Journal of Transport & Health 15 (2019) 100665

Contents lists available at ScienceDirect

Journal of Transport & Health

journal homepage: http://www.elsevier.com/locate/jth

Beyond "safe": Chilean "Kool" routes to school address social determinants of health

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ARTICLE INFO

Keywords:
Sustainable transport
Equity
Safe routes to school
Obesity epidemic
Social determinants of health

ABSTRACT

An abundant literature has examined the usefulness of "safe routes to school" programs to increase active transport (mainly walking and cycling) and with it levels of physical activity, hence health. To date, these have been applied mainly in the Global North, where they are supported by national networks and government.

Conditions in developing countries differ. While the obesity epidemic is rife, the sustainability trio of walk-bike-bus/Metro account for high percentages (66% or more) of daily travel (LTAAcademy, Singapore, 2011). In a rapidly urbanizing world, with 90% of its population already living in cities, Chile offers an excellent opportunity to study these issues. Both adults and children in Chile have extremely high rates of sedentarism (over 90%), overweight and obesity. This raises interesting questions about the potential impacts of programs focusing on active transport for school children in the Global South.

This research originally sought to explore potential for improving physical activity. Working with teachers, principals, local government and students in one of Chile's most vulnerable municipal jurisdictions, we created a program to raise awareness of sustainable transport impacts on children's health and happiness. As the program advanced, partners requested a broader agenda of participatory planning to transform territories around schools.

Findings to date reveal considerable potential for transformation in challenging spheres, including gender roles, gender-related violence and social insecurity, road safety, traffic calming, environmental and civic education. This suggests that, at least in developing countries, co-creating and innovating to achieve suitable adaptations of these programs with local actors should receive careful attention, to mobilize their potential for generating responses to a broader public policy agenda, able to address the social determinants of health.

1. Introduction: Adapting "safe" routes programs to address health issues in Chile

Sedentarism, obesity and related costs to health are crucial to Chile's efforts to provide quality health care, a major policy goal since the end of the military regime (1973–1990). Among OECD countries, Chile ranks 8th for obesity among adults, 2nd in Latin America (OECD, 2017). For children, Chile ranks 2nd in Latin America, after Mexico, for sedentarism and obesity.

Obesity and related health pathologies have risen steadily since the 1960s, with obesity reaching 38.4% among women and 30.3%

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https://doi.org/10.1016/j.jth.2019.100665
Received 26 February 2019; Received in revised form 27 September 2019; Accepted 10 October 2019
Available online 14 November 2019

among men (2017), similar to the US, the world leader (p. 23, Mardones et al., 2018). While malnutrition has declined, 34.6% of boys and girls under six years suffer from overweight or obesity. Similarly, among children starting primary school, rates hover around 25%, depending on whether they are pre-school (3–4 years old), kindergarten (5 years) or grade one (6 years) students (p. 26, Mardones et al., 2018). For the population overall, overweight and obesity affect 70% of the population, with obesity more common among women, in rural areas and low- to mid-income households (p. 28, Mardones et al., 2018).

Among children, overweight and obesity are associated with low self-esteem, depression and social exclusion, while childhood obesity is associated with cardiovascular mortality in later life. Overweight is also associated with higher rates of absenteeism from school, among children, and from work, among adults. A recent study indicates these conditions weigh heavily on the Chilean economy, with related costs in terms of health care, disability, absenteeism and premature mortality reaching 0.54% of GDP, and trending toward 1.46% of GDP in 2030 (Centro Avanzado de Enfermedades Crónicas, 2017, cited on p. 31, Mardones et al., 2018).

Moreover, the links between transport and health have become well established in recent years (Frumkin et al., 2004; Mindell et al., 2011; Rydin, 2012; Boniface et al., 2015; Mindell, 2017; Götschi et al., 2015; Mueller et al., 2015; Rydin et al., 2012). Risks to health arise from urban streetscapes increasingly dominated by the private car (Beckmann, 2001; Sheller and Urry, 2000; Urry, 2004), and include exposure to crashes, air pollution (Mindell, 2018), loss of spaces for sociability (Appleyard et al., 1981), isolation (Anciaes et al., 2016), recreation, play (Hillman et al., 1990; Hillman 1999) and diverse forms of physical activity.

At the same time, the positive effects of walking and cycling have become well established, and outweigh the risks by significant magnitudes (Teschke et al., 2012; Tainio et al., 2016). The "safety in numbers" paradox has revealed that the more people walk and cycle, the lower the rate of crashes and mortality among pedestrians and cyclists (Jacobsen, 2003; Putnam, 2000; Jacobsen et al., 2015; Elvik and Bjørnskau, 2017).

