

REGULAR ARTICLE

Predictors of continued playing or singing – from childhood and adolescence to adult years

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ABSTRACT

Aim: Many individuals play an instrument or sing during childhood, but they often stop later in life. This study surveyed adults representative of the Swedish population about musical activities during childhood.

Methods: We asked 3820 adults (65% women) aged from 27 to 54 from the Swedish Twin Registry, who took extra music lessons to those provided at school, to fill in a web-based questionnaire. Factors analysed were the age they started studying music, the instrument they played, kind of teaching, institution and educational content, number of lessons and perceived characteristics of the lessons, the music environment during their childhood years and their preferred music genre. All variables were dichotomised.

Results: Factors strongly associated with continued playing or singing were male sex, young starting age, cultural family background, self-selected instrument, attending music classes and more than once a week, church-related or private education, pop, rock or classical music, playing by ear and improvisation.

Conclusion: Several significant predictors determined whether a child continued to sing or play an instrument as an adult and many could be externally influenced, such as starting at a young age, taking music classes more than once a week, improvisation and the type of music they played.

INTRODUCTION

Active engagement in music can give rich, positive experiences and is important for the quality of life of many people (1). These positive effects probably arise both from the music itself and from the social interaction with other people in a musical context. Interestingly, however, although many play an instrument or sing during childhood, they often stop later in life. Interviews with large numbers of randomly selected Swedish people have been performed within the framework of the Swedish Survey of Living Conditions (2). About 10% of the 16- to 19-year-olds who were interviewed in 1982–1983, 1990–1991, 1998–1999 and 2006 sang in a choir at least once a week. The proportion decreased to 6% by the age of 20–29 and to approximately 5% by the age of 30–74. There was no change in the percentage of singers in 16–19 age range during the same period. The corresponding numbers for playing a musical instrument at least once during the past year were around 25% in 16- to 19-year-olds, decreasing from 33% to 20% during those years, 20% in the age group 20–29 and around 12% in the age group 30–74 (2). These findings suggest that there was not only a striking decrease in the number of musically active subjects from youth to adulthood, but that there was also a secular decrease in the number of children who started playing an instrument in Sweden.

Taking up and maintaining musical activity into adulthood is likely to depend on many factors. Some factors reflect properties of the individual, such as traits that make a person more or less interested, motivated and able to actively engage in music. Musical practice is thus related to personality, in particular, openness to experience and a proneness to have psychological flow experiences during musical activities, and the latter trait is associated with openness and other personality dimensions (3–6). Secondly, musical engagement is related to intrinsic rather than extrinsic motivation (7), with a tendency to perform tasks because they are rewarding in themselves (8). Finally, practicing music is correlated with cognitive abilities,

Key notes

- Many individuals play an instrument or sing during childhood, but they often stop later in life.
- We asked 3820 Swedish adults aged 27–54 who took extra music lessons to fill in a web-based questionnaire.
- Several significant predictors determined whether children continued to engage in music as adults, such as young starting age, taking music classes more than once a week, improvisation and the type of music played.

including both general intelligence and more narrow abilities, such as auditory discrimination and various linguistic abilities (9). In principle, these diverse associations could reflect various underlying causal scenarios. However, we have recently used twin modelling to study the genetic architecture of associations between musical training on the one hand and personality (3), intelligence (10) and musical discrimination ability (11) on the other hand. In each case, we found that the observed associations were essentially driven by pleiotropies, common genetic influences, rather than by causal effects of practicing on a trait or vice-versa. Indeed, we have found that genetic factors have a substantial influence on practicing behaviour itself (11). Evidence has also been found for gene–environment interaction, which showed that genetic effects on music accomplishment were stronger for those who had engaged in music practice, that is, that innate properties attract people with higher potential to practice more (12). An important mechanism underlying the associations between personal variables and practicing could thus be that individuals with a particular trait complex (13) tend to spontaneously engage in and maintain musical activities.

A second broad group of factors that is likely to influence practicing are various environmental variables that could reflect factors such as social support and opportunities for musical engagement and education. Although genetic factors could also certainly be involved in such associations, through gene–environment co-variation (12,14), environmental variables are of obvious interest, as in some cases they might be manipulated to influence practicing behaviour. Increased knowledge of such variables could be of practical relevance, such as when formulating educational policies. However, relatively few studies have investigated environmental effects on musical practicing behaviour, although the influence of factors, such as competing scheduling, after-school activities and preparation for state standardised testing, has been studied (15). With regard to the interaction between the young pupil, teacher and parent, Creech (16) found that learning outcomes were associated with parents soliciting the teacher's view on the child's progress. They were also related to the child's view of the level of parental involvement in negotiating practicing issues and providing structure for practice and in general how much parental interest there was in the child's performance and relationship with the teacher. When asking the pupils themselves, their own music efficacy and ability (17) and teachers' positive reinforcement emerges as the most important factor for continuing to practice and play (18). Music teachers identified 11 variables deemed important for dropping out of the music curriculum, the most important of which were parental discouragement, peer influence, quality of the curriculum, parental disinterest, unsupportive school climate, lack of principal's support and teacher efficacy (19). Already proficient adult musicians seem to be motivated to continue playing by

what is referred to as passion, a concept related to self-determination theory (20).

In the Swedish setting, community music schools have been important in generating interest in music training. During the years of this study, such schools offered Swedish children in the majority of communities with the chance to participate in music training outside regular school hours (21). Another important source of extra music training during the study period was special music schools. These schools have been operating with public money in most of the larger cities in the country. They offer extensive music teaching, mostly choir singing, as an integrated part of the regular school day. This form of teaching only engages a relatively small number of highly selected children, as acceptance of a child is based upon results in music tests. A much smaller number of children attend privately owned music schools operating either outside regular school hours or in the integrated way. Sweden is a country that offers children extensive opportunities for music training, but there are pronounced differences in the amount of reported music training between social classes, between boys and girls and between different regions (2).

