



Methods Report

BERLIN SCIENCE SURVEY

Pilot study winter semester 2021/2022

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The logo for the Berlin University Alliance features three overlapping, stylized shapes: a red triangle pointing right, a green triangle pointing left, and a blue triangle pointing right.

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Preliminary note

The Berlin Science Survey (BSS) is the core of the project "Berlin Research Landscape," which is located at the Robert K. Merton Center (RMZ) of Humboldt-Universität zu Berlin. The project is funded by Objective 3 of the Berlin University Alliance (BUA).

More information about the project can be found here:

www.berlinsciencesurvey.de

1. Target population and field access

1.1 Target population

The target population of the Berlin Science Survey (BSS) consists of scientists from the Berlin metropolitan area. In order to reach the target population appropriately, first, all BUA scientists were addressed, i.e., all scientists working primarily at the following institutions: Freie Universität zu Berlin (FU), Humboldt-Universität zu Berlin (HU), Technische Universität Berlin (TU), and Charité-Universitätsmedizin Berlin.

In addition, the questionnaire was adapted for the Berlin Research 50 (BR50) to include scientists from Berlin's non-university research institutions.

Since the 2022 baseline survey is the pilot study, not all subgroups of the target group were considered here. Thus, scientists from the universities of applied sciences (HAWs) in Berlin were not included in the sample for this baseline survey.

1.2 Field access

Since the email addresses of the scientists are not available as a complete list at all institutions, and researching addresses via the internet would have been beyond the scope of the baseline survey, two approaches were pursued in order to reach as high a proportion of the target population as possible:

First, PR efforts were used to provide information about the BSS at all four BUA facilities, as well as on BUA and BR50 social media channels to make the survey visible, and to make the target population aware of the BSS.

In addition, invitations for the survey were sent out via the in-house email distribution lists. In general, we assumed that reaching the target population via mailings from the executive board/dean's offices would be most efficient. We also tried to increase participation with additional reminders. In each institution, the aim was to resend the mailings via the executive board or dean's offices. If this was not possible, an attempt was made to send the reminders through as many different communication channels as possible in order to reach as many of the target group as possible, but also to test the existing communication channels.

For the FU, we were able to send an email and also a reminder to all scientists via the executive board. The advantage was that all scientists were contacted directly through their email address and did not have to be contacted in a top-down process using the organizational hierarchy.

At Charité – Universitätsmedizin Berlin, such a direct email dispatch through the dean's office to the personalized addresses of the scientists was conducted at least once. It was not possible to send a reminder email via the dean's office, as this mailing list is very exclusive and should not be overused. The reminder about the survey was therefore subsequently sent out in the newsletter.

At the TU, we were also able to invite respondents to the survey using an internal email distribution list. Since it was not possible to send out the reminder through this distribution list, we tried to write to the institutes of the faculties separately. However, there are usually no central contact persons at the institutes level on the web pages, so we carried out the reminder campaign at the lower level of research fields. We did not write to those contact persons at this level who provided only an online

contact form instead of an email address. The reason for this was the considerable amount of time that would have been required to identify the specific email addresses and the fact that the link to the survey included in the invitation could not be inserted as a link in the contact forms.

At the HU, the conditions were less optimal. It was possible to forward the invitations via the executive board, but the invitations were not sent directly to the personalized email addresses of the scientists. Instead, they were sent to the faculties to be forwarded from there. Therefore, we sent the subsequent reminders directly to the institutes and also to graduate schools, interdisciplinary centers, and clusters.

We reached BR50 scientists using a mailing from the BR50 office to all BR50 institutes. Here, too, we tried to test and use multiple approaches in the reminders to ensure we reached as many members of the target group as possible.

The invitation to take part in the survey was preceded by a lengthy process in which it was ascertained how the different institutions communicate, how the communication channels of the BUA and the BR50 run, and which communication channels have the greatest reach in each case. Thus, an attempt was made in advance to determine whether or in what way certain communication channels might induce a systematic exclusion of certain subgroups of the target group.

This procedure was complex and required the involvement of the data protection officers and the staff councils of the individual institutions. Because the processes took very different amounts of time at the different institutions, the survey could not be carried out at the same time in all four institutions, but the start dates were adjusted accordingly and the field time was extended.

