Department of Health
An Roinn Sláinte
Männystrie O Poustie
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RAPID REVIEW OF COVID-19

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Date: 12 May 2020

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Acknowledgement

We would like to thank all staff and organisations who willingly participated, provided advice and input into this review, for their co-operation particularly due to the short timeframe involved.

1. EXECUTIVE SUMMARY

1.1 On 15 April 2020 the Minister for the Department of Health (DoH) issued the following statement to the Ad Hoc Committee in relation to Personal Protective Equipment (PPE):

"I have already underlined the vital importance of distribution and deployment to all frontline settings – and stressed that all staff must know where to turn within their organisations when they have concerns or questions.

But I would remind colleagues of the scale of this issue. We must continue to support our staff and indeed the broader community in helping them understand and make informed decisions about when and how PPE is used.

The correct use of this precious resource is equally as important as confidence on supply chains. However if we are asking staff to trust the guidance on what PPE they need, then they are understandably relying on us to get that right PPE to them and at the time they need it.

That is why after speaking to the Chief Medical Officer, we have now agreed that there is going to be a thorough examination of the flow of PPE. I've made it clear that it would be inexcusable if delays were seeing PPE remaining in stores or in Trust buildings waiting for onward allocation, whilst staff and care facilities were going without."

1.2 The Minister also announced on 17 April 2020 that DoH had set up a new email contact point for the health and social care staff to raise PPE concerns which stated:

"This is the latest demonstration of just how seriously we are treating staff concerns on PPE.

"We continue to work very hard to build up our supplies and to make sure distribution right across Northern Ireland is the very best it can be.

"PPE is a major priority for the Department and across the Health and Social Care system."

1.3 The COVID-19 pandemic has caused governments across the world to take extraordinary decisions to protect their populations, to prepare for the impact of the pandemic and to provide care and treatment for those who contract COVID-19.

1.4 The role of Health and Social Care (HSC) workers in the global effort, and the importance of supporting them in their critical roles has been to the fore, with ever increasing public support and appreciation for the role they play. In return, HSC have the responsibility to plan well for the task ahead, and produce policy and clinical guidance to staff and teams based on clinical evidence and research, which can be applied by staff in their work setting and with their patients. A key element of that is the timely provision of appropriate PPE and associated training and advice so staff can confidently and safely undertake their duties.

1.5 In considering the approach to this review, the Review Team felt there was a need to provide sufficient context to assist in understanding of the present state, without providing unnecessary history. Several recurring issues were identified through the range of approaches adopted by the Review Team:

PPE Supply and Distribution

1.6 PPE supply had been extremely unstable. China is the main source of PPE worldwide and as a result of its lockdown there has been a catastrophic failure in the supply chain globally, exacerbated by a ban on export of PPE by China, followed by a shutdown in their manufacturing capability and in some instances the PPE did not meet the required specification and need e.g. long sleeve gowns. Global

markets reacted to the need for increasing levels of PPE, and governments locked down supply channels. This affected business continuity of supply. . Central emergency planning stockpiles were of insufficient volume to smooth out supply shortages to meet demand. This is likely to continue into the medium term.

1.7 That PPE distribution had to scale up significantly over a very concentrated time period (weeks) and new supply channels had to be set up to support the entire system of care including GPs, Independent Sector. In addition, modelling of predicted demand is in its infancy making it impossible for the HSC system to adequately plan.

1.8 From the evidence received at the point in time, the Review Team have identified that there are shortages of PPE stock in the system, particularly long sleeve gowns and certain types of masks. Going forward, the volatility of the supply chain will be a continuing and significant challenge to manage.

Extant Guidance

1.9 The guidance to HSC workers on the appropriate PPE has changed regularly over a short period of time, resulting in anxiety amongst staff and the natural inclination to be cautious in the risk assessment process for the use of PPE.

1.10 There is also a concern regarding the standardised approach to the effective use of PPE. This is due to a number of issues, including conflicting advice from key stakeholders e.g. resuscitation council, Academy of Medical Royal Colleges. Lack of standardisation of terminology; effective communication for differences between national and international guidance and the appropriate application in local context.

1.11 For all of the reasons above, staff have reported a lack of confidence in the system to ensure PPE stocks will be available in the right amounts.

Despite this many have reported that over recent weeks the system has been improving and becoming more reliable.

