



# **Effectiveness of Interventions for Reducing Screen Time in Children: Rapid Review of the Evidence**

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## **Key Messages**

1. Based on two recent systematic reviews, there is insufficient high-quality evidence to conclude whether interventions aimed at reducing screen time are effective in children 4-13 years of age.
2. There are limited, 'very poor-quality', studies that show small reductions in screen time (hours per week) in children 6 years or younger. This suggests that there is more promise in interventions directed to preschool children since parents have more control over lifestyle behaviours at this age.
3. Peel Public Health should place the Turn Off the Screens (TOTS) initiative on hold pending further evaluation to better understand the most effective type, and component(s) of interventions aimed at reducing screen time in elementary school-aged children.

## **Executive Summary**

### **Issue and Context**

Childhood overweight and obesity and sedentary behaviour are significant health issues in the Region of Peel. The most prevalent form of sedentary behaviour, besides sleeping, is time spent in front of a screen, which includes watching television, videos or DVD, computer use and playing video games. Recent evidence demonstrates that two or more hours of recreational screen time, independent of physical activity levels, is associated with increased risk of overweight or obesity, decreased fitness, and decreased self-esteem and academic performance.

To address this issue, Peel's *Turn of the Screens (TOTS)* initiative, which was designed to reduce after school screen-time while promoting physical activity, has been implemented in 30 Peel elementary schools. Although the initiative has shown high participation and satisfaction among students, the actual impact on screen time reduction is unclear. For this reason, the initiative was put on hold for the 2011-2012 school year until a rapid review of the evidence could be conducted to determine the effectiveness of screen-time interventions.

### **Research Question**

The objective of this rapid review is to examine the effectiveness of interventions aimed at reducing screen time in children 4 to 13 years of age.

## **Search Strategy**

Five search strategies were conducted to obtain relevant literature from pre-processed evidence registries, OVID MEDLINE and PsycINFO. Four systematic reviews met the relevance criteria, two of which met quality criteria, and were included in the rapid review. No practice guidelines were identified.

## **Synthesis of Findings**

The evidence from the two included systematic reviews demonstrates that some interventions have a small yet statistically significant effect in reducing screen time in children. The interventions that were most effective in reducing screen time targeted children 6 years or younger; one study used classroom-based lessons and the other an automated monitoring device to control screen time at home. The primary studies included in both systematic reviews had important design limitations.

## **Conclusion and Recommendations**

The public health significance of the research findings is unclear. There is insufficient high-quality evidence to conclude whether interventions aimed at reducing screen time are effective in children 4-13 years of age. There may be some benefit to interventions to reduce screen time in children six years or younger. Based on our rapid review, we recommend:

- Placing the TOTS initiative on hold pending further evaluation to better understand the most effective type, and component(s) of interventions.

- Collecting Peel-specific data on screen-time practices of children age 4 to 13 years, and assessing parental perceptions and attitudes to inform a school-based, screen time reduction policy and program.

## 1 Issue

Childhood overweight and obesity is a significant health issue in Peel, with 38% of boys and 27% of girls in grades 7 to 12 classified as overweight or obese<sup>1</sup>. In 2009, Peel Public Health's 10-Year Strategic Plan identified *Supportive Environments, Healthy Weights* as a program priority<sup>5</sup>. The overall goal of this priority is to prevent or slow the rise in the rate of overweight and obesity through multi-prong strategies involving modifications to the built environment, the food environment and active transportation. One component within these strategies has been to reduce sedentary behaviours among children, particularly recreational screen time as this the most prevalent form of sedentary behaviour during waking hours. To address this issue, in 2006 the Chronic Disease and Injury Prevention Division implemented the *Turn off the Screens (TOTS)* initiative, a school-based program designed to reduce after-school recreational screen time and promote physical activity. Since its inception, TOTS has been implemented in 30 Peel elementary schools. Although the initiative was multi-sectoral (involving school boards, Child Care Centres and Parks and Recreation Services) and showed high participation and satisfaction among students, the actual impact on screen time reduction is unclear. Also, no formal review of the published literature has been conducted to examine the effect of screen time reduction strategies. To determine whether Peel should continue, modify or discontinue the TOTS initiative, we conducted

a rapid review of the evidence to examine the effectiveness of interventions aimed at reducing screen time in children 4 to 13 years of age.

## **2 Context**

In the past decade, screen time, which includes watching television, videos or DVDs, computer use and playing video games (excluding cell phones or other hand held devices), has steadily increased among children and youth<sup>7</sup>. Recent Canadian data show that 6 to 19-year-olds are spending an average of 8.6 hours per day, or 62% of their waking hours being sedentary<sup>2</sup>. Although it is uncertain if they are engaged in screen time for this entire 8.6 hours, other studies show that children and youth get as much as 6 to 7 hours per day of screen time, suggesting most of these 8.6 hours are likely spent in front of various screens<sup>3</sup>. The Canadian Sedentary Behaviour Guidelines for children and youth recommend limiting recreational screen time to no more than two hours per day; as lower levels are associated with additional health benefits<sup>13</sup>. The evidence that informs these guidelines demonstrates that, independent of physical activity levels, two or more hours of screen time is associated with unfavourable body composition, decreased fitness, decreased self-esteem and decreased academic achievement<sup>4</sup>. Given the potential health implications associated with these health outcomes (e.g., risk of metabolic syndrome and cardiovascular disease), implementing interventions early in life is a priority for public health practitioners and policy makers. Since the effect of TOTS on reducing screen time is unclear, the initiative was put on hold for the 2011-2012 school year until further evaluation could be conducted to

determine its value. The following story reflects the experience of TOTS committee members when planning for the 2011- 2012 school year.

### **2.1 Anecdote:**

In the summer of 2011, TOTS committee members met with the Manager and Supervisor of the School Health Team to discuss the future of the TOTS initiative.

Throughout the discussion, several key questions were raised regarding screen time:

- What are the results of recent interventional studies in reducing screen time in children?
- What are the most effective components of a screen time intervention?
- What should be the primary focus of TOTS?
- How to improve the initiative for the following year?
- How to accurately evaluate the overall effectiveness of TOTS?

This conversation led to the decision by the committee that TOTS should be put on hold until a thorough review of the published literature is conducted to explore the effectiveness of screen time interventions in elementary school-aged children.

### **2.2 Conceptual Model:**

To conceptualize the impact of screen time as it relates to children's health, we developed a socio-ecological model that identifies the key determinants (e.g. social, environmental) and associated health outcomes related to two or more hours of screen time per day<sup>4</sup>. The socio-ecological model helps to identify opportunities to promote screen time reduction by recognizing the multiple factors that influence an individual's



behaviour. Efforts to change screen time behaviour are more likely to be successful when the multiple levels of influence are addressed at the same time (refer to Appendix A for the conceptual model).

### 3 Searching the Evidence

#### 3.1 Research Question:

The research question we aim to answer in this review is as follows: “What is the effectiveness of interventions for reducing screen time in children aged 4 to 13 years”.

The PICO framework was used to develop the research question, as described below:

- **Population (P)** = Elementary school-aged children (4-13 years of age)
- **Intervention (I)** = Screen time intervention
- **Control/Comparison (C)** = Non-treatment comparison/control
- **Outcome (O)** = Screen time reduction

#### 3.2 Search Strategy:

We applied five sequential search strategies to obtain relevant literature (Refer to Appendix B, for the search strategy): 1) We searched five pre-processed evidence registries for guidelines and systematic reviews through November 2, 2011. The search strategy used the terms customized for the registry, including derivations of the terms “screen time”, “television”, “computer”, “videogame”, “children”. 2) Electronic searches in Ovid MEDLINE (from 2001) and PsycINFO (from 2001) for reviews published between 2001 to November 3, 2011, using applicable Medical Subject Headings (MeSH) and key words. 3) An informal search of *Google Scholar* was done, using the

same search terms as outlined in strategy 1. 4) Key informants were contacted to identify any relevant review articles and/or sources of information, and 5) Reference lists of review articles selected for data extraction were searched for any relevant reviews not identified by strategies 1 to 4.

### **3.3 Inclusion and Exclusion of Studies**

Two reviewers independently screened articles for eligibility, and disagreements were resolved with discussion with a third reviewer. Articles qualified for full review were screened to determine eligibility using the following inclusion criteria: 1) published in the English language; 2) were practice guidelines, systematic reviews and/or meta-analyses designed to assess screen time reduction; 3) targeted children between the ages of 4 to 13 years; and 4) included measurement outcome of screen time (TV/DVD, computer use, and/or videogames).

### **3.4 Search Results**

Our search strategy identified 47 potentially relevant review articles (Refer to Appendix C for search results); no guidelines were identified, five reviews were excluded as duplicates, and 37 did not meet the relevance criteria after title and abstract screening. Five systematic reviews met the relevance criteria based on title and abstract screening. Of the five, the review published by Centers for Disease Control and Prevention was excluded as we were unable to retrieve full text version, despite three attempts to contact the authors. Four systematic reviews were retrieved and independently assessed for inclusion. All four reviews met inclusion and were critically appraised.

## 4 Critical Appraisal

Two independent reviewers used the Health-Evidence Quality Assessment Tool for Review Articles and its accompanying dictionary to assess and document the methodological quality of the four systematic reviews<sup>12</sup>. Disagreements were resolved through discussion with a third reviewer. The results of the independent assessments produced an overall rating of 8/10 ('strong' methodological quality) for the systematic review by Manniccia et al<sup>6</sup>, and a rating of 9/10 ('strong' methodological quality) for the systematic review by Wahi et al<sup>7</sup>. Our quality rating of both articles matched the ratings by Health Evidence. We rated the studies by Schmidt et al<sup>8</sup> and Steeves et al<sup>9</sup> as being poor (3/10) and moderate (5/10) quality, respectively, and therefore excluded them from our review (refer to Appendix F for description of excluded studies).