In this study, adults representative of the Swedish population was asked about musical activities during childhood.

The main aim of this study was to identify environmental variables that predict retention of musical activity from youth to adulthood, utilising a large Swedish sample of 3820 individuals aged 27–54 who had practiced music during childhood and adolescence. As there is a dearth of studies investigating this question, we chose an exploratory approach and studied a fairly broad set of variables that could reasonably be expected to have effects on long-term practicing behaviour. These included the age when the child started, the musical environment within and outside the family during childhood, the musical instrument and genre the person had engaged in and forms, intensity and content of musical education.

Method

Participants

In total, 3820 individuals (1322 men and 2498 women) aged 27–54 years were included in this study. Data were collected as part of a web survey sent out to a cohort of approximately 32 000 twins born between 1959 and 1985 – the STAGE cohort (21) – part of the Swedish Twin Registry (STR), one of the largest registries of its kind (21, 23). In total, 11 543 individuals participated in the web survey.

In this study, we were interested in associations on the phenotypic level. Relatedness in a sample can influence the strength of associations if factors are strongly correlated within pairs (due to shared genetic factors or to shared childhood circumstances). Accordingly, we first constructed a sample of unrelated participants that included all single twins (without a participating cotwin) and one randomly selected twin from each complete twin pair. The resulting unrelated sample consisted of 8599 individuals (3740 men and 4859 women).

The participants were asked to indicate whether they had ever played an instrument and/or participated in singing. In the following presentation, the word playing will refer to both playing and singing. Of the 7983 individuals (3465 men and 4518 women) who answered this question, 2261 individuals (1326 men and 935 women) reported that they had never played and 5722 individuals (2136 men and 3583 women) reported that they had been doing so. Those who responded positively were questioned about the number of hours of practice during four age intervals (age 0–5, 6–11, 12–17, and 18 until the age when they took part in the study), and how many hours a week during each of those intervals they practiced. As there were so few subjects who reported music practice in the age period 0–5, this period was excluded. Accordingly, only the age periods 6–11 and 12–17 have been included in this study. Of 5710 individuals, 5490 (3472 men and 2018 women) also reported how many hours they had played or sung at some stage before adulthood. Of these 5490, 3820 individuals (1322 men and 2498 women) had gone through music education in any form apart from the ordinary compulsory music lessons during age 6–17. These 3820 constituted the final sample used in the present analyses.

Informed consent to participate was obtained from all participants. The study was approved by the Regional Ethical Review Board in Stockholm (Dnr 2011/570-31/5, 2011/1425-31, 2012/1107/32).

Measures

Sex and age

Sex was coded one for males and zero for females (variable *sex*). Age was dichotomised using the median (40 years) as a cut-off with participants above median coded one and participants below median coded zero (*age above 40 years*). The participants reported at which age they began to play/sing (*age of playing onset*).

Early cultural exposure

Four items regarding musical and other cultural exposure during childhood and adolescence were included, that is:

1. The number of people who played an instrument or sang among family members and close friends when growing up. Answers were given on an eight-level scale ranging from zero individuals to 41 or more individuals. Approximately two-thirds reported up to five individuals (zero, one to two or three to five) and one-third reported more than five individuals who played. The latter ones were classified into the group *had more than five persons who played/sang in the surrounding when growing up* (coded one). The others were zero.
2. The number of music recordings present in the home. Answers were given on a nine-level scale ranging from zero recordings to 3201 recordings or more. The two-thirds who reported up to 100 recordings in their home when growing up were zero. One-third

reported more than 100 recordings and these were coded one and thus included in the group *had more than 100 recordings in the home when growing up*.

3. The frequency of concert attendance during childhood and adolescence. Answers were given on a four-level scale with the response alternatives once a year or more seldom, two to 11 times per year, one to three times per month and one to several times per week. Approximately one-third of the participants reported that they attended concerts two or more times per year and these were classified into the group *attended concerts more than once per year* (coded one).
4. The frequency of attending nonmusical cultural activities during childhood and adolescence. Answers were given on the same four-level scale as for the previous item. Roughly one-third of the participants reported that they attended cultural activities twice or more per year and these were classified into the group *attended other cultural activities more than once per year* (coded one).

Main musical instrument

The participants reported their main musical instrument. Singing was treated as an instrument. The instruments were classified into the following categories keyboard instrument, wind instrument, drums, guitar, stringed instrument (other than guitar), singing and unclassified. A variable was created for each instrument category. If the participants had reported a keyboard instrument as main instrument, they were coded one in the *keyboard instrument* variable and the others were zero, and so on for each instrument category variable. The participants also reported who was the most influential person behind the decision to start playing the instrument that they had played the most. Response alternatives were myself, parent or other relative, friend, music teacher or other person. The participants were classified into the group *chose their music instrument themselves* if they were answering myself which was coded one. All other options were zero.

Musical education

The participants were also asked about the contexts in which their music education mainly took place. The response categories were *music class, community music school, church, privately, and parent or other family member or relatives*. The participant could indicate more than one category. The participants who indicated that their main place of music education was in a music class were assigned to the *music class* group (coded one), and so on for all options. For each option, the participants who did not attend music class or community music school etc. were zero.

