



35 **Abstract**

36

37 **Introduction** Knowledge about global use patterns of contraceptive implants is limited. This study  
38 aims to describe implant use patterns from a user and prescriber perspective.

39 **Material and methods** In a cross-sectional design, we estimated the annual number of users by  
40 calculating doses sold per 1000 women-years in the Norwegian Prescription Database for the years  
41 2006-2012. For each contraceptive method, we calculated on an annual basis a proportion of defined  
42 daily doses (DDDs) of all hormonal contraceptives in five years age groups. Data were analyzed in  
43 SPSS version 22, with chi-square test, t-test, and survival analysis.

44 **Results** Sales from pharmacies for contraceptive implants more than doubled over the study years  
45 and was consistently higher in the younger age groups. The collection rate was 9.3 per 1000 women  
46 in 2012, when implant sales amounted to 2.4% of all daily doses of hormonal contraceptives sold.  
47 General practitioners and doctors with no specialty were the major prescribers to starters of  
48 contraceptive implants, whereas gynecologists prescribed nearly 12% of the volume, a higher  
49 proportion to women > 35 years of age than younger women. The cumulative proportions of  
50 continued users at 6-, 12-, 24-, and 36-months were 96.1%, 78.6%, 51.9%, and 34.9%, significantly  
51 lower for users who had doctors with no specialty as prescribers. At end of first expiration period,  
52 21% of starters continued using implants.

53 **Conclusion** Implants play a minor role in the overall use of hormonal contraception in Norway. One  
54 in five starters continue as long-term users.

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57 **Key words:** Female contraception, hormonal contraception, contraception behavior, electronic  
58 prescriptions, physician prescribing patterns, synthetic progestogens (all MeSH terms), contraceptive  
59 implants

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61 ***Abbreviations***

62 COCs – Combined oral contraceptives

63 LNG-IUD -Levonorgestrel-releasing intrauterine device

64 NorPD- Norwegian prescription database

65 OCs – Oral contraceptives

66 POPs – Progestin only pills

67 VR(s) – vaginal ring(s)

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70 **Key message**

71 Implants play a minor role in the overall use of hormonal contraception in Norway. It's use

72 amounted 2.4% of all hormonal contraception in 2012. Mean duration of use was 27 months (ranging

73 0-91 months).

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76 ***Introduction***

77 Contraceptive implants have been available publicly since 1983. In the Western world, the popularity  
78 of implants increased in the late 1990s when newer products with one or two rods replaced the six-  
79 rod package (Norplant I). Contraceptive implants, which act as progestin-only pills as they contain  
80 slow-releasing gestagens, entered the Norwegian market in 2002. Inserted subdermally, protection  
81 against pregnancy for three (Implanon/Nexplanon (one rod of etonogestrel)) or five years  
82 (Jadelle/Norplant II (two rods of levonorgestrel)) may be achieved. Contraceptive implants are very  
83 efficacious and safe methods of contraception in comparison with pills, vaginal rings, and the  
84 contraceptive patches (1–6). Reported continuation rates in clinical trials vary between 78–92%, 67–  
85 83%, and 61–67% at one, two, and three years respectively (1–4). Vaginal bleeding disorders are the  
86 most common reason for discontinuation (1–7).

87 Knowledge about implant use patterns worldwide is scarce (8). Norway has reported low user  
88 rates among teenagers (9) and among women in the general population (10). This study aims to  
89 analyze the use pattern of contraceptive implants in Norway in a client and a prescriber perspective.

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91 ***Material and methods***

92 The Norwegian Prescription Database (NorPD), which stores information about users and  
93 prescribers, was established January 1, 2004. The NorPD registers drugs delivered from pharmacies  
94 to users. A fictitious number is created from the personal identification number given to all  
95 Norwegians at birth or upon immigration. Through these pseudonyms, prescriptions can be followed  
96 over time for both users and prescribers. For users the NorPD includes information on month and  
97 year of birth, gender, and home municipality. Detailed information about the prescribed drugs is also  
98 registered. Prescriber information comprises gender, year of birth and graduation, profession, and  
99 year and type of specialty.

