

## Impact of a formulary on personal care homes in Manitoba

Marilyn R. Yakabowich,\* MSc Pharm; Gail Keeley, BSc Pharm; Patrick R. Montgomery,† MD, FRCPC

**Objective:** To assess the impact of a formulary on drug expenditures and prescribing trends in personal care homes (nursing homes).

**Design:** Quasi-experimental analysis of a drug prescription database before and after implementation of the formulary.

**Setting:** Personal care homes in Manitoba.

**Patients:** Residents occupying the 6848 beds of the 88 personal care homes that did not already have a formulary.

**Intervention:** Formulary, introduced Apr. 1, 1987.

**Main outcome measures:** Drug expenditures from Apr. 1, 1985, to Mar. 31, 1990; proportion of residents receiving a prescription by drug class and rate of prescriptions of nonformulary drugs in the year before and 2 years after the formulary was introduced.

**Main results:** The total drug expenditures per bed remained constant during the first year after the formulary was implemented, even though the annual drug inflation rate was 9.8% on average during the study period. Expenditures 2 and 3 years after implementation rose by 9.4% and 5.8% respectively. Those for specific agents and drug classes targeted as being inappropriate for long-term care decreased greatly because of reduced prescribing. Expenditures for some other drug classes increased mainly because newer, more expensive agents were used. The mean drug expenditure per bed varied widely between homes; neither size nor location were found to correlate with drug expenditure, but adherence to the formulary did predict personal care homes with decreased expenditures.

**Conclusions:** A formulary in personal care homes can improve therapeutic management. The impact on cost containment was not as strong after the first year, although expenditures remained less than the rate of inflation for drug costs.

**Objectif :** Évaluer l'effet de l'instauration d'une pharmacopée sur les dépenses en médicaments et les tendances des ordonnances dans les foyers de soins personnels (foyers de soins infirmiers).

**Conception :** Analyse quasi expérimentale d'une base de données sur les ordonnances avant et après la mise en oeuvre de la pharmacopée.

**Contexte :** Foyers de soins personnels du Manitoba.

**Patients :** Résidents occupant les 6848 lits des 88 foyers de soins personnels qui n'avaient pas déjà de pharmacopée.

**Intervention :** Pharmacopée, mise en oeuvre le 1<sup>er</sup> avril 1987.

**Principales mesures des résultats :** Dépenses consacrées aux médicaments du 1<sup>er</sup> avril 1985

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*Ms. Yakabowich is in the Faculty of Pharmacy and Dr. Montgomery is in the Section of Geriatric Medicine, University of Manitoba, Winnipeg, Man. Ms. Keeley is a pharmacy consultant for Manitoba Health, Winnipeg, Man.*

*Reprint requests to: Dr. Patrick R. Montgomery, Department of Geriatric Medicine, Rm. E4003, 409 Tache Ave., St. Boniface General Hospital, Winnipeg, MB R2H 2A6*

au 31 mars 1990; proportion des résidents recevant une ordonnance selon la catégorie de médicaments et taux d'ordonnance de médicaments hors-pharmacopées au cours de l'année précédant la mise en oeuvre de la pharmacopée et 2 ans après.

**Principaux résultats :** Les dépenses totales en médicaments par lit sont demeurées constantes au cours de la première année qui a suivi la mise en oeuvre de la pharmacopée, même si le taux d'inflation annuel du prix des médicaments a atteint 9,8 % en moyenne au cours de la période d'étude. Les dépenses effectuées 2 et 3 ans après la mise en oeuvre de la pharmacopée ont augmenté de 9,4 % et 5,8 %, respectivement. Les dépenses consacrées à des agents spécifiques et à des catégories de médicaments ne convenant pas aux soins de longue durée ont diminué considérablement à cause de la chute du nombre des ordonnances. Les dépenses consacrées à d'autres catégories de médicaments ont augmenté, principalement en raison de l'utilisation d'agents plus coûteux et nouveaux. Les dépenses moyennes en médicaments par lit ont varié considérablement entre les foyers; on n'a trouvé aucun lien entre la taille ou l'emplacement et les dépenses en médicaments, mais on a constaté qu'on pouvait effectivement prédire dans quels foyers de soins personnels les dépenses diminueraient, en fonction du degré d'observation de la pharmacopée.

**Conclusions :** L'utilisation d'une pharmacopée dans des foyers de soins personnels peut améliorer la gestion des traitements. L'impact sur la limitation des coûts n'a pas été aussi marqué après la première année, même si les dépenses sont demeurées sous le taux d'inflation des coûts des médicaments.

