

WITHDRAWN: Irish Medical Laboratory Professionals and COVID-19: Response, Effect and Reflection on Future Practice

James A. O'Connor

Mercy University Hospital <https://orcid.org/0000-0001-8139-5734>

Brigid Lucey

brigid.lucey@cit.ie

Munster Technological University <https://orcid.org/0000-0002-0872-202X>

Research article

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EDITORIAL NOTE:

The full text of this preprint has been withdrawn by the authors while they make corrections to the work. Therefore, the authors do not wish this work to be cited as a reference. Questions should be directed to the corresponding author.

Abstract

Background: The COVID-19 pandemic has had an unprecedented effect on healthcare staff across the globe. Medical laboratory professionals are central in the diagnosis and monitoring of treatment of most diseases, including COVID-19. The effects of the COVID-19 pandemic and previous pandemics have been examined for other healthcare professions, but there has been no study examining the effects of a pandemic, or any other healthcare emergency on medical laboratory professionals.

Method: A voluntary, online survey of 37 closed and open questions for medical and healthcare scientists working in Ireland was conducted in May 2020. The survey examined the responses and effects of COVID-19 on medical laboratory professionals along with any lessons learned. Statistical significance was determined by two-tailed t-test (unequal variance).

Results: There were 272 respondents, representing over 10% of the total workforce of Medical Scientists in Ireland. The respondents reflected all ages, grades, and disciplines in laboratories across Ireland and 87% of respondents reported a change to core working hours. Increasing workload complexity was reported by 70% of respondents. More than half of respondents reported increased work stress during the pandemic. The pandemic has also resulted in improved work-based solidarity. Approximately 90% of respondents were proud of their laboratory's response to COVID-19, although degree of pride was significantly higher among managerial staff as were feelings of being appreciated, suggesting opportunity for further communication of praise. The study reports lessons learned thus far in the pandemic, including realisation of their service's flexibility and adaptability, the necessity of collaboration and preparedness and the importance of their work.

Conclusions: The respondents have identified challenges, including lack of career progression opportunities and under-utilisation of their professional skills, paucity of public knowledge of the roles undertaken in the laboratory and remuneration disparities, combined with concerns regarding retention of newly-qualified and other staff owing to alternative career opportunities.

Background

The COVID-19 pandemic has affected all aspects of society and work. The burden on health care facilities and facilities has been widely reported (1, 2). To date there have been over 25,000 laboratory confirmed cases of COVID-19 in Ireland (3).

In Ireland scientists working in medical laboratories are responsible for conducting hundreds of different tests for disease in humans. They work to ISO standard 15189 and accreditation to the standard is the norm. The work of these laboratories, normally not overtly visible, has been placed in sharp focus by the arrival of the current pandemic, not least by the World Health Organisation's mantra to "test, test, test".

Medical laboratories are mostly single discipline and the primary disciplines include biochemistry (or chemical pathology), haematology, transfusion medicine (or blood banking), clinical microbiology

(bacteriology, virology), histopathology and immunology. Some laboratories are multidisciplinary and incorporate more than one discipline. There are other professionals who support the work of scientists in clinical laboratories, including medical laboratory aides, clerical staff and portering staff. Furthermore, the work of the diagnostic laboratory is underpinned and supported by laboratory quality, IT departments and laboratory management. The large majority, but not all scientists working in hospital laboratories belong to the medical scientist profession and it is estimated that there are some 2,400 practising medical scientists in the country, currently and perhaps two hundred scientists working in allied roles in the same laboratories. In Ireland, medical laboratories exist across the spectrum of healthcare providers including the public, voluntary and private healthcare sectors.

The laboratory confirmation of the viral aetiology of COVID-19; Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-CoV-2) is normally achieved through detection of the genetic material of the virus (viral nucleic acid) in respiratory samples or detection of antibodies to the virus (immune response after exposure to the virus) in blood samples. This work is primarily conducted in a clinical microbiology laboratory. These are new tests and they require careful validation before use. The uncertainty of supply of test reagents and test kits has meant that many clinical microbiology laboratories have needed to validate a variety of different systems for the detection of the virus over the past four months, however, introducing these new tests and responding to the additional testing associated with the pandemic while ensuring that all other pre-existing services were run concurrently. The management of the patient who is severely ill from COVID-19 disease requires additional tests (using long-established methods) to be conducted in the other disciplines.

The purpose of the current study was to investigate the effect of the COVID-19 pandemic on the scientists in medical laboratories in Ireland within the first three months of the pandemic in Ireland through a survey and to determine whether there were lessons to be learned for the future operation of these laboratories from the experiences and conclusions of the respondents.

Methods

Scientists working in medical laboratories in Ireland were surveyed using a survey designed by the authors (provided as additional file 1) for the current paper and comprising a combination of 37 open- and closed-ended questions on www.surveymonkey.com. Surveying was conducted anonymously and voluntarily between 9 and 26 May 2020, after which time a period of five days was allowed for a communicated request for withdrawal from the survey, in line with the conditions of ethical approval granted by the Research Ethics Committee of Munster Technological University (MTU). Analysis of results was conducted through Excel.

Statistical significance was tested using Welch's T test (2-tailed) for unequal variance with a p-value of less than 0.05 considered significant.

