



HAL
open science

Contraception use and knowledge related to pregnancy in diabetic women

Louise Feutry, Coralie Barbe, Aurélie Marquet-Dupont, Anne Fèvre, Céline
Lukas-Croisier, Géraldine Vitellius, Brigitte Delemer, Sara Barraud

► To cite this version:

Louise Feutry, Coralie Barbe, Aurélie Marquet-Dupont, Anne Fèvre, Céline Lukas-Croisier, et al..
Contraception use and knowledge related to pregnancy in diabetic women. *Annales d'Endocrinologie*
= *Annals of Endocrinology*, 2022, 83 (2), pp.88-94. 10.1016/j.ando.2022.01.007 . hal-03568883

HAL Id: hal-03568883

<https://hal.science/hal-03568883>

Submitted on 22 Jul 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial 4.0 International License

Contraception use and knowledge related to pregnancy in diabetic women

Louise Feutry^{a,1}, Coralie Barbe^{b,2}, Aurélie Marquet-Dupont^{c,3}, Anne Fèvre^{a,4},
Céline Lukas-Croisier^{a,5}, Géraldine Vitellius^{a,6}, Brigitte Delemer^{a,d,7}, Sara Barraud^{a,d,8}

^a CHU de Reims - Hôpital Robert Debré, Service d'Endocrinologie – Diabète – Nutrition,
Avenue du Général Koenig, 51092 REIMS CEDEX, FRANCE,

^b Comité Universitaire de Ressources pour la Recherche en Santé, Université de Reims
Champagne-Ardenne UFR Médecine, 51 rue Cognacq Jay, 51100 REIMS, FRANCE,

^c Polyclinique Reims-Bezannes - Service de Gynécologie-Obstétrique, 109 rue Louis
Victor de Broglie, 51430 BEZANNES, FRANCE,

^d CRESTIC EA 3804, Université de Reims Champagne Ardenne, UFR Sciences Exactes
et Naturelles, Moulin de la Housse, BP 1039, 51687 Reims CEDEX 2, FRANCE

¹ lfeutry@chu-reims.fr

² coralie.barbe1@univ-reims.fr

³ amarquet-dupont.amp@groupe-courlancy.com

⁴ afevre@chu-reims.fr

⁵ clukas-croisier@chu-reims.fr

⁶ gvitellius@chu-reims.fr

⁷ bdelemer@chu-reims.fr

⁸ sbarraud@chu-reims.fr

Corresponding author: Sara Barraud, sbarraud@chu-reims.fr, CHU de Reims - Hôpital
Robert Debré, Service d'Endocrinologie – Diabète – Nutrition, Avenue du Général Koenig,
51092 REIMS CEDEX, FRANCE

Declaration of interest: none

1 Louise Feutry^{a,1}, Coralie Barbe^{b,2}, Aurélie Marquet-Dupont^{c,3}, Anne Fèvre^{a,4}, Céline
2 Lukas-Croisier^{a,5}, Géraldine Vitellius^{a,6}, Brigitte Delemer^{a,d,7}, Sara Barraud^{a,d,8}

3

4 ^a CHU de Reims - Hôpital Robert Debré, Service d'Endocrinologie – Diabète – Nutrition,
5 Avenue du Général Koenig, 51092 REIMS CEDEX, FRANCE,

6 ^b Comité Universitaire de Ressources pour la Recherche en Santé, Université de Reims
7 Champagne-Ardenne UFR Médecine, 51 rue Cognacq Jay, 51100 REIMS, FRANCE,

8 ^c Polyclinique Reims-Bezannes - Service de Gynécologie-Obstétrique, 109 rue Louis
9 Victor de Broglie, 51430 BEZANNES, FRANCE,

10 ^d CRESTIC EA 3804, Université de Reims Champagne Ardenne, UFR Sciences Exactes
11 et Naturelles, Moulin de la Housse, BP 1039, 51687 Reims CEDEX 2, FRANCE

12

13 ¹ lfeutry@chu-reims.fr

14 ² coralie.barbe1@univ-reims.fr

15 ³ amarquet-dupont.amp@groupe-courlancy.com

16 ⁴ afevre@chu-reims.fr

17 ⁵ clukas-croisier@chu-reims.fr

18 ⁶ gvitellius@chu-reims.fr

19 ⁷ bdelemer@chu-reims.fr

20 ⁸ sbarraud@chu-reims.fr

21

22 Corresponding author: Sara Barraud, sbarraud@chu-reims.fr, CHU de Reims - Hôpital
23 Robert Debré, Service d'Endocrinologie – Diabète – Nutrition, Avenue du Général Koenig,
24 51092 REIMS CEDEX, FRANCE

25

26 Declaration of interest: none

27 **Abstract**

28 **Background:** Diabetes mellitus prevalence is increasing among women of child-
29 bearing age. Diabetic pregnancy is associated with major maternal and fetal risks,
30 and these can be reduced by Preconception Care. Pregnancy can be planned using
31 appropriate effective contraception. The objective of this study was to assess diabetic
32 patients' knowledge about pregnancy and to describe their contraceptive use.

33 **Study Design:** An observational study was conducted from February to July 2020 at
34 Reims University Hospital, France. Inclusion criteria were: women aged 18 to 40
35 years, with type 1 (T1D) or type 2 diabetes (T2D). Patients filled out a survey about
36 contraceptive use and knowledge regarding diabetic pregnancy and data were
37 completed from medical records.

38 **Results:** Eighty-nine T1D and 33 T2D patients were included, with mean ages of
39 27.9 ± 6.3 and 32.6 ± 4.6 years, respectively. Seventy-five percent reported that they
40 had been informed about pregnancy-related risks and 67% about the need to plan
41 pregnancy. The preconception HbA1c target was known by 33% of patients.
42 Appropriate knowledge about pregnancy was greater in T1D patients (65.9%, versus
43 36.4% in T2D patients; $p=0.003$). The rate of patients using an effective
44 contraceptive method was 66.4%. Fifteen percent patients for whom contraception
45 was recommended reported having no contraceptive method; 12.5% of contraception
46 users were using a contraindicated method.

