

Public Health Knowledge Gaps and Research Priorities: a synthesis of next steps

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December, 2007



National Collaborating Centre
for Methods and Tools

Centre de collaboration nationale
des méthodes et outils

Public Health Knowledge Gaps and Research Priorities:

a synthesis of next steps

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The National Collaborating Centres for Public Health are funded by the Public Health Agency of Canada. Production of this paper has been made possible through a financial contribution from the Public Health Agency of Canada. The views expressed herein do not necessarily represent the views of the Public Health Agency of Canada.

How to cite this resource:

Ciliska, D., Peirson, L., & Muresan, J. (2007). *Public Health Knowledge Gaps and Research Priorities: A Synthesis of Next Steps*. Hamilton, ON: National Collaborating Centre for Methods and Tools. [http://www.nccmt.ca/pubs/Gaps_EN.pdf]

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Summary

Purpose

- to identify priorities for public health research in Canada

Method

- the health-evidence.ca data base of systematic reviews was used, including reviews for 2006 and up to July of 2007
- 224 unique reviews were found, 99 relevant to this project
- research gaps were extracted, as identified by the original review authors

Results

- main topic themes included family health, communicable diseases, chronic diseases, injury prevention, seniors' health, environmental health, dental health, social determinants of health and global health
- methods gaps included the need for larger sample sizes, longer follow-up, assessment of cost-effectiveness, and assessment of effectiveness across different settings or population groups
- identified gaps can be used to develop targeted funding initiatives to meet these gaps
- identified gaps lend support to the IPPH Population Health Intervention Research Initiative for Canada, aimed at improving the quality and quantity of research and its use by practitioners and policy makers

Purpose

One of the four primary goals of the National Collaborating Centres in Public Health is to identify gaps in our knowledge about public health practice and policy impact (www.nccph.ca). The purpose of this document is to identify priorities for public health research in Canada.

Method

Systematic reviews that were in the www.health-evidence.ca reference manager database were used to identifying gaps. From that database, we selected all systematic reviews published in 2006 and up to the end of June, 2007 (English only reviews). We were confident in finding the majority of reviews by using the database for [health-evidence.ca](http://www.health-evidence.ca), as they have an extensive and detailed search for reviews related to public health in Canada (www.health-evidence.ca). Seventeen topic areas are searched extensively through 6 databases: Medline, CINAHL, Embase, Sociological Abstracts, BIOSIS, and PsycInfo, hand-searching of 20 relevant journals, contact with key experts in the areas, and review of reference lists of retrieved publications. The 17 topic areas are addiction/drug use; adult health; chronic diseases, communicable disease/infection; community health; dental health; environmental health; food safety and inspection; injury prevention/safety; mental health; nutrition; parenting, infants and children; physical activity; pregnancy; sex education; STDs; women's health. The health-evidence staff are just beginning work on specific strategies for searching Aboriginal health topics.

Of the 230 reviews found for the specified time period, six of the entries were duplicates and thus were removed from the sample, leaving us with an initial sample of 224 systematic reviews. If the review was judged to be relevant to public health in Canada, data extraction was done and entered into an excel database (i.e., author(s), date, title, source, objective, age group, target group, health problem/issue, intervention, type of study, author identified design/method gaps/needs, author identified content gaps/needs).

Two authors independently reviewed a sample of ten reviews then compared their decisions regarding relevance and identified gaps/needs; the process was repeated with five reviews when a third author joined. Thereafter, two authors divided the list of 224 systematic reviews and independently determined relevance and identified gaps in their portion of the sample. When there were questions about relevance or gaps, they discussed with each other until agreement was reached. If questions could not be resolved, the third author was included.

Initially, 112 reviews were eliminated, and on closer look during categorization and gaps extraction, another 13 reviews were judged to be not relevant; reasons included:

- Review topic and/or identified gaps focused more on primary care (eg., screening, treatment, secondary prevention, and diagnostic tests).
- Identified gaps were related to health care system issues as opposed to research needs.
- Authors did not identify any research gaps.
- Authors indicated that identified gaps were already being addressed by on-going research.

The remaining 99 reviews were then grouped into theme areas. Two authors independently categorized each review. One used the [health-evidence.ca](http://www.health-evidence.ca) key word tool to organize the reviews and this resulted in multiple codes being applied to most entries. The other used her clinical knowledge and experience as a public health nurse to categorize the reviews and

assigned a single code to each entry. When they compared their categorizations in all but a few instances there was agreement on a primary code. Through discussion they reached agreement about which code should be assigned to the remaining items. Theme areas within each code were then identified (e.g., under the communicable disease heading there were four main groupings: vaccine preventable diseases, harm reduction, sexual health, and sexually transmitted infections). Potential sub-themes were also discussed (e.g., within the vaccine preventable grouping there were several reviews focused on influenza, one focused on human papilloma virus, and one focused on meningitis).

