Case Study prepared by Technopolis Group

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Students taking part in a group interview activity in a pilot for the EduSaltS scale-up study (Zhenjiang City, Jiangsu Province, China). Source: EduSaltS study team.

1 Reducing salt intake through a school-based education programme in China

Summary

The School-EduSalt (School-based Education Programme to Reduce Salt) study tested a novel approach to lowering salt intake, focussing on children in primary school education in China.[1] High salt intake is a major factor in heart disease and stroke; even a modest reduction in salt intake has been shown to lower blood pressure and reduce the risk of cardiovascular disease.[2] The World Health Organization has recommended reduced salt intake in food as one of the 'best buy' interventions to tackle the global crisis in non-communicable disease[3] and WHO

[1] He F J, Wu Y, Feng X et al. School based education programme to reduce salt intake in children and their families (School-EduSalt): cluster randomised controlled trial BMJ 2015; 350:h770

[2] He FJ, Li J, MacGregor GA. Effect of longer-term modest salt reduction on blood pressure: Cochrane systematic review and meta-analysis of randomised trials. BMJ 2013; 346:f1325

[3] WHO. From Burden to "Best Buys": Reducing the Economic Impact of Non-Communicable Diseases in Low- and Middle-Income Countries. 2011. Available via https://www.who.int/nmh/publications/best_buys_summary.pdf. Accessed 7 June 2021

Member States agreed on a voluntary global non-communicable diseases (NCD) target for a 30% relative reduction in salt intake by 2025.[4]

School-EduSalt's rationale was that children who learn about the harmful effects of excessive salt intake will tell their families about the problem and persuade parents and grandparents to reduce the amount of salt used in food preparation. It tested if school health education lessons focussing on salt intake reduction over a 3.5-month period could reduce families' salt intake and lower blood pressure. The study was conducted in 28 primary schools in Changzhi, a city in northern China by a team of researchers from Queen Mary University of London, The George Institute for Global Health, Beijing (TGI), Peking University and Changzhi Medical College. It was funded through the 2011 GACD call targeting hypertension (2012-2015; £761,888/US$1.17m, funded by the UK Medical Research Council[5]).

The trial found that **educating primary school children was successful in reducing salt intake by around 25%, in both children and their parents, accompanied by a significant decrease in the adults' blood pressure**. The researchers estimated that this decrease could reduce the incidence of stroke by about 9% and ischaemic heart disease by about 5%, preventing around 153 000 deaths from stroke and 47 000 deaths from ischaemic heart disease a year in China. The findings were published in the British Medical Journal in 2015.[6]

The researchers continued work on a salt intake reduction action plan for China, collaborating with national government organisations. The School-EduSalt education package was expanded to include an application-based programme (AppSalt)[7] as part of the UK-China Collaboration Unit Action on Salt China (2017-2021), funded by the UK National Institute for Health Research (NIHR).[8] While the full analysis is still under way, preliminary results are encouraging.[9] The team then secured further funding through the GACD Scale-up call (2019-2023; £2.5m/US$3.16m, UK MRC and NIHR[10]). Currently in its early stages, the project will test whether the educational programme can be successfully delivered across multiple settings in China, involving at least 100 schools and covering a population of 3.2m (1.1m children and 2.1m adults). If successful, the intervention will be rolled out nationwide. School-EduSalt is also informing efforts to reduce salt intake elsewhere. Modelled on the EduSalt trial, a research team is carrying out a salt reduction study in Malawi, the 'NoToNa' study, funded by the UK MRC.[11]

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[4] WHO. Fact Sheet Salt Reduction. Available via https://www.who.int/news-room/fact-sheets/detail/salt-reduction. Accessed on 23 June 2021.

[5] Gateway to Research, MRC Research Grant: A school-based education programme to reduce salt intake in children and their families. Available via https://gatr.ukri.org/projects?ref=MR%2FJ015903%2F1#/tabOverview. Accessed on 8 June 2021.

