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Article

Becoming a 'pharmaceutical person': Medication use trajectories from age 26 to 38 in a representative birth cohort from Dunedin, New Zealand

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ABSTRACT

Despite the abundance of medications available for human consumption, and frequent concerns about increasing medicalization or pharmaceuticalization of everyday life, there is little research investigating medicines-use in young and middle-aged populations and discussing the implications of young people using increasing numbers of medicines and becoming pharmaceutical users over time. We use data from a New Zealand longitudinal study to examine changes in self-reported medication use by a complete birth cohort of young adults. Details of medications taken during the previous two weeks at age 38 are compared to similar data collected at ages 32 and 26, and by gender. Major drug categories are examined. General use profiles and medicine-types are considered in light of our interest in understanding the formation of the young and middle-aging 'pharmaceutical person' – where one's embodied experience is frequently and normally mediated by pharmaceutical interventions having documented benefit/risk outcomes.

1. Introduction and background

In recent decades, medicines have come to occupy an increasingly important place in health care practice within developed nations, as reflected in the numbers of prescriptions dispensed and in per capita consumption estimates. For example, in England, the number of prescription medicines dispensed was reported to have doubled in 20 years, from an average of 8.0 per person in 1989 to 16.4 in 2008 (Busfield, 2010). In Canada, per capita estimates for prescription drugs grew from 7.8 to 12.0 per person between 1995 and 2005 (Paris & Docteur, 2007). In New Zealand, 26.3 million prescription items were funded in 1980, according to Health Benefits Review N.Z. (1986). This number increased to 33.9 million in 2007/08 (New Zealand Government, 2008). Unsurprisingly, medicines have come to account for an increasing proportion of health care costs. This is evident in the share of national health spending allocated to pharmaceuticals, and in per capita spending. For example, between 1998 and 2009, per capita spending increases - from $353 to $692 per person in Canada, $229 to $381 per person in the United Kingdom, $237 to $503 per person in Australia, and $193 to $265 per person in New Zealand - have been documented (OECD, 2001, 2011).

Beyond the cost implications, the expansion in medicines has captured the attention of sociologists and public health researchers in two important ways. First, there are attempts to account for and critique the increasing prioritization of medicine use over other approaches to achieving health, such as through public-health-initiated disease prevention strategies (Batt & Lipmann, 2010), or psychotherapy rather than drug treatment for ADHD (Abraham, 2010, p. 605). Competing explanations, including medicalization, pharmaceuticalization and biomedicalism, suggest there are different processes at play.

Medicalization refers to the expansion of medical interpretation and jurisdiction over ever-increasing aspects of human lives. Initially conceptualized in primarily positive terms "involving the steady de-stigmatization of many human and social problems…and their removal from religious and legal scrutiny and thus from moral and punitive consequences" (Zola, 1972: 489), the concept of medicalization came to be subjected to critical scrutiny. Conrad (1975) emphasized the consequences of medicine's power to label, and to individualize social problems. Illich (1975) associated medicalization with the expansion of iatrogenic harm. In the context of increasing drug prescribing, medicalization continues to be interpreted with a critical lens, to emphasize the expansion of the physician-controlled sick role and redefinition of social deviance or dysfunctionality as medical problems requiring treatments using medicines (Abraham, 2010).

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Pharmaceuticalization - "the translation or transformation of human conditions, capabilities and capacities into opportunities for pharmaceutical intervention" (Williams, Martin, & Gabe, 2011: 711) overlaps with–but is also distinct from–medicalization (i.e. medical profession-driven expansion) (Abraham, 2010, Conrad, 2005; Clarke, Shim, Mamo, Fosket, & Fishman, 2003; Williams, Martin, & Gabe, 2011). This distinction is evident when, for example, the interests of the pharmaceutical industry in expanding its markets and increasing demand for its products drive both the manufacture of new conditions and their pharmaceutical treatments (Busfield, 2010; Conrad, 2007; Moynihan 2002; Ebeling 2011). Other interests influence pharmaceuticalization separately from medicalization, for example, where governments privilege industry interests over the public's, by cutting and streamlining drug manufacturing regulations and hastening the delivery of new drugs to the market (irrespective of evidence of their therapeutic benefit) (Lexchin, 2016; Abraham, 2010: 613). Or, where medicine users–as active consumers rather than passive patients–act to influence and promote pharmaceutical access for their particular interests (Abraham, 2010; Williams et al., 2011; Busfield, 2010). Direct-to-consumer advertising (DTCA) by the pharmaceutical industry reflects recognition of the autonomy and power of medicine users as consumers. While DTCA reflects how the medical professional's role in getting pharmaceuticals into patients' bodies may be circumvented, Ebeling (2011) emphasizes how the industry seeks to enlist physician participation in its efforts to influence patients' self-diagnosis and medication-seeking, for contested diagnoses such as pre-menstrual dysphoric disorder.