To formulate gaps statements, the authors first took one category (family health) and independently constructed statements. Upon comparison and review by the third author, it was agreed the statements were similar, and the main points were captured in the statements. The remaining categories were then divided between the two authors, with occasional review by each other, to ensure the statements correctly captured the information gleaned from the reviews.

Knowledge and Research Gaps

The 99 systematic reviews are clustered according to main themes of family health, communicable diseases, chronic diseases, injury prevention, seniors' health, environmental health, dental health, social determinants of health and global health. Where appropriate these categories are broken down into sub-themes.

1 Family Health

11 systematic reviews

Themes: reproductive health, parenting, infants and children

1.1 Reproductive Health

(Sub-themes: exercise, nutrition for pregnant adolescents, breastfeeding)

- i Effects of (different types of) regular prenatal aerobic exercise on maternal health (hypertension, pre-eclampsia), labour (pain, duration), delivery (pre-term, caesarean), and the infant (birth weight, placental size) (Kramer, 2006).
- ii Assessment (with follow up) of pregnant adolescents' dietary intake on nutritional status, weight gain, maternal and neonatal outcomes; investigation of socio-cultural influences on nutrient intake; formative, process and outcome evaluations of nutritional interventions proven effective with other adolescent or pregnant populations that compare individual-only to individual-environmental strategies to promote healthy prenatal eating and weight gain (Moran, 2007; Nielsen, Gittelsohn, Anliker, & O'Brien, 2006).
- iii Qualitative understanding of breastfeeding decision-making, practices, and experiences (including maternal satisfaction) in diverse subgroups of breastfeeding women; outcome and cost effectiveness studies assessing lay and/or professional support on breastfeeding duration and exclusivity, and comparing breastfeeding support interventions with different timing and modes of delivery (Britton, McCormick, Renfrew, Wade, & King, 2007; Nelson, 2006).

1.2 Parenting, Infants and Children

(Sub-themes: attachment, roles, abuse/neglect)

- i Effects of early parenting interventions on outcomes such as attachment, child development, mothering processes, parent-infant interactions, child abuse and neglect; determining the effectiveness of different program components and the dose-response relationship between the number of components and effectiveness (Gardner & Deatrick, 2006; Magill-Evans, Harrison, Rempel, & Slater, 2006; Mercer & Walker, 2006; Shaw, Levitt, Wong, & Kaczorowski, 2006).
- ii Evaluation and comparison of training programs for health professionals in the identification and management of child abuse/neglect by assessing measure-

able short and long term outcomes (Carter, Bannon, Limbert, Docherty, & Barlow, 2006).

- iii Methodological improvements including: longitudinal studies, RCT designs, expanding the diversity of study populations, use of culturally appropriate and valid instruments, use of definitive outcome measures, and use of intention to treat analysis (Carter et al., 2006; Corcoran & Pillai, 2007; Gardner et al., 2006; Magill-Evans et al., 2006; Mercer et al., 2006; Shaw et al., 2006).

2 Communicable Diseases

2.1 systematic reviews

Themes: vaccine preventable disease, harm reduction, sexual health, sexually transmitted infections

2.1 Vaccine Preventable Diseases

(Sub-themes: influenza, HPV, meningitis)

- i Efficacy of influenza vaccine in seniors who are high risk, the effect of vaccinating caregivers in long-term care facilities on infection prevention and control, and the impact of flu vaccine programs on specific socioeconomic, and ethnic groups (Ompad, Galea, & Vlahov, 2006; Rivetti et al., 2006); effect of reduced dose influenza vaccine in people <18 years of age, those who have chronic diseases, or who are immuno-compromised; RCTs with comparison of various doses of intramuscular flu vaccine on serology and infection rates (Wyatt, Ryan, & Sheerin, 2006); large scale studies of influenza vaccine efficacy in children, with direct comparison of vaccine types, and testing in healthy children <2 years; measurement of outcomes related to vaccine safety required specifically for inactivated vaccine in younger children (Manzoli, Schioppa, Boccia, & Villari, 2007; Smith et al., 2006).
- ii Long-term safety, duration of effect, and optimal age to immunize with prophylactic human papillomavirus (HPV) vaccines; evaluation of cervical screening programs is required to determine optimal method (Schmiedeskamp & Kockler, 2006).
- iii Long-term, controlled, multicentre evaluations of strategies to reduce the incidence of meningococcal disease among post-secondary students including comparison of interventions targeted at students prior to and after enrolment and identification of students at risk of the disease and for non-vaccination (Butler, 2006).

