

## Targeting the Inter-generational Transmission of Food Preferences: the Influence of Public Decision-Makers

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2025-45 Document de Travail/ Working Paper

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# Targeting the Inter-generational Transmission of Food Preferences: the Influence of Public Decision-Makers\*

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## Abstract

This paper analyzes the impact of the public decision-maker on the intergenerational transmission of food preferences. We develop a theoretical model of food preferences inter-generational transmission in which parents transmit their own food preferences to their children through their food practices but also have a concern for the future public health conditions influenced by their feeding efforts. We find that, even if people fully care about future public health, the mechanism of food preferences transmission leads to a heterogeneous population where unhealthy food preferences persist. In this setup, we show that public interventions (public good provision and nutritional education program) induce a distribution of food preferences which converge to an homogeneous population with healthy food preferences.

*JEL classification:* D10, H41, I18

*Keywords:* socialization effort, food preferences, inter-generational transmission, public health, public good provision, nutritional education program

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\*I thank all participants of the "40<sup>èmes</sup> Journées de Micro-économie Appliquée", the "Séminaire du GAINS - Laboratoire de recherche en Economie, Le Mans Université", and the "10 ans des Journées Doctorales « Analyse des Politiques Publiques » de l'université du Havre" for their remarks. I am also thankful to Johanna Etner, Noémi Berlin, and Frederic Gannon for their constructive and helpful comments that have substantially improved the paper.

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# 1 Introduction

Cultural traits and preferences are passed from generation to generation and this may explain the persistence over time and heterogeneity over space of different cultural traits and preferences. The cultural transmission approach argues that parents invest in socializing their offspring to their cultural traits. Parents may be motivated to pass their own preferences to their offspring if they believe their own preferences are the best for their children. Therefore, parents can exert a direct socialization effort to influence their children's process of preference formation. However, it is the pervasive evidence of the resilience of ethnic and religious traits across generations (Bisin and Verdier, 2000), the impact of political regime on preferences (Necker and Voskort, 2014), the effect of cultural traits on economic development (Tabellini, 2010), culture and institutions co-evolution (Touré, 2021), that motivates a large fraction of the theoretical and empirical literature on cultural transmission (see Bisin and Verdier (2011) and Bisin and Verdier (2022) for survey). Nevertheless, the inter-generational transmission of food preferences should be studied due to the correlation between parents' and children's eating habits and the increase in diet-related non-communicable diseases. Indeed, it is well known that eating unhealthy foods increases the risk of non-communicable diseases, which in turn leads to huge public health costs. Consequently, understanding how food habits are formed and the practices that can be used to modify them might help public decision-makers to limit the spread of unhealthy eating habits and therefore the risk of non-communicable diseases. Dietary habits are established at an early age and therefore parents can influence the dietary habits of their children through their food patterns. Even if a parent with unhealthy eating habits is aware that it is harmful to pass on an unhealthy food preference to their child, their behavior and eating patterns will give the child access to unhealthy items, which may encourage the child to eat unhealthily. For example, it's easier for a parent to prevent a child from eating chocolate if they don't eat it than if they eat it in front of the child. As children's eating habits are malleable, early exposure to unhealthy foods in the family environment, for example, can lead to a preference for unhealthy foods. Although children's

eating behaviors are difficult to modify directly, parental feeding practices are potentially a good target for public interventions to prevent children's unhealthy eating patterns.

There are now various public policies designed to improve people's eating habits, such as taxes on unhealthy goods, the use of nutritional labels and information campaigns. Nevertheless, unhealthy eating habits persist and are one of the main causes of the growing trend in obesity worldwide. This paper constructs a theoretical model of the transmission of food preferences which accounts for the persistence of unhealthy food preferences even if individuals are aware of the harms of unhealthy eating. We investigate in this paper how the policymaker can influence the distribution of food preferences in the population in a framework where parents transmit their food preferences to their children through their behavior and eating patterns.

Parents' food patterns have an influence on a child's overall diet quality and child's food preferences. Indeed, the family is an important social context where children learn and adopt eating behaviors. Specifically, parents play the role of health promoters, role models, and educators in the lives of children and they can shape children's food preferences. Empirical evidence suggests that there is a correlation between parents' dietary intake, parental practices, and children's eating habits ([Mahmood et al., 2021](#); [Yee et al., 2017](#); [Wang et al., 2011](#)). [Arcan et al. \(2007\)](#) examine longitudinal associations between parental reports of home food availability and their own dietary intakes, and adolescent intakes of fruit, vegetables and dairy foods. They find that parent eating behavior is a significant predictor of children's intake during young adulthood. [Fleary and Ettienne \(2019\)](#) aim to determine whether parents' and adolescents' dietary behaviors for fruits and vegetables, junk foods, and sugar-sweetened beverages align with parents' food parenting practices. They find that, for adolescents, parenting practices for fruits and vegetables are positively related to adolescents' fruit and vegetable consumption. It may be in a parent's interest to have a child with their own food preferences. Having the same food preferences as their child makes it easier for a parent to prepare and share food within the family. Hence, the family environment remains one of the first and most fundamental

contexts in which children's eating behaviors are formed.

However, parents are not the only people who can influence children's food preferences. Children may be influenced by the external environment in their eating behaviors. When they grow up and enter adolescence, children begin to experience peer effects in their eating behaviors through a friendship social network. Peer effects have an important influence on children's eating behaviors (Ragelienė and Grønhoj, 2021; Chung et al., 2017). Empirical studies have shown that peers can positively or negatively influence children's eating habits based on the eating behaviors of others in their friendship social network. Stok et al. (2015) investigate associations of subjective peer norms with adolescents' healthy eating intentions and intake of healthy and unhealthy food. They find that peer encouragement of healthy eating and peer discouragement of unhealthy eating are associated with adolescents' healthy eating intentions. Adolescents intend to eat more healthily when their peers encourage them to eat healthily, but also when their peers discourage them from eating unhealthily. In contrast, a child whose network consists of peers with unhealthy eating habits will tend to develop unhealthy eating habits. Fortin and Yazbeck (2015) study peer effects on adolescents' fast food consumption and weight gain. They find that an increase in his friends' mean fast food consumption induces an adolescent to increase his own fast food consumption.

The interaction of the family and external environments on the formation of children's food preferences implies that the establishment of food preferences can be studied as a dynamics process. This dynamics can lead to the existence and persistence of unhealthy eating habits as well as in the cultural transmission (Bisin and Verdier, 2000) where the population dynamics converge to a heterogeneous limit distribution in which minorities are never completely assimilated.

We assume that parents transmit their food preferences to their children via their behavior and eating patterns. The parent's influence in shaping the child's food preferences goes through monitoring the availability and accessibility of food items to the child. Indeed, parents create food options through food purchasing and preparation and directly influ-

ence children's food choices and intake. Parent-child feeding interactions are important in shaping children's preferences and intake patterns. Parents may use food availability and accessibility to influence their child's consumption. For example, they may avoid bringing at home foods that they do not wish their child to eat, and/or make more available and accessible foods they prefer their child to eat. Empirical evidence suggests that the availability and accessibility of a certain type of food for children can boost their consumption of that food (Blanchette and Brug, 2005; Yee et al., 2017). Children are more likely to eat foods that are available and easily accessible (Patrick and Nicklas, 2005). Wyse et al. (2011) find positive associations between children's fruit and vegetable consumption and fruit and vegetable availability and accessibility at home. Moreover, Boles et al. (2019) examine the relationship between the home food environment and child dietary intake of preschool-aged children. They find that home food availability of both healthy and unhealthy foods is positively associated with children's dietary intake. Parents can also affect their child's eating habits by sharing meals with their child at home. Mahmood et al. (2021) investigate both parents' and children's dietary behaviors, and find that family meals have the greatest impact on modeling children's eating habits. For family meals away from home, parents may also make decisions about whether they eat out, where to eat, and can select their child's meal.

We develop a model of inter-generational transmission of food preferences in which parents transmit their own food preferences to their children through their food practices. We consider two types of parents: parents with healthy food preferences and parents with unhealthy food preferences. Parents with healthy food preferences have healthy food practices, while parents with unhealthy food preferences have unhealthy food practices. Parents care about their children's food preferences and also have a concern for the public health conditions that are influenced by their food practices. The transmission of food preferences is a mechanism that interacts vertical socialization (inside the family) and oblique socialization (outside the family, in society at large). We find that, even if people fully care about public health, the mechanism of food preference transmission leads

to a heterogeneous population where unhealthy food preferences persist. In this setup, we show that public interventions (public good provision and nutritional education program) induce to a distribution of food preferences which converge to an homogeneous population with healthy food preferences.

