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Comparing data quality from personal computers and mobile devices in an online survey among professionals

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Abstract

It is increasingly common for respondents to complete web surveys using mobile devices (smartphones and tablets) rather than personal computers/laptops (PCs). Evidence of the impact of the use of mobile devices on response and data quality shows mixed results and is only available for general population surveys. We looked at response quality for a work-related survey in the UK among general practitioners (GPs). GPs were sent email invitations to complete a web survey and half (55%) completed it on a mobile device. While GPs using a mobile device were less likely to complete the full questionnaire than those using a PC, we found no differences in data quality between mobile and PC users, except for PC users being more likely to respond to open-ended questions.

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Introduction

The use of web surveys has increased dramatically over the past 20 years, and their use will continue to grow given their promise of lower costs and quicker turnaround times than more traditional face-to-face, telephone or postal surveys (Smith, 2013).

When completing web surveys, it is now increasingly common for respondents to use mobile devices (smartphones and tablets) rather than personal computers or laptops (PCs). For example, in an online panel study in the Netherlands (the CentERpanel), the use of mobile devices increased from 3% in 2012 to 16% in 2013 (de Bruijne and Wijnant 2014). In the fourth wave of the Longitudinal Study of Young People in England (LSYPE2), despite being advised against the use of a smartphone for the survey, 28% of the 16/17-year-olds completed the survey on a smartphone, while 12% used a tablet and 60%

a PC (Matthews et al, 2017/18). Studies have shown lower response rates, longer completion times (Cooper et al, 2016; Mavletova and Couper 2013) and higher break-off rates (Wells et al, 2013; Bosnjak et al, 2013) among those using mobile devices, as well as higher social desirability bias for sensitive questions when answering on a mobile device in public spaces (Toninelli and Revilla 2016a). Problems with lower response, longer completion times and higher break-off rates may be due to different types of respondents who choose to use mobile devices rather than PCs, or they may be the result of a failure of the research design to accommodate mobile device users (see for example Callegaro, 2014), or due to the greater likelihood of distractions, such as multi-tasking, when completing a survey on a mobile device outside the home or work environment (Toninelli and Revilla 2016b). There are other potential drawbacks with mobile devices, such as difficulties inputting answers due to the smaller size of some mobile device screens and the need to tap answers on the screen rather than using a keyboard, leading to increased data inputting errors and a lower likelihood of scrolling to see all response categories, and so on (Antoun et al, 2017; Couper et al, 2016; Williams et al, 2015).

Research has also found differences between the types of people who complete surveys using mobile devices and those using PCs (for example, women were more likely than men to use smartphones in the LSYPE, as were people with lower educational levels) (Matthews et al, 2017/18). However, studies on the impact of mobile device versus PC on data quality show mixed results, as highlighted by a number of recent studies and summaries including Tourangeau et al (2017), Matthews et al (2017/18), Antoun et al (2017) and Struminskaya et al (2015).

In general, research on device effects is 'still in its infancy' (Lugtig and Toepoel 2016). Moreover, all the published articles on this topic appear to relate to the general population, or particular sub-groups (for example, young people), and the majority refer to US or EU studies. We are not aware of any studies that have looked at the impact of mobile devices on response quality in the context of online workplace surveys (that is, a survey among a group of workers about their work). The current analysis refers to an online workplace survey of general practitioners (GPs) in the UK. We compare data quality between respondents who completed the survey using PCs and those who used mobile devices.

The survey

The 'Improving General Practice Services Survey' (IGPSS) was designed as an online survey to look at quality improvement activities in general practice as reported by GPs (as well as general practice managers, who are not included in this paper). The IGPSS was carried out between July and September 2017. It was a web survey only, with no other data collection modes made available to respondents.

The GP survey involved sending an email to all GPs on the Royal College of General Practitioners (RCGP) membership list on 24 July 2017 (n=46,238). The population of interest was GPs who had worked in NHS general practice in the UK within the last 12 months. We excluded GPs who had not worked in the UK in the last 12 months due to retirement, a career break or working abroad. Other categories of GPs ineligible for the survey were locum GPs, out-of-hours GPs and GPs not working in NHS general practice (for example, those working in prisons, hospitals or private practice).

All GPs were sent emails on either 26 or 27 July 2017 inviting them to take part in the survey. A first reminder was sent to all GPs who had not responded on 23 August. A second reminder was sent to GPs who had not yet responded on either 12 or 13 September 2017.