Pollution, social and road risk, however, tend to severely limit children's use of streets, the main public space in many urban neighbourhoods, undermining their healthy development (Hillman, 1999; Hillman et al., 1990). In the Global North, these concerns have led to widespread application of "safe routes to schools" programs. Created in Denmark in the 1970s, pilots have nourished the emergence of national networks in Canada, the UK and beyond, providing handbooks, policies and guidelines (SafeRoutesPartnership, 2019; NCSRS and CSN, 2011), "to make it safe, convenient, and fun for children to walk and bicycle to and from schools. The goal is to get more children walking and bicycling to school, improve kids' safety, and increase health and physical activity" (SafeRoutesUS, 2018).

In developing countries too, car-dominated roads cause major harm to children (UNEP/FIA, 2016). Risks are compounded by concern about public safety, gender and other forms of violence, including crime. While the obesity epidemic is rife throughout the Global South, walking, cycling and public transport (the "sustainability trio") account for high percentages (66% or more) of daily travel (LTAAcademy, 2011). This reflects socio-economic contexts that are very different from developing countries, where private cars tend to be the majority mode. In our cities, cars take up most of the space but move a minority of the population, making equity a central concern.

With 90% of its population already living in cities and major challenges regarding overweight and sedentarism, Chile offers an excellent opportunity to study these issues. Thus, our research initially sought to explore the potential of a Chilean adaptation to improve physical activity among school children in a vulnerable neighbourhood. Once a full program was developed with schools, we expanded to test its applicability under different conditions.

Combining actions and different actors — health, transport, public space, urban planning, education — is a challenge in today's governance environment. The evidence presented here suggests that expanding the focus of school programs to consider broader urban and social concerns, as we have done with our Kool Routes program, could assist in mobilizing communities to achieve multiple objectives, within a single, relatively simple approach. Indeed, our research indicates these programs can offer effective responses to a broader public policy agenda, able to address factors (social equity, human agency) usually considered within the framework of social determinants of health. This is particularly important in the Global South, where challenges are acute and resources scarce.

In this kind of research, ***methods, results and findings*** overlap and interlink. We have opted for a longer than usual methods section, to present a more detailed description of our PAR approach and the specific methods used to involve partners in co-creating specific programs for their schools. In section 3 we look at results, understood as how well the programs were integrated into the school settings; and findings, in terms of implications that could contribute to general knowledge, particularly in developing countries with complex problems and scarce resources. We close with some final reflections.

2. Methods: PAR to co-create a made-for-Chile program

This research was carried out by a collaboration, the *Laboratorio de Cambio Social* (Laboratory for Social Change), created by Living City, a community-based, citizen-led urban planning organization, and three research centres at the Pontificia Universidad Católica de Chile: the Department of Transport Engineering and Logistics, the Centre for Sustainable Urban Development (CEDEUS) and the Centre for Excellence in Bus Rapid Transit (BRT+). Our general research strategy involves partnering with lead community organizations, local and regional governments, and other practitioners to leverage diverse knowledge — experiential, technical, academic and theoretical — simultaneously. This requires a constant dialogue between theory and practice and typically involves multiple disciplines and methods, usually anchored in geography and planning, but including engineering, architecture and anthropology.

In late 2016, we began our Kool Routes program with a two-person team, consisting of a male anthropologist trained in gender and new masculinities, and an experienced female teacher, both with backgrounds in cycling, cycling pedagogies, mechanics and related fields. The challenge was to go beyond walking-cycling routes and/or teaching children to cycle. We needed to encourage children to re-value sustainable transport modes, particularly the walk-bike-bus trio (Sagaris and Arora, 2016; Sagaris et al., 2017; Sagaris and

Tiznado-Aitken, 2018), favourable to addressing transport-related social issues. We felt we could make no assumptions about specific communities: to this day, every new phase of our program begins with 2–3 months of exploratory workshops, where we share information on walking, cycling and sustainable transport, and co-design the program with local partners.

We started in three schools (2016) in El Bosque, one of Chile's poorest municipal jurisdictions, located in metropolitan Santiago, then selected the Escuela Mario Arce Gatica for full program development (2017–2018). By late 2017, we had a complete program from pre-kinder to eighth grade (from 3 to 13 years of age), as part of extracurricular activities. In 2018, the opportunity of integration in the regular curriculum arose, combined with demand from partners to reach beyond the school and act on the surrounding area, and we expanded to other neighbourhoods, as discussed below.

