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Changes in medication use from age 26 to 32 in a representative birth cohort

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Abstract

Background—To date, longitudinal studies of medications have been confined to older adults or clinical samples, with no data from prospective studies of younger adults. The aim of the study was to examine changes in medication usage between ages 26 and 32 in a prospective study of a representative birth cohort.

Methods—Medication use during the previous 2 weeks was investigated among 960 individuals at ages 26 and 32.

Results—Nearly two-thirds took at least one medication at each age, with medication prevalence higher among women than among men. Three-quarters of those taking at least one at age 26 were doing so at 32. Over-the-counter medication prevalence increased from 35 to 43% between 26 and 32 years of age. Although the prevalence of prescribed medications decreased (from just under half to just over one-third, and from two-thirds to below half among women), there was no significant difference between the ages once hormonal contraceptives were accounted for. By 32, reduced usage of hormonal contraceptives was apparent, with one-third of age-26 users still taking these at 32. Other categories showing major changes were analgesics (increased), anti-asthma drugs (decreased), antidepressants (increased) and antiulcer drugs (increased). At 32, 82% of those taking analgesics, 85% of those taking nutrient supplements, 71% of those taking antihistamines and 33% of those taking antiulcer drugs had self-prescribed them.

Conclusion—A considerable proportion of the sample used medications by age 32, and there was considerable change between 26 and 32. The changes are likely to have been due to a mix of ageing and period effects.

Keywords

prescription drug; nonprescription drug; cohort study; drug usage

Introduction

Pharmacoepidemiological research complements clinical research by providing information on the actual usage of medication among populations, and, by inference, the occurrence of

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physician- or self-diagnosed morbidity, which has required pharmacological intervention. To date, the great majority of the published literature in this field has come from cross-sectional surveys or clinical audits.

Longitudinal data from prospective cohort studies play an important role in postmarketing surveillance,¹ not only in detecting side-effects but also in providing data on changes in medication usage over time and with age. The latter information has a number of potentially useful features. First, it enables monitoring of changes in the use of particular preparations, such as statins or the 'third-generation' oral contraceptives, and the influence of particular research findings on prescribing practice. Second, it provides data on the natural history of medication use in populations, which may be used to enable estimation of the incidence of particular conditions; for example, the incidence of hypertension among older Americans was estimated by examining changes in antihypertensive medication use between two observations separated by a period of 1 year,² and later work in the same study was able to document trends in hypertension control.³ Conducted over longer periods, such studies will provide unprecedented information on changes in medication-use patterns in populations. For example, it is known that those patterns differ markedly between young adults and older people,⁴ with analgesics, hormonal contraceptives, nutrient supplements and anti-asthma drugs most common among the former, and cardiovascular drugs and analgesics predominate among the latter. However, it is not yet known whether this transition is largely incremental or whether it is more abrupt (occurring at one or more critical developmental stages, such as menopause). Third, such studies should be of interest to regulators and the pharmaceutical industry, as they can provide information on age-related and temporal changes in the source of medications (i.e. whether they were self- or physician prescribed), which could inform the regulation and marketing of particular medication categories.

To date, longitudinal studies of medication usage have been confined to older adults or clinical samples. There is a paucity of data from prospective cohort studies of younger adults. The aim of this study was to report on changes in medication usage between ages 26 and 32 among participants in a long-standing prospective study of a representative birth cohort.

Methods

The Dunedin Multidisciplinary Health and Development Study is a longitudinal study of a birth cohort of children who were born at the Queen Mary Hospital, Dunedin, New Zealand, between 1 April 1972 and 31 March 1973.⁵ The sample that formed the basis for the longitudinal study was 1037 children, and they were assessed within a month of their third birthdays. Periodic collections of health and developmental data have been undertaken since then, and the current study uses data collected at ages 26 and 32. Over 90 % of the cohort self-identified as being of New Zealand European origin. The cohort is representative of the population of the South Island of New Zealand and has health status similar to that of nationally representative samples of New Zealanders of the same age.⁶ Ethical approval for the study was obtained from the Otago Ethics Committee.