In all, 3,979 GPs started the questionnaire. Since the RCGP membership list does not include information on whether GPs are currently working in the NHS, the initial questions established eligibility for the survey and GPs who fell into one of the ineligible categories (as outlined above) were removed from completing the questionnaire at that stage. In all, 3,069 GPs were eligible for the survey. A further 692 GPs did not complete enough of the questionnaire to be included in the final dataset, which contained 2,377 GPs. This paper uses all 3,069 eligible GPs when looking at device type used for starting the survey and at drop-off rates. For analysis of data quality, it uses all GPs who completed the relevant questions, and this varies throughout the questionnaire depending on the point at which GPs stopped completion.

The GP survey questionnaire included questions on: type and size of practice; quality improvement (QI) activities undertaken; barriers and facilitators to QI activities; methods and tools used for QI; and demographic characteristics. For GPs who completed the full questionnaire, the average time spent was 16:42 (minutes:seconds).

The survey was administered using the Qualtrics software (**www.qualtrics.com**).

Results of the IGPSS will be available on the Health Foundation website (**www.health.org.uk**) in due course.

Methods

The methodological analysis looking at data quality according to device type used by respondents is serendipitous, as it was not built into the original IGPSS design. The fact that this was not an experimental design, and that respondents chose which device to use for completing the web survey, makes it difficult to disentangle measurement and selection effects, and is a limitation of this analysis. In similar non-experimental studies among the general population, it is often possible to control for covariates related to the selection of particular devices (such as gender, age, income, education level and so on), but this has not been done in the current analysis for several reasons: first, very few relevant covariates were collected (only gender and age); second, the respondents were already fairly homogeneous in all being members of the same professional group; and third, gender and age were collected at the end of the questionnaire and thus had high levels of missing data due to the relatively high proportion of GPs who did not complete the full survey. Another limitation of our analysis is that we are not able to examine differences between smartphones and tablets (for reasons described below).

Coding device type

For GPs who started the questionnaire, the Qualtrics software provided the research team with the following paradata:

- Browser (for example, Chrome, Safari)
- Operating system (OS) (for example, Android, iPad, iPhone, Windows NT)
- Screen resolution

This paradata was used to classify whether respondents completed the survey on one of two device types: laptop/desktop (PC) or phone/tablet (mobile). The rules used for classifying devices are shown in the appendix.

With the paradata available from Qualtrics, it was not always possible to distinguish between smartphones and tablets, which is why we have categorised them together as ‘mobile’ devices. This is not ideal given the findings of some other research about the smaller screens of smartphones being one of the key factors in finding differences between mobile devices and PCs. Although looking at differences between devices according to screen size or method of data entry (keyboard or touchscreen) are of interest (Lugtig and Toepoel 2016), these variables were not collected during the survey and thus were not available for analysis.

Data quality indicators

Differences in data quality between PCs and mobile devices were examined using eight quality indicators:

- Break-off rates
- Survey duration
- Item non-response
- Straightlining
- Primacy effect
- Number of responses to multi-coded questions
- Likelihood of response to open-ended questions
- Length of open text responses

These indicators have been used by other researchers to look at differences in data quality by device type.

Break-off rates: the proportion of respondents who stop completing the questionnaire at various points before reaching the end, have been found to be higher among those completing web surveys on mobile devices.

Survey duration: the length of time required to complete the survey, may lead to higher break-offs, and can give an indication of respondent burden. It has been shown that the additional scrolling required on mobile devices, especially for grid questions, is a major contributor to the longer completion times typically found for mobile devices compared with PCs (Couper and Peterson 2016). For the current analysis, very long durations suggest that respondents left the questionnaire open for periods when they were not, in fact, working on the survey. For example, in the GP survey, the longest duration recorded was over 72,000 minutes, which suggests the respondent never 'submitted' the questionnaire and the end time was thus recorded as the time and date the survey closed. We excluded outliers over 60 minutes from the analysis, which applied to about 10% of respondents who completed the full questionnaire. These outliers included similar proportions of mobile and PC users, suggesting that lengthy interviews were not associated with device type.