Medicalization and pharmaceuticalization have been distinguished from biomedicalism, or a progressive model of medical expansion, in which it is assumed that scientific progress accounts for the medical profession's broadening reach and the expansion of medicines into areas previously outside of medical jurisdiction (Abraham, 2010; Busfield, 2010). The concepts of medicalization and pharmaceuticalization would be redundant as explanations of the expansion of medicines, i.e., subsumed under biomedicalism, if all new pharmaceutical therapies represented advances in biomedical knowledge and effective treatment of illness conditions (Abraham, 2010). However, many do not offer clinically meaningful benefits to users (Lexchin, 2016) rendering the biomedicalism thesis 'unpersuasive' in these situations (Abraham, 2010: 606).

Thus, while they are similar and sometimes overlapping concepts, biomedicalism, medicalization, and pharmaceuticalization offer competing explanations of the macro-social forces that have led to medicines' *status quo* within developed health care jurisdictions.

Second, researchers have taken up the topic of medicines expansion in a set of overlapping areas of focus that problematize medication-taking. Meso- and micro-focused accounts of the social relations of medicines use are provided in studies on or critiquing: user compliance or adherence to medication-use directives (DiMatteo, 2004; Haynes, Ackloo, Sahota, McDonald, & Yao, 2008); the lay-professional prescriber relationship (Arney and Lewin, 2013; Barry, Stevenson, Britten, Barber, & Bradley, 2001; Stevenson et al., 2008); and user perspectives on and management of medicines (Ballantyne, Mirza, Austin, Boon, & Fisher, 2011; Dew, Chamberlain, Hodgetts, Norris, Radley, & Gabe, 2014; Pound, et al., 2005). This body of research serves as a reminder that changing patterns of medicine use observed in populations and sub-populations reflect micro-level processes involving real human bodies and lives. While, in general, medicines are assumed to be beneficial for individual users and for particular user-groups, even very early discussions of medicalization included a recognition of the potential risks of medical drugs for individuals (Zola, 1972). As medicine use has proliferated, so too has the need for careful scrutiny of its positive, neutral or negative impacts on individuals and populations.

In the current study, we focus on medicine use patterns in a cohort of community-dwelling younger/middle-aging adults at three ages. The data show the changes in medicine-use as the cohort ages, in a jurisdiction with an advanced health care system. Our use of cohort data involving a younger-aged community-based population is novel because little systematic research on medicine-use by young adults in general (i.e. non-clinical) populations has been undertaken, and few cohort studies include detailed medicine-use data. Furthermore, we present the data on younger adult medicine-use patterns with an eye to understanding whether these may provoke insights or discussion as to how people reach old age as entrenched medication users – a topic to which we now briefly turn.

In contrast to a paucity of studies examining medication use in non-clinical, community-dwelling younger-aged cohorts/populations, an abundance of such studies focused on older adults is available (Ballantyne, Clarke, Marshman, Victor, & Fisher, 2005; Linjakump et al., 2002; McKenzie & Keller, 2001; Paulose-Ram et al., 2003; Tordoff, Bagge, Gray, Campbell, & Norris, 2010). These show high levels of prescribing to (and use of medicines by) older adults. As illustration, examining medication-taking practices of community-dwelling adults aged 75+ from Dunedin, New Zealand, Tordoff et al. (2010) reported a median number of prescription and non-prescription medications per participant of 7 and 1 (with ranges of 0–19 and 0–14 respectively). A Canadian report indicated that, in 2008, 62% of adults aged 65+ on public drug programs had claims for five or more drug classes, 21% had claims for ten or more drug classes, and 6% had claims for fifteen or more drug classes (Canadian Institute for Health Information, 2010).

The high levels of polypharmacy among older adults—who are typically more health-vulnerable than younger adults—have spawned a body of research on the risks of medicines in this population. For example, Salazar, Poon, & Nair (2007) described the key and inter-related risks associated with older adult polypharmacy: adverse drug reactions (ADRs), drug-drug interactions, disease-drug interactions, food-drug interactions, medication-cascade effects of multi-medications, therapeutic duplication errors, patient-related administration errors and medication non-adherence. Referring to self-reported data from a representative sample of community dwelling older adults, Canada, and noting that users frequently combined prescription (mostly insured), and OTCs and natural health products (mostly paid out of pocket), Ballantyne and colleagues implored policy-makers to consider 'who chooses', 'who pays' and 'who monitors risks of' medicines used by older adults (Ballantyne et al., 2005).

In the current paper, we focus earlier in the life course, on medicines use in young/middle-aging adults, where the capacity for independent decisions to negotiate the use or avoidance of drugs can be assumed, and where use patterns may be established and may set the stage for medicines-use practices in later life. We examine profiles of overall medicine use, average numbers used, persistence of use, and common drug classes reported by young adult/middle aging participants in a prospective cohort study. We review documented benefit/risk profiles for the most prominent medicine categories observed, and consider potential accounts of their use from the perspectives of biomedicalism, medicalization and pharmaceuticalization.

Relative to the general picture of the increasing role of medicines in health care described previously, the New Zealand cohort data provide a more refined picture that we hope will inspire a continued surveillance of medicine use in populations, and ongoing dialogue on the implications of medicine use as a normal feature of living and aging across the life course.