100 A total of 9 237 169 hormonal contraceptive (ATC-codes G02B and G03A) prescriptions  
101 were registered in NorPD from January 1, 2004 to June 30, 2013. We excluded contraceptive  
102 prescriptions to men (n=1 723), research-related contraceptive prescriptions (n=643), prescriptions to  
103 non-Norwegian citizens/persons with incomplete identity (n=11 890), and obvious errors in year of  
104 birth (n=4 523). In addition, we excluded prescriptions undertaken by dentists (n=1 065), dental  
105 assistants (N=369), veterinarians (n=74), opticians (N=19), and prescriptions with errors in number  
106 of packages delivered over the counter at pharmacies (n=959). Among 9 215 904 valid prescriptions,  
107 we identified 19 935 first-time implant users from January 1, 2006 to December 31, 2012 as study  
108 participants. After excluding 78 women who lacked information on year of birth and/or gender of  
109 prescriber, the study population comprised 19 857 first-time implant users.

110 Use duration was estimated in months, from the date of the first collected implant  
111 prescription until the date of expiration of the last continuous implant prescription, or date of  
112 collection of prescription for other hormonal contraceptives, or study end June 30, 2013. The study  
113 includes women who collected other hormonal contraceptive prescriptions at the same time or within  
114 the first 20 days after an implant prescription (N=110; 0.6%), since they had obviously intended to  
115 start using an implant. Use duration for this group was set to zero months.

116 “Switchers” started implant use within 28 days from expiration of the last collected  
117 contraceptive, if last contraceptive was oral, vaginal ring, injection, or a patch. A time limit was not  
118 defined where the last hormonal contraceptive was a levonorgestrel releasing-intrauterine device  
119 (LNG-IUD), since we could not know the exact timing of removal before implant initiation. At study  
120 end, women who bought another hormonal contraceptive within 180 days after expiration of last  
121 implant prescription comprised the “switchers.” A “pause” in hormonal contraception use was  
122 restricted to women who submitted an implant prescription 29 days or later after the most recent  
123 collected contraceptive prescription expired. At the study’s end, pause denoted women who collected  
124 another hormonal contraceptive 180 days or later after expiration of the last dispensed implant.

125 Continuous implant users were women who collected another implant within 180 days after the  
126 expiration of the most recent collection.

127 In the overall assessment of hormonal contraceptive consumption, we set the implant use  
128 duration to two years (Implanon/Nexplanon) and four years (Jadelle), and the LNG-IUD  
129 (LevoNova/Mirena) to four years. For other hormonal contraceptives, we estimated the annual  
130 number of users by calculating the daily doses sold per day/1000 women in age groups spanning five  
131 years from 15 to 49 years depending on the number of packages and package size dispensed at each  
132 collection, as indicated in the ATC code. Statistics Norway online provided denominator data (age  
133 by calendar year) (11).

134 User age was categorized as 15–19, 20–24, 25–29, 30–34, 35–39, 40–44, and 45–49 years,  
135 whereas prescriber age was categorized as 24–34, 35–44, 45–54, 55–64, and 65–80 years. We  
136 included 58 starters aged 12–14 years in the 15–19 group, and 30 starters aged 50–54 years in the  
137 45–49 group. Prescriber’s profession was categorized as general practitioner, gynecologist, other  
138 specialty, public health nurse, or midwife. We categorized physicians without specialist status in the  
139 NorPD as doctors with no specialty. This category comprised postgraduate students from medical  
140 school doing their internship, physicians in a residency-training program, and medical students who  
141 had a valid license issued in fifth year of medical school. Physicians with more than one specialty  
142 were denoted with the most recent specialty.

143 All analyses were done in Statistical Package for Social Sciences (SPSS) version 22.0 with  
144 chi-square tests for categorical variables, t-test for continuous variables, and duration of use  
145 estimated by survival analysis with a significance level  $p < 0.05$ .

146 The board of the NorPD reviewed the protocol and gave permission for use of data.  
147 Studies using anonymously data from nationwide registers are by Norwegian legislation  
148 exempted from institutional regulatory board approvals and written informed consent from  
149 the patients.

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152 **Results**

153 The number of implants collected from pharmacies in Norway more than doubled in each age group.  
154 The total take out from 2006 through 2012 was consistently higher among the younger age groups  
155 (Table 1, upper panel). The take out rate in 2006 was 4.3 per 1000 women of reproductive age (15–  
156 49), versus 9.3 in 2012 (Table 1, upper panel). Related to proportions of daily doses of hormonal  
157 contraceptives sold, implant sales amounted to 1.2% in 2006, versus 2.4% in 2012, with a steady  
158 year-by-year increase (Table 1, lower panel). The relative use of implants to all other hormonal  
159 contraceptives was highest among teenagers and decreased significantly by age (Table 1, lower  
160 panel).

