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Risk factors for urinary incontinence in nursing home residents

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Summary

Question: What are potential risk factors for urinary incontinence in nursing home residents older than 65 years at the time of admission and over time?

Method: Secondary analysis of data from the Minimum Data Set of the Resident Assessment Instrument in a cross-section as well as a longitudinal section. The sample contained data of 2722 residents from 42 different geriatric and nursing homes in north-west Switzerland.

Results: The cross-sectional analysis showed the variable "moving in bed" as the most important personal variable for incontinence at admission.

Longitudinal analyses: The most important risk factor was 'moving in bed' as it continued its action even at 12 months. In a further analysis (incontinence one year after admission with the risk factors at admission) the items "long-term memory, state season and walking in room" were important factors.

Conclusion: The data suggest that mental and physical exercises could be a way to reduce urinary incontinence. However, physical exercises would be the most important, because "moving in bed" continued its action even at 12 months.

Despite some limitations attributable to the data collection, this is the first study in Switzerland to examine risk factors for urinary incontinence among nursing home residents.

Key words: urinary incontinence; geriatric patients; nursing home; mobility, cognitive abilities; Minimum Data Set; Switzerland

Introduction

Urinary incontinence affects more than half of all elderly nursing home residents. In a study carried out in Switzerland with 2610 geriatric and nursing home residents 65 years and older, the prevalence was 52% based on the Minimum Data Set of the Resident Assessment Instrument [1]. In other studies among residents 60 years and older the prevalence was between 49% and 62% [2–5].

Urinary incontinence among nursing home residents is associated with high expenses [6]. The elderly person's independence and self-confidence is also considerably impaired by urinary incontinence. Additionally, urinary incontinence influences old people's care dependency to a high degree [7], and increasing care dependency leads to increasing expenses.

Literature mentions various risk factors for urinary incontinence. Aggazzotti et al. [2] showed a higher prevalence among residents older than 95 years than among those who were younger than 65 years. In contrast to this, Welz-Barth et al. [7] did not discover any age-dependent increase in urinary incontinence. Both Aggazzotti et al. [2] and Borrie et al. [5] described a higher prevalence among females than males. The authors of this study [1] did not find any gender-specific differences, however, the prevalence at the time of admission was higher among men than women. Two studies identified dementia, impaired mobility and the male sex to be risk factors [8, 9]. Two other studies also discovered a relationship between urinary incontinence and dementia [7, 3] whereas the medical diagnoses of diabetes mellitus and depression revealed no association with urinary incontinence [3]. Brandeis et al. [3] discovered that there was a relationship between urinary incontinence and restrictions to the activities of daily life. Yu et al. [10] stated that urinary incontinence is more frequently

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a problem of mental and physical impairments than a functional disorder of the bladder.

In summary, contradicting results are found by various researchers. Moreover, studies regarding urinary incontinence in Switzerland and other German-speaking countries are lacking. In order to prevent urinary incontinence and to be able to provide medical treatment and care, it is essential to have differentiated knowledge of urinary incontinence and the relevant risk factors. This study therefore looks closer into the following question: Are "cognitive abilities, mobility, mood, faecal incontinence and incontinence auxiliaries, age and gender" potential risk factors for urinary incontinence in geriatric and nursing home residents older than 65 years at the time of admission and over time?

Design

This is a secondary analysis of data from the Minimum Data Set (MDS) of the Resident Assessment Instrument (RAI) in a cross-section as well as a longitudinal section.

Instrument

This study was carried out using data of the MDS (RAI 2.0). It is an instrument applied in geriatric and nursing homes and is mainly for the care planning, quality management, financing and resource management [11]. The MDS (RAI 2.0) consists of 16 areas. These are the usual problem areas of geriatric and nursing home residents (e.g. cognitive abilities, physical functions).