[6] He F J, Wu Y, Feng X et al. School based education programme to reduce salt intake in children and their families (School-EduSalt): cluster randomised controlled trial BMJ 2015; 350:h770

[7] He FJ, Zhang P, Luo R, et al. An Application- based programme to reinforce and maintain lower salt intake (AppSalt) in schoolchildren and their families in China. BMJ Open 2019;9:e027793. doi:10.1136/ bmjopen-2018-027793

[8] NIHR Award NIHR Global Health Research Unit Action on Salt China (ASC), Queen Mary University of London. Available via https://fundingawards.nihr.ac.uk/award/16/136/77. Accessed 8 June 2021

[9] Prof Fengjun He. Personal communication, 23 June 2021

[10] Gateway to Research, MRC Research Grant: School-based education programme to reduce salt: Scaling-up in China (EduSaltS). Available via https://gtr.ukri.org/projects?ref=MR%2FT024399%2F1. Accessed 8 June 2021

[11] Gateway to Research: NoToNa: Tackling cardiovascular risk in the adolescent life-course through a schools' salt-reduction intervention in sub-Saharan Africa. MR/R022186/1. Available via https://gtr.ukri.org/project/63E397B2-5B17-4D2C-AC1F-0A13E39FB683#/tabOverview. Accessed 23 June 2021.

1.1 Background

Cardiovascular disease (CVD), principally heart attacks and heart failure and stroke, is the leading cause of death and disability worldwide – and continues to rise.[12] Over the 1990 to 2019 period, cases of CVD worldwide nearly doubled from 271m to 523m, and the number of CVD deaths increased from 12m to 19m. These figures are expected to rise further as a result of population growth and aging, especially in LMICs where the share of older persons is projected to double between 2019 and 2050.[13]

A major factor in CVD is raised blood pressure, caused mainly by high salt intake in people's diets. Evidence shows that even a modest reduction in salt intake lowers blood pressure and reduces the risk of CVD.[14] The World Health Organization has recommended reduced salt intake in food as one of the 'best buy' interventions to tackle the global crisis in non-communicable disease, since it is not only highly cost-effective but also feasible and appropriate to implement within the constraints of the local LMICs.[15] WHO Member States agreed on a voluntary global NCD target for a 30% relative reduction in salt intake by 2025, with the long-term aim of achieving a target of less than 5g per day.[16]

Raised blood pressure caused by excessive salt consumption is highly prevalent in China, the largest developing country, especially in the northern regions.[17] Governments in high-income countries have started implementing action plans, predominately by setting salt reduction targets for processed food which have been successful in lowering salt intake. However, in China and other emerging economies, the main source of salt in the diet is salt added by the consumers during food preparation.[18] However, there were no examples of successful educational programmes leading to lower amount of salt used at home.[19] Although raised blood pressure and CVD typically present in adults, their origins are in childhood.[20,21] Hence, public health strategies to reduce salt intake aimed at younger people have great potential for decreasing CVD later in life.

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[12] Roth GA, Mensah GA, Johnson CO et al. Global Burden of Cardiovascular Diseases and Risk Factors, 1990–2019. JACC 2020; 76(25): 2982-3021. doi: 10.1016/j.jacc.2020.11.010

[13] United Nations. World Population Ageing 2019: Highlights. ST/ESA/SER.A/430. Available via https://www.un.org/en/development/desa/population/publications/pdf/ageing/WorldPopulationAgeing2019-Highlights.pdf. Accessed 7 June 2021

[14] He FJ, Li J, MacGregor GA. Effect of longer-term modest salt reduction on blood pressure: Cochrane systematic review and meta-analysis of randomised trials. BMJ 2013; 346:f1325

[15] WHO. From Burden to "Best Buys": Reducing the Economic Impact of Non-Communicable Diseases in Low- and Middle-Income Countries. 2011. Available via https://www.who.int/nmh/publications/best_buys_summary.pdf. Accessed 7 June 2021

[16] WHO. Fact Sheet Salt Reduction. Available via https://www.who.int/news-room/fact-sheets/detail/salt-reduction. Accessed on 23 June 2021.

[17] Zhao L, Stamler J, Yan LL et al. Blood pressure differences between northern and southern Chinese: role of dietary factors: the International Study on Macronutrients and Blood Pressure. Hypertension 2004; 43:1332-7

[18] Anderson CA, Appel LJ, Okuda N et al. Dietary sources of sodium in China, Japan, the United Kingdom, and the United States, women and men aged 40 to 59 years: the INTERMAP study. J Am Diet Assoc 2010; 110:736-45.

[19] He F J, Wu Y, Feng X et al. School based education programme to reduce salt intake in children and their families (School-EduSalt): cluster randomised controlled trial BMJ 2015; 350:h770

[20] Chen X, Wang Y. Tracking of blood pressure from childhood to adulthood: a systematic review and meta-regression analysis. Circulation 2008; 117:3171-80

[21] He FJ, MacGregor GA. Importance of salt in determining blood pressure in children: meta-analysis of controlled trials. Hypertension. 2006; 48: 861–869

1.2 The award

The School-EduSalt (School-based Education Programme to Reduce Salt) study aimed to develop a novel approach to lowering salt intake, focussing on children in primary school education in China.[22] The idea was that school children who learn about the harmful effects of excessive salt intake will tell their families about the problem. This will persuade parents and grandparents to reduce the amount of salt used in food preparation and result in lower salt intake for both children and their families.