This paper contributes to the literature studying the inter-generational transmission of cultural traits and preferences. Papers looking at the inter-generational transmission of cultural traits ([Bisin and Verdier, 2000, 2001](#); [Montgomery, 2010](#); [Prummer and Siedlarek, 2017](#)) and preferences ([Bezin, 2015](#)) consider that parents' or leaders' socialization decisions are motivated by their desire to transmit their cultural traits or preferences. In addition to the parents' desire to have a child with the same food preferences, we consider that parents also care about the future public health conditions their children will have in adulthood. Thus, parents with healthy food preferences are always willing to make efforts to transmit their food preferences, whereas parents with unhealthy food preferences face a trade-off between transmitting their food preferences and improving future public health conditions. This consideration of the future public health condition by parents allows us to study the dynamics of food preferences as a function of the weight given by parents to the future public health condition in their decision-making process. Thanks to this approach, we find a central result of the literature on the transmission of cultural traits which is that the transmission process leads to a heterogeneous population in which all cultural traits exist. Furthermore, we show in this paper that it is possible to achieve a homogeneous population in which only healthy food preferences exist through public policies.

The remainder of the paper is organized as follows. Section 2 presents the literature review. The model is described in Section 3. The individual socialization effort is determined in Section 4. In Section 5, we analyze the public policy implications. Finally, Section 6 concludes.

## 2 Related literature

Our paper is related to the literature on cultural transmission, particularly the transmission of preferences. The model of cultural transmission has been introduced in economics by [Bisin and Verdier \(2000, 2001\)](#), allowing for endogenous socialization choices on the part of parents. [Bisin and Verdier \(2000, 2001\)](#) model the transmission of cultural traits as a mechanism which interacts socialization inside the family and socialization outside the family, in society at large, via imitation and learning from particular role models like teachers, peers, etc. In other words, they assume that children of a given period are born without any particular cultural trait and subsequently acquire either the cultural trait of their parent or one that exists in the society. If the transmission of cultural traits is assumed to be endogenous, [Bisin and Verdier \(2000\)](#) find that the dynamics of the distribution of cultural traits in the population converge to an heterogeneous population in which minorities are never completely assimilated. The cultural transmission model of [Bisin and Verdier \(2000, 2001\)](#), with a single dichotomous cultural trait, has been extended to a model with multiple cultural traits ([Montgomery, 2010](#); [Bisin et al., 2009](#)). These extensions suggest that culturally heterogeneous stationary distributions tend to be supported in the multiple cultural traits case as well.

Our paper is also related to papers analyzing the role of leaders in a cultural transmission model where leaders hold some political power that allows them to further their own cultural traits ([Hauk and Mueller, 2015](#); [Prummer and Siedlarek, 2017](#)). [Verdier and Zenou \(2015\)](#) study the population dynamics of preference traits in a model of inter-generational cultural transmission with cultural leaders who interact with opposite objectives. They show that the presence of leaders can prevent the full assimilation or full integration of the population. However, our current framework differs from those in that the public authority (which plays the role of the leader) does not have predefined food preferences and therefore does not seek to spread its own preferences. The regulator's objective to improve public health benefits for all individuals regardless of their food preferences. Consequently, the regulator seeks to encourage parents with healthy food preferences to

increase their healthy feeding practice efforts and to discourage the unhealthy feeding practice efforts of parents with unhealthy food preferences.

Our paper is then related to the literature analyzing the role of specific public good provision in cultural transmission model. [Verdier and Zenou \(2018\)](#) propose a model where they study the dynamics of cultural traits in a model of inter-generational cultural transmission with public good provision. However, our modeling of the public good is different from theirs. They consider that each individual derives utility from a public good specific to their own cultural trait. So the public good in question (religious good) is interpreted as a club good since it is non-rivalrous but excludable. It benefits only individuals who have the cultural trait. In our model, the public good is non-rivalrous and non-excludable. Any individual can benefit from it if they decide to get healthy food. In other words, everyone benefits from the provision of the public good, which allows the regulator to influence parents' feeding practice efforts, whatever their food preferences.

Finally, our paper is related to the literature on inter-generational transmission of pro-environmental preferences. [Bezin \(2015\)](#) develops a model in which the future environmental quality depends on private contributions and green parents act pro-environmentally to socialize their children into environmentally friendly attitudes. She shows that there exists an interior equilibrium in which some, but not all, green agents contribute to improve the environment quality. Our model is, however, quite different from hers along two several dimensions. First, in her model, only green parents make socialization efforts through their contributions and the alternative preference trait (brown) is present by default. Secondly, only green parents derive utility from the quality of the environment. In our model, all parents make feeding practice efforts to socialize their children to their own food preferences. All parents also derive utility from future public health, which depends on their feeding practice efforts. The effect of public policies (taxes and education programs) on the inter-generational transmission of preferences is also documented in the literature. [Bezin \(2019\)](#) develops a model which formalizes the interplay between the formation of green consumer preferences and clean technologies where green preferences are formed

through cultural transmission and innovation responds to profit incentives and market size effects. She examines the implications of environmental taxes and environmental education and finds that the two policies are either complements or substitutes depending on the substitutability between clean and dirty goods.

### 3 Model

#### 3.1 Transmission mechanism of food preferences

As in [Bisin and Verdier \(2000, 2001\)](#), we model the transmission of food preferences as a mechanism that interacts vertical socialization (inside the family) and oblique socialization (outside the family, in society at large). Suppose that there are two types of food preferences in the population: parents with preferences for healthy food who have healthy food practices, denoted by  $h$ , and parents with preferences for unhealthy food who have unhealthy food practices, denoted by  $u$ . The fraction of individuals with preference  $i \in \{h, u\}$  at time  $t$  is denoted by  $q_t^i$ . Families are composed of one parent and a child. All children are born without defined food preferences and are first exposed to their parent's food preferences. The parent influences his or her child's food preferences by making the feeding practice effort  $\tau$ . The feeding practice effort  $\tau$  can be understood as the frequency with which the child is exposed to a type of food. With probability  $\tau^i$ , equal to the frequency with which the child of a parent with food preference  $i \in \{h, u\}$  is exposed to a diet of type  $i$ , the parent successfully passes his/her food preference to his/her child (i.e. vertical socialization). If a child from a family with food preference  $i$  does not directly acquire his/her parent's food preference, which occurs with probability  $1 - \tau^i$ , he/she then becomes subject to a second stage of influence by the social environment of his/her parent (i.e. oblique socialization). In that case, the child is matched to a role model chosen randomly in the population so that he/she acquires preference  $i$  with probability  $q_t^i$  and preference  $j \neq i$  with probability  $q_t^j = 1 - q_t^i$ ,  $j \neq i$ ;  $j, i \in \{h, u\}$ . To simplify the notations, we will denote the fraction of individuals with a preference for

healthy food at time  $t$  by  $q_t$ . Then  $(1 - q_t)$  is the fraction of individuals with a preference for unhealthy food. The preference transmission probabilities are given by:

$$P^{hh} = \tau^h + (1 - \tau^h)q_t \quad (1)$$

$$P^{uu} = \tau^u + (1 - \tau^u)(1 - q_t) \quad (2)$$

$$P^{uh} = (1 - \tau^u)q_t \quad (3)$$

$$P^{hu} = (1 - \tau^h)(1 - q_t) \quad (4)$$

with  $P^{ij}, i \neq j \in \{h, u\}$  is the probability that a child from a family with food preference  $i$  acquires the food preference  $j$ .

The process of preference evolution follows an inter-generational model of food preference transmission. Using (1) and (3), the food preferences dynamics of  $q_t$  is then given by:

$$q_{t+1} - q_t = q_t(\tau^h - \tau^u)(1 - q_t) \quad (5)$$

### 3.2 Parent's payoff and public health

We assume that parents care about their children's food preferences and get a certain payoff according to the type of food preference their child acquires. Let  $V^i(F^i)$  denote the payoff a parent with preferences  $i$  gets if their child acquires food preferences  $F^i$ , where  $i \in \{h, u\}$ . We consider the following payoff structure:

$$V^h(F^h) = v^{hh}$$

$$V^h(F^u) = v^{hu}$$

$$V^u(F^h) = v^{uh}$$

$$V^u(F^u) = v^{uu}$$

We assume that  $v^{ii} > v^{ij}$  whenever  $i, j \in \{h, u\}$ , with  $i \neq j$ . The hypothesis that the parent's payoff is greater when their child acquires their own food preference than if they acquire another food preference can be understood as follows. Consider, for example, that individuals may have preferences for vegan and non-vegan food items. If a parent with a preference for non-vegan (vegan) food items has a child who prefers vegan (non-vegan) food items, then this parent will have to purchase vegan (non-vegan) food items for their child. They will also have to give up their preferred menus and prepare menus with vegan (non-vegan) food items so that they can share the same food with their child at mealtime, or prepare different menus for themselves and their child. This situation requires extra preparation time for the parent or a change in their initial eating habits compared to the situation where the child would have acquired the same food preferences as the parent. This reduces the payoff to this parent with a preference for non-vegan (vegan) items. A parent with a preference for vegan may also have a psychological cost because their child eats non-vegan food items (less healthy and less environmentally friendly). The same thinking can be applied to other food item categories, such as organic and non-organic food items. If a parent and his/her child do not have the same food preferences, there may be a clash between their food preferences when it comes to decide the content of the family meals. This clash of food preferences will force both parties to engage in a process of negotiation to find a possible favorable outcome. This reduces the parent's payoff compared to a situation where his/her child acquires his/her own food preferences.

