Response Rates for Patient-Reported Outcomes Using Web-Based Versus Paper Questionnaires: Comparison of Two Invitational Methods in Older Colorectal Cancer Patients

Nicole JE Horevoorts1,2, MA; Pauline AJ Vissers1, MSc; Floortje Mols1, PhD; Melissa SY Thong1, PhD; Lonneke V van de Poll-Franse1, PhD

1Centre of Research on Psychology in Somatic Diseases (CoRPS), Tilburg University, Tilburg, Netherlands
2Netherlands Comprehensive Cancer Organisation, Utrecht, Netherlands

Corresponding Author:
Nicole JE Horevoorts, MA
Centre of Research on Psychology in Somatic Diseases (CoRPS)
Tilburg University
Warandelaan 2
Tilburg, 5037 AB
Netherlands
Phone: 31 882346811
Email: n.horevoorts@iknl.nl

Abstract

Background: Improving questionnaire response rates is an everlasting issue for research. Today, the Internet can easily be used to collect data quickly. However, collecting data on the Internet can lead to biased samples because not everyone is able to access or use the Internet. The older population, for example, is much less likely to use the Internet. The Patient-Reported Outcomes Following Initial Treatment and Long-Term Evaluation of Survivorship (PROFILES) registry offers a platform to collect Web-based and paper questionnaires and to try different measures to improve response rates.

Objective: In this study, our aim was to study the influence of two methods of invitation on the response rate. Our second aim was to examine the preference of questionnaire mode of administration (paper or Web-based) for the older patient in particular.

Methods: To test these two invitational methods, 3406 colorectal cancer patients between ages 18 and 85 years received an invitation containing an access code for the Web-based questionnaire. They could also request a paper questionnaire with an included reply card (paper-optional group). In contrast, 179 randomly selected colorectal cancer patients received a paper questionnaire with the invitation (paper-included group). They could also choose to fill out the Web-based questionnaire with the included access code.

Results: Response rates did not differ between the paper-optional and the paper-included groups (73.14%, 2491/3406 and 74.9%, 134/179, \( P = .57 \)). In the paper-optional group, online response was significantly higher when compared to the paper-included group (41.23%, 1027/2491 vs 12.7%, 17/134, \( P < .001 \)). The majority of online respondents responded after the first invitation (95.33%, 979/1027), which was significantly higher than the paper respondents (52.19%, 764/1464, \( P < .001 \)). Respondents aged 70 years and older chose to fill out a paper questionnaire more often (71.0%, 677/954). In the oldest age group (\( \geq 80 \) years), 18.2% (61/336) of the respondents filled out a Web-based questionnaire.

Conclusions: The lack of difference in response rates between invitation modes implies that researchers can leave out a paper questionnaire at invitation without lowering response rates. It may be preferable not to include a paper questionnaire because more respondents then will fill out a Web-based questionnaire, which will lead to faster available data. However, due to respondent preference, it is not likely that paper questionnaires can be left out completely in the near future.

(J Med Internet Res 2015;17(5):e111) doi:10.2196/jmir.3741

KEYWORDS

Internet; questionnaires; aged; aged, 80 and over; cancer, colon; cancer, rectum; characteristics, population; survey methods; respondents; patient-reported outcomes
Introduction

The first Web-based questionnaires were posted in the mid-1990s, but they were only available for a select few with access to a computer and to the Internet [1]. Today, the Internet is accessible for more and more households. In the Netherlands, access to the Internet is high with 97% of the households having an Internet connection in 2013 [2]. To optimally utilize this high level of access, the population-based Patient-Reported Outcomes Following Initial treatment and Long-Term Evaluation of Survivorship (PROFILES) registry was developed in 2010. Its goal is to collect, preferably, online data on patient-reported outcomes (PRO) of cancer patients at least once a year [3]. However, paper questionnaires can be provided if preferred by the respondent. Offering different modes of administration is a way to improve response as is offering incentives and sending reminders [4].

Although it is widely accepted that Web-based questionnaires offer advantages, these advantages are not all scientifically proven. Advantages of Web-based questionnaires compared to paper questionnaires that are supported by literature are more complete data [5], less data entry errors [6], and questionnaires returned more quickly [7]. Several studies also show that reliability of Web-based questionnaires and paper questionnaires is comparable [8-11]. An often-described disadvantage of Web-based questionnaires is sample bias [1] because not all population groups have access to or are proficient in using the Internet. Additionally, Web-based questionnaires often have lower response rates than paper questionnaires [12].

Recent literature shows that the online respondent is most likely to be young and highly educated [10,13,14]. On the other hand, cancer patients tend to be older. There are a few studies that report on Internet use of older patients, but these patients are described as one group (eg, 50 years and older or 65 years and older) with response percentages varying from 58% to 63% [15-20]. Studies on computer and Internet use that are stratified by age and include a group older than 60 years are sparse. We found 6 studies that stratified older age into groups for computer or Internet use [21-26]. Percentages varied from 10% for those aged ≥85 years for Internet use in 2007 [22] to 35% in the 60-69 years age range for computer use for email in 2011 [21]. A previous study from our group, performed in 2007, observed Internet access for 3 age groups (<50 years, 50-59 years, and 60-69 years) of 81%, 65%, and 47%, respectively [24]. According to Statistics Netherlands, 54% of Dutch individuals between ages 65 and 75 years had access to the Internet in 2007 [27]. Since 2007, access to the Internet in the Netherlands has increased rapidly. In the older population aged 65-75 years, 80% currently have access to the Internet [28]. Therefore, we expect that more older respondents will be able to fill out Web-based questionnaires.