Participants also reported the frequency of participation in music education or lessons outside regular school hours for the age categories 6–11 and 12–17. The response options were once per year or more seldom, two to 11 times per year, once to twice per month, once every second week,

once a week, twice per week and three or more times per week. The participants were classified into the group *participated in music education/lessons more than once a week* (coded one) if they reported twice per week or more in any of the two age intervals. The others were zero.

The type of music education that they had participated in was indicated for the age categories 6–11 and 12–17. For this question, participants could indicate more than one response out of *reading, played by ear, played in ensemble, memorising and improvising*. The participants who indicated that they were reading notes during the age period 6–11 constituted the group *reading 6–11* (coded one) and so on for all the options and for both time periods. The participants who indicated that they were reading notes, during any period, were also classified to the group *reading* (coded one). The participants who indicated that they played in ensemble were classified into the group *played in ensemble* (coded one) etc. for each response option. For each option, the participants who did not indicate that they had the particular type of music education that was asked for were zero.

Musical genre

The participants reported which type of genres they had been active in during the age periods 6–11 and 12–17. The options were *classical music, contemporary music, jazz music, pop/rock music, and ballads and folk music or other genre*. If they had practiced classical music during the age range 6–11 years, they were classified into the *classical music 6–11* group (coded one) etc. for each genre and both age intervals. Participants who reported that they had practiced classical music in any of the periods were classified into the *classical music* group (coded one) etc. for each genre.

Perception of music lessons

The participants were asked to describe how they perceived their music lessons during the 6–11 and 12–17 periods. The participants reported to which extent they agreed with the statements *The music lessons were fun, The music lessons were meaningful, The music lessons were stimulating and The music lessons were demanding* on a scale from one to seven. One corresponded to completely incorrect and seven to completely correct. Regarding the statement about fun lessons, the participants who indicated six or seven were classified into the groups *perceived lessons as fun 6–11* (coded one) and *perceived lessons as fun 12–17* (coded one), respectively. If they belonged to at least one of these groups, thus perceived the lessons as fun during any period, they were classified into the group *perceived lessons as fun* (coded one). The others were zero. The groups *perceived lessons as meaningful* and *perceived lessons as stimulating* were constituted in the same way. Regarding the statement about demanding lessons, the participants who reported five, six or seven were classified into the group *perceived lessons demanding* (coded one) and the others were zero.

Music practice support

The participants reported whether they received help with music practice at home or outside the music lessons from a parent, a friend or somebody else or whether they did not receive any help outside the music lessons for each age range during which they were practicing. Participants who reported that they received additional help from somebody other than a music teacher during the age range 6–11 and 12–17 were coded one and the others were coded zero. The participants who reported help from somebody during any of the periods were classified into *received help with music practice outside the music lessons* group (coded one).

Parental attitudes

The participants reported, on a scale from one to seven, to which extent they agreed to the following statements: *My parents were very positive to my music practice* and *My parents were very demanding regarding my musical achievements*. One indicated completely incorrect, seven completely correct and four partly correct/partly incorrect. With regard to very positive parents, two-thirds of the participants indicated six or seven and these were classified to the group *parents positive* (coded one). With regard to very demanding parents, two-thirds of the participants reported one, to the effect that this statement was not applicable. The remaining third who indicating that the statement was applicable or at least applicable to some extent were classified into the *parents demanding to some extent* group (coded one).

Hours of music practice

The participants were asked about number of years of practice during three age ranges – 6–11, 12–17 and 18 until the age when they took part in the study – and how many hours per week they practiced outside regular school hours during each of those intervals. One should note that we did not collect information on the specific practicing strategies or approaches, so the term music practice should here be taken generically. For example, it might not necessarily refer to the highly structured and goal-directed approach implied by more specific terms such as deliberate practice (24). Hours of total music practice were estimated for each age range. The number of hours of music practice during childhood and adolescence, from 6–17, was calculated as the total hours during the age ranges 6–11 and 12–17. There were very few participants who reported music practice in the youngest age period zero to five so this age range was not included in the study. For the age ranges 6–17, 6–11 and 12–17, respectively, the tertile of participants with the highest numbers of training hours were classified for each group with the following cut-offs: 6–17 was more than 1600 h (*top third*), 6–11 was more than 640 h of music practice and 12–17 was more than 1000 h of music practice.

Continuing musical activity in adulthood

The dichotomous-dependent variable in the following prediction analyses was labelled *continued playing* and was defined as one for those who reported more than 0 h of training in the age range 18 until now and zero for those who reported 0 h of training in that range. Note that *continued playing* refers to all musical production including singing.

There were also two questions regarding whether the participant was still singing or playing at the time of the study, and if not, at which age he or she stopped. This variable is labelled *still playing/singing* in the following.

Education

Level of education was assessed by means of a 10-graded scale reflecting the level of formal school education according to Statistics Sweden. The lowest level was unfinished elementary compulsory school and the highest level an academic doctoral degree. The four lower levels corresponded to no more than high school education whereas the six upper levels corresponded to at least some exposure to college or university education. The participants who reported that they belonged to the six upper levels were classified into the *higher education than high school* group (coded one). The others were zero.

Statistical analyses

As described above in the section Measures and data handling, all variables except the variables *age of playing/singing onset* and *age of playing/singing end* were dichotomised, if the variable was not already dichotomous by its nature, as for example sex. The dichotomisation was performed in such a way that – as close as possible – one-third of the participants had the factor assumed to stimulate continued music activity. The choice of tertiles, rather than quartiles, quintiles or deciles for instance, is common in epidemiology. The rationale behind this was that we wished to obtain a balance between need for contrast on one hand and sufficient numbers of subjects on the other hand. This strategy allowed us to treat all the explanatory variables in a uniform way. As our study sample was sufficiently large, we chose statistics which provide odds ratios for each explanatory variable – what is the likelihood that a participant will continue practicing music as an adult person when he/she has a given factor compared to when he/she does not? Univariate as well as multiple logistic regression analyses were performed. The odds ratio for an explanatory variable in the multiple regression analyses provides the same information as in the univariate analyses except that it is adjusted for all the other explanatory variables. To give the reader information about the possible societal impact, we also present the percentage of participants reporting the factor, for instance going to music class.