## 5 Description of Included Studies

Data extraction tables of the two systematic reviews are listed in Appendix D and E.

### ***5.1 Maniccia et al (2011). A Meta-analysis of Interventions that Target Children's Screen Time for Reduction***

The systematic review by Maniccia et al<sup>6</sup> included 29 intervention studies aimed at reducing screen time, defined as television, video/DVD, computer or video game use alone or in combination, in children 18 years and younger. Most studies were conducted in the United States.

### 5.1.1. Intervention Characteristics

The majority of the studies targeted children between the ages of 5 and 11 years. Overall, there was large variability between the types of interventions; studies used between 1 to 6 components alone or in combination. Most studies used behaviour modification techniques to reduce screen time, with the most frequently cited being goal setting, self-monitoring and rewards/reinforcement. More than one-half of the studies were theory based (Social Cognitive Theory was used most frequently followed by Theory of Reasoned Action), and the school was the most common intervention setting, followed by home, and the remainder did not specify. The following is a summary of the types of interventions categorized by setting:

**School-based Interventions:** Most (11/13) school-based interventions used classroom-based lessons integrated into the health promotion curriculum as a standalone strategy or in combination with another strategy; one study used an environmental component where children were encouraged to take additional physical education classes and changes were made to the school cafeteria, one used media diaries to self monitor screen time, four used a parent outreach strategy to educate parents on screen time behaviour, and one used an automated monitoring device to control screen time at home (see definition below).

**Home-based Interventions:** Most interventions (6/8) used an automated monitoring device to control screen time in combination with another strategy. The device controlled and monitored the use of television or computer screens, including video game systems, by enforcing a daily time budget (e.g. two hours of screen time/day). Six

studies also provided rewards/reinforcement if screen time requirements were met; three provided educational materials to parents and children on screen time usage; and one made screen time conditional on time spent being physically active (e.g. 30 minutes of physical activity would buy 30 minutes of screen time). One study did not report the intervention component.

**Other interventions:** Most (7/8) interventions provided educational material to reduce screen time alone or in combination with another component; three of the co-intervention studies provided physical activity opportunities.

## **5.2 Wahi et al (2011). Effectiveness of Interventions Aimed at Reducing Screen Time in Children**

The systematic review by Wahi et al<sup>7</sup> included 13 randomized controlled trials (RCT) targeting children 18 years and younger; nine measured screen time (hours per week) and body mass index (BMI), two measured screen time only and two measured BMI only (for the purpose of this review, only the RCTs targeting screen time reduction will be discussed in detail). Most of these studies were conducted in the United States; one in Australia, and one in the United Kingdom.

### **5.2.1. Intervention Characteristics**

The majority of the studies targeted children between the ages of 4 to 12 years. The duration of the interventions ranged from 1 to 24 months (median duration, 6 months). The settings varied: five trials recruited from schools; two recruited from medical clinics; and six recruited from community settings. The following is a summary of the type of screen time interventions categorized by settings:

**School-based Interventions:** All the interventions (5/5) used classroom-based lessons integrated into the health promotion curriculum as a standalone component or in combination with another strategy; two trials used physical activity and diet as co-interventions (i.e. providing opportunities to increase physical activity and healthy eating) and three did not use co-interventions.

**Clinic-based Interventions:** One study was conducted in a subspecialty medical clinic that used an intervention mapping workshop and newsletter to change screen time behaviour. The second study was conducted in a community clinic that used family counselling in combination with an automated monitoring device to control screen time at home.

**Community-based Interventions:** 3/6 interventions used individual/family counselling for parents and children. Three used an automated monitoring device to control screen time alone or in combination with counselling; one also used an undetermined home-based strategy, and one used an educational seminar in combination with an automated monitoring device to control screen time.

## 6 Synthesis of Findings

### 6.1 Study results

*Systematic review by Maniccia et al (2011)*

Overall, the \*27 interventions included in the systematic review showed a small yet statistically significant reduction in children's screen time. After the intervention, the standardized mean difference (SMD) in means effect size (weighted average of results

\* Two studies were excluded in the analysis because of a lack of variance reported by primary study authors.

of single studies) was  $-0.148$  (95% Confidence Interval [CI],  $-0.0224$  to  $-0.071$ ) in favour of the intervention group. Cohen's criteria<sup>10</sup> for magnitude of effect size are  $0.2 =$  small,  $0.5 =$  medium, and  $0.8 =$  large; the effect size in this meta-analysis is considered 'small'. The results showed that during the intervention period (i.e. while the intervention was being delivered), there was a large statistically significant reduction in children's screen time. The SMD during the intervention was  $-1.904$  (95% CI:  $-3.041$  to  $-0.767$ ) in favour of the intervention group.

In their subgroup analyses, the authors reported that 'school-based interventions' and 'other' interventions had a small yet statistically significant effect on reducing screen time, while home-based interventions did not. Theory based interventions also showed a small yet statistically significant effect, whereas non theory-based interventions did not.

*Systematic review by Wahi et al (2011)*

The meta-analysis of 13 RCTs aimed at reducing hours per week of screen time and BMI showed no effect for both outcomes (note: two studies were excluded from the screen time meta-analysis and five studies from the BMI met-analysis due to lack of data). For the screen time outcome, the difference in mean change hours per week of screen time from baseline in the intervention group compared to the control group was  $-0.90$  hours/week (95% CI,  $-3.47$  to  $1.66$  hours/week,  $P=0.49$ ). For the BMI outcome, the difference in mean change in BMI from baseline in the intervention group compared to the control group was  $-0.10$  (95% CI,  $-0.28$  to  $0.09$ ,  $P=0.32$ ).

The screen time analysis also showed a high amount of heterogeneity among interventions. To address this issue, the authors performed a subgroup analysis based

on age, separating interventions targeting pre-school children 6 years or younger (n=2) from interventions targeting children 7 years and older (n=7). The results for children 6 years or younger demonstrated a statistically significant reduction of 3.72 hours per week (95% CI, – 7.23 to – 0.20) of screen time in favour of the intervention group compared to the control group. Between the two studies, one used classroom-based lessons as part of the health promotion curriculum and the other used an automated monitoring device to reduce screen time at home. There was no significant effect shown for the seven interventions targeting children 7 years and older.

## **6.2 Quality of Evidence**

Although the systematic review by Manniccia et al<sup>6</sup> received a quality rating of 8/10, the authors did not conduct an adequate quality assessment of the primary studies. As a result, low quality interventions may have been included in the systematic review and influenced the overall effect estimate. For example, five studies included in the analysis did not have a control group and had a sample size that ranged from 2 to 10 participants, while nine studies did not use a validated tool to measure screen time. As evident in their meta-analysis, the effect size and corresponding confidence intervals of these studies were substantially larger relative to controlled studies with adequate sample sizes. Additionally, the authors used adjusted data from some studies and unadjusted data from other studies in their pooled analysis. Using adjusted values has been shown to overestimate the pooled effect size, thus only unadjusted values are recommended when conducting meta-analyses <sup>11</sup>.



The systematic review by Wahi et al<sup>7</sup> applied rigorous methods to the process of study selection, assessment of methodological quality (using the Cochrane Collaboration checklist and the Grading of Recommendations Assessments, Development and Evaluation tool), data extraction, and used only unadjusted data from primary studies for the pooled analysis – the authors excluded studies when unadjusted values were unavailable. Results of the quality assessment of the primary studies found ‘low-quality’ evidence for the BMI outcome and ‘very low-quality’ for the screen time outcome. The ‘low-quality’ rating was attributed to uncertainty of allocation concealment, uncertainty of blinding of participants and outcome assessors, and excessive number of participants lost to follow-up. In addition to these methodological limitations, the quality of evidence for the screen time outcome was further degraded to ‘very low-quality’ because of large differences between study results observed in the pooled analysis.

### **6.3 Synthesis of Findings**

In summary, the evidence from the two systematic reviews included in our review showed that different types of interventions can have a small yet statistically significant effect in reducing screen time and no effect in reducing BMI in children (Table 1). When assessing the primary studies included in both systematic reviews, there was high variability in intervention results and large differences between the types of interventions (Note: 7 of the 13 studies in Wahi et al<sup>7</sup> were also included in Manniccia et al<sup>6</sup>). Most studies used behaviour modification techniques to reduce screen time; the most commonly used were goal setting, self monitoring and rewards/reinforcement. These techniques were delivered through four types of interventions: 1) classroom-based

lessons as part of the school curriculum; 2) automated monitoring device controlling screen time at home; 3) counselling; and 4) unidentified or other educational strategies. These interventions were delivered on their own (e.g. classroom-based lessons) or in combination with one of the other strategies (e.g. classroom-based lessons with an automated monitoring device). However, because there were a large number of different intervention types, it was difficult for the review authors to determine the extent to which children utilized the behaviour modification techniques(s) and which technique(s) and types of interventions were most effective at changing screen time behaviour.

The interventions that were effective in reducing hours per week of screen time, based on a subgroup analysis by Wahi et al<sup>7</sup>, targeted children 6 years or younger; one study used classroom-based lessons and the other an automated monitoring device to control screen time behaviours. This suggests that interventions directed to preschool children may be more effective and sustainable since parents have more control over lifestyle behaviours at this age<sup>7</sup>. However, given that the authors rated these studies as ‘very low-quality’ and the results were limited to only two studies, the findings of the subgroup analysis should be interpreted with caution.