This paper describes a study in which our primary aim was to investigate whether including a paper questionnaire in the initial invitation would lead to a higher response rate. Furthermore, we wanted to compare patient characteristics and response rates between different modes of administration (Web-based vs paper). Our second aim was to evaluate the preference of administration mode for the older patient in particular. We hypothesized that including a paper questionnaire would increase the overall response rate because it may still be the preferred mode of administration for many older adults.

Methods

Setting

We used data from a large population-based survey conducted in 2010 among colorectal cancer (CRC) patients. Data were collected within the PROFILES registry [3]. The PROFILES registry collects data for the study of the physical and psychosocial impact of cancer and its treatment from a population-based cohort of short- and long-term cancer survivors. PROFILES contains a large Web-based component. However, because a large percentage of cancer patients are older, PROFILES also collects PRO data using traditional paper questionnaires. Collected PRO data are directly linked to clinical data from the Eindhoven Cancer Registry (ECR).

The questionnaire consisted of questions on work and lifestyle, health care use, comorbidity (the Self-Reported Comorbidity Questionnaire), diabetes (Problem Areas in Diabetes Questionnaire), quality of life (EORTC QLQ-C30), disease-specific symptoms (EORTC QLQ-CR38), health status (SF-12), personality (DS14), illness perception (Brief Illness Perception Questionnaire), fatigue (Fatigue Assessment Scale), and anxiety and depression (Hospital Anxiety and Depression Scale). A total of 182 items were to be answered. Respondents were informed that filling out the questionnaire could take up to 45 minutes. Online respondents could see the progress on a progress indicator and were able to log in again to continue completing the questionnaire from where they last left off. Online respondents were required to answer all questions, but could choose the option “I don’t want to say” when sensitive information was asked (eg, sexuality).

The ECR, which is part of the Comprehensive Cancer Center the Netherlands, compiles data of all newly diagnosed cancer patients in the southern part of the Netherlands, covering an area with 10 hospitals serving 2.3 million inhabitants [29]. All individuals aged between 18 and 85 years, diagnosed with CRC between January 2000 and June 2009, and registered in the ECR were eligible for participation in our study. Those with cognitive impairment, with stage 0/carcinoma in situ, and who died prior to start of the study were excluded, resulting in 3585 eligible patients. The CRC survey was approved by the Central Committee on Research Involving Human Subjects (approval number NL23463.015.08) and the Medical Ethics Committee of Máxima Medical Centre (approval number 0822). All patients signed informed consent. Further details on the method of data collection are published elsewhere [30].

Description of Study Groups

Patients were divided into 2 groups for this study (Figure 1). Patients in the paper-optimal group (n=3406) were invited via a return envelope (postage included) with which participants could choose the option “I don’t want to say” when sensitive information was asked (eg, sexuality).
could request a paper version of the questionnaire. Patients in the paper-included group (n=179) received the same letter, but with a paper questionnaire and a return envelope (postage included) also included. Nonrespondents from both groups were sent a reminder letter together with a paper questionnaire and return envelope (postage included). A reminder was sent after 3 months, on average. The number of patients needed for the paper-included group was calculated in advance. We sampled the number of patients to be able to test a statistically significant higher (1-sided test based on our hypothesis) response rate of 10% between both groups, assuming a response rate of 75% in the paper-optional group (power 80%, alpha 10%).

Figure 1. Flowchart of the colorectal cancer patient selection.

Demographics and Clinical Characteristics
Patients’ demographic and clinical information, including cancer stage, time since cancer diagnosis in years, and primary treatment were available from the ECR. The questionnaire contained questions about marital status and educational level. Information about response status, time of completion (either before or after the reminder), and the chosen mode of administration (paper or Web-based) was gathered from the PROFILES data manager application.

Statistical Analyses
Differences in characteristics of respondents and nonrespondents and between groups were analyzed using independent t tests and chi-square tests where appropriate. Further analyses within the paper-optional group were conducted to assess differences in clinical and demographic characteristics between online and paper respondents. All differences with a P value <.05 were considered statistically significant. To assess the difference in online response between the 2 groups, logistic regression models were constructed. An unadjusted and a logistic model adjusted for age, sex, educational level, and having a partner or not were used to assess differences in Web-based response. Odds ratios (ORs) and 95% confidence intervals (95% CI) were reported. All statistical analyses were performed using SAS v9.2 for Windows (SAS institute Inc, Cary, NC, USA).

Results
Of the 3406 invited CRC patients in the paper-optional group, 2491 (73.13%) responded. In the paper-included group, a similar response rate was found with 134 (74.9%) respondents of the 179 invited CRC patients.
Statistically significant differences in characteristics between respondents and nonrespondents were seen for gender (male: 55.16%, 1448/2625 vs 48.0%, 297/619, \(P<.001\)), age (mean 69.4, SD 9.53 vs mean 72.4, SD 9.9, \(P<.001\)), and cancer type (colon: 61.18%, 1606/2625 vs 66.9%, 414/619, \(P=.03\)) (Table 1). The age difference between the 2 groups was more pronounced after age was stratified into categories. The biggest response difference was found in the age category 60-70 years (32.27%, 847/2625 vs 23.4%, 145/619, \(P<.001\)) and \(\geq 80\) years (13.26%, 348/2625 vs 25.8%, 160/619, \(P<.001\)).

