

1 **Sex, Gender, and Diversity Analysis in Research Policies of Major Public Granting**
2 **Agencies: A Global Review**

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11

12 **Abstract**

13 National research agencies are funded by taxpayer monies and, as such, are responsible for
14 promoting excellent research that benefits all of society. Integrating sex, gender and diversity
15 analysis (SG&DA) into the design of research, where relevant, can improve research
16 methodology and provide new insights. To realize this potential, funding agencies have
17 developed policies for integrating this type of analysis into the grant proposal process. This study
18 reviews those policies for 23 agencies across six continents. Overall, one agency achieved
19 superior performance, six agencies scored excellent performance, five showed average
20 performance, two need some improvement and nine require improvement. Our study developed a
21 five-part SG&DA policy roadmap for agencies and collected best practices across that guide.
22 Standard practices, tailored as appropriate to country-specific cultures and regulatory landscapes,
23 will enhance collaboration potential, global equity, research excellence and reproducibility.

24

25 **Introduction**

26 Flawed research costs lives and money, and can lead to inequitable outcomes. Integrating sex,
27 gender and diversity analysis (SG&DA) into the design of research, where relevant, can improve
28 research methodology, enhance excellence in science and make research more responsive to
29 social needs¹. To realize this potential, funding agencies have begun implementing policies for
30 integrating this type of analysis into the grant proposal process. In 2003, the European
31 Commission (EC) endorsed ‘questioning systematically whether, and in what sense, sex and

32 gender are relevant in the objectives and methodology of projects². Other public-funding
33 agencies followed suit with policies implemented at the Canadian Institutes of Health Research
34 (2010), U.S. National Institutes of Health (2016), German Research Foundation (2020), National
35 Research Foundation of Korea (2020), among others.

36
37 Funding agencies are one of three pillars of the science infrastructure that need to coordinate
38 policies to achieve excellence in science; agencies can encourage integrating SG&DA at the
39 beginning of research¹. Pillar two, universities and research institutions, are responsible for
40 developing methods for this type analysis and for providing this expertise to future generations.
41 While faculties of humanities and social sciences typically include sex, gender and diversity
42 analysis in their curricula, many faculties of science, medicine and engineering fall short of
43 integrating knowledge of SG&DA into their core curricula³. Pillar three, peer-reviewed journals,
44 increasingly do so at the end when selecting manuscripts for publication^{4,5}. *The Lancet* and
45 *Nature*, for example, have implemented such policies^{6,7}.

46
47 Several national funding agencies plus the EC have reviewed their policies for integrating sex
48 and gender analysis into research design⁸⁻¹². One study, by the Global Research Council's
49 Gender Working Group, included questions about these policies in their larger survey on gender-
50 disaggregated data collection among their 128 member organisations. Overall, 65 agencies
51 responded. Of these, 23% collected data on the number of funded projects that include a gender
52 dimension, 15% collected data on sex and gender considerations in research design and 9%
53 collected data on sex and gender considerations in dissemination of research¹³. The Gender
54 Working Group, however, did not assess the quality of these policies. The Swedish Secretariat
55 for Gender Research also conducted a global review, with 28 agencies responding. They found
56 that agencies tended to confuse gender balance in teams with gender analysis in research
57 design¹⁴.