Consequently, we also began to apply these modules elsewhere (Independencia, Padre Las Casas and Lautaro), to test program robustness. Table 1 provides a summary of the main characteristics of the places where we have worked to date. Evaluations consist mainly of monitoring through exchanges with partners, coordination with city officials, video-taped interviews with participants and partners, and team meetings to examine results and plan next steps. Several short videos in (Sagaris et al., 2017, 2019) document methods and feedback from partners and participants.

Data took the form primarily of ongoing observations by the team leaders, conversations and evaluations with instructors and other participants, photographs (duly authorized by students' parents), and field notes, kept in a process diary and enriched with additional feedback from participants, including interviews for the video capsules that have summarized each stage of the process.

We also reached some conclusions regarding the program's policy potential based on petitions for us to expand to additional schools, neighbourhoods and cities, and the successful application for additional funding for the Lautaro part of our program. Finally, this work produced specific documents, technical educational specifications for the program's integration into the regular curriculum for different subject matters and reports to funders, university and peer groups, and presentations and exchanges during academic, practitioner and advocacy conferences. Information on women, safety and transport; sustainable transport patterns, innovations in collaborative governance to improve citizen participation are part of other lines of our research, and enriched our inputs to this program.

2.1. Participatory Action Research for social transformation

Participatory Action Research (PAR) has a long history in developing contexts, and can be defined as "a participatory, democratic process concerned with developing practical knowing in the pursuit of worthwhile human purposes" (p. 1, Reason and Bradbury, 2008). These authors note that it differs from traditional academic research, in that it is based on "different relationships, and has different ways of conceiving knowledge and its relation to practice".

Our action research approach builds on the ethics and the pedagogy of oppression/liberation developed by Paolo Freire (1998), which defines knowledge as intrinsic to people, and not an abstract value that can only be collected or disseminated by specially trained experts. From this perspective, we teach to learn, and those who work with us learn by teaching — us, each other, and other actors within socio-political systems relevant to urban planning and social change.

To do this, we apply a variation of "action science" as developed by Argyris and Schön (1974), which involves an "action scientist" who is an "interventionist", seeking to promote learning in a client system and to contribute to general knowledge (Argyris et al. quoted on p. 131, Friedman, 2008).

In our case, our research team started from existing partnerships with the urban planner at the El Bosque municipality, who connected us with school directors struggling with the challenges of serving very vulnerable school populations. We met with senior staff who supported the idea of a special program to raise issues of transport, health and gender, and offered us specific venues for carrying out a series of exploratory workshops with some of their students.

Friedman identifies four key components of action science: creating communities of inquiry within communities of practice;

Table 1
Rutas Bakanes: Comunas (municipal jurisdictions).

Starting date	Location	Main characteristics	Population 2017 census	Poverty	Modal share	
					Walk + bike + bus	Car
2016	El Bosque, Metro Santiago	Municipal jurisdiction on the outskirts of Metropolitan Santiago with high levels of vulnerability and poverty	162,505 total; 33,017 under 15 years of age	14.5% (almost triple the average for Santiago)	52%+ 3%+14%	17%
2018	Lautaro, 9th Region de la Araucanía	Small rural town with significant proportion of indigenous communities in the region.	38,000 total; 8440 under 15 .	30%, 10% higher than regional average	N/A	N/A
2018	Independencia, Metro Santiago	Municipal jurisdiction close to centre of Metropolitan Santiago, with mixed population, mainly low and middle income	100,281 total; 16,834 under 15.	10% (2015 data)	40%+ 4%+23%	25%

Source: Own elaboration using data from factsheets prepared by the Chilean National Library of Congress (reportescomunales.bcn.cl/2017/index.php,/Página_principal) accessed 11 December 2018. Modal share information from origin-destination survey (SECTRA 2012).

building theories in practice; combining interpretations with 'rigorous' testing; and creating alternatives to the status quo that inform change in light of values freely chosen by social actors (pp. 133–134, Friedman, 2008). For this research, we started by joining the community of practice associated with specific schools, to involve students and teachers in thinking about a gender-sensitive, sustainable transport-oriented version of safe routes to schools.