Results

A total of 272 valid responses was received. A provincial analysis of the survey showed that a total of 51% of respondents were working in Leinster (45% of the total respondents were in Dublin), 33% were in Munster, 15% were in Connaught and 1% were in Ulster. A total of 25% of respondents worked in small laboratories (consisting of fewer than 10 people), 43% worked in medium-sized laboratories of between 10 and 20 people) and 32% worked in large laboratories having more than 20 people. These laboratories included Health Service Executive (public) laboratories (59%), voluntary hospital (public) laboratories (29%), private hospitals and laboratories (11%) and the remaining 1% were in the Irish Blood Transfusion Service and working on the Maternal and Clinical Management System.

The proportion of respondents shown according to their scientific discipline (specialist) work area is provided in Fig. 1.

^Other (1%) denotes point of care and molecular genetics

Figure 1. Scientists working in Irish medical laboratories (n = 272) grouped according to specialist scientific discipline area

When asked to list their highest qualification, 69% of respondents had a Master's level qualification or higher qualification in their field of work. These included Master's degrees in areas of biomedical science (53%), a Fellowship from the Institute of Biomedical Science (10%), a PhD (4%); a smaller minority held a Master's degree in business administration or a Diploma or Fellowship of the Royal College of Pathologists (UK).

Regarding their job title some 45% of respondents were basic grade medical scientists, 28% were senior medical scientists, 10% were chief medical scientists and a further 3% were laboratory managers. Of the remaining 14%, approximately 4% were trainee medical scientists, 3% were specialist medical scientists, 2% were laboratory aides, 1% were senior or principal biochemists, 1% were clinical scientists; the remainder included quality managers and IT specialists.

Seventy-three percent of respondents were female, and taking the largest cohort of the respondents, which were the medical scientists, 77% of basic grade medical scientists were female, 80% of senior medical scientists were female, 57% of chief medical scientists were female and 55% of laboratory managers were female.

The length of time since respondents had qualified is shown in Fig. 2. The age-groups of these respondents were as follows: 18–24: 9.5%; 25–34: 28%; 35–44: 33%; 45–54: 19.5%; 55+: 10%, including 1% who were 65 + years old. Some 51% had spent fewer than 10 years in their current workplace, 34% between 10 and 19 years in their current workplace and the remaining 15% had spent 20 or more years in their current workplace.

A total of 7% of respondents said that they had taken up their current position as a direct result of the current pandemic.

Work Practices:

A summary of changes to work practices in Irish medical laboratories is shown in Fig. 3. Over 48% of respondents reported that they have been working more hours since the onset of the pandemic. There was no significant difference in this regard between grades, i.e. basic grade compared to senior and managerial grades. Those working in multidisciplinary laboratories and biochemistry were found to work significantly more hours than those working in other laboratories including, notably clinical microbiology (clinical biochemistry/clinical microbiology: $p < 0.04$, multidisciplinary/clinical microbiology $p < 0.002$). The examination of core working hours saw 87% of respondents reporting a change to their core working hours. All respondents working in clinical biochemistry reported a change to core hours, significantly more than colleagues in clinical microbiology ($p < 0.01$), haematology ($p < 0.04$) and blood banking/transfusion medicine ($p < 0.01$). The majority of laboratories offer an out-of-hours service (on-call service), covering night-time and weekend hours. The survey found that 55% of respondents have seen a change in their participation in such rotas. The disciplines that saw the most significant changes were clinical microbiology, where significant changes were observed when compared to those working in haematology ($p < 0.02$), blood banking/transfusion medicine ($p < 0.01$) and clinical biochemistry ($p < 0.05$). Notably, there was a significant change in participation in out-of-hours participation for those working in multidisciplinary laboratories when compared to colleagues working in haematology ($p < 0.04$) and blood banking/transfusion medicine ($p < 0.01$).

Approximately 70% of respondents reported an increase in workload complexity. Over 85% of staff employed in a clinical microbiology setting reported an increase in workload complexity, significantly higher than seen in all other disciplines ($p < 0.01$). Most respondents (72%) reported that their work during the COVID-19 pandemic affected their work/life balance and there was no significant difference in this regard between disciplines.

A total of 54.5% of respondents found work to be more stressful since the current pandemic and 24% disagreed that this was the case. There was no significant difference between either grade or discipline in perception of stress, however.

Disruption Of Studies By Covid-19

A diversity of courses, including final qualifications for the degree in biomedical science being undertaken by trainees, MSc, PhD, trainer, management, leadership and continuing professional development-associated courses were disrupted by the pandemic, affecting 21% of respondents in total. Those respondents aged less than 25 years were the worst affected, with 47% stating that their studies had been disrupted. For those aged 25–34, 26.5% reported having their studies disrupted, for 35–44 year olds the figure was 18%, for 45–54 year olds the figure was 13% and in the case of those aged between 55 and 64 years, 9% reported having their studies disrupted.

Solidarity, pride, self-awareness as a profession and the sense of being appreciated by others in the service

When asked whether the pandemic had brought about more solidarity in their own laboratory, 64% agreed that it had, 19% of them agreeing strongly that solidarity had increased. There was no significant difference between grades of scientist, but notably there was a significantly heightened difference in the sense of solidarity in clinical microbiology laboratories compared to all the other types of laboratories, including multidisciplinary laboratories (all comparators with the clinical microbiology departments having a p-value < 0.02).

