Social Science & Medicine 296 (2022) 114736

Contents lists available at ScienceDirect

Social Science & Medicine

journal homepage: www.elsevier.com/locate/socscimed

Intergenerational transmission of health behaviors in a changing demographic context: The case of smoking and alcohol consumption

Matthijs Kalmijn *

Netherlands Interdisciplinary Demographic Institute (NIDI)-KNAW/University of Groningen, Netherlands

ARTICLE INFO

Keywords:
Intergenerational transmission
Smoking
Alcohol consumption
Divorce
Stepfamilies
Parental involvement

ABSTRACT

Many studies have documented that health behaviors are transmitted from parents to children. Due to the rise in divorce and remarriage, the context of intergenerational transmission has changed. Using a national multi-actor survey from the Netherlands, the impact of parents' health behaviors on children was compared in different types of families. The focus was on smoking and alcohol consumption of adult children (25–45) in relation to the same health behaviors of multiple parent figures when the children were growing up. Analyses show that the influence of divorced fathers was smaller than that of married fathers. Stepfathers had a significant influence on children as well, on top of the effects of the biological parents. The impact of both divorced fathers and stepfathers was moderated by their involvement in the child's life after divorce. The overall transmission of health behaviors was smaller in single-parent families but larger in stepfamilies.

Health characteristics of parents and children are correlated. This association is found for mental and physical health and is present both during childhood and adulthood (Coneus and Spiess, 2012). The intergenerational association is also found for health behaviors, behaviors conducive or detrimental to a person's health and this is an important channel in which health advantages and disadvantages are transmitted across generations (Gilman et al., 2009; Vermeulen-Smit et al., 2012; Wickrama et al., 1999). Both nature and nurture are believed to play a role. On the one hand there is the genetic transmission of health, traditionally emphasized by medical scientists. For example, studies have shown heritability coefficients of .35 for depression (Sullivan et al., 2000), 0.50 for alcohol use (Deak et al., 2019), 0.50-0.70 for smoking (Li et al., 2003), and 0.25 for longevity (Deelen et al., 2019), pointing to a substantial role for genetic transmission. Social scientists have tended to emphasize the social channels in which health is transmitted. Via the processes of value socialization and role modeling, children may emulate the health behaviors of their parents (Chassin et al., 1998; Cox et al., 2018), leading to an intergenerational association of health outcomes of parents and children.

Rather than revisiting the debate about nature, nurture and its interplay, this paper problematizes the changing demographic context of transmission. Most societies have experienced an increase in the complexity of family relationships in the past six decades, exemplified by an increase in the number of children who are growing up in divorced families and children who ever live with a stepparent (Carlson and Meyer, 2014; Thomson, 2014). Increasing family complexity provides opportunities to answer questions about intergenerational transmission in a new way. If social transmission plays a role, one would expect an influence of stepparents on children's health behaviors and one would expect to observe variation in the influence of biological parents, depending on their marital history. If there was only genetic transmission, stepfathers would have no effect and marital status would not play a role for biological fathers. In this paper, a number of questions is addressed. Is the influence of parents' health behaviors on children's health behaviors reduced by divorce? Does the influence of divorced parents depend on the amount of involvement there was after divorce? And are children's health behaviors also affected by the health behaviors of stepparents?

The role of family dissolution and stepfamily formation has rarely been examined in health research. This is partly caused by a lack of suitable data. Most population surveys contain too few stepfamilies and many surveys do not ask health questions separately for biological fathers and stepfathers or for biological mothers and stepmothers. There is an elaborate research tradition on divorce (reviewed in Clarke-Stewart and Brentano, 2006) and stepfamilies (summarized in Ganong and Coleman, 2017) but little is known about the process of intergenerational transmission in this literature. A few authors have examined the transmission of other characteristics in stepfamilies. Studies of

* NIDI, Lange Houtstraat 19, 2511 CV, The Hague, Netherlands.
E-mail address: kalmijn@nidi.nl.

https://doi.org/10.1016/j.socscimed.2022.114736
Received 14 September 2021; Received in revised form 18 January 2022; Accepted 19 January 2022
Available online 29 January 2022

education and occupational status, for example, have found a substantial effect of stepparents' SES on children's SES, as well as a conditional impact of divorced fathers, depending on the nature of the post-divorce relationship (De Leeuw and Kalmijn, 2020; Erola and Jalovaara, 2017). Similarly, a study of gender ideologies found that stepparents transmitted their attitudes toward stepchildren, especially when the relationship to the stepchild was close (Carlson and Knoester, 2011). There is also research which compared the health behaviors of different kinds of siblings, including comparisons of full siblings and stepsiblings, but these studies did not measure the behaviors of multiple parent figures (Samek et al., 2014).

In this paper, a new national survey from the Netherlands was used that contained a register-based oversample of adult children (aged 25–45) who grew up in families in which the biological parents were not living together at age 15. As a result, the sample contained large numbers of children with divorced, separated, and stepparents. In the interview, a systematic inventory was made for all the biological and non-biological parent figures that were present in the child's life. For each parent figure, a number of traits was measured, including key health variables. Another innovation was the multi-actor nature of the data. All parent figures that were connected to the child were approached for a survey and in this survey, parents answered questions about their children and about their own traits and behaviors. Information was collected about parents' smoking and alcohol consumption, applied to the time the child was growing up, as well as about smoking and alcohol consumption of the adult child at the time of the survey. Smoking and drinking are among the most consequential behaviors for health and explain a substantial part of the inequalities in health and longevity in society (Ho and Fenelon, 2015; Petrovic et al., 2018). Smoking and drinking are also relatively easy to measure retrospectively.

Rather than focusing on the main effects of family structure on children's health behaviors, as has been done in the past (Brown and Rinelli, 2010; Burdette et al., 2017; Mollborn and Lawrence, 2018), the current contribution examines the *moderating* effects of family structure. The main research question is to what extent the effects of parental health behaviors on adult children's health behaviors are dependent on family structure and the type of parent? The paper tests relatively straightforward – but rarely tested – hypotheses about the role of biological and non-biological parents. Hypotheses are primarily based on the notion of social parenting, which argues that parents transmit their attitudes and behaviors to children via observational learning and value socialization. The mechanism of genetic transmission is not tested directly but used as a comparison point for the social hypotheses.

The processes of learning and socialization apply to a range of parental attitudes and behaviors (Axinn and Thornton, 1993; Maccoby, 2015) and have proven to be relevant for smoking and alcohol consumption as well. Parents' healthy or unhealthy behaviors may function as examples for children and provide opportunities for alcohol consumption and smoking at an early age (e.g., via the availability of alcohol and cigarettes at home). Parents who have a healthy lifestyle may also teach their children about the health risks of smoking and excessive drinking and may set stricter rules about smoking and drinking when the children are young (Chassin et al., 1998; Cox et al., 2018; Harakeh et al., 2005; Kandel and Wu, 1995; Pasqualini et al., 2019; van der Vorst et al., 2006). Positive learning and socialization effects often lead to a postponement of the age at which children begin to smoke and drink (van der Vorst et al., 2006), and this in turn can have a beneficial long-term effect on children's health behaviors when they are older and living independently.

Based on the idea of social parenting, one would expect that the health behaviors of stepparents affect adult children's health behaviors and that these effects are independent from, and additive to the influence of biological parents. In contrast, if there was only a genetic impact, stepparents will have no influence. Moreover, one would expect that the influence of divorced parents, and in particular divorced fathers is smaller than that of married fathers because their opportunities for influencing the child are more limited (Gilman et al., 2009). Most divorced fathers in the cohorts that were studied in this paper were non-resident fathers after divorce. Again, from a purely genetic logic, a divorce would not make a difference for the amount of influence of biological parents.

Whether the overall transmission of health behaviors is larger in stepfamilies will depend on how these two effects balance out. Some authors have argued that stepparents replace (non-resident) biological parents (Erola and Jalovaara, 2017), whereas others have argued that influences are cumulative (De Leeuw and Kalmijn, 2020). If divorced fathers retain their influence, an influential stepfather could increase the overall transmission of health behaviors. If divorced fathers 'lose' influence, the overall transmission could stay the same in stepfamilies and even become smaller in divorced single-parent families.

Hypotheses about differences across family types need to be amplified by hypotheses about differences within families. Previous research has demonstrated that there is considerable heterogeneity in the extent to which divorced fathers and stepparents are involved in the child's life when the child is growing up (Jensen, 2019; Jensen and Lippold, 2018; Kalmijn, 2015). Some stepfathers are highly involved in the life of a child and regarded as a 'real' parent by children, in other cases, stepfathers can be more distant. Similarly, in some divorces, fathers lose contact with their children, in other divorces, they remain involved as non-resident parents or become co-parents (Nielsen, 2018). One would expect that for stepfathers as well as for divorced fathers, the effects of their health behaviors on the child's health behaviors are moderated by the amount of involvement in the child's life. The more involved the stepfather was, the more likely it is that he will transmit his health behaviors to the child. Similarly, the more involved the biological father remains after divorce, the more likely it is that he will transmit his health behaviors to the child. According to the genetic perspective, such interaction effects would not emerge.