**Table 1: Effect of Screen Time Interventions: Results from Primary Studies Included in Reviews by Maniccia et al and Wahi et al**

Intervention	Outcomes		Setting
	Screen Time: Author (year) = Effect	BMI: Author (year) = Effect	
<ul style="list-style-type: none"> <li>Classroom-based lessons</li> </ul>	<ul style="list-style-type: none"> <li>Chin (2008) = 0</li> <li><sup>b</sup>Dennison (2004) = 0</li> <li>Foster (2008) = 0</li> <li><sup>ab</sup>Gortmaker (1999) = ↓</li> <li>Gortmaker(1999) = 0</li> <li>Harrison (2006) = 0</li> <li>Jones (2008) = ↓</li> <li><sup>ab</sup>Kipping (2008) = 0</li> <li>Niemeyer (1988) = 0</li> <li><sup>b</sup>Robinson (1999) = 0</li> <li><sup>b</sup>Salmon (2008) = ↑</li> <li>Weintraub (2008) = 0</li> </ul> <p>Total = 1/12 study showed significant increase (i.e. harm); 2/12 studies showed significant reductions.</p>	<ul style="list-style-type: none"> <li>NM</li> <li><sup>b</sup>Dennison (2004) = 0</li> <li>NM</li> <li><sup>a</sup>Gortmaker (1999) = ↓</li> <li>NM</li> <li>NM</li> <li>NM</li> <li>NM</li> <li><sup>a</sup>Kipping (2008) = 0</li> <li>NM</li> <li>NM</li> <li><sup>b</sup>Salmon (2008) = 0</li> <li>NM</li> </ul> <p>Total = 2/4 studies showed significant reductions</p>	<ul style="list-style-type: none"> <li>School</li> <li>Preschool (≤ 6 years)</li> <li>School</li> <li>School</li> <li>School</li> <li>School</li> <li>School</li> <li>School</li> <li>School</li> <li>School</li> <li>School</li> <li>School</li> <li>School</li> </ul>
<ul style="list-style-type: none"> <li>Automated device controlling screen time</li> </ul> <p>Note: Todd et al included a seminar component as a co-intervention.</p>	<ul style="list-style-type: none"> <li>Angelbuer (1998) = ↓*</li> <li><sup>b</sup>Epstein (2008) = 0</li> <li><sup>b</sup>Ford (2002) = 0</li> <li><sup>a</sup>Goldfield (2006) = ↓</li> <li>Jason (1987) = 0 *</li> <li>Jason (1993) = 0 *</li> <li>McCanna (1989) = 0 *</li> <li>Ni Mhurchu (2009) = 0</li> <li>Robinson (2003) = 0</li> <li>Todd (2008) = 0</li> </ul> <p>Total = 2/10 studies showed significant reductions</p>	<ul style="list-style-type: none"> <li>NM</li> <li><sup>b</sup>Epstein (2008) = ?</li> <li>NM</li> <li>NM</li> <li>NM</li> <li>NM</li> <li>NM</li> <li>NM</li> <li>Ni Mhurchu (2009) = 0</li> <li>NM</li> <li>Todd (2008) = 0</li> </ul> <p>Total = no studies showed significant reductions</p>	<ul style="list-style-type: none"> <li>Home</li> <li>Home (≤ 6 years)</li> <li>Other</li> <li>Home</li> <li>Home</li> <li>Home</li> <li>Home</li> <li>Home</li> <li>School</li> <li>Other</li> <li>Community</li> </ul>
<ul style="list-style-type: none"> <li>Classroom-based lessons and automated device controlling screen time</li> </ul>	<ul style="list-style-type: none"> <li><sup>b</sup>Robinson (1999) = ↓</li> <li>Robinson (2006) = 0</li> </ul> <p>Total = 1/2 study showed significant reductions</p>	<ul style="list-style-type: none"> <li><sup>b</sup>Robinson (1999) = ↓</li> <li>NM</li> </ul> <p>Total = 1/2 study showed significant reductions</p>	<ul style="list-style-type: none"> <li>School and home</li> <li>School and home</li> </ul>

Intervention	Outcomes		Setting
	Screen Time: Author (year) = Effect	BMI: Author (year) = Effect	
<ul style="list-style-type: none"> <li>Screen time contingent on physical activity</li> </ul>	<ul style="list-style-type: none"> <li><sup>a</sup> Faith (2001) = ↓*</li> </ul> <p>Total = 1/1 study showed significant reductions</p>	<ul style="list-style-type: none"> <li>NM</li> </ul>	<ul style="list-style-type: none"> <li>Home</li> </ul>
<ul style="list-style-type: none"> <li>Counselling (parents and children)</li> </ul> <p>Note: Ford et al included an automated monitoring device as a co-intervention.</p>	<ul style="list-style-type: none"> <li><sup>b</sup> Ford (2002) = 0</li> <li>NM</li> <li>NM</li> </ul> <p>Total = no studies showed significant reductions</p>	<ul style="list-style-type: none"> <li>NM</li> <li>Epstein (1995) = ?</li> <li>Epstein (2000) = 0</li> </ul> <p>Total = no studies showed significant reductions</p>	<ul style="list-style-type: none"> <li>Community-clinic</li> <li>Community</li> <li>Community</li> </ul>
<ul style="list-style-type: none"> <li>Other educational /Unclear</li> </ul>	<ul style="list-style-type: none"> <li>Eisenmann (2008) = 0</li> <li>Escobar-Chaves (2010) = 0</li> <li>Golan (1998) = 0</li> <li>Mauriello (2006) = 0</li> <li>Nemet (2005) = 0</li> <li>Nova (2001) = 0</li> <li>Robinson (2010) = 0</li> <li>Sage (1997) = 0</li> <li>Simon (2006) = 0</li> </ul> <p>Total = no studies showed significant reductions</p>	<ul style="list-style-type: none"> <li>NA</li> <li>NM</li> <li>NM</li> <li>NM</li> <li>NM</li> <li>NM</li> <li>NM</li> <li>Robinson (2010) = 0</li> <li>NM</li> <li>NM</li> </ul> <p>Total = no studies showed significant reductions</p>	<ul style="list-style-type: none"> <li>Home</li> <li>Medical clinic</li> <li>Unclear</li> <li>Unclear</li> <li>Unclear</li> <li>Unclear</li> <li>Unclear</li> <li>Community</li> <li>Unclear</li> <li>Unclear</li> </ul>

↓ = intervention significantly decreased screen time or BMI?.

0 = no effect.

↑ = intervention significantly increased screen time or BMI (i.e. harm)

\* no comparison group, lack of random allocation and very small sample size (range between 2 to 10 subjects).

? = undetermined.

NM = not measured.

<sup>a</sup> study was not included in the meta-analysis.

<sup>b</sup> study was included in both meta-analyses.

## 7 Applicability and Transferability

Peel Public Health staff (director, managers, supervisors and frontline practitioners) involved in the TOTS initiative and the *Supportive Environments, Healthy Weights* program priority<sup>5</sup> were invited to independently assess the applicability and transferability (A&T) of the evidence provided in this review. The assessment was conducted using the A&T tool adapted from The National Collaborating Centre for Methods and Tools

([http://www.nccmt.ca/pubs/2008\\_09\\_AT\\_paper\\_v\\_oct2007\\_ENG.pdf](http://www.nccmt.ca/pubs/2008_09_AT_paper_v_oct2007_ENG.pdf)). The tool is designed to capture the key contextual and situational factors that influence the implementation of a public health program. The following are the results of that discussion.

### 7.1 Political Acceptability or Leverage

- The issue of screen time is an emerging and important field of research, however it is still at the early stages of understanding the mechanisms in which it affects children's health and how to effectively design public health strategies to reduce the behaviour.
- What's promising is that there is political will to address the issue, as evident by the Ontario Public Health Standards, the province's priority to decrease childhood obesity, the recent release of the Canadian sedentary behaviour and physical activity guidelines and Peel's focus on supportive environments and healthy weights.

- There is uncertainty, however, as to how the public and target groups will accept and support a screen time reduction strategy. For example, public health programmers aiming to intervene at the school level must be cognisant of the current financial and temporal constraints faced by schools and school boards – adding another intervention to the curriculum will be challenging.

## **7.2 Social Acceptability**

- Strategies for decreasing sedentary screen behaviours are perceived as ethical, however screen time is inherently a fun leisurely activity, thus social acceptance by target populations will not be easy.
- If public health strategies (via policy or programming) are to limit or impose on the number of hours spent in front of screens (i.e. fun/leisure time), there is a need for some kind of justification besides just health consequences that parents and their children can agree upon – ideally an enjoyable (but in this case potentially harmful) activity should be displaced by another enjoyable (but positive) activity. Otherwise, social acceptance is unlikely, which may lead to high attrition rates, and inadequate behaviour change, as evident by the results from recent systematic reviews.
- The Family Health division has allocated resources to address screen time reduction in children 6 years and younger by exploring policy options in child care centres. This can potentially displace screen time behaviours to other fun and positive activities at an early age; however additional data are needed on the effectiveness of interventions targeting this age group to help guide policy options. Epidemiological

and qualitative data are also required to understand the impact of ethno-cultural diversity on intervention delivery and effectiveness.

### **7.3 Available Essential Resources (Human and Financial)**

- Given that there is no best practice model or intervention recommended for school age children, it will be challenging to determine the human and financial resources essential for local implementation – it may be useful to review published cost-effectiveness studies, if available.
- A population health approach that applies effective policy(s) across all school boards will be necessary to reach 250 thousand Peel school-aged children – other type of interventions could be prohibitively expensive.
- Existing partnerships between CDIP staff (i.e. managers and PHNs) and school boards may leverage collaborative multi-prong strategies at the school level – positive partnerships will play a significant role in implementing school-based and community-based interventions.

### **7.4 Organizational Expertise and Capacity**

- A screen time reduction strategy will complement the *Supportive Environments, Healthy Weights* program priority outlined in Peel Public Health's 10-Year Strategic plan.
- A screen time intervention may overlap with existing programs depending on the objectives set out for the intervention. The objectives can be any of the following: improve physical activity levels, independent of reducing screen time or vice versa,

or focus on improving both outcomes. The approach can lend itself to cross-divisional collaboration, with Family Health targeting children 6 years and younger and CDIP targeting children 6 to 18 years of age.

- Although the organization is motivated, there is uncertainty about the capacity of the health department and the school boards to implement population level reduction strategies.

