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Review Article

Systematic review of the use of data from national childhood obesity surveillance programmes in primary care: a conceptual synthesis

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Summary

This study reviewed the use in primary care of national surveillance data for children to determine the data's potential utility to inform policy and practice decisions on how to prevent and treat childhood obesity. We reviewed the 28 countries identified by the World Obesity Federation as having high-quality comparable body mass index data for children. Literature published from any period up to December 2013 was included. Peer review literature was searched using Web of Science (Core Collection, MEDLINE). Grey literature was searched using the Internet by country name, programme name and national health and government websites. We included studies that (i) use national surveillance obesity data in primary care, or (ii) explore practitioner or parent perspectives about the use of such data. The main uses of national surveillance data in primary care were to identify and recruit obese children and their parents to participate in school and general practice-based research and/or interventions, and to inform families of children's measurements. Findings indicate a need for school staff and practitioners to receive additional training and support to sensitively communicate with families. Translation of these findings into policy and practice could help to improve current uses of national child obesity surveillance data in primary care.

Keywords: Children, obesity, primary care, surveillance.

obesity reviews (2015)

Introduction

Governments worldwide are increasingly collecting data on childhood obesity for national surveillance purposes. Obese children are more likely to suffer from early onset of obesity-related comorbidities, such as hypertension and diabetes, and from psychosocial issues, such as bullying and school absences (1–4). The causes of obesity are complex, ranging from economic to environmental to psychological factors, and comprehensive prevention programmes are required to address it (5,6). The World Health Organization defines public health surveillance as 'the continuous, systematic collection, analysis and interpretation

of health-related data needed for the planning, implementation, and evaluation of public health practice' (7). Surveillance data on childhood obesity can be used for monitoring, development of interventions, screening or clinical management.

The National Child Measurement Programme (NCMP) in England is an example of one of the largest and most comprehensive national child weight surveillance programmes. Since the programme's establishment in 2006, it has annually weighed and measured children in reception (the class before year 1, equivalent to kindergarten, with children aged 4–5 years) and year 6 (aged 10–11 years). The programme reports data on body mass index (BMI;

kg m⁻²) categorized using the UK90 growth reference (8) for approximately 90% of all school children in these two age groups, who are attending state maintained schools in England. Data are used to inform local planning and delivery of children's services, gather population-level surveillance data, and increase awareness of weight issues in children (9). Recent legislation in England now permits the collection of an NHS number (unique identifier), which will facilitate longitudinal analysis of the programme's data, and possible cross referencing with other health datasets, to provide a better understanding of the consequences and tracking of obesity during childhood (9).

Childhood obesity surveillance programmes exist globally, yet there is not a comprehensive understanding of how data collected as part of these programmes are utilized. This systematic review aimed to describe what is known internationally about the use of national childhood obesity surveillance data in primary care.

Methods

Literature search

We undertook a broadly scoped systematic review following published guidelines of the Evidence for Policy and Practice Information and Co-ordinating Centre (10). We focused our review on the 28 countries identified by the World Obesity Federation as having comparable quality BMI measurements (11). PICOS terms (Population, Intervention, Comparator, Outcome, Study design) were used to conduct keyword searches, using the following themes: 'child' (Population); 'obesity' (Intervention/Outcome); 'programme' (Intervention); 'primary care' (Intervention); 'utility' (Outcome) (study design was open to any and no comparator was used). Peer-reviewed papers were searched for using Web of Science (Core Collection, MEDLINE). Grey literature was searched using the Internet by country name, programme name and national health and government websites. Bibliographic reference lists were also searched, and authors or database managers were contacted directly.

Inclusion and exclusion criteria

Inclusion criteria were (i) peer review and grey literature, including quantitative or qualitative methods, that studied national surveillance data on obesity; (ii) surveillance data to assess obesity using any validated body measurement; (iii) literature presenting findings on health services, including interventions, screening, professional or patient views and clinical management in primary care (including general practice, public health, school and community based services); (iv) literature published from any period up to

December 2013; and/or (v) the 28 countries identified by the World Obesity Federation (11).

We excluded literature that (i) were not in the English language; (ii) reported prevalence data only; (iii) only included individuals beyond the age of 16 years; (iv) used surveillance data only to study the programme itself (e.g. programme evaluation); (v) used self-reported body measures; (vi) were datasets not routinely collected (maximum of every 2 years); and/or (vii) used anonymized data that could not be linked to individual medical records.

Appraisals

Appraisals of each paper's relevance to the study were conducted independently by two reviewers. Data were extracted by one reviewer (EH) into a tailored data extraction form (which was piloted prior to use) and checked by a second (LE). Study quality was not central to the review, as we were interested rather in the type and amount of research activity on the topic, so formal quality appraisals were not conducted.