Participants were asked to bring to the assessment the containers for all medications that they had taken in the previous 2 weeks, and the details (name of drug, prescription source, prescriber, strength, frequency and duration of exposure) were systematically recorded during the general medical examination (by trained interviewers who were registered health practitioners and/or graduates in the allied health sciences). Where an individual had forgotten to bring his/her medication, a later phone call was made, or the person's recall was relied upon. Each medication was subsequently assigned a five-digit numeric code for analysis using a previously validated system,⁷ and those data were entered into an electronic database and analysed using SPSS (SPSS Inc., Chicago, IL, USA). After the computation of univariate statistics, bivariate

associations were tested for significance using the χ^2 test for categorical dependent variables, the independent samples *t*-test for continuous dependent variables which met the normality criterion, or the Mann–Whitney *U*-test for continuous dependent variables which did not. Changes in proportions between ages 26 and 32 were tested for statistical significance using the McNemar test, and the paired samples *t*-test (or the Wilcoxon test where appropriate) was used for continuous dependent variables.

Results

Medication data for both ages were available for 960 study members, of whom 471 (49.1%) were women. There were no systematic differences between those for whom longitudinal data were available and the remaining 37 individuals (data available on request). Data on medication prevalence are presented in Table 1. Nearly two-thirds were taking at least one medication at each of ages 26 and 32, with no significant difference between ages. At each age, medication prevalence was higher among women than among men, and this difference persisted when oral contraceptives were excluded. Of the 626 individuals taking at least one medication at age 26, 469 (74.9%) were also doing so at age 32. Although the prevalence of prescribed medications decreased between ages 26 and 32 (from just under half to just over one-third of the cohort, and from two-thirds to below half among women), there was no significant difference between the ages once hormonal contraceptives were allowed for. However, the use of over-the-counter (OTC) medications increased between ages 26 and 32.

Summary data on the most frequent medication categories used at ages 26 and 32 are presented in Table 2. At age 26, the most commonly used medications were (in order of decreasing prevalence) analgesics, hormonal contraceptives, nutrient supplements, anti-asthma drugs, topical preparations and antibiotics. The pattern had changed somewhat by age 32, when a considerably reduced prevalence of hormonal contraceptive use was apparent. Other noteworthy changes were increases in the use of antidepressants, antiulcer drugs, antihypertensives and steroid anti-inflammatories (although the last two changes were not statistically significant). Nearly half of those taking anti-asthma medication at age 26 were no longer taking it by age 32. By comparison, all those taking hypoglycaemic medication at age 26 continued to use it, and one-third of those taking hormonal contraceptives at age 26 were still taking these at age 32. At 26 years of age, 112 (53.8%) of the 208 women taking hormonal contraceptives were using the third-generation preparations, whereas by 32 years of age, 28 (24.8%) of the 111 women taking hormonal contraceptives were doing so (McNemar test; $P < 0.0001$). Half of those 28 individuals were not taking third-generation preparations at age 26, and 10 of those were not taking any oral contraceptive at age 26. Other than oral contraceptives, the only difference between men and women in the taking particular medication category was for nutrient supplements, which were used by 7.5% of women but only by 2.1% of men at both ages. Nutrient supplement use among women increased from 20.4% at age 26 to 24.2% by age 32, but fell from 12.9 to 9.0% among men.