Research on the transmission of health and health behaviors is relevant for health care, health policy, and families. It can inform our efforts to reduce social inequality and disease burden. If there is a strong genetic component in health transmission, this could lead to better screening policies, improved diagnosis and treatment, and prevention policies targeted at groups with the highest genetic predisposition. If health transmission is to a large extent social, this could be used to develop awareness and information campaigns for parents and family-based interventions to support families with problematic health behaviors. The context of the present study is the Netherlands, which is a representative example of a Western European country, with moderate to high divorce rates and late ages at motherhood (Andersson et al., 2017). Intergenerational transmission of education and occupational status is present but has declined during the 20th century (Ganzeboom and Luijkx, 2004).

1. Data, methods, and design

1.1. Data

The data came from a recently collected multi-actor survey in which adult children who grew up in divorced and repartnered families were overrepresented (Kalmijn et al., 2017, 2018). From the Dutch register in 2017, three groups were sampled: (a) respondents whose biological parents were married/cohabiting at age 14, (b) respondents who lived with one biological parent without a partner at that age, and (c) respondents who lived with one biological parent and his or her new partner. The sample was limited to respondents who were 25–45 years old at the time of the survey. The data were collected by Statistics Netherlands and are available in the public domain (Kalmijn et al., 2017). The response rate was 62%, which is quite good, especially for what is common in earlier Dutch surveys (De Leeuw and De Heer, 2002). The number of responding adult children was 6485.

Via the registers, all the parent figures of the respondents were identified and asked to participate, independently of whether the adult child responded (i.e., it was not necessary to obtain a response from the child nor was it necessary to obtain the child's permission to contact a parent figure). Ethical clearance for the study was provided by the university where the study was coordinated. The response rate of 38% was lower than it was for children because there was no face-to-face follow-up of the nonresponse and no personal incentive offered for participation. According to a non-response analysis of the parents, there was some selectivity in parental non-response related to indicators of the parent-child relationship (i.e., contact frequency, closeness, conflict, and support exchange), but the magnitude of this selectivity was modest and did not affect simple descriptive distributions of relevant family characteristics (Kalmijn, 2021).

To check the representativeness of the sample with respect to health behaviors, comparisons were made with data from Statistics Netherlands (people of ages 25–45 in 2016/2017; extracted from https://opendata.cbs.nl/#/CBS/en/). The numbers for OKiN were weighted to correct for the oversample of children from divorced families. The percentage of smokers according to Statistics Netherlands in this age group was 27.8; in the OKiN, the weighted percentage was 27.2. The percentage of binge drinkers among drinkers according to Statistics Netherlands was 13.8; in the OKiN it was 12. This latter comparison is affected by slight differences in question wording and applies to men only since Statistics Netherlands uses a different definition of binge drinking for women. Finally, the percentage of people with higher vocational or university training was 47.3 according to Statistics Netherlands; in the OKiN it was 45.6.

I selected respondents who grew up with both their biological parents and respondents whose parents divorced or separated when growing up (before age 18). Respondents were asked about their living arrangements after divorce and, in a separate set of questions, about the new partners of their parents. If a child had multiple stepfathers, detailed questions were asked about one stepfather (i.e., the stepfather who lived with the mother the longest when the child lived at home). Based on this information, three subgroups were constructed:

(a) children whose parents were continuously married or cohabiting in youth ($n = 2048$), called *married families*,
(b) children whose parents divorced or separated in youth, who lived with their mother after divorce (and not with their father), and who did not live with a stepfather (for two years or more) ($n = 972$), called *divorced families*,
(c) children whose parents were divorced or separated in youth, who lived with their mother after divorce, and who lived with a stepfather (for two years or more) ($n = 2134$), called *stepfamilies*.

The (smaller) sample of children who primarily lived with a father and a stepmother was not analyzed in this paper. Some children lived in a stepfather household and also in a stepmother household (388); these were not excluded from group (c) in order to retain as much observations for stepfather households. Children with a co-parenting arrangement were also included in group (b) and (c), but this was not so common in the cohorts analyzed ($n = 266$). The exclusion of brief stepfather experiences (less than two years) was done to ensure that there was some room for the stepfather to have an impact on the child.

1.2. Measures of health behaviors

Many ways exists to measure alcohol consumption in surveys (Dawson, 2003). In the OKiN survey, it was decided to focus on two measures: the frequency of alcohol consumption and the incidence of heavy drinking (e.g., binge drinking). Several authors have argued that regular drinking in combination with incidents of heavy drinking is a good predictor of experiencing alcohol problems in adolescents (Courtney and Polich, 2009; Presley and Pimentel, 2006). This suggests that it is useful to combine the measures, something that can also motivated empirically, the correlation between the two measures was $r = 0.48$.

The frequency of alcohol use in the past month was assessed with five categories (*daily*, *multiple times per week*, *once or twice*, *less often*, *no alcohol*). Following Dawson's suggestions (2008, p. 25), this variable was rescaled to the approximate number of occasions per four weeks (i.e., 28, 12, 6, 2, and 0). The question about 'binge' drinking was how often the respondent consumed six or more alcoholic beverages in a row in the past 30 days. This variable was also rescaled (0 = *not*, 1 = *once*, 2.5 = 2 or 3 times, 4 = *4 times or more*). The two items were standardized and summed into a single outcome measure which was analyzed with a linear regression model. Various dichotomizations were considered as well but it was difficult to decide what an optimal cutoff point would be. Moreover, the loss of variance in the outcome variable was considered less attractive in the context of testing notions about parental influences.

Adult respondents were asked if they smoked and if so, how many cigarettes per day. Two outcomes were analyzed. The first outcome contrasted smokers (1) to nonsmokers (0) and was analyzed with a logit model. The second variable was simply the number of cigarettes per day, ranging from 0 to 30. This outcome was analyzed with a negative binomial regression model, following Sharareh et al. (2020). The length and scope of the questionnaire did not allow for measuring the respondent's smoking history.

Table 1
Means, proportions and standard deviations of all variables.

Variable	N	Mean	Proportion	Std. Dev.	Min	Max
Dependent variables						
Alcohol use respondent	5154	-.108		.836	-.839	3.205
Smoking respondent	5154		.326		0	1
Smoking degree resp.	5153	3.003		5.980	0	30
Independent variables						
Alcohol use father	4803	1.684		.992	0	4
Alcohol use mother	5123	1.050		.856	0	4
Alcohol use stepfather	2105	1.611		.991	0	4
Smoking father	4858		.551		0	1
Smoking mother	5135		.480		0	1
Smoking stepfather	2106		.601		0	1
Control variables current						
Age	5154	33.504		5.671	25	46
Woman	5154		.529		0	1
Education (isled scale)	5154	6.875		1.538	2.3	8.7
Manual occupation	5105		.266		0	1
Higher prof/ manager	5105		.148		0	1
Lives with partner	5154		.707		0	1
Has children	5154		.543		0	1
Age start stepfamily	2163	9.462		4.058	1	18
Control variables youth						
Mother involvement	5152	0		1	−2.114	2.059
Father involvement	4919	0		1	−1.319	3.047
Stepfather involvement	2134	0		1	−1.297	2.707
Interparental conflict	4918	0		.886	-.779	2.263

Source: OKiN adult children 25–45 in 2017. See text for measurement details.

Table 1 presents descriptive information on all variables. Table 2 presents estimates of the adult child's health behaviors by the type of family. The table shows that 33% of the respondents smoked and 9% smoked more than 15 cigarettes a day (28% of the smokers). The numbers on alcohol use shows that 18% consumed alcohol three or more times per week and 18% engaged in binge drinking two times in the past month or more (25% of the respondents who did consume alcohol). Children of divorced families smoked more often than children of married families and children who lived in stepfamilies smoked most often. There was no association between alcohol consumption and the child's family structure in youth.

Information about the health behaviors of parents and stepparents was obtained from two sources. The adult children were asked about their biological parents and stepparents when they were growing up. The parents and stepparents themselves reported about their behaviors when they were raising the adult child. Information was asked about smoking (using a dichotomy) and consuming alcohol. Alcohol was measured with one variable (scaled as 1 = *not*, 2 = *only at occasions*, 3 = *modestly*, 4 = *much*, 5 = *excessively*).