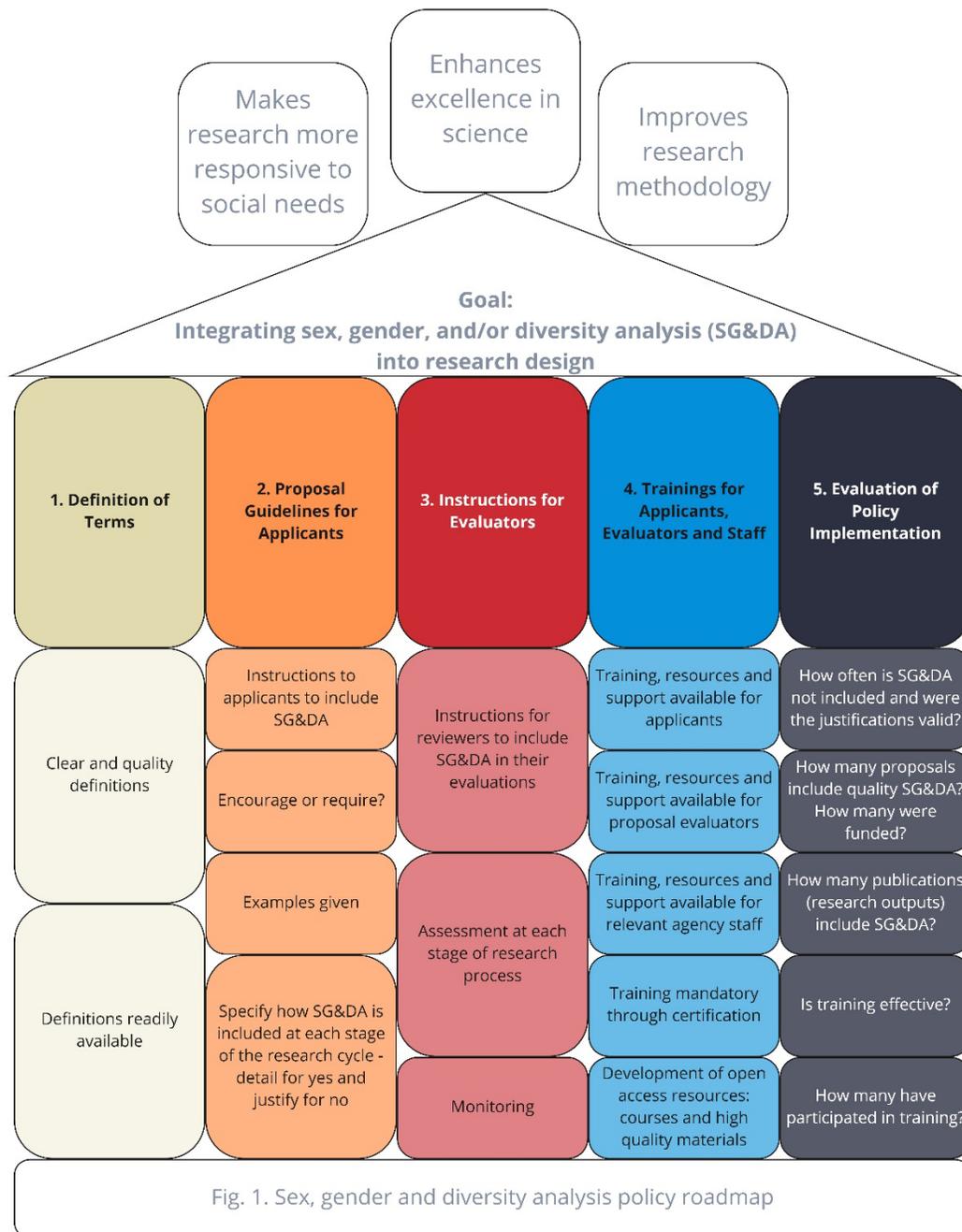
58
59 This study reviews SG&DA policies of 23 national public granting agencies across five global
60 regions. Our purpose is to provide a global map of best practices in agency policies and
61 processes, and to provide a framework for funders as they develop policies to ensure
62 international standards of excellence. Our results are divided into five sections: definitions of

63 terms, instructions for applicants, instructions for evaluators, trainings provided to applicants,
64 evaluators and staff, and agency evaluation of policy implementation. Our goal is to help
65 standardize international policies in this area while being sensitive to country-specific cultural
66 differences and regulatory landscapes.

67

68 **SG&DA Policy Roadmap and Agency Performance**

69 Based on a literature review and prior research¹⁵, we developed an instrument, consisting of a
70 five-part guide for evaluating successful funding agency policy for SG&DA in research design
71 (Fig. 1). We convened an international advisory group (Supplementary Information section 1)
72 that included representatives from public funders, expert researchers and policy specialists to
73 discuss and improve the roadmap's clarity, specificity and applicability.



75

76 We tested our framework through a pilot study of six funding agencies: the Canadian Institutes
 77 of Health Research (CIHR), EC, German Research Foundation (DFG), Irish Research Council
 78 (IRC), National Research Foundation of Korea (NRF) and US National Institutes of Health
 79 (NIH). Through an iterative process, we refined both the instrument and the scoring matrix.