Data on the use at ages 26 and 32 of categories of medication, which showed major changes (analgesics, anti-asthma drugs, antidepressants and antiulcer drugs), are presented in Table 3. Among the analgesics, there were increases in the prevalence of simple analgesics and non-steroidal anti-inflammatory drugs (NSAIDs), but with considerable differences in users between the two ages. There was a statistically significant decrease in inhaled β_2 -agonist usage. Over three-quarters of those using a β_2 -adrenergic agonist at age 32 had also been using one at age 26, and half of those using one at age 26 were still using one by age 32. Among the antidepressants, there was an increase in usage of selective serotonin re-uptake inhibitors (which increased from approximately 60% of the prescribed antidepressants at age 26 to 75% by age 32), and also a slight increase in usage of the tricyclic antidepressants. There was

considerable fluctuation in usage of both categories. The main feature of the antiulcer subcategories was the emergence of the proton pump inhibitors.

Analysis of the prescription source for the most prevalent medications taken at age 32 indicated that 82% of those taking analgesics, 85% of those taking nutrient supplements, 71% of those taking antihistamines and 33% of those taking antiulcer drugs had self-prescribed them.

At age 26, a total of 487 OTC medications were being taken by 335 individuals (35%), of whom 234 (70%) were taking one, 64 (19%) two, 28 (9%) three and 8 (2%) four or more. Nutrient supplements comprised 42% of the 487 OTC medications, with analgesics (41%) and antihistamines (6%) accounting for most of the others. By age 32, a total of 609 OTC medications were being taken by 412 individuals (43%), of whom 285 (69%) were taking one, 87 (21%) two, 24 (6%) three and 17 (4%) four or more. Analgesics were predominant, comprising 50% of the 609 OTC medications, with nutrient supplements (34%) and antihistamines (5%) accounting for the bulk of the remainder.

Discussion

To our knowledge, this is the first report on medication usage over time among a representative birth cohort of younger adults. An apparent decrease in overall medication use between ages 26 and 32 was found to be largely due to a reduction in oral contraceptive use among women, whereas there was an increase in OTC medication usage. Three-quarters of those who were taking one or more medications at age 26 were also taking medications by age 32.

If medicines are being used appropriately, the prevalence of use of a given medication type should closely approximate that of the condition being treated. This can be difficult to determine for medications (such as analgesics) that are used to treat the symptoms or manifestations of a wide range of conditions, but it is possible to do so for others, such as antidepressants. Where the antidepressants are concerned, the cohort's prevalence of self-reported depression in the previous year (at age 32) was approximately 18%, with approximately 5% having taken an antidepressant in the previous 2 weeks. Although appearing discordant, this ratio is consistent with epidemiological and clinical reports indicating that the majority of people who suffer from depression do not seek and/or receive treatment.⁸ The prevalence of self-reported diabetes was 0.7%, and 0.5% were taking hypoglycaemic medications; this difference is possibly due to two individuals being diet controlled. At 1.4%, the prevalence of anticonvulsant use was very close to that of self-reported epilepsy (at 1.3%, with 0.9% reporting a seizure in the previous year). Approximately 18% of study members reported asthma, with about half that proportion taking anti-asthmatic medication in the previous 2 weeks, and the 2.1% prevalence of hypertension was close to that of antihypertensive medication, at 1.4% (allowing some cases to use non-pharmacological methods of control). Although there appears to be an acceptable degree of concordance for most of these conditions and medications, caution should be exercised in interpreting these data because of differences in the reference periods (being 2 weeks for the medications, but 1 year for the conditions) and the chronicity of conditions.

The assessment of changes in medication use among the same individuals over time requires the observer to carefully consider the provenance of those changes. Of the changes that may have occurred between one assessment and the next, those that were due to intervening historical events (such as war or an economic recession) are known as 'period effects', and those that were due to the ageing of the cohort are described as 'ageing effects.'⁹ Disentangling these is difficult: while, on the one hand, the cohort is moving through a life stage where the gradual onset of some of the chronic diseases of middle age may be occurring (perhaps requiring symptomatic relief through the use of analgesics or antiulcer drugs), they are also