47 **Conclusion:** A large majority of diabetic women were aware of pregnancy-related
48 risks and the importance of pregnancy planning, but there are still gaps, especially in
49 T2D patients. We need to improve our practices by providing more information and
50 better access to appropriate effective contraception.

51 **Keywords:** Type 1 diabetes, Type 2 diabetes, Pregnancy, Contraception,
52 Preconception Care
53

54

55 ClinicalTrials.gov number: NCT04350879

56

57 Study approved by the Committee for the Protection of Persons Ile de France VII
58 of Kremlin Bicêtre, 02/12/2020

59

60 **1. Introduction**

61
62 Diabetes mellitus is an increasingly frequent chronic pathology affecting 5% of the
63 French population [1,2]. Among women in France with a live birth in 2012, 0.4% had
64 pregestational diabetes [3].

65 Pregestational diabetes is distinct from gestational diabetes. Beyond the risk of
66 fetal macrosomia and its complications, it is associated with increased maternal and-
67 fetal risks [3]. Moreover, these risks increase in cases of uncontrolled diabetes which
68 show a 3.23-fold increased risk of miscarriage and a 3.44-fold increased risk of
69 congenital malformation as compared to optimal glycaemic control [4].

70 In diabetic patients, the aim is a pregnancy outcome similar to that of the non-
71 diabetic population through a set of measures called Preconception care. Patients
72 are informed about the risks of diabetic pregnancy and necessary therapeutic
73 adaptations. Pregnancy should be planned only after reaching a glycated
74 haemoglobin (HbA1c) target level of 6.5% or less. Complications of diabetes should
75 be detected early and closely monitored. Preconception care reduces the risks of
76 diabetic pregnancy, including the risks of major congenital malformations [5]. French
77 data on the prevalence of Preconception care is outdated and mainly concerns type
78 1 diabetes [6].

79 Appropriate and effective contraception is of paramount importance in
80 Preconception care. Pregnancy planning allows diabetic women to achieve optimal
81 glycaemic control before conception. Contraceptive method must be effective yet
82 respect the contraindications in these patients with frequent vascular risk factors
83 [7,8].

84 The primary objectives of our study were to describe the knowledge about
85 diabetic pregnancy among women with type 1 (T1D) and type 2 diabetes (T2D) and
86 to assess their contraceptive use. The secondary objective was to evaluate the
87 factors associated with appropriate knowledge about diabetic pregnancy.

90 **2. Materials and Methods**

91 92 **2.1. Study design and population**

94 An observational, cross-sectional, single-centre study, with prospective inclusion
95 from 02/17/2020 to 07/31/2020 was conducted. Inclusion criteria were women aged
96 18 to 40 years, presence of T1D or T2D and follow-up at the Diabetes Unit of Reims
97 University Hospital. The non-inclusion criteria were the presence of diabetes
98 secondary to an endocrine, pancreatic or genetic pathology, premature ovarian
99 failure, impossibility of pregnancy (uterine aplasia, hysterectomy), opposition to
100 participate in the study, or inability to answer the survey due to language barriers.

101

102 **2.2. Ethical considerations**

103

104 The study was approved by the Committee for the Protection of Persons Ile de
105 France VII of Kremlin Bicêtre on 02/12/2020 and was registered in ClinicalTrials.gov
106 (NCT04350879). Signed consent forms were obtained from all participants.

107

108 **2.3. Study assessment and definitions**

109

110 Each patient completed a survey containing questions on their personal and
111 family medical and surgical history, use or not of contraception and type, knowledge
112 about diabetic pregnancy (disease-related pregnancy risks, the need for pregnancy
113 planning, and the preconception HbA1c target). Patient data were also collected from
114 medical records: the last HbA1c level or preconception HbA1c for pregnant patients,
115 diabetic complications (retinopathy, nephropathy, neuropathy, myocardial infarction,
116 stroke and peripheral arterial disease) and gynaecological and obstetrical history
117 (early miscarriage, stillbirth, congenital malformations, macrosomia).

118 Long-acting reversible contraception (LARC) is defined as all devices, chemicals
119 substances or agents that prevent conception with contraceptive activity in females,
120 which last for years and can be removed. It includes Intrauterine Devices (IUD) and
121 contraceptive implant. Contraceptive effectiveness was estimated by the Pearl Index
122 (PI) [9,10]. Based on these results, the World Health Organization (WHO) classifies
123 the method as "very effective" if the PI is less than 1 (LARC, reproductive
124 sterilization), "effective" if it is between 1 and 10 (Combined Oral Contraception
125 (COC) and Progestogen-Only Pill (POP)), "moderately effective" if it is between 10
126 and 20 (condom), and "less effective" if it is greater than 20 (Fertility awareness
127 methods).

128 Knowledge about diabetic pregnancy was considered appropriate when patients
129 had been informed about pregnancy-related risks and the need for pregnancy
130 planning.

131

132 **2.4. Statistical analysis**

133

134 Data were described using mean and standard deviation or median [range] for
135 quantitative variables and number and percentages for qualitative variables. Factors
136 associated with the appropriate knowledge about diabetic pregnancy were
137 investigated using univariate analysis (Student tests, Wilcoxon tests, Chi square tests
138 or Fisher exact tests, as appropriate) and multivariate analysis (logistic regressions
139 using stepwise selection, and entry and exit thresholds set at 0.10). All variables with
140 a *p* value less than 0.20 by univariate analysis were included in the multivariate
141 analysis. A *p* value less than 0.05 was considered statistically significant. Statistical
142 analyses were performed using the Statistical analysis system (SAS, version 9.4, Inc,
143 Cary, California).

