


Development Signs in Healthy Toddlers in Different Stages of Toilet Training: Can They Help Define Readiness and Probability of Success?

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Abstract

There is much uncertainty about when to start toilet training. Age cannot be a strict stand-alone criterion, as every child has its own pace of development. We observed toilet training (TT) related development signs (DS) in healthy toddlers and determined which can help to define the proper time to start TT and to predict success. The study group consisted of 269 healthy children, in different stages of TT: not started, during, and after completion. Sitting stable, picking up small objects, and spontaneously putting objects in containers were present in all children and had no predictive value. All other DS were significantly more present in those who had started and became more prevalent during completion of TT. Age had a significant association with 13/15 DS. Understanding and following instructions, and having a broader vocabulary were significantly more present when TT had been started. Dry during midday nap reached no significance.

Keywords

toilet training, development, healthy toddlers, readiness signs

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Introduction

In Western society, the age of completion of toilet training (TT) has been increasing over the past 70 years, and was shown to have negative consequences.¹⁻³ Many parents are uncertain about the appropriate moment to start TT, which contributes to postponing it.⁴ Their hesitation may be based on the findings that if TT is started too early or too late, it can prolong the TT process and eventually can cause psychological (anxiety and stress for child and parents), physical and social problems.⁵

Age cannot be used as a strict stand-alone criterion to decide when to start TT, as every child has its own pace of development. It has therefore been advised to wait until the child shows certain characteristics or skills known as development signs (DS).⁶⁻⁸ Several DS have been proposed in literature as indicators to start TT or as giving a high probability of success, but no research is available on which or how many are

needed.^{3,9-11} It remains moreover unclear whether DS are only expressions of a spontaneous development, or whether TT itself can influence the presence of DS.

A review of the literature of the past 60 years identified 21 previously described DS thought to have a relation to TT.¹² In a former study, we evaluated the ease to detect these DS, and an adapted list of 18 was withheld.¹³

In the present observational study, we assessed which DS were present during different stages of TT, in search of those most useful for determining the right moment to start TT and the probability of success.

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Table 1. Development Signs Related to Toilet Training Which Were Observed in Children in This Study.

Development sign 1	Child can imitate behavior
Development sign 2	Child can sit stable without help
Development sign 3	Child can walk without help
Development sign 4	Child can pick up small objects
Development sign 5	Child can say no, as a sign of independence
Development sign 6	Child understands and can respond to directions, questions or explanations and can follow simple commands
Development sign 7	Child expresses a need to evacuate and shows awareness of the need to void or to have a bowel movement
Development sign 8	Child puts things in containers spontaneously
Development sign 9	The child evacuates on the potty when it has the urge to pee or to have a bowel movement
Development sign 10	Child understands potty-related words
Development sign 11	The child has a broader vocabulary
Development sign 12	Child wants to participate in, cooperate with and shows interest in TT
Development sign 13	Child is dry after the midday nap
Development sign 14	Child insists on completing tasks without help and is proud of new skills
Development sign 15	Child wants to be clean and is distressed by wet or soiled diapers. The child indicates most of the time by himself/herself that he/she has wet/dirty pants
Development sign 16	Child can pull clothes up and down in a TT related context
Development sign 17	The child begins to put things where they belong
Development sign 18	Child can sit still on the potty for some time without being forced to do this

Material and Methods

The presence of 18 DS (Table 1) was evaluated prospectively in 270 healthy children in 10 day care centers during a period of 5 months. The children were between 15 and 35 months old and had a normal mental and physical development. They were divided into 3 groups depending on the stage of TT they were in at the time of the observation: group 1 = TT not started, group 2 = TT started but not completed, group 3 = TT successfully completed. Written informed consent was obtained from parents and Day Care responsible. EC approval was granted.

TT not started meant no activity in relation to TT. TT started but not completed meant active training for toileting was ongoing. TT successfully completed meant that the child was wearing undergarments and no diapers when awake during the day, showed awareness of a need to void or to have bowel movements, initiated the toileting without prompts from a trainer/parent, and had no or only very rarely an incontinence episode.

Individual observation was done during 1 day of 8 subsequent hours at the day care center by external observers who did not interfere with the normal daytime activities and schedule of the staff and children.

During the study parents were asked to fill in a questionnaire, giving age and gender of the child, number of days per week the child stayed in day care, when it had started TT, the presence of other and of older children in the family, their own educational level.

