Winner

# Tooth Fairy guilty of favouritism!

Raphael Patcas[1], Hubertus JM van Waes[1,2], Moritz M Daum[3,4], Markus A Landolt[3,5]


## Abstract

**Objectives:** To determine the proportion of children visited by the Tooth Fairy, the child-related factors that influence the likelihood of her visit, and the parent-related variables that affect the amount of money the Tooth Fairy leaves.

**Design:** Cross-sectional questionnaire study.

**Setting:** Zürich, Switzerland.

**Participants:** 3617 parents of children (mean age of children, 6.8 years; 51.9% girls) who had lost at least one deciduous tooth received a self-developed questionnaire; 1274 questionnaires were returned (35.2%).

**Main outcome measures:** Primary outcome variables were the Tooth Fairy's visit after tooth loss and the amount of money given in case of a visit. Child- and parent-related variables were assessed as predictors of the main outcomes.

**Results:** Most parents (71.0%) reported that the Tooth Fairy visited their child. She usually exchanged the lost tooth for money (55.8% of visits) or placed money next to the tooth (40.7%); rarely did she take the tooth without pecuniary substitution. The Tooth Fairy left an average of 7.20 Swiss francs (approximately AU$9.45). The Tooth Fairy favoured visiting for the teeth of older children (odds ratio [OR], per year, 1.87; 95% CI, 1.09–3.21), of boys (OR, 2.65; 95% CI, 1.09–6.42), and of children who believed in her (OR, 4.12; 95% CI, 1.77–9.64). The amount of money was influenced by maternal, but not paternal socio-demographic factors, including level of education (OR, per level, 0.78; 95% CI, 0.66–0.92) and country of origin (OR, Western countries *v* non-Western countries, 2.35; 95% CI, 1.20–4.62).

**Conclusions:** The Tooth Fairy does not visit all children after tooth loss, displaying clear preferences in her choice of business partners. The odds of a visit are dramatically increased if she is believed in, and the value of a deciduous tooth is influenced by socio-demographic factors.


Fairies, who generally live in Fairyland,[1] made their first recorded appearance in the 14th century.[2] In contrast to the company of the less philanthropic pixies, visits by fairies are generally welcome because of their well known affluence and generosity. The Tooth Fairy is a prominent member of the fairy family and has dedicated her professional career to the exchange of exfoliated deciduous teeth for money. The visit of the Tooth Fairy indeed constitutes a vital element in the lives of many children;[3] as a personification of magical generosity, she is surpassed only by Santa Claus.[4] But, compared with Santa Claus, the Tooth Fairy has to date received little scholarly attention.

The importance of the Tooth Fairy's visit cannot be overstated. She exposes children to the idea of capitalism at a very early age, introducing and familiarising them with concepts of private property, voluntary exchange, capital accumulation, and a price system. Yet tooth trading is, in its essence, morally problematic. In contrast to Santa Claus, who rewards good conduct with presents, the Tooth Fairy teaches children that anything, even their own body, can be turned into cash.[4]

A recent report revealed that Santa Claus rewards children indiscriminately (ie, not according to how nice or naughty they have been in the previous year), and that he is less likely to visit children in hospitals located in deprived areas.[5] This is shocking news. As the Tooth Fairy plays a key role in presenting the principles of economics to young children, a careful analysis of her job performance is a dire necessity. The aim of this study was therefore to determine how many children the Tooth Fairy actually visits, the child-related factors that influence the likelihood of a visit by the Tooth Fairy, and the parental factors that influence the amount of money the Tooth Fairy is willing to offer. We hypothesised that the Tooth Fairy, like Santa, approaches children indiscriminately (ie, is not influenced by child-related aspects) to exchange money for teeth, and that the value of a tooth is unrelated to the socio-economic background of the parents.

## Methods

### Study design and participants

This was a cross-sectional study of children who had recently lost at least one deciduous tooth, and of their parents. Data were collected between August 2016 and January 2017 with a self-developed paper-and-pencil questionnaire. Eligible participants were parents of kindergarten children and first graders who attended their annual dental check-up at one of the six public School Dental Services in the city of Zürich (Switzerland). As part of the local health service system, all school children undergo mandatory yearly dental examinations, free of charge. Although parents can choose to have their children examined by a private dentist, most children (81%) attend the School Dental Service for these examinations.[6] After completing the dental examination, children in our study were given an envelope containing an information letter and a two-page questionnaire for their parents. A stamped, self-addressed envelope was enclosed, together with a raffle ticket offering the chance to win one of five vouchers for a family visit to

[1]Centre of Dental Medicine, University of Zurich, Zürich, Switzerland. [2]Stadt Zürich Schul- und Sportdepartement, Zürich, Switzerland. [3]University of Zurich, Zürich, Switzerland. [4]Neuroscience Centre, University of Zurich and ETH Zurich, Zürich, Switzerland. [5]University Children's Hospital Zurich, Zürich, Switzerland. raphael.patcas@zzm.uzh.ch
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one of three local amusement parks. Parents were asked to return the completed questionnaire within 2 weeks.