Table 1. Demographic and clinical characteristics of respondents and nonrespondents in a colorectal cancer population.

| Characteristics                  | Respondents, n=2625 | Nonrespondents, n=619 | Unverifiable addresses, n=341 | \(P\)  |
|----------------------------------|---------------------|-----------------------|-------------------------------|-------|
| Gender, \(n\) (%)                |                     |                       |                               |       |
| Male                             | 1448 (55.16)        | 297 (48.0)            | 1644 (48.4)                   | .001  |
| Female                           | 1177 (44.84)        | 322 (52.0)            | 176 (51.6)                    | .001  |
| Age (years), mean (SD)           | 69.41 (9.53)        | 72.4 (9.9)            | 69.41 (9.53)                  | .001  |
| Age range (years), \(n\) (%)     |                     |                       |                               |       |
| <60                              | 410 (15.62)         | 65 (10.5)             | 80 (23.5)                     | .001  |
| 60-70                            | 847 (32.27)         | 145 (23.4)            | 201 (56.2)                    | .001  |
| 70-80                            | 1020 (38.82)        | 249 (40.2)            | 109 (32.1)                    | .001  |
| \(\geq 80\)                      | 348 (13.30)         | 160 (25.8)            | 64 (18.8)                     | .001  |
| Cancer type, \(n\) (%)           |                     |                       |                               |       |
| Colon cancer                     | 1606 (61.18)        | 414 (66.9)            | 208 (61.0)                    | .03   |
| Rectal cancer                    | 1019 (38.82)        | 205 (33.1)            | 133 (39.0)                    | .06   |
| Time since diagnosis (years), mean (SD) | 5.16 (2.80)        | 5.3 (2.9)             | 5.5 (3.0)                     | .05   |
| Invitational approach, \(n\) (%) |                     |                       |                               |       |
| Paper-optional                   | 2491 (94.90)        | 587 (94.8)            | 328 (96.2)                    | .57   |
| Paper-included                   | 134 (5.10)          | 32 (5.2)              | 13 (3.8)                      | 1.8   |
| Mode of completion, \(n\) (%)    |                     |                       |                               |       |
| Paper                            | 1581 (60.23)        | 58.36-62.10           |                               |       |
| Online                           | 1044 (39.77)        | 37.90-41.64           |                               |       |
| Time of completion, \(n\) (%)    |                     |                       |                               |       |
| After initial request            | 1836 (70.16)        | 68.19-71.70           |                               |       |
| After reminder                   | 781 (29.84)         | 28.00-31.50           |                               |       |

Differences in Response Rates Between Groups

No differences in overall response rate were found between the paper-optional and the paper-included groups, with 73.14% (2491/3406) and 74.9% (134/179, \(P=.57\)), respectively (Figure 2). For respondents aged 70 years and older, no difference in response rate was found, with a 68.84% (1290/1847) response rate in the paper-optional group and 75.7% (78/103) in the paper-included group (\(P=.38\)).

Characteristics of the respondents in the paper-optional group were comparable with those of the paper-included group, except for age which was slightly older in the paper-included group (\(\geq 70\) years: 51.79%, 1290/2491 vs 58.2%, 78/134, \(P=.04\)) (Table 2). The unadjusted logistic regression model showed patients in the paper-optional group were 4.82 times (95% CI 2.88-8.07, \(P<.001\)) more likely to fill out the Web-based questionnaire compared to patients in the paper-included group; this effect remained after adjustments for age, sex, educational level, and having a partner or not (OR 5.81, 95% CI 3.37-10.01, \(P<.001\)). In the paper-optional group, online response was significantly higher compared to the paper-included group (41.23%, 1027/2491 vs 12.7%, 17/134, \(P<.001\)).

Sending a reminder increased the response by 30% in both arms. Due to local logistical issues, the time of sending a reminder varied between 2 and 5 months. However, this variation did not influence overall response rates (data not shown) or mean time until response (Table 2).
Table 2. Demographic and clinical characteristics of colorectal cancer patients in the paper-optional and the paper-included groups.