The DS observation data and the reply to the questionnaire were entered in a database and analyzed using

the statistical package R, version 2.13.1 (www.r-project.org). A value of $P < .05$ was considered statistically significant. For multivariate analyses the data from the questionnaire were used. To compare the presence of DS, TT stage was used as the outcome variable, and the influence of covariates was tested. Comparison was made between group 1 and groups 2 and 3 combined, and between group 2 and 3 separately. For evaluating talking of the child (DS 11), linear regression was performed as this DS was scored numerically: 0 = the child does not use words and does not understand what you say; 1 = passive word knowledge; 2 = the child uses a few words; 3 = the child has a broad vocabulary. The influence of having a broad vocabulary was statistically evaluated more specifically.

For all the other DS, which had a binominal yes/no outcome, logistic regression was used.

Main research questions were: Which DS were observed in the children of each TT group and was there a statistically significant difference between the groups? Did covariates influence the presence of DS? Is it possible to determine which DS can be used as urinary TT readiness signs and can DS predict successful outcome?

Results

One child had to be excluded because of a medical problem, leaving 269 children (129 boys and 140 girls) being included. Fourteen children left day care to go to nursery school after the observation but before the questionnaire

Table 2. Characteristics of the Study Groups.

	Group 1 (N=31)	Group 2 (N=149)	Group 3 (N=89)	P value*
Age in months Mean \pm SEM (range)	19.51 \pm 2.88 (15-25)	23.14 \pm 3.56 (15-33)	28.88 \pm 2.41 (23-35)	<.001
Gender (M/F)	20/11	73/76	36/53	.06

Abbreviations: SEM, standard error of the mean; M, male; F, female. Group 1: before start of toilet training; Group 2: toilet training started but not yet completed; Group 3: toilet training completed.

*Age: Anova; Gender: chi-square test— $P < .05$ is considered statistically significant.

was filled in, leaving a total of 255 questionnaires handed out, and 221 came back completed (response rate of 87%).

Table 2 shows the number of children in each group, their age and gender. Age was significantly different between groups, but with a wide overlap. The percentage of male children was less in groups 2 and 3 but this did not reach statically significance ($P = .06$).

Table 3 shows the presence of DS in the different groups. A statistically higher number of children showed most of the DS during or after TT (groups 2 and 3), compared to those who had not started (group 1) except for DS 2-4-8 which were present in almost all children in the study. Missing data are due to specific circumstances that made observation of a DS not possible, for example, for DS 8 (putting things in containers spontaneously) when there were no containers available in a day care center. A minority of children in group 3 happened to have occasional dirty pants and thus only a small number could be evaluated if they indicated a leakage spontaneously by themselves.

Age had a significant association with 13/15 DS (no association with “understanding and following instructions”/DS 6; “putting objects in containers”/DS 8). The other covariates were significantly associated with only 1 or 2 different DS.

The significance of a possible influence of covariates in the outcome of the comparisons between groups are presented in Table 4. Only DS 11 (broader vocabulary) and DS 12 (participation and interest in TT) were statistically different in both comparisons. Accounting for age and covariates, many more DS were different between groups 2 and 3 than between groups 1 and 2 + 3 combined.

Finally, the model was trimmed, so that only the significant predictors of TT success remained. The strongest predictor was DS 7, followed by age, DS 16 and DS 14. A ROC curve gave an area under the curve of 0.97 indicating a high sensitivity and specificity in predicting successful outcome of TT. It was checked how the model would work in a different dataset by 10-fold cross validation. This gave a variety, depending on the method, between 88% and 92.5% confirming the accuracy.

We evaluated if the start of TT could have influenced the development of DS, accounting for age. The only DS influenced by TT were found to be DS 6 (understanding and following instructions), DS 10 (understanding potty related words), DS 11 (broader vocabulary), and DS 12 (participation and interest in TT).

Discussion

In the present study, in a large sample of healthy toddlers, we found a significant difference in the presence of DS, previously described in relation to TT, between children who had not started TT, were having TT or had completed TT. Sitting stable, picking up small objects, putting objects in containers spontaneously were present in almost all children independent of the stage of TT. This indicates that in a child with a normal development, the appearance of these 3 signs will not specifically inform on its readiness for TT. Also, the presence of DS 3 “walking without help,” and DS 1 “imitation” was very similar in all 3 groups. These 5 DS are known to appear in most children before the age of 15 months, which corresponds with the lowest age of the toddlers we observed.¹²

It is interesting that in those who did not start TT yet \pm 30% understood potty related words, and that one or a few showed interest in TT, indicated wet/dirty pants and pulled clothes up and down as if being under TT. It probably indicates that spending a large part of the day with other children under TT may arouse interest and stimulate imitation before TT is properly started.