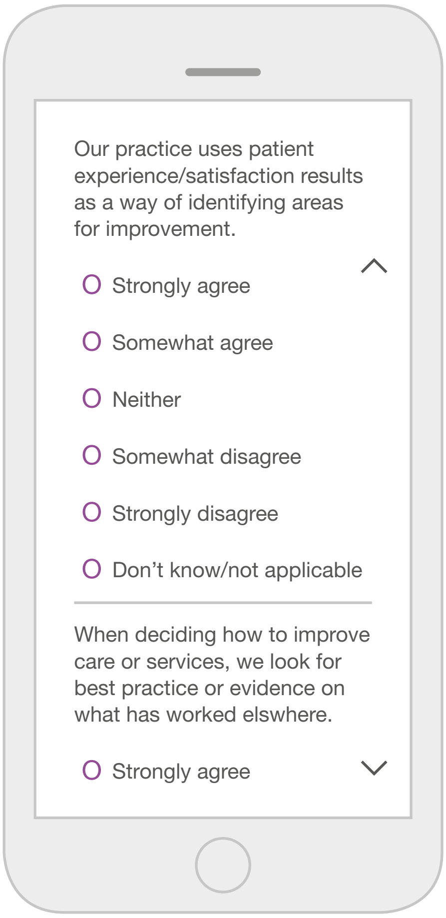
Item non-response: missing data can introduce bias into survey estimates, which includes respondents not answering a question or failing to give a substantive answer by ticking 'don't know', which could indicate the use of cognitive shortcuts. We look at item non-response for the four questions, containing 37 items, in the survey which involved Likert scales (for example, asking whether respondents agreed or disagreed with various statements). These were laid out in a grid format on PCs, but for smaller screen mobile devices, Qualtrics formats the statements into an 'accordion' so they can fit vertically on the screen (see Figure 1). For each item, we looked at the percent that were skipped or ticked don't know, and we provide the mean percentage over the 37 items.

Straightlining: is when a respondent provides the same answer to all of the items in a grid (or to a sub-set of consecutive items). It suggests that respondents may not be paying sufficient attention to answering the questions and taking cognitive shortcuts to get through the questionnaire more quickly. Current evidence shows straightlining for grid questions to be higher among respondents using mobiles than among those using PCs (Struminskaya et al, 2015). The same four questions looked at for item non-response described above were examined for straightlining. The first question included seven items and four response categories, and we considered straightlining if all seven items had the same response. The second question included eight items with five response categories, and was divided into two blocks of four items with the response headings repeated at the top of each block (for PCs). We defined straightlining as giving the same responses within each block. The third question contained 11 items and three response categories, and the items were divided into blocks of four, four, and three items (for PCs). We defined straightlining as giving the same response within each block. The fourth question contained 12 items and three response categories, and the items were divided into three blocks of four items each. We defined straightlining as giving the same response within each block. For mobile devices with smaller screens, instead of a grid format, the items were shown in accordion format with the response categories underneath each item in turn; this format may reduce the likelihood of straightlining, and we may, therefore, expect to find higher levels of straightlining for PCs.

Figure 1: Likert scale layout in grid format for PC (top) and accordion format for smartphone (bottom)

Thinking of activities to improve patient care and services within your practice in the last 12 months, please tick whether you agree or disagree with the following statements.

	Strongly agree	Somewhat agree	Neither	Somewhat disagree	Strongly disagree	Don't know/not applicable
Our practice uses patient experience/satisfaction results as a way of identifying areas for improvement.	O	O	O	O	O	O
When deciding how to improve care or services, we look for best practice or evidence on what has worked elswhere.	O	O	O	O	O	O
The GPs in our practice are able to monage the changes needed to improve the quality of care and services provided.	O	O	O	O	O	O
Our Practice Manager plays an important role in setting priorities for improving the services we provide.	O	O	O	O	O	O
Our practice is continually looking for ways to improve the care and services we provide.	O	O				O



The primacy effect: where respondents are more likely to select the first answer in a list, is another potential indication of cognitive shortcuts being taken. It has been shown to be more common for smartphones in cases where the list of responses does not all fit on a smaller screen display, especially for questions where respondents are asked to tick all that apply (Lugtig and Toepoel 2016). The GP questionnaire included one question with 13 items where respondents were asked to choose up to three responses, and another question with 15 items where respondents were asked to choose all that apply. We looked at the percentage of respondents who chose the first three answers on each list.