living in a dynamic society where advertising, therapeutic practice and health literacy are all changing. These considerations make it difficult to make categorical statements about many of the changes observed in the current study. However, the increase in OTC medication prevalence between ages 26 and 32 is most probably the result of ageing rather than period effects. Closer analysis of the OTC medications shows that, not only did their prevalence and total number being taken increase, but their nature also changed: analgesics and nutrient supplements were equally dominant at age 26 (each at just over 40%), but the analgesics comprised almost half of all medications by age 32, whereas nutritional supplements reduced to just over one-third. The increase in analgesic use is most probably the result of a combination of ageing and period effects, as, although there were no major changes in the availability of analgesics between the assessments, there was a classification change for the anti-inflammatory analgesics (NSAIDs such as potassium diclofenac, or Cataflam[®]) from prescription- only to OTC in the late 1990s. There was heavy direct-to-consumer advertising (DTCA) both before and after the change in classification for these products, and this may have had some impact.¹⁰ By contrast, although it is difficult to be certain of the reason for the overall fall in nutrient supplement usage, it is likely that the observed increase in their usage by women is at least partly due to a period effect (such as the influence of gender-specific advertising and the fashion industry). Pregnancy (or the prospect of it) is also likely to have had an influence on supplement usage, with 31 years the current median age of first childbirth among European women in New Zealand.¹¹

Other possible explanations for the increase in use of OTC medicines include the reclassification of many medicines from prescription-only to pharmacist-only status and the deregulation of others to the OTC category during (or just before) the study period;^{12,13} an improvement in health literacy among members of the public¹⁴ and the increased accessibility for consumers, particularly via the Internet (e-pharmacy), to health information and medicines purchase.¹⁵ People are being encouraged to become more involved in making decisions about their health care in general, and medicine-taking in particular,^{16,17} and this may be reflected in the increased self-prescription of OTC medicines.

Where the changes in the use of oral contraceptives by women are concerned, it is also likely that both ageing and period effects are operative. The reduction in oral contraceptive use from 44 to 24% between ages 26 and 32 may be a reflection of the life stage, with a higher proportion of women either having children or planning to by age 32 (although, at 32, the number who were pregnant at the time of the age-32 assessments was virtually the same as the 31 in that condition at age 26). However, continued publicity in the lay and medical press about third-generation oral contraceptives (such as ethinylloestradiol with desogestrel, or ethinylloestradiol with gestodene) with a greater risk of venous thrombotic disease may have led at least some individuals to cease using any oral contraceptive by age 32 (and perhaps change to an alternative method of birth control, although there were no instances of use of intrauterine drug delivery devices at that age). This would be considered to be a period effect, as would the observed fall in prevalence of third-generation oral contraceptives over the same time. It is noteworthy that, despite the publicity and greater apparent awareness of the higher risk associated with these preparations, some women have been started on them in the last few years.

New Zealand and the USA are the only Organization for Economic Cooperation and Development countries that allow DTCA of medications, which are only available by prescription.¹⁸ DTCA also occurs for nonprescription medications, of course, and the cohort's increased usage of NSAIDs and antiulcer medications may reflect DTCA activity during the period under consideration. However, this must remain speculative, as little is known about the effects of DTCA on prescribing activity, although one Canadian study showed that (i) patients were more likely to request a specific medication after they had been exposed to

advertisements for it, and (ii) physicians fulfilled most requests for DTCA drugs. The authors' interpretation of their findings was that 'more advertising leads to more requests for advertised medicines, and more prescriptions', with DTCA affecting not only prescribing volume but also product choice.¹⁹ Furthermore, there is a growing body of evidence that DTCA affects consumers' behaviour, with about one in four people speaking to their doctors about a medicine or condition in response to an advertisement.^{20,21}

In summary, this examination of medication use at ages 26 and 32 in a population-based cohort has found that an apparent decrease in prescribed medication usage was almost entirely due to a fall in hormonal contraceptive use, and that the use of OTC medications increased. The observed changes are likely to have been due to a mix of ageing and period effects.