2.2 Harm Reduction

(Sub-theme: injection drug use)

- i Research to build the evidence base for: safe injection sites, provision of bleach and injecting paraphernalia along with syringes, provision of optimal dose opiate substitution therapy, and the effect of behavioural interventions, on the incidence and prevalence of Hepatitis C; the effect of needle exchange programs in prisons on HCV transmission (Wright & Tompkins, 2006); comparison of one versus two intervention facilitators for HIV behavioural risk reduction programs (Copenhaver, Johnson, Lee, Harman, & Carey, 2006).

2.3 Sexual Health

(Sub-themes: education, contraception, partner violence)

- i Longitudinal research of sexual health educational interventions for people with mental illness, specifically assessing strategies tailored to the needs of the individual, the impact of booster sessions, and comparing effects of different group sizes and contact times on relapse in behaviour; identify subgroups at risk for behaviour relapse to target specific interventions (Higgins, Barker, & Begley, 2006).
- ii Development and evaluation of strategies intended to maximize emergency contraceptive pill (ECP) use and reduce unintended pregnancies; retrospective research analyzing trends in prescribing birth control and pregnancy terminations in countries with and without over the counter ECP; determining the amount and type of information that should be provided with over the counter ECP and the impact that use of ECP has on a woman's subsequent use of birth control (Anderson & Blenkinsopp, 2006; Raymond, Trussell, & Polis, 2007).
- iii Development and testing of targeted and culturally sensitive interventions to prevent partner violence in settings other than schools (Whitaker et al., 2006).

2.4 Sexually Transmitted Infections

(Sub-themes: HIV, partner notification, protected sex acts)

- i Development and evaluation of STI/HIV prevention interventions for adolescents tailored to specific cultural and socioeconomic attributes; structured reporting of evaluations and measurement of outcomes such as biological markers (Sales, Milhausen, & DiClemente, 2006); evaluation of HIV risk-reduction strategies for men who have sex with men (MSM) in diverse sub-populations and settings, with improved outcome measurement, testing specific components of interventions, and adaptations responding to technological, social and environmental changes (Herbst et al., 2007); cost-effectiveness of behavioural HIV risk reduction strategies, rigorous testing of these interventions in diverse sub-groups and settings, and evaluation of their real-world effectiveness (Lyles et al., 2007); high quality RCTs evaluating sexual risk reduction interventions for people living with HIV which include: testing comprehensive strategies targeted at HIV+ MSM, comparing intervention effectiveness in older and younger subgroups, and considering the issue of serosorting (Johnson, Carey, Chaudoir, & Reid, 2006); studies of alternative HIV testing methods that evaluate and report on outcomes

- such as testing acceptance, receipt of test results, frequency of false positive results for rapid HIV tests and the impact of this on the client, and links made to care and preventative services (Hutchinson, Branson, Kim, & Farnham, 2006).
- ii RCTs of partner notification strategies (for reportable STIs) require consistent standards for reporting and case management; evaluation of strategies to improve patient referral (by index client) for syphilis and HIV (Trelle, Shang, Nartey, Cassell, & Low, 2007).
 - iii Investigation of motivational and psychological factors affecting behaviour change related to condom-based sexual risk reduction (Smoak, Scott-Sheldon, Johnson, & Carey, 2006); effects of using female condoms on outcomes such as condom breaks or slipping and a woman's ability to negotiate safer sex; effects of promoting the use of male and female condoms together rather than male condoms alone; cost effectiveness of female condoms in practice (Vijayakumar, Mabude, Smit, Beksinska, & Lurie, 2006).