2. Questionnaire development

The BSS surveys researchers' experiences and assessments on various topics relevant to science. The focus is on the sometimes very different cultural conditions by research fields. The results of the BSS can reveal trends and changes in research culture over time. Some results are processed as indicators and flow into a comprehensive BUA monitoring in addition to data from other data sources. The perspective of the BSS is to let the scientists themselves "have their say" and to reflect critically on the changes in the Berlin research environment brought about by science policy control.

The questionnaire of the BSS's basic survey deals with the main topics of research quality, cooperation, knowledge transfer, and open science. An additional block of questions deals specifically with assessments of Berlin as a research location and the role of the BUA (or BR50).

2.1 Preliminary theoretical work

The construction of the questionnaire was preceded by extensive preliminary work, e.g., research on national and international data sources that could be relevant for the planned survey. On the one hand, the idea was to be able to link the collected data in a complementary way with secondary data. On the other hand, with a view to possible comparative studies, an extensive list of relevant items was compiled in order to adopt some items if necessary and thus enable comparisons.

In addition, the core topics of open science, knowledge transfer, and cooperation were prepared for the planned survey with comprehensive literature research and evaluations.

2.2 Professional exchange

In order to take the discussions and measures within the Berlin University Alliance into account in the core topics, multiple networks were established in all areas of the BUA. Through these networks, an intensive professional exchange took place on the respective topics. In addition, the content-related expertise of these actors was also included when constructing the questionnaire.

For example, the questions on the topic of knowledge transfer in the Berlin Science Survey were discussed and developed with Objective 2. With the Open Access Bureau Berlin (OABB) and the team of the BUA Open Science Dashboards (Quest Center BIH), as well as representatives of the Center for Open and Responsible Research (CORE), the questions on Open Science from the Berlin Science Survey and the results of the baseline evaluation were discussed. Members of the Robert K. Merton Center for the Study of Science (RMZ) were also consulted in an advisory capacity for questionnaire development.

Adjustments to the questionnaire for BR50 were discussed and developed jointly with members of BR50. For example, the BUA-related question block was replaced with a question block specific to BR50 topics.

2.3 Preliminary empirical work

When it comes to the topic of "research quality," previous quantitative (including survey-based) approaches have been the furthest from what the concept was intended to capture. Specifically, we assumed that research quality cannot be defined and measured in the same way across disciplines. Therefore, an exploratory, qualitative approach was taken to develop the research quality survey instrument. Based on 21 qualitative, guided expert interviews and their analysis, different dimensions of research quality were elaborated. The interviewees were asked what constitutes good research for them, how they define it, and how they recognize good or bad research. The conditions for good research were also asked. The various aspects of research quality mentioned by the respondents were grouped into individual categories and listed in order to obtain a comprehensive and systematic overview of the topic. Subsequently, the most relevant categories were selected for the questions on research quality, i.e., for the questions on goals, pressure of expectations, and one's own prioritization in scientific work.

In order to be able to consider the differences between the disciplines, the interviews were conducted with experts from five different disciplines. In the period between March 31, 2021, and June 09, 2021, four interviews were conducted in biology, five interviews in psychology, four in literary studies, five interviews in physics, and three interviews in mechanical engineering. To identify the interview subjects, a search was conducted in advance on the websites of the FU, HU, TU, and Max Delbrück Center for Molecular Medicine. In the composition of the experts, attention was paid to gender and status group diversity (professors, postdocs, predocs). The interviews lasted an average of 60 minutes and were conducted exclusively digitally due to the pandemic situation.

3. Pretest

The questionnaire was subjected to extensive pretests and modified step by step. Regular tests of the technical functions of the questionnaire were carried out. In addition, around 15 experts from the field

of science research tested in particular content-related aspects, such as the comprehensibility and meaningfulness of the questions, but also technical aspects, such as the feasibility and duration of responding.