Synthesis

Data were synthesized using the Conceptual Synthesis method described by the Evidence for Policy and Practice Information and Co-ordinating Centre (10), and the analytical framework provided by the Research Unit for Research Utilisation (12). Findings about the various types of utilization of national childhood obesity surveillance programmes were combined to create new understandings of how data might be used in primary care. The analysis was organized around the utility types identified in the review (there were a range of ways countries utilized the data, and these were categorized into 'utility types'). Studies were grouped thematically based on the types of data presented in each paper's findings. Then, under each utility type, a brief description of each finding and the authors' recommendations are presented. These were then combined to create a narrative around the utility of the data.

Results

The literature search

Figure 1 summarizes the search process. Nineteen papers in total were included in the synthesis.

Programmes identified

Table 1 describes the six countries – Australia, England, Germany, the Netherlands, New Zealand and the United States – found currently to utilize national child obesity

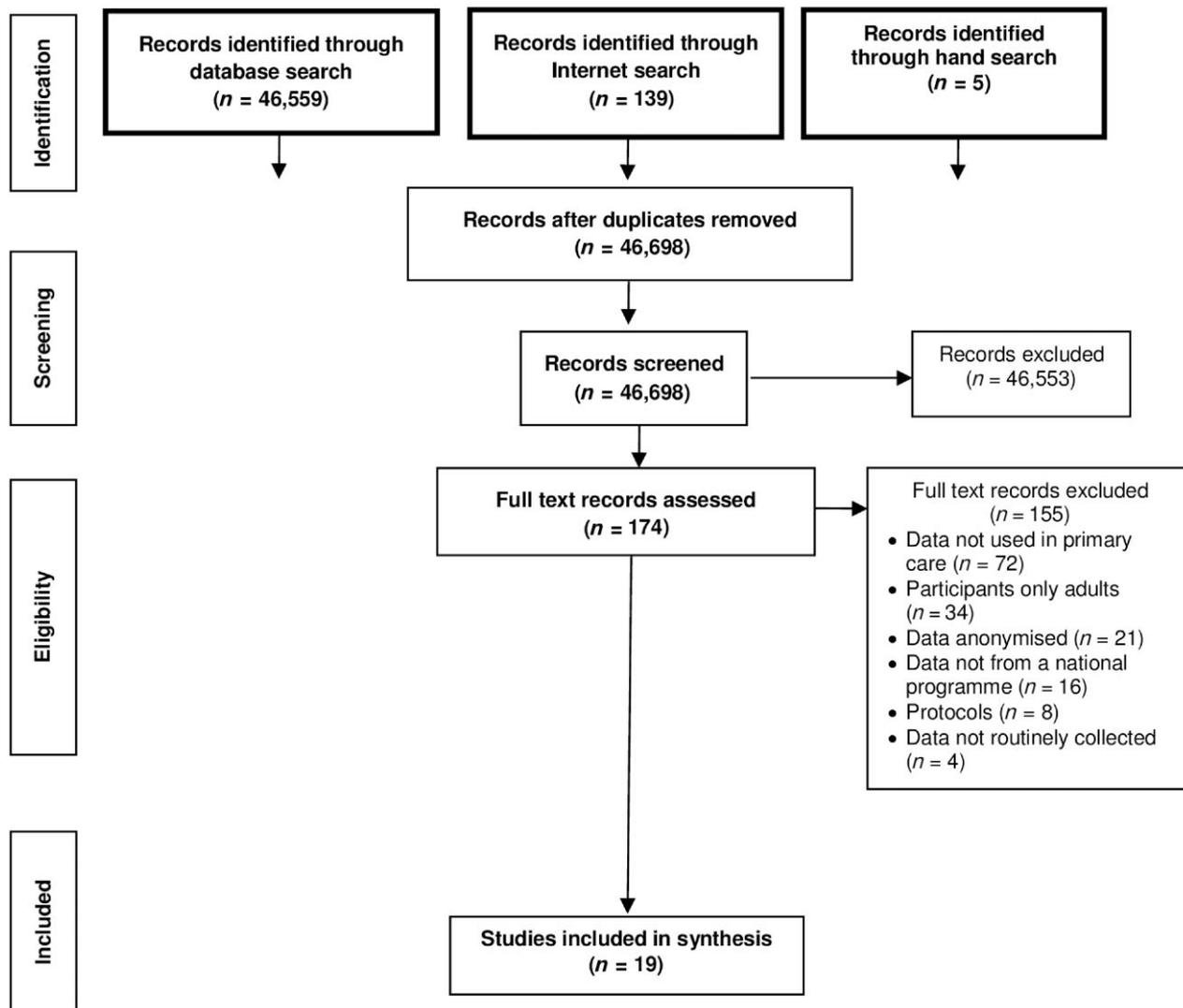


Figure 1 Search process and results.