### ***7.5 Magnitude of Health Issue in Local Setting***

- Peel estimates: Students in grades 7-12 spent a large portion of their day being sedentary, including watching TV, playing video games, and surfing the internet using computer and cell phones.
- Canadian estimates: 6-7 hrs per day<sup>3</sup>.
- Peel data gaps: Limited understanding of number of hours spent on different types of screens, particularly mobile devices (e.g. texting, watching videos on smart phones) and their impact on health outcomes; Peel data is also required on parental perceptions and attitudes on screen time.

### ***7.6 Magnitude of the “Reach” and Cost-effectiveness of the Intervention***

- A population level strategy is likely to have wide reach if implemented in schools and childcare centres. A childcare policy will be limited to children 4 years and younger.
- Cost-effectiveness of interventions has not been reviewed.

### ***7.7 Target Population Characteristics***



- Peel's target population characteristics are somewhat comparable to most study populations, given most interventions targeted boys and girls between 5 and 11 years of age, with 25% to 50% of the participants as non-white.

## **8 Recommendations**

1. Peel Public Health should place the TOTS initiative on hold pending further evaluation to better understand the most effective type, and component(s) of interventions aimed at reducing screen time in elementary school-aged children
2. Family Health staff should further investigate the effectiveness of interventions aimed to reduce screen time in children 6 years and younger.
3. Collect Peel-specific data on screen-time practices of children age 4 to 13 years, and assess parental perceptions and attitudes to inform a school-based, screen-time reduction policy and program.
4. Build Peel's screen time strategy on four pillars: 1) health status data; 2) research; 3) Peel situational assessment and 4) ethno-cultural diversity.

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## **Appendices**

**Appendix A: Concept Model**

**Appendix B: Search Strategy**

**Appendix C: Literature Search Flowchart**

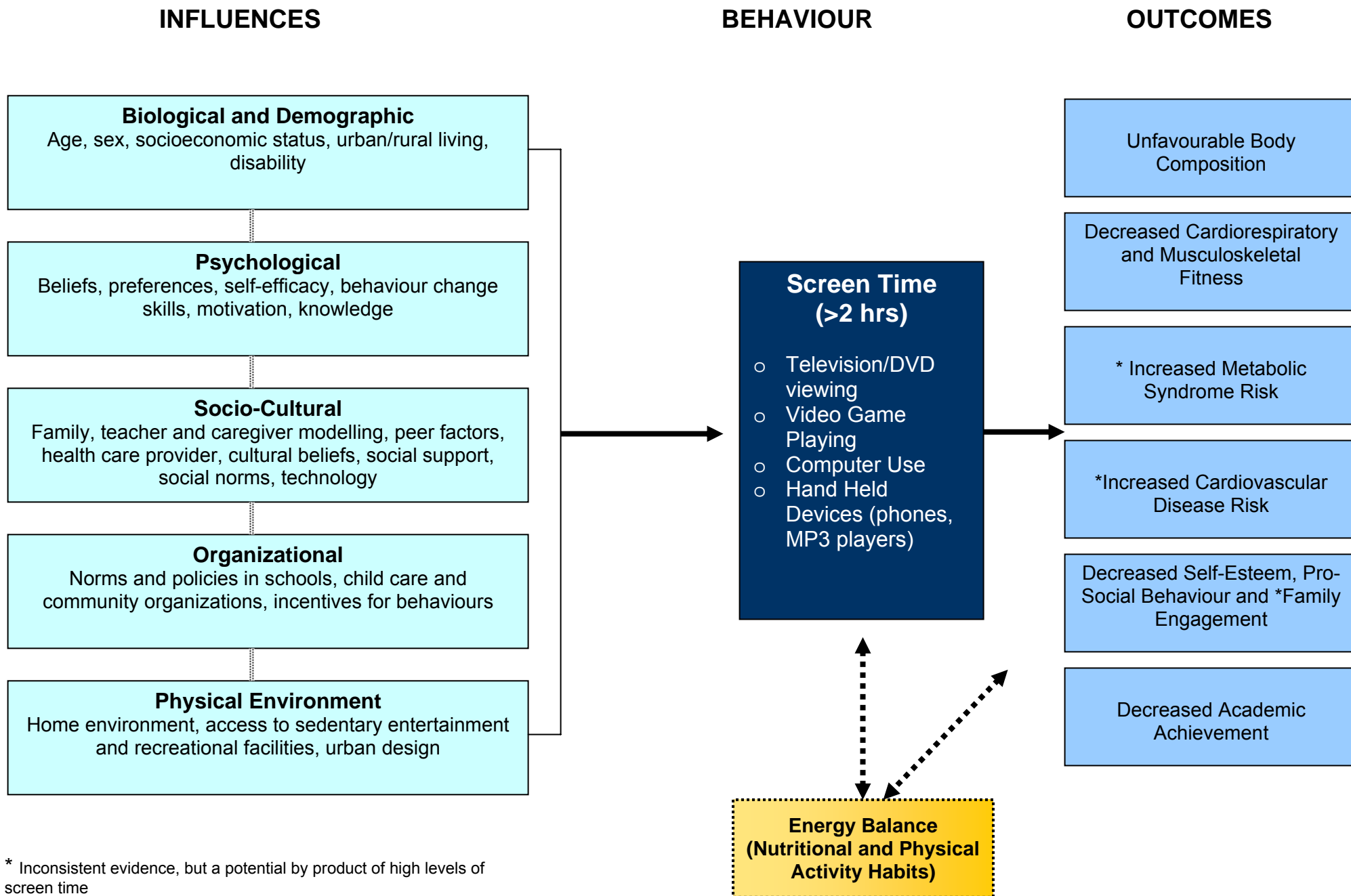
**Appendix D: Data Extraction Table of Review Articles**

**Appendix E: Data Extraction Table of Primary Study Results**

**Appendix F: Data Extraction Table of Excluded Studies**

**Appendix G: Applicability & Transferability Worksheet**

## Appendix A: Socio-Ecological Model of Screen Time and Health



\* Inconsistent evidence, but a potential by product of high levels of screen time

## Appendix B: Search Strategy

1. We searched the following five pre-processed sources for summaries and syntheses: Health-Evidence, Effective Public Health Practice Project Public Health Reviews, The Guide to Community Preventive Services, The Evidence for Policy and Practice Information and Co-ordinating Centre, and The National Institute for Health and Clinical Excellence. We used terms customized for the database, including derivations of “screen time” OR “television” OR “computer” OR “videogame” AND “children”.

2. Database: Ovid MEDLINE(R) <1948 to October Week 3 2011>  
Search Strategy:

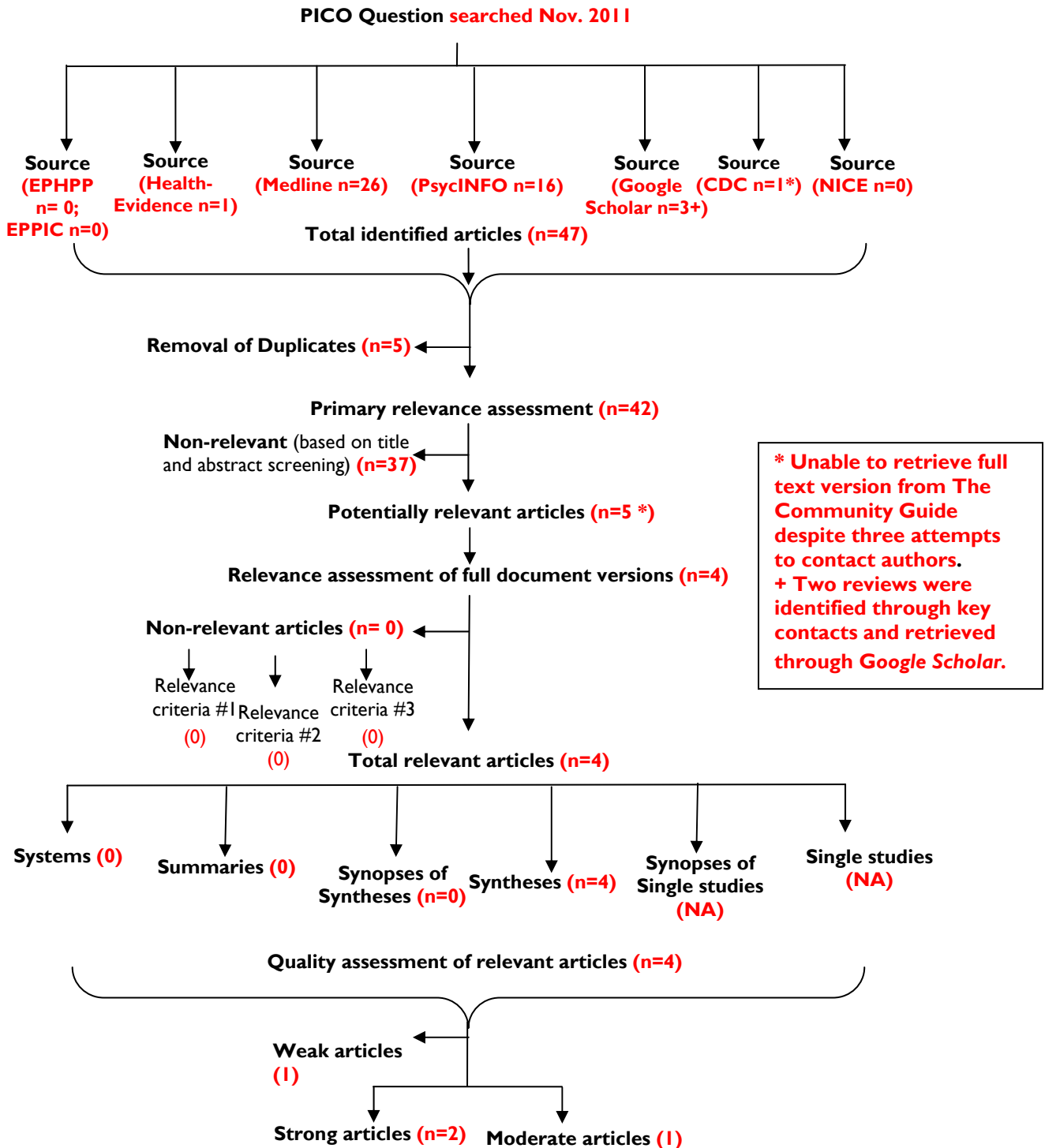
- 
- 1 Television/ (10707)
  - 2 television.tw. (8501)
  - 3 tv.tw. (6270)
  - 4 screen time.tw. (179)
  - 5 Video Games/ (1319)
  - 6 video gam\*.tw. (937)
  - 7 vcr.tw. (1746)
  - 8 dvd.tw. (564)
  - 9 screen usage.tw. (1)
  - 10 screen use\*.tw. (82)
  - 11 videogame\*.tw. (127)
  - 12 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 (22915)
  - 13 Child/ (1253964)
  - 14 Child, Preschool/ (689330)
  - 15 Adolescent/ (1459283)
  - 16 school age\*.tw. (11009)
  - 17 child\*.tw. (834737)
  - 18 13 or 14 or 15 or 16 or 17 (2391430)
  - 19 12 and 18 (6840)
  - 20 meta-analysis.mp.pt. (49464)
  - 21 systematic review.tw. (24399)
  - 22 cochrane database of systematic reviews.jn. (7918)
  - 23 or/20-22 (68596)
  - 24 exp guideline/ (21781)
  - 25 (practice guideline or guideline).pt. (21781)
  - 26 24 or 25 (21781)
  - 27 23 or 26 (89988)
  - 28 (comment or letter or editorial or note or erratum or short survey or news or newspaper article or patient education handout or case report or historical article).pt. (1505474)
  - 29 27 not 28 (85041)
  - 30 19 and 29 (54)
  - 31 limit 30 to yr="2001 -Current" (48)
  - 32 intervention\*.tw. (406407)
  - 33 strateg\*.tw. (420305)
  - 34 prevent\*.tw. (770184)
  - 35 education.tw. (227708)