| Characteristics                      | Paper-optional, n=2491 | Paper-included, n=134 | P    |
|--------------------------------------|------------------------|-----------------------|------|
|                                      | Group                  | 95% CI                | Group | 95% CI     |       |
| Gender, n (%)                        |                        |                       |      |            |      |
| Male                                 | 1368 (54.92)           | 52.96-56.87           | 80 (59.7) | 51.4-68.0 | .28  |
| Female                               | 1123 (45.08)           | 43.13-47.04           | 54 (40.3) | 32.0-48.6 |      |
| Age (years), mean (SD)               | 69.4 (9.59)            | 68.99-69.74           | 70.3 (8.5) | 68.8-71.7 | .29  |
| Age range (years), n (%)             |                        |                       |      |            |      |
| <60                                  | 396 (15.90)            | 14.46-17.33           | 14 (10.4) | 5.3-15.6   | .04  |
| 60-70                                | 805 (32.32)            | 30.48-34.15           | 42 (31.3) | 23.5-39.2  |      |
| 70-80                                | 954 (38.26)            | 36.39-40.21           | 66 (49.3) | 40.8-57.7  |      |
| ≥80                                  | 336 (13.53)            | 12.15-14.83           | 12 (9.0) | 4.1-13.8   |      |
| Education, n (%)                    |                        |                       |      |            |      |
| Low                                  | 494 (20.05)            | 18.27-21.40           | 26 (19.7) | 12.7-26.1  | >.99 |
| Medium                               | 1488 (60.39)           | 57.81-61.66           | 80 (60.6) | 51.4-68.0  |      |
| High                                 | 482 (19.56)            | 17.80-20.90           | 26 (19.7) | 12.7-26.1  |      |
| Marital status, n (%)                |                        |                       |      |            |      |
| Married                              | 1882 (76.19)           | 73.86-77.24           | 102 (76.7) | 68.9-83.3 | .23  |
| Divorced                             | 136 (5.51)             | 4.57-6.35             | 8 (6.0) | 2.0-10.0   |      |
| Widow                                | 373 (15.10)            | 13.57-16.38           | 15 (11.3) | 5.9-16.5   |      |
| Never married                        | 79 (3.20)              | 2.48-3.86             | 8 (6.0) | 2.0-10.0   |      |
| Time since diagnosis (years), mean (SD) | 5.16 (2.80)         | 5.05-5.27             | 5.3 (2.7) | 4.8-5.8    | .58  |
| Cancer type, n (%)                  |                        |                       |      |            |      |
| Colon cancer                         | 1528 (61.34)           | 59.43-63.25           | 78 (58.2) | 49.9-66.6  | .47  |
| Rectum cancer                        | 963 (38.66)            | 36.75-40.57           | 56 (41.8) | 33.4-50.1  |      |
| Mode of completion, n (%)            |                        |                       |      |            |      |
| Online                               | 1027 (41.23)           | 39.30-43.16           | 17 (12.7) | 7.1-18.3   | <.001|
| Paper                                | 1464 (58.77)           | 56.84-60.70           | 117 (87.3) | 81.7-93.0 |      |
| Time of completion, n (%)            |                        |                       |      |            |      |
| After first invitation               | 1743 (70.14)           | 68.17-71.77           | 93 (70.5) | 61.6-77.2  | .94  |
| After reminder                       | 742 (29.86)            | 27.99-31.58           | 39 (29.5) | 21.4-36.8  |      |
| Time until response (days), mean (SD)|                        |                       |      |            |      |
| After first invitation               | 21.46 (19.32)          | 20.56-22.37           | 19.1 (12.1) | 16.6-21.6 | .23  |
| After reminder                       | 20.11 (15.24)          | 19.01-21.21           | 19.4 (15.0) | 14.5-24.2 | .70  |

a Low: no/primary school; medium: lower general secondary education/vocational training; high: preuniversity education/high vocational training/university.
Comparison of Characteristics of Online and Paper Respondents in the Paper-Optional Group With a Focus on Older Patients

In the paper-optional group, men were more likely to complete the Web-based questionnaire than to return the paper questionnaire (61.73%, 634/1027 vs 50.14%, 734/1464, \(P<.001\)) (Table 3). Compared to paper respondents, online respondents were younger (mean 65.72, SD 9.28 vs mean 71.85, SD 8.89, \(P<.001\)), more often highly educated (30.34%, 311/1027 vs 11.88%, 171/1464, \(P<.001\)), more often married (83.93%, 862/1027 vs 70.69%, 1020/1464, \(P<.001\)), more often recently diagnosed (time since diagnosis: mean 4.94, SD 2.74 vs mean 5.31, SD 2.83, \(P<.001\)), and more often had a rectal cancer diagnosis compared to paper respondents (41.38%, 425/1027 vs 36.75%, 538/1464, \(P=.02\)). The majority of the online respondents responded after the first invitation (95.42%, 979/1027), which was significantly higher than the paper respondents (52.36%, 764/1464, \(P<.001\)).
After age was stratified, Web-based versus paper response differed per age group (*P*<.001, Figure 3). We saw that the turning point of filling out a Web-based questionnaire was approximately age 70 years: the majority of respondents younger than 70 years filled out a Web-based questionnaire and the majority older than 70 years chose a paper questionnaire. Among those aged ≥80 years, 18.2% (61/336) preferred a Web-based questionnaire.

### Table 3. Demographic and clinical characteristics of colorectal cancer patients in the paper-optional group stratified by questionnaire type used.