144

145

146 **3. Results**

147

148 **3.1. Population characteristics**

149

150 Among the 267 surveys sent out, 129 were collected. Seven patients were
151 excluded: one patient without diabetes, two with unspecified diabetes type, one with
152 MODY (Maturity Onset Diabetes of the Young), one with neonatal diabetes and two
153 patients whose surveys were received after inclusion period. Among the 122 patients
154 included in the study, 89 had T1D (73%) and 33 had T2D (27%). Table I shows
155 population characteristics.

156 Regarding diabetic microvascular and macrovascular complications, there was no
157 history of stroke or peripheral arterial disease. Retinopathies and nephropathies were
158 at an early stage. Past medical and surgical history revealed no personal histories of
159 breast cancer. Among patients using hormonal contraception, there was no history of
160 liver failure. Among patients on Combined Oral Contraceptive (COC), there was no
161 history of systemic lupus erythematosus or biological thrombophilia.

162 Fifty-four of all patients were nulligravida: 59.6% of the T1D and 39.4% of the T2D
163 patients. Concerning the gynaeco-obstetrical history, early miscarriages were
164 recorded in eight T1D and five T2D patients, and stillbirth before 22 weeks of
165 amenorrhea (WA) in three T1D and one T2D patients. Among the T1D patients, 9
166 reported histories of congenital malformations: 5 cardiac malformations (septal
167 defect, septal hypertrophy, valvopathy), 1 oesophageal atresia, 1 anal imperforation,
168 1 cleft palate and 1 cystic hygroma related to foetal monosomy X. One history of
169 malformation was reported among the T2D patients, an interatrial and interventricular
170 septal defect.

171 **3.2. Knowledge about diabetic pregnancy**

172

173 **3.2.1. Knowledge about pregnancy-related risks**

174

175 Ninety-one patients (75.2%) indicated that they had been informed about diabetic
176 pregnancy risks, 79.5% of the T1D and 63.6% of the T2D patients ($p=0.07$).

177 Information was given in 90.2% of cases by the diabetologist, 51.2% by the
178 gynaecologist, 46.3% by the general practitioner, and 17.1% by the midwife.

179 There was no significant difference between the two types of diabetes regarding
180 knowledge and misconceptions of diabetic pregnancy risks (Table II).

181

182 **3.2.2. Knowledge about the need to plan pregnancy**

183

184 Sixty-seven percent of the overall population had received information about the
185 need to plan a pregnancy. T1D patients had received more often information (73.9%
186 versus 48.5%, $p=0.01$). The mean age at the time they received this information was
187 24 ± 5.6 years in overall population. T1D patients had received information at
188 younger age (23 ± 5.6 years versus 28.3 ± 3.4 years, $p<0.0001$). This information
189 was given by the diabetologist in 92.2% of cases, the gynaecologist in 36.4% and the
190 general practitioner for 20.8%, with no significant difference between the groups.

191

192 **3.2.3. Knowledge about HbA1c target level**

193

194 Thirty-nine patients (32.5%) knew the correct HbA1c target value. T1D were
195 significantly more likely to identify the correct value (38.6% versus 15.6%, $p=0.02$). In
196 patients with T1D, 30.7% underestimated the correct value, 13.6% overestimated it

197 and 17.1% did not know. In T2D patients, 31.3% underestimated the correct value,
198 6.2% overestimated it and 46.9% did not know.

199

200 **3.3. Evaluation of contraception in diabetic patients**

201

202 Among the 122 patients, 88 (72.1%) were using contraception, with a trend
203 toward lower contraceptive use in patients with T2D (60.6% versus 76.4%, $p=0.08$)
204 (Table III).

205 Among the 34 patients not currently using contraception, 13 patients did not have
206 a partner, ten had a pregnancy desire, two believed themselves at low risk of
207 pregnancy because of their diabetes, and one cited diabetes as a barrier to obtaining
208 contraception. Other reasons cited by eight patients included homosexuality ($n=3$),
209 male infertility ($n=2$), poor contraceptive tolerance ($n=2$), and immediate postpartum
210 (<3 weeks) ($n=1$).

211 Among the ten patients with a pregnancy desire (Six T1D and four T2D patients),
212 two T1D patients had an HbA1c within target range but none with T2D. Among the
213 four T2D patients, one patient was on insulin therapy, two patients on Metformin and
214 one patient on pregnancy-contraindicated oral antidiabetic drugs.

215 Nineteen patients did not need contraception (absence of partner, homosexuality,
216 immediate post-partum and desire for pregnancy with target HbA1c). Of the patients
217 needing contraception, 15 (14.6%) did not use any.

218 Of the 88 patients using contraception, 31% of the T1D and 40% of the T2D
219 population used a LARC (Figure 1). No one used non-oral combined contraceptives,
220 macroprogestin methods, barrier methods other than condoms, or fertility awareness
221 methods. There was no significant difference in the distribution of different methods
222 ($p=0.95$), nor in the use of COC ($p=0.8$) between the two groups.

223 The great majority of patients used methods considered effective or very effective
224 according to WHO, 91.2% of T1D and 95% of T2D patients. A moderately effective
225 method (condom) was used by 8.8% of T1D and 5% of T2D patients. No patient used
226 a less effective method. Of the whole population of our study, 66.4% used an
227 effective or very effective method, 69.7% in T1D and 57.6% in T2D.

228 Thirty-three percent of the patients believed their fertility to be decreased
229 compared to non-diabetic women of the same age, more often in T2D patients
230 (48.4% versus 27.4%, $p=0.03$).

231

232 **3.4. Factors associated with appropriate knowledge about**
233 **diabetic pregnancy**
234

235 Seventy patients (57.9%) had appropriate knowledge about diabetic pregnancy.
236 The univariate and multivariate analysis of the factors associated with this
237 appropriate knowledge are detailed in Table IV.

238 In the multivariate analysis, appropriate knowledge about diabetic pregnancy was
239 significantly higher in T1D patients (OR = 4.9 [1.5-15.9]) and in patients with history
240 of pregnancy (OR = 5.8 [1.9-17.8]).

241 Among patients using contraception, patients for whom contraception had been
242 prescribed by a gynaecologist were more likely to have appropriate knowledge
243 (39/57, 68.4% versus 10/25, 40.0%; $p=0.02$).