Friedman's "community of inquiry" was implicit — we did not ask overworked teachers and staff to participate in abstract research. Rather, we offered a program that, we hypothesized, could be tailored to their needs and possibilities and, in fact, were able to co-create a set of modules through conversations with staff. We then tested and refined these modules, using activities that encouraged engagement and friendly conversations. Students' response was our main criteria for adjustments.

In Friedman's sense, our testing was "rigorous", in that it moved from "more abstract interpretations", ie "Safe routes to school programs could be good for Chilean school children," to more concrete, directly observable interpretations. We sought to answer relatively simple, but central, research questions:

Could we convert the idea into a successful practice?
Did it stir interest in the broader community around the school and, if so, what reasonably simple techniques could mobilize people effectively to achieve the necessary urban and social changes?
Did the program show enough potential for development as a general policy and, if so, under what conditions would this be most likely to succeed?

We are conscious that this research progresses up and down different scales and through iterative steps, as framed by some complexity theorists: we consider communities social *ecologies* in Holling's sense (2001), apply complexity as both explanatory and meaning-building metaphor (Chettiparamb, 2006; Chettiparamb et al., 2011), and as a lens for better understanding processes of change in cities (Byrne, 2001) and specific case studies (Byrne, 2005). These perspectives underline the *embeddedness* of scales, in our case the individual, embedded in a classroom - a school - a neighbourhood - city - region and country, all interconnected and highly relevant to the success of an individual program and a general policy.

We processed our observations during discussions in regular coordination meetings throughout program implementation, workshops with city partners, consultations with teachers, and other formal and informal activities that were recorded as an annual report (2016), a detailed curricular program and teachers' guide (2017), a report on new initiatives in Independencia (2018), revised project proposals for new programs (2018), and short films, photographs from activities, and notes from meetings and other written exchanges, including observations regarding field activities (2016–2019). As recommended for this kind of research, we present our "data" in mainly narrative form, summarizing key points and lessons, which are particular to each case, but may be relevant to others, elsewhere, grappling with similar research, theory and practice issues. This is coherent with our understanding that social reality is socially constructed.

In Byrne's sense, we use "dialogical research as an iterative process of elucidation of what is and how what is has come to be." This allows us to establish the "back trajectories of the systems of interest with a view to developing those systems in accordance with intentions and desires as expressed by the citizenry in interaction with 'experts'" (pp. 175–176, Byrne, 2003).

In other words, we generate situations with our program, and then we look backward to identify barriers and facilitating factors, in an ongoing process. Our conversations also reach backward to identify the roots of children's beliefs and offer them opportunities to modify and enrich them, and the practices and habits that result. From this perspective, as discussed below, we have identified some interesting results that could evolve into more complete theories of practice, Friedman's third criteria, but are still in the early stages, and do not make major theoretical claims.

On Friedman's fourth criterion, our program did seek to generate alternatives to the status quo, defined in our case as passive transport (cars and private buses) and passive forms of road safety, gender and other types of education. As discussed in more detail under findings, the program has generated new values and actions that are freely chosen by the communities of practice with whom we have engaged.

2.2. Specific methods applied in developing the school program

2.2.1. Phases, places and partners

Given equity considerations, we selected a low-income neighbourhood with strong links between the municipal government and community organizations. Located on the southern periphery of Metropolitan Santiago, El Bosque, posts a very high modal share for walking (52%, versus the city's average of 34%), less than average cycling (3% versus 4% for the city overall), and lower than expected use of public transit (14% versus 25% on average for the city overall). It became the focus for phase 1, exploration, development and testing of a school program from pre-school to eighth grade (2017).

Activities remained mainly in schools during this period. In 2018, we expanded to test the program in different contexts, specifically the centrally located, low- to middle-income *comuna* of Independencia, across the Mapocho River from downtown Santiago, and the towns of Padre Las Casas and Lautaro.

During our exploratory phase in El Bosque, we applied a one-day workshop in two schools, during which we tried out different activities and concepts, which developed into a four-week program to explore children's thoughts about gender, mobility, obesity, sedentarism, sustainability, and equity.

At the Paul Harris, a high-performing primary school, we developed an extracurricular program, part of "Fun Thursday" activities: these went over well, but there was a high turnover in groups, which changed every week. For the Mario Arce Gatica, a school that

accepts very vulnerable students often rejected by other schools, the program was mandatory for all students of 3rd, 5th, and 7th grades (children from 8 to 12 years old), as part of classes. This provided significant insights into program strengths and weaknesses when applied to the general population, rather than a select group of volunteers.