80

81 We invited 34 additional funding agencies to participate. In consultation with our advisory
 82 board, we selected countries based on geographic spread with the goal of including agencies
 83 from all continents that host such agencies. To maintain a global balance we limited the number
 84 of European funders invited. Only major publicly funded granting agencies at the national level
 85 were eligible. Of the 34 invited, 17 agreed, yielding a final sample of 23 agencies (Table 1).
 86

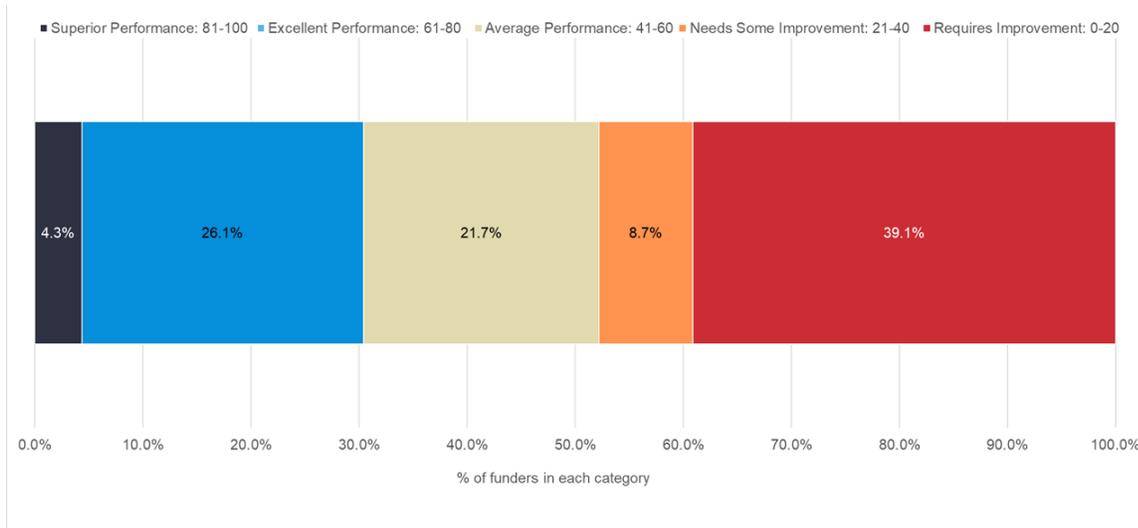
Region	Invited funders	Proportion of invited funders	Participating funders	Proportion of participating funders	Response rate
Europe and Central Asia	14	35.0%	9	39.1%	64.3%
Africa and Middle East	11	27.5%	3	13.0%	27.3%
South & East Asia and Pacific	7	17.5%	4	17.4%	57.1%
North America	5	12.5%	5	21.7%	100.0%
Latin America and Caribbean	3	7.5%	2	8.7%	66.7%
Total	40		23		

87 **Table 1. Global spread of participating agencies**

88
 89 Funders were invited to complete an online questionnaire and provided a detailed guidance note
 90 (invitation, Supplementary Information section 2; questionnaire, section 3; guidance note,
 91 section 4). Agencies were required to provide evidence (either publicly available or internally
 92 agreed upon) for each answer. Each agency was scored by two evaluators (scoring matrix,
 93 Supplementary Information section 5). All scores are confidential to funders and reported here
 94 only in aggregate.
 95

96 Overall, one agency achieved Superior Performance, six agencies scored Excellent Performance,
 97 five showed Average Performance, two Need Some Improvement and nine Require
 98 Improvement (Fig. 2).