The following items of the MDS (RAI 2.0) were used for the investigation:

- Urinary incontinence: Urinary incontinence is assessed as the response variable (yes-no). Incontinence is defined as at least two episodes of involuntary loss within one week. Residents with a bladder catheter or stoma are regarded as 'continent'. Hardly any residents in Swiss nursing homes have a catheter, incontinent nursing home residents wear pads.
- Cognitive abilities (7 items): The cognitive abilities comprise questions referring to memory (2 items), recollection ability (4 items) and the ability to make ordinary decisions (1 question). The four-part division of the variable "ability to make ordinary decisions" was combined in two categories: "no problem" for independent or partly independent residents and "problem" for those with medium or serious impairments.
- Mood (4 total scores): This area consists of 4 total scores regarding questions about verbal expression, sleep, sadness and indifference.
- Mobility (11 items): The questions in this area refer to movement (4 items), movement auxiliaries (3 items) and accidents (4 items). The five-part division of the variable "movement" was combined in: "no problems" for independent residents, "minor problems" for residents requiring supervision or assistance to a certain extent, "problems" for residents requiring increased help or being entirely dependent.
- Faecal incontinence and incontinence auxiliaries (4 items): This area consists of one question regarding faecal incontinence and 3 questions regarding incontinence auxiliaries.
- Demographic data (3 items): Age, gender and date of admission.

The instrument was carefully developed and thoroughly tested in the USA from 1987 to 1991 [12]. The next section describes the reliability and validity measurements of the MDS (RAI 2.0) subscales used for this research.

Hawes et al. [13] tested the interrater reliability of the following subscales: memory, recollection ability, ADL, continence (whole subscale), continence (only bladder and faecal incontinence). They obtained good to very good results that were confirmed by further studies [14, 15] (Subscale Incontinence).

Additionally, the concurrence between the MDS subscales and various instruments were tested with good results:

- MDS subscales with Mini-Mental State Examination, Dementia Rating Scale and Dementia Rating Scale Subset [16].
- MDS subscales with Global Deterioration Scale and Mini-Mental State Examination [17].
- MDS subscales with Mini-Mental State Examination [18].

Hartmeier et al. [18] showed that sensitivity and specificity of the MDS were over 0.90.

Another study [19] examined the concurrence between urinary incontinence (MDS) and the measured humidity of the patient's sanitary pads. It revealed that there was significant correlation when researchers examined the pads and no significant correlation when ward staff examined them.

Sample

The sample contained data of residents from 42 different geriatric and nursing homes in north-west Switzerland. 35 geriatric and nursing homes were in the canton of Solothurn, six in the canton of Aargau and one in the canton of Berne. All residents were older than 65 years and care dependent.

In five of the geriatric and nursing homes the investigation period started in January 1999, in 37 of the homes it started in January 2000 and it finished in June 2002 for all residents. During this period, 2722 residents were admitted to the geriatric and nursing homes.

The sample of the four logistic regression models showed the following:

Logistic regression 1, at the time of admission: 2112 observations. The difference to 2722 resulted from missing variables.

Logistic regression 2, 6 months after admission: 281 observations.

Logistic regression 3, 12 months after admission: 204 observations.

Logistic regression 4, urinary incontinence 1 year after admission with the risk factors at admission: 446 observations.

The missing variables of the logistic regression 2, 3 and 4 resulted from missing variables, residents that had died, or entered an other institution or entered the nursing homes after December 2001 (regression model 2, 3 and 4) or June 2001 (regression model 3 and 4), because the data gathering was finished in June 2002.

Additional to this, only the residents who were con-

tinent at admission were included in the logistic regression 2 and only those who were continent six months after admission were included in the logistic regression 3.

Data gathering

Data gathering was conducted by means of MDS (RAI 2.0). It is the usual assessment carried out by nursing staff in close cooperation with the other professional groups involved (physicians, physiotherapists, etc.) for all geriatric and nursing home residents upon admission and again at six-month intervals. In order to ensure correct performance of the assessment with MDS, all nursing staff members were trained for 1½ days.

Following written consent from all geriatric and nursing home directors, the data were made available to the investigator of the company responsible for the introduction, training and quality development of the RAI system in Switzerland.

In order to obtain higher credibility, the data were only used for this research after all nursing staff members had completed RAI system training and performance gathering had been carried out with this instrument. No previous data were included in the investigation.

Assessment was generally conducted upon admission and then again at six-month intervals. An interim assessment was required as soon as the resident's condition changed. However, analysis only included the data of the observations made upon admission and after six and twelve months.

Statistical analysis

Cross tables show the proportion of continent and incontinent patients in subgroups defined by the levels of several risk factors. This descriptive analysis was carried out by SPSS 11.0.