**A**s of June 1, 1990, 12.8% of Manitobans were 65 years and older.<sup>1</sup> About 8000 (5.5%) of the geriatric population resided in nursing homes (termed personal care homes in Manitoba).<sup>2</sup> Elderly people are major consumers of medications, and concern has been expressed regarding the appropriateness of therapeutic management in nursing homes.<sup>3</sup> At present, all drugs for residents of personal care homes in Manitoba are paid for by the province. Given the multiplicity of agents available and the complexities of the aging person, the selection of the most appropriate drug is often difficult.

On Apr. 1, 1987, the Manitoba government introduced a formulary for personal care homes called the *Manitoba Personal Care Home Prescribing Guide*.<sup>4</sup> The guide is part of a formulary system recommended by physicians practising in personal care homes who participated at the Symposium on the Institutionalized Elderly, held in Winnipeg in 1980 and again in 1984. At the symposium, the purpose and function of a personal-care-home formulary was defined: to have a rational list of drugs for elderly people; to reduce drug errors; to improve standards of care for residents; to alert health care providers to drugs that are unnecessarily costly or hazardous; to act as a vehicle for ongoing education for physicians, nurses, pharmacists and ancillary workers; and to control drug costs.

We analysed a drug prescription database to study the effect of the formulary on drug expenditures and therapeutic management in personal care homes. Information on drug expenditures and requests for nonformulary drugs for each home were analysed to understand the formulary's potential for cost containment in nursing homes.

## Methods

A personal care home is an institution with a pro-

fessional, coordinated staff and permanent facilities that provides a broad spectrum of health-related services, including continuous nursing and psychosocial and personal services, to people who are unable to live independently. The residents of personal care homes are largely elderly, do not require acute hospital care but do require a level of medical services on a continuous basis.<sup>5</sup> All prescriptions dispensed for use by residents are centrally recorded on a computer at the Manitoba Health Services Commission for reimbursement. Regular audits ensure the accuracy of claims. The prescribing guide is a compendium of drugs selected by a committee of physicians, pharmacists and nurses who work in the field of geriatrics and long-term care. The selection was based on a review of the current literature, statistics from personal care homes on drug use and criteria such as efficacy, safety, dosage form, strength and cost of the product. For each drug class the guide provides a brief monograph highlighting current therapeutic concepts, tables listing dosage information specific to elderly people and information on side effects, precautions and relative costs. For any drug not listed in the guide, the prescribing physician must fill out a nonformulary-drug request form indicating a reason for choosing the drug. The completed form authorizes the pharmacist to supply the drug for 1 year. No other limitations on prescribing nonformulary medications were instituted.

An extensive educational initiative targeted to physicians, nurses and pharmacists working in personal care homes was undertaken as part of the formulary's introduction. After that, the committee continued to meet regularly to review utilization data and update the formulary. Regular communication and visits were made to the homes to ensure compliance with the formulary and inform providers of changes to it.

Since implementation of the formulary was the only major change in the Manitoba Drug Program during the

study period, it served as the experimental intervention. We included 88 homes (urban and rural), which represented 6848 beds (14 to 284 beds per home). We excluded homes that already had a formulary (two large homes in Winnipeg and several small rural homes attached to a hospital). A one-group pretest-post-test quasi-experimental repeated measures design was used. The 1-year pretest period, before implementation of the formulary, was from Apr. 1, 1986, to Mar. 31, 1987. The 2-year post-test period was from Apr. 1, 1987, to Mar. 31, 1989.

Data were obtained on annual drug expenditures from 1985 to 1990, the mean number of requests for nonformulary drugs in each of those years and characteristics of the homes (e.g., size and location). These variables were correlated using multiple logistic regression analysis. The proportion of residents receiving a prescription for different drug classes in each year was compared with the use of Pearson's  $\chi^2$  analysis.

## Results

The mean number of prescriptions per resident each month was 3.98 in the year before the formulary was in place; it decreased slightly afterward, to 3.86 in 1987-88 and 3.73 in 1988-89. Since most pharmacies dispense a 1-month supply of a drug, these figures reflect the average number of drugs each resident receives for that month; this excludes stock agents (over-the-counter drugs given without a prescription, such as acetaminophen and antacids).