99
 100



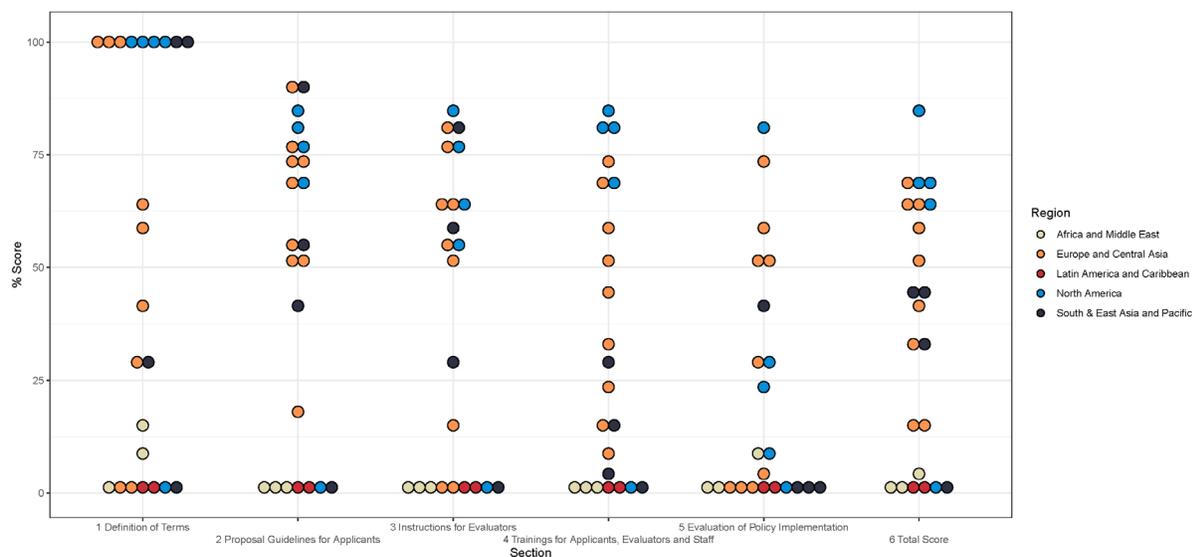
101

102 **Fig 2. Agencies per scoring bracket.** Almost half of the agencies studied require improvements
 103 to their SG&DA policies.

104

105 Agencies in Europe, North America and Asia/Pacific were among the highest scorers (Fig. 3).
 106 Across all global areas, almost half of agencies provided quality definitions of terms (44% were
 107 in the Excellent/Superior Performance category). Similarly, almost half of agencies have some
 108 form of proposal guidelines for applicants. Section five, evaluation of policy implementation,
 109 was the weakest, with only 9% of agencies scoring in the Excellent Performance category and
 110 none in the Superior category (Supplementary Information section 6).

111

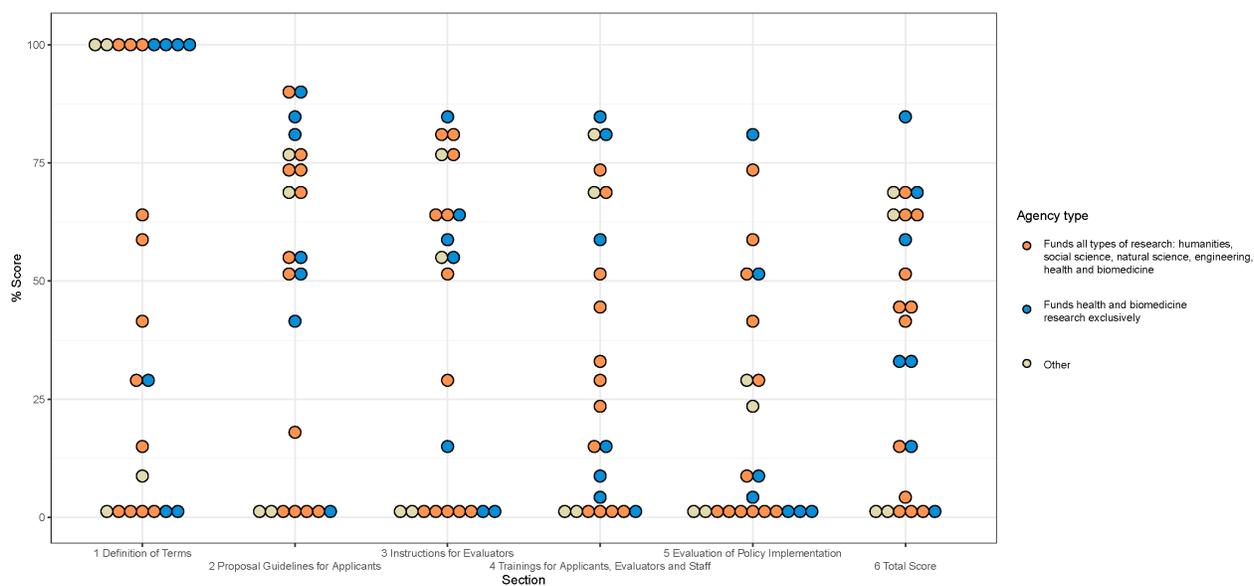


113 **Fig. 3. Agency scores across the five assessed sections, by region.**

114

115 One complicating factor in comparing agencies is that some agencies span all fields of the
 116 human and natural sciences, technology, and health and biomedicine while others focus
 117 exclusively on health and biomedicine, the social sciences or humanities. When we divided our
 118 data by agency type, we found no striking differences, suggesting that funders with wide remits
 119 can successfully implement these policies (Fig. 4).