3 Chronic Diseases

43 systematic reviews

Themes: heart health, nutrition and dietary supplements, physical activity, diet and physical activity, overweight/obesity, smoking, substance use, mental health

3.1 Heart Health

(Sub-themes: cardiovascular disease in women, coronary heart disease)

- i Testing the impact of clinical guidelines on the prevention or slowing of risk factors for cardiovascular disease (CVD) in women; development and testing of guideline implementation methods in health care and work place settings and communities; studies examining the role of communication of risks and barriers to CVD prevention and incorporation of findings into innovative dissemination approaches for diverse populations of women; development and testing of public policy and population wide interventions to prevent and control CVD (Mosca et al., 2007).
- ii Qualitative studies examining how participants perceive and respond to advice and interventions offered in educational interventions to reduce risks for coronary heart disease (useful for designing future interventions) (Ebrahim, Beswick, Burke, & Davey Smith, 2006).
- iii Development and empirical pilot testing of non-professional, environmentally-based approaches intended to increase behaviour changes that reduce risks for coronary heart disease (e.g., availability of foods, access to recreational facilities) across a range of diverse groups (Ebrahim et al., 2006).
- iv Nutrition and Dietary Supplements (Sub-themes: fruit/vegetable consumption, dairy

- products, healthy eating, osteoporosis, Mediterranean diet)
- v In-depth, longitudinal studies investigating outcomes and cost effectiveness of interventions promoting fruit and vegetable consumption among grade school children and adolescents; determination of what constitutes a meaningful change in intake; identification of which specific intervention components are effective (Knai, Pomerleau, Lock, & McKee, 2006); studies specifically examining associations between fruit and vegetable consumption and reduced risk of oral cancer in adults (Pavia, Pileggi, Nobile, & Angelillo, 2006) and increased bone mineral density in healthy children (Winzenberg, Shaw, Fryer, & Jones, 2006); studies investigating the long term (>1 year) effectiveness of telephone based counselling interventions (of varying intensities and in isolation from other approaches) to support increased fruit and vegetable consumption and reduced fat intake across a range of diverse groups; examining how dietary gains affect prevention of related chronic diseases (VanWormer, Boucher, & Pronk, 2006).
 - vi Prospective longitudinal studies to establish better evidence of the relationship between dairy products and health; research needs to account for simultaneous increases/decreases in the intake of other macronutrients and changes in non-dietary variables when participants alter their consumption of dairy products; defining an appropriate endpoint for each disease (e.g., symptomatic fractures for bone health studies, cancer incidence rather than mortality) (Alvarez-Leon, Roman-Vinas, & Serra-Majem, 2006).
 - vii Expanding the evidence base with more rigorous evaluations of promising interventions that modify or remove barriers (e.g., poor availability and high cost of healthy foods, personal preferences for fast food) and/or build on facilitators (e.g., improved nutritional labelling, individual concerns regarding personal appearance) for healthy eating among young people; qualitative research exploring the views of young people regarding barriers to and facilitators of healthy eating to inform the development and testing of meaningful, appropriate and effective interventions (Shepherd et al., 2006).
 - viii Use of natural health products (i.e., dietary supplements) in preventing and treating osteoporosis in women is not supported by RCT trial evidence; improvements needed in RCT designs (e.g., longer duration, larger sample sizes, more relevant outcome variables); further studies required to determine optimal formulation and dose of phytoestrogens (Whelan, Jurgens, & Bowles, 2006).
 - ix Strengthening the evidence base regarding associations between the Mediterranean diet and health, particularly in relation to chronic diseases, through the development of clinical and observational epidemiology in Mediterranean countries and objective systematic reviews (Serra-Majem, Roman, & Estruch, 2006)

3.3 Physical Activity

(Sub-themes: physical activity interventions for young people; excessive physical activity; diabetes; school playtime; transportation and travel policies and practice)

- i High quality RCTs, formative and process evaluations of interventions to promote physical activity among young people; research should focus on: community based

- strategies, initiatives that promote active recreation/lifestyles and the reduction of sedentary behaviours, and interventions that target socially excluded and socially diverse groups of young people (Rees et al., 2006).
- ii Research examining the eminent and long-term adverse impacts of excessive physical activity on growing adolescents; determining how much physical activity is enough (Hallal, Victora, Azevedo, & Wells, 2006).
 - iii Studies are needed to identify the combination, duration and pace of physical activities that reduce the risk of type 2 diabetes (Jeon, Lokken, Hu, & van Dam, 2007).
 - iv Larger, longer term investigations of elementary school children's playtime activities; research should: monitor all available playtimes across the day to determine playtime's contribution to physical activity, match playground set-up and activities to child and school needs, investigate seasonal influences on children's physical activity, consider the effect of playground equipment on children's physical activity and behaviour, examine the role of adult supervisors in promoting physical activity, and investigate the influence that school size has on physical activity (Ridgers, Stratton, & Fairclough, 2006).
 - v Population wide studies are needed to build the evidence base regarding the effectiveness of transportation and travel policy and practice interventions that aim to increase physical activity or improve fitness (Heath et al., 2006).