161 The number of women who started using contraceptive implants increased from 2 252 in  
162 2006 to 4 319 in 2012. There was a significant shift to younger starters at the end of the study as the  
163 proportion of starters less than 25 years of age increased from 44% in the first study year to over  
164 60% in the last study year, whereas the proportion of starters 25 years or older decreased (Table 2).

165 As the NorPD was established on January 1, 2004, we restricted the analysis of previous use  
166 of hormonal contraception to those who started after January 1, 2010. This restriction gave the  
167 women a wider time period in which they had a chance to collect at least one hormonal contraceptive  
168 prescription before initiating implant use. Most women starting with a contraceptive implant began  
169 after a pause in using hormonal contraception (Table 3). The proportion of women without previous  
170 use of hormonal contraception increased by age. For these women the contraceptive implant was the  
171 first use of any hormonal contraception after January 1, 2004. More young women switched from  
172 OCs to implant, whereas more elderly women may have switched from LNG-IUDs to implants.  
173 There were minor differences across age in the proportion of women switching from POPs to  
174 implants. Only a small proportion of women switched from a patch, vaginal ring, or injectable  
175 contraceptive to an implant.

176 Women across all age groups selected their provider independent of provider's sex (Table 4).  
177 Young doctors with no specialty prescribed nearly 40% of the implants, more often to younger  
178 women. General practitioners were the main implant providers, covering 40% of the teenagers, while  
179 increasing to over 50% in the age groups above 30 years. Other specialists prescribed 4% of the  
180 volume evenly distributed across age groups. Gynecologists prescribed nearly 12% of the total  
181 volume, more often to older than young women (Table 4). Public health nurses/midwives are not  
182 certified to prescribe implants. Thus over the entire study period, only 27 instances implicated these  
183 professions in implant distribution. Female doctors dominated in all professional groups listed in  
184 Table 4 at ages below 50, whereas males dominated among doctors 50 years of age or above (data  
185 not shown).

186 Within 180 days after collecting the initial implant, approximately 4% of the users had taken  
187 out another hormonal contraceptive prescription, independent of provider's profession or user's age.  
188 The cumulative proportions of continued users at 6-, 12-, 24-, and 36-months were 96.1%, 78.6%,  
189 51.9%, and 34.9% respectively. These rates were significantly lower for users whose prescribing  
190 doctors had no specialty, versus users whose prescribing doctors were general practitioners,  
191 gynecologists, or other specialists. Mean use duration was 27.6 months (range 0–91; 95% CI: 27.3–  
192 27.9), versus 24.9 months for users who were prescribed an implant by a doctor with no specialty,  
193 and 29.5 months for users who were prescribed an implant by any other profession ( $p < 0.001$ ).  
194 Analysis of use duration was minimally impacted when excluding the 110 (0.6%) women who had  
195 another prescription for hormonal contraceptive within 20 days after the first implant prescription.

196 Among users who had taken out an implant prescription before 2010 ( $n = 9\ 605$ ), 20.8%  
197 continued to use another implant within 180 days after the recommended use time. Within this subset  
198 of women, the mean use duration was 57.7 months (range 41–91).

199 Women consult a physician's office for removing the rod(s). At the same time, most women  
200 seek consultation on contraception and may receive another contraceptive prescription. Within 180



201 days after the expiration of the first implant, nearly all women had taken out another prescription for  
202 hormonal contraception (Table 5). Most women were still using an implant, increasing from 50% in  
203 the younger to over 75% in the older age groups. Switching to OCs and POPs were more prevalent in  
204 younger women. Fewer women switched to a vaginal ring, patch, or injectable once the first implant  
205 prescription expired. Compared to young women, those 30 years or older were more inclined to  
206 switch to a hormonal IUD once the implant prescription expired (Table 5).

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## 208 **Discussion**

209 Despite increasing numbers, less than 1% of women at fertile age (15–49 years) in Norway  
210 were collecting a contraceptive implant prescription in 2012. Use increased in all age groups from  
211 2006 to 2012, with highest use in the 15–19 and 20–24 age groups. Implant use is increasing relative  
212 other hormonal contraceptive methods, amounting to 2.4% of all hormonal contraception in 2012.  
213 Over time, the proportion of starters with implants increased among the younger age groups but  
214 decreased in all age groups above 25 years.