### Major outcomes

Primary outcome variables were the occurrence of a visit by the Tooth Fairy after losing a deciduous tooth (categorical item: yes, no) and the performed activity of the Tooth Fairy (categorical item: exchanges money for the tooth, places money next to the tooth, takes the tooth without giving any money, other). If the Tooth Fairy gave money, we asked the parents to report the exact amount per tooth in Swiss francs (CHF).

### Independent variables

In order to analyse factors influencing the Tooth Fairy's visit and the amount of money she left, the following variables were assessed.

**Child-related variables.** The age and sex of the child were recorded. Duration of noticeable tooth wiggle (three levels: a few days, more than a week, more than a month), frequency of tooth brushing per day (five levels: less than once, once, twice, thrice, more than three times), and emotion associated with a dental appointment (three levels: negative, neutral, positive) were each assessed. In addition, parents were asked if their child believed in the Tooth Fairy (yes, no, not sure) or other fantastic entities (Santa Claus, angels, Easter Bunny, witches, monsters, unicorns).

**Parent-related variables.** Parental education was assessed separately for mothers and fathers and categorised according to the five levels of the Swiss education system.[7] In addition, the birthplaces and religion of the mothers and fathers were assessed by open questions. For data analysis, countries were grouped into the following categories: Switzerland, western Europe, other Western countries (Australia, United States, Canada etc.), eastern Europe and the Middle East, Africa, Asia, and Latin America. Religion was categorised as Catholicism, Protestantism, Islam, Judaism, Buddhism, Hinduism, other, and none.

### Statistical methods

Data were analysed in SPSS 24 (IBM). $P < 0.05$ (two-sided) was deemed statistically significant. All variables were descriptively reviewed, and when appropriate, grouped for further analyses. Two multivariate logistic regression models were computed to identify influencing factors and to calculate odds ratios (with 95% confidence intervals [CIs]). The first model (Tooth Fairy visit model) calculated the odds of being visited by the Tooth Fairy and receiving money for the tooth. In the second model (monetary reward model), the amount of money given by the Tooth Fairy (dichotomised into CHF 2.00 or less *v* more than CHF 2.00; this threshold corresponds to the Swiss currency unit approximating the average exchange rate for amounts cited in previous studies[8,9]) was the dependent variable. The following child-related predictors were included in the Tooth Fairy visit model: age and sex of the child; time of noticeable tooth wiggle (three levels); frequency of tooth brushing (five levels); child's attitude to a dental appointment (three levels); and belief in the Tooth Fairy. Predictors for the monetary reward model included country of origin of mother and father (Switzerland, western Europe and other Western countries *v* all other countries), education of mother and father (five levels), and religion of mother and father (Christian religions *v* non-Christian religions). When data were incomplete for any of these variables, the individual was not included in the analysis.

### Ethics approval

A waiver was obtained from the local Ethics Committee (reference, 62-2015) attesting that the planned survey was in accordance with ethics guidelines. All participants gave informed consent before taking part in the study.

## Results

### Socio-demographic characteristics

A total of 3617 questionnaires were distributed during the study period, of which 1274 (35.2%) were returned and evaluated. The mean age of the 1274 children of participating parents was 6.8 years (standard deviation [SD], 0.8 years; range, 4.8–9.3 years); 661 (51.9%) were girls. Most mothers (58.1%) and fathers (60.7%) had college degrees or a university education, were born in Switzerland or another western European country (mothers, 72.1%; fathers, 72.9%), and identified as Christians (mothers, 54.8%; fathers, 52.8%) (Box 1).