244

245 **3.5. Contraception use**
246

247 Forty-nine patients (43%) considered they did not have a free choice of
248 contraceptive method, 45.2% of T1D and 36.7% of T2D patients ($p=0.4$).

249 Among patients using contraception, 20.7% ($n=18$) were not satisfied with their
250 current method, with no significant difference between the two groups ($p=1$). The
251 reasons mentioned were mainly adverse effects (61.1%), but also forgetting oral
252 contraceptive (16.7%) and concerns about the health risks of contraception (16.7%).

253 Among oral contraceptive users, 50% regularly forgot to take it without significant
254 difference between the two groups (37.5% in T2D versus 52.6% in T1D patients,
255 $p=0.7$). However, 79.6% said they knew what to do if they had forgotten, with no
256 significant difference between the two groups (60% in T2D versus 84.6% in T1D
257 patients, $p=0.18$).

258 Regarding contraindications to contraception, one patient was on a Progestogen-
259 Only Pill (POP) with a history of malabsorptive bariatric surgery (By-Pass). Among
260 the users of COC, 5 patients had a duration of diabetes greater than or equal to 20
261 years, two patients were older than 35 years, eight patients had a Body Mass Index
262 (BMI) ≥ 25 kg/m², and one patient smoked. A total of 11 patients on contraception
263 (12.5%) were using a contraindicated contraceptive method, 7 T1D (10.3%) and 4

264 T2D patients (20%). Among them, six patients on COC had an accumulation of
265 several risk factors, in addition to diabetes.

266

267

268 **4. Discussion**

269

270 The objective of our study was to assess the knowledge about pregnancy in T1D
271 and T2D patients and describe their contraceptive use. The vast majority of patients
272 were informed about specific risks of diabetes during pregnancy and about the need
273 to plan pregnancy. Of the patients needing contraception, only 15% did not use any.
274 However, almost 13% of contraception users were receiving a contraindicated
275 method.

276 Our population included a majority of T1D patients, which appears to be higher
277 than expected in diabetic women of reproductive age [3,11,12]. This difference may
278 reflect the more frequent follow-up of T2D patients in general practice [13]. Results
279 showed several differences between the two types of diabetes. As expected, the
280 prevalence of obesity was higher in T2D, probably related to metabolic syndrome.
281 Also, T1D was associated with a higher prevalence of complications, due to a longer
282 duration of the disease. The mean HbA1c of our population was similar to the French
283 population, 7.9% and 7.1% in T1D and T2D patients, respectively [14]. In French
284 population, Lemaitre *et al* found a 5.9% rate of malformations based on the number
285 of live births [15] In our study, the number of malformations may seem higher given
286 the sample size, but the exact rate of malformations was not possible to assess due
287 to the study design. It can be assumed that this difference is related to sample size or
288 recruitment bias, as patients with complex histories are more often followed in tertiary
289 centres.

290 Most of the patients were aware of the pregnancy-related risks and the need to
291 plan pregnancy, which is encouraging. However, even we should remain cautious in
292 our conclusions given the small sample size of T2D patients, this group seems less
293 informed compared to T1D group. The reasons for these differences remain to be
294 investigated. It could be linked to less frequent or delayed specialized follow-up, or to
295 socioeconomic factors [16,17]. Furthermore, although patients were aware of the
296 importance of glycaemic control, they had limited knowledge of the exact HbA1c
297 target level. The Diabetes and Pregnancy Group (DPG) also showed that few

298 patients know the exact HbA1c target, but they rarely overestimated it [6]. Besides, it
299 is probably less important to know the exact HbA1c level than the need to plan
300 pregnancy. Indeed, information about the exact HbA1c target is especially needed
301 once pregnancy is desired. From these results, we can question whether this
302 knowledge has a positive impact on diabetic pregnancies in France. Thus, in the
303 study of Lemaitre *et al* [15], the mean preconception HbA1c level was 7.2% (6.5-8.1)
304 but only 25.3% of patients had an HbA1c of 6.5% or less. Further research may be
305 interesting regarding the barriers to reaching preconception HbA1c target. Finally, it
306 should be mentioned that a number of patients believed that their infants would
307 develop neonatal diabetes. This finding is similar to the DPG's study and shows the
308 importance of improving patient education [6].

309 Contraception is essential in diabetic patients from the very beginning of sexual
310 life. The mean age of first sexual intercourse in our population and in the general
311 population are comparable [18,19] and close to the average age of first
312 contraception. Contraceptive use reached 72%, which is comparable to the data
313 found in diabetic patients by Britton *et al* (71.2%) [20]. Despite the need of
314 contraception, 15% of the patients used none, a result higher than data from the
315 French non-diabetic population (8%) [21] but much lower than data from the
316 American diabetic population (28.8%) [20]. Nevertheless, more than 90% of the
317 patients using contraceptive used a very effective or effective method, compared with
318 78.2% in the general population [21]. This is also much higher than the rate of 52.8%
319 found by Britton *et al* [20]. T2D patients tended to start contraception later. This may
320 be related to a higher prevalence of obesity and cardiovascular risk factors. Indeed, it
321 has been described that obesity leads to less contraceptive use and less
322 gynaecological follow-up [22]. We can also mention practitioners' reticence to
323 prescribe hormonal contraception in these patients with higher cardiovascular risk.
324 Accordingly, Shawe *et al* found a significantly lower prescription of COC in patients
325 with T2D [23]. Finally, slightly more than 10% of patients received contraception that
326 was theoretically contraindicated. This points to the need for further education of
327 health care professionals and the possible need for a dedicated contraception
328 consultation for these patients.

329 Our study shows that T2D seems to be associated with less knowledge about
330 diabetic pregnancy. This highlights the importance of improving our practices with
331 these patients, especially given the increasing prevalence of T2D and the higher risk

332 of obstetrical complications as compared to T1D, with identical glycaemic levels [24].
333 However, we must be cautious about the significance of these differences because of
334 the relatively small sample of T2D patients. These results could be further
335 investigated in larger population. History of pregnancy was also associated with more
336 appropriate knowledge. However, we must not forget that our role is mainly
337 preventive, and that information must be given prior to any pregnancy plan.