Logistic regression models with incontinence (yes/no) as the binary response variable were used to identify statistically significant risk factors. A cross-sectional model was developed to describe the relationship between incontinence and the personal characteristics at the time of admission into the nursing home. Two additional models investigated the occurrence of incontinence after six months and after a year of living in the home. In the first case, only those people were included in the analysis that were continent at the time of admission, in the second case only those who were still continent after a period of six months. A further analysis listed the probability of incontinence a year after admission to a home depending on the risk factors at the beginning of the stay. All models included age group and gender as explanatory variables. The remaining risk factors, which were examined in the model building process, referred to problems in the areas of mobility, cognitive abilities, mood, faecal incontinence and incontinence auxiliaries. Additionally, the interactions between age groups as well as gender and all other variables were tested in this model.

An automatic selection procedure was implemented on the basis of Akaike's Information Criterion (AIC). Potential models were also compared with each other regarding changes in the deviance as Goodness-of-Fit statistics. The definite models include all variables that could not have been omitted without significantly increasing the deviance. On the other hand, none of the risk factors not included in the definite model would have significantly reduced the deviance. For the purpose of easier interpretation, the regression coefficients were transformed into odds ratio (OR). The relevant odds for incontinence were then compared with those of a reference group. All regression analyses were carried out by means of the R statistical software package release 1.6.0 and the methods for generalised linear models of binomial data [20].

Results

Characteristics of newly admitted residents

2722 residents were examined who entered the nursing homes in the period from January 1999 (2000) to June 2002. There were 910 (33%) men and 1809 (67%) women. 288 (11%) residents were 65–75 years old, 991 (36%) were 75–85 years old, 1216 (45%) were 85–95 years old and 227 (8%) were over 95 years of age.

Table 1

Characteristics of continent and incontinent residents at admission

	Continent			incontinent		
	no problems	**minor probl.**	**problems**	**no problems**	**minor probl.**	**problems**
Long-term memory ¶	1118 (65.1%)		598 (34.9%)	412 (41.2%)		588 (58.8%)
Impaired recollection ability: state season ‡	1258 (73.3%)		458 (26.7%)	464 (46.4%)		537 (53.6%)
Cognitive abilities to make ordinary decisions ‡	1126 (65.6%)		590 (34.4%)	354 (35.4%)		647 64.6%)
Mobility: Moving in bed †	1039 (60.4%)	368 (21.4%)	312 (18.2%)	311 (31.1%)	294 (29.3%)	396 (39.6%)
Mobility: Moving in room *	1013 (68.7%)	301 (20.4%)	161 (10.9%)	304 (40.3%)	253 (33.6%)	197 (26.1%)
Mobility: Moving about on own corridor **	972 (58.6%)	419 (25.2%)	269 (16.2%)	257 (28.1%)	319 (34.9%)	339 (37%)
	No Continent		**Yes Continent**	**No Incontinent**		**Yes Incontinent**
Mobility: Permanently dependent on wheelchair	1491 (86.7%)		228 (13.3%)	762 (76%)		241 (24%)
Accidents: Hip fracture in last 6 months	1640 (95.4%)		79 (4.6%)	961 (95.8%)		42 (4.2%)

¶ 6 observations missing for this variable
‡ 5 observations missing for this variable
† 2 observations missing for this variable
* 493 observations missing for this variable
** 147 observations missing for this variable

Table 2

P-values and odds ratio for urinary incontinence at admission.