Parent  $i$  can choose their feeding practice effort  $\tau^i$ , at some cost. Let  $C^i(\tau^i)$  denote the transmission cost, where  $\tau^i$  is the probability of direct transmission of the parent's food preference with preference  $i$ . We assume that the cost of transmitting food preferences to children is higher for parents with healthy food preferences than for parents with unhealthy food preferences. The intuition behind this assumption is that children's acceptance of unhealthy foods (with a high sugar content, for example) is higher than their acceptance of healthy foods. For example, it's easier for a parent to give a child candy

bars than fruits. So it takes longer for a parent to convince their child to eat healthily than to eat unhealthily.

We assume that  $C^i(\tau^i)$  is a quadratic socialization costs:

$C^h(\tau^h) = \frac{1+c^h}{2}\tau^h{}^2$  and  $C^u(\tau^u) = \frac{1+c^u}{2}\tau^u{}^2$ , with  $c^u < c^h$  is part of the transmission cost that relates to the type of food (healthy or unhealthy) that the parent wants to make available and accessible to their child. We assume that it is more costly to transmit healthy food preferences than unhealthy ones ( $c^u < c^h$ ). Indeed, the low acceptance of healthy foods by children and their preferences for unhealthy foods makes the transmission of healthy food preferences more challenging. Parents report several barriers to the establishment of healthy diets for children, such as children's dislike of vegetables, parents' limited time for food preparation and avoiding parent-child conflicts (Arthur et al., 2023; Donin et al., 2024). In contrast, it is well documented that children prefer unhealthy foods like foods with a sweet taste (Sobek et al., 2020; Kostecka et al., 2021).

We assume that the distribution of food preferences in the population constitutes an externality on public health. Specifically, a preference for healthy food leads to a higher consumption of healthy food and therefore to a higher public health in the long-run. In contrast, a preference for unhealthy food leads to a higher consumption of unhealthy food that may cause overweight or obesity in the long-run, which usually comes with health problems. These negative effects of the consumption of unhealthy food on health lead to poor public health. Specifically, if healthy preferences are acquired, adult health equals  $\bar{H}$ ; otherwise it equals  $\underline{H}$ , with  $\bar{H} > \underline{H}$ , which means that children in period  $t$  who acquire healthy food preferences will have better health in  $t + 1$  than children in period  $t$  who acquire unhealthy food preferences. More precisely, the public health function in period  $t + 1$  is given by:

$$H(q_{t+1}) = q_{t+1}\bar{H} + (1 - q_{t+1})\underline{H} \quad (6)$$

Thus, the public-health function directly aggregates the future health prospects of all children. We assume that parents care about the public health condition their children will

have when they become adults and derive utility from it as well. Parents value the public health condition because it captures both the expected future health of their child and the broader health environment in which the child will evolve, consistent with models in which individual well-being and collective health outcomes are jointly relevant for parental preferences. Formally, the expected utility of a parent with preferences  $i$  is then:

$$U^i(\tau^i) = P^{ii}v^{ii} + P^{ij}v^{ij} - C^i(\tau^i) + \alpha^i H(q_{t+1}) \quad (7)$$

With  $\alpha^i \in [0; 1]$  the weight that the parent  $i$  gives to the public health condition their children will have in adulthood in its utility function. The parameter  $\alpha^i$  can be interpreted as a degree of parental altruism regarding the future public health condition their children will have in adulthood. If  $\alpha^i = 0$ , this means that the parent  $i$  is not altruistic and does not care about the future public health condition.

## 4 Individual feeding practice effort and food preferences dynamics

We assume that parents care about the effect of their feeding practice on public health. Then the parent  $i$  chooses their feeding practice effort ( $\tau^i$ ) that maximizes their expected utility (7) under the constraints of the preference transmission probabilities (1 to 4):

$$\begin{aligned}
\max_{\tau^i} \quad & U^i(\tau^i) = P^{ii}v^{ii} + P^{ij}v^{ij} - C^i(\tau^i) + \alpha^i H(q_{t+1}) \\
s.t. \quad & \begin{cases} P^{hh} = \tau^h + (1 - \tau^h)q_t \\ P^{hu} = (1 - \tau^h)(1 - q_t) \\ P^{uu} = \tau^u + (1 - \tau^u)(1 - q_t) \\ P^{uh} = (1 - \tau^u)q_t \\ q_{t+1} = q_t + q_t(\tau^h - \tau^u)(1 - q_t) \\ H(q_{t+1}) = q_{t+1}\overline{H} + (1 - q_{t+1})\underline{H} \end{cases} \quad , \text{ with } i \neq j; i, j \in \{h, u\}
\end{aligned} \tag{8}$$

The feeding practice efforts are given by:

$$\tau^{h*} = \frac{(1 - q_t)\Delta v^h + \alpha^h q_t(1 - q_t)(\overline{H} - \underline{H})}{1 + c^h} \tag{9}$$

$$\tau^{u*} = \frac{q_t\Delta v^u + \alpha^u q_t(1 - q_t)(\underline{H} - \overline{H})}{1 + c^u} \tag{10}$$

where  $\Delta v^i = v^{ii} - v^{ij}, i \neq j; i, j \in \{h, u\}$  is the parent  $i$ 's "intolerance", i.e. the subjective utility gain of parent  $i$  of having a child with the same food preferences. In other words,  $\Delta v^i$  is the parent  $i$ 's relative value of child with the same food preferences as theirs.

Equations (9) and (10) give the feeding practice effort done by each parent. The feeding practice effort of parents with healthy food preferences is positive. If the weight that parents with unhealthy food preferences give to public health in their utility function is very low ( $\alpha^u \rightarrow 0$ ), then they will make a positive feeding practice effort.

Results of the comparative statics, at a given period  $t$ , with respect to the parent's subjective utility gain to transmit their own food preferences ( $\Delta v^i$ ), the fraction of individuals with preference for the healthy food ( $q_t$ ), and the weight the parent gives to public health

in their utility function are summarized in table 1<sup>1</sup>.

Table 1: Comparative statics

Parameters	Preference for healthy food (effects on $\tau^h$ )	Parameters	Preference for unhealthy food (effects on $\tau^u$ )
$\Delta v^h$	+	$\Delta v^u$	+
$q_t$	- if $q_t \geq \frac{1}{2}$ ± if $q_t < \frac{1}{2}$	$q_t$	+ if $q_t \geq \frac{1}{2}$ ± if $q_t < \frac{1}{2}$
$\alpha^h$	+	$\alpha^u$	-
$c^h$	-	$c^u$	-

The individual feeding practice effort increases with the parent's subjective utility gain of having a child with the same food preferences ( $\Delta v^i$ ). The more a parent wants to transmit their food preferences to their child, the more they will make feeding practice efforts. The individual feeding practice effort of parents with healthy food preferences increases with the weight they give to public health, whereas the individual feeding practice effort of parents with unhealthy food preferences decreases with the weight they give to public health ( $\alpha^i$ ). The sign of the effect of the proportion of individuals with healthy food preferences on parents' levels of feeding practice effort depends on the composition of the population. If the proportion of individuals with healthy food preferences is high ( $q_t \geq \frac{1}{2}$ ), parents with unhealthy food preferences increase their feeding practice effort, while parents with healthy food preferences reduce their feeding practice effort. On the other hand, if the proportion of individuals with healthy food preferences is low ( $q_t \leq \frac{1}{2}$ ), the effects of the fraction of individuals with a preference for healthy food on both parents' feeding practice efforts are ambiguous.

Using equations (9) and (10), the dynamics of the fraction of the population with healthy food preferences (equation 5) under individual feeding practice effort is given by:

$$q_{t+1} - q_t = q_t(1 - q_t) \left[ \frac{(1 - q_t)\Delta v^h + \alpha^h q_t(1 - q_t)(\bar{H} - \underline{H})}{1 + c^h} - \frac{q_t\Delta v^u + \alpha^u q_t(1 - q_t)(\underline{H} - \bar{H})}{1 + c^u} \right] \quad (11)$$

We obtain the stationary states by setting  $q_{t+1} - q_t = 0$ . Equation (11) shows that there

<sup>1</sup>See Appendix A for proof of the comparative statics.

are three stationary states in the evolution of food preferences dynamics. Two stationary states with a perfectly homogeneous food preference in the population ( $q^* = 0$  and  $q^* = 1$ ) and one interior stationary state ( $q^*$ ) in which both food preferences coexist in the population.

**Proposition 1.**

(i) Equation (11) has are three stationary states: 0 ; 1 and one interior stationary state  $q^*$

(ii) The interior stationary state in which both food preferences coexist in the population is the unique stable stationary state.

*Proof.* See Appendix B

□

Intuitively, if the proportion of individuals with healthy food preferences is very high, parents with healthy food preferences will make less effort to directly transmit their own food preferences to their children, since their children will acquire with high probability the predominant food preferences. In contrast, parents with unhealthy food preferences who belong to the minority will make more feeding practice efforts to transmit their own food preferences to their children. Vertical socialization and oblique socialization operate as substitutes in the process of food preference transmission. The parents with the majority food preferences in the population will always make less feeding practice efforts than the parents with the minority food preferences. Consequently, the mechanism of food preference transmission leads to a heterogeneous society where there will be both food preferences.