There was no significant difference between any one discipline and another's level of pride in their response to the pandemic. In total 47.5% felt very proud and 39% felt proud of their laboratory's response to the pandemic. There was no significant difference between any one discipline and any other; however, there was a very significant difference between senior medical scientists' level of pride and that of lab chiefs/managers (whereby the latter were much more proud, $p < .01$) and between basic grade medical scientists' and lab chiefs/managers' level of pride (more significantly different again, having a p-value of < .001).

There was no significant difference between departments as to whether they feel more appreciated for their efforts during the COVID-19 pandemic; overall 5.5% of people agreed strongly with this statement and a further 37% agreed with it; however, there was a significant difference between chiefs and managers' feelings of being appreciated versus senior medical scientists ($p < .01$) or basic grade medical scientists ($p < .01$). There was no significant difference in this regard between basic grade and senior medical scientists.

The survey asked an open-ended question of respondents about lessons that they have learned as a result of the pandemic. A total of 173 of those surveyed responded to this question and the answers were analysed and grouped using a realist thematic analysis approach and the most commonly encountered answers are illustrated in Fig. 4.

Future Developments:

When asked whether COVID-19 had changed the way in which the respondents viewed their profession 47% said that it had and 18% disagreed that it had. There was no significant difference in the level of agreement with this statement either between disciplines or between different grades of scientist, however. The respondents' views (166 respondents had commented on this question) on what improvements will be needed in the medical laboratory over the next decade are represented proportionally according to the frequency of statement in Fig. 5.

Discussion

The current study surveyed more than 10% of the total workforce in Ireland's medical laboratories, distributed across all practice disciplines, grades and working in public, voluntary and private hospitals. Almost three-quarters of the respondents were female, which reflects the preponderance of females in the profession overall.

In Ireland, there are core-laboratory hours, during which there is the highest level of staffing and when most routine samples are processed. Most laboratories have an out-of-hours or on-call service, whereby a scientist (or scientists) process samples that are deemed urgent 24/7. These services are well established for haematology, clinical biochemistry and blood transfusion and from the responses in the current survey, there tended to be multi-disciplinary cover of the clinical microbiology urgent requests outside of routine hours, with little or no out-of-hours service for histopathology and immunology. The survey identified that there were significant sacrifices made by clinical laboratory professionals in response to the COVID-19 pandemic. Approximately half of the respondents have had changes to the number of hours worked per week with increased participation in out of hours service provision and 87% had changes to their core/routine working hours, for example (see Fig. 3), showing that the current pandemic had brought about the need for a high degree of change in how the service was administered across the whole of pathology to optimise the service that they provided. It should probably be mentioned that medical scientists are qualified to work in all disciplines and their additional qualifications reflect the discipline in which they have chosen to work – whether they needed to transfer from one discipline to another during the pandemic was not investigated in the current study, unfortunately. A recent study from Wuhan, China, found that there was a correlation between longer working hours for healthcare workers and increased risk of contracting COVID-19 (4). This increase in working hours against a background of travel restrictions resulted in many scientists being unable to see family and friends for an extended period. This finding is in line with many healthcare workers experiencing longer working hours and seeing less of their families in response to COVID-19 (5). The COVID-19 pandemic has seen a significant increase in participation in out-of-hours service for scientists working in clinical microbiology, compared to disciplines where out-of-hours services were already well established. This indicates that more resources have been provided to clinical microbiology services by management, and there was also demonstrated to be a significantly increased commitment of clinical microbiology scientists to facilitate testing out-of-hours. There was a significant reported increase in workload complexity in clinical microbiology compared to other settings ($p < .01$). This is not unexpected as many scientists in microbiology laboratories had to establish appropriate molecular protocols for the detection of SARS-CoV2 RNA. Moreover, 70% of respondents across all disciplines reported an increase in work complexity. This increase is due to the morbidity and mortality associated with COVID-19 illness which has resulted in increased laboratory investigations across all disciplines to ensure appropriate patient management (6). This is further demonstrated by over 70% of clinical decisions requiring some laboratory investigation to support diagnosis, treatment and monitoring of patient outcome in general medicine (7).

The findings suggest that the validation and implementation of new types of testing to clinical microbiology laboratories together with a necessarily extended out of hours service may have increased the sense of solidarity to a significant extent relative to other disciplines. Some of the clinical

microbiology laboratories needed initially to introduce molecular-based testing for the first time in response to the need to diagnose SARS-CoV-2 infection, while others added this test to the suite of molecular tests that they were already conducting on patient samples. In each case the detection of virus from patient samples was required to be conducted at any hour of the week, urgently. Subsequently, there has been the addition of tests to detect antibody to the virus in patients' blood samples. Those working in this discipline also reported more complexity in their work than was reported in the other disciplines. This finding suggested that these laboratories faced their challenges with a team spirit and certainly that they depended on one another to run the service effectively. A sense of solidarity among colleagues is to be welcomed and this may have been (at least) accentuated by external factors in this case. A study of organisational factors that bring about solidarity concluded that high levels of formal and informal information exchange and less hierarchical authority were factors that aided a sense of solidarity (8), factors that are necessary to be able to function when managing an ongoing emergency situation such as provision of a medical laboratory service during a pandemic.