3.3 Diet and Physical Activity

(Sub-themes: telephone and computer-tailored interventions)

- i How to best disseminate and translate the evidence supporting the efficacy of telephone based physical activity and dietary behaviour change interventions for population health practice; evaluations comparing intervention types and intensities to determine the optimal duration of intervention, the optimal number of calls, and the most effective combination of intervention components (Eakin, Lawler, Vandell-anotte, & Owen, 2007).
- ii Research comparing the efficacy and cost-effectiveness of computer tailored interventions promoting physical activity and healthy dietary behaviours (i.e., person specific educational materials delivered in a non-personal manner) against other state-of-the-art strategies; identification of the mechanisms underlying successful computer tailoring; understanding why and when computer tailoring initiates changes in participants' diets and/or physical activities; establishing how elaborate these interventions should be to effect change (Kroeze, Werkman, & Brug, 2006).

3.4 Overweight/Obesity

(Sub-themes: primary prevention and early intervention, sedentary behaviour, macro-environmental strategies)

- i High quality studies testing early intervention programs that focus on gestation and infancy which are critical periods of obesity development; examine existing

community-based health promotion programs to identify assessment tools that can be adopted or adapted for the urban Canadian low SES group and extrapolate and test these interventions (Conroy, Ellis, Murray, & Chaw-Kant, 2007).

- ii Larger, longitudinal trials to evaluate and compare the effectiveness and cost effectiveness of primary, secondary and combined childhood obesity prevention strategies; research should: measure retention of behavioural change (follow up >6 months), focus on interventions for 8 to 10 year olds (most of the ineffective interventions target this group), consider the impact of effective preventive interventions on the need to monitor and treat individual children, investigate whether specific messages in educational programs reduce or increase risk, and explore whether overweight/obesity prevention programs contribute to childhood underweight (Doak, Visscher, Renders, & Seidell, 2006; Sharma, 2006; Westwood et al., 2007).
- iii RCTs to identify effective weight reduction strategies for children and measure long-term outcomes (e.g., sustained weight loss, co-morbidities and mortality into adulthood); long-term epidemiological studies to identify which children are most at risk of obesity persisting into adulthood and consequent adverse outcomes (Westwood et al., 2007).
- iv Development of theoretically based, reliable and valid measurements of sedentary behaviour and attitudinal antecedents of behaviour that are appropriate for children as young as 2; investigations of community based interventions aimed at reducing sedentary behaviour (e.g., TV and video use) including school and afterschool programs and large scale community campaigns (DeMattia, Lemont, & Meurer, 2007; Sharma, 2006, 2007).
- v Population based research exploring the impact of altering macro-environmental variables (e.g., widespread restrictions on access to unhealthy foods including removing vending machines from schools) on obesity; research should: measure food intake to explore whether increased acquisition of healthier foods through strategies like taxation and subsidies displaces the subsequent consumption of less healthy foods, and measure body weight to assess whether altering food acquisition behaviours influences body weight (Faith, Fontaine, Baskin, & Allison, 2007).

3.5 Smoking

(Sub-themes: prevention, cessation)

- i Smoking prevention evaluation research should focus on: programs that combine social influence and general social competence approaches (Thomas & Perera, 2006); the effectiveness of programs for specific subgroups (Thomas & Perera, 2006; Thomas et al., 2006) including need for a systematic review; the effect of combining multi-modal school programs with community initiatives (Thomas & Perera, 2006; Thomas et al., 2006) the effectiveness of family interventions to prevent adolescent smoking and the intensity of such programs required to produce sustained effects (Thomas, Baker, & Lorenzetti, 2007); and determining which computer based smoking prevention programs best affect behavioural outcomes, what types of computer based applications are most effective, which types of tailoring