Let's consider the case where parents are well calibrated about the weight they attribute to public health (i.e.,  $\alpha^i = 1$ ). More precisely, we assume that parents perfectly care about the effect of their feeding practice on the future public health conditions their children will have in adulthood.

Then, at the optimum equations (9) and 10 become:

$$\tau^{h*} = \frac{(1 - q_t)\Delta v^h + \alpha^h q_t(1 - q_t)(\bar{H} - \underline{H})}{1 + c^h} \quad (12)$$

$$\tau^{u*} = \frac{q_t\Delta v^u + q_t(1 - q_t)(\underline{H} - \bar{H})}{1 + c^u} \quad (13)$$

$$\text{with } \Delta v^i = v^{ii} - v^{ij}, \quad i \neq j; \quad i, j \in \{h, u\}$$

The comparison of equations (9) and (10) to equations (12) and (13) shows that for any  $\alpha^i < 1$ , parents with healthy food preferences make less individual feeding practice effort, whereas those with unhealthy food preferences make more individual feeding practice effort compared to the feeding practice effort they should make if they were well calibrated about the weight they attribute to public health. However, the levels of feeding practice efforts parents make in the case they are well calibrated ( $\alpha^i = 1$ ) do not lead to a homogeneous society in which the entire population will have healthy food preferences (see Figure 1).

**Proposition 2.** *The interior stationary state will persist even if parents are well calibrated about the weight they attribute to public health.*

Intuitively, even if parents with unhealthy food preferences perfectly care about the future public health conditions their children will have in adulthood, their feeding practices will always make unhealthy items available to their children. Thus, the likelihood of their children developing a preference for these unhealthy items remains strictly positive.

Furthermore, from equation (13) if the "intolerance" of parents with unhealthy food preferences ( $\Delta v^u$ ) is very high ( $\Delta v^u > |(1 - q_t)(\underline{H} - \bar{H})|$ ), they will have relatively higher incentives to transmit their food preferences to their children. Then, their feeding practice effort will be always positive and increasing as they become a minority in society. This mechanism leads to a heterogeneous population where unhealthy food preferences always persist.

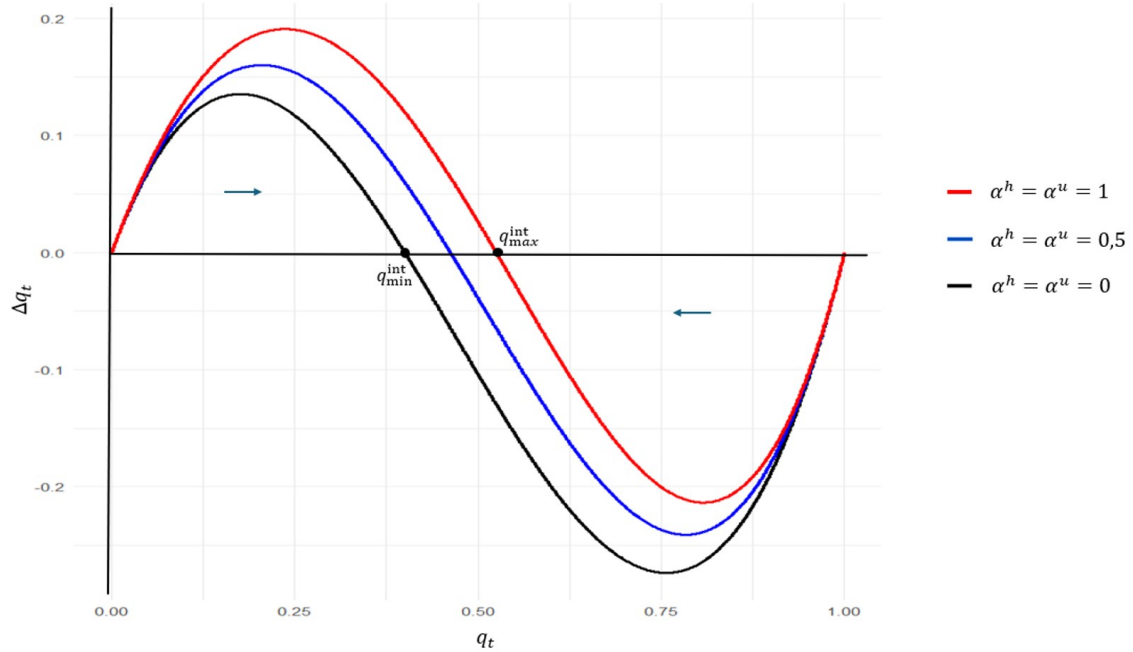
We run numerical simulations to identify the interior stable stationary state and how it varies as a function of the weight given to public health by parents (see Figure 1). We will

Table 2: Predefined values of parameters

Parameters	Predefined values
$\Delta v^h$	10
$\Delta v^u$	10
$\overline{H}$	20
$\underline{H}$	15
$c^u$	3
$c^h$	5

also use these same predefined values (in Table 2) to study the impact of public policies on this stable stationary state.

Figure 1: Stationary states of food preferences dynamics under individual feeding practices

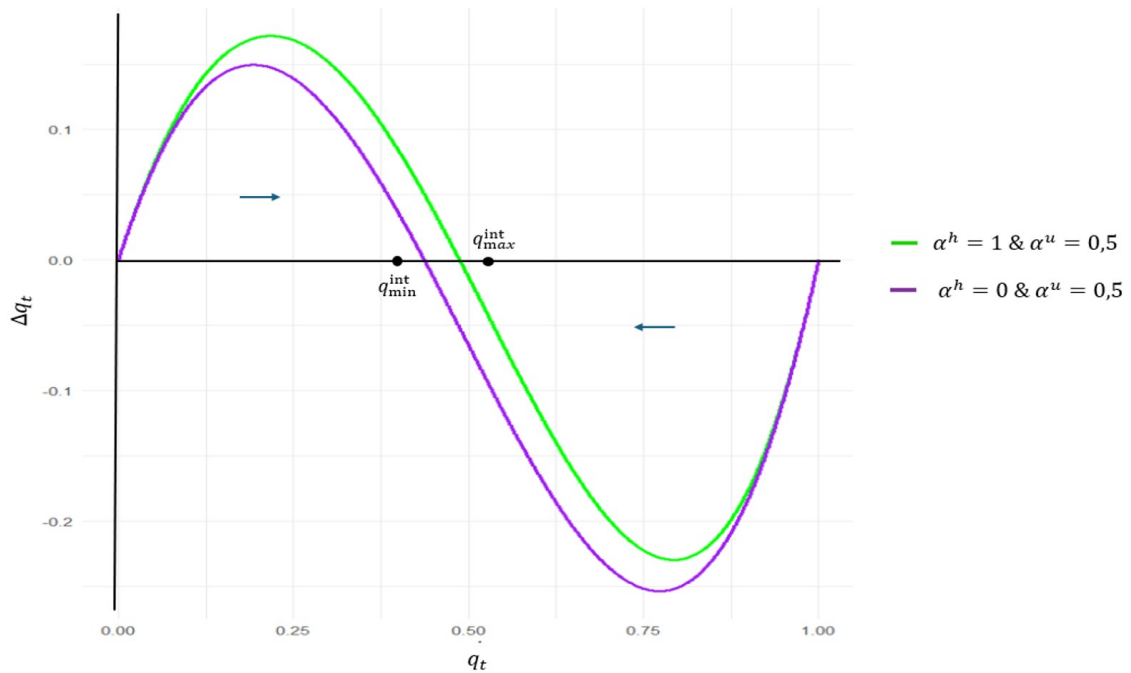


Notes: The Stationary states of the dynamics of food preferences are represented for the same weight given to public health by parents ( $\alpha^h = \alpha^u$ ).

Figure 1 shows the three stationary states of food preference dynamics when both parents give the same weight ( $\alpha^h = \alpha^u$ ) to public health (intersection between the curve and the horizontal axis). The basin of attraction of the dynamics of food preferences is at the interior stationary state in which both food preferences coexist in the population. The lowest proportion of individuals with healthy food preferences at the stable stationary state

( $q_{min}^{int}$ ) is reached when parents do not care about the future public health condition their children will have in adulthood (i.e  $\alpha^h = \alpha^u = 0$ ). If parents fully care about the future public health condition (i.e  $\alpha^h = \alpha^u = 1$ ), then the highest proportion of individuals with healthy food preferences at the stable stationary state ( $q_{max}^{int}$ ) is achieved. For any other configuration of weights given to public health by parents ( $\alpha^h \neq \alpha^u$ ), the stable steady state is somewhere between these two proportions of individuals with healthy food preferences (see Figure 2). These graphs illustrate our proposition 2, which suggests that the dynamics of food preferences does not converge to a homogeneous steady state even if the parents are well calibrated about the weight they attribute to public health.