In a further pretest, the questionnaire was tested in a slightly adapted form at selected universities of applied sciences (HAWs). In addition to testing the questionnaire, the intention here was to gain initial insights into the possibility of including Berlin's HAWs in subsequent waves of the BSS. Problems with access to the HAWs became apparent in this process. Contacting them through the press offices and attempting to forward the invitation to participate in the survey only worked in rare cases. To achieve the goal of integrating HAWs in subsequent waves of the BSS, an adapted recruitment strategy will need to be developed for HAWs.

After the pretest phase, the questionnaire was deployed in the field. Due to the thorough accompanying monitoring at the beginning of the field phase, it quickly became apparent that a significant proportion of participants dropped out of the survey on the first content page ("Scientific goals, expectations & own research practice"). Another higher proportion dropped out at the topic block "Cooperation," which was located rather centrally in the questionnaire. Both question pages contained significantly more items than the other topic blocks.

In order to avoid these premature dropouts, some cuts were made to the questionnaire 3 days after the field start, with the aim of reducing the burdens on these pages:

- The item battery on science goals, expectations, and prioritizations was shortened from 14 to 7 items. A previously conducted factor analysis with the previous pretest data and the first survey data provided the empirical basis for this. Thus, it was shown that the extracted dimensions of research quality can be mapped well with the remaining factors. The dimensions include: 1) research-related intrinsic goals, 2) relevant topics of science policy discourse, and 3) common tasks in science. The third dimension is sufficiently represented by "good teaching" and "publication output," so that the items "acquisition of third-party funding" and "promotion of young researchers" could be omitted here. The second dimension of science policy discourse is well covered by "open science," "societal impact," and "interdisciplinarity," so that the omission of "science communication," "transdisciplinarity," and "internationality" was acceptable. We originally counted four items for the first dimension of research-immanent goals, but then deleted the items "long-term nature of research agendas" and "engagement in the scientific community," so that the two items "methodological rigor" and "originality" now represent the dimension.
- The question block "Cooperation" was also shortened. The question about the reasons for cooperation has been omitted. This question was very extensive, as we considered it important to distinguish collaboration with companies from collaboration with research institutions. Since many respondents stated that they had both types of research collaboration, they had to answer the question about the reasons twice: for collaboration with companies and with research institutions. Thereby, the list of possible reasons for collaboration with seven items was also quite long and the response time extensive. Since we also asked for additional reasons for collaboration with an open question, the shortening eliminated four complex questions for many respondents at once. Thus, eliminating the question about reasons for collaboration has enormous potential to shorten the survey length. At the same time, this question was the least relevant to assessing collaboration. From a policy perspective, the question about obstacles or difficulties and cooperation needs in

general is far more meaningful. The question about reasons for initiating cooperation will be addressed in a subsequent in-depth survey.

- A further reduction was achieved by randomization. Specifically, two question blocks were no longer presented to all participants, but only to a randomized half. In each case, 50% of the participants were asked to answer a comparatively extensive question block on the topic of "Open Science," while the remaining 50% were presented with a shortened question block on "Open Science" and additionally the topic block "Science and Society."

4. Field phase

The survey took an average of 12 to 15 minutes and was conducted online using the software Limesurvey. In all facilities, the invitation to the survey was sent by email. The survey could be opened and answered via a corresponding link within the invitation email.

The Berlin Science Survey started on November 23, 2021, at the Freie Universität Berlin. The invitation was sent through the executive board to all scientists at the FU Berlin. On February 14, 2022, a reminder was sent out again through the executive board.

On November 29, 2021, an invitation to the survey was sent through the HU executive board to all institutes with the request to forward it to all scientists of the HU. A first reminder was sent to all institute offices of the HU on December 09, 2021, followed by a second reminder on February 14, 2022, which was also sent to all institutes and additionally to the graduate schools of the HU. On February 15, 2022, all interdisciplinary centers and clusters of the HU were also invited to participate in the survey. Again, the invitations were sent to the offices with the request to forward the invitations to the scientists.

The scientists of the Charité - Universitätsmedizin Berlin were invited to take part in the survey on January 18, 2022, by an email sent out through the dean's office. A subsequent reminder campaign started on February 10, 2022, using the Charité internal newsletter.