Variables	logistic regression 1		
	P-values	**Odds ratio**	**95% CI**
Gender *			
male	<0.001	1.69	1.36–2.09
Age groups †			
65 to 74	0.84	3.73	. – . ‡‡
75 to 84	0.16	76.36	0.17 –. ‡‡
85 to 94	0.10	154.93	0.37 –. ‡‡
Long-term memory ‡			
No problem	0.005	0.70	0.54–0.90
State season §			
no	<0.001	1.59	1.24–2.04
Cognitive abilities ‡			
no problem	<0.001	0.64	0.49–0.83
Walking in room ¶			
no problem	–	–	–
minor problems	–	–	–
Moving about in own corridor ¶			
no problem	0.57	0.78	0.33–1.85
minor problems	0.33	0.64	0.26–1.58
Moving in bed ¶			
no problem	<0.001	0.51	0.36–0.73
minor problems	0.49	0.89	0.64–1.24
Wheelchair **			
yes	–	–	–
Hip fracture§			
none	0.10	141.55	0.36 –. ‡‡
Age – Moving about			
65 to 74 – no problem	0.17	0.33	0.07–1.57
75 to 84 – no problem	0.01	0.28	0.11– 0.75
85 to 94 – no problem	0.33	0.63	0.25– 1.61
65 to 74 – minor problems	0.71	0.74	0.15– 3.68
75 to 84 – minor problems	0.98	1.02	0.37– 2.83
85 to 94 – minor problems	0.85	1.10	0.41– 2.93
Age – Hip fracture			
65 to 74 – none	0.91	0.50	. – . ‡‡
75 to 84 – none	0.24	0.03	. – 11.09
85 to 94 – none	0.11	0.01	. – 3.04

* Female patients are the reference group.
† Age group "95 and older" is the reference group.
‡ Reference level is "problems".
§ Reference level is "yes".
** Reference level is "no".
¶ Reference level is "problems"
‡‡ Values are missing if smaller than 0.01 or higher than 100.

Upon admission, 37% of the residents were urinary incontinent of whom 34% females and 43% males (p = <0.0001). Division into age groups (65–75, 75–85, 85–95 and over 95 years) revealed hardly any age-related differences in the urinary incontinent residents (34% to 38%).

Table 1 illustrates the bivariate correlation between selected items of the two areas "cognitive abilities and mobility" and urinary incontinence. Although cross-tables were created for all items, table 1 only shows those characteristics that proved to be important for the bivariate analyses.

It was established that in all areas the residents with problems were more frequently incontinent than those without problems. The only exception was the variable "accidents: hip fracture in the last 6 months".

Correlation between personal characteristics, risk factors and urinary incontinence

Apart from age groups and gender, 26 personal characteristics were examined in total, of which 8 appeared in the definite regression models. The four models (tables 2, 3 and 4) included the same

Table 3

P-values and odds ratio for incontinence 6 months (logistic regression 2) and 12 months after admission (logistic regression 3)

Variables	logistic regression 2			logistic regression 3		
	P-values	Odds ratio	95% CI	P-values	Odds ratio	95% CI
Gender *						
male	0.33	0.56	0.18–1.78	0.90	1.08	0.35–3.29
Age groups †						
65 to 74	0.76	1.27	0.28–5.68	0.54	0.54	0.07–3.96
75 to 84	0.39	1.71	0.50–5.79	0.31	0.44	0.09–2.15
85 to 94	0.94	1.04	0.33–3.30	0.62	0.70	0.17–2.92
Long-term memory ‡						
No problem	<0.001	0.19	0.08–0.46	–	–	–
State season §						
no	0.35	1.51	0.63–3.62	–	–	–
Cognitive abilities ‡						
no problem	–	–	–	–	–	–
Walking in room ¶						
no problem	–	–	–	–	–	–
minor problems	–	–	–	–	–	–
Moving about in own corridor ¶						
no problem	–	–	–	0.01	0.15	0.03–0.67
minor problems	–	–	–	0.03	0.20	0.04–0.85
Moving in bed ¶						
no problem	<0.001	0.17	0.06–0.48	0.005	0.13	0.03–0.55
minor problems	0.60	0.76	0.27–2.13	0.009	0.14	0.03–0.62
Wheelchair **						
yes	0.11	6.98	0.64–76.54	–	–	–
Hip fracture §						
none	0.03	6.38	1.16–34.66	–	–	–
Gender – State season						
male – no	0.08	4.24	0.85–21.13	–	–	–

* Female patients are the reference group.
† Age group "95 and older" is the reference group.
‡ Reference level is "problems".
§ Reference level is "yes".
** Reference level is "no".
¶ Reference level is "problems"
‡‡ Values are missing if smaller than 0.01 or higher than 100.

variables to a great extent. These were the variables of the two areas "cognitive abilities" and "mobility".

Cross-sectional analysis: The first regression analysis examined the relationship between incontinence and the personal characteristics at the time of admission. The best model based on the AIC and the change of deviance comprises eight explanatory variables. Table 2 illustrates the P-values and the odds ratio (OR), including 95% confidence intervals (CI).