surveillance data in primary care. Canada, France and Ireland conduct large-scale national surveys, and policy documents indicate they are considering the use of the data in primary care for obesity screening (13–15). No literature was found for the remaining countries, which collect anonymized surveillance data from very small though nationally representative samples (Belgium, Czech Republic, Denmark, Iceland, India, Japan, Mexico, Poland, Slovakia and Switzerland), including those involved in the WHO European Childhood Obesity Surveillance Initiative (COSI) (Greece, Hungary, Italy, Norway, Portugal, Slovenia, Spain, Sweden, Turkey).

England was the only country with a dedicated obesity-related national surveillance programme that aims to include the vast majority of the national population of primary school children. Australia and New Zealand collect measurements at the time of an optional central

government-funded immunization programme, and a not-for-profit organization in Germany screens for growth disorders through participating general practices. The Dutch government provides comprehensive care for young people, whereby all care including immunizations and growth monitoring are delivered in the community. The United States has two types of programmes, both of which are conducted at the state level. The first type is school based, as in England; the second is run via the Medicaid programmes in conjunction with health screening, as in Australia and New Zealand. Countries that collect longitudinal data (i.e. measurements collected more than once per child) include England (twice), Germany (annually) and the Netherlands (multiple).

Table 2 shows that studies were found from Australia ($n = 4$), England ($n = 4$), Germany ($n = 2$), the Netherlands ($n = 2$) and the United States ($n = 8$). Despite having a

Table 1 Summary of measurement programme by country

Country	Survey programme (organization)	Measures	Age (years)	Sample	Participation	Occurrence (locale)	Start date	Stated purpose	Storage of data
Australia	'Healthy Kids Check' (Medicare Benefits Schedule)	Height Weight	4	All children at time of immunization	Parent consent required	Once per child (clinics of any qualified provider)	2008	'To improve the health and well-being of Australian children and promote early detection of lifestyle risk factors, delayed development and illness.'	General practices
England	'National Child Measurement Programme' (NCMP) (Public Health England)	Height Weight	4-5; 10-11	All school children in reception year and year 6 (state schools only)	Automatic unless parents opt-out	Once aged 4-5 years; once aged 10-11 years (reception and primary school)	2006	'To inform local planning and delivery of services for children; gather population-level surveillance data to allow analysis of trends in growth patterns and obesity; to increase public and professional understanding; to engage with children and families about healthy lifestyles and weight issues.'	Health and Social Care Information Centre
Germany	'CrescNet' (a non-profit based in University of Leipzig)	Height Weight	0-16	Any participating general practices	Parent consent required	Annually (general practice)	1998	'Regular screening for disorders of growth and weight development to enable a systematic early detection of growth and weight gain disorders'	University Hospital Leipzig
The Netherlands	Youth Health Care	Height Weight	0-4	All children accessing service	Voluntary	10 times <2 years; 2 years; 3 years; 4 years (Parent and Child Centres)	2008	'To monitor growth and development . . . conduct examinations, administer vaccinations and provide information and advice.'	Electronic Youth Health Care records
New Zealand	'B4 school check' (Ministry of Health)	Height Weight	4	All children entering school	Parent and child consent required	Once per child (clinics of any qualified provider)	2008	'For growth measurement and monitoring'	B4 School Check National Information System
USA	'Well Child Check Up' (State Medicaid)	Height Weight	0-20	Medicaid recipients (low-income families)	Mandatory	Determined by each state (clinics of any qualified provider)	1995	'To ensure children and adolescents receive appropriate preventive, dental, mental health, and developmental, and specialty services'	Centers for Medicare and Medicaid Services
	State-level, school-based measurement programmes	Height Weight	Variable by state	Variable by state	Variable by state	Variable by state (primary schools)	Variable by state	Variable by state	Variable by state