Four DS were significantly more present during TT compared to pre-TT. These were 4 psychological/cognitive DS: “understanding and following instructions, using potty-related words, having a broader vocabulary and participation and interest in TT.” “Child understands and can respond to directions, questions or explanations and can follow simple commands and child understands potty-related words” lost significance during the progress to completeness of TT.

Almost all children who had completed TT (Group 3) did say no, could complete skills alone and were proud of new skills. This in contrast with Groups 1 and 2 where

Table 3. Presence of Development Signs in Different Stages of Toilet Training.

	Group 1 (N= 31)	Group 2 (N= 149)	Group 3 (N= 89)	P value*
DS1: imitation	29/31	144/149	89/89	.04
DS2: sitting stable	31/31	149/149	89/89	1.00
DS3: walk without help	29/31	149/149	89/89	.01
DS4: pick up small objects	30/30	149/149	89/89	1.00
DS5: saying no	14/31	97/146	86/87	<.001
DS6: understanding and following instructions	23/31	145/149	89/89	<.001
DS7: expressing a need and showing awareness	0/31	11/148	76/89	<.001
DS8: putting things in containers spontaneously	19/22	114/126	81/85	.27
DS9: evacuating on potty related to urge to evacuate	NA	39/117	88/88	<.001
DS10: understands potty related words	9/31	122/149	89/89	<.001
DS11: broader vocabulary	4/31	52/149	85/89	<.001
DS12: participation and interest in TT	5/31	95/149	89/89	<.001
DS13: dry after nap	2/29	16/142	37/81	<.001
DS14: completing tasks alone, proud of new skills	9/31	77/149	79/88	<.001
DS15: wants to be clean and indicates wet/dirty pants	1/29	14/132	18/24	<.001
DS16: pulling clothes up and down related to TT	5/31	35/149	82/88	<.001
DS17: child begins to put things where they belong	13/31	107/149	89/89	<.001
DS18: sitting still on the potty for some time	NA	101/112	89/89	<.001

Abbreviations: DS, development sign; TT, toilet training; NA, not applicable.

Group 1: before start of toilet training; Group 2: toilet training started but not yet completed; Group 3: toilet training completed.

Data are presented as number/total number observed.

*Development signs: likelihood ratio test. Statistical significance was set at $P < .05$.

only half or less than half of the children showed these DS. The high prevalence in group 3 of expressing a need and showing awareness to evacuate, voiding on potty related to urge, participation and interest in TT, wanting to be clean and indicating wet or dirty pants, pulling clothes up and down related to TT, indicate that TT is a learning process and that toileting specific DS appear and develop during its course. As expected children who had started or completed TT (Groups 2 and 3) used more potty-related words and could better sit still on the potty for some time. In the TT groups 2 and 3, children also significantly began to put things where they belong, indicating a grow in behavior.

A significant association was found between completing TT and age. This confirms the findings of Schum et al¹⁴ that older age is a predictor of TT completion. As in other studies our data showed that using day care does not significantly influence TT completion.^{5,15} Gender has been identified as significant factor in several previous studies, but in our study statistical significance was not reached.¹⁵⁻¹⁸

As reported by Largo et al,¹⁷ we did not find a significant association of presence of DS with the parents' educational background, the TT duration, the total number of children in the family, or having older brothers/sisters. In contrast Schum et al⁵ found a significant association between the time to completion of TT and the educational

level of the parents and the number of children in the family. Different demographics and childcare organization might explain these different findings.

The parents view on TT, their beliefs and attitudes have been described before in a sample of 2000 children, indicating that too many children are toilet trained after the minimum school age of 30 months. Mothers with a paid occupation and higher educational level try more proactively to have their children completing TT before entering school.¹⁹ As both parents often work outside the home, the role of day care has become increasingly important as most children attend daycare centers during a large part of the TT period. Results from 429 centers showed that half of the childcare workers base the decision to start TT on DS while 44.5% use a combination of age and DS.¹²

With multivariate regression analysis, Schum et al⁵ concluded that older age, non-Caucasian race, female gender and single parenthood were more strongly associated with TT completion than were either cognitive developmental level or temperament. Joinson et al⁷ found an association between difficult temperament traits and later initiation of TT and difficulties to develop daytime bladder control. In our multivariate analysis, several cognition and temperament related DS were found to differ between the start and completing of TT. The 9 DS significantly associated with completing TT,

Table 4. Influence of Covariates on the Statistical Significance of Associations of DS in Groups in Different Stages of TT.