Finally, scientists of Technische Universität Berlin were invited to the survey on February 10, 2022, through an in-house email distribution list. Reminder emails were sent on February 15, 2022, at the departmental level.

On December 02, 2022, the survey also started in a slightly modified form for the scientists of the BR50. The emails were sent through the BR50 office to all institutes of the BR50. On December 09, 2021, a first reminder was sent out to the general addresses of the member institutes of BR50. On January 05, 2022, as well as on February 08, 2022, a reminder was sent to the communication departments of BR50 with the request to forward it to the member institutes.

The problem with the field access is that it took place in different ways and at different times at all BUA institutions and at BR50. Thus, the scientists of the individual institutions had different probabilities to receive the invitation and to be able to participate. At the same time, field control by the BSS team was very limited. This point is discussed in detail in Section 7 Limitations and Outlook. The field phase of the BSS ended at all participating institutions on February 22, 2022.

5. Sample statistics

1,842 individuals participated in the baseline survey, of which 1,098 individuals with complete interviews and privacy statements are included in the processed net analysis dataset. Of these, 873 were individuals from BUA. The respondents were distributed slightly differently among the four BUA institutions: 294 persons were from FU, 194 persons from HU, 158 persons from TU, and 227 persons from Charité. 24% (N= 263) of the respondents are primarily employed at non-university research institutions. The percentage sum of the distribution is slightly above 100% because there are also persons with double affiliations in the sample.