| Characteristics                       | Paper questionnaire, n=1464 | Web-based questionnaire, n=1027 |  |
|---------------------------------------|----------------------------|---------------------------------|---|
|                                       | Group                      | 95% CI                          | Group                      | 95% CI                          | *P*  |
| **Gender, n (%)**                     |                            |                                 |                            |                                 |     |
| Male                                  | 734 (50.14)                | 47.58-52.70                     | 634 (61.73)                | 58.76-64.71                     | <.001|
| Female                                | 730 (49.86)                | 47.30-52.42                     | 391 (38.27)                | 35.29-41.24                     |     |
| **Age in years, mean (SD)**           |                            |                                 |                            |                                 |     |
| <60                                   | 71.85 (8.89)               | 71.41-72.29                     | 65.72 (9.28)               | 65.16-66.29                     | <.001|
| 60-70                                 |                            |                                 |                            |                                 |     |
| 70-80                                 |                            |                                 |                            |                                 |     |
| ≥80                                   |                            |                                 |                            |                                 |     |
| **Education, n (%)**                  |                            |                                 |                            |                                 |     |
| Low                                   | 400 (27.80)                | 25.04-29.61                     | 94 (9.17)                  | 7.39-10.92                      | <.001|
| Medium                                | 868 (60.32)                | 56.77-61.81                     | 620 (60.49)                | 57.38-63.36                     |     |
| High                                  | 171 (11.88)                | 10.04-13.32                     | 311 (30.34)                | 27.47-33.09                     |     |
| **Marital status, n (%)**             |                            |                                 |                            |                                 |     |
| Married                               | 1020 (70.69)               | 67.32-72.03                     | 862 (83.93)                | 81.69-86.18                     | <.001|
| Divorced                              | 82 (5.68)                  | 4.42-6.78                      | 54 (5.26)                  | 3.89-6.62                       |     |
| Widow                                 | 288 (19.96)                | 17.64-21.71                     | 85 (8.28)                  | 6.59-9.96                       |     |
| Never married                         | 53 (3.67)                  | 2.66-4.58                      | 26 (2.53)                  | 1.57-3.49                       |     |
| **Time since diagnosis (years), mean (SD)** | 5.31 (2.83) | 5.17-5.45                     | 4.94 (2.74)                | 4.77-5.11                       | <.001|
| **Cancer type, n (%)**                |                            |                                 |                            |                                 |     |
| Colon cancer                          | 926 (63.25)                | 60.78-65.72                     | 602 (58.62)                | 55.61-61.63                     | .02  |
| Rectal cancer                         | 538 (36.75)                | 34.28-39.22                     | 425 (41.38)                | 38.37-44.39                     |     |
| **Time of completion, n (%)**         |                            |                                 |                            |                                 |     |
| After initial request                 | 764 (52.36)                | 49.63-54.74                     | 979 (95.42)                | 94.04-96.62                     | <.001|
| After reminder                        | 695 (47.64)                | 44.91-50.03                     | 47 (4.58)                  | 3.30-5.85                       |     |
| **Time until response (days), mean (SD)** | 36.08 (17.05) | 34.87-37.29                     | 10.03 (11.84)               | 9.29-10.77                      | <.001|
| After reminder                        | 20.66 (15.21)              | 19.53-21.80                     | 11.76 (13.34)              | 7.80-15.72                      | <.001|

*a* Low=no/primary school; medium=lower general secondary education/vocational training; or high=preuniversity education/high vocational training/university.
Discussion

Principal Findings

Our study showed that including a paper questionnaire with the first invitation did not increase overall response rates. In contrast, it negatively influenced the online response. Sending a reminder improves response rates by 30%. Compared to patients responding on paper, online respondents were more often male, younger, married, and highly educated. The majority of respondents in both arms chose to fill out a paper questionnaire. The turning point of preference for a Web-based questionnaire was approximately age 70 years. The majority of respondents who were younger than 70 years preferred to fill out the Web-based questionnaire. The majority of respondents older than 70 years chose the paper questionnaire. We did not find evidence that including a paper questionnaire led to a higher response among older patients.

We expected the overall response rate in the paper-included group to be higher than in the paper-optional group because respondents in the paper-included group received the paper questionnaire immediately at invitation. However, we observed similar overall response rates. A previous review of the literature showed that when respondents can choose between paper and Web-based questionnaires, paper response is higher than online response in most studies [31]. A recent literature review confirmed this, although they expect the difference to diminish in the near future [6]. The absence of this expected difference in response rates in our study could not be explained by differences in patient characteristics between the 2 groups. A possible explanation for the comparable response rates could be the willingness of respondents to participate because the subject of the questionnaire (ie, cancer and health-related quality of life) felt relevant to them. Furthermore, the respondents received the invitation directly from their medical specialist, so they might have felt a moral obligation to participate. The lack of difference in response rates implies that researchers can leave out a questionnaire at first invitation without lowering response. It is preferable not to include a paper questionnaire because more respondents will fill out the Web-based version of a questionnaire, which will enable researchers to access data more quickly and to have a more complete dataset.

Several studies have compared response rates between patients invited via paper only and Web only, or mixed-mode and Web only, or paper only and mixed-mode [5,7,8,10,11,13,14,32-36]. However, few studies are available that address the influence of including a paper questionnaire on response rate in the invitation for a mixed-mode survey. We found an American study that compared the response rates of 3 modes of administration, namely paper only, paper with an Internet option, or Internet with a paper option [37]. The response for the Internet with a paper option and for the paper with an Internet option was 37% and 42%, respectively. These are the same manners of invitation we used in our study. The difference with
our study is that instead of sending 1 reminder, the other study sent 4 reminders. Only the last reminder for the Internet with a paper option contained a paper questionnaire. A second difference is that this study was done in 2000 in the United States, so the use of Internet was lower than in 2010 in the Netherlands, when our study was done. Internet use in the United States in 2000 was 51% compared to 90% in the Netherlands in 2010 [38,39]. This might explain the lower response rates for both groups and the bigger difference in response rates between the groups in that study. A Dutch study among 277 long-term childhood cancer survivors in 2010 used a comparable invitation approach and mode of administration [40]. The study used a mixed invitation group (paper with the option of Internet) and a Web-only invitation group (Internet with the option of paper) leading to a response of 83% and 89%, respectively. A different approach with regard to reminders was chosen in that study compared to ours; after sending 1 reminder letter, nonrespondents were contacted by telephone in their study. Another difference is that only young women were included in that study. Both studies [37,40] did not address the (preference of) the older patient.