2. Methods

The Dunedin Multidisciplinary Health and Development Study (DMHDS) 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 (Poulton et al., 2015). The 1037 children (of whom 90% are of New Zealand European origin) in the sample that formed the basis for the longitudinal study were first assessed

within a month of their third birthdays, after which periodic collections of health and developmental data were undertaken. The current study uses data collected at ages 26 (in 1998/99), 32 (in 2004/05) and 38 (in 2010/11), where medicine use data were collected. Ethical approval for each assessment phase was obtained from the Lower South Regional Research Ethics Committee, New Zealand Ministry of Health, and participants gave informed consent.

For the collection of medicines use data, participants were asked to bring to each assessment the containers for all medications–prescription and over-the-counter, dietary supplements and alternative health products–taken in the previous two weeks. Details (name of drug, source, and duration of taking) were systematically recorded during a general medical examination by trained interviewers who were registered health practitioners and/or graduates in the allied health sciences. If someone had forgotten to bring his/her medication, a phone call was made later, 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 (Thomson, 1997). Those data were entered into an electronic database and analysed using SPSS. After the computation of univariate statistics, bivariate associations were tested for significance using the Chi-square 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 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.

Complete medication-use data were available for 978 participants at age 26, 960 at age 32, and 959 at age 38. Complete medication-use data for all three ages were available for 932 participants. Data presented in this article pertain to those 932 individuals (89.9% of the original cohort – 92.5% of whom are of New Zealand European origin).

3. Results

In this section, self-reported medication use by cohort members is described for each age. Details (general types/quantity) of medications taken during the previous two weeks at age 38 are compared to similar data collected at ages 32 and 26, and by gender. Major drug categories are illustrated. Our interpretation of the data is limited by its structure. The data are derived from a single cohort. We are unable to distinguish period effects from cohort aging – that is, the effects of distinct features of the socio-political or health care environment that were also likely evolving/changing over time as the cohort aged. Nor are we able to identify what is distinct about the Dunedin cohort from others aging at the same time in different settings. Nonetheless, the data provoke many questions about the implications of the growing reliance on medicines in society.

3.1. Reported medication prevalence - over time

Table 1 presents the prevalence and extent of any medications, prescription medications and over-the-counter medications reported by cohort members at ages 26, 32 and 38, by sex. The proportion reporting *any medication* (> 60%) changed only slightly at cohort ages 26, 32 and 38. At each age, the proportion of women reporting any medication was significantly higher than for men. However, the gender difference changed over time, with women's use decreasing and men's increasing slightly over time.

The proportion reporting prescription medication use dropped between 26 and 32, and then rose again at age 38 (from 46.2% to 36.1% to 40.8%). At each age, the proportion of women reporting prescription medication use was significantly higher than for men. However, the gender difference fell over time. Women's use decreased between 26 and 32 and then rose slightly again. Men's use increased slightly at each point. Removing oral contraceptives from the analysis greatly reduced the proportion of women reporting prescription medicine use. This reduced but did not eliminate the gender differences in the percentage reporting prescription medicines at ages 26 and 38, while the gender difference at age 32 was no longer significant.

At least one-third of the sample reported use of over-the-counter (OTC) medicines (including dietary supplements and alternative products) at each age. At ages 32 and 38, more women than men reported using OTC medicines.

3.2. Quantity of medicines reported

At each age, a portion of respondents reported using no medicines

Table 1
Prevalence and extent of prescribed and over-the-counter (OTC) medications at ages 26, 32 and 38, by sex.

	At age 26			At age 32			At age 38		
	All	Men	Women	All	Men	Women	All	Men	Women
Any medication									
Number taking (%)	616 (66.1)	239 (51.2)	377 (81.1)[a]	600 (64.4)	251 (53.7)	349 (75.1)[a]	597 (64.1)	258 (55.2)	339 (72.9)[a]
Mean no. taken among those taking this category (sd)	1.8 (1.2)	1.6 (1.0)	2.0 (1.3)[a]	1.9 (1.2)	1.8 (1.1)	2.0 (1.3)[a]	2.3 (1.6)	2.1 (1.4)	2.5 (1.7)[a]
Range	1–7	1–6	1–7	1–7	1–7	1–7	1–11	1–11	1–11
Prescribed medications									
Number taking (%)	431 (46.2)	115 (24.6)	316 (68.0)[a]	336 (36.1)[b]	116 (24.8)	220 (47.3)[a]	380 (40.8)[c,d]	142 (30.4)	238 (51.2)[a]
Mean no. taken among those taking this category (sd)	1.5 (0.8)	1.5 (0.8)	1.5 (0.9)	1.6 (1.0)	1.6 (1.1)	1.6 (1.0)	2.0 (1.5)	2.0 (1.5)	2.0 (1.5)
Range	1–6	1–5	1–6	1–7	1–7	1–6	1–10	1–10	1–8
Prescribed medications excluding hormonal contraceptives									
Number taking (%)	286 (30.7)	115 (24.6)	170 (36.6)[a]	258 (27.7)	116 (24.8)	142 (30.5)	334 (35.8)[d]	142 (30.4)	192 (41.3)[a]
Mean no. taken among those taking this category (sd)	1.6 (0.9)	1.5 (0.8)	1.6 (1.0)	1.7 (1.0)	1.7 (1.0)	1.7 (1.0)	2.0 (1.5)	2.0 (1.5)	2.1 (1.5)
Range	1–6	1–5	1–6	1–7	1–7	1–6	1–10	1–10	1–8
OTC medications									
Number taking (%)	330 (35.4)	157 (33.6)	173 (37.2)	401 (43.0)[b]	175 (37.5)	226 (48.6)[a]	357 (38.3)[d]	160 (34.3)	197 (42.4)[a]
Mean no. taken among those taking this category (sd)	1.5 (0.8)	1.4 (0.8)	1.6 (0.9)	1.5 (0.9)	1.4 (0.9)	1.5 (1.0)	1.7 (1.1)	1.6 (0.9)	1.8 (1.2)
Range	1–6	1–6	1–5	1–7	1–6	1–7	1–6	1–6	1–6