The questions were phrased in the same way in the adult child data and the parent data. For the responding parents and stepparents, it was possible to check the level of agreement between child and parent reports. For smoking, the correlation between child and parent reports was $r = 0.74$ for mothers, $r = 0.68$ for fathers, and $r = 0.68$ for stepfathers. The correlations for alcohol consumption were $r = 0.56$, $r = 0.50$, and $r = 0.51$ respectively. These results provided confidence in the reliability of the proxy reports and were consistent with previous studies showing that (younger) children reported with reasonable accuracy about parents' smoking behavior (Harakeh et al., 2006). Methodological studies on retrospective data have shown that the quality of retrospective data is good as long as concrete and relatively simple behaviors and conditions are assessed (Hardt and Rutter, 2004). To develop the scales for the analyses, the two reports were averaged if two reports were available; in other cases, one report was used (the adult-child report).

Table 1 shows that parents smoked considerably more often than adult children, in line with the general historical decline in smoking (Bruggink, 2013; Tuithof et al., 2020). Fathers smoked more often than mothers and there were few differences between fathers and stepfathers. Mothers had lower scores on the alcohol consumption scale than both fathers and stepfathers. The alcohol consumption of the children was measured with a scale of two variables so that the mean could not be compared to the mean of the parents, which was based on a single variable.

The health behaviors of parents were correlated. The alcohol consumption of the mother and the father had a correlation of $r = .208$, the alcohol consumption of the mother and the stepfather had a correlation of $r = 0.395$. For smoking, the correlations were $r = 0.235$ and $r = 0.313$ respectively (odds ratios of 2.65 and 3.83). In other words, there was a (modest) spousal similarity with respect to health behaviors, with somewhat stronger levels of similarity in the mothers' new unions. These correlations are in line with past research and can be attributed to both assortative mating (selection) and spousal influences in couples (Agrawal et al., 2006).

1.3. Control variables

Two types of control variables were included: characteristics of the parents during youth and demographic characteristics of the children at the time of the survey. First, I included an index of interparental conflict during marriage, as reported and witnessed by the respondent. The conflict scale consisted of three items: (a) tensions and conflicts between parents, (b) parents not wanting to talk to each other, (c) occurrence of serious fights between parents. Each item had three answering categories (1 = *never*, 2 = *sometimes*, 3 = *often*). The items combined had a

Table 2
Smoking and alcohol consumption of respondent by family structure in youth.

	Family structure							
	Married		Divorced		Stepfather		Total	
	%	N	%	N	%	N	%	N
Smoking								
Yes	26.7	546	32.6	317	38.3	818	32.6	1681
Total	100.0	2048	100.0	972	100.0	2134	100.0	5154
$X^2 = 64.78$								
$p = .000$								
Amount of smoking								
Non-smoker	73.3	1502	67.4	655	61.7	1316	67.4	3473
0-4	10.4	214	9.1	88	10.7	228	10.3	530
5-14	9.8	201	13.7	133	15.9	340	13.1	674
15+	6.4	131	9.9	96	11.7	249	9.2	476
Total	100.0	2048	100.0	972	100.0	2133	100.0	5153
$X^2 = 85.18$								
$p = .000$								
Alcohol frequency last month								
Daily	2.7	55	4.4	43	3.1	67	3.2	165
Several times per week	15.2	311	15.2	148	14.4	307	14.9	766
Once or twice a week	27.1	554	26.4	257	26.1	557	26.5	1368
Less often	29.6	607	28.3	275	30.2	644	29.6	1526
No	25.4	521	25.6	249	26.2	559	25.8	1329
Total	100.0	2048	100.0	972	100.0	2134	100.0	5154
$X^2 = 8.23$								
$p = .411$								
6 + beverages last month								
Never	67.1	1374	68.7	668	65.1	1389	66.6	3431
Once	14.8	303	14.0	136	16.2	345	15.2	784
Two or three times	12.7	260	11.2	109	13.1	280	12.6	649
Four times or more	5.4	111	6.1	59	5.6	120	5.6	290
Total	100.0	2048	100.0	972	100.0	2134	100.0	5154
$X^2 = 6.38$								
$p = .382$								

Source: OKiN adult children 25–45 in 2017.

high degree of internal reliability (α = 0.86). If parents were divorced, the questions pertained to the time before the divorce.

Second, I included measures of parental involvement. The involvement measure was obtained from research on family-based social capital (McNeal, 1999; Teachman et al., 1997) and included (a) talking with the child about school, (b) helping the child with homework, (c) talking with the child about personal matters, (d) participating with the child in leisure activities, and (e) taking/bringing the child from/to sports. Answers were 1 = *never/not done*, 2 = *sometimes*, 3 = *often*, 4 = *very often*. The reliability of the scale was good (α = 0.83 for fathers and α = 0.88 for stepfathers). The scale was the average across standardized items. For children in divorced families and stepfamilies, involvement referred to the post-divorce period.

Third, I included the age at which the child began to live with the stepfather. The level of involvement could be due to a timing effect. There is some research showing that children are more sensitive of their parents' health behaviors at specific ages (Gilman et al., 2009), suggesting that the age at which the stepfather entered the family could be relevant for the degree of transmission as well.

The following characteristics of the adult children at the time of the survey were included: living with a partner, having children, educational level, and occupational class. Education was scaled in the metric of the ISLED scale (Schröder and Ganzeboom, 2014). Occupational class was coded in three categories: (a) managerial and professional occupations, (b) other nonmanual occupations, and (c) manual occupations. No parental socioeconomic variables were included since there is little evidence that parental SES affects health behaviors independent of respondent's education (Wiles et al., 2007).

1.4. Design and models

The design of the analysis was based on standard practice in research on intergenerational status attainment (Ganzeboom et al., 1991). A regression model was estimated in which effects of the parents' health behaviors were estimated on the corresponding health behaviors of the adult child. Models were estimated for each of the three groups of families separately: married families, divorced families (without a stepfather), and stepfather families. Selected tests were done within groups (comparing effects of fathers and mothers within a group) and between groups (comparing effects of fathers across groups). The groups were not pooled since the third group had a different set of independent variables due to the presence of the stepfather.

Three nested models were estimated for each group and each outcome. Model 1 contained only the age and sex of the child and the parents' health behaviors. Model 2 contained the set of parent control variables, which referred to the youth of the respondent. Model 3 contained the set of demographic variables of the child. These variables referred to the presence and were therefore added last. Because both sets of control variables can function as mediators, the uncontrolled model is also important to look at. Note, however, that the causal direction is not always clear. For example, conflict between parents can be the result of alcohol abuse but conflict can also lead to drinking problems (Pasqualini et al., 2019). In the former case, conflict is a mediator, in the latter case, it is a confounder. For the children's variables, it is clearer that they are potential mediators since they refer to adulthood while the parental health behaviors refer to childhood. For stepfamilies, two versions of Model 1 were estimated: a model without the stepfather variables (Model 1a) and a model with the stepfather variables (Model 1b). This allowed me to examine if the effect of the stepfather came 'at the expense' of the father.

To assess the moderator role of parental involvement, the focus was on stepfamilies. The effects of a stepfather's health behavior was interacted with the level of involvement of the stepfather. The biological father's health behavior was interacted with his level of involvement. The involvement variables were standardized before including the interaction effects ($M = 0$, $SD = 1$). The age at which the stepparent entered the family was also used as a moderator variable.

In an extra analysis, it was assessed what the implications of family structure were for the overall transmission in different types of families. For this analysis, two hypothetical families were compared within each type of family structure (married families, divorced families, and stepfather families). On the one extreme, a family was selected with the 'most healthy' parents, on the other extreme, a family was selected with the 'least healthy' parents. For married families, for example, this meant comparing a child living with two smoking parents and a child with two non-smoking parents. For stepfamilies, this meant comparing a child with three smoking parents (a resident mother, stepfather, and a non-resident father) versus three non-smoking parents. Using the regression estimates, it was then estimated what the child's probability of smoking would be during adulthood for the two hypothetical families. A similar prediction was done for the alcohol use of parents and children.

Missing values were imputed using a multiple imputation procedure in Stata, based on chained estimations, 20 imputations, and Rubin's rules to combine the imputed estimates (Williams, 2012). The significance tests were one-tailed since all hypotheses were directional.

2. Findings

2.1. Alcohol consumption

Table 3 presents the results for alcohol consumption. In married families, fathers' and mothers' alcohol consumption were positively associated with the child's alcohol consumption. The effects of the mother and the father were similar ($p = .429$). In divorced families without a stepparent, the effects were different. The effect of divorced mothers was similar to the effect of married mothers but the effect of divorced fathers was weaker than the effect of married fathers, in line with the hypothesis. A test showed that the difference in the effects of the alcohol use of the divorced father vis-à-vis the married father was significant ($p = .039$). A within-model comparison further showed that in divorced families, the effect of the mother was 90% stronger than the effect of the father (i.e., 0.126/0.066); this difference was marginally significant ($p = .069$). In other words, a divorce was associated with a 'matrilineal tilt' in the transmission process.