When studying different age groups, we found that almost 20% of the respondents aged ≥80 years filled out the questionnaire online. We expected a lower percentage because of the so-called “grey digital divide” referring to the low use of computers and the Internet in the older population [41]. This grey digital divide is also confirmed by a British study that found that only 10% of respondents aged ≥85 years have used the Internet at any point in their lives [22]. To fill out a Web-based questionnaire, a respondent must not only be able to use a computer, but also be skilled on the Internet. The high number of older respondents who used the Internet in our study might imply that the grey digital divide is closing in the Netherlands and more older people are becoming familiar with the Internet. Numbers from Statistics Netherlands (CBS) confirm this, showing that there is an increase in Internet use among individuals aged between 65 and 75 years in recent years [28]. Daily use of the Internet among these individuals increased from 15% in 2005 to 55% in 2013. Eurostat Statistics also show these numbers: a rise in frequent use of the Internet among people aged 65 to 74 years from 41% in 2008 to 73% in 2013 in the Netherlands [42]. Unfortunately, a group of users is left out in these statistics, namely the people older than 75 years. The statistics do, however, indicate a trend of older people being more online. With this in mind, researchers could more easily consider using the Internet as a primary mode for data collection without the inclusion of a paper questionnaire with the first invitation.

Strengths of this study are that it is population-based, including (very) older people, has a high overall response rate, and the cooperation of medical specialists. Furthermore, the influence of sending a paper questionnaire in 2 mixed-mode groups has rarely been studied. Thirdly, our results are more recent than other studies that compare paper versus Web-based questionnaires, which is important because of the rapid changes in Internet access. Lastly, we have looked at many patient characteristics to assess the differences in patient characteristics of online and paper respondents.

A limitation of this study is that the time a reminder was sent varied per hospital due to local logistical issues. However, analyses showed that the difference in reminder time did not have any effect on outcomes. A second limitation is that the comparison between the paper-optional group and the paper-included group shows a slight discrepancy in the age categories, although mean age did not differ. There is a slightly higher percentage of respondents older than 70 years in the paper-included group. Although an age difference existed before data collection in the initial random selection of this group, it was not significant (results not shown). Thus, the significant discrepancy found in our results after data collection is a consequence of (un)willingness to cooperate. In the future, further evaluation of nonrespondents may clarify this difference. It is not unlikely that the results found in our study are applicable to other populations, for example, patients with a different type of cancer, a different disease (eg, diabetes), or a normative population. However, further research is needed to confirm this.

Conclusion

Although this study was on a CRC survivor population, we are of the opinion that the significant lack of difference in response rates between invitation modes implies that researchers may leave out a paper questionnaire at invitation without lowering the response rate. It may even be more preferable not to include a paper questionnaire because more respondents then will fill out a questionnaire online, which will lead to faster available data. However, due to respondent preference, it is not likely that paper questionnaires can be left out completely in the near future.

Acknowledgments

We would like to thank all patients and their doctors for their participation in the study. Special thanks go to Dr M van Bommel, who was willing to function as an independent advisor and to answer questions of patients. In addition, we want to thank the following hospitals for their cooperation: Amphia Hospital, Breda; Bernhoven Hospital, Veghel and Oss; Catharina Hospital, Eindhoven; Elkerliek Hospital, Helmond; Jeroen Bosch Hospital, ’s-Hertogenbosch; Maxima Medical Centre, Eindhoven and Veldhoven; Sint Anna Hospital, Geldrop; St Elisabeth hospital, Tilburg; Twee Steden Hospital, Tilburg and Waalwijk; VieCuri Hospital, Venlo and Venray. This research was supported by a VENI grant (#451-10-041) from the Netherlands Organization for Scientific Research (The Hague, the Netherlands) awarded to Floortje Mols, a Social Psychology Fellowship from the Dutch Cancer Society to Melissa Thong (#UVT2011-4960), and a Cancer Research Award from the Dutch Cancer Society (#UVT-2009-4349) to Lonneke V van de Poll-Franse. The PROFILES registry was funded by an Investment Subsidy (#480-08-009) of the Netherlands Organization for Scientific Research (The Hague, the Netherlands). These funding agencies had no further involvement in the conduct of this study or in the writing of this manuscript.
role in study design; in the collection, analysis, and interpretation of data; in the writing of the report; and in the decision to submit the paper for publication.

Conflicts of Interest
None declared.