120



122 **Fig. 4. Agency scores across the 5 assessed sections, by type of funding.**

123

124 **Emerging Best Practices**

125 Here we explore key considerations for each part of our SG&DA policy roadmap and highlight
126 leading-edge policies that may serve as models.

127

128 **Definition of terms**

129 The first step in policy development is clear definition of terms. We chose to evaluate agencies
130 on ‘sex’ and ‘gender’ analysis because sex and gender were historically the categories included
131 in agency policy, for example, by the EC. While sex is a biological characteristic of humans and
132 numerous non-human organisms and is an important category to continue to call out, gender is at
133 the same epistemic level as other aspects of sociocultural diversity. We privilege gender here
134 because most agency policy include this term, and this allowed us to evaluate developed policy
135 practices. Second, we considered evaluating on intersectional analysis but, after policy reviews
136 and consultation with our advisory board, judged diversity a more generally used term.

137

138 Different countries have different regulatory landscapes and axes of historical discrimination.
139 This will influence each agency’s choice of which diversity characteristics to prioritize. Funders
140 are increasingly moving beyond sex and gender to include other categories of diversity. Some
141 agencies, such as those in Australia, use guidelines set through national legislation as drivers for
142 updating definitions¹⁶. We would expect an intersectional approach across sociocultural aspects
143 of diversity.

144

145 In this section, we evaluated: a. whether agencies have clear definitions for sex, gender, other
146 diversity or intersectional characteristics; and b. whether these definitions were easily found. It is
147 important that the same definitions are shared with applicants, evaluators and staff to support
148 consistency across the agency. For example, the Canadian Tri-Agency (CIHR, Natural Sciences
149 and Engineering Research Council of Canada (NSERC) and Social Sciences and Humanities
150 Research Council) provides web portals and guidance in both English and French describing
151 Gender-Based Analysis Plus (GBA+) that links across agency materials ¹⁷⁻²².

152

153 Agencies seeking model definitions of key terms can find peer-reviewed definitions of sex,
154 gender, intersectionality and race & ethnicity on the Gendered Innovations website²³. This

155 resource has been developed, since 2011, in collaboration with the EC. Other model definitions
156 of sex and gender are available at the NIH²⁴ and sex, gender and intersectionality at CIHR²⁵⁻²⁷.

157

158 **Proposal guidelines for applicants**

159 Agencies take four basic approaches in their request to applicants to integrate SG&DA into their
160 proposal, where relevant: most encourage applicants to integrate SG&DA; some flag research
161 areas where this type of analysis is expected; a few require this type of analysis; some only
162 encourage applicants but instruct evaluators to score this element, making it de facto mandatory.
163 In this study, more points were awarded to funders who required SG&DA; however, more
164 research is needed to determine the differential impact of these various approaches. In all cases,
165 the ‘where relevant’ is crucial. No agency asks for SG&DA in pure mathematics, for example,
166 where no body of literature has established its relevance.

167

168 The trajectory of the EC is of interest. Since 2003, the Commission has encouraged sex and
169 gender analysis, referred to as the ‘gender dimension’, in research. To strengthen the policy,
170 Horizon 2020 in 2014 flagged topics for which taking the gender dimension into account was
171 mandatory. Since 2021, Horizon Europe requires all proposals to consider sex, gender and
172 intersectional analysis in research, unless otherwise specified. The Horizon Europe Programme
173 Guide states: ‘the integration of the gender dimension into research and innovation
174 content...becomes a requirement by default...unless the non-relevance for a specific topic is
175 specified [by the Commission] in the topic description’²⁸.

176

177 The US NIH have, since 2016, required all applicants to consider ‘sex as a biological variable’
178 (SABV) and have published peer-reviewed articles detailing how this type of analysis supports
179 good science^{29,30}. This requirement supplements policies for inclusion in clinical trials launched
180 in the 1990s that focused on sex/gender, race and ethnicity^{31,32} and, in clinical research, age
181 (Inclusion Across the Lifespan³³) added in 2019.

182

183 The DFG implemented its SG&DA guidelines in 2020 after a two-year consultation and study
184 period. They read, ‘researchers examine whether and to what extent gender and diversity
185 dimensions may be of significance to the research project (with regard to methods, work

186 programme, objectives, etc.)³⁴. The DFG does not require applicants to address SG&DA,
187 emphasizing that it funds ‘proposals in curiosity-driven basic research’ in fields selected by
188 applicants where freedom of research is core³⁵. In the evaluation process, however, reviewers are
189 instructed to take SG&DA into account. Similar to the EC, the DFG scores SG&DA under the
190 ‘excellence’ or ‘intellectual merit’ criteria for research design.