As a first step in the investigation of factors that were associated with continued playing during adulthood, number and percentage of the participants who *continued to play or sing* as adults and who *did not continue to play,*

respectively, were calculated. To investigate differences between the two groups, chi-square tests were performed for each categorical predictor. The predictors *present age* and *age of playing onset* were compared between the groups using *t*-test. For all categorical (dichotomous) predictors, percentage of participants within the two groups who were coded one – the outcome that was expected to predict continued playing – for each variable was calculated.

To explore factors that had *independent* statistical value in the prediction of continued playing, three separate logistic regression models were performed including the participants who were playing during at least one of the two age ranges, that is the total period 6–17, and during each one of the younger 6–11 and the older 12–17 age periods, respectively. The dependent variable was *continued playing*. The independent variables were all the dichotomous predictors described in the method and data handling section with the exception of main music instrument category during childhood and adolescence, such as *keyboard instrument, wind instrument* and so on. Type of main instrument could not be included in the logistic regression models because of co-variance problems. Level of education was not included because 25% of the participants did not report their education level.

Additionally, the same logistic regression models were performed again including also the dichotomous variable hours of music practice for each age period. For all tests, the level of significance was set at $p \leq 0.05$, two-tailed. The analyses were conducted with IBM Statistics 20 (SPSS Inc., Chicago, IL, USA).

RESULTS

Table 1 shows the percentages of participants who did and did not continue playing as adults in relation to age group, achieved general education, age at start of playing/singing and age at stopping playing/singing. The Table also shows how the highest tertile of hours of music practice is distributed among those who continued and did not continue playing/singing as adults, and whether group differences were significant according to chi-square analyses. The results are presented for those who played during each age period 6–11 and 12–17, as well as for all of them, that is, those who played during any age from 6–17 years of age.

First of all, the number of subjects who continued playing as adults when they had played as children was almost the same as the number who stopped (1908 versus 1912). In other words, in this study participants who started playing/singing as children had a 50% likelihood of continuing as adults. The majority (64%) of those who continued as adults still played at the time of the study. Among those who continued playing as adults, there was an over-representation of men and of participants with a high level of education. There was a pronounced difference in the percentage of subjects belonging to the highest tertile of hours of music practice. For the total age period of 6–17 with more than 1600 h of accumulated practice, this was 58% for those who continued playing versus 9% for those

Table 1 Group statistics and differences between continuers and noncontinuers. Age period 6–17

	Did not continue playing/singing n = 1912	Continued playing/singing n = 1908	p Value
Men, % of total group	30	39	<0.001
Mean age (range)	40 (27–54)	41 (27–54)	0.001
Age above 40 years (median age in total group), %	49	54	0.002
Higher education than high school, %	68	78	<0.001
Mean age at start of playing/singing (range)	9 (0–16)	8 (0–17)	<0.001
Still playing/singing, %	n/a	64	n/a
Mean age at stop of playing/singing (range)	14 (6–17)	n/a	n/a
Above 1600 h of music practice (top third)	9%	58%	<0.001
Age period 6–11			
	Did not continue playing/singing n = 1552	Continued playing/singing n = 1416	p Value
Men, % of total group	28	36	<0.001
Median age (range)	40 (27–54)	41 (27–54)	<0.001
Age above 40 years (median age in total group), %	48	53	<0.001
Higher education than high school, %	70	82	<0.001
Median age at start of playing/singing (range)	9 (3–11)	8 (0–11)	<0.001
Still playing/singing, %	n/a	65	n/a
Median age at stop of playing/singing (range)	13 (6–17)	n/a	n/a
Above 640 h of music practice (top third)	25%	50%	<0.001
Age period 12–17			
	Did not continue playing/singing n = 1145	Continued playing/singing n = 1630	p Value
Men, % of total group	31	38	<0.001
Median age (range)	40 (27–54)	41 (27–54)	<0.001
Age above 40 years (median age in total group), %	49	54	<0.001
Higher education than high school, %	68	78	<0.001
Median age at start of playing/singing (range)	9 (3–16)	8 (1–17)	<0.001
Still playing/singing, %	n/a	64	n/a
Median age at stop of playing/singing (range)	15 (12–17)	n/a	n/a
Above 1000 h of music practice (top third)	11%	63%	<0.001

Median (range) or % when indicated.

who did not. All these findings were statistically highly significant. The findings for the separate age periods 6–11 and 12–17 were similar, with one exception: Numbers of hours of practice had a more pronounced predictive value in the age period 12–17 than in the younger age period. In the age period 6–11, the percentage belonging to the highest tertile – more than 640 h of accumulated practice – was 50% among those who continued and 25% among those who did not continue. In the older age period 12–17, the corresponding percentages were 63% and 11%, respectively.

Table 2 shows the corresponding analyses for exposure to music and culture during childhood/adolescence, main instrument, type of musical education, type of music genre, main source of musical education, perception of music lessons and parental attitudes to the musical activities.