References
1. Dillman D, Smyth J, Christian L. Internet, Mail, and Mixed-Mode Surveys: The Tailored Design Method. Hoboken, NJ: Wiley & Sons; 2009.
2. Centraal Bureau voor de Statistiek. 2014 Apr 16. StatLine: ICT gebruik van personen naar persoonskenmerken URL: http://statline.cbs.nl/StatWeb/publication/%7We=nl%26CP=7000%3D%26PL=NL%26VS=1%26VRS%3D101%26C=104%26T=1001%26Year=2014%26Month=04%26Day=16%26CSV=1%3D%26DF=0%3D&HD=1%3D%26HR=C%26G%26STB=T [accessed 2014-02-27] [WebCite Cache ID 6PQ18H4pD]
3. van de Poll-Franse LV, Horevoorts N, van EM, Denollet J, Roukema JA, Aaronson NK, Profiles Registry Group. The Patient Reported Outcomes Following Initial treatment and Long term Evaluation of Survivorship registry: scope, rationale and design of an infrastructure for the study of physical and psychosocial outcomes in cancer survivorship cohorts. Eur J Cancer 2011 Sep;47(14):2188-2194 [FREE Full text] [doi: 10.1016/j.ejca.2011.04.034] [Medline: 21621408]
4. Cho YI, Johnson TP, VanGeest JB. Enhancing surveys of health care professionals: a meta-analysis of techniques to improve response. Eval Health Prof 2013 Sep;36(3):382-407. [doi: 10.1177/0163278713496425] [Medline: 23975761]
5. Bech M, Kristensen MB. Differential response rates in postal and web-based surveys among older respondents. Survey Res Methods 2009;3:1-6.
6. van Gelder MM, Breitveld RW, Roelveldt N. Web-based questionnaires: the future in epidemiology? Am J Epidemiol 2010 Dec 1;172(11):1292-1298 [FREE Full text] [doi: 10.1093/aje/kwq291] [Medline: 20880962]
7. Kwak N, Radler B. A comparison between mail and web surveys: response pattern, respondent profile, and data quality. Journal of Official Statistics 2002;18:257-273.
8. Ritter P, Lorig K, Laurent D, Matthews K. Internet versus mailed questionnaires: a randomized comparison. J Med Internet Res 2004 Sep 15;6(3):e29 [FREE Full text] [doi: 10.2196/jmir.6.3.e29] [Medline: 15471755]
9. Duracinsky M, Lalanne C, Goujard C, Herrmann S, Cheung-Lung C, Brosseau J, et al. Electronic versus paper-based assessment of health-related quality of life specific to HIV disease: reliability study of the PROQOL-HIV questionnaire. J Med Internet Res 2014;16(4):e115 [FREE Full text] [doi: 10.2196/jmir.3330] [Medline: 24769643]
10. Callas PW, Solomon LJ, Hughes JR, Livingston AE. The influence of response mode on study results: offering cigarette smokers a choice of postal or online completion of a survey. J Med Internet Res 2010;12(4):e46 [FREE Full text] [doi: 10.2196/jmir.1414] [Medline: 20965873]
11. Whitehead L. Methodological issues in Internet-mediated research: a randomized comparison of internet versus mailed questionnaires. J Med Internet Res 2011;13(4):e109 [FREE Full text] [doi: 10.2196/jmir.1593] [Medline: 22155721]
12. Lozar Manfreda K, Bosnjak M, Berzelak J, Haas I, Vehovar V. Web surveys versus other survey modes. International Journal of Market Research 2008;50:79-104.
13. Hirsch O, Hauschild F, Schmidt MH, Baum E, Christiansen H. Comparison of Web-based and paper-based administration of ADHD questionnaires for adults. J Med Internet Res 2013;15(3):e47 [FREE Full text] [doi: 10.2196/jmir.2225] [Medline: 23518816]
14. Zuidegeest M, Hendriks M, Koopman L, Spreeuwenberg P, Rademakers J. A comparison of a postal survey and mixed-mode survey using a questionnaire on patients’ experiences with breast care. J Med Internet Res 2011;13(3):e68 [FREE Full text] [doi: 10.2196/jmir.1241] [Medline: 21946048]
15. de Bernardo DH, Curtis A. Using online and paper surveys: the effectiveness of mixed-mode methodology for populations over 50. Research on Aging 2012 Mar 30;35(2):220-240. [doi: 10.1177/0164027512441611]
16. Gallagher S, Doherty DT. Searching for health information online: characteristics of online health seekers. J Evid Based Nurs 2009 May;2(2):99-106. [doi: 10.1111/j.1756-5391.2009.00121.x] [Medline: 21348996]
17. Cresci MK, Yarandi HN, Morrell RW. The Digital Divide and urban older adults. Comput Inform Nurs 2010;28(2):88-94. [doi: 10.1097/NCN.0b013e3181cd8184] [Medline: 20182159]
18. Selwyn N. The information aged: a qualitative study of older adults’ use of information and communications technology. Journal of Aging Studies 2004 Nov;18(4):369-384. [doi: 10.1016/j.jaging.2004.06.008]
19. Slegers K, van Boxtel MP, Jolles J. Computer use in older adults: determinants and the relationship with cognitive change over a 6-year episode. Computers in Human Behavior 2012 Jan;28(1):1-10. [doi: 10.1016/j.chb.2011.08.003]
20. Choi NG, Dinitto DM. The digital divide among low-income homebound older adults: Internet use patterns, eHealth literacy, and attitudes toward computer/Internet use. J Med Internet Res 2013 May;15(5):e93 [FREE Full text] [doi: 10.2196/jmir.2645] [Medline: 23639979]
21. Werner JM, Carlson M, Jordan-Marsh M, Clark F. Predictors of computer use in community-dwelling, ethnically diverse older adults. Hum Factors 2011 Oct;53(5):431-447 [FREE Full text] [Medline: 22046718]
22. Morris A, Goodman J, Brading H. Internet use and non-use: views of older users. Univ Access Inf Soc 2006 Nov 18;6(1):43-57. [doi: 10.1007/s10209-006-0057-5]

23. Brody BL, Field LC, Roch-Leveaq C, Depp C, Edland SD, Minasyan L, et al. Computer use among patients with age-related macular degeneration. Ophthalmic Epidemiol 2012 Aug;19(4):190-195. [doi: 10.3109/09286586.2012.672618] [Medline: 22775273]