The next columns contain the estimates for stepfamilies. In stepfather families, the effect of divorced fathers' alcohol consumption was weaker than the effect of the alcohol consumption of divorced mothers (Model 1a). A test showed that this difference was marginally significant ($p = .057$), in line with the results for divorced families without a stepfather. When combining divorced and stepfamilies, the difference between the effects of mothers and fathers was fully significant ($p = .016$). Moreover, a between-model test showed that the effect of the father's alcohol use in stepfamilies was weaker than the effect of the father's alcohol use in married families ($p = .029$).

In Model 1b, the alcohol consumption of the stepfather was added. Two important findings appeared. First, there was a significant association between the alcohol consumption of the stepfather and the alcohol consumption of the adult child after the alcohol consumption of the biological parents was taken into account. A test showed that the effects of the stepfather and the biological father were similar ($p = .220$). Second, the effect of the alcohol consumption of the divorced father did not decline when the alcohol consumption of the stepfather was added (Model 1b vs. Model 1a). This suggests that the stepfather's influence did not come at the expense of the effect of the biological father but added to the overall transmission.

In Model 2 and 3, an elaborate set of control variables was included. Most of the effects were in line with previous studies on alcohol consumption. Alcohol consumption was lower for women and for people who had a partner and who had children. There were no effects of education, showing that for this specific health behavior in this age group, the higher educated were not 'healthier.' There were small positive effects of (step)father involvement on alcohol consumption in

Table 3
Linear models of respondent's alcohol use in the past month.

	(1) Married	(1) Divorced	(1a) Stepfamily	(1b) Stepfamily	(2) Married	(2) Divorced	(2) Stepfamily	(3) Married	(3) Divorced	(3) Stepfamily
Alcohol mother	.140**	.126**	.107**	.089**	.144**	.119**	.079**	.131**	.117**	.077**
	(5.96)	(4.10)	(5.38)	(4.16)	(6.10)	(3.90)	(3.67)	(5.53)	(3.81)	(3.60)
Alcohol father	.132**	.066**	.059**	.059**	.134**	.086**	.070**	.133**	.083**	.064**
	(5.90)	(2.49)	(3.45)	(3.44)	(5.86)	(3.11)	(3.98)	(5.85)	(3.03)	(3.66)
Alcohol stepfather				.040*			.047**			.041*
				(2.10)			(2.43)			(2.15)
Age	-.008**	-.002	-.006*	-.006*	-.009**	.000	-.003	-.002	.009	.008*
	(-2.91)	(-.40)	(-1.66)	(-1.70)	(-3.17)	(.08)	(-.86)	(-.75)	(1.61)	(2.11)
Woman	-.535**	-.513**	-.576**	-.574**	-.527**	-.509**	-.565**	-.506**	-.473**	-.530**
	(-15.80)	(-9.33)	(-16.35)	(-16.27)	(-15.23)	(-9.23)	(-15.99)	(-14.27)	(-8.30)	(-14.92)
Interparental conflict					-.042	-.027	-.006	-.048	-.030	-.003
					(-1.43)	(-.88)	(-.30)	(-1.64)	(-1.00)	(-.18)
Father involvement					-.019	.091**	.090**	-.021	.088**	.081**
					(-.92)	(2.95)	(4.57)	(-1.02)	(2.82)	(4.18)
Mother involvement					-.016	.018	-.005	-.015	.020	-.010
					(-.73)	(.68)	(-.27)	(-.69)	(.74)	(-.50)
Stepfather involvement							.043*			.045*
							(2.05)			(2.23)
Education								.021	.032	.015
								(1.46)	(1.52)	(1.12)
Higher prof/manager								.054	-.025	.078
								(1.09)	(-.31)	(1.34)
Manual occupation								.005	.117	-.061
								(.10)	(1.61)	(-1.42)
Lives with partner								-.028	-.010	-.148**
								(-.63)	(-.16)	(-3.68)
Has children								-.154**	-.195**	-.252**
								(-3.64)	(-2.99)	(-6.23)
Constant	.223*	.097	.274**	.232*	.237*	.015	.142	-.046	-.424*	-.054
	(2.05)	(.56)	(2.42)	(2.02)	(2.12)	(.08)	(1.22)	(-.28)	(-1.71)	(-.34)
N	2048	972	2134	2134	2048	972	2134	2048	972	2134

Note: No fit statistics because of multiple imputation. One-sided significance tests.
*p < .05, **p < .01.

Table 4
Logit models of respondent's smoking: Average marginal effects.

	(1) Married	(1) Divorced	(1a) Stepfamily	(1b) Stepfamily	(2) Married	(2) Divorced	(2) Stepfamily	(3) Married	(3) Divorced	(3) Stepfamily
Smoking mother	.110**	.077**	.139**	.118**	.110	.072*	.114**	.092**	.036	.086**
	(5.40)	(2.44)	(6.36)	(5.08)	(5.39)	(2.26)	(4.85)	(4.58)	(1.18)	(3.73)
Smoking father	.102**	.045	.079**	.078**	.099	.039	.075**	.082**	-.002	.063**
	(4.99)	(1.34)	(3.35)	(3.33)	(4.81)	(1.14)	(3.16)	(4.06)	(-.07)	(2.76)
Smoking stepfather				.064**			.065**			.046*
				(2.78)			(2.84)			(2.07)
Age	-.007**	-.007**	-.007**	-.007**	-.007	-.008**	-.007**	-.007**	-.004	-.003
	(-4.38)	(-2.61)	(-3.35)	(-3.53)	(-4.41)	(-2.76)	(-3.35)	(-3.83)	(-1.56)	(-1.59)
Woman	-.133**	-.096**	-.079**	-.077**	-.134	-.095**	-.081**	-.115**	-.045	-.067**
	(-7.15)	(-3.27)	(-3.84)	(-3.75)	(-7.12)	(-3.23)	(-3.93)	(-6.00)	(-1.53)	(-3.24)
Interparental conflict					.007	.032*	.022*	.014	.040**	.025*
					(.44)	(2.01)	(1.91)	(.90)	(2.64)	(2.18)
Father involvement					-.014	.001	.002	-.010	.019	.015
					(-1.18)	(.05)	(.17)	(-.84)	(1.19)	(1.31)
Mother involvement					.004	-.018	.005	.004	-.007	.014
					(.31)	(-1.25)	(.45)	(.35)	(-.49)	(1.26)
Stepfather involvement							.007			.013
							(.61)			(1.13)
Education								-.032**	-.068**	-.047**
								(-4.48)	(-6.68)	(-6.25)
Higher prof/manager								-.007	-.009	-.102**
								(-.25)	(-.20)	(-2.67)
Manual occupation								.075**	.061*	.051*
								(3.18)	(1.72)	(2.11)
Lives with partner								-.086**	-.085**	-.136**
								(-3.77)	(-2.70)	(-6.09)
Has children								.005	-.047	-.009
								(.20)	(-1.40)	(-.36)
N	2048	972	2134	2134	2048	972	2134	2048	972	2134

Note: No fit statistics because of multiple imputation. One-sided significance tests.
*p < .05, **p < .01.

stepfamilies. The effects of the stepfather's alcohol use remained significant after the control variables were added. The effects of the mother's alcohol use declined somewhat when the control variables were added, especially in divorced and stepfamilies, making the influences of fathers and mothers in these families more similar. This may indicate that effects of mothers were partly mediated by the control variables.

2.2. Smoking

Results for smoking are presented in Table 4. To improve the comparison of effects in the logit model, average marginal effects were presented in the tables (Mood, 2010). In married families, smoking of both the father and the mother was positively associated with smoking by the adult child. When a father smoked, the likelihood that the child smoked increased by about 10 percentage points. For mothers, this was 11 percentage points. In divorced families without stepparents, transmission appeared to be attenuated. The effect of the divorced mother's smoking was similar to the effect of the married mother's smoking. The effect of the divorced father's smoking was smaller than that of the married father: 0.045 versus 0.102, a marginally significant difference ($p = .061$).

In the model for stepfather families, the effect of the mother's smoking was stronger than the effect of the father's smoking (i.e., 0.139 versus 0.079) and this difference was significant ($p = .049$). More importantly, the stepfather's smoking in youth was positively associated with the adult child's smoking after controlling for the effects of the two biological parents' smoking. When a stepfather smoked, the likelihood that the adult child smoked was 6.4 percentage points higher. Again, the effect of the father was not altered when the stepfather's smoking was added (Model 1b vs. 1a). The effect of the father's and stepfather's smoking were similar in magnitude ($p = .361$).

The negative binomial models for the amount of smoking in Table 5 yielded more or less the same patterns of effects. There were significant and positive effects of the biological mother, the biological father, and the stepfather on the amount of smoking by the adult child. The effects of the father was smaller in divorced families than in married families (although not significant, p = .159) and smaller in stepfamilies than in married families ($p = .059$). There was again a significant effect of the stepfather's smoking on the amount of smoking of the child. The effect of stepfather's smoking did not change the effect of the father's smoking.