To test this hypothesis, a team of researchers from Queen Mary University of London, UK (QMUL), the George Institute for Global Health, Beijing, China (TGI), Peking University and Changzhi Medical College carried out a trial in 28 primary schools in Changzhi, a city in northern China. The School-EduSalt study was funded by the UK Medical Research Council (MRC) through the 2011 GACD call targeting hypertension (HT04, MR/J015903/1; 2012-2015; £761,888/US$1.17m[23]). In total, 279 ten-year-old children in Grade 5 and 553 adult family members - two per child - participated in the study. Over a 3.5-month period, health education lessons (part of the usual curriculum) focussed on salt intake reduction using lesson plans, activity worksheets and homework assignments developed around cartoon characters. The children's homework included telling their families about ways to substitute salt in food preparation, e.g. with flavourful herbs and spices, and developing a home salt reduction action plan. Parents were kept informed through a newsletter which also contained shared activities, such as a family quiz. To assess whether these activities led to a change in the salt intake, the researchers compared the amount of sodium excreted in urine samples collected over 24 hours from study participants at the start of the trial and again at the end. This is the most accurate method for assessing salt intake.

Stakeholder engagement was a key element of School-EduSalt. The team first talked to policy makers at the local education authority about the importance of reducing salt intake and how the project was planning to tackle this issue. As a result, the local authority fully supported the research and encouraged schools to take part – a crucial endorsement that led to nearly all schools agreeing to participate. The team then met with teachers, students and their parents, to explain why the project was important and to co-design strategies, e.g. for the collection of all urine over a 24 hour period. This achieved a sample collection of high quality, employing strategies such as providing different coloured bottles/jugs for different family members, hanging up a poster in the toilet as a reminder to collect the urine, and logging the start and end time through a home visit. These meetings also provided the researchers with insights into family's beliefs and resulting routines related to the benefits of consuming salt, such as mothers adding extra salt on days the child has PE lessons, and the opportunity to educate the parents about salt reduction.

1.3 Outputs, outcomes, impacts

The School-EduSalt study confirmed that the amount of salt consumed in Changzhi is high, at an average of 11.7g per day for adults, more than double the WHO recommended level of 5g per day. The trial found that educating primary school children about the importance of eating less salt and empowering them to persuade their parents and grandparents to reduce the amount of salt used during food preparations at home was successful in **reducing salt intake by around 25%, in both children and adults**. This was accompanied by a significant fall in the adults' blood pressure. Based on data from blood pressure-lowering trials, the researchers estimated that this decrease in blood pressure would reduce the incidence of stroke by about 9% and ischaemic heart disease by about 5%. In China, this could prevent about 153 000 deaths from strokes and about 47 000 deaths from ischaemic heart disease a year. The findings were published in the British Medical Journal in 2015.[24]

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[22] He F J, Wu Y, Feng X et al. School based education programme to reduce salt intake in children and their families (School-EduSalt): cluster randomised controlled trial BMJ 2015; 350:h770

[23] Gateway to Research, MRC Research Grant: A school-based education programme to reduce salt intake in children and their families. Available via https://gtr.ukri.org/projects?ref=MR%2FJ015903%2F1#/tabOverview. Accessed on 8 June 2021.

[24] He F J, Wu Y, Feng X et al. School based education programme to reduce salt intake in children and their families (School-EduSalt): cluster randomised controlled trial BMJ 2015; 350:h770

The research team also conducted sub-studies to gather further evidence on whether the School-EduSalt intervention is suitable for broader use. These led to three publications:

- In northern China, salt is iodised to prevent iodine deficiency. However, despite the 25% reduction in salt intake, the researchers were able to confirm that participants' iodine intake was still adequate.[25]
- A cost-effectiveness analysis concluded that implementing the School-EduSalt intervention carries a relatively low cost and would be highly cost-effective, and even cost-saving in the best scenario, if rolled out across China as a long-term government-lead policy strategy.[26]
- Children's behaviour is shaped by their social network. The School-EduSalt study showed that children with supportive social networks (family, friends and teachers) were more likely to reduce their salt intake. The finding indicates that future salt-reduction programmes may benefit from strategies that actively engage families and teachers, and that enhance interconnectivity among peers.[27]