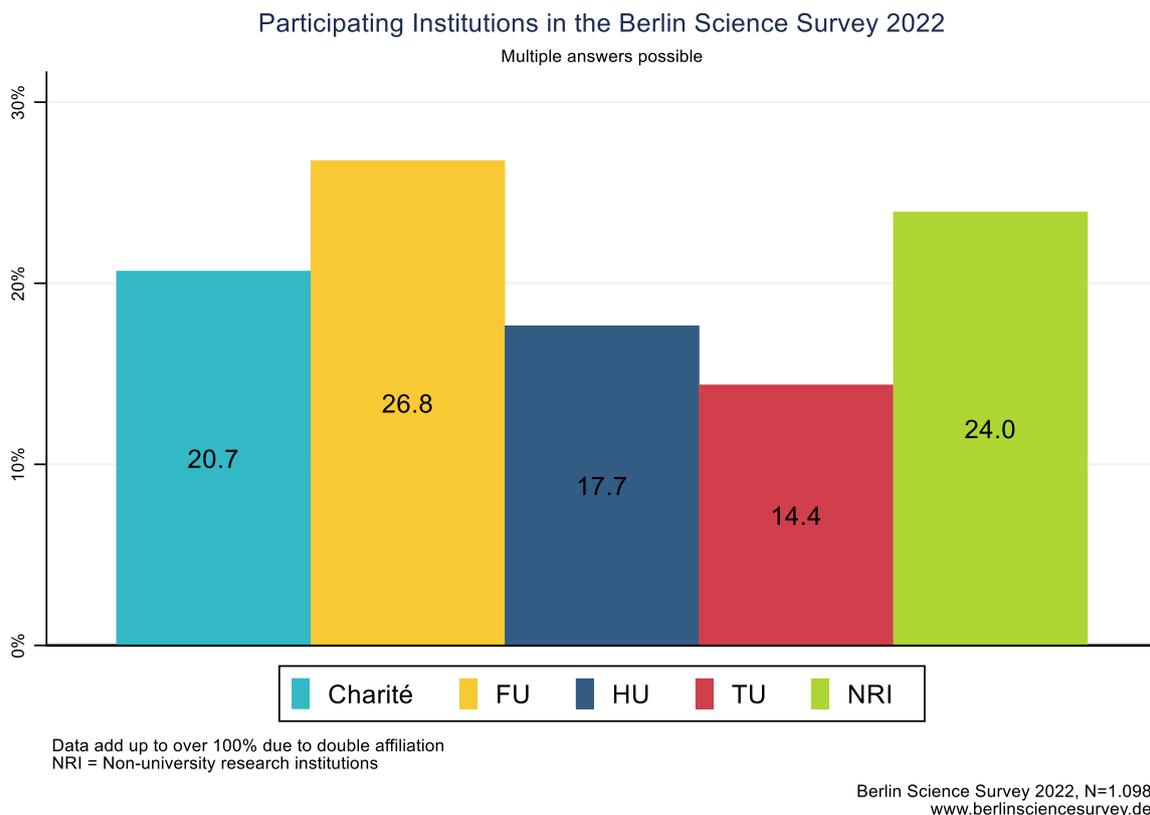


Figure 1 Participating Institutions in the BSS

The disciplines to which the respondents assign themselves were collapsed into five categories based on the classification of scientific fields by the German Research Foundation (DFG). In our sample, the life sciences account for the largest share with just under 30%, followed by the social sciences with 24.4% and the natural sciences with 22.2%. The humanities, with 15.4%, and especially engineering, with only 8.5%, are the subject groups with the smallest shares in the survey.

The group of doctoral and post-doctoral students makes up the majority of respondents, each with about 40%. 18.7% of the respondents hold a professorship or junior professorship.

At 50.9%, the proportion of male respondents slightly outweighs the proportion of female respondents.

Sample Composition

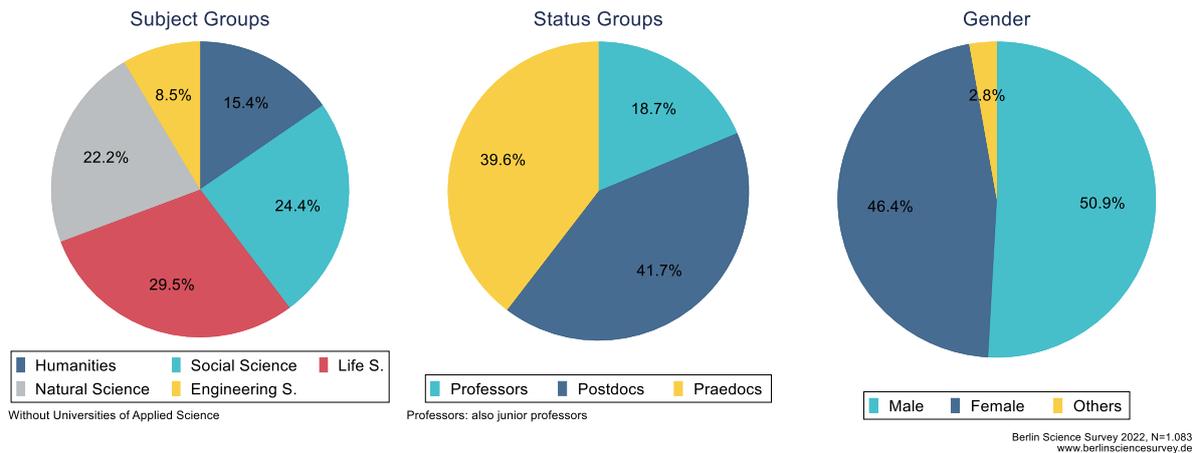


Figure 2 Sample Composition

From the pilot survey, a pool of volunteers was recruited who were willing to be interviewed again during the year and specifically on current or special topics. There were 308 people who agreed to be included in this pool of panelists. Contact details were collected from these (email address and full name). The contact information is necessary for the targeted invitations.

6. Data quality

In order to assess the quality of the data, it is useful to compare the distribution in the survey with the distribution in the population. In the present case, this is only possible on a very rough level due to the different personnel statistics. Thus, while we can look at the distribution of gender and status group and compare them, we cannot compare subject groups, since an assignment to subject groups was not included in the personnel statistics. Another limitation in comparing survey statistics and personnel statistics is that we have to exclude respondents from Charité and BR50 from the comparison.

We are very pleased that we were able to include BR50 in our survey on such short notice. Unfortunately, in the short time available, it has not been possible to prepare the personnel statistics for all BR50 facilities.

The personnel statistics of Charité could also not be made available to us at such short notice, so that we are limited here to the information from the Charité website. This contains only a few key figures. We can see that a total of 4988 employees come from the group of researchers and physicians. Unfortunately, this group is not shown separately, so that we cannot capture our target group in more detail. Furthermore, we know that there are 301 professors. The percentages of male and female employees cannot be broken down to the group of scientists.