Number of responses to multi-coded questions: for the three questions which asked GPs to select all that applied, we looked at the number of responses chosen. If more answers are chosen, it may indicate greater cognitive effort on the part of respondents, and is likely to be more challenging when not all responses fit on smaller screen sizes, which means respondents need to make more effort by scrolling to see all categories. The three questions included eight, ten and 13 response options (excluding 'other' and 'don't know'). We looked at the mean number of responses chosen.

Likelihood of responding to open-ended questions and length of response to such questions: have been found to differ between PCs and mobile devices, mainly because of the different methods of data entry (touch screen versus keyboard) and, in particular, on mobile devices with smaller screen sizes which make typing more difficult (Wenz 2017). We looked at four questions where respondents were asked to type in their responses, and we present the mean percentage responding to these questions, as well as the mean length of response (in characters). (We have not looked at length of response to 'other' answers where pre-coded responses were also included.)

Results

Device used for survey completion

Of the 3,069 GPs known to be eligible for the survey, 1,328 used a PC for completing the survey, 1,604 used a mobile device (and 137 were uncertain). Overall, 45% of GPs used a PC and 55% used a mobile device (after excluding those whose device could not be classified). The proportion of GPs using a mobile device is higher than the proportion of respondents who use mobile devices in the general population to complete web surveys (for example, 23% of British adults in the 2013-14 Community Life web survey used a mobile device, according to Wenz 2017).

There were noticeable differences by gender and age, with women and younger GPs more likely than men and older GPs to complete the survey using a mobile device. As Table 1 shows, three in five women (60%) used a mobile device, compared with only two in five men (40%). Women aged under 50 were nearly twice as likely to use a mobile device as men aged 50+ (66% and 37% respectively).

Table 1: Device type used to complete survey by age within gender, GPs

	PC	Mobile
Women		
Aged under 50	34%	66%
Aged 50+	49%	51%
All	40%	60%
Men		
Aged under 50	56%	44%
Aged 50+	63%	37%
All	60%	40%

Response quality indicators

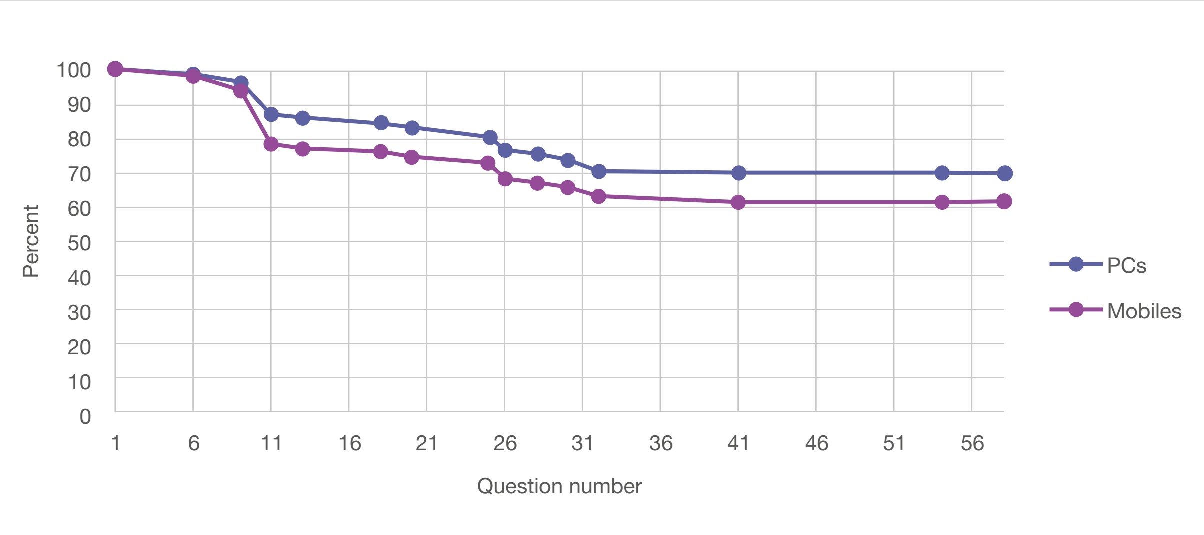
Below, we provide the results for the eight quality indicators described above.