- 36 exp Health Promotion/ (44507)
- 37 health promotion.tw. (14910)
- 38 32 or 33 or 34 or 35 or 36 or 37 (1629847)
- 39 31 and 38 (26)
- 40 limit 39 to yr="2001 -Current" (26)

Database: PsycINFO <2002 to November Week 1 2011>  
Search Strategy:

- 
- 1 Television/ (1951)
  - 2 television.tw. (5273)
  - 3 tv.tw. (1943)
  - 4 screen time.tw. (91)
  - 5 Video Games/ (1680)
  - 6 video gam\*.tw. (1282)
  - 7 vcr.tw. (50)
  - 8 dvd.tw. (508)
  - 9 screen usage.tw. (2)
  - 10 screen use\*.tw. (17)
  - 11 videogame\*.tw. (184)
  - 12 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 (8951)
  - 13 Child/ (0)
  - 14 Child, Preschool/ (0)
  - 15 Adolescent/ (0)
  - 16 school age\*.tw. (5152)
  - 17 child\*.tw. (179695)
  - 18 13 or 14 or 15 or 16 or 17 (180296)
  - 19 12 and 18 (2086)
  - 20 meta-analysis.mp.pt. (6903)
  - 21 systematic review.tw. (4838)
  - 22 cochrane database of systematic reviews.jn. (0)
  - 23 or/20-22 (10806)
  - 24 exp guideline/ (0)
  - 25 guideline\*.tw. (19418)
  - 26 24 or 25 (19418)
  - 27 23 or 26 (29771)
  - 28 (comment or letter or editorial or note or erratum or short survey or news or newspaper article or patient education handout or case report or historical article).pt. (0)
  - 29 27 not 28 (29771)
  - 30 19 and 29 (64)
  - 31 limit 30 to yr="2001 -Current" (64)
  - 32 intervention\*.tw. (113668)
  - 33 strateg\*.tw. (103106)
  - 34 prevent\*.tw. (68444)
  - 35 education.tw. (100524)
  - 36 exp Health Promotion/ (7997)
  - 37 health promotion.tw. (6477)
  - 38 32 or 33 or 34 or 35 or 36 or 37 (316949)
  - 39 31 and 38 (27)
  - 40 limit 39 to yr="2007 -Current" (16)

## Appendix C: Literature Search Flowchart



Source: Health-evidence.ca. Keeping Track of Search Results: A Flowchart. [Retrieved Nov. 22, 2011]



## Appendix D: Data Extraction Table of Review Articles

GENERAL INFORMATION	SEARCH STRATEGY OF REVIEW	DETAILS OF INTERVENTIONS INCLUDED IN REVIEW	OUTCOME MEASUREMENTS	RESULTS	QUALITY RATING
<p><b>REVIEW ARTICLE # 1</b></p> <p><b>Author(s) and Date:</b></p> <ul style="list-style-type: none"> <li>Maniccia et al., 2011</li> </ul> <p><b>Country:</b></p> <ul style="list-style-type: none"> <li>United States</li> </ul>	<p><b>Number of Primary Studies Included:</b></p> <ul style="list-style-type: none"> <li><math>n = 29</math></li> </ul> <p><b>Types of Studies Included:</b></p> <ul style="list-style-type: none"> <li>Level I (randomized control trials),</li> <li>Level II (non-randomized trials, cohort, and case control )</li> <li>Level III (uncontrolled studies)</li> </ul> <p><b>Note:</b></p> <ul style="list-style-type: none"> <li>The vast majority of the studies included an intervention and comparison group.</li> <li>Five interventions used 1 group with a pretest-posttest design.</li> <li>Amongst studies with 2 groups of participants, most used randomization to assign group allocation.</li> </ul> <p><b>Search Period:</b></p> <ul style="list-style-type: none"> <li>From 1985 to December 6, 2008</li> </ul> <p><b>Number of Databases</b></p>	<p><b>Types of Interventions:</b></p> <ul style="list-style-type: none"> <li>Most studies used behaviour modification techniques to reduce screen time, with the most frequently cited being goal setting, self-monitoring and rewards/reinforcement.</li> <li>These techniques were delivered using 4 frequently cited types of intervention as either standalone or in combination with another strategy:               <ol style="list-style-type: none"> <li>Classroom-based lessons integrated into the health promotion curriculum;</li> <li>Automated monitoring device controlling screen time;</li> <li>Counselling; and</li> <li>Unclear/Other (e.g. one study used an environmental component described below)</li> </ol> </li> </ul> <p><b>Intervention Settings:</b></p> <ul style="list-style-type: none"> <li>The school was the most</li> </ul>	<p><b>Primary Outcome:</b></p> <ul style="list-style-type: none"> <li>Reduction of screen time, measured as television viewing alone or with any combination of video viewing, computer time, or videogame use (measured as the standardized mean difference in means effect size)</li> </ul>	<p><b>Main Results of the Review:</b></p> <p>1. The 27 studies included in the meta-analysis showed there was a small yet statistically significant reduction in children's screen time</p> <ul style="list-style-type: none"> <li>The difference in SMD in means effect size in the intervention group compared to the controlled group was -0.148 (95% CI: -0.224 to -0.071), and Hedges <math>g</math> was -0.144 (95% CI: -0.217 to -0.072) (data not shown)</li> </ul> <p>2. During the intervention period (while the intervention was being delivered), there was a large statistically significant reduction in children's screen time</p> <ul style="list-style-type: none"> <li>SMD: -1.904 [95% CI: -3.041 to -0.767]),</li> </ul>	<p><b>8/10 = Strong</b></p> <ul style="list-style-type: none"> <li>Rated using <i>Health-Evidence Tool</i>:</li> </ul> <p><b>Generalizability to Local Population:</b></p> <ul style="list-style-type: none"> <li>Given the broad range of studies included in the analysis and most interventions targeting children between 5 and 11 years , 25% to 50% non-white participants and 25% to 50% male children, there is moderate to strong generalisability of the results to Peel's population</li> </ul>

GENERAL INFORMATION	SEARCH STRATEGY OF REVIEW	DETAILS OF INTERVENTIONS INCLUDED IN REVIEW	OUTCOME MEASUREMENTS	RESULTS	QUALITY RATING
	<p><b>Searched:</b></p> <ul style="list-style-type: none"> <li><math>n = 14</math></li> <li>Databases: Centre for Reviews and Dissemination, Cochrane library, CRISP, Dissertation and theses, Medline [Ebsco, PubMed], National Academy of Medicine Grey Literature, PapersFirst and Proceedings First, PsychInfo, Science Direct, Scirus, Social Sciences Abstracts, Social Work Abstracts, and the Web site worldwidescience.org</li> <li>Also searched reference lists of Cochrane Collaboration Reviews of obesity interventions and articles selected for inclusion in the meta-analysis</li> </ul> <p><b>Inclusion and Exclusion Criteria:</b></p> <ul style="list-style-type: none"> <li>A study was eligible for inclusion if it met all of the following criteria: (1) described an intervention/program to change behaviour in children 0 and 18 years;</li> </ul>	<p>common intervention setting (13/29), followed by home (8/29) and other/unclear (8/29)</p> <ul style="list-style-type: none"> <li>Most studies (20/29) were conducted in the United States; 1 Netherlands; 2 Israel; 1 Canada; 1 Ireland; 1 England; 1 Italy; 1 Australia and 1 in France</li> </ul> <p><b>School n=13:</b></p> <ul style="list-style-type: none"> <li>More than half (7/13) of the interventions reported no significant reductions in TV/video viewing; 2/6 studies showed significant reductions in video-game use; no studies showed reductions in computer use</li> <li>There was much variability between intervention components, with studies using 1 to 6 components alone or in combination of each other.</li> <li>Almost all (11/13) studies used class-room lessons alone or in combination with another strategy to reduce screen time; 1 used an environmental component (encouraging</li> </ul>		<p>and Hedges <math>g</math> was - 1.807 (95% CI: - 3.069 to -0.545) (data not shown).</p> <p><b>Limitations:</b></p> <ul style="list-style-type: none"> <li>Methodological quality of the primary studies were not assessed</li> <li>5 studies included in the analysis did not have a control group and had a sample size that ranged from 2 to 10 participants.</li> <li>9 studies did not use a validated tool to measure screen time</li> <li>Amongst the studies using a control group, 5 did not randomly allocate to groups</li> <li>Although there was heterogeneity between studies, no significant moderators were identified to explain this variability</li> <li>Inadequate use of search terms to identify relevant studies</li> </ul>	