Among those who continued playing as adults, there was a higher proportion of participants who had more than five

persons who sang or played in their social environment when they grew up, who attended concerts and other cultural activities more than once per year and who estimated that there were more than 100 recordings of music in their home when they grew up. With regard to main instrument, playing a keyboard or wind instrument was negatively associated with continued playing in adulthood. Singing and playing the drums or guitar or was positively associated with continued playing, while playing a string instrument other than guitar was not associated per se with likelihood of continued playing. The same pattern was seen for the age intervals 6–11 and 12–17 independently. The largest differences were observed for the participants whose main instrument were singing and those who were playing a wind instrument. Those who had chosen their instrument themselves had a higher probability of continuing to sing or play as adults than those who had not chosen themselves.

Table 2 Group statistics and differences between continuers and noncontinuers. Age period 6–17

	Did not continue playing/singing n = 1912, %	Continued play/singing n = 1908, %	p Value
Exposure to music and culture during childhood/adolescence			
Had more than five persons who played/sang in the surrounding when growing up	21	42	<0.001
Attended concerts more than once per year	20	34	<0.001
Attended other cultural activities more than once per year	61	78	<0.001
More than 100 recordings in the home when growing up	38	45	<0.001
Main instrument			
Keyboard instruments	28	21	<0.001
Wind instruments	31	17	<0.001
Guitar	11	18	<0.001
Stringed instruments (except guitar)	8	8	0.857
Drums	2	4	0.005
Singing	19	33	<0.001
Unclassified instrument	1.3	0.2	<0.001
Chose their music instrument themselves	42	54	<0.001
Type of musical education			
Played in ensemble	31	53	<0.001
Improvised	6	16	<0.001
Memorised	52	54	0.331
Reading	78	82	0.008
By ear	14	32	<0.001
Type of genre			
Classical music	26	41	<0.001
Contemporary music	8	12	<0.001
Jazz music	4	10	<0.001
Pop/Rock music	36	60	<0.001
Ballads and folk music	73	75	0.106
Other genre	19	28	<0.001
Main source of musical education			
Music class	4	9	<0.001
Community music school	65	69	0.009
Church	16	30	<0.001
Private	20	29	<0.001
Parent	3	7	<0.001
Perceptions of music lessons			
Fun	37	60	<0.001
Stimulating	32	57	<0.001
Meaningful	33	58	<0.001
Demanding	35	44	<0.001
Participated in music lessons more than once a week	15	43	<0.001
Received help with music practice outside the music lessons	56	67	<0.001
Parental attitudes towards the musical activities			
Completely positive attitude	66	80	<0.001
Demanding attitude to some extent	37	40	0.018

With regard to type of musical education, those who had played in ensemble (54% versus 31%), who had practiced improvisation but not so frequently (16% versus 6%), who had been playing by ear (32% versus 14%) and had been trained to read music (82% versus 78%) were more likely to have continued playing. There was no statistical predictive value of memorisation (54% versus 52%).

With regard to music genre, it was noticed that ballads and folk music were very common genres and that genre had no predictive power in relation to continued playing (75% versus 73%). For all the other genres, significant differences were observed between continuing and non-continuing participants. The largest differences were observed for pop/rock music (60% versus 36%) and for classical music (41% versus 26%). Jazz (10% versus 4%) and contemporary music were rare (12% versus 8%).

With regard to main source of musical education, it was observed that attendance to music class was relatively uncommon but associated with a large relative difference (9% versus 4%). A similar pattern was observed when a parent was the main teacher (7% versus 3%). For community music school, the opposite was found, it was a frequent exposure but only associated with a small relative difference between those who continued and those who did not continue (69% versus 65%). Private education had an intermediate position (29% versus 20%). Music education related to a church was relatively common and was associated with a pronounced difference (30% versus 16%).

With regard to perception of music lessons, it was observed that in these bivariate simple statistical analyses all characteristics – fun, stimulating, meaningful, demanding and receiving help outside music lessons – were reported more often among those who continued than in the others. Similarly, a positive as well as a somewhat demanding attitude in the parents was associated with increased likelihood of continued playing. There was a much higher proportion of participants who participated in music education/lessons more than once a week in the continued playing group (43% versus 15%).

The findings separated for age period 6–11 were similar to those for the total age period 6–17 with the exception that jazz music was very uncommon during this age period, reported by only 2% of those who continued and those who did not continue. Another difference was that memorisation was significantly negatively associated with continued playing (44% versus 49%, $p = 0.004$).

In the age period 12–17, the findings were very similar to those in the total age period 6–17. However, training to read music was not significantly associated with continued playing in this age period (78% versus 76%, $p = 0.091$), and community music school experience did not have a significant relationship with continued playing (70% versus 67%, $p = 0.067$). In addition, a demanding parental attitude was not related to continued playing (42% versus 41%, $p = 0.969$).

Table 3 presents the results of the multiple logistic regression. In this analysis, all the predictors have been

Table 3 Predictors of continued playing/singing in multivariate analysis (n = 3820). Both age periods combined (age 6–17)