Of all non-interacting variable, "moving in bed" was the most important personal variable for incontinence, which was demonstrated by the minimal OR of 0.51. The odds for incontinence were therefore approximately half as high for a mobile person as for somebody who needs assistance when moving in bed. The two variables "state season" and "cognitive abilities" were almost of the same importance. The odds for incontinence for people with problems in these areas were 1.6 times higher than for people without such problems. Male gender was a significant characteristic as well. The odds for incontinence for males were 1.7 times higher than for females.

Interpretation of the results of interacting variables was more complicated. In order to compare two groups, the relevant odds ratio of main effect and interaction had to be multiplied with each other. The odds for incontinence for a 90-year-old person without hip fracture, for example, were $154.93 \times 0.01 = 1.55$ times higher than for a resident of at least 95 years of age, also without hip fracture. The confidence intervals for odds ratio comparing age groups or people with and without hip fractures were quite large, so that the subsequent results should be interpreted with due care.

Longitudinal analyses: A second regression analysis examined the relationship of risk factors with incontinence six months after admission to the home. In order to respect the chronological development, this regression model only considered those people who were still continent at the time of admission. The best model according to the AIC

Table 4

P-values and odds ratio for urinary incontinence 1 year after admission with the risk factors at admission (logistic regression 4)

Variables	logistic regression 4		
	P-values	**Odds ratio**	**95% CI**
Gender *			
male	0.29	0.58	0.21–1.60
Age groups †			
65 to 74	0.04	0.43	0.19–0.95
75 to 84	0.16	0.62	0.32–1.21
85 to 94	0.18	0.64	0.34–1.23
Long-term memory ‡			
No problem	0.001	0.53	0.36–0.78
State season §			
no	<0.001	1.99	1.33–2.97
Cognitive abilities ‡			
no problem	0.07	0.69	0.47–1.03
Walking in room ¶			
no problem	<0.001	0.34	0.18–0.63
minor problems	0.82	0.92	0.44–1.91
Moving about in own corridor ¶			
no problem	–	–	–
minor problems	–	–	–
Moving in bed ¶			
no problem	–	–	–
minor problems	–	––	–
Wheelchair **			
yes	–	–	–
Hip fracture §			
none	0.05	2.50	1.01–6.61
Gender – Walking			
male – no problem	0.19	2.10	0.70–6.33
male – little assistance	0.03	4.65	1.16–18.60

* Female patients are the reference group.
† Age group "95 and older" is the reference group.
‡ Reference level is "problems".
§ Reference level is "yes".
** Reference level is "no".
¶ Reference level is "problems"
‡‡ Values are missing if smaller than 0.01 or higher than 100.

and the change of deviance comprised seven explanatory variables. Table 3 (logistic regression 2) illustrates the results. "Moving in bed" was the most important rater for incontinence. The odds for incontinence were 5.88 (= 1/01.7) times higher for patients with difficulties in moving in bed than for patients without those problems. The second important factor concerned problems with long-term memory. The odds for incontinence were 5.26 (= 1/0.19) times higher for persons with long-term memory problems than for persons without such impairments. The factor "state season" was looked at separately for females and males, because there was an interaction with gender. The odds for incontinence were 6.4 (= 1.51 × 4.24) times higher for males with memory difficulties regarding the season than for those without. The analogue comparison of females revealed odds ratio of only 1.51.

In a third regression analysis, we examined the association between risk factors and incontinence 12 months after admission to the home. To enable examination of the chronological development, the regression model only took into account those people that were still continent six months after admission. The best model according to AIC and the change of deviance comprised four explanatory variables. Table 3 (logistic regression 3) contains the results. Again "moving in bed" was the most important rater for incontinence. The odds for incontinence were 7.69 (1/0.13) times higher for residents with problems in moving in bed than for those without any such problems. The second important factor was "moving about in own corridor". The odds for incontinence were 6.67 (1/0.15) times higher for residents with difficulties in moving about in own corridor than for those without.