It was evident that there was a strong sense of pride in their laboratory's response to the pandemic, whereby 86% of respondents reported feeling proud to a greater or lesser extent. One Swedish study concluded that the core determinants of occupational health among healthcare workers seem to be work-pride (in what is achieved individually and as a group in departments, with a sense of belonging) and confidence (based on the strong support that exists at the workplace from managers and co-workers) (9). Most strikingly in the current study, however, there was a significantly enhanced sense of pride among the most senior members of staff, when compared to the lower grades of staff. This may suggest that the communication of more senior members' pride in their laboratory's achievement may not be filtering down to the more junior staff and that an opportunity to reward these employees with praise for their work is being missed.

In line with the findings for feelings of pride, when asking the question whether respondents felt appreciated, there was a significantly enhanced sense of feeling appreciated among management staff when compared to junior staff in the laboratory or even middle management in the laboratory, namely the senior medical scientists (overall, 42.5% of respondents felt appreciated). A study of healthcare workers in Singapore during the Severe Acute Respiratory Syndrome (SARS) pandemic found that 77% of respondents felt appreciated by society (10). It is debatable whether there is any great public understanding of what scientists in hospital laboratories do, currently, and this would need a separate study.

The lessons learned by medical laboratory professions are positive, for the most part. As shown in Fig. 4 nearly a third of respondents felt that the early stages of this pandemic made them realise how important their role is in healthcare. This is an important intrinsic motivator and should go some way towards maintaining morale among at least some of the respondents. The second most common theme was a realisation of the flexibility and adaptability of the workforce in response to the new service requirements resulting from COVID-19 (i.e. increased testing and change in work hours and practices). Other positives gleaned from the experience included an enhanced understanding of the importance of teamwork and

collaboration and planning/preparedness. There were negative responses also: many of these mirrored changes that were desired for the future of the profession, including lack of awareness by others of the role of the scientist in the hospital laboratory, a need for more resources and that the role of the medical laboratory scientist is underappreciated. These findings are important considerations for healthcare managers and practitioners when planning staff and resources for future pandemics, or indeed a second wave of the current pandemic.

The current career structure for scientists who remain in conventional medical scientist roles in Ireland is, for the most part linear (basic grade medical scientist progressing to senior medical scientist to chief medical scientist and, for a small minority, to laboratory manager). This survey found that there is a large cohort of scientists who currently identify a lack of career progression options and lack of advanced practice (26% of respondents). Advanced practice roles include clinical scientists, whereby the scientist takes a more clinical role. This role has been well described previously (11) and includes practicing at the clinical interface between laboratory and patient, providing scientific, diagnostic and interpretative advice, advising and training clinical colleagues, maintaining and advancing the scientific basis of the service to the highest quality levels. The clinical scientist role is well advanced and supported in the National Health Service of the United Kingdom (NHS), where there is a defined career and supported training pathway and curriculum that is central to planning the service (12). The majority of medical scientists in Ireland are educated to Masters level or higher (the current study showed 69%). Furthermore, there is a culture of continuous improvement in the profession, as evidenced by 21% of respondents stating that the pandemic has affected their studies. An examination of the breakdown of these respondents shows diversity in age (46% are aged 35 years or older), years since qualification (44% have been qualified over 10 years) and current highest level of qualification (42% already have a masters (or equivalent qualification, 4% already have a PhD and a further 1% already have attained Fellowship of the Royal College of Pathologists (UK)). The shortage of advanced roles is highlighted through the present study as fewer than 4% of respondents had a specialist, clinical scientist, biochemist, or indeed a consultant level scientific role (this latter respondent was an individual who took up a position as a direct response to the pandemic crisis), although anecdotally, it is very commonplace for these roles to be filled by those with a primary degree in biomedical science as a first qualification. The primary management question may be whether having an ever-increasing number of increasingly qualified scientists, coupled with few advancement opportunities may lead to these scientists leaving the profession for other opportunities (e.g. academia, industry), which would be unfortunate, given that the implementation of advanced roles has been associated in a number of studies with better patient outcomes, resolving recruitment and retention issues and, importantly, improving job satisfaction (11, 13, 14). It was illuminating that 21% of respondents had their studies disrupted by the COVID-19 pandemic, across the age spectrum from the youngest to the most senior in years. This shows a culture of lifelong learning among scientists in medical laboratories, perhaps more strikingly illustrative than the finding that the large majority of respondents already have (at least) one Master's degree or further qualification.

The results presented in Fig. 5, where respondents were asked what they think are going to be the future needs of their profession, were mapped to Maslow's hierarchy of needs (15). Stated needs tended

towards self-fulfilment and psychological needs- 26% of comments described a need for improved career options, including more promotional activities, advanced practice and more clinically orientated roles. Furthermore, over a quarter of replies indicated that there needed to be improved knowledge of the profession in the public, tending towards fulfilling prestige and feelings of accomplishment of Maslow's esteem needs. A recurring theme in the comments from respondents that favoured improved public knowledge about the profession was frustration with a lack of understanding or misinformation in media reports regarding who was doing the testing. This had led to a perceived minimisation and invisibility of the role of scientists in the effective management of the pandemic. The intrinsic motivating factors of recognition and responsibilities were diminished among respondents as a result. This may be an important finding in the current study as high levels of intrinsic motivation factors in a job are proven to result in higher levels of satisfaction - and higher levels of job satisfaction are inversely correlated with emotional exhaustion (16). This commentary from the respondents was accompanied by further comments from scientists, who felt there needed to be more active representation of scientists working in medical laboratories on a national stage.