Figure 2: Stationary states of food preferences dynamics under individual feeding practices



Notes: The Stationary states of the dynamics of food preferences are represented for different weights given to public health by parents ( $\alpha^h \neq \alpha^u$ ).

Public interventions are required to achieve a homogeneous society with healthy food preferences. One possible solution would be to address parents' feeding practices either by altering their subjective utility gain of having a child with the same food preferences or by raising their feeding practice effort cost.

## 5 Public policies

In this section, we investigate the case of two public policies. Firstly, a policy of providing public good which modifies parents' payoff, and secondly, a nutritional education program which modifies the socialization costs of parents.

### 5.1 Public good provision

Suppose that the central planner holds some political power to influence the feeding practice of parents and thus the dynamics of the population. More precisely, we assume that the objective of the central planner is to promote the diffusion of healthy food preferences among the population. Thus, he provides a public good  $G$  that can only be used to make healthy food available and accessible to parents and children. An example of this type of public good can be the fruits and vegetables voucher, which can only be used for the purchase of fruits and vegetables. Indeed, the feeding practice effort of parents in our model refers to the availability and accessibility to children of food items. So the provision of a fruits and vegetables voucher will lead to greater availability and accessibility for children to fruits and vegetables.

We assume that the public good is financed by a tax on parents' unhealthy feeding practices. Let's note by  $\theta$  the tax rate. The utility of parents with unhealthy eating habits will be reduced by  $\theta\tau^u$ . The tax proceeds are used to finance the provision of the public good. Then, the quantity of public good provided by the regulator is therefore given by  $G = (1 - q_t)\theta\tau^u$ .

To justify this formulation, it is important to note that the tax  $\theta\tau^u$  should be interpreted as a reduced-form representation of a broad range of public interventions that increase the effective cost of unhealthy feeding practices rather than a literal tax on parental effort. In practice, governments rely on instruments such as taxes on unhealthy food. These policies make it more costly to maintain unhealthy feeding habits at home, thereby reducing the incentive for parents to engage in unhealthy socialization. Modeling the intervention as a

tax on unhealthy practices provides a tractable way to incorporate these mechanisms into the framework. The term  $\theta\tau^u$  therefore captures the idea that policy instruments increase the marginal cost of unhealthy socialization behaviors, while the proceeds  $G = (1 - q_t)\theta\tau^u$  reflect the regulator's budget for financing public-health interventions.

Since the public good can be used by anyone who wants to consume healthily, a parent can use it to make more healthy items available and accessible to their child. Therefore, parents who have healthy food preferences will have more interest in reinforcing their feeding practices by making more healthy items available to their children to fully use the public good. In contrast, parents with unhealthy food preferences will have an interest in modifying their feeding practices by making available to their children less unhealthy and more healthy items to benefit from the public good even if only to make healthy items available and accessible to the child. Therefore, the additional payoff that a parent obtains if their child acquires a preference for healthy food with the provision of the public good will be greater than the additional payoff that a parent obtains if their child acquires a preference for unhealthy food. We normalize to zero the additional payoff that a parent gets if their child acquires a preference for unhealthy food with the provision of the public good. The payoff structure of parents then becomes:

$$V^h(F^h) = v^{hh} + \beta^h G$$

$$V^h(F^u) = v^{hu}$$

$$V^u(F^h) = v^{uh} + \beta^u G$$

$$V^u(F^u) = v^{uu}$$

With  $\beta^i$ , the value that parent  $i$  attributes to the public good.  $\beta^i = 0$  means that the parent does not give any importance to the public good. If we go back to our example of the fruits and vegetables voucher,  $\beta^i = 0$  means that the parent  $i$  does not derive any additional satisfaction from receiving the voucher.

Under the public good supply, the maximization problem for a parent  $i$  becomes:

$$\begin{aligned} \max_{\tau^i} \quad & U^i(\tau^i) = P^{ii}(v^{ii} + \beta^i G) + P^{ij}(v^{ij} + \beta^i G) - C^i(\tau^i) + \alpha^i H(q_{t+1}) \\ \text{s.t.} \quad & \begin{cases} P^{hh} = \tau^h + (1 - \tau^h)q_t \\ P^{hu} = (1 - \tau^h)(1 - q_t) \\ P^{uu} = \tau^u + (1 - \tau^u)(1 - q_t) \\ P^{uh} = (1 - \tau^u)q_t \\ G = (1 - q_t)\theta\tau^u \\ q_{t+1} = q_t + q_t(\tau^h - \tau^u)(1 - q_t) \\ H(q_{t+1}) = q_{t+1}\bar{H} + (1 - q_{t+1})\underline{H} \end{cases} \quad , \text{ with } i \neq j; i, j \in \{h, u\} \end{aligned}$$

Under the public good supply, the feeding practice efforts are given by:

$$\tau_G^{h*} = \frac{(1 - q_t)[\Delta v^h + \beta^h(1 - q_t)\theta\tau^{u*}] + \alpha^h q_t(1 - q_t)(\bar{H} - \underline{H})}{1 + c^h} \quad (14)$$

$$\tau_G^{u*} = \frac{q_t \Delta v^u + \beta^u q_t(1 - q_t)\theta + \alpha^u q_t(1 - q_t)(\underline{H} - \bar{H}) - \theta}{2q_t \beta^u(1 - q_t)\theta + (1 + c^u)} \quad (15)$$

$$(16)$$

$$\text{with } \Delta v^i = v^{ii} - v^{ij}, \quad i \neq j; i, j \in \{h, u\}$$

Equations (14) and (15) give the feeding practice effort provided by each type of parent as a function of the public good.

Using equations (14) and (15), we can then rewrite the food preferences dynamics of equation (5) under the public good provision as:

$$q_{t+1} - q_t = q_t(1 - q_t) \left[ \tau_G^{h*} - \tau_G^{u*} \right] \quad (17)$$

**Proposition 3.** *There exists a level of tax on unhealthy feeding practices that leads to a*

*homogeneous population with healthy food preferences.*

*Proof.* See Appendix C

□

Parents with healthy food preferences will have more incentive to transmit their own food preferences to their children their own food preferences, to derive maximum benefit from the public good. Their "intolerance" and the satisfaction they derive from the public good have a positive impact on their feeding practice effort. On the other hand, for parents with unhealthy food preferences, the tax they pay has a negative impact on their feeding practice efforts. Then there is a level of tax on unhealthy feeding practices for which they will no longer make unhealthy items available to their children. Hence, the process of food preference transmission will only be shaped by oblique socialization and the feeding practice effort of parents with healthy food preferences. Consequently, the mechanism of food preferences transmission will lead to a homogeneous population with healthy food preferences (see Figure 3).

We now turn to the question of the optimal tax on unhealthy feeding practice and the optimal level of public good. The central planner's objective is to improve the public health through the provision of the public good. Anticipating the feeding practice efforts of both types of parents with the provision of the public good, the central planner chooses the level of tax on unhealthy feeding practice  $\theta$  that maximizes public health function. His problem is to determine the level of tax on unhealthy feeding practices that will lead to the best state of public health. His program is as follows:

$$\max_{\theta} H(q_{t+1}) = q_{t+1}\bar{H} + (1 - q_{t+1})\underline{H} \quad (18)$$

Then we obtain:

$$\theta^* = \Delta v^u \quad (19)$$

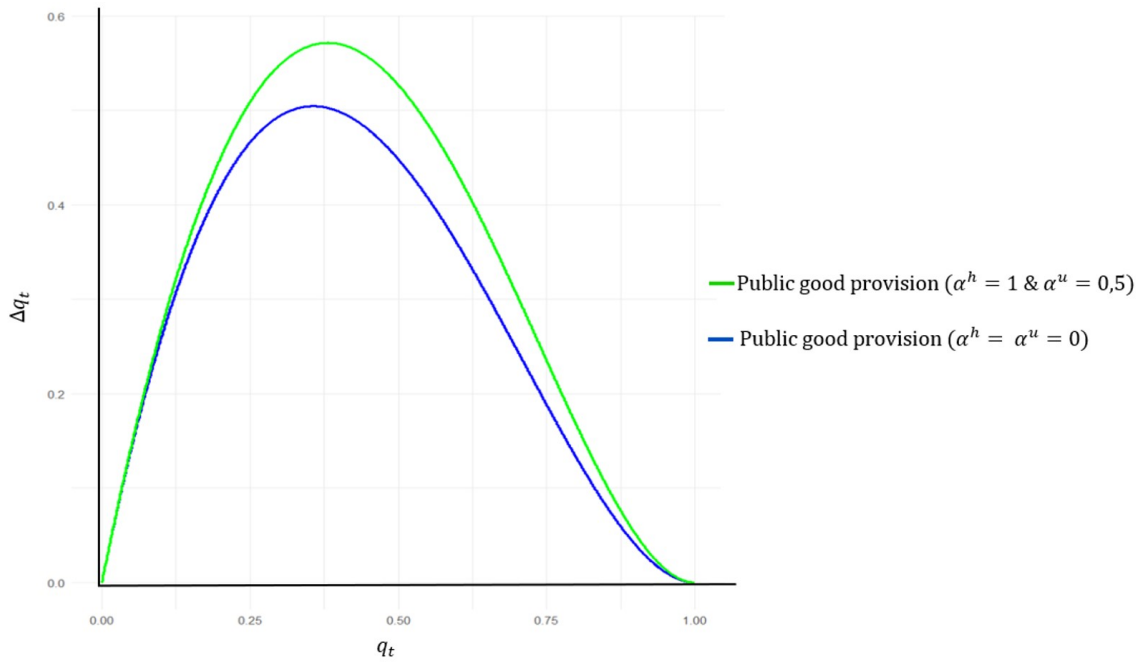
And

$$G^* = (1 - q_t)\Delta v^u \tau^u \quad (20)$$

*Proof.* See Appendix D □

The optimal tax on unhealthy feeding practices should be equal to the subjective utility gain of having a child with the same food preferences of a parent with unhealthy food preferences.