- are most effective and for who, cost and time benefits of computer based applications, and diffusion studies examining how to best integrate technology into educational and health care settings (Walters, Wright, & Shegog, 2006).
- ii Smoking cessation research should focus on: ways to combine face to face counselling with telephone follow up to support quit attempts and reduce relapse rates, and evaluations of reactive helpline services that compare different counselling protocols and schedules of call-back sessions (Stead & Lancaster, 2006); determining if exercise is equally effective in natural environments during actual quit attempts, and understanding the mechanisms involved in quit attempts such as stress reduction or neurobiological mechanisms (Taylor, Ussher, & Faulkner, 2007); evaluations of interventions targeting various subgroups (e.g., older adults; lesbian, gay, bisexual and transgendered populations; aboriginal groups; women; people with psychiatric diagnoses; illicit drug addicts; alcoholics) (Doolan & Froelicher, 2006); comprehensive studies on concurrent treatment for smoking cessation and chemical dependence, explaining interaction effects among depression and smoking cessation (Ranney, Melvin, Lux, McClain, & Lohr, 2006); assessing the cost effectiveness of treatment per disability and quality of adjusted life years saved in teen smoking cessation studies (Sussman, Sun, & Dent, 2006); comparing person to person programming with group level programming on effectiveness and assessing the importance of different program components (Sussman et al., 2006); more thorough exploration of the characteristics and processes of proactive telephone counselling and participant characteristics (Pan, 2006); replication and testing of promising psychosocial interventions in different settings (Grimshaw & Stanton, 2006); exploring the role of motivation to quit and other predictive variables for cessation (Grimshaw et al., 2006); trials of brief interventions and self-help materials (Grimshaw et al., 2006); nicotine replacement therapy in adolescents (Grimshaw et al., 2006); trials examining the effects of brief advice interventions delivered by nurses, and studies considering the additive and/or multiplicative effects of interventions delivered by 2 or more health professionals (Hill Rice, 2006).
 - iii Methodological improvements to smoking research should include the use of: well designed and executed RCTs; adequate sample sizes and procedures to reduce attrition rates; appropriate controls; multiple site/school studies; bogus pipeline or biochemical measurements to validate self-reported smoking behaviour; behavioural outcomes in addition to measures of knowledge and attitudes; and follow up assessments to measure long-term effects (>12 months) (Doolan et al., 2006; Grimshaw et al., 2006; Hill Rice, 2006; Park, 2006; Sussman et al., 2006; Thomas & Perera, 2006; Thomas et al., 2006; Thomas et al., 2007; Walters et al., 2006).

3.6 Substance Use

(Sub-themes: non-school based and parenting interventions)

- i Research to build the evidence base on the effectiveness of non-school based interventions to prevent or reduce illicit drug use (i.e., education; skills training; motivational interviewing; brief, family, and multi-component community interventions); large

sample size RCTs are needed to show significant differences in substantive drug use, economic and health outcomes (Gates, McCambridge, Smith, & Foxcroft, 2006).

- ii Studies of parenting programs to prevent or reduce use or misuse of drugs, alcohol, or tobacco in children and adolescents are needed that use rigorous, independent (not self-report) measures to investigate: change processes involved in such interventions and their relationships to outcome variables; long-term program effects; effectiveness in preventing development of regular use in experimental or occasional users; and applicability of prior research findings beyond two-parent families and to populations outside the US (Petrie, Bunn, & Byrne, 2007).

3.7 Mental Health

(Sub-themes: eating disorders, childhood depression, bullying)

- i Investigations of internet-based interventions for preventing eating disorders in adolescent girls and young women should address complicating factors such as geographical boundaries (e.g., service availability in rural areas), computer literacy and ethical concerns regarding internet privacy; future studies should increase sample sizes and control for covariates (e.g., involvement in other interventions) (Newton & Ciliska, 2006).
- ii Studies testing the efficacy of programs to prevent depression in children and adolescents should examine if certain risk factors (e.g., parental depression, gender, age) moderate the relation between the intervention and outcomes (useful for targeting programs to appropriate groups); methods of investigation should incorporate basic findings about depression (e.g. when to initiate intervention, timing and duration of follow up assessments, choice of outcome measures) (Horowitz & Garber, 2006).
- iii Well-designed RCT evaluations comparing different types of school-based anti-bullying interventions; need to examine the effectiveness of different program components and the dose-response relationship between the number of components and effectiveness (Baldry & Farrington, 2007; Vreeman & Carroll, 2007).

4 Injury Prevention

8 systematic reviews

Themes: car seats, workplace safety, bicycle helmets, wrist guards, fire safety

- 1 Larger, long-term (>6 months), high quality RCT and prospective controlled trials using observational and self-report data to evaluate the effectiveness of efforts to increase booster seat use; research should: assess the cost-effectiveness of booster seat programs, examine the impact of booster seat laws on use, evaluate the effects of single program strategies (e.g., incentives only, education only, distri-