GENERAL INFORMATION	SEARCH STRATEGY OF REVIEW	DETAILS OF INTERVENTIONS INCLUDED IN REVIEW	OUTCOME MEASUREMENTS	RESULTS	QUALITY RATING
	<p>(2) outlined the results of an intervention to reduce screen time; (3) compared a nontreatment control, comparison group, or pre-intervention period with an intervention group or period; (4) included screen time (watching television or videos/ DVDs, playing video or computer games, and using a computer for purposes other than school work alone or in combination) as an outcome variable; and (5) measured television viewing alone or with any combination of video viewing, computer time, or videogame use.</p> <ul style="list-style-type: none"> <li>• Only articles published in English were eligible for inclusion</li> </ul>	<p>additional physical education classes); 1 used media diaries; 4 used parent outreach; 1 used automated control device</p> <ul style="list-style-type: none"> <li>• Most interventions (9/13) were theory based (social cognitive theory was used most frequently [6/9]); followed by Trans theoretical Model (2/9), Theory of Reasoned Action (1/9)</li> </ul> <p><b>Home n=8:</b></p> <ul style="list-style-type: none"> <li>• 5/8 studies reported significant reductions in screen time</li> <li>• There was much variability between intervention components, with studies using 1 to 6 components alone or in combination of each other.</li> <li>• Almost all interventions (6/8) used a automated control device in combination with another component; 6/8 provided rewards/reinforcement if screen time requirements were met; 3/8 provided information to reduce screen time; 1 made</li> </ul>			

GENERAL INFORMATION	SEARCH STRATEGY OF REVIEW	DETAILS OF INTERVENTIONS INCLUDED IN REVIEW	OUTCOME MEASUREMENTS	RESULTS	QUALITY RATING
		<p>screen time contingent on physical activity and 1 did not report the intervention component</p> <p><b>Unclear/Other n= 8:</b></p> <ul style="list-style-type: none"> <li>• Most interventions (6/8) did not report significant reductions in screen time</li> <li>• Almost all (7/8) interventions provided information to reduce screen time, alone or in combination with another component; 3/8 provided physical activity opportunities</li> </ul> <p><b>Intervention Providers:</b></p> <ul style="list-style-type: none"> <li>• Not available</li> </ul> <p><b>Theoretical Frameworks:</b></p> <ul style="list-style-type: none"> <li>• 18 of 29 studies were theory based (social cognitive theory was used most frequently)</li> </ul> <p><b>Target Groups:</b></p> <ul style="list-style-type: none"> <li>• Majority of the interventions targeted children between 5 and 11 years (20 of 29).</li> <li>• Most study populations included 25% to 50% non-white participants and 25% to 50% male</li> </ul>			

GENERAL INFORMATION	SEARCH STRATEGY OF REVIEW	DETAILS OF INTERVENTIONS INCLUDED IN REVIEW	OUTCOME MEASUREMENTS	RESULTS	QUALITY RATING
		children. <ul style="list-style-type: none"> <li>• Ten studies targeted high-risk children.</li> <li>• Eight studies limited participation to overweight or obese children, and 5 excluded children who did not use a predetermined amount of screen time.</li> </ul>			
<b>REVIEW ARTICLE # 2</b>  <b>Author(s) and Date:</b> <ul style="list-style-type: none"> <li>• Wahi et al., 2011</li> </ul> <b>Country:</b> <ul style="list-style-type: none"> <li>• Canada</li> </ul>	<b>Number of Primary Studies Included:</b> <ul style="list-style-type: none"> <li>• <math>n = 13</math></li> </ul> <b>Types of Studies Included:</b> <ul style="list-style-type: none"> <li>• Level I (randomized control trials)</li> </ul> <b>Search Period:</b> <ul style="list-style-type: none"> <li>• From 1948 to April 21, 2011</li> </ul> <b>Number of Databases Searched:</b> <ul style="list-style-type: none"> <li>• <math>n = 6</math></li> <li>• Databases: OVID Medline [from 1948], EMBASE [from 1980], Cochrane Central Register for Controlled Trials [from first quarter 2011], Psycinfo [from 1967], ERIC [from</li> </ul>	<b>Overview of intervention description:</b> <ul style="list-style-type: none"> <li>• Sample sizes of the included studies ranged from 21 to 1295 participants (median 90)</li> <li>• Duration of the interventions ranged from 1-24 months (median 6 months)</li> </ul> <b>Types of Interventions:</b> <ul style="list-style-type: none"> <li>• Type of interventions varied: 5 included classroom-based health promotion curriculum, 2 included individual counselling for parents and children; 4 included automated monitor controlling screen time; 1 home based; and 1 workshop.</li> </ul>	<b>Primary Outcome:</b> <ul style="list-style-type: none"> <li>• Reduction in Body Mass Index (BMI)</li> </ul> <b>Secondary Outcome:</b> <ul style="list-style-type: none"> <li>• Reduction in screen time (i.e. television, video games, and/or computer use) measured in hrs per week</li> </ul>	<b>Main Results of the Review:</b>  <b>1. Primary outcome BMI:</b>  The 6 studies included in meta-analysis showed no effect in reducing children's BMI <ul style="list-style-type: none"> <li>• The difference in mean change from baseline in the intervention group compared to the controlled group was -0.10 (95% CI, -0.28 to 0.09, <math>P=0.32</math>)</li> <li>• Insignificant heterogeneity was observed (<math>I^2=38\%</math> and <math>P=0.20</math>)</li> </ul> <b>2. Secondary Outcome Screen Time:</b>	<b>9/10 = Strong</b> <ul style="list-style-type: none"> <li>• Rated using <i>Health-Evidence Tool</i>:</li> </ul> <b>Generalisability to Local Population:</b> There is moderate to strong generalisability based on the following: <ul style="list-style-type: none"> <li>• The average age of participants in trials ranged from 3.9 to 11.7 years.</li> <li>• Most trials were conducted in the United States</li> </ul>

GENERAL INFORMATION	SEARCH STRATEGY OF REVIEW	DETAILS OF INTERVENTIONS INCLUDED IN REVIEW	OUTCOME MEASUREMENTS	RESULTS	QUALITY RATING
	<p>1965], and EBSCOHost-CINAHL [from 1982]</p> <ul style="list-style-type: none"> <li>To identify unpublished studies, databases of registered clinical trials (clinicaltrials.gov) and conference proceedings (PaperFirst and ProceedingsFirst) were hand searched</li> </ul> <p><b>Inclusion and Exclusion Criteria:</b></p> <ul style="list-style-type: none"> <li>Inclusion criteria were RCT (study design), participants aged 18 years or younger (population), and interventions that included a reduction of screen time (i.e. television, video games, and/or computer use)</li> </ul>	<p><b>Intervention Settings:</b></p> <ul style="list-style-type: none"> <li>The setting varied: 5 trials recruited from schools; 2 from medical clinics; 1 from a community centre; and 5 from community settings</li> <li>Non of the studies included in screen time outcome pooled analysis reported significant reductions</li> <li>Most studies (11 of 13) were conducted in the United States. 1 in Australia and 1 in United Kingdom</li> </ul> <p><b>School n=5:</b></p> <ul style="list-style-type: none"> <li>3/5 studies reported a significant reductions in screen time</li> <li>All the interventions used a classroom-based health promotion curriculum as a component; 2 trials used PA and diet as co-interventions and 3 did not use co-intervention</li> </ul> <p><b>Clinic n=2:</b></p> <ul style="list-style-type: none"> <li>Non of the interventions reported significant reductions in screen time</li> <li>First study was</li> </ul>		<p>a) The 9 studies included in the pooled meta-analysis showed no effect in reducing children’s screen time (hrs per week)</p> <ul style="list-style-type: none"> <li>The difference in mean change from baseline in the intervention group compared to the controlled group was -0.90 (95% CI, -3.47 to 1.66 hrs/week, <math>P=0.49</math>)</li> <li>2 studies were excluded because trial authors did not provide unadjusted values</li> <li>There was high amount of statistical heterogeneity (<math>I^2=66%</math>, <math>P=0.003</math>).</li> </ul> <p>b) In a sub-analysis of two studies targeting children younger than 6 years, there was a statistically significant reduction in screen time (hrs per week)</p> <ul style="list-style-type: none"> <li>The difference in mean change from baseline in the intervention group compared to the</li> </ul>	

GENERAL INFORMATION	SEARCH STRATEGY OF REVIEW	DETAILS OF INTERVENTIONS INCLUDED IN REVIEW	OUTCOME MEASUREMENTS	RESULTS	QUALITY RATING
		<p>conducted in a subspecialty medical clinic that used intervention mapping workshop and newsletter; second study was conducted in a community clinic that used family counselling and automated monitor controlling screen time</p> <ul style="list-style-type: none"> <li>Both did not use co-interventions</li> </ul> <p><b>Community n=6:</b></p> <ul style="list-style-type: none"> <li>2/6 interventions reported significant reductions</li> <li>3/6 interventions used individual/family counselling for parents and children; 3/6 used automated monitor controlling screen time alone or in combination with counselling; 1 used a home-based approach and 1 used seminar with automated monitor</li> </ul> <p><b>Intervention Providers:</b></p> <ul style="list-style-type: none"> <li>Not available</li> </ul> <p><b>Theoretical Frameworks:</b></p> <ul style="list-style-type: none"> <li>Not reported</li> </ul>		<p>controlled group was -3.72, 95% (CI, -7.23 to -0.20 hrs per week, <math>P=0.04</math>)</p> <p><b>Limitations:</b></p> <ul style="list-style-type: none"> <li>Quality assessments of primary studies were non-transparent (i.e. lack of two independent reviewers)</li> <li>Primary studies were considered “low” quality – mostly attributed to deficiencies in reporting of participant and outcome assessor blinding</li> <li>RCTs were excluded when unadjusted outcomes were unavailable - the two largest studies excluded from the pooled analysis had differing results and, if included, might have altered the results</li> <li>Included trials used self-or parent reporting to measure screen time - there is</li> </ul>	