338 Our study found that three-quarters of the patients were aware of pregnancy-
339 related risks and two-thirds of the need for pregnancy planning. However, there are
340 still gaps, especially in T2D. The great majority of patients received an effective
341 contraceptive method, but contraceptive use remains insufficient, particularly in T2D,
342 compared to French general population. Practices must be improved to ensure that
343 information is easily available to these patients, and to train all health professionals
344 involved in their care.

345

346

347

348

349 **Acknowledgments:** We would like to acknowledge Grace Stockton-Bliard for her
350 help for English editing. We would also like to thank all the participants of the study.

351

352 **Funding source:** This research did not receive any specific grant from funding
353 agencies in the public, commercial, or not-for-profit sectors.

354

355 **Author contributions:**

356 Louise Feutry: Conceptualization; Investigation; Writing – Original Draft – Review
357 & Editing; Visualization

358 Coralie Barbe: Conceptualization; Methodology; Formal analysis; Writing –
359 Review & Editing

360 Aurélie Marquet-Dupont: Conceptualization; Methodology; Writing – Review &
361 Editing

362 Anne Fèvre: Writing – Review & Editing

363 Céline Lukas-Croisier: Writing – Review & Editing

364 Géraldine Vitellius: Writing – Review & Editing

365 Brigitte Delemer: Supervision; Writing – Review & Editing

366 Sara Barraud: Supervision; Conceptualization; Methodology; Writing – Original
367 Draft – Review & Editing

368

369 All authors have given their permission for the final version of the published work.

370

371

372
373

References

- 374 [1] Saeedi P, Petersohn I, Salpea P, Malanda B, Karuranga S, Unwin N, et al.
375 Global and regional diabetes prevalence estimates for 2019 and projections for
376 2030 and 2045: Results from the International Diabetes Federation Diabetes
377 Atlas, 9th edition. *Diabetes Res Clin Pract* 2019;157:107843.
378 <https://doi.org/10.1016/j.diabres.2019.107843>.
- 379 [2] Mandereau-Bruno L, Fosse-Edorh S. Prévalence du diabète traité
380 pharmacologiquement (tous types) en France en 2015. Disparités territoriales et
381 socio-économiques. *Bull Epidémiol Hebd* 2017;27–28:586–91.
- 382 [3] Billionnet C, Mitanchez D, Weill A, Nizard J, Alla F, Hartemann A, et al.
383 Gestational diabetes and adverse perinatal outcomes from 716,152 births in
384 France in 2012. *Diabetologia* 2017;60:636–44. [https://doi.org/10.1007/s00125-](https://doi.org/10.1007/s00125-017-4206-6)
385 [017-4206-6](https://doi.org/10.1007/s00125-017-4206-6).
- 386 [4] Inkster ME, Fahey TP, Donnan PT, Leese GP, Mires GJ, Murphy DJ. Poor
387 glycated haemoglobin control and adverse pregnancy outcomes in type 1 and
388 type 2 diabetes mellitus: systematic review of observational studies. *BMC*
389 *Pregnancy Childbirth* 2006;6:30. <https://doi.org/10.1186/1471-2393-6-30>.
- 390 [5] Ray JG, O'Brien TE, Chan WS. Preconception care and the risk of congenital
391 anomalies in the offspring of women with diabetes mellitus: a meta-analysis.
392 *QJM* 2001;94:435–44. <https://doi.org/10.1093/qjmed/94.8.435>.
- 393 [6] Diabetes and Pregnancy Group. Knowledge about preconception care in French
394 women with type 1 diabetes. *Diabetes Metab* 2005;31:443–7.
395 [https://doi.org/10.1016/s1262-3636\(07\)70214-8](https://doi.org/10.1016/s1262-3636(07)70214-8).
- 396 [7] American Diabetes Association. Cardiovascular Disease and Risk Management:
397 Standards of Medical Care in Diabetes—2020. *Diabetes Care* 2020;43:S111–
398 34. <https://doi.org/10.2337/dc20-S010>.
- 399 [8] O'Brien SH, Koch T, Vesely SK, Schwarz EB. Hormonal Contraception and Risk
400 of Thromboembolism in Women With Diabetes. *Diabetes Care* 2017;40:233–8.
401 <https://doi.org/10.2337/dc16-1534>.
- 402 [9] World Health Organization, Department of Reproductive Health and Research
403 (WHO/RHR), John Hopkins Bloomberg School of Public Health/Center for
404 Communication Programs (CCP), Knowledge for Health Project. Family
405 planning: a global handbook for providers (2018 update). Baltimore and Geneva:
406 CCP and WHO; 2018.
- 407 [10] Trussell J. Contraceptive failure in the United States. *Contraception*
408 2011;83:397–404. <https://doi.org/10.1016/j.contraception.2011.01.021>.
- 409 [11] Fagot-Campagna A, Weill A, Paumier A, Poutignat N, Fournier C, Fosse S, et al.
410 Que retenir du bilan d'Entred 2007-2010 ? *Med Des Mal Metab* 2010;4:212–8.
- 411 [12] Coton SJ, Nazareth I, Petersen I. A cohort study of trends in the prevalence of
412 pregestational diabetes in pregnancy recorded in UK general practice between
413 1995 and 2012. *BMJ Open* 2016;6:e009494. [https://doi.org/10.1136/bmjopen-](https://doi.org/10.1136/bmjopen-2015-009494)
414 [2015-009494](https://doi.org/10.1136/bmjopen-2015-009494).
- 415 [13] Druet C, Bourdel-Marchasson I, Weill A, Eschwege E, Penfornis A, Fosse S, et
416 al. Type 2 diabetes in France: epidemiology, trends of medical care, social and
417 economic burden. *Presse Med* 2013;42:830–8.
418 <https://doi.org/10.1016/j.lpm.2013.02.312>.
- 419 [14] Fagot-Campagna A, Fosse S, Roudier C, Romon I, Penfornis A, Lecomte P, et
420 al. Caractéristiques, risque vasculaire et complications chez les personnes