- bution only, legislation only), compare single program options against one another and against multi-component interventions, and explore what strategies work best in different settings (e.g., urban versus rural) and with different populations (e.g., high versus low SES) (Ehiri et al., 2006b; Ehiri et al., 2006a); preliminary population based study to determine how commonly preterm infants experience serious adverse events in car seats due to incorrect positioning, complemented by qualitative research exploring parents' perceptions and concerns regarding pre-discharge demonstrations of car seat positioning and subsequent assessment of the infants' cardiorespiratory stability (Pilley & McGuire, 2006)
- 2 High quality, well-designed RCT evaluations of workplace safety and training interventions that examine worker safety and health training relative to more specific safety knowledge and performance and safety and health outcome variables, as well as the influence of individual (e.g., worker motivation, work experience) and situational variables (e.g., organizational safety climate, opportunities to apply knowledge and skills, type of work) on worker safety and health training effectiveness (Burke et al., 2006; Tuncel, Lotlikar, Salem, & Daraiseh, 2006).
 - 3 Studies evaluating whether bicycle helmet laws affect head injury outcomes and providing detailed evidence regarding the effectiveness of legislative components; comparative studies across communities with and without helmet legislation; research exploring the transition effect of helmet law expansion from younger to all ages (Karkhaneh, Kalenga, Hagel, & Rowe, 2006).
 - 4 High quality, rigorous RCTs comparing the effectiveness of different types of wrist guards for preventing injuries among snowboarders of varying experience and ages as well as compliance with using the devices; non-wrist upper extremity injuries included among outcome measures (Russell, Hagel, & Francescutti, 2007).
 - 5 More rigorous RCT evaluations of community-based fire injury prevention interventions (Ta, Frattaroli, Bergen, & Gielen, 2006).

5 Seniors' Health

2 systematic reviews

Themes: home visiting, vision screening, dementia

- 1 Well designed and theoretically based evaluations of nurse-provided home visiting programs for seniors that provide contextual details about the interventions, measure client outcomes across different subgroups of seniors, determine the effectiveness of different program components, and examine whether the nursing role makes a difference in client outcomes (Markle-Reid et al., 2006).
- 2 Studies examining the effectiveness of vision screening tools (e.g., brief screening instruments), procedures (e.g., including measures such as visual fields or contrast sensitivity) and agents (e.g., optometrists); qualitative research to gain seniors' perspectives on their visual problems, their needs for intervention, and perceived

barriers to accessing interventions (Smeeth & Iliffe, 2006).

6 Environmental Health

2 systematic reviews

Themes: second hand smoke, waterborne illness

- 1 National studies assessing: the quality of public knowledge regarding the health effects of second hand smoke (SHS), public perceptions of SHS compared to other health hazards, perceived immediacy or distance of harm, frequency and effectiveness of prompts regarding SHS harm; studies exploring how “rights” to smoke free places is balanced with preferences for permitted smoking; evaluations of major interventions for smoke free homes (e.g., mass media campaigns) paying particular attention to impacts on disadvantaged populations; qualitative studies exploring (a) household and social contexts related to smoke free homes and (b) complexities involved in policy formulation and implementation (Thomson, Wilson, & Howden-Chapman, 2006).
- 2 Rigorous, multi-arm RCTs in various settings that compare programmatic approaches to improving the quality of drinking water; studies that determine the effectiveness of interventions to improve water quality in preventing death, particularly among vulnerable populations (e.g., children <5 years, people living with HIV/AIDS); assessing correct and consistent use of household interventions over the long-term; cost effectiveness and cost benefit analyses to inform priority setting regarding water quality interventions (Clasen, Schmidt, Rabie, Roberts, & Cairncross, 2007).

7 Dental Health

2 systematic reviews

Theme: dental decay and caries

- 1 Larger well conducted trials comparing different types of slow-release fluoride devices (e.g., gels, varnishes), bonding materials/methods, and the amount of fluoride released from such devices for preventing, arresting or reversing the progression of dental decay; particular attention needs to be given to investigating the efficacy of fluoride varnishes in children <5 years; analyses should include intention to treat and cost-benefit (Bonner, Clarkson, Dobbryn, & Khanna, 2006; Gussy, Waters, Walsh, & Kilpatrick, 2006)

8 Social Determinants of Health

1 systematic review

Theme: urban regeneration programs

- 1 High-quality impact evaluations of area based investments/interventions that explicitly identify the theory of change, provide detailed descriptions of program elements and contextual factors, investigate both positive and adverse impacts on socioeconomic and health outcomes, and ensure assessment of intervention impacts on original residents of the targeted areas (Thomson, Atkinson, Petticrew, & Kearns, 2006).