Table 2 Studies of national child obesity surveillance data used in primary care

Author/s (year)	Country (programme)	Design (child age/s)	Utilization of data	Findings	Recommendations
Denney-Wilson (2013) (16)	Australia (Healthy Kids Check)	Practice nurse perspectives of routine preventative child obesity consultations, by questionnaire and interview (4–5 years)	Primary care-led intervention	Strong desire for training, especially workshops on BMI assessment and lifestyle advice (b) Increased awareness of child overweight among practitioners (b)	Practice nurses are well placed and motivated to provide support to parents
Robinson <i>et al.</i> (2013) (17)	Australia (Healthy Kids Check)	Nurse perspectives of the use of database to provide preventative routine advice in general practice setting, by questionnaire and interview (4–5 years).	Primary care-led intervention	-Barriers to using database for prevention: Lack of practitioner confidence; limited autonomy; low motivation and negative reactions from parents (b)	Practice nurses are interested in preventative role Training and support is needed, on lifestyle assessment and advice; positive practitioner attitudes towards obese people; self-efficacy/confidence in delivering services effectively Community-wide, multi-strategy approaches to obesity prevention are worthwhile investments.
de Silva-Sanigorski <i>et al.</i> (2010) (19)	Australia (Maternal and Child Health Service)	'Romp and Chomp' trial. Community capacity building and environmental changes (2–3.5 years)	Recruitment to trial	Variable recruitment success (c) After 3 years follow-up, decreased BMI (d) Lower intake of unhealthy snacks and sugary drinks (d)	Community-wide, multi-strategy approaches to obesity prevention are worthwhile investments. Requires long-term, committed partnerships and consistent policy
Edvardsson <i>et al.</i> (2009) (18)	Australia (Maternal and Child Health Service)	Nurse views of raising issues about children's overweight when clinical measurements indicate obesity, by interview (0–5 years)	Primary care-led intervention	Difficult to raise the issue of child obesity due to some strong reactions from parents (b) Nurses emphasized addressing obesity sensitively by building trust, using tactful language and being culturally aware (b)	Further research in communications is needed, e.g. patient-centred approaches, understanding patient social context
Falconer (2013) (27)	England (NCMP)	Parent perspectives of interventions, by questionnaire and interview (4–5 years and 10–11 years)	Feedback letter of child's measurements to parents versus feedback letter plus telephone call	Letter alone acceptable to parents (a) Significant minority of parents upset (a) Positive behavioural changes Parents sought further (d) information, but not primary care support (d)	Continue providing feedback by letter alone Ensure healthcare capacity to deal with increased help seeking

Table 2 Continued

Author/s (year)	Country (programme)	Design (child age/s)	Utilization of data	Findings	Recommendations
Mooney <i>et al.</i> (2010) (26)	England (NCMP)	Parent perspectives of intervention, by postal survey and follow-up phone interviews (4–5 years and 10–11 years)	Feedback letter of child's measurements to parents	High level of acceptability of intervention (a) Mixed responses from parents, some upset (a) Letter did not prompt parents to seek professional help (d)	'Scare tactics' should not be used Proactive follow-up required to induce change Training needed for staff receiving calls from parents
Grimmett <i>et al.</i> (2008) (28)	England (NCMP)	Parent and child perspectives of intervention, by before and after questionnaires (6–7 years and 10–11 years)	Feedback letter of child's measurements to parents	65% of parents wanted weight feedback on a regular basis (a) A minority of children and parents found the process upsetting, including teasing (a)	Weight feedback is acceptable to 'opt in' participants Feedback process needs to be managed sensitively
Alff <i>et al.</i> (2012) (20)	Germany (CrescNet)	Exit survey of non-participation to a telephone intervention trial (3.5–17.4 years)	Recruitment to trial. Overweight children were screened and recruited via their paediatrician	Non-participation occurred more among low-income groups (c)	Screening still results in missing 'hard to reach' groups
Markert <i>et al.</i> (2012) (21)	Germany (CrescNet)	Recruitment process of a telephone intervention trial (4–17 years)	Recruitment to trial. Overweight children were screened and recruited via their paediatrician	Participation rates low (9%) (c)	'Hard to reach' groups for participation in obesity interventions were single parent families and those with adolescents
van Grieken <i>et al.</i> (2013) (22)	The Netherlands (Youth Health Care)	'Eat right, be active' RCT. Families were invited to three annual counselling sessions with lifestyle advice and motivational interviewing, the first held at the well child visit (5 years)	Recruitment to trial. All children attending well-child visit were measured, and overweight children were screened and recruited via Youth Health Care teams	Attendance was poor (c) Clinicians did not always recruit overweight patients (c) No change in BMI at 2-year follow-up between intervention and control (d)	Intervention at well-child visit is a better time and place, rather than having follow-up sessions, though phone/Internet follow-up worth exploring. Stronger community-wide links with parents needed.
Gerards <i>et al.</i> (2013) (23)	The Netherlands (Youth Health Care)	'Lifestyle Tripple P' RCT. Health professional views of barriers to recruitment, by interview (0–4 years)	Recruitment to trial. Overweight children retrospectively and prospectively recruited via Youth Health Care teams	Barriers to recruitment: • Parents were 'in denial' and resisted discussing weight issues (b, c) • Professionals had poor training and low self-efficacy (b, c)	More training for professionals needed; parents' awareness needs to be raised.
Woo Baidal <i>et al.</i> (2013) (25)	USA (Medicaid, MA)	'High Five for Kids' RCT. Parental perceptions of motivational interviewing, by questionnaire (2–6 years)	Recruitment to trial. Recruit through practice records of well child check up.	After 1 year, satisfaction was higher among non-US born, low SES and high BMI parents (a)	Motivational interviewing approaches need to be informed by socio-demography of participants