[a] $P < 0.05$; refers to cross-sectional comparisons between men and women at each age.
[b] $P < 0.05$; refers to the observed change in prevalence between ages 26 and 32.
[c] $P < 0.05$; refers to the observed change in prevalence between ages 26 and 38.
[d] $P < 0.05$; refers to the observed change in prevalence between ages 32 and 38.

Table 2a
Cohort changes in numbers of medicines, by age.

Reported number of any medicines	Assessment age 26[a]	32[a]	38[a]
None	316 (33.9)	332 (35.6)	335 (35.9)
1–2	485 (52.0)	457 (49.0)	393 (42.2)
3–4	105 (11.3)	116 (12.4)	147 (15.8)
5+	26 (2.8)	27 (2.9)	57 (6.1)
Total	932	932	932

[a] Column percentages.

(Table 1). About one hundred people (10.4%) used no medicines at any age (data not shown); non-use (any age) was higher among males (1 in 6) than females (1 in 33). Socioeconomic differences in non-use were also evident, such that one in six low-SES, one in eleven medium-SES and one in thirteen high-SES individuals reported taking no medicines at any ages. (data not shown; see Elley & Irving, 1985; Irving & Elley, 1977 for the SES measure employed). In a context where the definition of 'medicines' includes prescriptions, over-the-counter and dietary supplements and alternative products, where health care and (selected) medicines are publicly insured, and where most cohort members report using medicines of some kind across the study period, the level of non-use of medicines is noteworthy.

The mean number of 'any medicines' (that is, either prescribed or OTC) reported by both women and men did not change over time (Table 1). At all ages, the mean number reported by women was significantly higher than for men for 'any medicines', but there were no gender differences in mean number reported when separating prescription from over-the-counter medicines.

Examining details in the quantity of 'any medicines' taken from age 26 to 38, Table 2a illustrates that the proportion reporting taking no medicines increased slightly. The proportion reporting 1–2 medicines fell from age 26 to age 38 (from 52% to 49% to 42%). Although most of the cohort reported taking between none, one or two medicines throughout the observation period (86% at 26, 85% at 32, and 78% at 38 years old), the proportion taking larger numbers of medicines rose as the cohort aged (Tables 2a, 2b). For most, the number of medicines reported was fairly consistent from age 26 to 38. For example, most reporting no medicines at age 26 were taking none at age 32, and 46% of them reported taking no medicines at age 38. Most of those who reported 1–2 medicines at age 26 also reported taking 1–2 at age 32, and 43% of them reported taking 1–2 at age 38. Most of those who reported 3–4 medicines at age 26 reported 1–2 at age 32, and 41% reported taking 1–2 at age 38. Those who reported 5 or more medicines at age 26 tended to report taking fewer than this at later ages, but they were more likely than others to also take 5 or more medicines at ages 32 and 38 (Table 2b).

Table 2b
Changes over time in the total number of medicines reported.

Number of medicines taken at age 26	Number of medicines taken at age 32	Number of people (%)[a]	Number of medicines taken at age 38	Number of people (%)[a]
None (N = 316)	None	176 (55.7)	None	147 (46.5)
	1 or 2	120 (38.0)	1 or 2	128 (40.5)
	3 or 4	16 (5.1)	3 or 4	30 (9.5)
	5 or more	4 (1.3)	5 or more	11 (3.5)
1 or 2 (N = 485)	None	139 (28.7)	None	162 (33.4)
	1 or 2	260 (53.4)	1 or 2	210 (43.3)
	3 or 4	71 (14.6)	3 or 4	88 (18.1)
	5 or more	15 (3.1)	5 or more	25 (5.2)
3 or 4 (N = 105)	None	14 (13.3)	None	23 (21.9)
	1 or 2	66 (62.9)	1 or 2	43 (41.0)
	3 or 4	22 (21.0)	3 or 4	25 (23.8)
	5 or more	3 (2.9)	5 or more	14 (13.3)
5 or more (N = 26)	None	3 (11.5)	None	3 (11.5)
	1 or 2	11 (42.3)	1 or 2	12 (46.2)
	3 or 4	7 (26.9)	3 or 4	4 (15.4)
	5 or more	5 (19.2)	5 or more	7 (26.9)

[a] Column percentages.