215 Reliable, global-scale estimates on use of modern contraception, and implants in particular,  
216 are lacking (8). From the most recent World Contraceptive Patterns, few countries reported on  
217 implants (8). In the most recent contraceptive surveys from England (13), the US (12), and France  
218 (14) implants are not reported separately, but included with long-acting reversible contraceptives  
219 (LARC). The latter studies are based on surveys among women in need of contraception (12, 14),  
220 while the study from England reports contraceptive methods for women in contact with the Sexual  
221 and Reproductive Health Services (13). From what national authorities report to WHO, Norway had  
222 the highest worldwide implant use rate in 2011, followed by Australia, United Kingdom, and Austria  
223 (8).

224 The strength of this study is the large dataset based on compulsory electronic reporting from  
225 all pharmacies to the NorPD, and the information about providers. Furthermore, this study evaluates

226 the real-life situation of implant use patterns over time. A limitation is that we do not know whether  
227 the contraceptive methods collected at the pharmacies are actually used. However, repeated  
228 prescriptions do suggest that the contraceptives are used, where nearly 100% of the women who had  
229 reached the first implant's expiration time obtained another prescription for hormonal contraception.

230 In Norway, all citizens have a right to choose a general practitioner from a list of authorized  
231 physicians (16). Over the study years, 99% of the target population of women at reproductive age  
232 had a primary care physician (16). Contraceptive counselling is considered a task for general  
233 practice, thus explaining why general practitioners were the main providers of implants at any age.  
234 Gynecologists contribute to contraceptive counselling, but far less than general practitioners and  
235 doctors with no specialty.

236 Doctors with no specialty are at the start of their career and may meet women who seek  
237 contraception on irregular basis without a permanent professional relationship. Factors related to the  
238 situation in which contraceptive counselling takes place, the premature contraceptive counselling  
239 experience among this subgroup of physicians, or factors related to the women who seek doctors  
240 with no specialty, may explain why users of this subset of physicians had a significantly shorter use  
241 duration.

242 Women participating in clinical trials on hormonal contraception are often recruited from  
243 patient lists in health management systems of general practitioners, gynecologists, or health facilities  
244 that offer a wider range of service. Most eligible women in these settings will be previous or current  
245 contraception users. Clinicians may invite healthy, previous users to clinical trials based on  
246 established information in their medical information systems. The cumulative proportion of implant  
247 users reported in this study is in the lower range of what is reported from clinical trials after one  
248 year, but lower than what is reported after two and three years (1–4). Women in clinical trials of  
249 long-acting contraceptive methods may be more motivated for long-term use than women being  
250 advised the method on general terms. In addition, participation in clinical trial includes regular but

251 shorter follow-up windows, better overall care, and investigators that may have an interest in keeping  
252 the women in the studies.

253 The present estimates on continuation rates, expressed as cumulative proportions, may be  
254 overestimated as the rods may have been removed before the next prescription for a hormonal  
255 contraceptive is collected, despite the fact that subsequent prescription were collected within the  
256 implant's expiration window.

257         When comparing results from clinical trials to registry-based studies, there are inborn pitfalls  
258 that hamper comparisons. The recruitment setting may explain why more starter women in clinical  
259 trials switched from OCs to implants (23–27%) compared to our study (16%), whereas there were  
260 less differences in non-users prior start (3, 7). At study end more starters continued implant use in  
261 our study, while more women switched to OCs in another study (7). There are limited data in the  
262 literature on switching and pauses in hormonal contraceptive use.

263         Women in Norway pay for implants. Assuming that an average implant user continues for at  
264 least 30 months, the monthly price for implants is similar to the cost for the cheapest OCs. The only  
265 levonorgestrel-containing implant (Jadelle) was withdrawn from the market in 2011, while the  
266 etonogestrel-releasing implant “Implanon” was replaced by a new insertion package and a new brand  
267 name, “Nexplanon,” in 2010. We do not consider the media attention and “Nexplanon” campaigning  
268 as important for the increase in overall implant use, as there was a steady increase in implants from  
269 the first to the last study year. During the entire study period the Norwegian government has  
270 encouraged greater LARC use, including implants, especially in the younger age groups, in order to  
271 make women more conscious of reaching their own reproductive goals (17, 18). An increased LARC  
272 uptake, may generate cost savings for both the health care system and the contraceptive user by  
273 better contraceptive adherence, and lead to a decrease in unplanned pregnancies (19).