### Visits by the Tooth Fairy: frequency and outcomes

Most parents (71.0%) reported that their child was visited by the Tooth Fairy after losing a deciduous tooth, but only about half the children actually believed that the Tooth Fairy existed (47.8%) (Box 2). Belief in the Tooth Fairy was comparable with that in other religion-related figures (data not shown), and higher than belief in other fantastic creatures (Box 3). In most cases, the Tooth Fairy exchanged money for the tooth or placed money next to the tooth; rarely did the Tooth Fairy take the tooth without paying for it

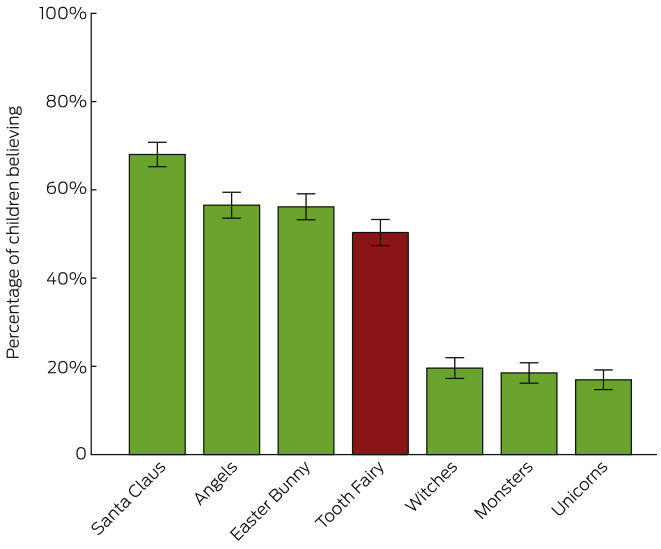
1 Parent-related socio-demographic characteristics

| | Mother | Father |
|---|---|---|
| Total number | 1274 | 1274 |
| Education | | |
| Basic education | 126 (9.9%) | 140 (11.0%) |
| Completed apprenticeship | 293 (23.0%) | 257 (20.2%) |
| Completed high school | 88 (6.9%) | 62 (4.9%) |
| College or higher education | 286 (22.4%) | 246 (19.3%) |
| University | 455 (35.7%) | 527 (41.4%) |
| Unknown | 26 (2.0%) | 42 (3.3%) |
| Country of origin | | |
| Switzerland | 651 (51.1%) | 610 (47.9%) |
| Western Europe | 268 (21.0%) | 319 (25.0%) |
| Other Western country | 11 (0.9%) | 11 (0.9%) |
| Eastern Europe and the Middle East | 153 (12.0%) | 143 (11.2%) |
| Africa | 35 (2.7%) | 49 (3.8%) |
| Asia | 64 (5.0%) | 50 (3.9%) |
| Latin America | 49 (3.8%) | 50 (3.9%) |
| Unknown | 43 (3.4%) | 42 (3.3%) |
| Religion | | |
| Catholicism | 395 (31.0%) | 394 (30.9%) |
| Protestantism | 303 (23.8%) | 279 (21.9%) |
| Islam | 90 (7.1%) | 112 (8.8%) |
| Judaism | 41 (3.2%) | 40 (3.1%) |
| Buddhism | 17 (1.3%) | 6 (0.5%) |
| Hinduism | 22 (1.7%) | 23 (1.8%) |
| Other | 72 (5.7%) | 60 (4.7%) |
| None | 313 (24.6%) | 337 (26.5%) |
| Unknown | 21 (1.6%) | 23 (1.8%) |

**2 Parent-reported data for variables related to their children and the Tooth Fairy**

| Characteristic | |
|---|---|
| Total number of children | 1274 |
| Time of child's noticeable tooth wiggle | |
| A few days | 169 (13.3%) |
| More than a week | 573 (45.0%) |
| More than a month | 472 (37.0%) |
| Missing data | 60 (4.7%) |
| Child's daily frequency of tooth brushing | |
| Less than once | 8 (0.6%) |
| Once | 92 (7.2%) |
| Twice | 579 (45.4%) |
| Thrice | 585 (45.9%) |
| More than three times | 10 (0.8%) |
| Child's attitude to a dental appointment | |
| Negative | 128 (10.0%) |
| Neutral | 771 (60.5%) |
| Positive | 345 (27.1%) |
| Missing data | 30 (2.4%) |
| Child's belief in Tooth Fairy | |
| Yes | 609 (47.8%) |
| No | 372 (29.2%) |
| Unsure or missing data | 293 (23.0%) |
| Tooth Fairy activity | |
| Exchanged tooth for money | 505 (39.6%) |
| Placed money next to the tooth | 368 (28.9%) |
| Took the tooth without giving money | 11 (0.9%) |
| Other | 21 (1.6%) |
| Missing information or no Tooth Fairy visit | 369 (29.0%) |

**3 Level of children's belief in fantastic beings**




Whiskers depict 95% confidence intervals. ◆

(Box 2). The Tooth Fairy left an average of CHF 7.19 (SD, CHF 7.94; median, CHF 5.00; range: CHF 0–70, Box 4). Parents reported that the following creatures also occasionally engaged in tooth trading: the Tooth Mouse (5.3%), as well as ants, birds, dinosaurs, the Dummy Fairy, a Tooth Angel, Santa Claus, and dwarves (each < 1%).