Table 3
Prevalence of the use of the most common therapeutic categories of medication at ages 26, 32 and 38 (with categories presented in descending order of their prevalence at age 26).

Therapeutic category	Number taking at age 26 (%)	Number taking at age 32 (%)	Number taking at age 38 (%)	Number taking at all 3 ages (%)
Hormonal contraceptives[a]	208 (44.7)	111 (23.9)[b]	91 (19.6)	23 (4.9)
Analgesics	222 (23.8)	304 (32.6)	251 (26.9)	46 (4.9)
Nutrient supplements	154 (16.5)	156 (16.7)	198 (21.2)[b]	17 (1.8)
Antiasthma drugs	103 (11.1)	83 (8.9)	84 (9.0)	42 (4.5)
Antihistamines (systemic)	34 (3.6)	40 (4.3)	56 (6.0)	2 (0.2)
Antibiotics	32 (3.4)	35 (3.8)	29 (3.1)	0 (0.0)
Antidepressants	14 (1.5)	47 (5.0)[b]	83 (8.9)[b]	3 (0.3)
Anticonvulsants	14 (1.5)	12 (1.3)	16 (1.7)	6 (0.6)
Steroid anti-inflammatory (systemic)	10 (1.1)	8 (0.9)	9 (1.0)	1 (0.1)
Psychotherapeutics	9 (1.0)	15 (1.5)	26 (2.8)	1 (0.1)
Antiulcer drugs	6 (0.6)	17 (1.8)[b]	37 (4.0)[b]	2 (0.2)
Antihypertensives	5 (0.5)	11 (1.2)	33 (3.5)[b]	0 (0.0)
Antineoplastics	5 (0.5)	7 (0.8)	5 (0.5)	0 (0.0)
Antinauseants	4 (0.4)	3 (0.3)	4 (0.4)	0 (0.0)
Anticholinergics	4 (0.4)	2 (0.2)	8 (0.9)	0 (0.0)
Antipsychotics	3 (0.3)	3 (0.3)	10 (1.1)	1 (0.1)
Antimigraine preparations	3 (0.3)	1 (0.1)	6 (0.6)	0 (0.0)
Laxatives	3 (0.3)	1 (0.1)	5 (0.5)	0 (0.0)
Anorectics	2 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)
Hypoglycaemics	2 (0.2)	3 (0.3)	5 (0.5)	2 (0.2)
Antivirals	2 (0.2)	4 (0.4)	7 (0.8)	0 (0.0)
Antidiarrhoeals	2 (0.2)	3 (0.3)	9 (1.0)	1 (0.1)
Hypolipidaemics	1 (0.1)	2 (0.2)	18 (1.9)	0 (0.0)
Cardiac inotropics	0 (0.0)	1 (0.1)	0 (0.0)	0 (0.0)

[a] Percentages calculated for women only (N = 469) for this category.
[b] $P < 0.05$; McNemar test for change in prevalence from the previous age.

3.3. Common therapeutic categories

Table 3 shows the most common therapeutic categories of medicines reported at ages 26, 32 and 38, in descending order of prevalence at age 26. This shows that (for women) at age 26, hormonal contraceptives were the most commonly reported drug group, but their use had fallen significantly by age 32, and it fell further by age 38. Analgesics were the next most commonly reported medicine group at age 26, rising to be the most common category at ages 32 and 38. Nutritional supplements (various vitamin or mineral preparations, along with other dietary supplement groups such as oils, botanical products, complete and/or supplementary nutrition products, or sports supplements) were the third most commonly used category, and their prevalence rose between 32 and 38. No significant changes in reported use of medicines for asthma or anti-histamines (the next two most common therapeutic categories at age 26) were evident, with the former showing a slight decline with age and the latter a slight increase. Antibiotic use was relatively consistent across ages. Anti-depressant use rose significantly between age 26 and 32, and again between 32 and 38 (from 1.5% to 5.0% to 8.9%). Interestingly, the reported rates of anti-depressant use are considerably lower than the prevalence of diagnosed major depressive episodes (16.2%, 15.8% and 16.3% at ages 26, 32 and 38 – diagnosis data not presented). The use of other psychotherapeutic drugs also rose over time, as did the use of anti-ulcer drugs (from ages

26 to 32 and 32 to 38) and anti-hypertensives (from age 32 to 38).

Analgesic, oral contraceptive or asthma drug-use was reported by nearly 5% of the cohort at all three ages. Of the remaining drug categories, the proportion of the sample reporting their use across all three ages was nil to less than one percent.

4. Discussion

The data on medicines use observed for members of the DMHDS illustrate the level of medication-taking in a young/middle aging cohort, and indicate fluctuations in numbers and types of medicines used as cohort members aged. Medicine-use was common at all three ages. While in general, the proportion reporting any use does not increase with age/over time, the quantity of use does. A substantial proportion of the cohort reported non-use of any type of medicines at all three ages. Gender differences in the level of medicine use, and in changes over time are evident. A diverse range of types of medicine were reported by cohort members.

