composition did not improve with physical activity: change in BMI not significantly different between children who received a school-based physical activity intervention and those in the control group. -2 of 3 studies not amenable to meta-analysis did not report a significant change in BMI with the intervention.	-This review concluded that physical activity interventions did not improve BMI.
Hoehner et al., 2008 (15)	School-based physical education interventions. -Interventions increase amount of time students spend in PE/are active in PE/engage in MVPA. Often involve a health education component.	-3 of 3 studies reporting on PA outcomes had positive results: positive net change in % time in MVPA during PE classes, positive net change in estimated caloric expenditure, positive net change in % time being very active during PE classes, and % time walking during PE classes.	N/R	N/R	-This review concluded that there is strong evidence in support of school-based physical education as a strategy to increase physical activity in school children and adolescents in Latin America.

Author	Policy / Intervention Description	Physical Activity Levels	Sedentary Behaviours	BMI or Weight-Related	Conclusions
Kriemler, 2011 (16)	-School-based PA and fitness Interventions -Within the systematic update, 4 programs focused on education, four applied curricular changes, one changed the environment, and the remaining used a combination of educational, curricular or environmental approaches.	-All 20 trials in the review update showed a positive effect on in-school, out-of-school or overall PA in at least one sub-group.	N/R	N/R	-This review concluded that there was strong evidence for the positive effect of school-based interventions on PA in children and adolescents. -Interventions involving more than one approach (i.e. curricular change + family component) show a high level of evidence for increasing overall PA.
Matson-Koffman, 2005 (14)	-Policy and environmental approaches to promoting PA in the school setting (i.e. enhanced access to PA, opportunities for more PA & PE throughout the day).	-6 of 10 studies found a positive association with physical activity and 2 of 10 found a negative association. -Of the 10 studies, 1 found a positive association in girls, but not in boys, and 1 found a positive association in boys, but not in girls.	N/R		-This review found moderately good evidence that giving students more opportunities for PE classes taught by better trained PE teachers is effective in increasing students' physical activity levels at school.
Robertson-Wilson, 2012 (13)	U.S school-based PA policies and legislation (i.e. state safe routes to school legislation and DPA laws).	-Outcomes for 3 policy reforms at the state-level were reported including two state DPA laws and one safe routes to school legislation. -These studies found that school-based policies were effect in increasing youth activity levels (i.e. attaining a certain % of time students are active in physical education class, increased active travel).	N/R	N/R	-This review concluded that the three policy reforms that were evaluated for impact were effective in increasing levels of physical activity.

Author	Policy / Intervention Description	Physical Activity Levels	Sedentary Behaviours	BMI or Weight-Related	Conclusions
Verstraeten, 2012 (20)	School-based obesity interventions -PA-only interventions (n=10) -Combined PA and nutrition (n=11). -13 interventions out of the total 21 were multi-component, involving school staff, communities, parents, children and/or families. -1 PA-only and 3 combined interventions involved a counselling component.	3 of 4 interventions evaluating time spent being physically active found a significant increase in the intervention group. -ES ranged from trivial to large (-0.21 to 1.61). -2 were multi-component interventions.	N/R	-Significant effect on BMI or BMI z score in 3 of 4 PA –only studies for the overall sample or for girls. -Beneficial effect on BMI or BMI z scores in 5 of 6 combined interventions for the overall sample or for boys only. - 3 of 7 studies reporting on overweight or obesity prevalence found a significant decrease in obesity prevalence in this group (0.8-32.5 percentage points)	-This review concluded that school-based interventions have the potential to improve physical activity behavior and to prevent unhealthy body weights in low and middle-income countries. -Effect interventions targeted both diet and physical activity, involved multiple stakeholders, provide additional PA sessions and integrate educational activities into curriculum.
Williams et al., 2013 (19)	-Physical activity policies (n=5): physical activity across the curriculum; walking school bus theme; professional led PE classes; increasing PE duration of 1 hour per week, guidelines. -Combined (n=6): School health and wellness programs; variety of diet and physical activity-related	N/R	N/R	-8 studies examined physical activity related policies and 2 were not included in meta-analysis. The pooled effect of all policies related to physical activity was a small and non-significant reduction in BMI-SDS. -Combined interventions were too varied to pool,	-The review concluded that, when implemented alone, school physical activity related policies appear insufficient to prevent or treat overweight or obesity in children. -They do appear to have an effect when developed and

Author	Policy / Intervention Description	Physical Activity Levels	Sedentary Behaviours	BMI or Weight-Related	Conclusions
	policies.			but significant reductions in weight-related outcomes were demonstrated.	implemented as part of a more extensive intervention program.