In Models 2 and 3 of Tables 4 and 5, control variables were added. In line with past studies, smoking was associated with a lower education, a manual occupation, and living without a partner. Men were more likely to smoke than women. The pattern of effects for parental smoking behaviors was more or less the same as the pattern without control variables. What became clearer after adjustment, is that the effects of parents' smoking were weaker in divorced families.

2.3. Moderator effects

To what extent were the effects of parents modified by their degree of involvement? This question was most immediately relevant for parents who were not fully present during the child's youth, i.e., biological divorced fathers and stepfathers. Table 6 presents interactions of father's and stepfather's health behaviors and their own (post-divorce) involvement in the child's life. Because the involvement variables were standardized, the main effect of the stepfather's health behavior in this

Table 5
Negative binomial regression of th number of cigarettes smoked by the respondent (including 0).

	(1) Married	(1) Divorced	(1a) Stepfamily	(1b) Stepfamily	(2) Married	(2) Divorced	(2) Stepfamily	(3) Married	(3) Divorced	(3) Stepfamily
Smoking mother	.571**	.397*	.560**	.478**	.625	.380*	.445**	.572**	.208	.317**
	(3.35)	(1.93)	(4.53)	(3.70)	(3.67)	(1.84)	(3.39)	(3.46)	(1.03)	(2.50)
Smoking father	.784**	.447*	.387**	.372**	.781	.449*	.361**	.631**	.293	.306**
	(4.80)	(2.10)	(2.95)	(2.84)	(4.80)	(2.10)	(2.74)	(3.91)	(1.41)	(2.44)
Smoking stepfather				.275*			.285*			.305**
				(2.18)			(2.26)			(2.49)
Age	-.023*	-.007	-.010	-.011	-.024	-.011	-.014	-.026*	-.006	-.001
	(-1.68)	(-.39)	(-.92)	(-1.00)	(-1.74)	(-.66)	(-1.20)	(-1.80)	(-.30)	(-.05)
Woman	-.623**	-.289	-.306**	-.299**	-.677	-.307	-.319**	-.599**	-.102	-.348**
	(-4.11)	(-1.47)	(-2.63)	(-2.58)	(-4.38)	(-1.56)	(-2.73)	(-3.87)	(-.52)	(-3.02)
Interparental conflict					.208	.119	.081	.371**	.186*	.124*
					(1.63)	(1.14)	(1.30)	(2.95)	(1.80)	(2.02)
Father involvement					-.126	-.022	-.065	-.130	.062	-.017
					(-1.39)	(-.21)	(-1.04)	(-1.43)	(.62)	(-.28)
Mother involvement					.028	-.137	.041	.094	.008	.091
					(.31)	(-1.44)	(.67)	(1.00)	(.09)	(1.50)
Stepfather involvement							-.015			-.005
							(-.24)			(-.08)
Education								-.234**	-.350**	-.251**
								(-3.53)	(-4.90)	(-5.45)
Higher prof/manager								-.655**	-.179	-.630**
								(-2.88)	(-.64)	(-3.15)
Manual occupation								.573**	.493*	.238*
								(2.85)	(2.08)	(1.75)
Lives with partner								-.604**	-.559**	-.587**
								(-3.25)	(-2.71)	(-4.72)
Has children								.145	-.302	-.007
								(.82)	(-1.42)	(-.06)
Constant	1.202	.985*	1.165**	1.076**	1.338	1.099*	1.150**	3.261**	3.566**	2.780**
	(2.46)	(1.70)	(3.09)	(2.84)	(2.72)	(1.88)	(2.98)	(4.65)	(4.16)	(5.44)
lnalpha										
Constant	2.409	2.181**	1.900**	1.895**	2.401	2.170**	1.891**	2.272**	2.015**	1.782**
	(42.00)	(29.70)	(41.04)	(40.89)	(41.80)	(29.49)	(40.78)	(38.60)	(26.49)	(37.54)
N	2048	972	2133	2133	2048	972	2133	2048	972	2133

Note: No fit statistics because of multiple imputation. One-sided significance tests.
*p < .05, **p < .01.

Table 6
Models of the respondent's health behaviors in stepfamilies with interactions.

	(1)	(2)	(3)
	Alcohol use respondent	Smoking respondent	Smoking degree respondent
Alcohol mother	.070**		
	(3.32)		
Alcohol father	.076**		
	(4.46)		
x involvement	.070**		
	(4.04)		
Alcohol stepfather	.053**		
	(2.71)		
x involvement	.056**		
	(2.98)		
x age stepfamily	.020		
	(1.13)		
Smoking mother		.444**	.400**
		(4.06)	(3.20)
Smoking father		.292**	.319**
		(2.61)	(2.54)
x involvement		.061	.048
		(.57)	(.40)
Smoking stepfather		.215*	.259*
		(2.01)	(2.12)
x involvement		.002	.047
		(.02)	(.42)
x age stepfamily		.001	-.219*
		(.01)	(-1.78)
Father involvement (z)	-.041	.006	-.076
	(-1.19)	(.07)	(-.79)
Stepfather involvement (z)	-.044	.099	.019
	(-1.30)	(1.24)	(.22)
Age start stepfamily	-.038	.024	.166*
	(-1.15)	(.31)	(1.75)
N	2118	2118	2117

Note: No fit statistics because of multiple imputation. One-sided significance tests. Involvement and age stepfamily variables standardized.
(1) linear regression, (2) logit model, (3) negative binomial model.
*p < .05, **p < .01.

model applied to the *average* (step)father and the interaction can be interpreted as the change in the effect on the child's health behaviors *per standard deviation* increase in (step)father involvement.

The interaction effects for the alcohol use of the child were consistent with the hypothesis. A positive and significant main effect was observed for the stepfather's alcohol consumption as well as a positive interaction with his involvement. In other words, the stepfather's alcohol consumption had a positive effect on the child's alcohol consumption and this effect was stronger when he was more involved in the life of the child. One standard deviation increase in stepfather involvement, compared to the mean, would double the effect of the stepfather's alcohol consumption: from $b = 0.053$ for stepfathers with an average involvement to $b = 0.053 + 0.056 = 0.109$ for stepfathers with an involvement one *SD* above the mean. Moreover, there was also a significant interaction of the effect of the biological divorced father and his level of involvement with the child after divorce. The positive effect of the divorced father was stronger on the child when he was more involved after divorce.

The interaction effects are illustrated in Fig. 1, showing the predicted level of alcohol consumption of the child based on the model. The figure shows that when there was little involvement of a father figure, there was no gap in adult children's alcohol consumption depending on the parent's alcohol consumption. The effect of the (step)father's alcohol consumption on the child increased with the level of involvement of the (step)father.

While these results were in line with expectations, the interaction effects for smoking were small and insignificant. The negative binomial model for this outcome yielded no significant interaction effect either.

Interaction effects were also included with the age of the child when the stepfamily was formed. For the models of alcohol use, these interactions were not significant. In the model for the amount of smoking, the interaction was significant and in the expected direction. The older the child was when the stepfather entered the family, the weaker the effect of his smoking on the child's number of cigarettes smoked.

To explore possible additional moderators of the effects of parental health behaviors, I considered the role of the adult child's current age, gender, and education. Each of these variables was interacted with the health behaviors of all three parents in stepfamilies for both smoking (dichotomized) and alcohol consumption. The interactions were included one-by-one (i.e., a model for age interactions, a model for gender interactions, a model for education interactions). Of the 18 interactions tested, only one was (marginally) significant. The effect of the stepfather's alcohol use on the child's alcohol use was weaker for daughters than for sons ($p = .067$).

2.4. Implications for transmission

In the last part of the analysis, it was evaluated what the implications of the regression models were for the effects in different types of families (Fig. 2). First, a distinction was made between a 'healthy' and an

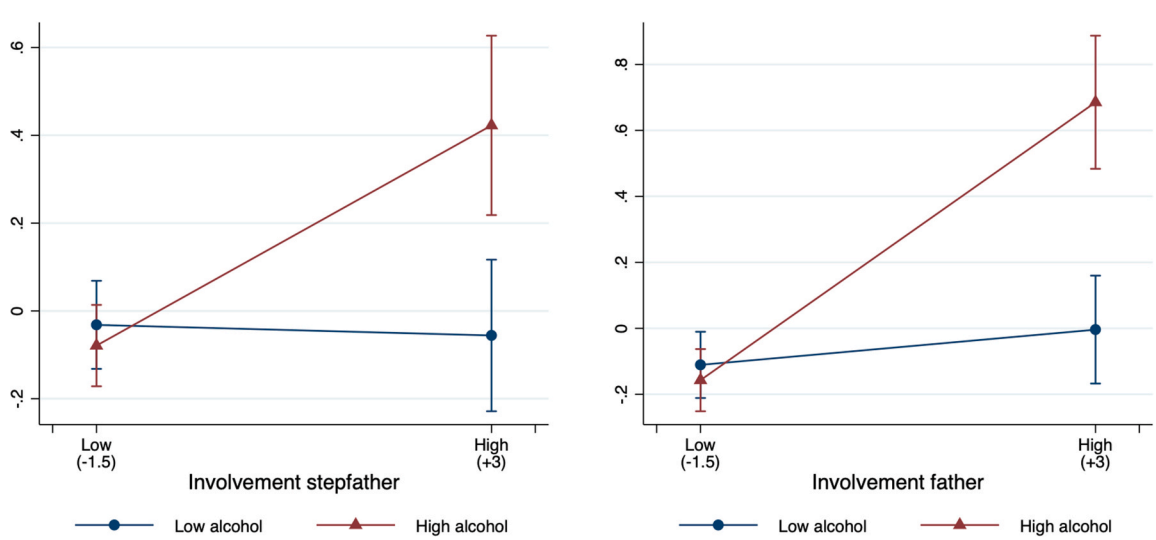

Fig. 1. Alcohol use child by (step) fathers' alcohol use and involvement.