Break-off rates

Compared with surveys of the general population, break-off rates for GPs were high: only two-thirds (66%) of all eligible GPs who started the questionnaire completed it in full, while one-third broke off at some stage of completion. As Figure 2 shows, respondents using PCs were more likely to fully complete the questionnaire (defined as completion through to Q58) than those using mobile devices (70% compared with 62%). For both devices, there was a significant drop-off between questions 9/10 and 11. Questions 9/10 were the first questions that were not tick boxes but asked GPs to type in text: either their NHS practice number at Q9 or, if that was not known, their practice's address at Q10. Drop-off rates were higher for mobile than PC users: 16% of mobile users left the survey at this point, compared with 10% of PC users.

After that point, break-offs tended to be steady throughout the remainder of the questionnaire, and at a similar rate of about 1-2 percentage points per question for PCs and mobiles alike.

Figure 2: Percent responding by question number, GPs



Survey duration

Our results showed PC users spending longer on the survey than mobile users, with mean completion times of 13:10 (mm:ss) and 11:38 (mm:ss) respectively. However, this is explained by the higher break-off rates of mobile users. Mean duration times for GPs who completed the questionnaire in full were the same for PC and mobile users (16:38 and 16:36 (mm:ss) respectively).

Item non-response

There was no difference in the likelihood of not providing a substantive response (that is ticking 'don't know' or skipping the question) to the questions we examined. The mean percentage of 'don't know'/not answered for the 37 items was 13% for PC respondents and 14% for mobile respondents.

Straightlining

We looked at the mean percentage of straightlining over nine blocks of questions containing 38 items, and found a small difference between PC users (17%) and mobile users (15%). (The mean percentage of straightlining appears quite high, but this is explained by one block of three items which had high levels of consistent answers between all the items, despite having exactly the same format and response categories of the two blocks, of four items each, immediately preceding it. If this block is excluded, the mean percentage of straightlining was around 10%.)

Primacy effects

The percentage of respondents selecting the first answer category presented for each of the two questions examined showed no differences between PC and mobile users. The mean percentages selecting the first item listed was 54% for PC users and 53% for mobile users. Looking at the likelihood of selecting the first three categories showed a similar pattern.

Number of responses to multi-coded questions

The mean number of responses selected to the three questions that asked GPs to tick all answers that apply was 5.2 for PC users and 4.5 for mobile users. This difference is not statistically significant, and is consistent with evidence from previous research (for example Lugtig and Toepoel 2016).

Length of open-ended answers

GPs using PCs were more likely to type in an answer to open-ended questions than those using mobile devices: 31% and 25% respectively. Also, among those who did provide an answer, they were on average somewhat longer for PC users than mobile users (77.1 characters versus 72.6 characters), but not to an extent that would appear to affect data quality. Two of the open-ended questions were of the type where GPs were asked if they had anything else to say with respect to the topic in the previous question, and one was the final question asking if they had anything else to say about QI in general practice. Only one of the open-ended questions was a direct question which all respondents were expected to answer – the question asked GPs to type in their top priority for improving patient care. The differences found between PC and mobile users were larger for this question: 61% of PC users answered the question compared with 51% of mobile users; and those responding on a PC gave longer responses than mobile users (58 versus 49 characters).

The results to the response quality indicators are summarised in Table 2.

Table 2: Response quality indicators by device type, GPs

	PC	Mobile
% break-offs	30	38
Mean completion time (minutes:seconds)	13:10	11:38
% item non-response	13	14
% straightlining	17	15
% primacy effect	54	53
Mean number of responses to tick all that apply questions	5.2	4.5
% providing answers to open-ended questions	31	25
Mean length of answers to open-ended questions (characters)	77	73

Discussion

The current analysis compares responses given by highly qualified/experienced professionals (GPs in the UK) using PCs with those using mobile devices to complete an online workplace survey. We have drawn three key conclusions.

First, by sending electronic links to the survey included in an email invitation to our highly educated GPs, we found a higher proportion (55%) completing the survey on a mobile device than is commonly found in online surveys in the general population, even those targeted at younger adults. It seems critical, therefore, that online workplace surveys targeted at similar professionals are optimised for use on small-screen devices (for examples of how to design surveys for small screens, see Hanson and Matthews 2016/17; de Bruijne 2015).

Second, respondents were likely to stop completing the survey when they first encountered an open question that asked them to type in text rather than select a pre-coded item from a list, but this was more likely for those completing the survey on a mobile device. It appears that this is particularly likely to be the case for respondents who are less motivated to take part as, among those who did continue past this first text question, there were no large differences in the amount of text entered in subsequent open-ended questions (although those on mobile devices were somewhat more likely not to enter any text). The implication is that open-ended questions should appear towards the end of the questionnaire, rather than at the start.