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Table 1
Prevalence and extent of prescribed and OTC medications at ages 26 and 32, by sex

	Drugs taken at age 26			Drugs taken at age 32			No. taking 1 + at both ages
	All combined	Men	Women	All combined	Men	Women	
Any medication							
Number taking (%)	626 (65.2)	246 (50.3)	380 (80.7) *	619 (64.5)	264 (54.0)	355 (75.4) *	469
Mean no. taken among those taking this category (SD)	1.84 (1.16)	1.63 (0.96)	1.98 (1.26) *	1.93 (1.22)	1.76 (1.13)	2.05 (1.27) *	
Range	0-7	0-6	0-7	0-7	0-7	0-7	
Prescribed medications							
Number taking (%)	439 (45.7)	120 (24.5)	319 (67.7) *	350 (36.5) **	126 (25.8)	224 (47.6) *	240
Mean no. taken among those taking this category (SD)	1.51 (0.84)	1.52 (0.76)	1.51 (0.87)	1.64 (1.01)	1.62 (1.06)	1.64 (0.99)	
Range	1-6	1-5	1-6	0-7	0-7	0-6	
Prescribed medications excluding hormonal contraceptives							
Number taking (%)	294 (30.6)	121 (24.7)	173 (36.9) *	271 (28.2)	126 (25.8)	145 (30.8)	154
Mean no. taken among those taking this category (SD)	1.56 (0.89)	1.52 (0.76)	1.61 (0.97)	1.69 (1.02)	1.62 (1.06)	1.75 (1.02)	
Range	1-6	1-5	1-6	0-7	0-7	0-6	
OTC medications							
Number taking (%)	334 (34.8)	160 (32.7)	174 (36.8)	412 (42.9)	183 (37.4)	229 (48.6) *	171
Mean no. taken among those taking this category (SD)	1.47 (0.84)	1.38 (0.79)	1.56 (0.87) *	1.48 (0.92)	1.40 (0.86)	1.54 (0.95)	
Range	1-6	1-5	1-6	0-7	0-7	0-6	

* $P < 0.05$, refers to cross-sectional comparisons at each age;
 ** $P < 0.05$, refers to the decrease in prevalence between ages 26 and 32;
 *** $P < 0.05$, refers to the increase in prevalence between ages 26 and 32. OTC, over-the-counter; SD, standard deviation.

Prevalence of the use of the most common therapeutic categories of medication at ages 26 and age 32