We are left to address the implications of the data presented here. The explanations offered previously include: biomedicalism, referring to advancements in biomedical science and pharmacology; medicalization, referring to expanded medical professional authority over new realms of human lives; and pharmaceuticalization, referring to the expansion of pharmaceutical-specific solutions to treat human problems. Pharmaceuticalization, as noted previously, can be driven by the commercial interests of pharmaceutical manufacturers, by the nature of State-based regulation of drug manufacturing and marketing and health system funding, by consumer demand (or resistance), or by the medical profession's interest in drug-based health care. Medicalization and pharmaceuticalization – where they reflect progress in diagnosis and advancements in pharmacology – are subsumed by biomedicalism.

Debates about medicalization or pharmaceuticalization emerge because the meaning of 'progress' or 'advancement' is value-laden. That is, it is differently interpreted by different interest groups. Along with biomedicalism, the terms offer different accounts of the medication use patterns observed in the DMHDS data, with different implications of medicine use for the individual user. For example, that the proportion taking larger numbers of medicines rose as the cohort aged can be interpreted in different ways: that a subset of people are getting sicker, are more frequently medicalized by age 38, or are choosing or being prescribed medications over other possible courses of action. Observed gender differences may suggest: differences in health help-seeking or in perceptions or awareness of symptoms, and of responses to them by men and women; gender-differentiated prescribing by physicians; or gender-targeted pharmaceutical development and marketing by pharmaceutical manufacturers.

While the nature of the data limit our ability to verify these possible interpretations, a consideration of the risks and benefits associated with particular medicine categories can elucidate the kinds of impacts these medicines may have on users' lives. We turn here to review the documented benefits and risks of the most common drug categories reported by the DMHDS sample.

4.1. Oral contraceptives

Oral contraceptives (OCs) have been on the market for fifty years. Their many iterations with dramatically reduced hormonal dosages, improved safety, and refinement of risk/benefit features (Liao & Dollin, 2012), and well-established non-contraceptive health benefits (Maguire & Westhoff, 2011) account for their sustained popularity (indicating biomedicalism). Estimated to be the most common method of avoiding unplanned pregnancies by women (Guttmacher Institute, 2015), the popularity of OCs sustains a robust global market, forecasted to grow to $14.5B by 2016 – a 4% increase from 2009 (Research & Markets, 2011). A saturated market with high competition for shares by different manufacturers requires creative marketing, along with flexible regulation. For example, some OCs are marketed for their non-contraceptive benefits, such as in the case of Diane-35 in Canada and NZ, where it is sold as an acne medication (MedSafe New Zealand, 2015; Mintzes, 2010;). Yaz is a synthetic progesterone/estrogen combination used for birth control but also marketed as a treatment for 'pre-menstrual dysphoric disorder' (Ebeling, 2011; MedSafe New Zealand, 2016). Arguably, these examples reflect the pharmaceuticalization of OC products – and more specifically, manufacturers' efforts to retain competitiveness in the OC market (Busfield, 2010) and/or medicalization – where physicians are complicit in promoting the new conditions (PMDD) or new indications for OCs (acne).

While the availability of oral contraceptives has led to women's expectation of control and autonomy over fertility (pharmaceuticalization), the availability of effective alternative contraceptives, the inconvenience of daily pill-taking, their failure rate under typical conditions of use (Fisher & Black, 2007), and their side-effects (particularly the risks of venous thromboembolism) result in many women discontinuing OCs, or being ambivalent about starting them ("de-pharmaceuticalization" – see Abraham, 2010, p. 611; Busfield, 2010, p. 610). For example, in their study of young women's decision-making about hormonal contraceptives, Cheung and Free (2005) conceptualized different types of users. Consistent and persistent users included those who expressed a very strong desire to avoid pregnancy and those who valued the control over menstruation afforded by hormonal contraceptives. Reluctant users or discontinuers were those concerned with taking medicines in general - and 'unnatural' hormonal medicines in particular - and those concerned about interrupting natural menses. Littlejohn (2013) uncovered that relatively minor OC side-effects of weight gain and emotional volatility resulted in some women's dissatisfaction with (and discontinuation) of OCs. Hansen et al. (2009) described young women's uncertainty about their risks, and misinformation about OCs, including a belief in the need to take breaks or to change brands as a way to minimize risks of long-term use. These user studies show the complexities of OC use, and may help to account for the observed fluctuations in their use in the DMHDS cohort.

4.2. Analgesics

The prevalence rates for analgesic use observed in the DMHDS mirror similarly high and increasing rates reported elsewhere (Antonov & Isacson, 1998; Paulose-Ram et al., 2003; Sarganas et al., 2015), reinforcing that pain is a common problem, and raising concerns about analgesics' adverse effects - gastrointestinal, renal, hepatic, cardiovascular, cardiac and respiratory effects, intoxication, interactions and adverse reactions, dependence and abuse potential, non-fatal self-poisoning, overdose and suicide (McAvoy, Dobbin & Tobin, 2011; Paulose-Ram et al., 2003; Rigg & Murphy, 2013; Robinson, Robinson, McCarthy, & Cameron, 2010; Sarganas et al., 2015).