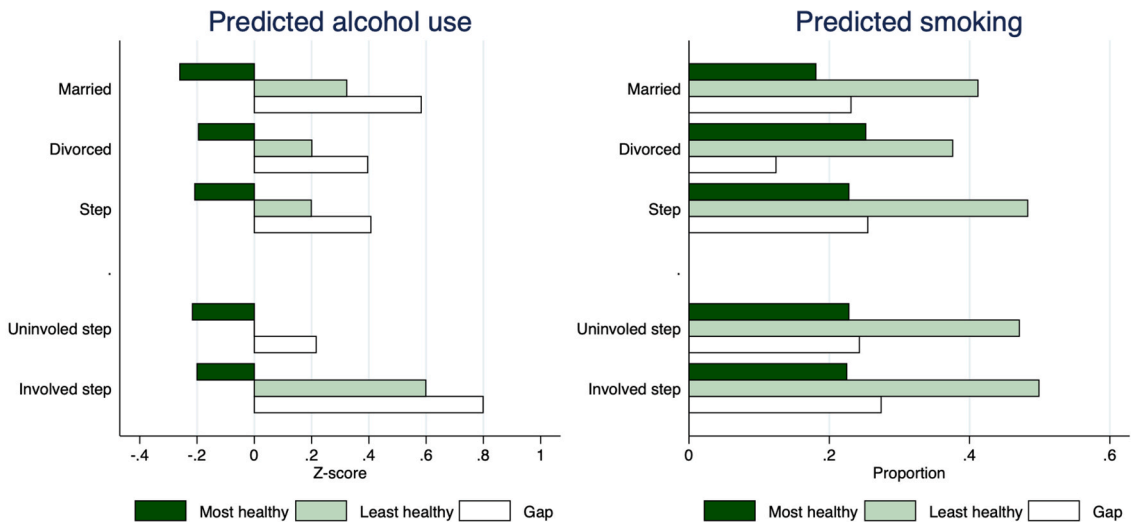

Fig. 2. Predicted health behaviors in different family configurations.

'unhealthy' parent, defined as smoking versus not smoking and one *SD* below or above the mean level of alcohol consumption. Using the effects estimated in the regression models, I calculated predicted levels of smoking and alcohol consumption for adult children with healthy parents and children with unhealthy parents in each type of family. A further contrast was made between families with two uninvolved (step) fathers (one *SD* below the mean) and families with two involved fathers (one *SD* above the mean). For alcohol use, the linear model was used; for smoking, the logit model was used but the predictions were made in terms of probabilities.

The overall degree of transmission was defined as the predicted difference in the health behaviors of children with the most and the least healthy set of parents. Note that this is a *potential* effect of the family, which is not to be confused with the concept of the 'total family effect' as measured in sibling studies (Warren et al., 2002). Fig. 2 shows that for smoking, transmission was somewhat stronger in stepfamilies because biological parents retained their effects while the stepfather added an effect. If all three parents smoked, it was predicted that 48% of the adult children smoked; if none of the three parents smoked, only 23% of the adult children were expected to smoke. Transmission was weaker for single-parent families compared to married families, to a large extent because both parents had a smaller effect on the child when there was a divorce. In other words, a divorce alone reduced transmission of smoking whereas stepfamily formation increased transmission. The level of involvement of the fathers in stepfamilies made little difference for how much transmission there was.

For alcohol consumption, overall transmission declined as a result of family complexity, to a large extent because the biological parents lost in influence due to divorce, something that was not compensated sufficiently by the effect of a stepfather. Adding the distinction between involved and uninvolved (step)fathers made an important difference, however. Taking the difference between children with the least and the healthiest families again as a criterion, it was clear that the largest degree of transmission was occurring in stepfamilies with involved fathers and stepfathers. The level of alcohol consumption of children in 'healthy' and 'unhealthy' stepfamilies, assuming a high level of involvement, was −0.200 and +0 .599, a difference of 0.799 *SD* on the scale of alcohol consumption. In comparison: the gap was 0.58 *SD* for children in 'healthy' and 'unhealthy' married families. In other words, the transmission of children's alcohol consumption was larger in involved stepfamilies than in the average married family.

3. Conclusion and discussion

As a result of the historical rise in divorce and remarriage, increasing numbers of children are living with either one parent or with a parent and a stepparent (Thomson, 2014). Of Dutch children who did not live with both their biological parents in the beginning of the 21st century, 28% was living with a stepparent (Steenhof, 2007). These numbers apply to the Netherlands but are not so different from estimates elsewhere in Europe (Andersson et al., 2017) although they are lower than they are in the US (Raley and Sweeney, 2020). Increasing family complexity may have changed the way families transmit advantages and disadvantages to future generations and introduce new opportunities for testing hypotheses about social and genetic influences. The question of the current paper was how health advantages and disadvantages are transmitted across generations in a new demographic context of divorce, remarriage, and stepfamily formation.

Analyses of a large and representative sample of Dutch stepfamilies showed that the health behaviors of stepparents had significant effects on the health behaviors of their children when these were adult, independent of the effects of the two biological parents. This is new evidence that the intergenerational transmission of health behaviors is social in nature and not purely genetic. Moreover, family complexity changes the way in which health is transmitted in families. When a divorce is combined with the formation of a stepfamily, the overall transmission of health behaviors appeared to be larger. If three parents all had favorable or unfavorable health behaviors, this had a cumulative effect on the (later) health behaviors of their children, in particular when these parents were also involved in the child's life. This was aggravated by the fact that there was assortative mating on health behaviors, not only for the biological parents but also for biological mothers and stepfathers. For example, when the mother smoked, the father and the stepfather were also more likely to smoke. The combination of assortative mating, multiple parent figures, and independent effects of each parent figure, is likely to lead to an accumulation of differences in health behaviors in future generations.

Parental divorce seemed to have a somewhat different effect if no stepparent was involved in the child's life after divorce. For alcohol consumption, effects of divorced parents, and in particular divorced fathers were weaker, showing that the lack of shared residence reduced the father's influence on the child's health behaviors. This too is evidence for the social nature of the transmission process and shows that a purely genetic perspective is insufficient to explain transmission of health behaviors. The influence of mothers was stronger than that of fathers in divorced families, whereas their influences were similar in

married families. For smoking, a smaller impact was found for *both* biological parents, in comparison to married families, showing that children of divorced single-parent families were less strongly influenced by their parents. For both health behaviors, I found weaker overall transmission in divorced single-parent families than in married families. A possible reason for this is that the children in these families were influenced more by social forces outside of the family, a scenario that would be in line with past studies of two-parent families showing that peer groups had a stronger effect on children's substance abuse if there was less monitoring at home (Kiesner et al., 2010).

There was evidence that the transmission of alcohol consumption was stronger when the level of parental involvement in the child's life after divorce was higher. This moderator effect is in line with earlier studies of the intergenerational transmission of educational attainment (De Leeuw and Kalmijn, 2020) and gender role attitudes in stepfamilies (Carlson and Knoester, 2011).

While my findings support general ideas in socialization theory, several more specific mechanisms may be involved in the findings (van der Vorst et al., 2006; Vermeulen-Smit et al., 2012). One mechanism lies in value socialization. The transmission of health behaviors may depend on parents' norms and values. More involvement of parents implies that parents' ideas about the risks of drinking and smoking at an early age are more likely to be communicated to the child and that more monitoring occurs of the child's health behavior. An argument against this mechanism is that our focus was on the parents' behaviors whereas value socialization depends on the parents' views about health behaviors. According to past research, the correlation between attitudes and behavior in this domain is positive but not strong, suggesting that parents who drink heavily and parents who smoke may still be relatively strict toward their children's use of alcohol when the children are adolescents (Mares, van der Vorst, Engels and Lichtwarck-Aschoff, 2011).