	Percentage of total	OR	95% CI	p Value
Male gender	35	2.11	1.78–2.49	<0.001
Above 40 years (median age in total group)	51	1.51	1.29–1.76	<0.001
Age at start of playing/singing (OR/each increased year)		0.93	0.89–0.96	<0.001
Exposure to music and culture during childhood/adolescence				
Had more than five persons who played/sang in the surrounding when growing up	31	1.66	1.39–1.97	<0.001
Attended concerts more than once per year	27	1.14	0.94–1.39	0.185
Attended other cultural activities more than once per year	69	1.59	1.34–1.88	<0.001
More than 100 recordings in the home when growing up	41	0.84	0.72–0.98	0.031
Chose their music instrument themselves	48	1.50	1.29–1.74	<0.001
Type of musical education				
Played in ensemble	42	1.22	1.03–1.45	0.021
Improvised	11	1.35	1.03–1.77	0.031
Memorised	57	0.71	0.61–0.83	<0.001
Reading	80	0.93	0.76–1.14	0.475
By ear	23	1.44	1.19–1.75	<0.001
Type of genre				
Classical music	34	1.82	1.52–2.17	<0.001
Contemporary music	10	0.69	0.50–0.86	0.003
Jazz music	7	0.96	0.69–1.34	0.820
Pop/Rock music	48	2.49	2.13–2.91	<0.001
Folk music	74	1.15	0.97–1.37	0.118
Other genre	24	1.61	1.33–1.95	<0.001
Main source of musical education				
Music class	7	1.85	1.32–2.58	<0.001
Community music school	67	1.33	1.11–1.61	0.004
Church	23	1.63	1.33–1.98	<0.001
Private	25	1.61	1.31–1.97	<0.001
Parent	5	1.47	0.99–2.17	0.054
Perceptions of music lessons				
Fun	48	1.06	0.82–1.36	0.681
Stimulating	45	1.33	0.99–1.79	0.057
Meaningful	45	1.23	0.93–1.63	0.144
Demanding	39	0.99	0.84–1.16	0.904
Participated in music education/lessons more than once a week	24	1.75	1.43–2.15	<0.001
Received help with music practice outside the music lessons	62	1.13	0.96–1.33	0.141
Parental attitudes towards the musical activities				
Completely positive attitude	73	1.21	1.01–1.45	0.035
Demanding attitude to some extent	38	0.93	0.79–1.10	0.398

introduced so the results represent the possible independent contributions of each one of the studied variables.

The variables that did *not* contribute significantly to the prediction were *attended concerts more than once a year during childhood/adolescence, training music reading, jazz music, folk music and fun, meaningful and demanding music education* as well as *received help with music practice outside the music lessons, and demanding parental attitude*. *Stimulating lessons* was the only factor related to the perception of the lessons that came close to an independent predictive power, 1.33 (0.99–1.79) in the ages 6–17.

Particularly strong positive predictors of continued playing with odds ratios above 1.5 were as follows: male sex, age above 40 years, more than five persons in the surrounding who played when the subject grew up, attended other cultural activities more than once per year during childhood,

chose music instrument himself/herself, participated in music education/lessons more than once a week, played classical music, played pop/rock music, played other genre, attended music class and attended music education associated with church and private education.

Community music schools were attended by 67% of those who had any experience of playing during childhood. This was significantly associated with continued playing in adult years (OR 1.33 with CI 1.10–1.61). Other factors significantly and positively associated with continued playing, although with odds ratios below 1.5, were ensemble playing, improvisation, playing by ear and completely positive parental attitude.

Factors that were *negatively* associated with continued playing were age at playing/singing onset – the higher the age, the less likely that the subject would continue playing/singing as an adult (OR per ageing year 0.93 with CI 0.89–

0.96) – and more than 100 recordings at home when growing up, memorised music and playing contemporary music.

The multivariate findings were similar in the age period 6–11 although the number of recordings, frequency of music lessons, ensemble playing, improvisation, playing by ear and playing contemporary music did not have significant predictive value. Playing jazz was negatively associated with likelihood of continuing but this was an uncommon music genre in this age period (2%).

The age period 12–17 showed a multivariate prediction pattern that was similar to those for the total age period 6–17. However, the association between number of recordings in the parental home, attendance to community music school and improvising music had no significant independent explanatory value. Nor did a completely positive attitude in the parent have any importance. In the age period 12–17, stimulating lessons were significantly and independently positively associated with likelihood to continue playing, with an odds ratio (OR) of 1.54 with a 95% confidence interval (CI) of 1.08–2.1.

Logistic regression models were also performed including the hours of practice variable as a predictor. These analyses showed that number of hours of music practice during the age period 12–17 was a very strong predictor of continued playing (OR 9.06, CI 7.16–11.46) but were of less importance during the age range 6–11 (OR 1.38, CI 1.10–1.72).

DISCUSSION

Associations between music, health and well-being have been discussed extensively, and several putative mechanisms underlying such associations have been proposed (24). We have previously shown that lifelong accumulated hours of music practice are associated both with cognitive and emotional capacity. Although our studies showed that these associations were mainly determined by genetic factors (10,25,26), others have argued on the basis of intervention studies that the development of cognition could potentially be stimulated by early music training (9). Further, both cognition and emotional ability are important for good health (27,28).

The purpose of the study was to explore factors of significance for continued playing in adult years. The results show that there are several independent predictors.

The strongest predictor of continued playing was total amount of music practice. Motivation is likely to be a strong underlying factor in this association. Motivation has been described as a personality-related variable with a substantial genetic influence (5). Amount of training is an intermediate variable and was therefore not included in the main multivariate analyses. Notably, training also proved to covary strongly with several other variables, which is consistent with a high heritability, in that the same genetic influences could also affect the environmental make-up.

Our findings are in accordance with those of Ng and Hartwig (19) who examined factors of importance for dropping out of music teaching. The most important ones in

their study were parental discouragement, peer influence, quality of the curriculum, parental disinterest, unsupportive school climate, lack of principal's support and teacher efficacy. In our study, we did not include variables related to peers, school climate and principle's support but the other factors were significant in our study as well as in theirs.