Based on the results from El Bosque (2016–2018), we expanded into the Independencia *comuna,* to the north of Santiago's city centre. Here, rather than the school itself, our lead partner was the education department within the municipal government. This department had already tried a safe routes program, which was not working. We carried out an exploratory pilot, using modules developed in El Bosque, in one school (2018) and developed a complete program for three additional schools in 2019.

Through the Lab's collaboration with the southern region of Temuco-Padre Las Casas, the city of Lautaro asked us to develop a program for all six public schools. Located in the region of La Araucanía, 800 kms south of Santiago, daily rainfall tends to equal annual rains in Santiago. Weather was perceived as a significant barrier to active transport. One sixth of the Mapuche, Chile's largest indigenous group, live in this region, making rights and culture central to political and daily life.

Lautaro had generated a significant governance modification: a roundtable to improve cooperation between health, sports and education areas. This allowed us to capitalize on the virtues of each. Health offered communications with primary health centres interested in promoting active transport, while sports offered local gyms so we could function rain or shine (it rained a lot), and education coordinated with schools. This internal alliance proved a goldmine. In contrast to El Bosque, where we became overwhelmed by coordination tasks, the Lautaro arrangement has assured coordination by municipal staff themselves, and extraordinary buy-in from schools and students.

3. Results and findings: Careful adaptation to local realities for multiple benefits

The first result from our exploratory workshops in El Bosque emerged when students insisted they did not want safe but rather Kool Routes, to school. More than a simple change of name, their insistence and the diverse, complex and sometimes heartrending situations we discovered in this early program discouraged a "cut-and-paste" approach: we could not follow guidelines from programs in the Global North, but rather had to listen to our students and teachers, and make the most of every asset. This made specific, local innovations the centre of all program development. We developed a central core of methods, modules, games and other activities (Fig. 1), but chose which to use, how, when and where, in conjunction with local staff and in response to children's own interests.

We have organized this section using the three main questions presented under Methods.

Fig. 1. Scenes from Kool Routes, as it reached beyond the school, to change the surrounding urban environment. Top left, collaboration to change gender roles in favour of greater equality between boys and girls; top right, Please slow down, 20 km/h maximum: grandmothers crossing. Bottom left: leadership and collaboration to paint a zebra crossing; and bottom right, girls learning cycle mechanics, as part of understanding women too can work in transportation. Source: Rutas Bakanes archives.

3.1. Could we convert the idea of safe routes into a successful practice?

We evaluated "successful practice" in terms of students' level of participation and enjoyment, and in terms of whether teachers boycotted or participated/aided the process. We were also able to compare the results from the volunteer program (Paul Harris) with results where the program is more fully integrated into regular course work (the schools that followed). We found both students and teachers liked and contributed to building the programs, as presented in more detail below.

3.1.1. Lessons from schools

In the most vulnerable schools, we found children tended to react violently to disagreement. This occurred when the group had to choose what type of game, urban intervention, or other smaller task. Particularly boys', but also some girls' first reaction to any "problem" was violence and, if answered by violence, would quickly escalate. Teachers helped maintain order, but at first, we did not know how to respond. Children's daily lives teach them that violence is an appropriate response to most problems. Indeed, the urban landscape around some schools is extremely violent, with decayed streets, smashed pavements, vandalized bus stops, unmaintained "green" areas, drug and alcohol use in broad daylight, scenarios, moreover, for institutional violence coming from police or other authorities.

As sessions progressed, we noted fewer disruptions and teachers reported a noticeable increase in children's levels of collaboration and participation (recorded interviews, Laboratorio de Cambio Social 2018). Degrees of violence varied among the schools, but all presented some degree, whether verbal, physical, psychological, gender, transphobic or homophobic, which emerged and were processed using the methods described in the next section.

3.1.2. Casual conversations to bring out key issues

Casual conversations helped to identify alternative strategies for responding to problems of violence, fear, aggression and discrimination routinely faced by most children. School outings used public transit to visit the outdoor train museum or the control centre for the public transit system, raising questions and improving understanding of "sustainable" and "socially just" transport. When we began, we used a survey and later a poster-style origin-destination poll, finding that children generally identified with the car as the desirable mode. In response, our workshops used arts and crafts to show the advantages of buses over cars (carry more people in less space, with lower emissions per person). Similarly, children learned from operators to plan better bus routes, painted colourful new signs for streets and bus stops, and heard from the winner of the Best Woman Bus Driver Award or a woman bike messenger on women in male-dominated work.