GENERAL INFORMATION	SEARCH STRATEGY OF REVIEW	DETAILS OF INTERVENTIONS INCLUDED IN REVIEW	OUTCOME MEASUREMENTS	RESULTS	QUALITY RATING
		<p><b>Target Groups:</b></p> <ul style="list-style-type: none"> <li>• 18 years or younger – the average age of participants in trials ranged from 3.9 to 11.7 years</li> </ul>		<p>no published validated outcome measure for screen time</p> <ul style="list-style-type: none"> <li>• Trials had short duration of interventions (median of 7 months)</li> </ul>	



## Appendix E: Data Extraction Table of Primary Study Results

Review Author (year)	Intervention	Outcomes		Setting
		Screen Time: Author (year) = Effect	BMI: Author (year) = Effect	
<i>Mannicia et al (2011)</i>	<ul style="list-style-type: none"> <li><b>Classroom-based lessons</b></li> </ul> <p>Total = 12 studies</p>	<ul style="list-style-type: none"> <li>Chin (2008) = 0</li> <li><sup>b</sup> Dennison (2004) = 0</li> <li>Foster (2008) = 0</li> <li><sup>a</sup> Gortmaker (1999) = ↓</li> <li>Gortmaker (1999) = 0</li> <li>Harrison (2006) = 0</li> <li>Jones (2008) = ↓</li> <li><sup>b</sup> Kipping (2008) = 0</li> <li>Niemeyer (1988) = 0</li> <li><sup>b</sup> Salmon (2008) = 0</li> <li>Weintraub (2008) = 0</li> </ul> <p>Total = 2/11 studies showed significant reductions</p>	<ul style="list-style-type: none"> <li>NA</li> </ul>	<ul style="list-style-type: none"> <li>School</li> <li>School</li> <li>School</li> <li>School</li> <li>School</li> <li>School</li> <li>School</li> <li>School</li> <li>School</li> <li>School</li> <li>School</li> </ul>
	<ul style="list-style-type: none"> <li><b>Automated device controlling screen time</b></li> </ul> <p>Total = 9 studies</p>	<ul style="list-style-type: none"> <li>Angelbuer (1998) = ↓*</li> <li><sup>b</sup> Epstein (2008) = 0</li> <li><sup>b</sup> Ford (2002) = 0</li> <li><sup>a</sup> Goldfield (2006) = ↓</li> <li>Jason (1987) = 0 *</li> <li>Jason (1993) = 0 *</li> <li>McCanna (1989) = 0 *</li> <li>Robinson (2003) = 0</li> </ul> <p>Total = 2/9 studies showed significant reductions</p>	<ul style="list-style-type: none"> <li>NA</li> </ul>	<ul style="list-style-type: none"> <li>Home</li> <li>Home</li> <li>Other</li> <li>Home</li> <li>Home</li> <li>Home</li> <li>Home</li> <li>Home</li> <li>School</li> </ul>

Review Author (year)	Intervention	Outcomes		Setting
		Screen Time: Author (year) = Effect	BMI: Author (year) = Effect	
	<ul style="list-style-type: none"> <li>Classroom-based lessons and automated device controlling screen time</li> </ul> <p>Total = 2 studies</p>	<ul style="list-style-type: none"> <li><sup>b</sup> Robinson (1999) = ↓</li> <li>Robinson (2006) = 0</li> </ul> <p>Total = 1 study showed significant reductions</p>		<ul style="list-style-type: none"> <li>School and home</li> <li>School and home</li> </ul>
	<ul style="list-style-type: none"> <li>Other educational /Unclear</li> </ul> <p>Total = 7 studies</p>	<ul style="list-style-type: none"> <li>Eisenmann (2008) = 0</li> <li>Golan (1998) = 0</li> <li>Mauriello (2006) = 0</li> <li>Nemet (2005) = 0</li> <li>Nova (2001) = 0</li> <li>Sage (1997) = 0</li> <li>Simon (2006) = 0</li> </ul> <p>Total = no studies showed significant reductions</p>	<ul style="list-style-type: none"> <li>NA</li> </ul>	<ul style="list-style-type: none"> <li>Home</li> <li>Unclear</li> <li>Unclear</li> <li>Unclear</li> <li>Unclear</li> <li>Other</li> <li>Other</li> </ul>
	<ul style="list-style-type: none"> <li>Screen time contingent on physical activity</li> </ul> <p>Total = 1 study</p>	<ul style="list-style-type: none"> <li><sup>a</sup> Faith (2001) = ↓*</li> </ul> <p>Total = 1/1 study showed significant reductions</p>	<ul style="list-style-type: none"> <li>NA</li> </ul>	<ul style="list-style-type: none"> <li>Home</li> </ul>

Review Author (year)	Intervention	Outcomes		Setting
		Screen Time: Author (year) = Effect	BMI: Author (year) = Effect	
<i>Wahi et al (2011)</i>	<ul style="list-style-type: none"> <li>• <b>Classroom- based lessons</b></li> </ul> <p>Total = 5 studies</p>	<ul style="list-style-type: none"> <li>• <sup>b</sup>Dennison (2004) = ↓</li> <li>• <sup>ab</sup>Gortmaker (1999) = ↓</li> <li>• <sup>ab</sup>Kipping (2008) = 0</li> <li>• <sup>b</sup>Robinson (1999) = ↓</li> <li>• <sup>b</sup>Salmon (2008) = ↑</li> </ul> <p>Total = 1/5 showed significant increase in screen time (i.e. harm); 3/5 studies showed significant reductions.</p>	<ul style="list-style-type: none"> <li>• <sup>b</sup>Dennison (2004) = 0</li> <li>• <sup>ab</sup>Gortmaker (1999) = ↓</li> <li>• <sup>ab</sup>Kipping (2008) = 0</li> <li>• <sup>b</sup>Robinson (1999) = ↓</li> <li>• <sup>b</sup>Salmon (2008) = 0</li> </ul> <p>Total = 2/5 studies showed significant reductions</p>	<ul style="list-style-type: none"> <li>• Pre-school (≤ 6 yrs)</li> <li>• School</li> <li>• School</li> <li>• School</li> <li>• School</li> </ul>
	<ul style="list-style-type: none"> <li>• <b>Automated monitor device controlling screen time</b></li> </ul> <p>Total = 3 studies</p>	<ul style="list-style-type: none"> <li>• <sup>b</sup>Epstein (2008) = ↓</li> <li>• Ni Mhurchu (2009) = 0</li> </ul> <p>Total = 1/2 studies showed significant reductions</p>	<ul style="list-style-type: none"> <li>• <sup>b</sup>Epstein (2008) = ↓</li> <li>• Ni Mhurchu (2009) = 0</li> </ul> <p>Total = 1/2 studies showed significant reductions</p>	<ul style="list-style-type: none"> <li>• Community (≤ 6 yrs)</li> <li>• Community-based</li> </ul>
	<ul style="list-style-type: none"> <li>• <b>Counselling</b></li> </ul> <p>Total = 3 studies</p>	<ul style="list-style-type: none"> <li>• <sup>b</sup>Ford (2002) = 0 (in combination with an automated monitoring device controlling screen time)</li> </ul> <p>Total = no study showed significant reductions</p>	<ul style="list-style-type: none"> <li>• <sup>b</sup>Ford (2002) = NM</li> <li>• Epstein (1995) = ↓</li> <li>• Epstein (2000) = 0</li> </ul> <p>Total = 1/2 studies showed significant reductions</p>	<ul style="list-style-type: none"> <li>• Community-clinic</li> <li>• Community</li> <li>• Community</li> </ul>
	<ul style="list-style-type: none"> <li>• <b>Seminar and automated device monitoring screen time</b></li> </ul> <p>Total = 1 study</p>	<ul style="list-style-type: none"> <li>• Todd (2008) = 0</li> </ul> <p>Total = 1 study showed significant reductions</p>	<ul style="list-style-type: none"> <li>• Todd (2008) = 0</li> </ul> <p>Total = no study showed significant reductions</p>	<ul style="list-style-type: none"> <li>• Community</li> </ul>

Review Author (year)	Intervention	Outcomes		Setting
		Screen Time: Author (year) = Effect	BMI: Author (year) = Effect	
	<ul style="list-style-type: none"> <li>• <b>Workshop/other</b></li> </ul> Total = 2 studies	<ul style="list-style-type: none"> <li>• Escobar-Chaves (2010) = 0</li> <li>• Robinson (2010) = 0</li> </ul> Total = no studies showed significant reductions	<ul style="list-style-type: none"> <li>• Escobar-Chaves (2010) = NM</li> <li>• Robinson (2010) = 0</li> </ul> Total = no study showed significant reductions	<ul style="list-style-type: none"> <li>• Subspecialty medical clinic</li> <li>• Community</li> </ul>

↓ = intervention significantly decreased screen time.

0 = no effect.

↑ = intervention significantly increased screen time.

\* no comparison group, lack of random allocation and very small sample size (range between 2 to 10 subjects).

NA = not applicable.

NM = not measured.

<sup>a</sup> study was not included in the meta-analysis.