### Predictors of a visit by the Tooth Fairy

Higher age, being a boy, and believing in the Tooth Fairy each significantly increased the odds of a nocturnal visit by the Tooth Fairy (Box 5). Frequency of tooth brushing, duration of tooth wiggle, and the child's attitude to dental appointments, on the other hand, did not influence the likelihood of a visit.

### Predictors of the amount of money traded by the Tooth Fairy

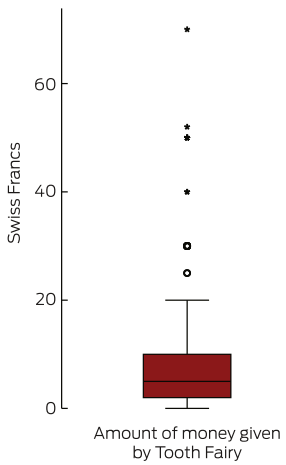
Only maternal factors influenced the amount of money received from the Tooth Fairy. The odds of greater profit (ie, more than CHF 2.00 per tooth) were significantly greater if the child's mother had not received higher education or her country of origin was not in the Western world. Paternal factors and parental religion had no effect on the amount left (Box 6).

## Discussion

The unexpected discovery of Santa Claus' disenchanting conduct[5] prompted us to rigorously revisit the Tooth Fairy's job performance. Cognisant of the fact that the Tooth Fairy introduces children to the market system through tooth trading — an ethically and legally debatable approach, to say the least — we examined her interactions with children. In an unprecedented and highly overdue investigation, it is the first time that the Tooth Fairy's preferences have been subjected to statistical scrutiny.

The results indicate that, contrary to our initial hypothesis, the Tooth Fairy does not visit all children, and that she is indeed blatantly selective. She favours trading for the teeth of older children, boys, and children who believe in her. On an educationally rather disappointing note, it seems that an important factor that can be intentionally modulated by children — teeth-brushing frequency — has no effect on the likelihood of a Tooth Fairy visit. The time span of

**4 Distribution of monetary rewards offered by the Tooth Fairy for a single deciduous tooth**




The box depicts the interquartile range (IQR), with the median indicated by the internal line. Whiskers enclose the lowest to highest values, apart from outliers; that is, values that lie within 1.5 × IQR of the lower and upper quartiles. Stars mark extreme outliers (value more than 3 × IQR beyond the upper quartile); circles mark mild outliers. ◆

5 Tooth Fairy visit model: summary of logistic regression predicting the Tooth Fairy visiting and trading a tooth for money ($n = 777$)

| Variable | Odds ratio (95% CI) | P |
|---|---|---|
| Age, per year | 1.87 (1.09–3.21) | 0.023 |
| Sex, boys *v* girls | 2.65 (1.09–6.42) | 0.031 |
| Time of noticeable tooth wiggle, per level | 1.15 (0.63–2.08) | 0.65 |
| Frequency of daily tooth brushing, per level | 1.45 (0.80–2.63) | 0.22 |
| Child's attitude to a dental appointment, per level | 1.14 (0.58–2.27) | 0.70 |
| Belief in Tooth Fairy, yes *v* no | 4.12 (1.77–9.64) | 0.001 |

CI = confidence interval. ◆

tooth wiggle is apparently also inconsequential, so that our survey provides evidence that premature tooth-pulling does not pay off. Nor does the child's attitude to a dental visit influence the Tooth Fairy; rumours of an alliance between dentists and the Tooth Fairy can thus be summarily dismissed as fabrications. Perhaps the most important observation is that the Tooth Fairy's visit is most strongly associated with the child's belief in her. To paraphrase the dictum "seeing is believing": when it comes to the Tooth Fairy, believing is seeing. The fact that the Tooth Fairy seems to prefer older children and boys is difficult to interpret, and remains open to speculation.