191
192 Many funding agencies set policy through national legislation. In Japan, the government renews
193 both the basic plans for Science, Technology and Innovation (STI) and Gender Equality (GE)
194 every five years. In 2020, the sixth STI Basic Plan and the fifth GE Basic Plan both included
195 integrating the gender perspective and gender analysis into research and technology
196 development^{36,37}. In 2021, the Republic of Korea passed the Amendment of the Framework Act
197 on Science and Technology to include integrating sex and gender into research³⁸. This
198 strengthened the Korean NRF’s funding policy for research that promotes national economic
199 development and the quality of citizens’ lives.

200
201 Agencies provide instructions to applicants in various ways. Some funders provide checklists³⁹
202 or key questions⁴⁰ to help applicants decide whether SG&DA is relevant for their research.
203 Others provide separate FAQs⁴¹ or include a description⁴² of what is expected in the overall
204 research. Still others include a mandatory open-ended text box on the submission form for
205 applicants to indicate how SG&DA is integrated into the proposal or to justify its exclusion⁸. In
206 our study, we evaluated whether applicants are instructed to detail how SG&DA analysis is
207 incorporated into all phases of research—from establishing project objectives to developing
208 methodologies, gathering and analysing data, to evaluating and reporting results^{43,44}. If SG&DA
209 is not relevant to the proposed research, applicants should be asked to provide literature to
210 demonstrate that no sex, gender or other relevant differences have been found⁸.

211 212 **Instructions for evaluators**

213 Evaluators are crucial to the success of these policies. To be successful, agencies must instruct
214 evaluators to consider sex, gender and/or diversity analysis across all stages of the research
215 process. CIHR found that ‘targeting applicants alone to adopt new sciences policies without
216 concomitant pressure by evaluators...may not be effective’⁸. Since 2018, CIHR has required

217 evaluators to rate the quality of the SG&DA as a ‘strength’, ‘weakness’ or ‘not applicable’ and to
218 provide a rationale for their rating along with recommendations to applicants for improvement.

219
220 Funders should provide applicants and evaluators similar forms and instructions for consistency
221 across the research process. Some agencies, such as the EC, are limited in the overall instructions
222 they can provide on this particular requirement given the number of topics that need to be
223 covered. Agencies may provide ‘good research guides’ that reference assessing SG&DA
224 alongside other elements of peer review, such as ethics and reproducibility³⁴.

225
226 Agencies must monitor the evaluation process to confirm that SG&DA is addressed in reviewer
227 comments and that those comments are high quality. CIHR, for example, samples 5% of
228 reviewer rationale for their SG&DA ratings⁸.

229

230 **Trainings for applicants, evaluators and staff**

231 SG&DA is not yet consistently part of university curricula in the physical and life sciences,
232 health and biomedicine, and engineering. Until universities step up to the task, funding agencies
233 need to fill this gap.

234

235 Some funding agencies provide excellent training for applicants, evaluators and agency staff.
236 Some are in-person (or virtual) workshops with experts; some are dedicated websites, booklets,
237 videos and other similar resources. The most comprehensive open access training to date is by
238 CIHR and NIH. Each of these agencies provides on-line, interactive courses on health, medicine
239 and biomedical research. CIHR released three online trainings in 2015, entitled ‘integrating sex
240 and gender into biomedical research’, ‘sex and gender in primary data collection with humans’
241 and ‘sex and gender analysis of secondary data from human participants’⁴⁵.

242

243 After a multi-year consultancy with numerous experts, NIH released four, interactive courses
244 designed to assist the biomedical research community—including researchers, grant applicants
245 and peer reviewers—account for and appropriately integrate SABV across the full spectrum of
246 biomedical sciences: the Health of Women and Men, Experimental Design, Analyses and
247 Research Reporting⁴⁶.

248
249 CIHR evaluated the effectiveness of their online trainings. The trainings themselves included a
250 pre-test and a post-test, which showed that 62% of participants who completed the basic science
251 module demonstrated improved knowledge, 84% those completing the human data collection
252 module and 73% of those completing the secondary data analysis module demonstrated
253 improved knowledge of sex and gender analysis⁴⁷.