Table 2 Continued

Author/s (year)	Country (programme)	Design (child age/s)	Utilization of data	Findings	Recommendations
Taveras <i>et al.</i> (2011) (24)	USA (Medicaid, MA)	'High Five for Kids' RCT. Primary care restructuring, motivational interviewing (2–6 years)	Recruitment to trial. Recruit through practice records of well child check-up.	High parent satisfaction (a) Low recruitment but high retention rates (c) After 1 year, intervention practices reduced TV viewing, but not BMI (d)	Interventions that restructure primary care, including electronic medical records, are able to address complexities of child obesity
Madsen (2011) (34)	USA (California Department of Education Fitness Programme)	Impact of mandated school-based BMI screening with optional parent notification (primary and secondary school)	Feedback letter of child's measurements to parents	No association observed between change in BMI and feedback letters to parents (d)	Schools should consider alternative means of improving student health until there is stronger evidence for notification.
Bennett Johnson <i>et al.</i> (2009) (29)	USA (state-mandated, FL)	Parent reaction to state-mandated screening programme, by interview (4–13 years)	Feedback letter of child's measurements to parents	66% wanted the screening programme (a) 34% reported contacting their doctors (d)	Reporting results to parents may serve as an intervention. Parents amenable to other obesity-related programmes offered through school.
Hendershot <i>et al.</i> (2008) (33)	USA (state-mandated, AR, CA, FL, IL, MO, PA, TN, WV)	Nurse perspectives of BMI measurements taken in schools, by questionnaire (primary school)	Feedback letter of child's measurements to parents	62% thought results should be sent home (b) 55% thought negative parent response was a barrier to obtaining measurements (b)	School nurses have a leadership role to play in reducing childhood obesity
University of Arkansas Medical Sciences College of Public Health (2008) (30)	USA (state-mandated, AK)	Parental assessment of BMI reporting process, by questionnaire (primary school)	Feedback letter of child's measurements to parents	Data for 4 years shows • 6% of parents had negative feedback (a) • Less than 1% of parents took their child to a weight loss clinic (d)	n/a
Young Kubik <i>et al.</i> (2007) (31)	USA (state-led, MN)	Parent opinion about school-based BMI programmes, by focus groups (4–11 years)	Feedback letter of child's measurements to parents	Parents generally in support of BMI screening (a) Raised issues of privacy and respect, and dissemination of results to avoid 'weight labelling' (a)	School should foster environments where stigmatization and discrimination are not tolerated.
Johnson and Ziolkowski (2006) (32)	USA (state-led, PA)	Description of a 5-year nurse-led programme to screen BMI in schools that already measured height and weight for growth monitoring (4–18 years)	Feedback letter of child's measurements to parents.	8% parents who received letters were upset that the screening had taken place (a) Parents were given the option to not receive the letter (a)	Engage parents and professionals in the planning process

(a) Perspectives of parents; (b) perspectives of health care professionals; (c) evaluation of study recruitment; (d) changes in body measures and/or lifestyle behaviour.

national child obesity surveillance programme, no studies from New Zealand were found.

Synthesis of study findings

Table 2 shows surveillance data were utilized in the following three ways: (i) by primary care to provide interventions on an individual level ($n = 3$); (ii) to identify and recruit overweight and/or obese participants to trials ($n = 9$); (iii) to provide feedback to parents on their children's BMI and weight status, in the form of letters sent home which sometimes include brief advice and referral to health services ($n = 10$).

Four types of study findings were thematically identified and are indicated in the findings column of Table 2 as (i) patient/parent perspectives ($n = 9$); (ii) practitioner perspectives ($n = 6$); (iii) evaluation of study recruitment ($n = 9$); (iv) changes in body measures and/or lifestyle behaviour ($n = 7$).