- 421 diabétiques en France métropolitaine : d'importantes évolutions entre Entred
422 2001 et Entred 2007. *Bull Epidemiol Hebd* 2009;450–5.
- 423 [15] Lemaitre M, Ternynck C, Bourry J, Baudoux F, Subtil D, Vambergue A.
424 Association between HbA1c levels on adverse pregnancy outcomes during
425 pregnancy in type 1 diabetic patients. *J Clin Endocrinol Metab* 2021;dgab769.
426 <https://doi.org/10.1210/clinem/dgab769>.
- 427 [16] Agardh E, Allebeck P, Hallqvist J, Moradi T, Sidorchuk A. Type 2 diabetes
428 incidence and socio-economic position: a systematic review and meta-analysis.
429 *Int J Epidemiol* 2011;40:804–18. <https://doi.org/10.1093/ije/dyr029>.
- 430 [17] Gualdani E, Di Cianni G, Seghieri M, Francesconi P, Seghieri G. Pregnancy
431 outcomes and maternal characteristics in women with pregestational and
432 gestational diabetes: a retrospective study on 206,917 singleton live births. *Acta*
433 *Diabetol* 2021. <https://doi.org/10.1007/s00592-021-01710-0>.
- 434 [18] Magnusson BM, Nield JA, Lapane KL. Age at first intercourse and subsequent
435 sexual partnering among adult women in the United States, a cross-sectional
436 study. *BMC Public Health* 2015;15:98. [https://doi.org/10.1186/s12889-015-1458-](https://doi.org/10.1186/s12889-015-1458-2)
437 [2](https://doi.org/10.1186/s12889-015-1458-2).
- 438 [19] Bajos N, Rahib D, Lydié N. Baromètre santé 2016. Genre et sexualité. D'une
439 décennie à l'autre. Saint Maurice : Santé Publique France 2018:6.
- 440 [20] Britton LE, Hussey JM, Berry DC, Crandell JL, Brooks JL, Bryant AG.
441 Contraceptive Use Among Women with Prediabetes and Diabetes in a US
442 National Sample. *J Midwifery Womens Health* 2019;64:36–45.
443 <https://doi.org/10.1111/jmwh.12936>.
- 444 [21] Rahib D, Le Guen M, Lydié N. Baromètre santé 2016. Contraception. Quatre
445 ans après la crise de la pilule, les évolutions se poursuivent. Saint Maurice :
446 Santé Publique France 2017:8.
- 447 [22] Bajos N, Wellings K, Laborde C, Moreau C, CSF Group. Sexuality and obesity, a
448 gender perspective: results from French national random probability survey of
449 sexual behaviours. *BMJ* 2010;340:c2573. <https://doi.org/10.1136/bmj.c2573>.
- 450 [23] Shawe J, Mulnier H, Nicholls P, Lawrenson R. Use of hormonal contraceptive
451 methods by women with diabetes. *Prim Care Diabetes* 2008;2:195–9.
452 <https://doi.org/10.1016/j.pcd.2008.10.003>.
- 453 [24] Clausen TD, Mathiesen E, Ekbom P, Hellmuth E, Mandrup-Poulsen T, Damm P.
454 Poor Pregnancy Outcome in Women With Type 2 Diabetes. *Diabetes Care*
455 2005;28:323–8. <https://doi.org/10.2337/diacare.28.2.323>.
- 456
- 457