Figure 3: Stationary states of food preferences dynamics under public good provision vs. individual feeding practices



*Notes:* The Stationary states of the dynamics of food preferences are represented for the same weight given to public good ( $\beta^h = \beta^u = 0.25$ ) and different weights given to public health ( $\alpha^i$ ) by parents.

We can see in Figure 3 that the provision of the public good removes the stable interior stationary state towards which the dynamics were converging. The provision of public goods leads the dynamics of food preferences to converge to the stationary state with a perfectly homogeneous food preference where the whole population has healthy food

preferences.

## 5.2 Nutritional education program

Instead of assuming that the central planner provides a public good, one could assume that they implement a nutritional education program to favor the transmission of healthy preferences. One way of understanding this type of program is to think about nutritional education at school, which teaches children the benefits of eating healthily and the harms of eating unhealthily and encourages them to develop healthy food preferences. The nutritional program education therefore acts as a complement to the feeding practice of parents with healthy food preferences by reducing the cost of their feeding practice effort (less time spent teaching healthy preferences at home to encourage the child to consume a healthy item, for example). In contrast, the nutritional education program goes against the feeding practice of parents with unhealthy food preferences by increasing the cost of their feeding practice effort (more teaching of unhealthy food preferences is needed at home to convince the child to consume an unhealthy item, for example).

Let's assume that the implementation of the nutritional education program generates an additional transmission cost (for parents with unhealthy food preferences) and a reduction of the transmission cost (for parents with healthy food preferences). Specifically, the transmission costs become:  $C^h(\tau^h, \epsilon) = \frac{1+c^h}{2(1+\epsilon)}(\tau^h)^2$ , for parents with healthy food preferences, and  $C^u(\tau^u, \epsilon) = \frac{1+c^u+\epsilon}{2}(\tau^u)^2$ , for parents with unhealthy food preferences. The parameter  $\epsilon$  might be interpreted as the intensity (or efficacy) of the nutritional education program. Intuitively, the nutritional education program will lower children's barriers to eating healthy foods, such as their dislike of vegetables, and reduce their temptation to consume unhealthy foods.

The more intense the nutrition education program ( $\epsilon$  is high), the more children will be aware of the benefits of healthy eating and the harms of unhealthy eating on their future health. This will increase children's willingness to eat healthy foods, making feeding practices easier (less costly) for parents who want to provide them healthy foods, and

more difficult (more costly) for parents wishing to feed them with unhealthy foods.

Under the implementation of the nutritional education program, the maximization problem for a parent  $i$  becomes:

$$\begin{aligned} \max_{\tau^i} \quad & U^i(\tau^i) = P^{ii}v^{ii} + P^{ij}v^{ij} - C^i(\tau^i, \epsilon) + \alpha^i H(q_{t+1}) \\ \text{s.t.} \quad & \begin{cases} P^{hh} = \tau^h + (1 - \tau^h)q_t \\ P^{hu} = (1 - \tau^h)(1 - q_t) \\ P^{uu} = \tau^u + (1 - \tau^u)(1 - q_t) \\ P^{uh} = (1 - \tau^u)q_t \\ q_{t+1} = q_t + q_t(\tau^h - \tau^u)(1 - q_t) \\ H(q_{t+1}) = q_{t+1}\overline{H} + (1 - q_{t+1})\underline{H} \end{cases} \quad , \text{ with } i \neq j \in \{h, u\} \end{aligned} \quad (21)$$

Under the implementation of the nutritional education program, the feeding practice efforts are given by:

$$\tau_\epsilon^{h*} = \frac{(1 + \epsilon)[(1 - q_t)\Delta v^h + \alpha^h q_t(1 - q_t)(\overline{H} - \underline{H})]}{1 + c^h} \quad (22)$$

$$\tau_\epsilon^{u*} = \frac{q_t \Delta v^u + \alpha^u q_t(1 - q_t)(\underline{H} - \overline{H})}{1 + c^u + \epsilon} \quad (23)$$

$$\text{with } \Delta v^i = v^{ii} - v^{ij}, \quad i \neq j \in \{h, u\}$$

Under the implementation of the nutritional education program, equations (22) and (23) give the feeding practice effort made by each parent.

Using equations (22) and (23), we can then rewrite the food preferences dynamics of equation (5) under the implementation of the nutritional education program as:

$$q_{t+1} - q_t = q_t(1 - q_t) \left[ \frac{(1 + \epsilon) [(1 - q_t)\Delta v^h + \alpha^h q_t(1 - q_t)(\bar{H} - \underline{H})]}{1 + c^h} \right] - q_t(1 - q_t) \left[ \frac{q_t \Delta v^u + \alpha^u q_t(1 - q_t)(\underline{H} - \bar{H})}{1 + c^u + \epsilon} \right] \quad (24)$$

**Proposition 4.** *Nutritional education program leads to a homogeneous population with healthy food preferences.*

*Proof.* See Appendix E

□

The intuition goes as follows. When the nutritional education program is intense ( $\epsilon$  is high), children become more and more aware of the benefits of healthy food and the harms of unhealthy food. As a result, their acceptance of healthy food may increase. Therefore, parents with healthy food preferences should be able to offer more healthy items to their children. Indeed if it is easier for parents with healthy food preferences to give their children healthy items, they will do so more and more. In contrast, it becomes more difficult for parents with unhealthy food preferences to provide unhealthy items to their children. They will give less and less unhealthy items to their children. Then, Children will be more likely to develop preferences for healthy foods. This mechanism leads to a homogeneous population with healthy food preferences (see Figure 4).

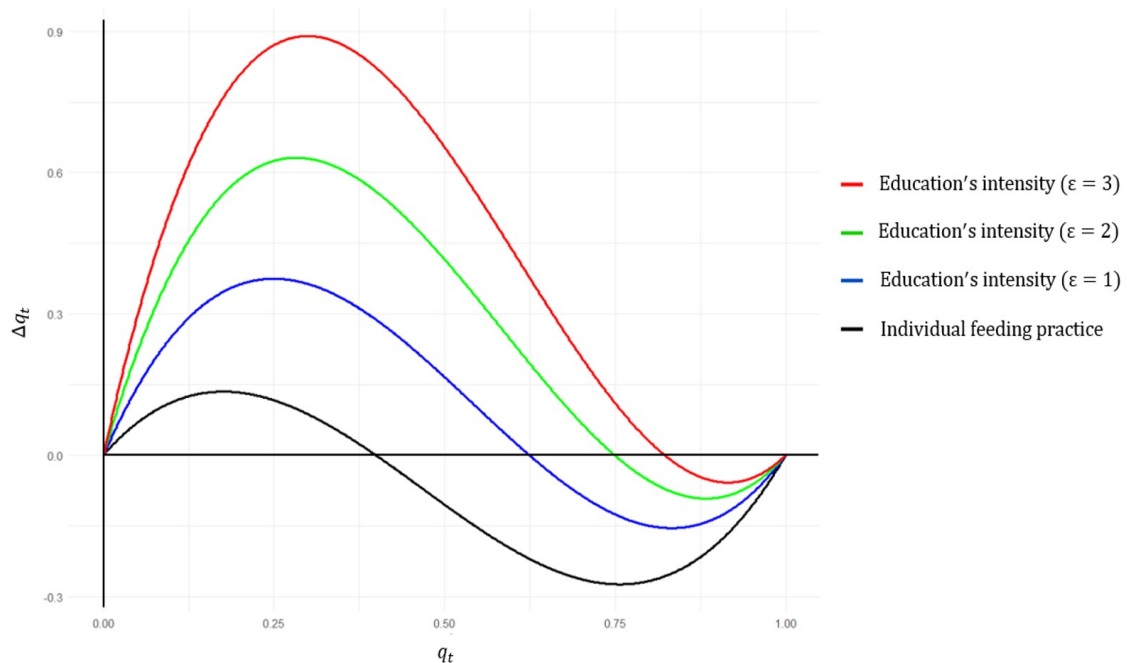
One question that may arise here concerns the optimal intensity (efficacy)  $\epsilon$  of the nutritional education program. The nutritional education program can only be considered effective if it allows to achieve the best public health outcome. To determine the optimal intensity ( efficacy )  $\epsilon$ , the central planner's program will be given by:

$$\max_{\epsilon} H(q_{t+1}) = q_{t+1}\bar{H} + (1 - q_{t+1})\underline{H} \quad (25)$$

The optimal intensity (efficacy)  $\epsilon$  of the nutritional education program is such that the

subjective utility gain of parents with unhealthy food preferences of having a child with the same food preferences (their "intolerance") is equal to zero ( $\Delta v^u = 0$ )<sup>2</sup>. The intuition behind this is that the nutrition education program should make the transmission process very costly for parents with unhealthy food preferences, such that their intolerance is totally eliminated. In other words, they become indifferent (in terms of payoff obtained) between having a child with their own food preferences and having a child with healthy food preferences ( $v^{uu} = v^{uh}$ ).