Primary care-led interventions

The three studies on primary care-led interventions were limited to nurse perspectives. Nurses are motivated to be involved in prevention of childhood obesity using patient BMI data (16,17), but face barriers such as managerial support (17) and negative reactions from parents (17,18). Nurses reported a need for more training in BMI measurement and lifestyle advice, and skills in dealing with obese children sensitively (17,18), for example, using patient-centred approaches (18). It was acknowledged that adequate resource management must be allocated to support these actions (17). Author recommendations suggest nurses believe it is part of their role to address obesity (16,17), but training and support are required to deliver effective interventions that are acceptable to patients (17,18).

Recruitment to trials

These studies reported recruitment outcomes ($n = 6$), effects of trials on body measures and/or behaviours changes ($n = 3$) and practitioner ($n = 2$) and patient perspectives ($n = 2$). Overall, recruitment to trials proved challenging (19–24). People in deprived areas were less likely to be recruited (20,21). Authors recommend better communication with patients and the wider community (19,22,23), and restructuring of primary care to address the complexities of obesity (24). Behaviour change intervention studies found families improved their diets (19) and reduced TV viewing (24). BMI was reduced in one study after follow-up (19), but two studies found no change (22,24). Patient satisfaction of the trial was high in one study (24), but high in another only among non-US born, low socio-economic (SES) and high BMI parents (25). Practitioners did not

always deliver interventions for fear of negative reactions from patients (23) or the belief they or the intervention was ineffective (22).

Feedback letters

Studies of feedback letters to parents reported views of parent perspectives ($n = 7$), practitioner views ($n = 1$) and behaviour change and/or change in BMI ($n = 4$). All seven studies reporting parent perspectives show the majority (greater than 50%) approve of receiving letters (26–32) with five reporting a minority of parents who disapproved or were upset (26–28,30,32). Two studies found the feedback letter had the potential to stigmatize and discriminate against obese children (28,31). To address this, children should be respected (31), participation should be 'opt-in' only (32), and families and practitioners should be engaged in the planning process (31,32). From the one study reporting practitioner perspectives, there was a division in views as to whether letters should be sent home at all, and experience of conflict when discussing the letters with parents (33). Parent and practitioner perspectives concord in terms of the potential for parents to respond negatively to receiving the letters. All studies recommended feedback continue to be provided by letters, but there needs to be adequate health care capacity (27) and sensitivity training for school staff carrying out measurements (28,31) and receiving calls from parents (26), with the potential for active follow-up to effectively reduce BMI and/or change behaviours (26). There were mixed results as to whether the letter prompted parents to seek primary care services. One study reported one-third contacted their practitioners (29) and three reported limited to no contact (26,27,30). Letters did not help to reduce BMI (34).

Discussion

This study reviewed the use of national obesity-related surveillance data in primary care, by drawing on international experience, to determine the data's potential utility. The main uses of such data were to identify and recruit obese children and their parents to participate in school and general practice-based research and/or interventions, and to inform families of children's measurements. While systematically conducted, this review provides a broad overview of current practices, rather than an in-depth analysis of study findings. However, as the research question is driven by public health practice, this approach allowed for a quicker review that can inform design of future policy and research (35). We limited our search to countries most likely to have national child obesity surveillance programmes, based on the availability and quality of their national BMI data, and literature in the English language. It is possible there are other countries running such programmes that this study did not review.

England was found to be the only country with a dedicated obesity-related national surveillance programme, which aims to include the vast majority of the national population. Australia and New Zealand collect measurements at the time of an optional central government-funded immunization programme. Countries found to collect longitudinal data (i.e. measurements collected more than once per child) were England, Germany and the Netherlands. While the availability of longitudinal data may be preferable for more complex interventions, the presence of only cross-sectional data does not limit the utility of surveillance data in primary care, as Australia still use such data in the clinical setting and in England and US states, the data are used to provide feedback on measurements to parents.

We make the following recommendations for research, policy and practice. Parents and practitioners raise concerns over how their children's data are used and reported. On their report on evaluating health promotion in schools, the WHO has warned 'concentration on the promotion of physical well-being to the exclusion of emotional, mental and social well-being may have detracted from the effectiveness of school-based programmes' (36). Careful consideration of training for school and practice staff on how to sensitively communicate with families their children's measurements and related management of obesity will need to be made. We would reiterate recommendations made in some of the studies reviewed here that public consultations be held as a means to better engage families and schools in the planning and decision making processes. Consultations with public health and primary care organizations will also need to be made, given the resource implications utilizing measurement data in these settings also identified in this review.