Table 2

Therapeutic category	Number taking at age 26 (%)	Number taking at age 32 (%)	Number taking at both ages (%)	Per cent taking it at age 32 who were also doing so at age 26	Per cent taking it at age 26 who were still doing so by age 32
Analgesics	220 (22.9)	312 (32.5)*	102 (10.6)	32.7	45.9
Hormonal contraceptives [†]	208 (44.3)	113 (24.1)*	70 (14.9)	61.9	33.3
Nutrient supplements	159 (16.6)	157 (16.4)	45 (4.7)	28.5	28.3
Anti-asthma drugs	106 (11.1)	85 (8.9)*	55 (5.8)	64.7	51.9
Topical preparations	55 (5.8)	20 (2.1)*	5 (0.5)	25.0	8.9
Antihistamines (systemic)	33 (3.5)	42 (4.4)	4 (0.4)	9.5	12.1
Antibiotics	32 (3.4)	36 (3.8)	3 (0.3)	8.3	9.4
Antidepressants	16 (1.7)	51 (5.3)*	6 (0.6)	11.8	37.5
Anticonvulsants	15 (1.6)	13 (1.4)	9 (0.9)	69.2	60.0
Psychotherapeutics	10 (1.0)	8 (0.8)	2 (0.2)	25.0	20.0
Steroid anti-inflammatory (systemic)	9 (0.9)	15 (1.6)	3 (0.3)	20.0	33.3
Antulcer drugs	6 (0.6)	18 (1.9)*	2 (0.2)	11.1	33.3
Antihypertensives	6 (0.6)	13 (1.4)	1 (0.1)	7.7	16.7
Antineoplastics	5 (0.5)	7 (0.7)	3 (0.3)	42.9	60.0
Antinauseants	4 (0.4)	3 (0.3)	0 (0.0)	0.0	0.0
Anticholinergics	4 (0.4)	2 (0.2)	0 (0.0)	0.0	0.0
Antipsychotics	3 (0.3)	3 (0.3)	1 (0.1)	33.3	33.3
Antimigraine preparations	3 (0.3)	2 (0.2)	0 (0.0)	0.0	0.0
Laxatives	3 (0.3)	1 (0.1)	1 (0.1)	100.0	33.3
Anorectics	2 (0.2)	0 (0.0)	0 (0.0)	0.0	0.0
Hypoglycaemics	2 (0.2)	5 (0.5)	2 (0.2)	40.0	100.0
Hypolipidaemics	2 (0.2)	3 (0.3)	1 (0.1)	33.3	50.0
Antivirals	2 (0.2)	4 (0.4)	1 (0.1)	25.0	50.0
Antidiarrhoeals	2 (0.2)	3 (0.3)	1 (0.1)	33.3	50.0
Cardiac inotropics	0 (0.0)	1 (0.1)	0 (0.0)	0.0	0.0
Miscellaneous	21 (2.2)	14 (1.5)	2 (0.2)	14.3	9.5

* $P < 0.05$; McNemar test.

[†] Percentages calculated for women only ($N = 471$) for this category.

Table 3
Prevalence of the use of subcategories of selected therapeutic categories of medication at ages 26 and age 32

Therapeutic category	Number taking at age 26 (%)	Number taking at age 32 (%)	Number taking at both ages (%)	Per cent taking at age 32 who were also doing so at 26	Per cent taking at age 26 who were still doing so by 32
Analgesics					
Simple	144 (15.0)	183 (19.2)*	42 (4.4)	22.8	29.2
NSAIDs	73 (7.6)	113 (11.8)*	19 (2.0)	16.7	26.0
Coxibs	0 (0.0)	2 (0.2)	0 (0.0)	0.0	0.0
Antigout preparations	0 (0.0)	2 (0.2)	0 (0.0)	0.0	0.0
Narcotic analgesics	18 (1.9)	23 (2.4)	5 (0.5)	20.8	29.8
Anti-asthma drugs					
β2-agonists	95 (9.9)	63 (6.6)*	48 (5.0)	76.2	50.5
Glucocorticoids	54 (5.6)	48 (5.0)	23 (2.4)	47.9	42.6
Anticholinergics	1 (0.1)	1 (0.1)	0 (0.0)	0.0	0.0
Xanthines	1 (0.1)	0 (0.0)	0 (0.0)	0.0	0.0
Other inhalants	2 (0.2)	0 (0.0)	0 (0.0)	0.0	0.0
Antidepressant					
Selective MAOIs	7 (0.7)	13 (1.4)	2 (0.2)	15.4	28.6
Selective serotonin re-uptake inhibitors	10 (1.0)	40 (4.2)*	3 (0.3)	7.5	42.9
Other	0 (0.0)	0 (0.0)	0 (0.0)		
Antulcer drugs					
H ₂ -receptor antagonists	4 (0.4)	3 (0.3)	0 (0.0)	0.0	0.0
Prostaglandins	1 (0.1)	0 (0.0)	0 (0.0)	0.0	0.0
Proton pump inhibitors	0 (0.0)	11 (1.2)	0 (0.0)	0.0	0.0
Other	2 (0.2)	5 (0.5)	0 (0.0)	0.0	0.0

* $P < 0.05$, McNemar test. NSAIDs, non-steroidal anti-inflammatory drugs. MAOIs, Monoamine oxidase inhibitors.