Figure 4: Stationary states of food preferences dynamics under nutritional education program vs. individual feeding practices



Notes: The Stationary states of the dynamics of food preferences are represented for the same weight given to public health by parents in the individual feeding practice ( $\alpha^h = \alpha^u = 0$ ) and for different intensities of the nutritional education program:  $\epsilon = 1$   $\epsilon = 2$   $\epsilon = 3$ .

Figure 4 shows that under the implementation of the nutritional education program, the stable interior stationary state converges to the stationary state where all people have healthy food preferences as the program intensity increases.

<sup>2</sup>See Appendix F

## 6 Conclusion and discussion

This paper proposes a theoretical model of the inter-generational transmission of food preferences. Our point is that parents transmit their own food preferences to their children through their food practices but also have a concern for public health conditions. The public health depends on the distribution of food preferences across the population, which is influenced by the feeding practices of parents. Then, parents are facing a trade-off between transmitting their own food preferences and improving public health. Our model highlights the persistence of unhealthy food preferences even if individuals are aware of the harms of unhealthy eating.

We consider two types of parents: parents with healthy food preferences and parents with unhealthy food preferences. Parents care about their children's food preferences and can transmit their own food preferences to their children through their feeding practices. The transmission of food preferences is a mechanism that interacts vertical socialization (inside the family) and oblique socialization (outside the family, in society at large). Parents also derive utility from public health, which depends on the distribution of food preferences. We find that the mechanism of food preference transmission leads to a heterogeneous population where unhealthy food preferences persist, even if they fully care about public health. The approach allows us to examine the implications of public interventions. We show that public interventions (public good provision and nutritional education program) induce a distribution of food preferences which converge to an homogeneous population with healthy food preferences.

From a policy perspective, these findings underscore the potential of public interventions to alter the distribution of food preferences within the population. Public policies should focus on improving access to healthy food and promoting better nutritional awareness. Implementing targeted subsidies for nutritious foods (e.g., fruits, vegetables) while taxing high-calorie, low-nutrient products (e.g., sugary drinks, ultra-processed snacks) can encourage healthier consumption. Enhancing school meal programs and public catering services by integrating nutritional criteria is essential. Nutrition education programs

should begin early, integrating food literacy into school curricula to help children develop healthy eating habits from a young age.

While our model provides valuable insights, it predicts convergence toward complete food preferences homogeneity in the long run, which needs to be clarified. This result stems from a set of strong but transparent modeling assumptions that remove the long-term incentive to transmit unhealthy food habits. In particular, the regulator is assumed to tax the socialization effort of parents with unhealthy eating practices. This tax reduces the effective net benefit of transmitting unhealthy preferences, and when it is sufficiently strong relative to the intrinsic value parents place on food preference transmission, it fully offsets the incentive to invest in unhealthy socialization efforts. As a consequence, parents with healthy practices exert a relatively higher effective socialization effort, and their food preferences become dominant over time. Furthermore, the model assumes perfect observability of parental practices and perfect enforcement of the tax, which amplifies the strength of the policy instrument and accelerates the convergence process. Together, these assumptions create a deterministic dynamic system in which one food preference type eventually drives the other out of the population. While complete homogeneity may not fully reflect the complexity and persistence of real-world dietary cultures, the result should be interpreted as a benchmark. It highlights the theoretical conditions under which a regulator can eliminate the inter-generational transmission of unhealthy eating habits.

Our model of food preference transmission can be extended to include the consumption of both healthy and unhealthy food. Indeed, it could be assumed that children acquire food preferences through the consumption of food and not just by exposure (availability and accessibility). In this case, the parents' feeding practice effort would be, for example, the quantity of each type of food (healthy and unhealthy) they provide to their children. Thanks to this extension, it would be quite possible to examine the implications of other types of public policy such as taxes on unhealthy food. Our two public policies can also be experimentally tested. For example, the evaluation of a nutritional education program is possible with the implementation within a school of an intervention policy

whose objective will be to raise children’s awareness of the benefits of eating healthily and the harmful effects of unhealthy eating. An alternative policy to the nutrition education program could be to raise parents’ awareness about the benefits of healthy eating and the harms of unhealthy eating, thereby changing their feeding practices. These extensions are left for future research.

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## Appendices

### Appendix A. proof of the comparative statics in table 1

From equations (9) and (10), we obtain:

$$\frac{\partial \tau^{h*}}{\partial \Delta v^h} = \frac{1 - q_t}{1 + c^h} \geq 0 \quad (\text{A1})$$

$$\frac{\partial \tau^{u*}}{\partial \Delta v^u} = \frac{q_t}{1 + c^u} \geq 0 \quad (\text{A2})$$

$$\frac{\partial \tau^{h*}}{\partial \alpha^h} = \frac{q_t(1 - q_t)(\bar{H} - \underline{H})}{1 + c^h} \geq 0 \quad (\text{A3})$$

$$\frac{\partial \tau^{u*}}{\partial \alpha^u} = \frac{q_t(1 - q_t)(\underline{H} - \bar{H})}{1 + c^u} \leq 0 \quad (\text{A4})$$

$$\frac{\partial \tau^{h*}}{\partial c^h} = -\frac{(1 - q_t)\Delta v^h + \alpha^h q_t(1 - q_t)(\bar{H} - \underline{H})}{(1 + c^h)^2} \leq 0 \quad (\text{A5})$$

$$\frac{\partial \tau^{u*}}{\partial c^u} = -\frac{q_t \Delta v^u + \alpha^u q_t(1 - q_t)(\underline{H} - \bar{H})}{(1 + c^u)^2} \leq 0 \quad (\text{A6})$$

$$\frac{\partial \tau^{h*}}{\partial q_t} = \frac{-\Delta v^h + \alpha^h(\bar{H} - \underline{H})(1 - 2q_t)}{1 + c^h} \quad (\text{A7})$$

The first term of equation (A7) is negative and the second term is negative if  $q_t \geq \frac{1}{2}$ . If  $q_t < \frac{1}{2}$ , the sign of equation (A7) is ambiguous.

$$\Rightarrow \frac{\partial \tau^{h*}}{\partial q_t} \begin{cases} < 0 & \text{if } q_t \geq \frac{1}{2} \\ \leq 0 & \text{if } q_t < \frac{1}{2} \end{cases} \quad (\text{A8})$$

$$\frac{\partial \tau^{u*}}{\partial q_t} = \frac{\Delta v^u + \alpha^u(\underline{H} - \bar{H})(1 - 2q_t)}{1 + c^u} \quad (\text{A9})$$

The first term of equation (A9) is positive and the second term is positive if  $q_t \geq \frac{1}{2}$ . If  $q_t < \frac{1}{2}$ , the sign of equation (A9) is ambiguous.

$$\Rightarrow \frac{\partial \tau^{u*}}{\partial q_t} \begin{cases} > 0 & \text{if } q_t \geq \frac{1}{2} \\ \leq 0 & \text{if } q_t < \frac{1}{2} \end{cases} \quad (\text{A10})$$

### Appendix B. proof of Proposition 1

Equation (11) is obtain from equation (5) by using equations (9) and (10). Then it can be rewritten as follows:

$$q_{t+1} - q_t = q_t(1 - q_t)(\tau^{h*} - \tau^{u*}) \quad (\text{B1})$$

Obviously, (0, 1) are stationary states of (B1), as well as all  $q$  which solve the equation  $\tau^{h*} - \tau^{u*} = 0$ .  $\tau^{h*} - \tau^{u*} = 0$  is a second-degree equation whose solutions are obtain from:

$$\frac{(1 - q_t)\Delta v^h + \alpha^h q_t(1 - q_t)(\bar{H} - \underline{H})}{1 + c^h} - \frac{q_t\Delta v^u + \alpha^u q_t(1 - q_t)(\underline{H} - \bar{H})}{1 + c^u} = 0 \quad (\text{B2})$$

$$\Rightarrow [(1 - q_t)\Delta v^h + \alpha^h q_t(1 - q_t)(\bar{H} - \underline{H})](1 + c^u) - [q_t\Delta v^u + \alpha^u q_t(1 - q_t)(\underline{H} - \bar{H})](1 + c^h) = 0$$

$$\begin{aligned} \Rightarrow & [\Delta v^h - q_t\Delta v^h + \alpha^h q_t(\bar{H} - \underline{H}) - \alpha^h q_t^2(\bar{H} - \underline{H})](1 + c^u) \\ & - [q_t\Delta v^u + \alpha^u q_t(\underline{H} - \bar{H}) - \alpha^u q_t^2(\underline{H} - \bar{H})](1 + c^h) = 0 \end{aligned}$$

$$\begin{aligned} \Rightarrow (1+c^u)\Delta v^h + q_t [(\overline{H} - \underline{H})[\alpha^h(1+c^u) + \alpha^u(1+c^h)] - \Delta v^h(1+c^u) - \Delta v^u(1+c^h)] \\ - q_t^2 [(\overline{H} - \underline{H})[\alpha^h(1+c^u) + \alpha^u(1+c^h)]] = 0 \end{aligned}$$

$$\begin{aligned} \nabla = [(\overline{H} - \underline{H})[\alpha^h(1+c^u) + \alpha^u(1+c^h)] - \Delta v^h(1+c^u) - \Delta v^u(1+c^h)]^2 \\ + 4 [(\overline{H} - \underline{H})[\alpha^h(1+c^u) + \alpha^u(1+c^h)]] (1+c^u)\Delta v^h > 0 \end{aligned}$$