Early prevention and treatment will play an important role in addressing the complexities of obesity, and future innovations may derive from the utilization of surveillance data in primary care, and by linking it with health and social care records. For example, a recent study linking NCMP data of individuals was able to demonstrate that overweight children in reception year were highly likely by year 6 to become obese (37). BMI data can be tracked over time to help identify those at highest risk of unhealthy weight gain, particularly in areas of high deprivation and among some ethnic minority groups (38). This life course approach can also be used to develop new targeted interventions, given the limited range of treatment interventions for children that are demonstrated to be successful over the longer term (39). Furthermore, surveillance data could be used for advocacy purposes to put pressure on policy-makers to take action in health systems on the wider determinants of health.

There are potential limitations to linking surveillance data with primary care records. There will be country-specific governance and logistical issues, relating to infor-

mation technology, data cleaning and data transfer. Thus, assessments of the technical issues of transferring data to primary care records may need to be carried out. A full evaluation of measurement programmes, and potential links with other school-based interventions, should also be considered and the logistics evaluated. A retrospective audit of practice-based interventions could be conducted across primary care organizations, particularly in high-risk areas such as those with high levels of deprivation (40), to gain an understanding of current practice.

This review found a range of international research to support policy and practice partners' decisions about how national childhood obesity surveillance data can be utilized in primary care. Closer consideration of the translatability of these findings to each country's unique primary care and public health systems is needed. Collaboration between countries on specifics of their healthcare systems could be useful to further share the learning this review identified.

Conflict of interest statement

Dr Henderson, Prof Hunter and Prof Rubin have nothing to disclose. LE has a part-time secondment to Public Health England.

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References

1. Cote AT, Harris KC, Panagiotopoulos C, Sandor GG, Devlin AM. Childhood obesity and cardiovascular dysfunction. *J Am Coll Cardiol* 2013; 3: 3011–3018.
2. Haines L, Wan KC, Lynn R, Barrett TG, Shield JPH. Rising incidence of type 2 diabetes in children in the U.K. *Diabetes Care* 2007; 30: 1097–1101.
3. Wijga A, Scholtens S, Bemelmans W *et al.* Comorbidities of obesity in school children: a cross-sectional study in the PIAMA birth cohort. *BMC Public Health* 2010; 10: 184.
4. Gatineau M, Dent M. *Obesity and Mental Health*. National Obesity Observatory: Oxford, 2011.
5. Foresight. *Tackling Obesities: Future Choices – Modelling Future Trends in Obesity and Their Impact on Health*. Department of Innovation Universities and Skills: London, 2007.
6. Finegood DT. The importance of systems thinking to address obesity. *Nestle Nutr Inst Workshop Ser* 2012; 73: 123–137, discussion 39–41.
7. World Health Organization. [Internet]. Health Topics: Public Health Surveillance. 2011. [WWW document]. URL http://www.who.int/topics/public_health_surveillance/en (accessed July 2015).
8. Cole TJ, Freeman JV, Preece MA. Body mass index reference curves for the UK, 1990. *Arch Dis Child* 1995; 73: 25–29.
9. Public Health England. *National Child Measurement Programme Operational Guidance*. Public Health England: London, 2014.