Fig. 1 depicts the total drug expenditures per bed before and after the prescribing guide was introduced. In the first year after implementation the total expenditures increased negligibly, from \$434 to \$437 per bed. Subsequently, they rose more rapidly, from \$478 per bed in 1988-89 to \$506 in 1989-90 (increases of 9.4% and

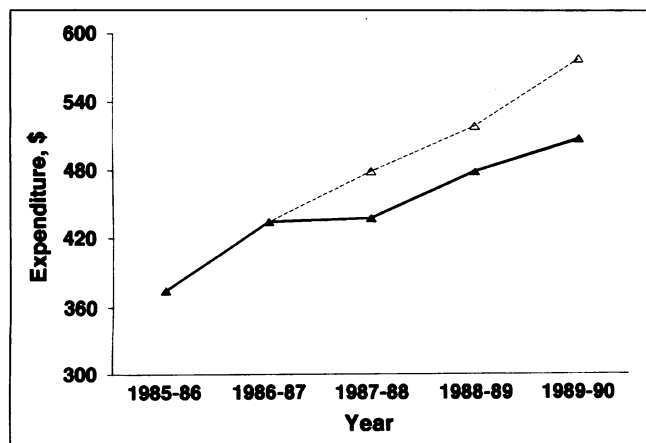


Fig. 1: Drug expenditures per bed in Manitoba personal care homes before and after the introduction of a formulary on Apr. 1, 1987. Solid line indicates actual expenditures, and dotted line represents the increase predicted by the inflation rate for drugs purchased by the Personal Care Home Drug Program.

5.8% respectively). However, these increases were less than the annual rate of inflation for drugs purchased by the Personal Care Home Drug Program, which was 9.8% on average during the study period. Given the effects of inflation, there was an overall cost savings of about \$280 000 in the first year after implementation and up to \$1 000 000 in the first 3 years.

For certain targeted drug classes the expenditures were lower in 1987-88 than in 1986-87 (Table 1). These included analgesics, antianemic agents, antibiotics, diuretics, vasodilators and vitamins. In the second year after implementation of the guide, substantial declines continued for diuretics, vasodilators and vitamins, whereas expenditures rebounded for antibiotics and analgesics.

Table 2 shows the proportion of residents who received a prescription by drug class (the probability of prescription). There was a corresponding decline in expenditures and probability for antianemic agents, diuretics, vasodilators and vitamins. Although the probability of receiving a prescription did not decrease for the analgesic and antibiotic classes in concert with declining expenditures, we do not have data on the intensity of use, which could have decreased.

For antacids, antidiarrheals, antiemetics and laxatives, there was a significant decline in the proportion of residents who received a prescription even though there was no decrease in expenditures. This could have been because of fewer side effects and secondary treatments; the prescribing guide emphasized dietary interventions for constipation and discouraged nonspecific treatment with antacids.

Consistent increases in expenditures in the first 2 years after implementation of the guide were noted for cardiac drugs, anticonvulsants, antidiabetics, antihypertensive drugs, antiparkinsonism drugs, miscellaneous gastrointestinal drugs (mainly  $H_2$ -receptor antagonists) and psychotherapeutic drugs. Concomitant increases in the proportion of residents who received a prescription were recorded only for the anticonvulsant, antihypertensive and miscellaneous gastrointestinal drugs.

Certain drugs left off the formulary showed decreases in use of up to 81% during 1988-89: nylidrin (81%), mineral oil containing laxatives (81%), flurazepam (55%), sedative barbiturates (48%) and ergoloid mesylates (41%). Similar declines were observed for various topical antimicrobial agents, anti-inflammatory drugs and combination products not included in the prescribing guide; although there was no persistent decline overall in the use of topical products, prescription shifted to guide-approved single-agent formulations.

Data on the use of sedative-hypnotic drugs are presented in Table 3. Although the total number of doses increased slightly, there was a nonsignificant trend toward declining proportions of residents receiving such a prescription (Table 2). The most significant decrease in usage occurred with agents left off the for-

mulary, especially the sedative barbiturates and flurazepam.

In each year approximately 45% of the residents received a prescription for a psychotherapeutic agent (either a major tranquilizer or an antidepressant). The use of antipsychotic drugs decreased by 7% over the study period; however, expenditures for this class increased by approximately 10% per year, mainly because of increased costs of established generic drugs such as haloperidol. The use of antidepressants increased by 7%, expenditures rising more rapidly in the first year than in the second year after implementation of the formulary (by 22% and 12% respectively). In this class, expenditures were increased because of a switch from non-guide-approved drugs (e.g., amitriptyline-perphenazine combination) to newer agents suitable for geriatric patients (e.g., desipramine and trazodone).