254
255 Similar training materials are required for subjects not covered, such as engineering (e.g.
256 mechanical, civil and electrical), computer science (e.g. natural language processing, computer
257 vision and machine learning) marine science and environmental sciences. The EC supported the
258 Gendered Innovations Expert Groups in 2011-2013 and 2018-2020 to create case studies across
259 EC funding areas^{43,48}. DFG has some introductory materials⁴⁹. All Canadian Tri-Agency
260 materials are in English and French; Gendered Innovations has been translated in full or in part
261 into Chinese, French, German, Spanish and Swedish. Additional translations of training
262 materials would support researchers more globally. Agencies can coordinate and share trainings
263 internationally; there is no need to duplicate efforts, except where specific cultural needs require
264 a particular approach.

265
266 Most trainings are voluntary. However, some funders, CIHR for example, require applicants to
267 submit a certificate of completion for some large, strategic competitions. Use of the same
268 training materials by applicants, evaluators and agency staff helps ensure consistency in policies,
269 terminology and expectations. The EC and CIHR, however, found that evaluators valued
270 coaching tailored to their research area^{50,8}. This training may be provided as part of the reviewer
271 induction process. For agency staff, some funders embed SG&DA training requirements in the
272 agency's overall equality plans⁵¹.

273
274 Some agencies foster training in this area through research institutions. The NIH, for example,
275 has invested \$160 million in Specialized Centers of Research Excellence across 25 research
276 institutions to 'train researchers in experimental design and analyses that consider sex and/or
277 gender'. These research hubs also support the development of standards and policies for
278 analysing SABV and sex differences in biomedical research⁹. Professional societies and

279 academies could support these efforts by integrating these topics into their licensing and
280 professional development materials.

281

282 **Evaluation of policy implementation**

283 Only three agencies in our study had performed policy implementation evaluations. A further
284 nine were in the planning stages; the majority had no plans in place. We strongly recommend
285 that agencies implement evaluation plans as they develop policies in order to facilitate
286 appropriate quantitative and qualitative evaluation.

287

288 We recommend a multi-part evaluation:

289 1. The number and proportion of grants that include SG&DA. CIHR found that from 2011
290 to 2019, the proportion increased from 22% to 83% for sex analysis and from 12% to
291 33% for gender analysis. The level of integration differed across sectors with the lowest
292 in biomedical and the highest in clinical research⁸. An independent study of the NIH
293 found that applicants who adequately addressed SABV in their experimental design,
294 analysis and reporting rose from 51% in 2016 to 66% in 2017⁵².

295

296 2. The quality of SG&DA in proposals. The EC conducted a mid-term evaluation of
297 Horizon 2020 in 2017, including the quality of the gender dimension. They considered
298 methods, impacts, dissemination and also whether the project had moved the gender
299 dimension ahead in that field and could serve as a ‘good practice.’ They concluded that
300 the quality of the gender dimension in project proposals was not high and that more
301 training was needed¹⁰.

302

303 For agencies where SG&DA is a separate question, policy evaluators may monitor the
304 quality of reviewers’ work by checking correlations between reviewers’ scores and the
305 quality of applicants’ proposals⁵³. This may also be used to measure evaluation quality
306 across different funding streams.

307

308 CIHR built the assessment of the quality of SG&DA in proposals into the review process.

309 As noted above, CIHR requires evaluators to rate the sex and gender aspects of proposals

310 and to provide a rationale for that rating⁸. Each application is evaluated by three
311 independent evaluators; applications that receive the top score from at least two
312 evaluators is considered high quality.

313
314 Qualitative analysis showed conflation of the terms sex and gender at both the EC and
315 CIHR.

316
317 3. The quality of evaluators' scoring and comments. CIHR manually sampled 5% of
318 evaluators' comments to check the quality of responses⁸.

319
320 The EC reviewed the effectiveness of review panels and found that only 36% considered
321 the gender dimension and of those 70% included a gender expert, suggesting that review
322 panels require guidance from experts¹⁰.

323
324 The EC experimented with computer-assisted textual analysis given the volume of
325 applications per year¹⁰. These methods are in their infancy.

326
327 An external review of NIH found that, in 2017, 88% of reviewers felt confident that they
328 understood the SABV policy, but only 68% thought that SABV was important for all
329 NIH funded research⁵². This study did not evaluate the quality of reviewers' evaluations.