A second mechanism in the transmission of health behaviors lies in role modeling. When parents are more involved in the child's life, the child will observe the parents' health behaviors often. This can occur at home but also during shared activities with the child. Observing a parent consume alcohol or smoke will thus be more 'effective' when the parent is more involved in the child's life. Shared activities with a parent in the later teenage years may also create direct opportunities for the child to drink or smoke. The data do not allow me to distinguish between socialization and role modeling mechanisms directly and the findings in this paper are consistent with both. Nonetheless, since the focus was on parent's behaviors, a role modeling interpretation is probably more plausible. A role modeling approach also seems useful in the context of family complexity where a child may observe all three parents engaging in risky behaviors, a situation that is likely to signal weak norms against such behaviors.

The current paper studied adult children (25–45) and hence, addressed the long-term effects of parents' health behaviors. Most studies in the past have focused on parents and younger children at home. It is plausible that effects of parents' health behaviors are stronger at an earlier age since children will experience many social, economic, and cultural changes when making the transition to adulthood and these later experiences could in part work against the influences of parents. Given these considerations, it is not surprising that the effect sizes that were found in the data were modest and that some of the differences were only marginally significant. Still, it is important to recognize that later influences in the life course will not lead to biases in the effects that I found. They could mediate early parent effects, but that would not represent bias in the conventional way. Still, parallel influences such as effects of peer groups and school settings, remain important to study in this context, especially to examine whether such external conditions have differential effects on children, depending on the type of family in which children grew up.

The multi-actor survey with a register-based oversample of children growing up in divorced families is relatively unique in the field of family research but also has limitations. First, the measures were retrospective and this may have resulted in systematic and random measurement error in the reports (De Vries and De Graaf, 2008). Whether this leads to an upward or downward bias in the intergenerational effects is not clear. Second, the survey was aimed at a broad set of sociological and demographic topics and was not a health survey. As a result, the measures of smoking and alcohol consumption were relatively simple, especially in comparison to those asked in specialized adolescent surveys. Similarly, the measures of parenting were general in nature (i.e., involvement) and not directly related to health behaviors (e.g., rule setting). It remains possible that the use of more elaborate scales of alcohol consumption would have yielded stronger intergenerational effects. Similarly, detailed measures of smoking histories would have added insights into the underlying processes. Nonetheless, the effects in the current analyses were all in the expected direction. Moreover, combining parent and child reports to measure health behavior was a strength and will have led to a reduction in measurement error. The trade-off between the level of detail in the measures on the one hand, and the strength of the data and design on the other hand, seems appropriate given how little is known about the intergenerational transmission of health in divorced families.

Author statement

Matthijs Kalmijn contributed to the conceptualization, formal analysis, and writing, and was principal investigator of the data collection.

Acknowledgement

I thank the reviewers for helpful comments. The survey was conducted as part of a larger project on Family Complexity funded by a personal grant to Matthijs Kalmijn from the European Research Council in the Horizon 2020 scheme for the program FamilyComplextiy (grant number ERC AdG 669334).

References

Agrawal, A., Heath, A.C., Grant, J.D., Pergadia, M.L., Statham, D.J., Bucholz, K.K., Madden, P.A.F., 2006. Assortative mating for cigarette smoking and for alcohol consumption in female Australian twins and their spouses. Behav. Genet. 36 (4), 553–566. https://doi.org/10.1007/s10519-006-9081-8.

Andersson, G., Thomson, E., Duntava, A., 2017. Life-table representations of family dynamics in the 21st century. Demogr. Res. 37, 1081–1229. https://doi.org/10.4054/DemRes.2017.37.35.

Axinn, W.G., Thornton, A., 1993. Mothers, children, and cohabitation: the intergenerational effects of attitudes and behavior. Am. Socio. Rev. 58, 233–246.

Brown, S.L., Rinelli, L.N., 2010. Family structure, family processes, and adolescent smoking and drinking. J. Res. Adolesc. 20 (2), 259–273. https://doi.org/10.1111/j.1532-7795.2010.00636.x.

Bruggink, J.-W., 2013. Ontwikkelingen in het aandeel rokers in Nederland sinds 1989. Tijdschr. Gezondheidswetenschappen (TSG) 91 (4), 234–240.

Burdette, A.M., Needham, B.L., Taylor, M.G., Hill, T.D., 2017. Health lifestyles in adolescence and self-rated health into adulthood. J. Health Soc. Behav. 58 (4), 520–536. https://doi.org/10.1177/0022146517735313.

Carlson, D.L., Knoester, C., 2011. Family structure and the intergenerational transmission of gender ideology. J. Fam. Issues 32 (6), 709–734. https://doi.org/10.1177/0192513x10396662.

Carlson, M.J., Meyer, D.R. (Eds.), 2014. Family Complexity, Poverty, and Public Policy, vol. 654.

Chassin, L., Presson, C.C., Todd, M., Rose, J.S., Sherman, S.J., 1998. Maternal socialization of adolescent smoking: the intergenerational transmission of parenting and smoking. Dev. Psychol. 34 (6), 1189–1201. https://doi.org/10.1037/0012-1649.34.6.1189.

Clarke-Stewart, A., Brentano, C., 2006. Divorce: Causes and Consequences. Yale University Press, New Haven.

Coneus, K., Spiess, C.K., 2012. The intergenerational transmission of health in early childhood-Evidence from the German Socio-Economic Panel Study. Econ. Hum. Biol. 10 (1), 89–97. https://doi.org/10.1016/j.ehb.2011.03.002.

Courtney, K.E., Polich, J., 2009. Binge drinking in young adults: data, definitions, and determinants. Psychol. Bull. 135 (1), 142–156. https://doi.org/10.1037/a0014414.

Cox, M.J., Janssen, T., Lopez-Vergara, H., Barnett, N.P., Jackson, K.M., 2018. Parental drinking as context for parental socialization of adolescent alcohol use. J. Adolesc. 69, 22–32. https://doi.org/10.1016/j.adolescence.2018.08.009.

Dawson, D.A., 2003. Methodological issues in measuring alcohol use. Alcohol Res. Health 27 (1), 18–29.