The influence of the prescribing guide could also be seen in the class of nonsteroidal anti-inflammatory drugs (NSAIDs). In 1987-88 the total number of doses of NSAIDs dispensed fell by 13%, and expenditures decreased by 20%. There was an increase of 8% in the use of NSAIDs included in the guide, which was counterbalanced by a decrease of 46% in the use of non-guide-approved NSAIDs.

The annual expenditure per bed for individual homes varied fourfold, each facility tending to remain in a rank order of relative cost. Table 4 shows the results of

the multiple logistic regression analysis of factors predicting variability in drug expenditures between homes. Neither size (number of beds) nor location (rural v. urban) were found to correlate with drug expenditure. However, adherence to the prescribing guide (the mean number of requests for nonformulary drugs per bed) was inversely correlated on a consistent basis with drug expenditure for each personal care home.

## Discussion

Numerous studies have been performed on the development and evaluation of formularies. Most, however, have focused on hospital formularies.<sup>6-11</sup> We found no studies that focused on the effects of a formulary on prescribing in nursing homes.

The development and maintenance of a restrictive formulary is widely accepted and promoted as a standard of practice for institutional pharmacy,<sup>12</sup> and many studies have documented the impact of formularies on prescribing.<sup>13-15</sup> However, the evidence for economic benefits of formularies is unclear and may be limited to certain high-cost items such as parenteral antibiotics and enteral-nutrition products not widely used in nursing homes. Green, Chawla and Fong<sup>16</sup> stated that no documentation exists of a direct correlation between cost savings and restrictiveness of a formulary. In contrast, Hazlet and Hu<sup>17</sup> reviewed US hospital data and found

Table 1: Drug expenditures in personal care homes in Manitoba from 1986 to 1989 by drug class

AHFS* category	Drug class	Year; cost, \$			% change	
		1986-87	1987-88	1988-89	Year 1-2	Year 2-3
4:00	Antihistamine	16 569	16 762	16 985	+1	+1
8:00	Antibiotic	103 322	95 992	114 059	-7	+19
12:00	Autonomic	117 487	120 976	141 581	+3	+17
20:04	Antianemic	53 708	41 375	41 460	-23	+0.2
24:04	Cardiac	123 415	143 752	174 374	+16	+21
24:08	Antihypertensive	70 361	88 905	115 276	+26	+30
24:12	Vasodilator	133 163	107 526	90 259	-19	-16
28:08	Analgesic, antipyretics	313 043	281 899	314 987	-10	+12
28:12	Anticonvulsant	49 324	61 376	75 025	+24	+22
28:16	Psychotherapeutic	255 394	294 144	328 475	+15	+12
28:24	Sedative-hypnotic	75 930	75 290	71 640	-1	-5
40:28	Diuretic	65 749	59 427	55 507	-10	-7
52:00	EENT† drug	106 951	129 015	127 318	+21	-1
56:12	Laxative	391 952	389 658	410 776	-1	+5
56:00	Other gastrointestinal (GI) drug	230 872	265 447	302 080	+15	+14
68:20	Antidiabetic	35 352	43 839	53 737	+24	+23
84:00	Dermatologic	154 588	151 177	188 105	-2	+24
86:16	Respiratory	45 840	46 221	47 161	+1	+2
88:00	Vitamin	40 519	32 696	29 730	-19	-9
92:00	Antiparkinsonism	186 620	213 240	233 007	+14	+9

\*AHFS = American Hospital Formulary System.

†EENT = eye, ear, nose and throat.

Table 2: Proportion of residents in personal care homes in Manitoba receiving a prescription each year by drug class