24. van de Poll-Franse LV, van Eemenbergen MC. Internet use by cancer survivors: current use and future wishes. Support Care Cancer 2008 Oct;16(10):1189-1195. [doi: 10.1007/s00520-008-0419-z] [Medline: 18293014]

25. Crab R, Rafie W, Seingardt KR. Health-related internet use in older primary care patients. Gerontology 2012;58(2):164-170. [doi: 10.1159/000329340] [Medline: 21734360]

26. Dreisbach N, Axler F, Kotranski L, Malinowski WR, Ingerman S, Ramirez N, et al. The 139th Annual Meeting of the American Public Health Association. Assessing the digital divide among older adults residing in an urban and suburban metropolitan area URL: http://www.chdbdata.org/uploads/datareports/Internet&Older%20Adults_10.28.pdf [accessed 2015-02-11] [WebCite Cache ID 6WGMIKKXHp]

27. Centraal Bureau voor de Statistiek. 2014 16. Statline: ICT gebruik van personen naar persoonskenmerken URL: http://statline.cbs.nl/StatW...?DM=SLNL&P...&ID=23-133&D2=3-6&D3=a&HDR=G1&STB=T&G2&VW=T [accessed 2014-03-05] [WebCite Cache ID 6PZ4piQz]

28. Centraal Bureau voor de Statistiek. 2013 Dec 13. Rapid increase internet usage among older people URL: http://www.cbs.nl.nl-.../vrije-tijd-cultuur/publicaties/artikelen/archief/2013/2013-4005-wm.htm [accessed 2014-05-14] [WebCite Cache ID 6PZ4xbO9]

29. Janssen-Heijnen MLG, Louwman WJ, van de Poll-Franse LV, Coebergh JWW, editors. Results of 50 Years Cancer Registry in the South of the Netherlands: 1955-2004 (in Dutch). Eindhoven: Eindhoven Cancer Registry; 2005.

30. Mols F, Denollet J, Kaptein AA, van der Pal HJ, Versluys AB, Bresters D, van Leeuwen FE, et al. Using web-based and paper-based questionnaires for collecting data on fertility issues among female childhood cancer survivors: differences in response characteristics. J Med Internet Res 2011;13(3):e76 [FREE Full text] [doi: 10.2196/jmir.1707] [Medline: 21955527]

31. Fricker RD, Schonlau M. Advantages and disadvantages of Internet research surveys: evidence from the literature. Field Methods 2002 Nov 01;14(4):347-367. [doi: 10.1177/1525822022377275]

32. Basnow M, Kongsved SM, Bech P, Hjollund NH. Reliability of short form-36 in an Internet- and a pen-and-paper version. Inform Health Soc Care 2009 Jan;34(1):53-58. [doi: 10.1080/17538150902779527] [Medline: 19306199]

33. Hohw... a... version. J Med Internet Res 2007;9(3):e25 [FREE Full text] [doi: 10.2196/jmir.9.3.e25] [Medline: 17942387]

34. Shannon DM, Bradshaw CC. A comparison of response rate, response time, and costs of mail and electronic surveys. The Journal of Experimental Education 2002 Jan;70(2):179-192. [doi: 10.1080/0022097029599505]

35. Smith AB, King M, Butow P, Olver I. A comparison of data quality and practicality of online versus postal questionnaires in a sample of testicular cancer survivors. Psychooncology 2013 Jan;22(1):233-237. [doi: 10.1002/pon.2052] [Medline: 23978658]

36. Basnow M, Kongsved SM, Holm-Christensen K, Hjollund NH. Response rate and completeness of questionnaires: a randomized study of Internet versus paper-and-pencil versions. J Med Internet Res 2007;9(3):e25 [FREE Full text] [doi: 10.2196/jmir.9.3.e25] [Medline: 17942387]

37. Smith AB, King M, Butow P, Olver I. A comparison of data quality and practicality of online versus postal questionnaires in a sample of testicular cancer survivors. Psychooncology 2013 Jan;22(1):233-237. [doi: 10.1002/pon.2052] [Medline: 23978658]

38. Smith AB, King M, Butow P, Olver I. A comparison of data quality and practicality of online versus postal questionnaires in a sample of testicular cancer survivors. Psychooncology 2013 Jan;22(1):233-237. [doi: 10.1002/pon.2052] [Medline: 23978658]

39. Shannon DM, Bradshaw CC. A comparison of response rate, response time, and costs of mail and electronic surveys. The Journal of Experimental Education 2002 Jan;70(2):179-192. [doi: 10.1080/0022097029599505]

40. Smith AB, King M, Butow P, Olver I. A comparison of data quality and practicality of online versus postal questionnaires in a sample of testicular cancer survivors. Psychooncology 2013 Jan;22(1):233-237. [doi: 10.1002/pon.2052] [Medline: 23978658]

41. Millward P. First Monday. 2003 Jul 07. The ‘grey digital divide’: Perception, exclusion and barriers of access to the Internet for older people URL: http://journals.uic.edu/ojs/ind.../article/view/1066/986 [accessed 2015-04-30] [WebCite Cache ID 6YB0U07MX]

42. Eurostat. Digital inclusion-Individuals URL: http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do [accessed 2014-07-24] [WebCite Cache ID 6RlkZcyu9]

http://www.jmir.org/2015/5/e111/