Type of music instrument turned out to be an important predictor of continuation in univariate analysis. Singing and guitar playing were associated with increased likelihood of continued playing whereas the opposite was found for piano playing and wind instruments. A plausible speculation regarding this finding is that piano playing may have been a common parent choice, which proved to be a negative factor in multivariate analysis. Among those who had played piano as children, only 36% reported that they had chosen this instrument themselves. On the other hand, 60% of the guitar players reported that they had made the choice themselves. The percentages among wind instrument players and singers were almost equal at 46% and 52%, respectively. Playing the drums during childhood was not so common ($n = 111$), but this instrument had very often been selected by the participant himself/herself, in 69% of cases. Because of the inconsistency of relationships between kind of instrument and self-selection in relation to continued playing, the latter factor cannot in itself totally explain why playing some types of instruments are positively and others negatively associated with continued playing. Another possible explanation is that singing and guitar playing are particularly socially functional. Communal singing round the bonfire is a typical example of the social context at parties and gatherings both indoors and outdoors where others may appreciate someone providing the accompaniment of an easily transportable instrument. Singing also often serves the function of conveying a message, either by selecting a song that is appropriate for the occasion, be it a wedding or a funeral, for example, and it is common to also compose a personal text to a well-known song for such occasions. In summary, there are many different social gratifications to reap for someone who can provide these services.

The study was performed in Sweden, a country with strong music traditions and a strong interest in music training (2,21). In particular, there has been political emphasis on creating opportunity for children to achieve music training outside regular school in community music schools. Indeed, this was by far the most common source of music education in our study because 67% of the participants had received their music training outside regular school in this form of education. It has been claimed that the quality of the music teaching in community music schools have deteriorated during later years due to growing numbers of pupils not matched by sufficient increase in resources. Although highly speculative, decreasing quality could be one of several factors possibly contributing to the fact that participants in the younger half of the studied population (27–40 years old, aged 6–17 in the years 1978–2002) had less likelihood of continuing than those in

the older half (41–54 years old, aged 6–17 in the years 1964–1988). As indicated above in the statistics, there is a secular trend of decreasing musical activity in the Swedish society and this could also be an explanation (2).

The representativeness of participants in the Swedish Twin Registry could be a matter of debate. In addition, there was considerable attrition in several steps. Demographic analysis of the participants shows that there is wide representation of occupations and educational levels in our study. However, 78% of those responding to the question about musical activity reported that they had ever played an instrument or participated in singing. This indicates that we have an overrepresentation of individuals with any experience of music practice as on the basis of interviews in the normal population half that number could be expected in the normal population. However, as the present report is based upon only those who have had any such experience this overrepresentation may not be important.

The inclusion of a large number of predictors ($n = 31$) could be criticised. However, rank correlations were computed for all pairs of included predictors in the multivariate analysis and no correlation exceeded 0.3. Accordingly, collinearity was not a problem in this analysis. The large sample allows us to use concomitantly a large number of predictors.

The emphasis in the present study was on childhood factors, but the situation in the adult years could also be important. According to Swedish statistics, the amount of musical activity decreases during the ages of 27–54 included in the present study. This could partly be because engagement in work makes it difficult to continue musical activity. This explanation is supported by the fact that musical activity tends to increase slightly again after retirement. On the other hand, having or not having children had no straightforward relationship with musical activity in the Swedish data (2). Conditions during adult years should accordingly also be examined but this has not been the focus of the present study.

The influence of the participants' assessment of the lessons, for example as stimulating and fun, was small to insignificant. The only characteristic of the lessons that had significant predictive power was stimulating during the age period 12–17. An obvious problem is that such an assessment is quite subjective (intrinsic) and may therefore, to start with, not be strongly related to any objective quality of the lessons, such as the competence or enthusiasm of the tutor. The same lesson could be perceived as stimulating if the pupil has a strong intrinsic interest but dreadfully boring if there is no such interest. Based on this, one would expect pupils who were more motivated and did better in their development to rate their lessons as more stimulating or better in other respects, which would be trivial. However, this expected correlation might be offset by the more talented students being less challenged in relation to their level of motivation, and hence experiencing them worse than less motivated students. More than one lesson per week was positively associated with continued playing.

A strong positive predictor of continued playing was male sex. The relatively few boys who did start music practice were more likely than girls to continue playing as adults. According to official Swedish statistics (20), the percentage of girls to boys in the Swedish community music schools was 58% to 59% in 2011 and 41% to 42% in 2013. It could be that music practice is regarded as an appropriate activity for girls and that some girls that are given the opportunity to take music lessons have low motivation. Boys were more likely to take courses in media technique in the community culture schools than girls in 2013 (65% versus 35%). Accordingly boys who start playing music have a stronger motivation than girls.

Music and culture background were important positive predictors. Interestingly however, in the multivariate analysis those who reported that the family had many recordings of music when they were children were *less likely* to continue playing as adults. This is the only example in which the observed direction of the difference between those who stopped and those who continued to play changed to the opposite one going from univariate to multivariate statistics. This could be explained by the adjustment for other variables: When subjects are comparable with regard to other background factors, character of music education, selecting instrument etc., it is quite possible that a high number of recordings could influence willingness to continue playing in the negative direction. When recorded professional music is being played frequently, the motivation to sing or play in instrument may diminish because hope goes down ever to achieve the high-level heard in the recordings. The higher the age at start the lower the probability that an individual would continue as an adult. This is an expected negative finding. The genre associated with the highest likelihood of continued playing was pop/rock followed by classical music.

Attendance to music class was strongly correlated with continued playing which is an expected finding. A similar positive effect, however, was found for church-based teaching. Attendance to community music school on the other hand was associated with only a small increase in likelihood of continued playing. It should be pointed out, however, that a large proportion of the participants have attended community music schools so the total societal impact of the community music school is still considerable.

Interestingly, a negative predictor was memorising. Perhaps this could be perceived as too demanding? Weaker but positive and significant predictors were ensemble playing, improvisation and playing by ear. These latter findings are supported by other research, for instance Björkqvold emphasised the importance of improvisation and playful components in music learning (29).