AHFS* category	Drug class	Year; % of residents			p value*
		1986-87	1987-88	1988-89	
4:00	Antihistamine	5.0	4.2	4.5	NS
8:12	Antibiotic	46.7	47.5	46.9	NS
8:40	Cotrimoxazole	22.6	24.1	23.9	NS
10:00	Antineoplastic	1.1	1.3	1.4	NS
12:08	Anticholinergic	10.0	9.5	9.3	NS
12:12	Adrenergic	5.4	5.7	7.0	< 0.001
20:04	Antianemic	14.9	13.5	9.4	< 0.001
24:04	Cardiac	23.9	23.3	23.5	NS
24:08	Antihypertensive	8.5	8.6	9.7	0.012
24:12	Vasodilator	15.7	14.3	12.0	< 0.001
28:08	Analgesic, antipyretic	58.5	57.9	57.2	NS
28:12	Anticonvulsant	8.4	9.0	9.7	0.016
28:16	Psychotherapeutic	44.6	45.0	44.1	NS
28:24	Sedative-hypnotic	33.3	32.8	31.7	NS
40:28	Diuretic	48.1	46.4	45.3	0.002
48:08	Antitussive	3.5	2.7	2.3	< 0.001
52:04	EENT drug, anti-infective	19.9	19.2	19.1	NS
56:04	Antacid	12.4	11.3	7.2	< 0.001
56:08	Antidiarrheal	4.9	3.5	2.8	< 0.001
56:12	Laxative	38.4	32.5	29.2	< 0.001
56:22	Antiemetic	8.6	8.9	7.4	0.001
56:40	Miscellaneous GI drug	10.7	11.7	13.1	< 0.001
68:20	Antidiabetic	8.4	8.0	7.8	NS
68:36	Thyroid drug	8.1	8.5	8.9	NS
84:04	Dermatologic, anti-infective	25.8	24.1	25.6	NS
84:06	Dermatologic, anti-inflammatory	24.6	25.1	25.4	NS
86:16	Respiratory	7.1	7.1	6.7	NS
88:08	Vitamin B complex	12.8	10.7	8.7	< 0.001
88:28	Multivitamin	9.2	7.4	4.7	< 0.001

\*Most significant p value for differences between proportions in 1986-87 and those in 1987-88 or 1988-89. NS = not significant.

Table 3: Number of prescriptions of sedative-hypnotic drugs in personal care homes in Manitoba

Drug	Year; no. of doses			% change	
	1986-87	1987-88	1988-89	Year 1-2	Year 2-3
Triazolam	242 597	271 313	238 487	+12	-12
Lorazepam	148 387	194 333	231 110	+31	+19
Diazepam	131 615	122 520	103 301	-7	-16
Oxazepam	48 905	54 029	53 093	+10	-2
Alprazolam	35 644	33 076	39 089	-7	+18
Flurazepam*	26 899	12 167	13 629	-55	+12
Chlordiazepoxide*	20 810	13 832	14 560	-34	+5
Miscellaneous benzodiazepines*	22 260	14 453	16 669	-35	+15
Miscellaneous sedative barbiturates*	20 002	10 178	9 599	-49	-6
Total	697 119	725 901	719 537	+4	-1

\*Drugs not included in the formulary.

that a well-controlled formulary was associated with lower pharmacy drug expenditures.

For the most part implementation of the prescribing guide in Manitoba has led to drugs being selected from the guide and good control of expenditures in the first year. However, expenditures increased in the second and third year after implementation. Factors contributing to this increase include a gradual switch from older, cheaper drugs to newer guide-approved agents for certain indications (e.g., calcium-channel blockers or angiotensin-converting-enzyme inhibitors rather than diuretics as antihypertensive drugs, and newer antidepressants to replace older drugs with adverse side effects) and an increased use of new, more expensive dosage forms (sustained-release capsules and tablets and transdermal patches). Despite the increase in overall disbursements, the guide may have been instrumental in keeping expenditures below the inflation rate of 9.8% for drugs.

The fact that the largest positive effect on expenditures occurred in the first year after implementation could also be related to the educational sessions and attention to prescribing that surrounded the guide's implementation. Other studies have shown positive effects on prescribing in nursing homes by such educational initiatives directed to physicians.<sup>18</sup> In many areas we noted a tendency for the use of non-guide-approved items to creep back up after the first year; therefore, educational strategies should be repeated at intervals to maintain their effect. This recommendation is supported by the experience of Feely and associates,<sup>14</sup> who found that the beneficial effects of their formulary on drug expenditures and quality of prescribing required ongoing, active educational interventions.<sup>14</sup>

The largest impact of the prescribing guide was in the area of marker drugs for rational geriatric prescribing. Dramatic declines in prescription rates were noted for nylidrin and similar peripheral vasodilators, a class of drugs used for cerebrovascular disease, dementia and

peripheral vascular disease but with minimal demonstrated efficacy.<sup>19</sup> As well, other drugs such as ergoloid mesylates and flurazepam, which are generally disapproved of by geriatricians,<sup>20,21</sup> were prescribed at much lower rates than before the guide was implemented.