In the fourth logistic regression, the effect of the risk factors as estimated at the time of admission was examined for incontinence after one year. According to the AIC and the change of deviance the best model comprised seven explanatory variables. The results are illustrated in table 4 (logis-

tic regression 4). The most important factor was "walking in the own room". The effect of problems in this area was different for males than females due to existing interaction with gender. The odds for incontinence were 1.40 (= 1/[2.1 × 0.34]) times higher for men with walking problems than for those without. For females the effect was even stronger. The odds were now 2.94 (= 1/0.34) times higher for females with walking problems than for women without these difficulties. In addition, we were dealing with the risk factors of subscale "cognitive abilities".

Discussion

This study provided an answer to the research question: What is the association between "cognitive abilities, mobility and demographic data" with urinary incontinence of nursing home residents older than 65 years at the time of admission, and after 6 and 12 months? The results of the cross tables (tables 1) showed that residents who had problems with "cognitive abilities and mobility" suffered more frequently from urinary incontinence than residents without those problems.

The results of the logistical regression are discussed separately: first the cross-sectional (table 2) and then the longitudinals (tables 3 and 4).

Cross-sectional analysis: The most important item was "moving in bed". In the subscale "cognitive abilities" three items (long-term memory, state season, cognitive abilities) were important. Other researchers also found that dementia was associated with urinary incontinence at the time of admission [7, 8]. Another important factor was "hip fracture". The interpretation of the (-interacting) variable "hip fracture" should be interpreted with due care, because the confidence intervals for odds ratio comparing age groups or people with and without hip fractures were quite large. Nevertheless, possibly residents with a hip fracture might receive better care than residents without a hip fracture. Better care might have a positive effect on urinary incontinence.

The odds for incontinence for males were 1.7 times higher than for women. Therefore, more incontinent men than incontinent women entered the nursing home. A possible reason could be that care-dependent men are cared for longer at home than women. According Welz-Barth [7] care dependency and incontinence are in strong correlation [7].

Longitudinal analyses: Table 3 showed different risk factors for urinary incontinence. From admission to 6 months after admission (logistic regression 2), the factors "long-term memory" and "moving in bed" were important predictors for urinary incontinence. In both, the odds for incontinence were more than 5 times higher for persons with these problems than for persons without. In the time-period from 6–12 months after admission (logistic regression 3), the factors "moving in bed" and "moving about in own corridor" were risk factors. Other researchers [3, 8, 9] also determined an association between urinary incontinence and impaired mobility at different points of time of the stay in a nursing home. The most important factor seemed to be "moving in bed", as it continued its action even at 12 months.

Table 4 (logistic regression 4) lists the probability of incontinence one year after admission depending on the risk factors at admission. "Walking in room" was an important predictor for urinary incontinence for women and men. But for women the effect was stronger. Variables of the subscale "cognitive abilities" were important predictors for urinary incontinence, as well. It is quite interesting that these variables played no role in logistic regression 3. It can be interpreted that the risk factors "cognitive abilities" were only important if residents had this since the beginning of the stay in a nursing home.

The items of the subscales "mood, faecal incontinence and incontinence auxiliaries" did not reveal any association with urinary incontinence at any point of time. However, Ouslander et al. [9] showed an association between faecal incontinence and the development of urinary incontinence, which might be due to the different designs, samples and measures.

Nevertheless, the present study also has some restrictions. The most significant restriction is probably that the measures were secondary data that were not gathered for research. Some security precautions were still made, e.g. the data for this research were not taken until all nurses had been trained in the assessment with MDS, and the nursing homes had at least one year of practice using the instrument. No previous observations were included in the research.

The association between urinary incontinence and mental and physical problems at various times was reported. It was established that different items of the subscales "cognitive abilities and mobility" did have an influence on urinary incontinence. This led to the conclusion that residents with cognitive and / or mobility impairments were more frequently incontinent. Mental and physical exercises could therefore be a way to reduce urinary incontinence. However the most important would be physical exercises, because "moving in bed" continued its action even at 12 months.

However, in the future, it is essential to do more research with specific questionnaires regarding mobility and cognitive abilities and with a more controlled data collection. Experimental research could then determine the advantages of mental and physical exercises for the improvement of urinary continence. In addition, the attitudes of nurses to-

wards patients with urinary incontinence should be explored, because the nurses play an important role in the prevention and treatment of urinary incontinence in their patients.

The reduction of urinary incontinence in elderly people remains an important topic as urinary incontinence diminishes the elderly person's independence and self-esteem.

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