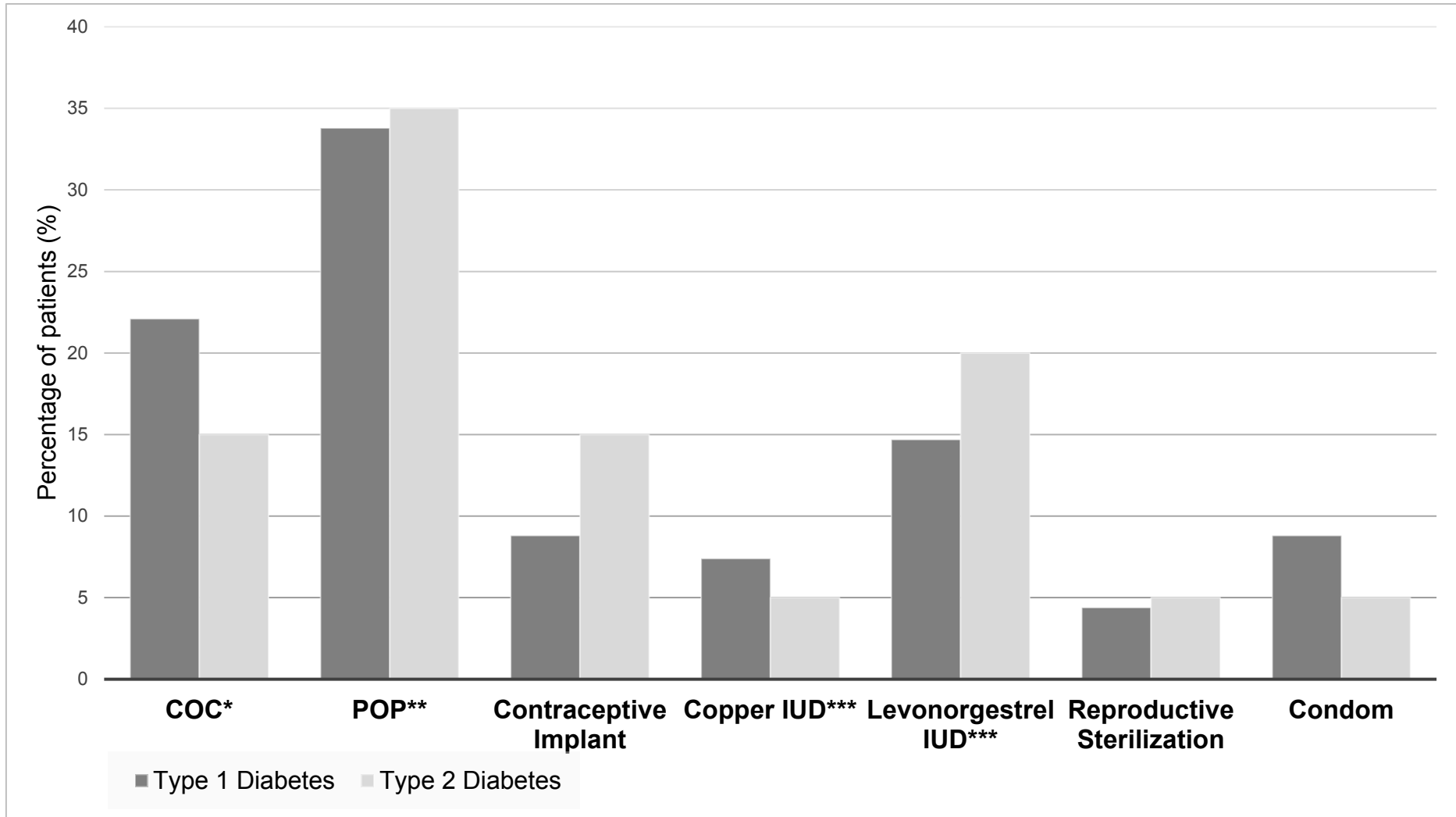


Figure 1: Distribution of contraceptive methods

Results in percentage of patients (%)

*Combined Oral Contraception, **Progestogen-Only Pill, ***Intrauterine Device

Table 1: Population Characteristics

Characteristics ^a	Number ^b	Total Population	Type 1 Diabetes	Type 2 Diabetes	<i>p</i>
Age (years)	122	29.1 ± 6.3	27.9 ± 6.3	32.6 ± 4.6	<0.0001
BMI ^c (kg/m ²)	112	28.9 ± 8.3	25.8 ± 5.4	37.6 ± 8.7	<0.0001
<i>Normal</i>		41 (36.6)	41 (50.0)	0 (0.0)	<0.0001
<i>Overweight</i>		30 (26.8)	24 (29.3)	6 (20.0)	
<i>Obese</i>		41 (36.7)	17 (20.7)	24 (80.0)	
Duration of diabetes, median [minimum-maximum] (years)	118	10 [0.5-33]	13 [0.5-33.0]	3 [1.0-11.0]	<0.0001
Last HbA1c, mean ± standard deviation [Median]	119	7.6 ± 1.6 [7.4]	7.8 ± 1.6 [7.5]	7.1 ± 1.3 [6.7]	0.03
Diabetic complications					
<i>Retinopathy</i>	122	12 (9.8)	12 (13.5)	0 (0.0)	0.04
<i>Nephropathy</i>	122	8 (6.6)	6 (6.7)	2 (6.1)	0.99
<i>Neuropathy</i>	122	1 (0.8)	1 (1.1)	0 (0.0)	0.99
<i>Myocardial Infarction</i>	122	1 (0.8)	1 (1.1)	0 (0.0)	0.99
Medical/Surgical History					
<i>Personal/Familial History of venous thromboembolism</i>	86	9 (10.5)	5 (8.2)	4 (16.0)	0.44
<i>Personal history of cardiovascular disease</i>	86	1 (1.2)	1 (1.6)	0 (0.0)	0.71
<i>Migraine with aura</i>	86	11 (12.8)	6 (9.8)	5 (20.0)	0.28
<i>Hypertension</i>	88	14 (15.9)	5 (8.1)	9 (34.6)	0.004
<i>Active Smoking or cessation ≤ 3 years</i>	110	29 (26.4)	22 (28.2)	7 (21.9)	0.33
<i>Antiepileptic or HIV^d therapy</i>	86	1 (1.2)	1 (1.6)	0 (0.0)	0.99
<i>Bariatric Surgery</i>	86	5 (5.8)	2 (3.3)	3 (12.0)	0.14
Ongoing Pregnancy	122	10 (8.2)	6 (6.7)	4 (12.1)	0.27
Patients with one or more pregnancy	122	56 (45.9)	36 (40.4)	20 (60.6)	0.047
Patients with one or more children	122	47 (38.5)	29 (32.6)	18 (54.5)	0.03

^a Results presented as mean ± standard deviation or number (%) unless otherwise specified, ^b Number of patients for whom data were available, ^c Body Mass Index, ^d Human Immunodeficiency Virus

Table 1: Population Characteristics

Characteristics ^a	Number ^b	Total Population	Type 1 Diabetes	Type 2 Diabetes	<i>p</i>
Age (years)	122	29.1 ± 6.3	27.9 ± 6.3	32.6 ± 4.6	<0.0001
BMI ^c (kg/m ²)	112	28.9 ± 8.3	25.8 ± 5.4	37.6 ± 8.7	<0.0001
<i>Normal</i>		41 (36.6)	41 (50.0)	0 (0.0)	<0.0001
<i>Overweight</i>		30 (26.8)	24 (29.3)	6 (20.0)	
<i>Obese</i>		41 (36.7)	17 (20.7)	24 (80.0)	
Duration of diabetes, median [minimum-maximum] (years)	118	10 [0.5-33]	13 [0.5-33.0]	3 [1.0-11.0]	<0.0001
Last HbA1c, mean ± standard deviation [Median]	119	7.6 ± 1.6 [7.4]	7.8 ± 1.6 [7.5]	7.1 ± 1.3 [6.7]	0.03
Diabetic complications					
<i>Retinopathy</i>	122	12 (9.8)	12 (13.5)	0 (0.0)	0.04
<i>Nephropathy</i>	122	8 (6.6)	6 (6.7)	2 (6.1)	0.99
<i>Neuropathy</i>	122	1 (0.8)	1 (1.1)	0 (0.0)	0.99
<i>Myocardial Infarction</i>	122	1 (0.8)	1 (1.1)	0 (0.0)	0.99
Medical/Surgical History					
<i>Personal/Familial History of venous thromboembolism</i>	86	9 (10.5)	5 (8.2)	4 (16.0)	0.44
<i>Personal history of cardiovascular disease</i>	86	1 (1.2)	1 (1.6)	0 (0.0)	0.71
<i>Migraine with aura</i>	86	11 (12.8)	6 (9.8)	5 (20.0)	0.28
<i>Hypertension</i>	88	14 (15.9)	5 (8.1)	9 (34.6)	0.004
<i>Active Smoking or cessation ≤ 3 years</i>	110	29 (26.4)	22 (28.2)	7 (21.9)	0.33
<i>Antiepileptic or HIV^d therapy</i>	86	1 (1.2)	1 (1.6)	0 (0.0)	0.99
<i>Bariatric Surgery</i>	86	5 (5.8)	2 (3.3)	3 (12.0)	0.14
Ongoing Pregnancy	122	10 (8.2)	6 (6.7)	4 (12.1)	0.27
Patients with one or more pregnancy	122	56 (45.9)	36 (40.4)	20 (60.6)	0.047
Patients with one or more children	122	47 (38.5)	29 (32.6)	18 (54.5)	0.03