The average price the Tooth Fairy is ready to pay for a milk tooth in Zürich is currently CHF 7.20 (approximately AU$9.45, £5.80, US$7.20), considerably more than the previously reported £1.50 (United Kingdom, 2012)[8] and US$3.20 (United States, 2015).[9] Some surveys have tracked the exchange rate of a tooth against the consumer price index or, more recently, against the Standard and Poor's 500 index,[10] and have concluded that the Tooth Fairy generally keeps up with inflation.[11] Yet this only partially explains the current high market price of baby teeth in Switzerland. Perhaps another explanation should be considered. Since the time of Hippocrates it has been common knowledge that baby teeth are made of milk ("ἀπὸ τοῦ γάλακτος").[12] Switzerland, a country renowned for its cheese and milk products and derivatives, including its fine chocolate, offers the best conditions for superior quality milk teeth. With an annual milk consumption per capita of 319 kg (2013), Switzerland is indeed internationally ranked fifth in this respect.[13] The assumption that excessive consumption of high quality milk explains the higher price of Swiss milk teeth on the market thus requires no more than a modest leap of logic.

6 Monetary reward model: logistic regression of factors predicting the Tooth Fairy leaving more than 2 Swiss francs for a tooth ($n = 626$)

| Variable | Odds ratio (95% CI) | P |
|---|---|---|
| Mother | | |
| Country of origin* | 2.35 (1.20–4.62) | 0.013 |
| Education, per level | 0.78 (0.66–0.92) | 0.003 |
| Religion, Christian *v* non-Christian[2] | 1.44 (0.64–3.25) | 0.37 |
| Father | | |
| Country of origin* | 1.44 (0.77–2.67) | 0.25 |
| Education, per level | 0.99 (0.85–1.16) | 0.92 |
| Religion, Christian *v* non-Christian | 1.06 (0.47–2.39) | 0.88 |

CI = confidence interval. * Switzerland, western Europe, other Western countries *v* all other countries. ◆

The reported payment by the Tooth Fairy of 70 CHF for one tooth deviated markedly from her other imbursements, and may be regarded as an extreme outlier. Analysis of this exceptional case offered no clue as to the reason for such generosity, other than the parent's testimony that the Tooth Fairy would pay this amount for a first baby tooth, but far less for subsequent teeth. This observation either indicates that pixies have a soft spot for firstlings, or that the reported rate of imbursement was subject to recall bias.

Contrary to our hypothesis, multivariate analysis found that socio-demographic variables influenced the amount of money given by the Tooth Fairy. More money is given to the children of mothers without higher education or who were not born in a Western country. These findings are reassuring: the Tooth Fairy may show favouritism, but she helps the socio-demographically underprivileged. She is a true fairy after all.

Another observation is the major difference between Santa Claus and the Tooth Fairy with respect to the Tooth Fairy's very competitive business environment. In contrast to rewarding children at Christmas — Santa Claus' undisputed area of responsibility — we found that creatures other than the Tooth Fairy sometimes also engaged in tooth trading, particularly the Tooth Mouse (5.3% of teeth), but also other fictional and non-fictional creatures who contest the trade. The fact that even Santa Claus has apparently dabbled in tooth trading is irritating, and poses a serious ethical challenge.

While this study has several strengths and sheds some light on the activities of the Tooth Fairy, there are also some noteworthy limitations. As often occurs with questionnaire-based surveys, the response rate was moderate, possibly restricting the generalisability of our findings. Another obvious weakness was that the questionnaire was directed to parents. This regrettable state of affairs was necessary because the Tooth Fairy was unavailable for questioning. Future research should attempt to contact the Tooth Fairy directly, to obtain better insight into her work and motivation for collecting teeth. Another unploughed field of investigation remains the Tooth Fairy's preference for deciduous over permanent teeth.

As charmingly provocative as this discussion might be, some observations undoubtedly have wider implications. The shedding of a deciduous tooth has long been recognised as an event of great significance during the child's age of magical thinking.[14] We found that during this developmental stage the Tooth Fairy garners a greater faith in her existence than any other fantasy creature, and that she has gained acceptance second only to that of other religious figures. But in addition to confirming that the Tooth Fairy's visit has become an essential part of the magic of growing up, this survey shows that the factor most strongly associated with the visit is the child's belief in the Tooth Fairy. Echoing the words of Charles Dickens that "in an utilitarian age, of all other times, it is a matter of grave importance that Fairy tales should be respected",[15] our study underlines the pivotal importance of parental support in infant belief. If you believe, anything can sprout wings and fly. Even the Tooth Fairy.

## Conclusion

In an attempt to clarify which factors influence the Tooth Fairy when exchanging money for a deciduous tooth, we discovered that she was biased, in that she favours boys, older children, and children who believed in her. The amount of money the Tooth Fairy gives seems influenced by socio-economic factors related to the mother.

**Competing interests:** No relevant disclosures.

**Provenance:** Not commissioned; externally peer reviewed. ■



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