From the Mario Arce Gatica school, we learned that although urban mobility might seem "boring", it can also empower, stimulate curiosity, and generate civic engagement and agency at a young age. Creative games that mixed traditional Chilean games with mobility issues were a great success, as was walking through neighbourhoods, critically "grading" streets and sidewalks around schools. Children voiced opinions and discussed local experience, transforming their observations into proposals for changes, through a participatory and collective process, often supported by artistic activities.

These experiences in different contexts underlined the importance of responding flexibly to educational agendas: schools taught us a lot about what facilitates implementation. Paul Harris's "Fun Thursdays" stimulate creative activities, but since children choose — every time — we had new students in every class, making it hard to consolidate. This contrasted with schools where our program became part of regular classes attended by all students, improving learning and increasing teacher participation. As with programs elsewhere, commitment from the school administration is a strong contributor to good outcomes, making their inclusion in every aspect central.

3.1.3. Gender empowerment and re-education

Baseline conversations revealed little gender awareness, with default ideas reflecting traditional, patriarchal values that separate women into carers and men into doers. The children participated actively in thinking critically about these preconceptions, especially when the conversation was rooted in an entertaining activity. A dual gender focus was necessary: we found that the boys needed to address violent, homophobic, misogynist, and "machista" attitudes, which required a stronger focus on developing social skills. With girls, we focused on empowerment, but also generating support for their capacities as agents and leaders. We did not interact with explicitly trans, non-binary, or dissident gender identities, as none were self-identified, but children showed great interest in these topics, since they do not normally get the chance to discuss them.

This module was first tested during the volunteer program at the Paul Harris school, and was well received, so became a permanent part of the program. Instructors explored concepts of gender, gender relations, and equity, with children from 8 to 13 years of age, as we taught them bike mechanics. We heard about pre-conceived gender biases (i.e. girls can't handle tools or boys are stronger) and normally unspoken rules on gender-related behaviour.

The first mechanics group (Paul Harris) began mainly with boys, but over the first month, more girls joined. Girls enjoyed handling tools, taking bikes apart and repairing. In fact, their participation revealed strong empowerment and belief in their own agency. The main difference between boys and girls arose squarely in terms of social skills, specifically their abilities to act collectively. While boys were prone to fight each other for tools or who would fix which part of a bike, girls supported each other. In fact, they tended to get the bikes running in half the time required by boys.

We found that the younger the children, the less trouble they had questioning pre-conceptions, especially when the conversation was grounded in specific, daily examples. For example, we asked boys their opinions on girls using tools and heard "they're not strong enough" or "it's just not a girl thing". When asked if their mothers knew how to use tools, however, they all said proudly "of course",

with some adding "my mom fixes everything at our house". Examples like this were common, bringing out meaningful contradictions that allowed them to reconsider.

When asked to evaluate the program, teachers emphasized the values of collaboration and peaceful conflict resolution, and highlighted the importance of learning about transportation, the environment and how to care for the city and each other by making better transport choices (filmed interviews, Laboratorio de Cambio Social 2018).

3.1.4. Games to measure equity and attract arts-centred students

Games became a permanent part of the program and our team has continued to develop its skills through our own practice and through training at international fora such as the World Bicycle Forum and the Velo-City global cycling conference.

The fundamentals for this aspect of our pedagogy were designed at the Mario Arce Gatica school, and have accumulated lessons from each new context. Our program typically begins with children sharing stories about how they move around their neighbourhoods, and we then relate these experiences to sustainable transport and mobility. Our first attempt produced one of the most enriching

Fig. 2. Sample report detailing activities in the Women's cycling program, including photographs of activities, 30 May 2019.

methods: games that allow children to understand space and equity on streets (Why do three cars that can carry 12 people crowd out buses carrying 100?). We also introduced a diversity perspective, getting them to experiment with walking blind, with a baby, or carrying bags on public transport. We walked around the neighbourhood to critique streets, crossings, and pedestrian space. Above all, the program focused on making urban mobility fun and understandable for kids from 9 to 13 years of age.

An artist, involved in repainting downtown Santiago streets to improve walkability, joined the team, teaching children to design street signs, icons for "Kool Routes" and other components. These activities attracted children who dislike sports. This phase culminated in 2017 with a participatory painting of a pedestrian crossing outside the school, where the existing crosswalk had faded for lack of maintenance. With cooperation from bus drivers, teachers and support staff we created a safe setting for the children to paint a zebra crossing. Sadly, national transport authorities denounced this activity, and the municipality erased the crossing with black paint, promising to replace it with a crossing that met regulatory standards. As of December 2018, this promise remained unfulfilled.