9 Global Health

9 systematic reviews

Themes: malaria, iron supplementation, Hib vaccine, HIV prevention, dengue control

- 1 Impact evaluations of insecticide-treated nets (ITNs) for preventing malaria in pregnant women are required in areas with less intense and *Plasmodium vivax* transmission such as Asia and Latin America as well as studies examining the benefits of combining intermittent preventive therapy with ITNs (Gamble, Ekwaru, & ter Kuile, 2006); comparison of prophylaxis or intermittent preventive therapy with prompt treatment of morbidity (fever and anemia) in the mother (Garner & Gulmezoglu, 2006); research on new formulations of the SPf66 vaccine with increased immunogenicity for preventing *P. falciparum* malaria in areas outside Africa such as South America (Graves & Gelband, 2006b); research on malaria vaccines that combine the NANP epitope with other antigens; studies evaluating the effectiveness of CS102 and ME-TRAP; improving the immunogenicity and effectiveness of the RTS,S vaccine and methods of combining it with DNA vaccines or antigens from other malaria stages; testing candidate vaccines in infants (Graves & Gelband, 2006a).
- 2 RCTs are needed in developing countries to determine the health risks and benefits associated with iron supplementation in young children (0-4 years), particularly those who are HIV-positive, born to HIV-positive mothers, or who have tuberculosis or malaria (Iannotti, Tielsch, Black, & Black, 2006); well-designed studies on children and adolescents are needed to validate findings of increased physical growth resulting from energy and iron supplementation, these studies should include specific estimates of appetite and energy intake to elucidate the role of these factors and evaluate the role of micronutrient (e.g., iron, zinc, vitamin A) interactions in determining physical growth (Sachdev, Gera, & Nestel, 2006).
- 3 Research on haemophilus influenzae type b vaccination of children in developing countries is needed to: evaluate the impact of vaccination on Hib-specific mortality; determine the duration of protection afforded by vaccination; provide local or regional data on Hib disease burden, background epidemiology, and cost analysis

- of Hib disease; consider the effectiveness and safety of combination vaccines (e.g., HibDTPHepB); and evaluate the efficacy of Hib vaccines in immunocompromised patients or those with chronic illnesses (Obonyo & Lau, 2006).
- 4 Rigorous evaluations of interventions in resource-poor countries to determine whether they reduce HIV incidence (as a specific outcome); regional epidemiological profiling and collection of contextual (e.g., geographic, sub-population) information to better inform HIV intervention selection; studies examining population (e.g., policy, structural) level HIV interventions (Wegbreit, Bertozzi, DeMaria, & Padian, 2006).
 - 5 Studies to determine which specific intervention components (e.g., larvicides, biological control agents), in combination with community participation and/or other partnerships, have the greatest impact on dengue control and are cost effective (Heintze, Garrido, & Kroeger, 2007).

Conclusions

The primary limitation and strength of the methods of this paper is that the gaps were identified through systematic reviews. There are many topics within the realm of public health that do not lend themselves to randomized trials and as such, are less likely to be the topic of a systematic review, and then would not be part of the listing above. For example, there are few reviews on determinants of health; the few that exist are theoretically or epidemiologically based as opposed to focused on interventions to change determinants of health. On the strength side, systematic review authors are in a good position to produce the “next steps” after immersion in the literature around a specific question. A further strength is that the method used here was very systematic and thorough in terms of finding relevant public health reviews. Most often, people are polled and asked about research gaps. For example, a Core Public Health Functions Research Priority Think Tank was held in British Columbia in April 2007 where researchers and public health experts met and identified research priorities. The research priorities include some of those gaps described above, but most are more system issues addressing disparities, how to get knowledge into action, models of public health care, integration with primary care, policy interventions to decrease health inequities, raising the profile of public health, human resource capacity needs.

In 2004, the Cochrane Health Promotion and Public Health Field convened a Global Priorities Taskforce to identify health promotion and public health topics needing a systematic review. The group keeps a running list of the topics and indicates where protocols or reviews are underway. Topics not yet reviewed include: strategies for community building; capacity development for health promotion; prenatal and early infancy interventions to prevent mental illnesses; multi-component environmental, social and educational strategies to prevent infectious diseases, gender disparities in food distribution; improved nutrition in refugee populations; interventions to enhance compliance with regulations of water supply systems (Cochrane Health Promotion and Public Health Field, 2004) .

The research gaps covered specifics of many different public health topics. The methods gaps were fairly consistent across topics, including the need for larger sample sizes, longer follow-up, assessment of cost-effectiveness, and assessment of effectiveness across different settings or population groups. Identified gaps can be used to develop targeted funding initiatives to meet these gaps.

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