10. Evidence for Policy and Practice Information and Co-ordinating Centre. *EPPI-Centre Methods for Conducting Systematic Reviews*. Institute of Education, University of London: London, 2010.
11. National Observatory of Obesity. [Internet]. Table 1: Percentage of children overweight (including obese) by selected country based on BMI from measured height and weight using IOTF cut-off. 2015. [WWW document]. URL http://www.noo.org.uk/NOO_about_obesity/child_obesity/international (accessed July 2015).
12. Nutley S, Davies H, Walter I. Briefing Note 1: What is a conceptual synthesis? 2002. [WWW document]. URL <http://www.ruru.ac.uk/pdf/KnowDo%20paper.pdf> (accessed July 2015).
13. Ontario PH. *Addressing Obesity in Children and Youth: Evidence to Guide Action for Ontario*. Queen's Printer for Ontario: Toronto, ON, 2013.
14. National Taskforce on Obesity. *Obesity: The Policy Challenges*. Health Service Executive. 2005.
15. INSERM Collective Expertise Centre. *Childhood obesity: Screening and prevention*. Institut national de la santé et de la recherche médicale. 2000.
16. Denney-Wilson. Nurses in primary health care: the front line for obesity prevention. *Chronic Dis Netw* 2013; **25**: 7–8.
17. Robinson A, Denney-Wilson E, Laws R, Harris M. Child obesity prevention in primary health care: investigating practice nurse roles, attitudes and current practices. *J Paediatr Child Health* 2013; **49**: E294–E299.
18. Edvardsson K, Edvardsson D, Hornsten A. Raising issues about children's overweight – maternal and child health nurses' experiences. *J Adv Nurs* 2009; **65**: 2542–2551.
19. de Silva-Sanigorski AM, Bell AC, Kremer P *et al*. Reducing obesity in early childhood: results from Romp & Chomp, an Australian community-wide intervention program. *Am J Clin Nutr* 2010; **91**: 831–840.
20. Alff F, Markert J, Zschaler S, Gausche R, Kiess W, Bluher S. Reasons for (Non)Participating in a Telephone-Based Intervention Program for Families with Overweight Children. *PLoS ONE* 2012; **7**: e34580. doi: 10.1371/journal.pone.0034580.
21. Markert J, Alff F, Zschaler S, Gausche R, Kiess W, Bluher S. Prevention of childhood obesity: recruiting strategies via local paediatricians and study protocol for a telephone-based counselling programme. *Obes Res Clin Pract* 2013; **7**: E476–E486.
22. van Grieken A, Veldhuis L, Renders CM *et al*. Population-based childhood overweight prevention: outcomes of the 'Be Active, Eat Right' study. *PLoS ONE* 2013; **8**: e65376. doi: 10.1371/journal.pone.0065376.
23. Gerards S, Dagnelie PC, Jansen MWJ *et al*. Lifestyle Triple P: a parenting intervention for childhood obesity. *BMC Public Health* 2012; **12**: 267. doi: 10.1186/1471-2458-12-267.
24. Taveras EM, Hohman KH, Price SN *et al*. Correlates of participation in a pediatric primary care-based obesity prevention intervention. *Obesity (Silver Spring)* 2011; **19**: 449–452.
25. Woo Baidal JAW, Price SN, Gonzalez-Suarez E *et al*. Parental perceptions of a motivational interviewing-based pediatric obesity prevention intervention. *Clin Pediatr (Phila)* 2013; **52**: 540–548.
26. Mooney A, Statham J, Boddy J, Smith M. *The National Child Measurement Programme: Early Experiences of Routine Feedback to Parents of Children's Height and Weight*. Thomas Coram Research Unit, Institute of Education, University of London: London, 2010.
27. Falconer C. Findings from the LSHTM study into the impact of providing parents with feedback from the NCMP: Information for practitioners. [Internal Report]. 2013.
28. Grimmett C, Croker H, Carnell S, Wardle J. Telling parents their child's weight status: psychological impact of a weight-screening program. *Pediatrics* 2008; **122**: E682–E688.
29. Bennett Johnson S, Pilkington LL, Lamp C, He J, Deeb LC. Parent reactions to a school-based body mass index screening program. *J Sch Health* 2009; **79**: 216–223.
30. University of Arkansas Medical Sciences. *Arkansas Act 1220 of 2003 to combat childhood obesity: year four evaluation*. Fayetteville, AR. 2008.
31. Young Kubik M, Story M, Rieland G. Developing school-based BMI screening and parent notification programs: findings from focus groups with parents of elementary school students. *Health Educ Behav* 2007; **34**: 622–633.
32. Johnson A, Ziolkowski GA. School-based body mass index screening program. *Nutr Today* 2006; **41**: 274–279.
33. Hendershot C, Telljohann SK, Price JH, Dake JA, Mosca NW. Elementary school nurses' perceptions and practices regarding body mass index measurement in school children. *J Sch Nurs* 2008; **24**: 298–309.
34. Madsen KA. School-based body mass index screening and parent notification a statewide natural experiment. *Arch Pediatr Adolesc Med* 2011; **165**: 987–992.
35. Mays N, Pope C, Popay J. Systematically reviewing qualitative and quantitative evidence to inform management and policy-making in the health field. *J Health Serv Res Policy* 2005; **10**: 6–20.
36. Stewart-Brown S. Evaluating health promotion in schools: reflections. In: Rootman I, Goodstadt M, Hyndman B *et al*. (eds). *Evaluation in Health Promotion: Principles and Perspectives*. World Health Organization Regional Publications: Copenhagen, 2001, pp. 271–284.
37. Pearce M, Webb-Phillips S, Bray I. Changes in objectively measured BMI in children aged 4–11 years: data from the National Child Measurement Programme. *J Public Health (Bangkok)* 2015; **37**. doi: 10.1093/pubmed/fdv058.
38. Ells LJ, Hancock C, Copley VR *et al*. Prevalence of severe childhood obesity in England: 2006–2013. *Arch Dis Child* 2015; **37**. doi: 10.1093/pubmed/fdv058.
39. Luttikhuis HO, Baur L, Jansen H *et al*. Interventions for treating obesity in children. *Cochrane Database Syst Rev* 2009; **187**: CD001872.
40. Health and Social Care Information Centre. *National Child Measurement Programme – England 2012/13 School Year*. Government Statistical Service: Leeds, 2013.