However, it should be noted that not all responses were towards the top of Maslow's pyramid, with some 14% of respondents commenting on a need for more pay for the work being undertaken. The rationale behind pay increases were through comparison by some of the respondents of remuneration with others in allied professions. It has been shown that increased pay is a motivator, but importantly, those that perceive that their salary is not fair by comparison with others are demotivated (17). Moreover, extrinsic motivational factors or remuneration alone will not resolve all worker motivational problems (18). Therefore, in the case of medical laboratory professionals in Ireland, it is important that senior health service managers consider the many factors that have been identified by the workforce to future-proof these professions.

Conclusion

Scientists working in medical laboratories in Ireland have demonstrated a high degree of flexibility, adaptability, solidarity, and resilience in response to COVID-19. They have changed how and when they work in a short period of time whilst introducing complex new testing protocols against a background of an increasingly complex workload in order to address the needs of their communities for expedient testing. Laboratory management have been shown to be particularly proud of their workforce but may need to communicate this more effectively. There is a culture of continuous improvement and advancement among these scientists, demonstrated by high level of qualifications and on-going education across all ages and grades.

The current study details the lessons learned from the current pandemic by laboratory scientists that should aid in a rapid response of clinical laboratories for ongoing and future pandemics. These include the need for effective collaboration, teamwork, planning and preparedness.

Scientists in medical laboratories have proposed their professional needs for the future, including improved and advanced career opportunities, increased knowledge of the profession in the public and equity regarding pay. It is important that senior healthcare managers engage with staff to ensure that future improvements for the profession act as extrinsic, but also intrinsic motivational factors, especially around improved career opportunities and enhanced clinical participation.

Declarations

Ethical approval and consent to participate:

Granted by MTU ethics committee. The survey was voluntary, informed consent was presumed by participation, as detailed in the survey introduction which included details of how to withdraw from survey.

Consent for publication:

Not applicable.

Availability of data and materials:

The datasets generated and/or analysed during the current study are not publicly available. Data may however be available from the authors upon reasonable request and with permission from CIT ethics committee.

Conflict of interest:

The authors declare that they have no competing interests.

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None received for the present study.

Authors' contributions:

JOC and BL have contributed equally to the derivation of the survey, the analysis of results and the writing of this paper. All authors have read and approved the manuscript.

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Authors' information:

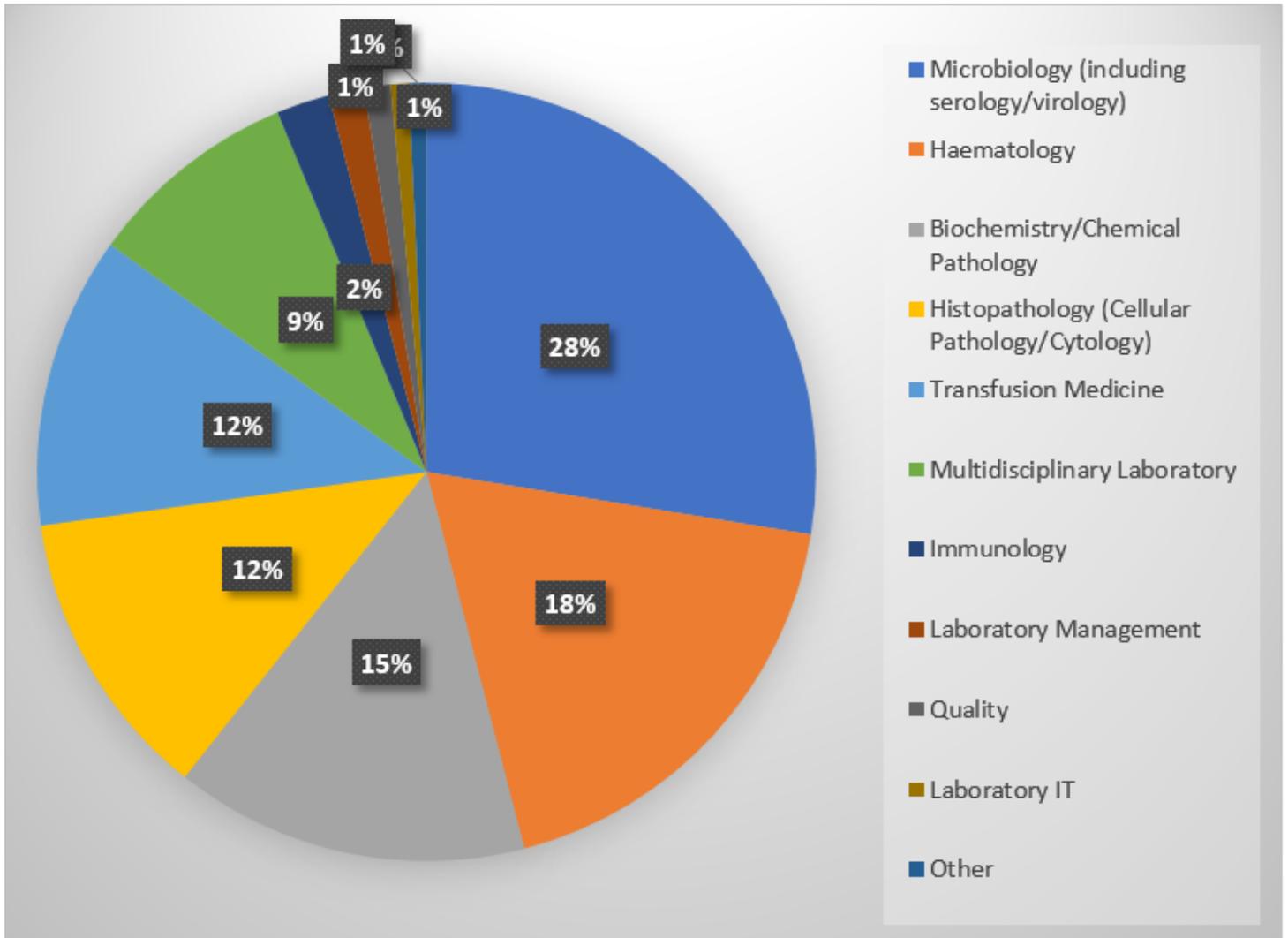
Both authors are medical scientists by profession; JOC is a specialist medical scientist practitioner and BL is head of department in MTU.