Parents seemed to have an important role as music education received from the parent and a positive attitude to the child's music practice increased continued playing.

The finding that age at start was an important predictor of continued playing deserves particular attention. For each

delay in start there was a 7% decrease in likelihood of continued music playing. As far as we know this has not been studied systematically.

In conclusion, we found several independent factors of significance for continued playing, such as age at start, lessons perceived as stimulating during adolescence, home environment, parental support, source of music education, genre, choice of instrument, ensemble playing and improvisation.

References

- Gabrielsson A. How do strong experiences with music relate to experiences in everyday listening to music? In: Deliège I, Davidson J, editors. *Music and the mind. Essays in honour of John Sloboda*. New York: Oxford University Press, 2011.
- Statistics Sweden: 2008. Nya kulturvanor. Svenska kulturvanor i ett 30-perspektiv (Swedish cultural habits in a 30-year perspective). Kulturrådet: Kulturen i siffror 2008:06.
- Butkovic A, Ullén F, Mosing M. Common genetical effects on openness, musical flow experiences, and musical practice. Under review.
- Corrigan K, Schellenberg E, Misura N. Music training, cognition, and personality. *Front Psychol* 2013; 4: 222.
- Mosing MA, Pedersen NL, Cesarini D, Johannesson M, Magnusson PK, Nakamura J, et al. Genetic and environmental influences on the relationship between flow proneness, locus of control and behavioral inhibition. *PLoS One* 2012; 7: e47958.
- Ullén F, de Manzano Ö, Almeida R, Magnusson P, Pedersen N, Nakamura J, et al. Proneness for psychological flow in everyday life: associations with personality and intelligence. *Pers Individ Dif* 2012; 52: 167–72.
- McPherson G, Cormick J. Motivational and self-regulated learning components of musical practice. *Bull Council Res Music Educ* 1999; 141: 98–102.
- Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *Am Psychol* 2000; 55: 68–78.
- Schellenberg E, Weiss M. Music and cognitive abilities. In: Deutsch D, editor. *The psychology of music*. London, UK: Academic Press, 2013: 499–550.
- Mosing M, Madison G, Ullén F. Shared genetic influences explain associations between music practice and intelligence: No cognitive transfer. Under review.
- Mosing MA, Madison G, Pedersen NL, Kuja-Halkola R, Ullén F. Practice does not make perfect: no causal effect of music practice on music ability. *Psychol Sci* 2014; 25: 1795–803.
- Hambrick D, Tucker-Drob E. The genetics of music accomplishment: evidence for gene-environment correlation and interaction. *Psychon Bull Rev* 2014. [Epub ahead of print].
- Ackerman PL, Heggestad E. Intelligence, personality, and interests: evidence for overlapping traits. *Psychol Bull* 1997; 121: 219–45.
- Plomin R, DeFries J, Knopik V, Neiderhiser J. *Behavioral genetics*. New York, NY, USA: Worth Publishers, 2013.
- Zamboni K. Factors influencing the retention of instrumental music students of rural school districts in the Somerset and Cambria counties of Pennsylvania [Master Thesis]. Indiana: University of Pennsylvania, 2011.
- Creech A. Learning a musical instrument: the case for parental support. *Music Educ Res* 2010; 12: 3–32.
- Martin L. The musical self-efficacy beliefs of middle school band students: an investigation of sources, meanings, and relationships with attributions for success and failure. *Bull Council Res Music Educ* 2012; 191: 45–60.
- Lowe G. Lessons for teachers: what lower secondary school students tell us about learning a musical instrument. *Int J Music Educ* 2012; 30: 227–43.
- Ng C, Hartwig K. Teachers' perceptions of declining participation in school music. *Res Stud Music Educ* 2011; 33: 123–42.
- Bonneville-Roussy A, Lavigne GL, Vallerand RJ. When passion leads to excellence: the case of musicians. *Psychol Music* 2011; 39: 123–38.
- SMOK, Sveriges Musik- och Kulturskoleråd (Swedish council for community music and culture schools), Nulägesrapport (Present statistics) 2013.
- Lichtenstein P, Sullivan PF, Cnattingius S, Gatz M, Johansson S, Carlstrom E, et al. The Swedish Twin Registry in the third millennium: an update. *Twin Res Hum Genet* 2006; 9: 875–82.
- Magnusson PK, Almqvist C, Rahman I, Ganna A, Viktorin A, Walum H, et al. The Swedish Twin Registry: establishment of a biobank and other recent developments. *Twin Res Hum Genet* 2013; 16: 317–29.
- Ericsson KA. Why expert performance is special and cannot be extrapolated from studies of performance in the general population: A response to criticisms. *Intelligence* 2014; 45: 81–103.
- Theorell T. *Psychological health effects of musical experiences - theories, studies and reflections in Music Health Science*. London: Springer, 2014.
- Theorell T, Lennartsson A-K, Mosing MA, Ullén F. Musical activity and emotional competence – a twin study. *Front Psychol* 2014; 5: 774.
- Evren C, Cagil D, Ulku M, Ozcetinkaya S, Gokalp P, Cetin T, et al. Relationship between defense styles, alexithymia, and personality in alcohol-dependent inpatients. *Compr Psychiatry* 2012; 53: 860–7.
- Grabe HJ, Schwahn C, Barnow S, Spitzer C, John U, Freyberger HJ, et al. Alexithymia, hypertension, and subclinical atherosclerosis in the general population. *J Psychosom Res* 2010; 68: 139–47.
- Björkqvold J. *Den musiska människan (Musical Man)*. Stockholm: Runa, 1991.