3.1.5. Major progress: Integration into the regular curriculum

In Independencia, strong support from the education director contributed to substantial buy-in from the principal, school coordinators and teachers. This facilitated connecting program goals, school expectations, municipal objectives, and created spaces to voice concerns, experiences, opinions, and proposals. These enriched the program and simplified implementation, in a municipality where we had not worked before. Kool Routes was incorporated as part of regular course work, bringing more active support from students and teachers. This allowed us to contribute to, rather than distract from goals for each grade and constituted a major breakthrough, although we did not realize it at the time.

Independencia demonstrated the importance of active participation in program approval, but also design and implementation, to ensure ease of application and success. This approach also prevented friction, through a better understanding of the different hierarchies, roles and functions (i.e. Municipal Director of Education, School Principal, Inspector, Teacher, etc) and reinforced buy-in, as everyone felt in charge. By the end of the pilot (2018), the school asked the Lab to take on three more classes, and the municipality requested we take on three more schools (2019).

3.2. Did it stir interest in the broader community around the school and, if so, what reasonably simple techniques could mobilize that interest effectively to achieve necessary urban and social changes?

In 2018, local planning staff in El Bosque invited us to work more closely with different departments, a process that led to on-street, car-free activities in the neighbourhoods around three schools. This aspect of the program was designed to reach out to local *juntas de vecinos* (neighbourhood associations), which exist throughout Chile.

Thus, we went from Kool "routes" to a "Kool triangle". One offshoot was that we developed a complementary, "Flying around El Bosque - Cycling for Women's transport" program, when mothers approached us during a car-free event, asking what we could do for them. We partnered with the local Women's Centre (2018–2019) in a program that culminated in May 2019, with 28 women learning to ride, plan safe routes, carry children, and use a tricycle for cargo, an activity led by an instructor and leader of the local association of informal recyclers (Fig. 2).

In terms of our research, we realized that we were following a "snowball" pattern of dissemination, connection with new partners and expansion, which has proven a permanent part of the research process. New partners hear what we are doing and want to bring the program into their schools, which strains our limited research budget, but opens the way to new research on models for service delivery, which has become increasingly important in 2019–2020.

In terms of the program, these developments made us stop thinking only about "lines" (routes) and start thinking about space — reorganizing whole territories to make them more woman- and child-friendly. At the practical level, the tasks involved in coordination with up to 10 municipal departments, neighbourhood and other associations became extremely onerous, and threatened to undermine the quality of the program, leading us to evaluate, redefine skills and priorities, and seek additional resources.

With project funding from the national development corporation, Corfo, the smaller scale of Lautaro (2018–2019) and the enthusiasm of local authorities revealed several innovations that could be highly relevant for peer cities, but also larger *comunas* and cities. Collaboration with health-transport-education departments has made it possible to integrate open streets and traffic calming measures, as in El Bosque and Independencia, but also to consider "complete street" strategies, to improve walkability and cycle-inclusion on car-centred road networks.

Over a hundred children attended participatory mapping workshops and an initial street audit during the program launch, reinforcing both regular school curriculum activities and a strong urban planning component. This last has demanded greater participation from the university and community partners of our Lab, taxing our small team but also pushing us to make the most of complete street and traffic calming approaches within our Kool Routes. As a result, we are testing a model that centres on training local teachers to deliver the program, reducing dependency on an external team such as ours.

3.3. Does the program show enough potential for development as a general policy and, if so, under what conditions would this be most likely to succeed?

These results suggest that Kool Routes to School programs could be very successful in combining and meeting multiple objectives, in the health, transportation, gender and environmental spheres. Children who enter the program generally reflect societal aspirations to have their own car, but as they advance their main priority for transport to school becomes walking and above all cycling. Participation in the program itself involves considerable levels of physical activity, both in learning to ride bikes and in the many street

audits, car-free street and other related activities.

Enabling children to actually walk or cycle to school, however, is complex in an urban environment plagued by road safety, gender and other violence-related risks. These are major challenges to turning a basic educational program into a common urban practice, that is, restoring the walk-bike-bus patterns of urban and rural transport to school, common only a generation or two ago. Even in a small city, Lautaro, problems with lighting during dark winter days and fear of walking past bars and other places associated with aggressive behaviour emerged, as the program moved beyond schools.