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Figures



^Other (1%) denotes point of care and molecular genetics

Figure 1

Scientists working in Irish medical laboratories (n=272) grouped according to specialist scientific discipline area

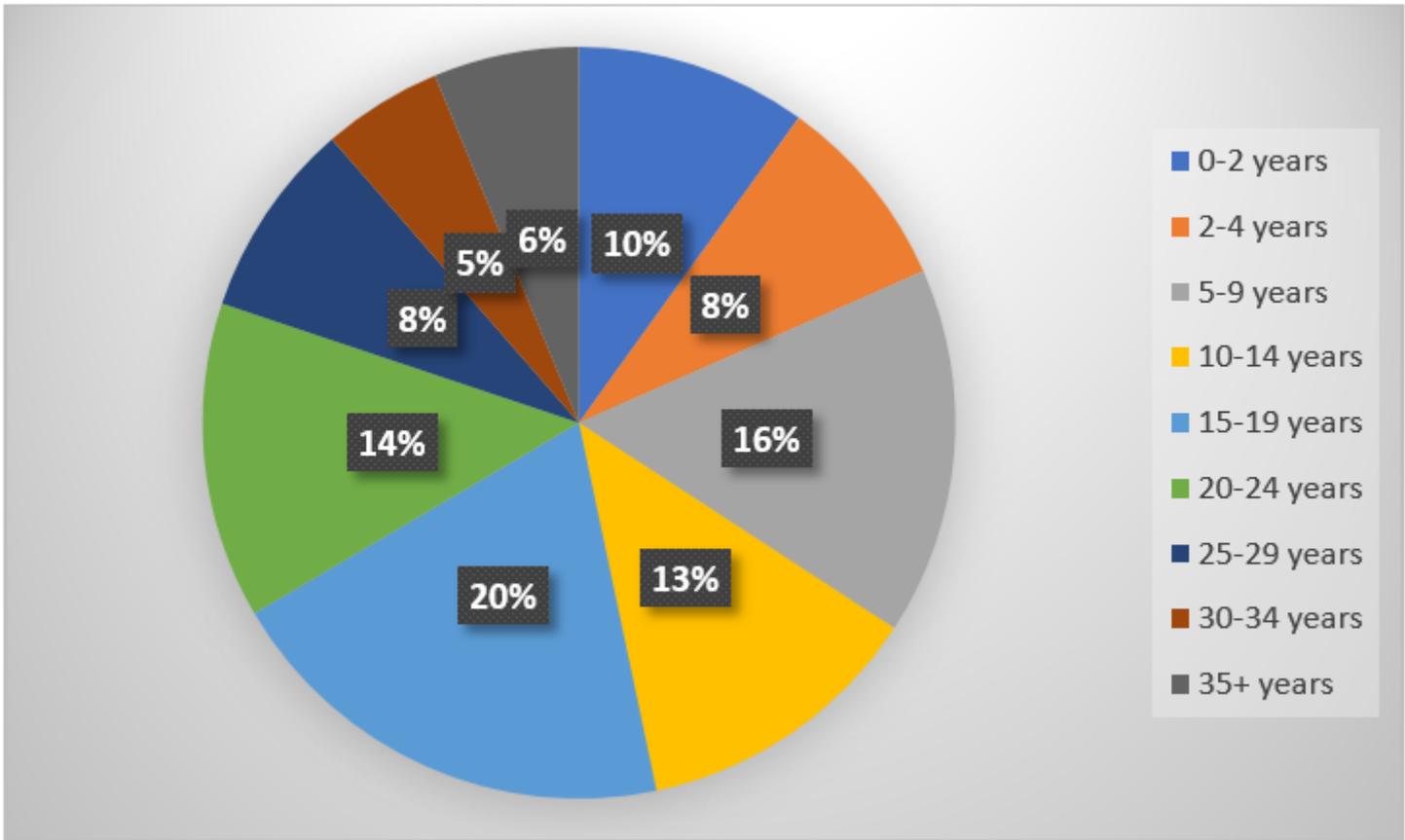


Figure 2

Length of time since qualification of 272 scientist respondents working in hospital laboratories in the Republic of Ireland