Taken together, **the School-EduSalt findings suggest that an education programme delivered to primary school children as part of the usual curriculum can be used to lower salt intake in children and their families, and that the WHO's target of 30% reduction in salt intake by 2025 can be achieved in China**. This also presents important opportunities elsewhere: Traditionally, prevention and control of hypertension are managed within the healthcare system, but health systems in China and other developing countries have little capacity for prevention.[28] School-EduSalt's approach draws on the education system to deliver the intervention and brings the additional benefit that it reaches a wide range of the population, from children to adults. By including children, the intervention has the potential to set habits and attitudes in younger generations that will persist throughout adulthood.

The research has had a wide reach, and has been disseminated to policy makers, health professionals and a large proportion of the general population. Members of the National Committee of the Chinese People's Political Consultative Conference with an interest in salt and health were provided with a book on the intervention programme and research findings. WASH (World Action on Salt and Health) and The George Institute issued press releases when the main trial results were published in the BMJ, which were picked up by a range of media outlets and generated wider media coverage in the UK, China and other countries.[29] The BMJ paper has received a high attention score compared to outputs of the same age and source (89th percentile).[30] In addition, the PI

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[25] He FJ, Ma Y, Feng X, et al Effect of salt reduction on iodine status assessed by 24 hour urinary iodine excretion in children and their families in northern China: a substudy of a cluster randomised controlled trial. BMJ Open 2016; 6:e011168. doi: 10.1136/bmjopen-2016-011168

[26] Li X, Jan S, Yan LL et al. Cost and cost-effectiveness of a school-based education program to reduce salt intake in children and their families in China. PLoS ONE 2017; 12(9):e0183033. https://doi.org/10.1371/journal.pone.0183033

[27] Ma Y, Feng X, Ma J, et al Social support, social network and salt-reduction behaviours in children: a substudy of the School-EduSalt trial BMJ Open 2019;9:e028126. doi: 10.1136/bmjopen-2018-028126

[28] Liu Q, Wang B, Kong Y, Cheng KK. China's primary health-care reform. Lancet 2011;377:2064-6.

[29] E.g. Food Manufacture: Children help cut parent's salt intake. March 2015. Available via https://www.foodmanufacture.co.uk/Article/2015/03/20/Salt-intake-slashed-with-kids-help; BHC Medical Centre News: Could your children teach you about salt? Dec 2015. Available via https://bhcmedicalcentre.com.au/mfood/could-your-kids-teach-you-about-salt/; The Conversation: No Need to Pickle Children: Get Big Food to Cut Salt for Better Health. May 2015. Available via https://theconversation.com/no-need-to-pickle-children-get-big-food-to-cut-salt-for-better-health-39123. Accessed 8 June 2021

[30] Altmetric - Overview of attention for article published in British Medical Journal, March 2015. Available via https://bmj.altmetric.com/details/3803289/citations. Accessed on 8 June 2021.

and other study team members have presented the results at numerous national and international conferences, to audiences including academic researchers, health professionals, and policy makers.

Strong stakeholder engagement underpinned the success of the project. Asked if she would make any changes to the trial in hindsight, the study's PI, Professor He, commented: *"I wouldn't have done anything different. It went so well and it was better than I expected, it was really amazing. We learnt so much from the study. It was really interesting to talk to all of the children and parents and teachers. You could see that they were so keen to get out the message."*[31]

1.4 Further work and potential for future impact

In 2017, the QMUL-TGI team secured funding from the UK National Institute for Health Research (NIHR) to set up the UK-China Collaboration Unit 'Action on Salt China' (ASC). This NIHR Global Health Research Unit is funded over 4.5 years through a £6.6m award (2017-2021).[32] The collaboration expanded to include additional partners in China, such as the Chinese Center for Disease Control and Prevention (China CDC) and the Chinese Center for Health Education (CCHE), and several provincial health and education authorities. The ASC is testing several packages for a comprehensive salt reduction programme in China, targeting salt intake reduction in different settings and populations. Building on the findings of School-Edusalt, one strand of the ASC involved the development of an application-based programme (AppSalt) to provide educational content (in place of the in-school programme), and to allow children and their families to monitor their salt intake at home.[33] The app was tested in a cluster randomised controlled trial; while the full analysis is still under way, preliminary results were encouraging.[34]

In 2018, the research team secured further funding through the GACD Scale-up call, to test whether an educational programme aimed at school children and their families can be successfully delivered across multiple settings in China. The project 'School-based education programme to reduce salt: Scaling-up in China' (EduSaltS) is supported by the UK MRC and NIHR (SU14, MR/T024399/1; 2019-2023; £2.5m/US$3.16m[35]). It involves the School-EduSalt collaborators along with new partners, e.g. from Beihang University and the National Health Education Centre.