$\nabla$  is positive, which means that the equation (B2) has two solutions.

$$q_1 = \frac{- [(\overline{H} - \underline{H})[\alpha^h(1+c^u) + \alpha^u(1+c^h)] - \Delta v^h(1+c^u) - \Delta v^u(1+c^h)] - \sqrt{\nabla}}{-2(\overline{H} - \underline{H})[\alpha^h(1+c^u) + \alpha^u(1+c^h)]} > 0$$

$$q_2 = \frac{- [(\overline{H} - \underline{H})[\alpha^h(1+c^u) + \alpha^u(1+c^h)] - \Delta v^h(1+c^u) - \Delta v^u(1+c^h)] + \sqrt{\nabla}}{-2(\overline{H} - \underline{H})[\alpha^h(1+c^u) + \alpha^u(1+c^h)]} < 0$$

$q^* = q_2 < 0$  is not considered as a stationary state ( $q \in [0; 1]$ ).  $q_1$  must be less than 1 to be considered as a solution of equation (B2).

$$q_1 < 1$$

$$\begin{aligned} \Rightarrow - [(\overline{H} - \underline{H})[\alpha^h(1+c^u) + \alpha^u(1+c^h)] - \Delta v^h(1+c^u) - \Delta v^u(1+c^h)] - \sqrt{\nabla} > \\ -2(\overline{H} - \underline{H})[\alpha^h(1+c^u) + \alpha^u(1+c^h)] \end{aligned}$$

$$\Rightarrow -[-\Delta v^h(1+c^u) - \Delta v^u(1+c^h)] - \sqrt{\nabla} > -(\overline{H} - \underline{H})[\alpha^h(1+c^u) + \alpha^u(1+c^h)]$$

$$\Rightarrow -\sqrt{\nabla} > -(\overline{H} - \underline{H})[\alpha^h(1+c^u) + \alpha^u(1+c^h)] - \Delta v^h(1+c^u) - \Delta v^u(1+c^h)$$

$$\Rightarrow \sqrt{\nabla} < (\overline{H} - \underline{H})[\alpha^h(1+c^u) + \alpha^u(1+c^h)] + \Delta v^h(1+c^u) + \Delta v^u(1+c^h)$$

$$\Rightarrow \nabla < [(\overline{H} - \underline{H})[\alpha^h(1+c^u) + \alpha^u(1+c^h)] + \Delta v^h(1+c^u) + \Delta v^u(1+c^h)]^2$$

$$\Rightarrow \Delta v^u(1+c^h) > 0 \tag{B3}$$

*Inequality (B3) is always verified. Then the three stationary states of equation (11) are:  $q^* = 0$ ,  $q^* = 1$  and  $q^* = q_1$ .*

*Let's note  $q_{t+1} - q_t = \Delta q$ , and examine how the dynamics of food preferences equation (11) evolve according to the values of  $q$ .*

$$\partial \Delta q / \partial q|_{q=0} = \tau^{h^*}(0) - \tau^{u^*}(0) = \Delta v^h > 0$$

*with  $\tau^{i^*}(0)$  is the value of  $\tau^{i^*}$  if  $q = 0, i \in \{h, u\}$*

$$\partial\Delta q/\partial q|_{q=1} = \tau^{h^*}(1) - \tau^{u^*}(1) = -\Delta v^u < 0$$

with  $\tau^{i^*}(1)$  is the value of  $\tau^{i^*}$  if  $q = 1, i \in \{h, u\}$

If the proportion of individuals with healthy food preferences is very low ( $q \rightarrow 0$ ), only parents with healthy food preferences will make feeding practice efforts. The feeding practice effort of parents with healthy food preferences will progressively increase the proportion of individuals with healthy food preferences in the population. Then, the stationary state  $q^* = 0$  is unstable. On the other hand, if the proportion of individuals with healthy food preferences is very high ( $q \rightarrow 1$ ), only parents with unhealthy food preferences will make feeding practice efforts. The feeding practice effort of parents with unhealthy food preferences will progressively decrease the proportion of individuals with healthy food preferences in the population. Therefore, the stationary state  $q^* = 1$  is also unstable. Consequently, parents' feeding practice efforts imply that the basin of attraction of the dynamics of food preferences is at  $q^* \in ]0; 1[$ . As a result, parents' feeding practice efforts move the dynamics of food preferences away from full homogeneity:  $q^* = 0$  and  $q^* = 1$  are locally unstable stationary states of equation (11).

### Appendix C. proof of Proposition 3

From equations (14) and (15) we obtain:

$$\frac{\partial\tau_G^{h^*}}{\partial\theta} = \frac{(1 - q_t)^2 \beta^h \tau^{u^*}}{1 + c^h} \geq 0 \quad (\text{C1})$$

and

$$\frac{\partial\tau_G^{u^*}}{\partial\theta} = \frac{-2q_t(1 - q_t) [q_t \Delta v^u + \alpha^u \beta^u q_t (1 - q_t) (\underline{H} - \bar{H})] - (1 + c^u)}{[2q_t \beta^u (1 - q_t) \theta + (1 + c^u)]^2} \leq 0 \quad (\text{C2})$$

The provision of public good financed by a tax on unhealthy feeding practices will

increase the feeding practice effort of parents with healthy food preferences and decrease the feeding practice effort of parents with unhealthy food preferences. These effects of the provision of the public good on the parents' feeding practice efforts will always raise the proportion of individuals with healthy food preferences regardless of the composition of the population. The interior stable stationary state will tend towards 1 ( $q^* = 1$ ).

**Appendix D.** *proof of the optimal tax on unhealthy feeding practices and the optimal level of public good (equations 19 and 20)*

The public health function reaches its maximum at  $q_{t+1} = 1$ . The optimal level of public good is therefore such that the interior stationary state converges and becomes merged with the homogeneous state  $q^* = 1$ . In other words, we should have  $\tau_G^{h*} - \tau_G^{u*} = 0$  if  $q_t = 1$

$$\Rightarrow \frac{\Delta v^u - \theta}{1 + c^u} = 0 \quad (\text{D1})$$

$$\Rightarrow \theta^* = \Delta v^u \quad (\text{D2})$$

And

$$G^* = (1 - q_t) \Delta v^u \tau^u \quad (\text{D3})$$

**Appendix E.** *proof of Proposition 4*

Indeed, whatever the proportion of individuals with healthy food preferences in the population ( $q_t$ ), we have from equations (22) and (23):

$$\frac{\partial \tau_\epsilon^{h*}}{\partial \epsilon} = \frac{(1 - q_t)\Delta v^h + \alpha^h q_t(1 - q_t)(\bar{H} - \underline{H})}{1 + c^h} \geq 0 \quad (\text{E1})$$

and

$$\frac{\partial \tau_\epsilon^{u*}}{\partial \epsilon} = -\frac{q_t\Delta v^u + \alpha^u q_t(1 - q_t)(\underline{H} - \bar{H})}{(1 + c^u + \epsilon)^2} \leq 0 \quad (\text{E2})$$

*The feeding practice effort of parents with healthy food preferences increases with the intensity of the nutritional education program, while that of parents with unhealthy food preferences decreases with the intensity of the nutritional education program. As a result, with the nutritional education program, the proportion of individuals with healthy food preferences will be continuously increasing. Then, the dynamics of food preferences will tend towards to an homogeneous population with healthy food preferences.*

**Appendix F.** *proof of the optimal intensity (efficacy)  $\epsilon$  of the nutritional education program*

*The public health function reaches its maximum at  $q_{t+1} = 1$ . The optimal intensity (efficacy) is therefore such that the interior stationary state converges and becomes merged with the homogeneous state  $q^* = 1$ . Meaning, we should have  $\tau_\epsilon^{h^*} - \tau_\epsilon^{u^*} = 0$  if  $q_t = 1$*

$$\Rightarrow \frac{-\Delta v^u}{1 + c^u + \epsilon} = 0 \quad (\text{F1})$$

$$\Rightarrow \Delta v^u = 0 \quad (\text{F2})$$