Third, among our group of highly educated professionals who completed the survey, there were very few differences in response quality between those using PCs and those using mobile devices. There were no differences in survey duration, item non-response, straightlining, primacy effect or number of items selected at multi-coded questions. The only noticeable differences were that PC users were more likely than mobile users both to type in responses to open-ended questions, and to give slightly longer responses when they did answer, which is likely explained by the greater ease of using a PC's keyboard compared with a mobile's touchscreen. Even these differences, however, were not very large.

There are a number of limitations to the current study. One is that it was not designed as an experiment, and GPs were free to choose which device they used to complete the survey. This means selection effects cannot easily be disentangled from potential differences in response quality, nor did we have sufficient demographic data to control for respondent differences (for example, age) in the analysis. A second is that we were not able to distinguish devices used according to screen size, as it may be small screens rather than device type that has the most significant impact on response quality (Wenz 2017), especially if the questionnaire is not optimised for smaller screens (Antoun 2017). In future surveys, we will attempt to capture data on screen size to look at this more fully in the analysis. A third limitation is that the questionnaire was not designed as 'mobile first'. While we did incorporate some elements of 'mobile friendly' design (such as showing grids in accordion format on mobile devices), other elements were not 'mobile friendly' (such as longer lists of responses which do not fit on a small screen and require the user to scroll down to see all response options). It could be that if the survey was designed as 'mobile first', the questionnaire would be more comparable across different types of devices. A fourth limitation is that the response rate to the GP survey was low. While low response is typical of GP surveys in the UK, it makes it difficult to be confident that the findings are representative of all UK GPs. Related to this, the current analysis looks at a particular group of highly qualified and very busy professionals, which may hinder the extent to which our findings will generalise to other workplace surveys, even those of other professional groups.

Conclusions

In conclusion, the findings are encouraging, as it appears that once health professionals have engaged with a survey, the device they are using to complete it does not appear to have a significant effect on the quality of their responses. Discouraging, or even blocking, the use of mobile devices, as some have suggested (Hanson and Matthews 2016/17; de Bruijne and Wijnant 2014), does not appear to be necessary in these circumstances. Of course, optimising survey questions for different devices or screen sizes is still important, and the Qualtrics software used for the IGPSS adjusts question layout for different devices. For example, a grid (or matrix table as referred to by Qualtrics) that includes a number of statements in rows and response categories (or scale points) in columns in PC format, is transferred into an 'accordion format' on a mobile device, so that each statement and the list of response categories can be included on screen. Our analysis of a workplace survey supports findings from previous analyses of general population surveys which show that surveys that are optimised for mobile devices can provide data quality as good as that obtained from PC users (see for example, Dale et al, forthcoming). Given that the use of mobile devices for completing surveys is likely to continue to increase, researchers should be encouraged to continue to examine ways to optimise questionnaire design for different types of device while at the same time maintaining consistency (for example, of question wording) and minimising mode effects.

Appendix

The rules for classifying devices into either laptop/desktop or phone/tablet, using information collected by the Qualtrics software on browser, operating system and screen resolution, were as follows:

For non-Windows OS:

All Android were classed as mobile

All iPad OS were classed as mobile

All iPhone OS were classed as mobile

All Macintosh OS were classed as PC

For Windows OS:

All Windows NT 5 and Windows NT 6 were classed as laptop/desktop

All Windows Phone 8 and Windows Phone 10 were classed as phone/tablet

For Windows NT 10, the classification was based on screen resolutions, following the guidance provided on GlobalStats statcounter website (**http://gs.statcounter.com/screen-resolution-stats/**):

1366 x 768	PC
1920 x 1080	PC
1440 x 900	PC
1280 x 1024	PC
1280 x 800	uncertain
1600 x 900	PC
1024 x 768	uncertain
1536 x 864	PC
1680 x 1050	PC
768 x 1024	phone/tablet
1280 x 800	uncertain
800 x 1280	mobile
600 x 1024	mobile
1024 x 768	uncertain
601 x 962	phone/tablet
1054 x 600	phone/tablet
1024 x 1366	phone/tablet
962 x 601	phone/tablet

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