Development sign	Group 1 versus 2 + 3		Group 2 versus group 3	
	Univariate analysis	Association, accounting for covariates	Univariate analysis	Association, accounting for covariates
DS5: saying no	<.001	NS	<.001	<.001
DS6: understanding and following instructions	<.001	.004	NS	NS
DS7: expressing a need and showing awareness	<.001	NS	<.001	<.001
DS9: evacuating on potty related to urge to evacuate	NA	NA	NS	<.001
DS 10: potty related words	<.001	<.001	NS	NS
DS11: broader vocabulary*	<.001	<.001	<.001	<.001
DS12: participation and interest in TT	<.001	<.001	NS	<.001
DS13: dry after nap	.02	NS	<.001	NS
DS14: completing tasks alone, proud of new skills	<.001	NS	<.001	<.001
DS15: wants to be clean and indicates wet/dirty pants	.01	NS	<.001	.05
DS16: pulling clothes up and down related to TT	<.001	NS	<.001	<.001
DS17: child begins to put things where they belong	<.001	NS	NS	.01

Abbreviations: NA, not present in group 1; NS, not significant; DS, development sign; TT, toilet training.

after correction for the covariates, are a combination of psychological, cognitive and motor DS.

Our results support previous findings that if a child expresses the need to evacuate and can pull clothes up and down in a TT related context, this increases the probability of becoming dry.^{16,18,20} It is thus advisable to dress children in comfortable, easy to remove clothing when performing TT.

Being dry after the midday nap was only present in 46% of children who completed TT following our definition, and even much less in the 2 other groups. This DS has been thought to correspond with the development of enough bladder capacity to allow completion of TT. For previous generations, this DS was even one of the most important reasons to start TT.¹ Our data indicate that dry after midday nap is less important.

Certain limitations of our study must be considered. All children were recruited in day care centers. But it was found before that attending day care does not affect TT completion.^{5,15} As all children in our study were in day care, evaluation of the importance of day care itself in becoming toilet trained was not possible.

The respondents were almost all Flemish parents who were married or cohabiting. Therefore, we could not investigate the effect of ethnic origin or of being a single parent. Several authors have shown that cultural differences and being a single parent can influence the TT-process, implying that generalization of our findings to other cultures or household structures may not be appropriate.^{7,10,20}

Observation of DS is reliable. Inter-rater reliability while observing DS has been tested previously, showing reliability from good to perfect depending on the DS.

Furthermore, an observation period of 8 hours was found to be sufficient to detect the presence/absence of all DS which were evaluated.¹³

Our study has not evaluated the role of the parents and day care workers. Their attitude will influence the outcome of TT and may even be at the basis of complications years later.²¹⁻²³

This study is a cross-sectional, observational study. This limits the conclusions that can be drawn on the evolution of DS. Cross-sectional studies are often biased by a low response rate. However, the response rate (questionnaires on covariates) in our study was high (86%).

Conclusion

To our knowledge, our study is the first to systematically assess all previously published DS related to TT, in different stages of this process (before, during, and after). We found that “understanding and following instructions,” “having a broader vocabulary,” “using potty-related words” and “participating and showing interest in TT” differed greatly in children who had started TT compared to children before TT, regardless of their age. The cognitive and temperament DS “saying no,” “having a broader vocabulary,” “completing tasks and being proud of new skills” and “putting things where they belong” were significantly associated with the completion of TT, after correction for covariates including age. The DS “expressing a need and showing awareness to evacuate,” “evacuating on a potty, related to urge to evacuate,” “participating and showing interest in TT,” “wanting to be clean and indicating wet/dirty pants,” and “pulling clothes up and down related to TT” were

important DS specifically related to toileting associated with a successful completion of TT.

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Author Contributions

NK: development of study design, collecting the data, making first analysis. WM: evaluation of results, correcting paper. VA: evaluation of results, correcting the paper. WJJ: development of study design, helping in progress of data collection, evaluation of results, writing manuscript.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical Approval

The University Antwerp Ethical committee granted permission (December 6, 2011) IRBnr 24339 (UZA—mandaat N. Kaerts).

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