A particular concern is with codeine dependency from OTC combination analgesics (McAvoy et al., 2011; Robinson et al., 2010). Examining data from NZ and Australia, McAvoy et al. (2011) argued that insufficient controls on OTC codeine products and the pharmaceutical industry's resistance to restrictions on their sales implicate the regulators and industry in their overuse (McAvoy et al., 2011: 31). In North America, researchers emphasize the failures of health care administrators and physician/prescribers in assessments of an opioid-use crisis responsible for growing rates of opioid-related premature mortality, especially among young people (Centres for Disease Control, & Prevention, 2013; Fischer, Rehm, & Tyndall, 2016; Gomes et al., 2014).

Other studies focus on use of these drugs for non-therapeutic purposes (Dowling, Storr, & Chilcoat, 2006; Rigg & Murphy, 2013). Dowling et al. (2006) attributed rising rates of prescription opioid abuse to increasing accessibility and initiation among adolescents and young adults since the mid-1990s. Rigg and Murphy (2013) described users' accounts of substance-abusing families and their attempts to escape from other adverse life events, the wide availability of opioid

products in the social environment, and contact with the health care system providing 'legitimate' access to a prescription painkiller as contributory factors.

Given the various potential positive and negative outcomes of analgesic use, many questions pertaining to their uses by members of the DMHDS emerge. Do analgesic profiles reflect appropriate access and use, over-prescribing, or abuse of analgesic medications by the user? Did the increase in prevalence at age 32, followed by a decrease in use by the cohort at age 38 imply rational use based on need, resistance to marketing messages, or harm-avoidance by refusing prescriptions offered? Were the observed prevalence rates at different ages influenced by direct-to-consumer marketing of analgesic products in New Zealand? Will the observed rates of analgesic use predict future use, benefits and harms as the cohort continues to age into later middle and older ages? While the limitations of the data prevent our directly addressing these questions, they do suggest important trajectories for follow-up research to refine our understanding of the benefits and risks of analgesic medications across the life course.

4.3. Nutritional supplements

The DMHDS data show nutritional supplement use to have increased as the cohort aged (from 16.5 to 21.2%), but those prevalence estimates are considerably lower than both the 2008/09 estimate of 30.7% for the New Zealand population aged 15 and over (University of Otago/ Ministry of Health, 2011) and US time-series estimates of 40% in 1988–1994, and over one-half in 2003–2006 (Gahche et al. 2011). However, each of these sources indicates both the importance of the so-called "natural health products" (NHPs) in the public's self-care regimes, and the need to consider carefully their use in populations.

That supplement use may be harmful to health is a major implication of the DMHDS use profiles. Indeed, a large US longitudinal study of 55-to-69-year-old women observed greater mortality among users of almost all supplements studied (Mursu, Robien, Harnack, Park, & Jacobs, 2011). A systematic review of RCTs of antioxidant dietary supplements found that supplemental use of beta carotene, vitamin A and vitamin E may increase mortality (Bjelakovic, Nikolova, Gluud, Simonetti, & Gluud, 2012).

There is concern that users are unaware of the risks associated with some NHPs (Cvijovic, Boon, Jaeger, Vohra, & Sonar Group, 2011; Giveon, Liberman, Klang, & Kahan, 2004; Raynor, Dickinson, Knapp, Long, & Nicolson, 2011) and most believe them to be safe or harmless (Hansen et al., 2009; Giveon et al., 2004; Walji, Boon, Barnes, Austin, Baker, & Welsh, 2009). That NHPs are typically used alongside prescription or other medicines (Ballantyne et al., 2005; Singh & Levine, 2006;) and that many users avoid reporting their use to medical practitioners (Ballantyne et al., 2011; Giveon et al., 2004), suggest that harm may be unobserved and its consequences unaddressed. This is evident in a 3000-fold higher adverse reaction rate from a comparison of 'passive' and 'active' surveillance for natural health product adverse reactions (Vohra et al., 2012), and a considerably higher rate of adverse events for persons using natural health products than for those taking prescription medicines only (Necyk et al., 2014). These findings suggest a need for a precautionary approach to NHPs, given the market's scale and growing value (Research & Markets, 2015). The concerns raised by Allen, Thomson, Emmerton, and Poulson (2000) with respect to nutritional supplement use by members of the DMHDS cohort at age 26 certainly apply in the current data; their call for regulation of NHP manufacture, sale and usage (along with research into their efficacy) continues to resonate.