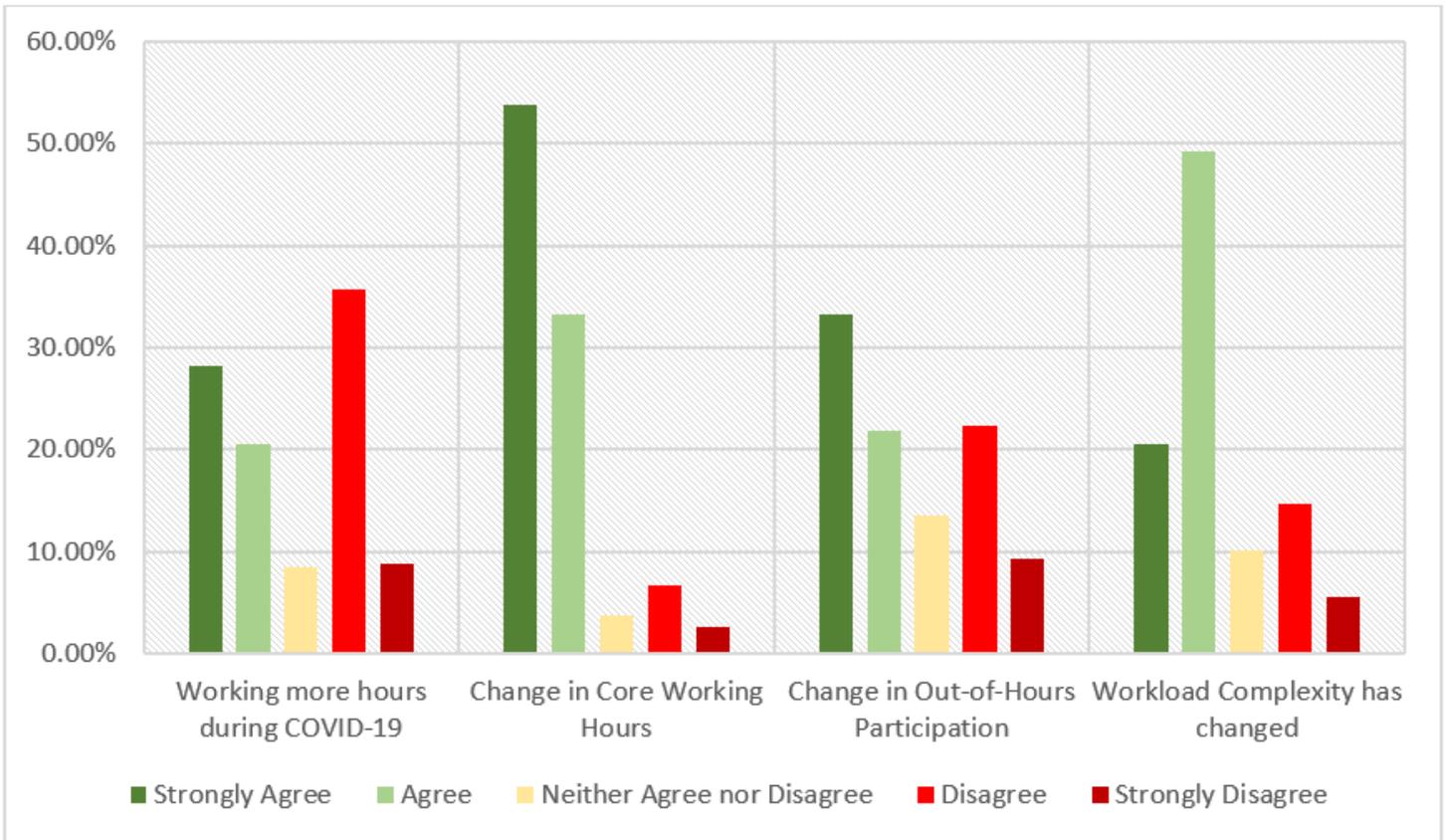


Figure 3

A summary of the way in which the COVID-19 pandemic has affected work practices in Irish hospital laboratories