274         In summary, implants play a minor role in the overall use of hormonal contraception  
275 in Norway. Implant use is increasing, especially among young women under 25 years of age. Main

276 implant prescribers are general practitioners and doctors with no specialty status. The cumulative  
277 proportions of continuing implant users at one, two, and three years are lower than reported from  
278 clinical trials. One out of five starters renewed the prescription at expiration time and continued as  
279 long-term users.

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282 **Funding:** None

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Table 1: Estimated proportion of contraceptive implant users per 1 000 women in the general population (upper panel) and per 1 000 women using hormonal contraception (lower panel), by age and calendar year. Norway 2006 through 2012 (%).

Year/ Age	2006	2007	2008	2009	2010	2011	2012
	%	%	%	%	%	%	%
15–19	6	8	8	9	7	11	15
20–24	9	12	13	14	12	18	23
25–29	6	7	7	8	6	9	11
30–34	5	5	5	6	5	6	7
35–39	4	4	3	4	3	4	5
40–44	2	2	2	3	2	3	3
45–49	0.4	0.6	1	1	1	1	2
Total	4	5	5	6	5	7	9
Year/ Age							
15–19	14	19	20	22	19	26	36
20–24	14	16	18	20	16	23	30
25–29	11	13	13	15	12	17	22
30–34	12	13	12	16	12	17	19
35–39	12	13	11	12	10	14	18
40–44	09	09	11	11	09	11	13
45–49	04	06	09	08	07	09	12
Total	12	14	15	16	13	19	24





Table 3: Switching contraceptive method prior starting a contraceptive implant, by age and total. Norway 2010 through 2012 (%).

Age/ Method used	15–19	20–24	25–29	30–34	35–39	40–44	45–49	Total
	N=2598	N=3496	N=1650	N=1175	N=767	N=412	N=154	N=10252
	%	%	%	%	%	%	%	%
Pause	30.3	45.9	53.6	54.4	49.2	40.0	28.6	43.9
1 <sup>st</sup> registr.	15.0	8.3	14.8	13.0	20.2	21.8	38.3	13.5
OCs	29.0	19.9	7.6	5.4	4.2	5.3	3.9	16.6
Vaginal ring	2.5	3.4	2.0	1.4	0.4	0.7	0.6	2.3
Patch	2.8	2.2	1.5	1.0	1.7	1.0	0.0	2.0
POPs	16.5	16.2	13.9	14.5	10.6	13.3	9.7	15.1
Injectable	3.5	2.9	2.9	3.0	5.2	5.6	4.5	3.4
LNG-IUD	0.4	1.2	3.7	7.3	8.6	12.1	14.3	3.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

1<sup>st</sup> registr. = 1<sup>st</sup> registration in the Norwegian Prescription Database. OCs = oral contraceptives. POPs = progestin-only pills. LNG-IUD = levonorgestrel intrauterine device.



Table 5: Switching contraceptive method within 180 days after expiration of a contraceptive implant prescription, by age and total. Norway 2006 through 2012 (%).

Age user/ New method collected	15–19	20–24	25–29	30–34	35–39	40–44	45–49	Total
	N=4 684	N=6 305	N=3 328	N=2 510	N=1 801	N=923	N=306	N=19 857
	%	%	%	%	%	%	%	%
Pause	0.5	0.5	0.5	0.5	0.6	0.7	0.3	0.5
OCs	30.7	26.6	20.6	15.6	10.0	5.7	1.6	22.3
Patch	4.4	5.1	4.6	2.6	2.9	0.8	1.0	4.1
Vaginal ring	3.5	2.8	2.9	2.2	1.7	0.7	0.0	2.7
POPs	9.5	10.5	11.3	8.3	6.7	5.5	4.2	9.5
Injectable	2.9	2.4	2.7	2.9	4.2	4.8	2.6	2.9
Implant	47.7	50.2	53.9	61.4	66.4	74.6	86.9	54.8
LNG-IUD	0.9	1.9	3.6	6.6	7.6	7.3	3.3	3.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

OCs = oral contraceptives. POPs = progestin-only pills. LNG-IUD = levonorgestrel intrauterine device.