330
331 4. The number of applicants, evaluators and staff who engaged in trainings and what type of
332 training. If possible, the correlation between trainings applicants attend and the success of
333 proposals submitted post-training should be assessed. Some funders, such as the Spanish
334 Carlos III Health Institute, reported in our questionnaire that they monitor the number of
335 applicants who participate in SG&DA training and are setting targets to improve this over
336 time.

337
338 5. The number and proportion of peer-reviewed publications or other recognized modes of
339 dissemination that result from grants that incorporated SG&DA. To monitor this, funders
340 will need to track papers and research outputs using grant numbers. Science Foundation

341 Ireland (SFI) reported in our study that they collect researcher-reported publication data
342 to check that proposals that included sex and/or gender analysis reported that dimension
343 in publications. This will allow SFI scientific program managers to raise any concern at
344 the mid-term award review.

345
346 Through their review process, CIHR found other correlations of note. Consistent with
347 other literature⁵⁴, CIHR discovered that women applicants are more likely to integrate sex
348 and gender analysis into their proposals. Further, they found that applicants who scored
349 well on the sex/gender question scored well overall, i.e. this improved the overall quality
350 of the proposal, and applicants were more likely to get funded⁸.

351
352 SG&DA policies are only as good as their outcomes, namely the impact on the research outputs.
353 It was difficult to develop scoring mechanisms for this study that accurately correlate with
354 impactful SG&DA policies because so few funders have such policies in place and even fewer
355 have evaluated those policies. While we have established essential elements of quality SG&DA
356 policies through our five-part policy roadmap, further quantitative and qualitative analysis is
357 necessary to validate the scoring. This includes the weighting of the five sections to help
358 understand which elements provide the best policy outcomes. However, all aspects of the scoring
359 framework are necessary for a successful policy; none stands on its own.

360

361 **The Road Forward**

362 As an immediate next step, we will work with colleagues globally to provide a toolkit of best
363 policies and practices to consider when implementing policy to be hosted by Gendered
364 Innovations. As we continue to test our evaluation strategy, it may be appropriate to add sections
365 to our policy roadmap. Agencies, for example, may support SG&DA with different funded
366 initiatives. In addition to their Centers of Excellence mentioned above, the NIH convened a key
367 stakeholders workshop to develop methods and techniques to support SABV. They also provide
368 a Sex/Gender Administrative Supplement to encourage researchers with ongoing NIH funding to
369 integrate sex and gender analysis where it may still be lacking. Finally, they issue calls for
370 proposals in areas that require more research, such as analysing how sex and gender interact in

371 health outcomes⁹. Similarly, the EC will offer funding to gender studies and intersectional
372 research to support SG&DA²⁸.

373
374 A trend we continue to watch is the broadening of sex and gender analysis to include other social
375 dimensions. Already, the EC has added ‘intersectional’ analysis to their Gender Dimension;
376 these policies, however, remain under the broader Gender Equality strategy. The DFG started
377 with sex, gender and ‘diversity’ on equal terms. The NIH has included ‘age’, which they term
378 ‘Inclusion across the Lifespan’. A number of funding agencies, such as NSERC, have signaled
379 that they incorporate research design policies under a broader Equity, Diversity and Inclusion
380 (EDI) umbrella⁴⁴. This change in terminology reflects the overarching objectives of NSERC to
381 incorporate wider aspects of diversity into the research process. In the past, EDI has typically
382 focused on ‘who’ is doing the research not ‘how’ research is done, meaning that special care will
383 be needed to expand EDI to include research methodologies.

384
385 Publicly funded research agencies began implementing SG&DA policies in the 2000s. The goal
386 of our study has been to evaluate those policies and practices, while being sensitive to unique
387 regulatory and cultural research ecosystems. Our five-part SG&DA policy roadmap (Fig. 1) is
388 designed to lay out key elements for effective policy in this area. Effective SG&DA policy is not
389 a single question added to instructions to applicants, but consists of quality definitions of terms,
390 proposal guidelines for applicants, instructions for evaluators, training for applicants, evaluators
391 and staff, and evaluation of policy implementation. This project provides agencies with a
392 roadmap of best practices globally for promoting rigorous, reproducible and equitable research.
393 Through this process, we seek to ensure international standards of research excellence.

394
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397
398 **Author Contributions:** LH and LS developed all materials, administered the questionnaire,
399 scored results, conceptualised and wrote the paper. LH created the visualisations.

400
401 **No competing interests.**

402

403 **Supplementary Information** is available for this paper.

404

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