Because of these limitations in the coverage of the target group at Charité and BR50, we base our comparison between survey statistics and the population here only on the institutions FU, HU, and TU. The percentages for gender do not quite add up to 100% here, because the specification "diverse" was also possible in the questionnaire and was selected by some respondents (N= 23). Additionally, some respondents (N= 10) did not answer this question. Due to rounding errors, the totals generally do not always add up smoothly to 100.

Table 1 below shows the distribution for the BSS subsample of respondents from FU, HU, and TU (right column). Additionally, it shows the distributions from the three institutions according to the personnel statistics. The FU personnel statistics correspond to the official personnel statistics as of December 31, 2020. The HU personnel statistics are as of December 01, 2020. The TU personnel statistics were read as of November 15, 2021.

A general comparison of the partial population consisting of the aggregated personnel statistics of the FU, HU, and TU with the corresponding BSS subsample can be made using the two columns on the right (gray background). Here it can be seen that the proportion of female respondents corresponds exactly to the proportion in the partial population. The proportion of scientists without a doctorate is also exactly replicated in the BSS. In contrast, scientists with doctorates are underrepresented in the BSS sample, while professors are overrepresented.

In order to be able to compare the shares at the facility level, the personnel statistics were supplemented by the figures from the BSS in percent in each cell in red font. The bottom row shows the absolute and percentage figures from the personnel statistics by institution and the respective percentage share from the BSS subsample. This clearly shows that the TU is well-represented in terms of percentage despite this institution having had the shortest field period. At the same time, it is clear that the outstandingly good recruitment at the FU has led to an overrepresentation of this institution in the BSS sample. In contrast, scientists from the HU are underrepresented in the sample, which is probably due at least in part to the way the invitations were forwarded. For the HU, there is also a clear difference in the proportions between the BSS subsample and the personnel statistics for professors and scientists without doctorates: While the latter are underrepresented in the BSS survey, the former are overrepresented. This may indicate that the forwarding of invitations at the institute level is more likely to reach professors than doctoral candidates. A systematic exclusion of scholarship holders may also be a cause.

A completely different pattern emerges for the TU, which is well-represented in terms of the overall proportion, but also shows greater differences in the distributions: Here, both males and scientists with doctorates are significantly underrepresented, while scientists without doctorates are strongly overrepresented. It is possible that systematic exclusions in the invitation mailing process also contributed to this distortion.

The distribution of gender and status groups from the FU subsample represents the distribution from the personnel statistics quite well. Thus, not only is the response rate highest here, but the data quality is also best.

	<i>FU</i>	<i>HU</i>	<i>TU</i>	<i>Total</i>	<i>BSS subsample</i>
<i>male</i>	1511 53.0% 52.7%	2951 52.4% 45.4%	1902 67.2% 54.4%	6364 56.3%	328 51.1%
<i>female</i>	1338 47.0% 42.2%	2685 47.6% 49.5%	927 32.8% 40.5%	4950 43.8%	281 43.8%
<i>professor</i>	538 18.9% 22.1%	458 8.1% 29.9%	384 13.6% 17.1%	1380 12.2%	148 23.1%
<i>PostDocs</i>	957* 33.6% 33.0%	2130 37.8% 39.7%	1786 63.1% 23.4%	4873 43.1%	209 32.6%
<i>PräDocs</i>	1354 47.5% 44.9%	3048 54.1% 30.4%	659 23.3% 59.5%	5061 44.7%	285 44.4%
<i>total</i>	2849 25.2% 45.8%	5636 49.8% 30.2%	2829 25.0% 24.6%	11,314 100%	642 100%

Table 1 Comparison of partial population and BSS subsample for FU, HU, and TU, without Charité and BR50.

* According to statistics, 818 have a doctorate. This is not clear for another 139 persons, but we assume they hold a doctorate due to their scientific role.