<sup>b</sup> study was included in both meta-analyses.

## Appendix F: Data Extraction Table of Excluded Systematic Reviews

Author and Year/ Journal	Publication Type	Title	Reason for Exclusion
Schmidt M.E. et al., 2012/ <i>Obesity</i>	Review (narrative)	"Systematic review of effective strategies for reducing screen time amongst young children"	<ul style="list-style-type: none"> <li>• Rated as 'poor' methodological quality (3/10 using health-evidence tool). The key methodological issues were as follows:               <ul style="list-style-type: none"> <li>○ Ambiguous research question</li> <li>○ Limited search strategy</li> <li>○ Level of evidence of the primary studies was not described</li> <li>○ Did not assess methodological quality of the primary studies</li> <li>○ Results were not transparent</li> </ul> </li> </ul>
Steeves J.A. et al., 2012/ <i>Journal of Obesity</i>	Review (narrative)	"A review of different behavior modification strategies designed to reduce sedentary screen behaviors in children"	<ul style="list-style-type: none"> <li>• Rated as 'moderate' methodological quality (rated 5/10 using health-evidence tool). The key methodological issues were as follows:               <ul style="list-style-type: none"> <li>○ Ambiguous research question</li> <li>○ Limited search strategy (i.e. only searched PubMed)</li> <li>○ Did not assess methodological quality of the primary studies</li> <li>○ Results were not transparent</li> </ul> </li> </ul>

## Appendix G: Applicability & Transferability Worksheet

Factors	Questions	Notes
<b>Applicability (feasibility)</b>		
Political acceptability or leverage	<ul style="list-style-type: none"> <li>• Will the intervention be allowed or supported in current political climate?</li> <li>• What will the public relations impact be for local government?</li> <li>• Will this program enhance the stature of the organization?               <ul style="list-style-type: none"> <li>◦ <i>For example, are there reasons to do the program that relate to increasing the profile and/or create a positive image of public health?</i></li> </ul> </li> <li>• Will the public and target groups accept and support the intervention in its current format?</li> </ul>	<ul style="list-style-type: none"> <li>• The issue of screen time is an emerging and important field of research, however it is still at the early stages of understanding the mechanisms in which it affects children's health and how to effectively design public health strategies to reduce the behaviour.</li> <li>• What's promising is that there is political will to address the issue, as evident by the Ontario Public Health Standards, the province's priority to decrease childhood obesity, the recent release of the Canadian sedentary behaviour and physical activity guidelines and Peel's focus on supportive environments and healthy weights.</li> <li>• There is uncertainty, however, as to how the public and target groups will accept and support a screen time reduction strategy. For example, public health programmers aiming to intervene at the school level must be cognisant of the current financial and temporal constraints faced by schools and school boards – adding another intervention to the curriculum will be challenging.</li> </ul>
Social acceptability	<ul style="list-style-type: none"> <li>• Will the target population find the intervention socially acceptable? Is it ethical?               <ul style="list-style-type: none"> <li>◦ <i>Consider how the program would be perceived by the population.</i></li> <li>◦ <i>Consider the language and tone of the key messages.</i></li> <li>◦ <i>Consider any assumptions you might have made about the population. Are they</i></li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Strategies for decreasing sedentary screen behaviours are perceived as ethical, however screen time is inherently a fun leisurely activity, thus social acceptance by target populations will not be easy.</li> <li>• If public health strategies (via policy or programming) are to limit or impose on the number of hours spent in front of screens</li> </ul>

	<p><i>supported by the literature?</i></p> <ul style="list-style-type: none"> <li>○ <i>Consider the impact of your program and key messages on non-target groups.</i></li> </ul>	<p>(i.e. fun/leisure time), there is a need for some kind of justification besides just health consequences that parents and their children can agree upon – ideally an enjoyable (but in this case potentially harmful) activity should be displaced by another enjoyable (but positive) activity. Otherwise, social acceptance is unlikely, which may lead to high attrition rates, and inadequate behaviour change, as evident by the results from recent systematic reviews.</p> <ul style="list-style-type: none"> <li>● The Family Health division has allocated resources to address screen time reduction in children 6 years and younger by exploring policy options in child care centres. This can potentially displace screen time behaviours to other fun and positive activities at an early age; however additional data is needed on the effectiveness of interventions targeting this age group to help guide policy options. Epidemiological and qualitative data is also required to understand the impact of ethno-cultural diversity on intervention delivery and effectiveness.</li> </ul>
<p>Available essential resources (personnel and financial)</p>	<ul style="list-style-type: none"> <li>● Who/what is available/essential for the local implementation?</li> <li>● Are they adequately trained? If not, is training available and affordable?</li> <li>● What is needed to tailor the intervention locally?</li> <li>● What are the full costs? <ul style="list-style-type: none"> <li>○ <i>Consider: in-kind staffing, supplies, systems, space requirements for staff, training, and technology/administrative supports.</i></li> </ul> </li> <li>● Are the incremental health benefits worth the costs of the intervention? <ul style="list-style-type: none"> <li>○ <i>Consider any available cost-benefit analyses</i></li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● Given that there is no best practice model or intervention recommended for school age children, it will be challenging to determine the human and financial resources essential for local implementation – it may be useful to review published cost-effectiveness studies, if available.</li> <li>● A population health approach that applies effective policy(s) across all school boards will be necessary to reach 250 thousand Peel school-aged children – other type of interventions could be prohibitively expensive.</li> </ul>

	<p><i>that could help gauge the health benefits of the intervention.</i></p> <ul style="list-style-type: none"> <li>○ <i>Consider the cost of the program relative to the number of people that benefit/receive the intervention.</i></li> </ul>	<ul style="list-style-type: none"> <li>● Existing partnerships between CDIP staff (i.e. managers and PHNs) and school boards may leverage collaborative multi-prong strategies at the school level – positive partnerships will play a significant role in implementing school-based and community-based interventions.</li> </ul>
Organizational expertise and capacity	<ul style="list-style-type: none"> <li>● Is the intervention to be offered in line with Peel Public Health’s 10-Year Strategic Plan (i.e., 2009-2019, ‘Staying Ahead of the Curve’)?</li> <li>● Does the intervention conform to existing legislation or regulations (either local or provincial)?</li> <li>● Does the intervention overlap with existing programs or is it symbiotic (i.e., both internally and externally)?</li> <li>● Does the intervention lend itself to cross-departmental/divisional collaboration?</li> <li>● Any organizational barriers/structural issues or approval processes to be addressed?</li> <li>● Is the organization motivated (learning organization)? <ul style="list-style-type: none"> <li>○ <i>Consider organizational capacity/readiness and internal supports for staff learning.</i></li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● A screen time reduction strategy will align symbiotically with the Supportive Environments Healthy Weights program priority outlined in Peel Public Health’s 10-Year Strategic plan.</li> <li>● A screen time intervention may overlap with existing programs depending on the objectives set out for the intervention. The objectives can be any of the following: improve physical activity levels, independent of reducing screen time or vice versa, or focus on improving both outcomes. The approach can lend itself to cross-divisional collaboration, with Family Health targeting children 6 years and younger and CDIP targeting children 6 to 19 years of age.</li> <li>● Although the organization is motivated, there is uncertainty about the capacity of the health department and the school boards to implement population level reduction strategies.</li> </ul>
<b>Transferability (generalizability)</b>		
Magnitude of health issue in local setting	<ul style="list-style-type: none"> <li>● What is the baseline prevalence of the health issue locally?</li> <li>● What is the difference in prevalence of the health issue (risk status) between study and local settings? <ul style="list-style-type: none"> <li>○ <i>Consider the Comprehensive Health Status Report, and related epidemiological reports.</i></li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● Peel estimates: pending results from the 2011 Peel Student Health Survey.</li> <li>● Canadian estimates: 6-7 hrs per day<sup>3</sup>.</li> <li>● Peel data gaps: Limited understanding of number of hrs spent on different types of screens, particularly mobile devices (e.g. texting, watching videos on smart phones)</li> </ul>



		and their impact on health outcomes; Peel data is also required on parental perceptions and attitudes on screen time.
Magnitude of the “reach” and cost effectiveness of the intervention above	<ul style="list-style-type: none"> <li>• Will the intervention appropriately reach the priority population(s)? <ul style="list-style-type: none"> <li>○ What will be the coverage of the priority population(s)?</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• A population level strategy is likely to have wide reach if implemented in schools and childcare centres. A childcare policy will be limited to children 4 years and younger.</li> <li>• Cost-effectiveness of interventions has not been reviewed.</li> </ul>
Target population characteristics	<ul style="list-style-type: none"> <li>• Are they comparable to the study population?</li> <li>• Will any difference in characteristics (e.g., ethnicity, socio-demographic variables, number of persons affected) impact intervention effectiveness locally? <ul style="list-style-type: none"> <li>○ <i>Consider if there are any important differences between the studies and the population in Peel (i.e., consider demographic, behavioural and other contextual factors).</i></li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Peel’s target population characteristics are somewhat comparable to most study populations, given most interventions targeted boys and girls between 5 and 11 years of age, with 25% to 50% of the participants as non-white.</li> </ul>
<p><b>Proposed Direction (after considering the above factors):</b></p> <ol style="list-style-type: none"> <li>1. Discontinue the TOTS program until further investigation can be conducted by CDIP staff to better understand the most effective type, and component(s) of interventions aimed at reducing screen time in children between 4 to 13 years of age.</li> <li>2. Family Health staff should further investigate the effectiveness of interventions aimed to reduce screen time in children 6 years and younger.</li> <li>3. Collect additional Peel data on screen time practices, including hand held mobile devices (e.g. texting, watching videos), and parental perceptions and attitudes.</li> <li>4. Build Peel’s screen time strategy on four pillars: 1) health status data; 2) research; 3) Peel situational assessment and 4) ethno-cultural diversity.</li> </ol>		

Form Completed by: Marco Ghassemi