^a Results presented as mean ± standard deviation or number (%) unless otherwise specified, ^b Number of patients for whom data were available, ^c Body Mass Index, ^d Human Immunodeficiency Virus

Table II: Knowledge and misconceptions about diabetic pregnancy risks

Variables^a	Total Population	Type 1 Diabetes	Type 2 Diabetes	p
Knowledge – Miscarriage				0.40
– Yes	70 (57.9)	54 (61.4)	16 (48.5)	
– No	19 (15.7)	12 (13.6)	7 (21.2)	
– IDK ^b	32 (26.4)	22 (25.0)	10 (30.3)	
Knowledge – Malformations				0.10
– Yes	87 (71.9)	66 (75.0)	21 (63.6)	
– No	11 (9.1)	5 (5.7)	6 (18.2)	
– IDK ^b	23 (19.0)	17 (19.3)	6 (18.2)	
Knowledge – Stillbirth				0.39
– Yes	59 (48.8)	46 (52.3)	13 (39.4)	
– No	22 (18.2)	14 (15.9)	8 (24.2)	
– IDK ^b	40 (33.0)	28 (31.8)	12 (36.4)	
Knowledge – Fetal Macrosomia				0.28
– Yes	86 (71.1)	66 (75.0)	20 (60.6)	
– No	15 (12.4)	9 (10.2)	6 (18.2)	
– IDK ^b	20 (16.5)	13 (14.8)	7 (21.2)	
Misconceptions – Neonatal Diabetes				0.13
– Yes	60 (49.6)	39 (44.3)	21 (63.6)	
– No	32 (26.4)	27 (30.7)	5 (15.2)	
– IDK ^b	29 (24.0)	22 (25.0)	7 (21.2)	
Misconceptions – No risk for pregnancy				0.10
– Yes	3 (2.5)	3 (3.4)	0 (0.0)	
– No	104 (85.9)	78 (88.6)	26 (78.8)	
– IDK ^b	14 (11.6)	7 (8.0)	7 (21.2)	

^a Results presented as number (%), ^b I Don't Know

Table III: Sexuality and contraception

Variables ^a	Number	Total Population	Type 1 Diabetes	Type 2 Diabetes	p
Patients who had already had sexual intercourse	122	110 (90.2)	81 (91.0)	29 (87.9)	0.73
Age of first sexual intercourse (years)	105	17.4 ± 2.5	17.2 ± 2.3	18.2 ± 2.9	0.07
Patients who had already used contraception	122	108 (88.5)	80 (89.9)	28 (84.9)	0.52
Age of first contraception (years)	104	17.5 ± 3.3	17.1 ± 2.3	18.9 ± 5.1	0.09
Patients currently using contraception	122	88 (72.1)	68 (76.4)	20 (60.6)	0.08

^a Results presented as mean ± standard deviation or number (%) unless otherwise specified

Table IV: Univariate and Multivariate analysis of the factors associated with appropriate knowledge about diabetic pregnancy

Variables ^a	Patients with appropriate knowledge (n=70)	Patients without appropriate knowledge (n=51)	Univariate analysis	Multivariate analysis ^b	
			p	OR ^c [CI 95% ^d]	p
Type of diabetes			0.003		0.007
<i>Type 1</i>	58/88 (65.9)	30/88 (34.1)		4.9 [1.5-15.9]	
<i>Type 2</i>	12/33 (36.4)	21/33 (63.6)			
Sexually active			0.20		
Yes	66/110 (60.0)	44/110 (40.0)			
No	4/11 (36.4)	7/11 (63.6)			
Use of contraception			0.39		
Yes	53/88 (60.2)	35/88 (39.8)			
No	17/33 (51.5)	16/33 (48.5)			
Number of pregnancies			0.005		0.002
No pregnancy	30/65 (46.2)	35/65 (53.8)		5.8 [1.9-17.8]	
One or more pregnancy	40/56 (71.4)	16/56 (28.6)			
Diabetes complications			0.41		
No complication	58/103 (56.3)	45/103 (43.7)			
One or more complication	12/18 (66.7)	6/18 (33.3)			
Duration of diabetes (years)	8.1 ± 6.7	13.1 ± 8.5	0.0009		
Significant gynaeco-obstetrical histories			0.03		
No histories	29/61 (47.5)	32/61 (52.5)			
One or more histories	26/37 (70.3)	11/37 (29.7)			

^a Results presented as mean ± standard deviation or number (%) unless otherwise specified,

^b Variables included in multivariate analysis were the type of diabetes, the histories of one or more pregnancies, the duration of diabetes and the presence of significant gynaeco-obstetrical histories,

^c Odd Ratio, ^d Confidence Interval 95%