7. Limitations and outlook

Some issues posed challenges for the BSS pilot study, indicating where adjustments will need to be considered for the BSS trend study. For one thing, the time frame was quite tight. This was exacerbated by the fact that, in order to conduct the BSS, the staff councils at all four BUA facilities had to vote to approve it, and data protection was also checked separately at all facilities. This is a rather unusual procedure, since staff councils typically only get involved in employee surveys. Since the survey was funded by BUA even though it was actually a research study, this may have been a special case. The separate audit of the data protection guidelines in the individual institutions is also rather unusual, since the implementing institution, in our case the HU, normally takes over and certifies the audit.

In addition to the time restrictions and the abundance of tasks that had to be accomplished in this short time, the fact that two other surveys had started in the BUA at the same time was also unfavorable. Finally, the general situation at the time of the field start of the BSS was also extremely tense, as the pandemic situation was considered to be particularly stressful at that time.

Nevertheless, it was possible to conduct a credible pilot study in a fairly short time and also to achieve a respectable number of participants – net 1,098 persons. It is also particularly pleasing that it was possible to include the Berlin Research 50 in the survey immediately after the merger.

Nevertheless, there are a few limitations in the quality of the pilot study, and these will be addressed in the following survey waves.

First, the survey could not start at the same time in all institutions. Thus, scientists from some institutions had more time for participation and thus a higher probability for reachability and participation than scientists from other institutions. Also, the reminder emails were not coordinated and adjusted at all institutions, so scientists were reminded of the survey with varying intensity. This also means that the probabilities for the accessibility and participation of the target persons are not comparable. Far more important, however, in addition to the differences in field initiation, is that there is ambiguity about the general accessibility of the target subjects. Depending on the institution, different communication channels were used, and these channels have different reach and also address different groups of people. At the same time, there is hardly any information about this. This means that there is no information on how up-to-date and complete the respective email distribution lists were that were used at the individual facilities, nor on who could ultimately be reached with the email distribution lists. Consequently, it cannot be ruled out that people who were no longer working at the facilities in question received invitations to the BSS, while people who belong to the target population could not be reached via the email distribution lists. If part of the target population has been fundamentally unreachable using the chosen communication channels, this is referred to as systematic exclusions. These systematic exclusions cannot be completely ruled out due to the lack of knowledge about some of the channels. As a result, field control on the part of the BSS team was also only possible to a limited extent.

Another limitation of the Berlin Science Survey results from the fact that the target population cannot be clearly defined. This is due to the currently available personnel statistics of the individual institutions. These are not made available in the same way at all institutions and include different subpopulations from the target group. For example, the TU's personnel statistics do not include scholarship holders. At the HU, scholarship holders are only included in the personnel statistics if they

are also enrolled as doctoral students. Due to these differences and systematic exclusions in the personnel statistics, a gross-net comparison for the BSS data is only possible to a limited extent. It follows that the response rate for the pilot study cannot be calculated either. Thus, statements on data quality as well as comparisons across the institutions are only possible to a very limited extent.

For the follow-up waves of the BSS, therefore, three different objectives are being pursued:

First of all, we are trying to obtain detailed personnel statistics from all facilities in order to be able to estimate the population correctly. In particular, the Charité-Universitätsmedizin is an important contact, since we can so far only access the personnel statistics from the website of this institution. Since no distinction can be made here between personnel working purely as physicians and those working as scientists, the statistics are very rough and insufficient for calculating the target group. For the provision of detailed personnel statistics, intensive exchange and a very concretely worked out specification for the personnel statistics as they are needed for the survey are required in advance.

Secondly, the recruitment should be standardized. Since it has been shown that the existing email distribution lists are not suitable for controlling the survey process, address research should be carried out on the web pages of the institutions for each survey wave. This is not possible for Charité-Universitätsmedizin Berlin, as there are no comprehensive employee pages on the Charité website. Thus, an alternative solution has to be found in order to reach the scientists as directly and in a controlled manner as possible and to ensure recruitment is carried out under adequate survey conditions.

Finally, a common field start across all institutions will be aimed at for the follow-up surveys. While the pilot study was conducted under very strong time restrictions, the time frame for the follow-up surveys is much more flexible. As a result of this and the knowledge gained in the pilot study about various preconditions and in-house processes and lead times, it should be possible to get the necessary processes for the follow-up surveys underway at an early stage so that a joint field start can be achieved in all facilities.

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