De Leeuw, E.D., De Heer, W., 2002. Trends in household survey nonresponse: a longitudinal and international comparison. In: Groves, R.M., Dillman, D.A., Eltinge, J.L., Little, R.J.A. (Eds.), Survey Nonresponse. Wiley, New York, pp. 41–54.
De Leeuw, S.G., Kalmijn, M., 2020. The intergenerational transmission of socioeconomic status in stepfamilies: what happens if two fathers are involved in the transmission process? J. Marriage Fam. 82 (2), 657–674. https://doi.org/10.1111/jomf.12610.
De Vries, J., De Graaf, P.M., 2008. Is the intergenerational transmission of high cultural activities biased by the retrospective measurement of parental high cultural activities. Soc. Indicat. Res. 85, 311–327.
Deak, J.D., Miller, A.P., Gizer, I.R., 2019. Genetics of alcohol use disorder: a review. Curr. Opin. Psycho. 27, 56–61. https://doi.org/10.1016/j.copsyc.2018.07.012.
Deelen, J., Evans, D.S., Arking, D.E., Tesi, N., Nygaard, M., Liu, X.M., Murabito, J.M., 2019. A meta-analysis of genome-wide association studies identifies multiple longevity genes. Nat. Commun. 10, 14. https://doi.org/10.1038/s41467-019-11558-2.
Erola, J., Jalovaara, M., 2017. The replaceable: the inheritance of paternal and maternal socioeconomic statuses in non-standard families. Soc. Forces 95 (3), 971–995. https://doi.org/10.1093/sf/sow089.
Ganong, L., Coleman, M., 2017. Stepfamily Relationships: Development, Dynamics, and Interventions. Springer, New York.
Ganzeboom, H.B.G., Luijkx, R., 2004. Recent trends in intergenerational occupational class reproduction in The Netherlands 1970-1999. In: Breen, R. (Ed.), Social Mobility in Europe. Oxford University Press, Oxford.
Ganzeboom, H.B.G., Treiman, D.J., Ultee, W.C., 1991. Comparative intergenerational stratification research: three generations and beyond. Annu. Rev. Sociol. 17, 277–302.
Gilman, S.E., Rende, R., Boergers, J., Abrams, D.B., Buka, S.L., Clark, M.A., Niaura, R.S., 2009. Parental smoking and adolescent smoking initiation: an intergenerational perspective on tobacco control. Pediatrics 123 (2), E274–E281. https://doi.org/10.1542/peds.2008-2251.
Harakeh, Z., Engels, R., de Vries, H., Scholte, R.H.J., 2006. Correspondence between proxy and self-reports on smoking in a full family study. Drug Alcohol Depend. 84 (1), 40–47. https://doi.org/10.1016/j.drugalcdep.2005.11.026.
Harakeh, Z., Scholte, R.H.J., de Vries, H., Engels, R., 2005. Parental rules and communication: their association with adolescent smoking. Addiction 100 (6), 862–870. https://doi.org/10.1111/j.1360-0443.2005.01067.x.
Hardt, J., Rutter, M., 2004. Validity of adult retrospective reports of adverse childhood experiences: review of the evidence. JCPP (J. Child Psychol. Psychiatry) 45 (2), 260–273. https://doi.org/10.1111/j.1469-7610.2004.00218.x.
Ho, J.Y., Fenelon, A., 2015. The contribution of smoking to educational gradients in US life expectancy. J. Health Soc. Behav. 56 (3), 307–322. https://doi.org/10.1177/0022146515592731.
Jensen, T.M., 2019. A typology of interactional patterns between youth and their stepfathers: associations with family relationship quality and youth well-being. Fam. Process 58 (2), 384–403. https://doi.org/10.1111/famp.12348.
Jensen, T.M., Lippold, M.A., 2018. Patterns of stepfamily relationship quality and adolescents' short-term and long-term adjustment. J. Fam. Psychol. 32 (8), 1130–1141. https://doi.org/10.1037/fam0000442.
Kalmijn, M., 2015. Father-child relations after divorce in four European countries: patterns and determinants. Comp. Populat. Stud. 40 (3), 251–276. https://doi.org/10.12765/CPoS-2015-10en.
Kalmijn, M., 2021. Are National Family Surveys Biased toward the Happy Family? A Multi-Actor Analysis of Selective Survey Nonresponse. Sociological Methods & Research, forthcoming.
Kalmijn, M., Ivanova, K., Van Gaalen, R., De Leeuw, S., Van Houdt, K., Van Spijker, F., 2017. A Multi-Actor Survey of Adult Children in the Netherlands [Codebook Release 1.0. The Hague/Heerlen: University of Amsterdam/Statistics Netherlands, Amsterdam.
Kalmijn, M., Ivanova, K., van Gaalen, R., de Leeuw, S.G., van Houdt, K., van Spijker, F., Hornstra, M., 2018. A multi-actor study of adult children and their parents in complex families: design and content of the OKiN survey. Eur. Socio Rev. 34 (4), 452–470. https://doi.org/10.1093/esr/jcy016.
Kandel, D.B., Wu, P., 1995. The contributions of mothers and fathers to the intergenerational transmission of cigarette-smoking in adolescence. J. Res. Adolesc. 5 (2), 225–252. https://doi.org/10.1207/s15327795jra0502_4.
Kiesner, J., Poulin, F., Dishion, T.J., 2010. Adolescent substance use with friends moderating and mediating effects of parental monitoring and peer activity contexts. Merrill-Palmer Q. J. Dev. Psychol. 56 (4), 529–556.
Li, M.D., Cheng, R., Ma, J.Z., Swan, G.E., 2003. A meta-analysis of estimated genetic and environmental effects on smoking behavior in male and female adult twins. Addiction 98 (1), 23–31. https://doi.org/10.1046/j.1360-0443.2003.00295.x.
Maccoby, E.E., 2015. Historical overview of socialization research and theory. In: Grusec, J.E., Hastings, P.D. (Eds.), Handbook of Socialization Research. Guilford, New York, pp. 3–32.
Mares, S.H.W., van der Vorst, H., Engels, R., Lichtwarck-Aschoff, A., 2011. Parental alcohol use, alcohol-related problems, and alcohol-specific attitudes, alcohol-specific communication, and adolescent excessive alcohol use and alcohol-related problems: an indirect path model. Addict. Behav. 36 (3), 209–216. https://doi.org/10.1016/j.addbeh.2010.10.013.
McNeal, R.B., 1999. Parental involvement as social capital: differential effectiveness on science achievement, truancy and dropping out. Soc. Forces 78, 117–144.
Mollborn, S., Lawrence, E., 2018. Family, peer, and school influences on children's developing health lifestyles. J. Health Soc. Behav. 59 (1), 133–150. https://doi.org/10.1177/0022146517750637.
Mood, C., 2010. Logistic regression: why we cannot do what we think we can do, and what we can do about it. Eur. Socio Rev. 26 (1), 67–82. https://doi.org/10.1093/esr/jcp006.
Nielsen, L., 2018. Joint versus sole physical custody: children's outcomes independent of parent–child relationships, income, and conflict in 60 studies. J. Divorce & Remarriage 1–35.
Pasqualini, M., Pieroni, L., Tomassini, C., 2019. How much and why does the mum matter? Mechanisms explaining the intergenerational transmission of smoking. Adv. Life Course Res. 40, 99–107. https://doi.org/10.1016/j.alcr.2019.03.004.
Petrovic, D., de Mestral, C., Bochud, M., Bartley, M., Kivimaki, M., Vineis, P., Stringhini, S., 2018. The contribution of health behaviors to socioeconomic inequalities in health: a systematic review. Prev. Med. 113, 15–31. https://doi.org/10.1016/j.ypmed.2018.05.003.
Presley, C.A., Pimentel, E.R., 2006. The introduction of the heavy and frequent drinker: a proposed classification to increase accuracy of alcohol assessments in postsecondary educational settings. J. Stud. Alcohol 67 (2), 324–331. https://doi.org/10.15288/jsa.2006.67.324.
Raley, R.K., Sweeney, M.M., 2020. Divorce, repartnering, and stepfamilies: a decade in review. J. Marriage Fam. 82 (1), 81–99. https://doi.org/10.1111/jomf.12651.
Samek, D.R., Keyes, M.A., Hicks, B.M., Bailey, J., McGue, M., Iacono, W.G., 2014. General and specific predictors of nicotine and alcohol dependence in early adulthood: genetic and environmental influences. J. Stud. Alcohol Drugs 75 (4), 623–634. https://doi.org/10.15288/jsad.2014.75.623.
Schröder, H., Ganzeboom, H.B.G., 2014. Measuring and modelling level of education in European societies. Eur. Socio Rev. 30 (1), 119–136. https://doi.org/10.1093/esr/jct026.
Sharareh, P., Leili, T., Abbas, M., Jalal, P., Ali, G., 2020. Determining correlates of the average number of cigarette smoking among college students using count regression models. Sci. Rep. 10 (1) https://doi.org/10.1038/s41598-020-65813-4.
Steenhof, L., 2007. Schatting van het aantal stiefgezinnen. Bevolkingstrends 4, 19–22.
Sullivan, P.F., Neale, M.C., Kendler, K.S., 2000. Genetic epidemiology of major depression: review and meta-analysis. Am. J. Psychiatr. 157 (10), 1552–1562. https://doi.org/10.1176/appi.ajp.157.10.1552.
Teachman, J.D., Paasch, K., Carver, K., 1997. Social capital and the generation of human capital. Soc. Forces 75, 1343–1359.
Thomson, E., 2014. Family complexity. Ann. Am. Acad. Polit. Soc. Sci. 654, 245–258.
Tuithof, M., Dorsselaer, S.v., Rombouts, M., Kleinjan, M., Monshouwer, K., 2020. Roken en alcoholgebruik onder Nederlandse scholieren. Tijdschr. Gezondheidswetenschappen (TSG) 98, 42–51.
van der Vorst, H., Engels, R., Meeus, W., Dekovic, M., 2006. The impact of alcohol-specific rules, parental norms about early drinking and parental alcohol use on adolescents' drinking behavior. JCPP (J. Child Psychol. Psychiatry) 47 (12), 1299–1306. https://doi.org/10.1111/j.1469-7610.2006.01680.x.
Vermeulen-Smit, E., Koning, I.M., Verdurmen, J.E.E., Van der Vorst, H., Engels, R., Vollebergh, W.A.M., 2012. The influence of paternal and maternal drinking patterns within two-partner families on the initiation and development of adolescent drinking. Addict. Behav. 37 (11), 1248–1256. https://doi.org/10.1016/j.addbeh.2012.06.005.
Warren, J.R., Hauser, R.M., Sheridan, J.T., 2002. Occupational stratification across the life course: evidence from the Wisconsin longitudinal study. Am. Socio. Rev. 67, 432–455.
Wickrama, K.A.S., Conger, R.D., Wallace, L.E., Elder, G.H., 1999. The intergenerational transmission of health-risk behaviors: adolescent lifestyles and gender moderating effects. J. Health Soc. Behav. 40 (3), 258–272. https://doi.org/10.2307/2676351.
Wiles, N.J., Lingford-Hughes, A., Daniel, J., Hickman, M., Farrell, M., Macleod, J., Lewis, G., 2007. Socio-economic status in childhood and later alcohol use: a systematic review. Addiction 102 (10), 1546–1563. https://doi.org/10.1111/j.1360-0443.2007.01930.x.
Williams, R., 2012. Using the margins command to estimate and interpret adjusted predictions and marginal effects. STATA J. 12 (2), 308–331. https://doi.org/10.1177/1536867x1201200209.