EduSaltS aims to first deliver education on salt reduction via the existing school health education system in three cities in China. This research will involve at least 100 schools per city, covering a population of 3.2m (1.1m children and 2.1m adults) in rural and urban areas. Participating schools will be able to choose between the in-person educational package or the app developed as part of the ASC, depending on local context and preference. While the Covid-19 pandemic has led to delays, the team has prepared the intervention materials and completed one of the study pilots as planned.[36]

[31] Prof Fengjun He. Personal communication, 23 June 2021

[32] NIHR Award NIHR Global Health Research Unit Action on Salt China (ASC), Queen Mary University of London. Available via https://fundingawards.nihr.ac.uk/award/16/136/77. Accessed 8 June 2021

[33] He FJ, Zhang P, Luo R, et al. An Application- based programme to reinforce and maintain lower salt intake (AppSalt) in schoolchildren and their families in China. BMJ Open 2019;9:e027793. doi:10.1136/ bmjopen-2018-027793

[34] Prof Fengjun He. Personal communication, 23 June 2021

[35] Gateway to Research, MRC Research Grant: School-based education programme to reduce salt: Scaling-up in China (EduSaltS). Available via https://gtr.ukri.org/projects?ref=MR%2FT024399%2F1. Accessed 8 June 2021

[36] SU14 – EduSaltS. Available via https://www.youtube.com/watch?v=Sf7jKHkt8uc. Accessed 8 June 2021

The team is planning to start the scale-up study in September 2021. In the final phase, planned for 2023, the intervention will be rolled out nationwide.

Students learning about salt reduction in class (You County, Hunan Province, China).

Source: EduSaltS study team

Again, as for School-EduSalt and the ASC collaboration, the researchers set up the study with a clear pathway to implementation. The Chinese Center for Health Education, whose Director General is a co-PI for the study, is a national governmental organisation which can facilitate dialogue with educational authorities at local, regional, and national levels to gain support for the research and ensure schools' participation. Working with policy makers through established trusted connections will also be a key factor in securing policy support for a national roll-out, should the scale-up study yield positive results at the regional level. Sustained engagement through School-EduSalt, ASC and now EduSaltS has raised the authorities awareness of the importance of the work, and built a strong level of support, paving the way for implementation of the intervention. As Xing Li, Deputy Director of Education at the education authority in Changan district, Shijiazhuang city, commented on the research: *"It is the first time that I am involved in this kind of health educational project. I used to think that salt reduction is only related with adults and I didn't realize the importance of salt reduction on children until I came into contact with this project. Salt reduction has far-reaching impact to the children and their families. I am willing to put my effort to do this project well and help the children establish a healthy lifestyle."*[37]

The GACD Network has provided a supportive forum for the study team to learn about salt intake in other geographies and share experiences in (and challenges to) implementing research projects with other teams. The scale up project EduSaltS has joined with the other GACD scale up projects in participating in a GACD workgroup applying a systems lens to identify the challenges, enablers and barriers to scale-up.**School-EduSalt is also informing efforts to reduce salt intake elsewhere**. Modelled on the EduSalt trial, a research team is carrying out a salt reduction study in Malawi, the 'NoToNa' study, funded by the UK MRC.[38] Professor He is a member of NoToNa's Trial Steering Committee and has provided support to the study, e.g. via input to the protocol and analysis plan and sharing her experience and expertise gained from the School-EduSalt trial. Similar

[37] Stakeholder interviews, Action on Salt / AppSalt, June 2020 Shijiazhuang City, Hubei Province, China

[38] Gateway to Research: NoToNa: Tackling cardiovascular risk in the adolescent life-course through a schools' salt-reduction intervention in sub-Saharan Africa. MR/R022186/1. Available via https://gtr.ukri.org/project/63E397B2-5B17-4D2C-AC1F-0A13E39FB683#/tabOverview. Accessed 23 June 2021.

to EduSalt, NoToNa study team includes researchers from the UK and a local research unit, as well as policy makers from the Malawi Ministry of Health and the School Health and Nutrition programme – standing the study in good stead for impact on policy and health.