REFERENCES

1. World Health Organization. Population-based prevention strategies for childhood obesity. Geneva, Switzerland.2010.
2. Lagarde F, LeBlanc CM. Policy options to support physical activity in schools. Canadian Journal of Public Health/Revue Canadienne de Sante'e Publique. 2010:S9-S13.
3. Gladwin CP, Church J, Plotnikoff RC. Public policy processes and getting physical activity into Alberta's urban schools. Canadian Journal of Public Health/Revue Canadienne de Sante'e Publique. 2008:332-8.
4. Taylor JP, McKenna ML, Butler GP. Monitoring and evaluating school nutrition and physical activity policies. Canadian Journal of Public Health/Revue Canadienne de Sante'e Publique. 2010:S24-S7.
5. Yale Rudd Center for Food Policy and Obesity. 2015; Available from: http://www.uconnruddcenter.org/.
6. Bridging the Gap: Research informing policies and practices for healthy youth. 2015; Available from: http://www.bridgingthegapresearch.org/.
7. Active Living Research: Promoting active friendly communities. 2015; Available from: http://activelivingresearch.org/.
8. Dobbins M, DeCorby K, Robeson P, Husson H, Tirilis D. School-based physical activity programs for promoting physical activity and fitness in children and adolescents aged 6-18. The Cochrane Library. 2009.
9. Shea BJ, Hamel C, Wells GA, Bouter LM, Kristjansson E, Grimshaw J, et al. AMSTAR is a reliable and valid measurement tool to assess the methodological quality of systematic reviews. Journal of clinical epidemiology. 2009;62(10):1013-20.
10. Mikton C, Butchart A. Child maltreatment prevention: a systematic review of reviews. Bulletin of the World Health Organization. 2009;87(5):353-61.
11. Melchiors AC, Correr CJ, Venson R, Pontarolo R. An analysis of quality of systematic reviews on pharmacist health interventions. International journal of clinical pharmacy. 2012;34(1):32-42.
12. Beets MW, Beighle A, Erwin HE, Huberty JL. After-school program impact on physical activity and fitness: a meta-analysis. Am J Prev Med. 2009 Jun;36(6):527-37.
13. Robertson-Wilson JE, Dargavel MD, Bryden PJ, Giles-Corti B. Physical activity policies and legislation in schools: a systematic review. American journal of preventive medicine. 2012;43(6):643-9.
14. Matson-Koffman DM, Brownstein JN, Neiner JA, Greaney ML. A site-specific literature review of policy and environmental interventions that promote physical activity and nutrition for cardiovascular health: what works? Am J Health Promot. 2005 Jan-Feb;19(3):167-93.
15. Hoehner CM, Soares J, Parra Perez D, Ribeiro IC, Joshu CE, Pratt M, et al. Physical activity interventions in Latin America: a systematic review. Am J Prev Med. 2008 Mar;34(3):224-33.

16. Kriemler S, Meyer U, Martin E, Van Sluijs E, Andersen L, Martin B. Effect of school-based interventions on physical activity and fitness in children and adolescents: a review of reviews and systematic update. British journal of sports medicine. 2011;45(11):923-30.
17. Chriqui JF. Obesity Prevention Policies in U.S. States and Localities: Lessons from the Field. Curr Obes Rep. 2013 Sep;2(3):200-10.
18. Harris KC, Kuramoto LK, Schulzer M, Retallack JE. Effect of school-based physical activity interventions on body mass index in children: A meta-analysis. [References]. Canadian Medical Association Journal. [Journal Peer Reviewed Journal]. 2009;180(7):719-26.
19. Williams AJ, Henley WE, Williams CA, Hurst AJ, Logan S, Wyatt KM. Systematic review and meta-analysis of the association between childhood overweight and obesity and primary school diet and physical activity policies. The international journal of behavioral nutrition and physical activity. 2013;10:101.
20. Verstraeten R, Roberfroid D, Lachat C, Leroy JL, Holdsworth M, Maes L, et al. Effectiveness of preventive school-based obesity interventions in low- and middle-income countries: a systematic review. Am J Clin Nutr. [Review]. 2012 Aug;96(2):415-38.
21. Sanchez-Vaznaugh EV, Sánchez BN, Rosas LG, Baek J, Egerter S. Physical education policy compliance and children's physical fitness. American journal of preventive medicine. 2012;42(5):452-9.
22. Kim J. Are Physical Education-Related State Policies and Schools' Physical Education Requirement Related to Children's Physical Activity and Obesity? Journal of School Health. 2012;82(6):268-76.
23. National Collaborating Center for Healthy Public Policy. Method for synthezing knowledge about public policies 2010 [cited 2015 May]; Available from: http://www.ncchpp.ca/docs/MethodPP_EN.pdf.
24. Amis JM, Wright PM, Dyson B, Vardaman JM, Ferry H. Implementing childhood obesity policy in a new educational environment: the cases of Mississippi and Tennessee. American journal of public health. 2012;102(7):1406-13.