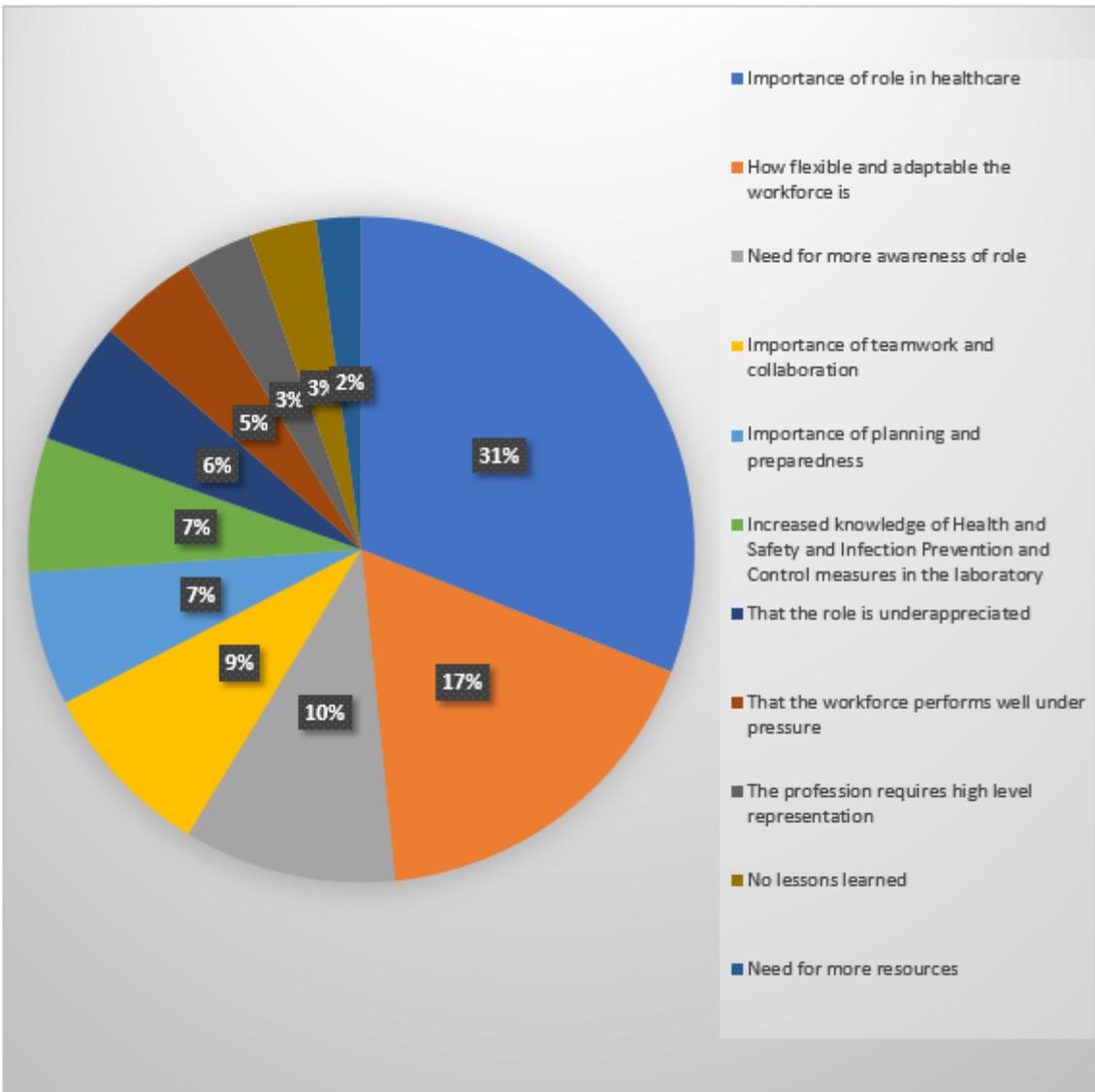


Figure 4

Lessons reported as having been learned in their professional life as hospital laboratory scientists by the respondents since the pandemic began in Ireland (Number of question respondents= 173)

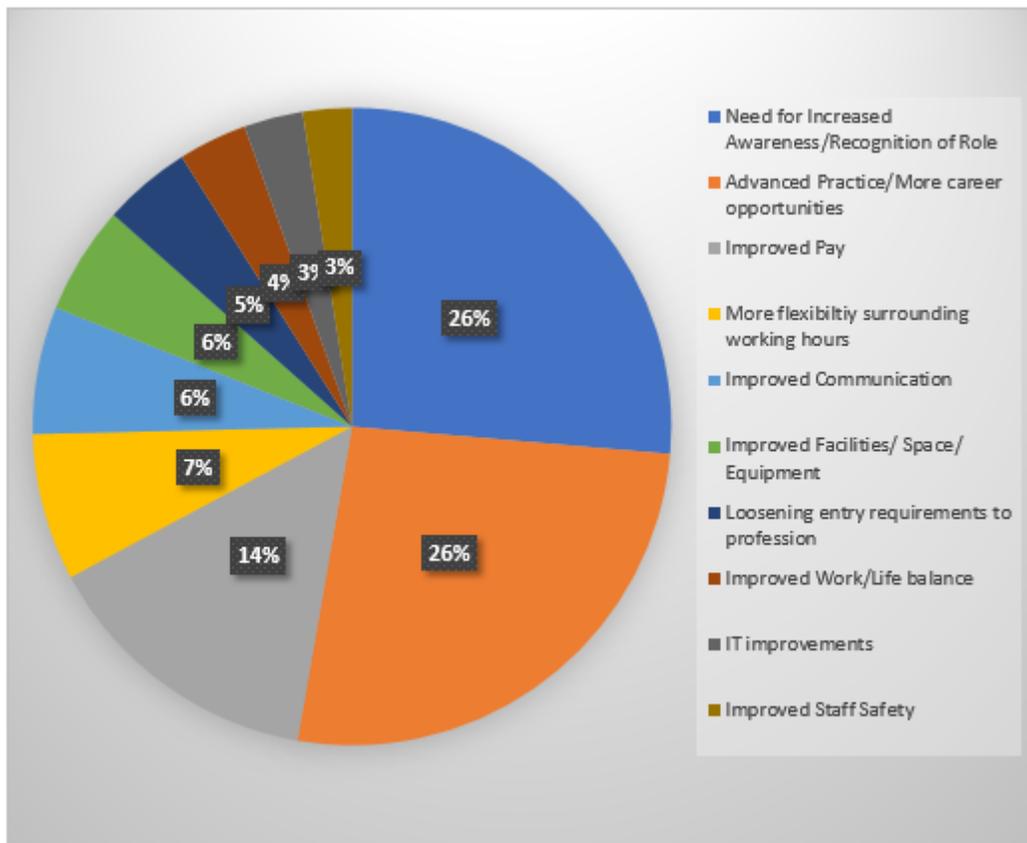


Figure 5

Analysis of improvements suggested by respondents as being needed for medical laboratories in the future

Supplementary Files

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- [SurveyQuestionsSupplementarymaterial1.docx](#)