4.4. Antidepressants

The increase in the use of antidepressants observed in the DMHDS data reflects a similar pattern found in the international literature (New Zealand Ministry of Health, 2007;Olfson & Marcus, 2009; OECD, 2013; Spence, Roberts, Ariti, & Bardsley, 2014). This trend may reflect prescribers' belief that antidepressants are effective and that "depression is a disturbance of brain chemistry which can be corrected by the use of antidepressants" (Middleton & Moncrieff, 2011: 48), a perspective that supports biomedicalism or science development. Indeed, some empirical evidence suggests there may be 'real' growing levels of depression within socioeconomically marginalized groups (Ball and Boseley, 2011) or that result from key social events, such as the 2008 economic depression (Spence et al., 2014).

Others have argued that the increased attention to screening, diagnosis and treatment of depression using the broadened criteria found in the DSM-IV and DSM-V reflects greater physician autonomy to prescribe antidepressants for non-specific diagnoses such as 'current depressive disorder', 'recurrent depressive disorder', 'unspecified dementia with co-morbidity'(New Zealand Ministry of Health, 2007), for mild forms of depression, generalized anxiety disorders or social phobia (Hollingworth et al., 2010; Mercier, Auger-Aubin, Lebeau, Van Royen, & Peremans, 2011), or for grief and sadness (Dowrick & Frances, 2013). These support medicalization as an explanation for rising rates of use. The rather alarming conclusion of recent systematic reviews—that there is unlikely to be a clinically significant difference between antidepressants and placebo for patients with mild or moderate symptoms (Barbui, Cipriani, Patel, Ayuso-Mateos, & van Ommeren, 2011; Fournier et al., 2010)—may suggest pharmaceuticalization - through industry promotion of antidepressants, or through consumer demand for them - as the explanation for greater antidepressant use.

The antidepressant-use profile in the DMHDS demands consideration of users' perspectives of them. Positive views of antidepressants —as helpful for recovery (Fullagar, 2009), or as "bringing relief from distressing negative emotions" (Price, Cole, & Goodwin, 2009: 213) — need to be weighed against side-effects such as stomach complaints, insomnia, fatigue, weight fluctuations, headaches, sexual problems (Pestello & Davis-Berman, 2008), the reduction of positive emotions, greater emotional detachment, and personality changes (Price et al., 2009). Additional concerns—that antidepressants provide only a partial fix to a complex problem; that antidepressants impact one's sense of autonomy and are stigmatizing, that their long-term effects are unknown; users' fears about dependency and of ceasing their use (Gibson, Cartwright & Read, 2014; Malpass et al., 2009; Ridge, Kokanovic, Broom, Kirkpatrick, Anderson, & Tanner, 2015)—suggest that deciding to use antidepressants is complicated and consequential.

The DMHDS data provoke important questions that can direct future research. Does the changing prevalence of antidepressant use reflect improved diagnosis and 'real' increases in depression as cohort members aged, the medicalization of distress, or the effectiveness of pharmaceutical promotion of antidepressants? To what extent did cohort members' use of antidepressants result in improved mental health and/or iatrogenic effects that are undocumented – and therefore unavailable for prescribers' consideration?

5. Conclusion

The DMHDS data provide a picture of medication uptake across an important part of the life course, from young adulthood toward middle age. The fluctuating medicine use patterns in the DMHDS cohort suggest that medicines are negotiated by individuals who draw on available information or beliefs (or advisors) to make decisions. The data show the extent to which medicines have come to mediate human lives and the increments by which medication use is normalized. The data also reflect the public's uptake of the intent of medicalization or pharmaceuticalization–that requires lay participation both in defining one's problems and seeing one's body/mind as amenable to pharmaceutical management, and in accessing and treating those problems–the living of medicated lives, the becoming a 'pharmaceutical person' (Ballantyne, et al., 2011).

We were interested in the idea that it may be in young-adulthood/

middle-age where use patterns are established and set the stage for medicines-use in later life. While the available data do not enable us to confirm this unequivocally, they do suggest a fruitful direction for future research. The use patterns shown here suggest important questions for follow-up. Do they imply a type of 'dedicated' user (or non-user)? Would identifying user-types enable prediction of future population use/demand for medicines? Would it enable estimation of future, preventable, iatrogenic outcomes, or the identification of future older adult subgroups at risk of polypharmacy? Does higher use in younger/middle aging groups persist into old age? How does anyone get to the point of using 19 medicines at once (Tordoff et al., 2010)?

Regarding different interpretations of medicine-use patterns in the DMHDS data, biomedicalism offers an optimal, but often unrealistic account of medicine expansion. Interpretations drawing on medicalization or pharmaceuticalization reinforce that other interests (than optimal/effective diagnosis and treatment) are at play, and result in the expansion of medical definitions and treatments that may be sub-optimal or even harmful. Why does this matter? Because the mis-interpretation of causes, meanings and solutions to individuals' health problems can lead to them being unresolved, becoming over-treated, and to continued human harm or suffering. Ineffective treatments result in the inefficient use of limited health care resources, or the outright waste of those resources, and diversion from alternative ways of understanding human problems and seeking more optimal methods of addressing them.

Ethics approval

On behalf of my co-authors, I certify that the research upon which this manuscript is based received approval from the Lower South Regional Research Ethics Committee, New Zealand Ministry of Health.

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