Although size and location of personal care homes were found not to correlate with lower drug expenditures, adherence to the guide was. This is an important finding, because previous research has shown a conflicting relation between cost savings and restrictiveness of a formulary.<sup>16,17</sup> The association between guide adherence and expenditures may reflect the generally lower costs of drugs included in the guide than of nonformulary agents in the same class. Alternatively, guide adherence may correlate with physicians who were more careful in general with prescribing and thus be a marker for the "prudent geriatric prescriber." Distinguishing between these possibilities could be important, since policy changes to save money might include restricting the drug benefits to exclude non-guide items altogether. If "sloppy" prescribing is the cause of higher drug expenditures in certain homes, this restriction will not produce the desired savings. Rather, educational strategies and monitoring efforts should be enhanced. The beneficial effect of the formulary on controlling expenditures likely results from these latter effects.

The trends in prescribing and expenditures we observed may not be directly related to the introduction of the prescribing guide. Other possible explanations include a change in the resident population. Turnover of residents in personal care homes in Manitoba is approximately 20% per year; new residents tend to bring with them a drug list that reflects agents being used in hospitals and the community. There are also changes in the pharmaceutical industry, more emphasis being placed on new formulations such as sustained-release products. The cost projections we made are impossible to validate without a control population. None the less, the direct costs of implementing the guide (about \$40 000, which includes the cost of the educational campaign) were far lower than the estimated savings with this system. Finally, the impact of the formulary might be related more to the educational efforts and the Hawthorne effect of the formulary introduction rather than to the formulary itself. Nevertheless, the strengthening association several years after implementation between guide adherence and drug expenditures suggests a genuine effect of the formulary on drug expenditures.

In conclusion, despite some gains in rational prescribing, newer, expensive agents pushed up drug expenditures in the second and third year after implementation of the formulary in personal care homes in Manitoba. However, substantial and increasing savings are accruing with ongoing refinement of the prescribing guide. The second edition of the guide was printed in the fall of 1991, and drug expenditures and utilization will continue to be monitored.

Table 4: Characteristics of personal care homes as predictors of drug expenditure per bed\*

Characteristic	Year; r <sup>2</sup> coefficient		
	1987-88	1988-89	1989-90
Size	0.03	0.03	0.07
Location (rural v. urban)	0.02	0.03	0.07‡
Adherence to formulary†	0.09‡	0.14§	0.28

\*Multiple logistic regression of characteristics (independent variables) and their relation to drug expenditures in the individual home for that year (dependent variable).

†Represented as the mean number of requests for nonformulary drugs per bed.

‡p < 0.05.

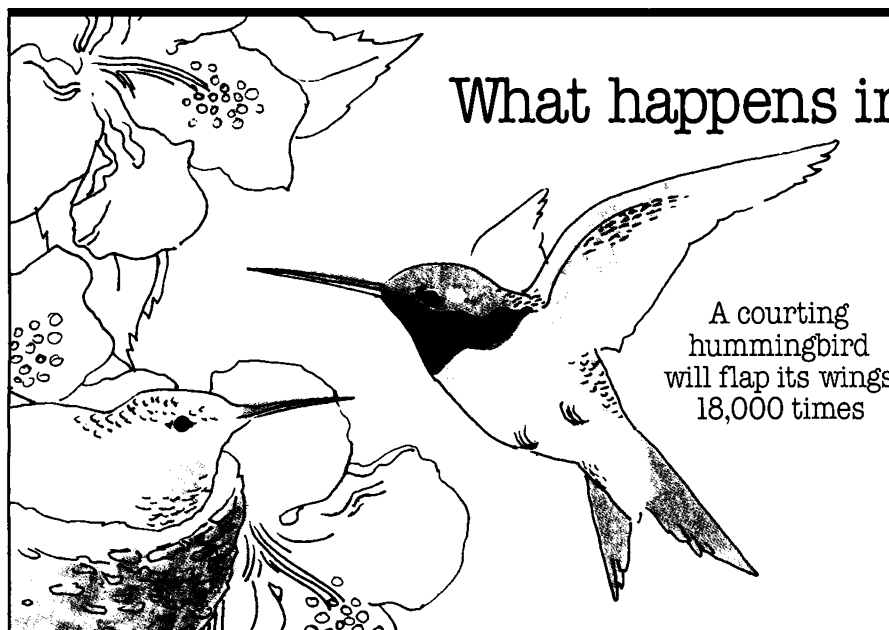
§p < 0.01.

||p < 0.001.

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