Thus, in 2019, citizen-led urban planning, another area developed by our research, emerged as a crucial element within the Kool Routes program. The results from this phase of the program look promising to date, as we combine complete street strategies (Hui et al., 2017, Ontario Professional Planners Institute 2017, Smith-Lea et al., 2015, Winters et al., 2015) with our own community- and school-based engagement, but it is too early to provide a detailed review of these experiences. We note, however, that Hawaii has become one of the few to integrate both Safe Routes and Complete Street approaches (Heinrich et al. 2011). These results from Chile suggest that this combination could leverage some very substantial health gains.

Also underway in 2019 is a more specific study focusing on potential paths for integrating these programs into general policy, which has involved interviews with policymakers at local, regional and national scales, and innovation in Lautaro, as mentioned, to train teachers themselves to provide these programs, rather than depending on an external team. We think this could evolve as one model for broader application, but it requires further research on the resources and incentives that could make this more effective, and on other models, such as program training and certification, by NGOs, consultants or other actors.

4. Final reflections: Different "Routes" can lead to more complete health impacts

Urban planning and design strategies are often dominated by the skillsets of engineers and architects. In contrast, this Chilean adaptation of Safe-routes-to-school programs focuses on people and their needs. It also generates opportunities for collaborative governance, which can simplify the complex transitions in lifestyles that are essential to achieving greater sustainability. Planning, design and social involvement are central to creating healthier, happier cities: this approach has shown significant promise to meet the challenge of "how" practitioners could apply new knowledge about transport and health links.

These findings underline a challenge and a strategic opportunity, which arise from demands from children, schools, local communities, and municipal governments to take the program into a broader arena of urban transformation. While not conclusive, we are finding that this program requires substantial development as both an urban planning and an educational activity. Working with communities through schools shows significant promise to bring neighbourhood and other associations on board for changes that can improve road, gender and social safety at entire neighbourhood or city scales.

Although we initially saw safe routes to school as a way of enhancing physical activity, these findings suggest that programs like Kool Routes show significant potential to address the social determinants of health (SDH), a more complex concept, focusing on power and justice, developed by the World Health Organization and more consistent with theories of social capital and civic participation (Hartell, 2009; Barber, 1998; De Souza Briggs, 2008; Sirianni, 2009).

The SDH framework brings into focus "social, economic and political mechanisms" that influence health directly and indirectly through access to health and other vital social benefits. It also provides guidance on how societies can collectively work through governance, macroeconomic, social and public policies, in combination with cultural and social values. Core values include equity, rights and the distribution of power, particularly the "guiding ethical principle" of avoiding "unfair or remediable differences in health among social groups" (p. 14, WHO, 2010).

The SDH report, Closing the Gap in a Generation (WHO; Commission on Social Determinants of Health, Final Report, 2008), recommends three strategic areas for action: improving daily living conditions; tackling the inequitable distribution of power, money and resources; and monitoring to better understand and assess the impacts of actions taken.

Kool Routes programs, such as these emerging in Chile, seem well suited to the first imperative, improving daily life, particularly equity "from the start"; and placing health equity at the heart of urban governance. As program development advances, meeting the challenge of designing cities for and with children has become central, and we offer a variety of educational and participatory planning methods adaptable to local conditions. Empowering children to act on their environment involves civic skills essential for the world's many new democracies and to achieving healthy, inclusive cities.

For 2019–2020, we have focused on developing students' skills as city planners, learning to interact with municipal staff and co-design the improvements required for their safety and health.

The single most important lesson from this work so far is that merely adapting children to a hostile environment is not enough. They need to know they can act on that environment, and change it. Understanding concepts such as "sustainable transport", "transport justice" and "gender equity" is key. As we enter our forth year, we can see that learning to exercise their rights as citizens may be the most important lesson, a vital prerequisite for children to develop the autonomy, the physical and social skills necessary to move freely through their neighbourhoods, to truly enjoy good mental and physical health, and develop to their fullest potential.

Acknowledgements

This research was supported by the BRT Centre for Excellence and the Centro de Estudios de Desarrollo Urbano Sustentable (CEDEUS) at the Pontificia Universidad Católica de Chile, with funding from Conicyt, FONDAP No. 15110020. We are particularly grateful to the El Bosque school communities of Mario Arce Gatica, Villa Santa Elena, and Paul Harris elementary schools, their principals, administrative staff and teachers, who helped to co-design and ensure the success of these programs. We would also like to