1.12 The Review Team found that although there had been considerable challenges to overcome, the present state of distribution and control of PPE indicates a fit for purpose and adaptable system, which needs capacity to be further scaled up and extended over a longer period. These points will be expanded on in this report, but are summarised below:

Scale of the Supply and Distribution Operation

1.13 The size of the task and efforts by all parties in the supply chain can be emphasised by the vast quantities of PPE stock movement, with 34 million (**Annex 1** provides a further breakdown) items being distributed across the Health sector in the period 23 March – 15 April.

Processes for Distribution

1.14 Processes for the management and distribution of PPE stock have totally changed in the last five weeks, with new stores being opened, teams established to operate these stores and systems for stock control being developed. Systems are evolving at pace to provide more informed and effective management information that can be used to enhance forecasting and demand modelling which must be improved for more efficiency in the control and distribution of stock.

Mutual Aid

1.15 There are long standing mutual aid principles in place across the four nations within the UK which have been agreed. As part of these arrangements NI has received 5.5 million PPE items from central stores in the UK which would suggest the processes are effective, however this has not been tested at a time of short supply.

1.16 There are also ad-hoc local arrangements which exist between Trusts on a case by case basis which appear to be working effective.

Experience on the Ground

1.17 Given the tight timescale which the Review Team had to complete this Rapid Review we have managed to gain significant spread of input from as many stakeholders as possible at all levels of the supply chain and users throughout the health sector including HSC Trusts, GPs, Care Homes and Domiciliary Care. We believed that getting insight into staff experience of the PPE system and practices at the frontline was critical. A section of the report has been dedicated to capturing and learning from the comments we received.

Next Steps

1.18 A number of recommendations have been made within this report (Section 8) for the short-term and in preparation for a second wave of COVID-19. In order to take these recommendations forward successfully an overall strategic governance structure across the HSC system, Primary Care and Independent Sector will be required to ensure the right PPE gets to the right place at the right time.

2. INTRODUCTION

2.1 The Minister of Health commissioned a review of PPE regarding the appropriate receipt, storage, distribution and use of PPE across the HSC system during the current COVID-19 pandemic.

2.2 The Terms of Reference for this review was approved by the Minister on 15 April 2020. Fieldwork took place during 16 – 20 April 2020.

Scope of Review

2.3 The scope of the review included the following areas:

- The adequacy of current PPE stock levels – focussing specifically on critical items that are either in short supply or are experiencing increased usage during the current pandemic wave;
- Whether the PPE is being used appropriately, and in line with extant guidance - particularly critical items that are in short supply or have increased usage;
- Arrangements for the receipt into stock, storage, and subsequent distribution and delivery mechanisms for PPE from warehouse to point of use in health and care services;
- The robustness of measures for demand modelling across all areas, and the extent to which such modelling feeds into all supply decisions;
- The extent to which mutual aid principles, across the NI health and social care sector and the UK, are being properly applied and are effective; and
- An assessment of readiness for continuing response during the current pandemic wave and by way of preparation for a second wave of COVID-19.

2.4 Guidance has been issued on recommended PPE for HSC workers. This Guidance is issued jointly by NI Public Health Agency (PHA); Department of Health and Social Care (DHSC); Public Health Wales

(PHW); Health Protection Scotland (HPS); Public Health England (PHE) and NHS England as official Guidance. The Health and Safety Executive (HSE) has also reviewed the PPE Guidance and have agreed the appropriate sessional use of PPE. This review included the following PPE items as outlined in the Guidance:

- Disposable Gloves;
- Disposable Plastic Apron;
- Disposable fluid-resistant coverall/gown;
- Surgical mask;
- Fluid-resistant Surgical Mask (FRSM);
- Various ranges of respirator masks; and
- Eye/face protection.

Annex 2 outlines the visual guide for PPE issued by PHE at the time of this review.

2.5 The Guidance for PPE has been changed eight times between February and April 2020: 14 February, 19 February, 6 March, 13 March, 21 March, 27 March, 2 April, 10 April and 17 April. This does not include the amendments in relation to guidance for specific settings such as community settings, ambulance services, children's homes, community pharmacies etc.

3. REVIEW APPROACH

Review Team

3.1 The Review Team consisted of the following personnel:

NR DoH Internal Audit (lead)
NR, DoH Internal Audit
NR (MoD)
NR Deputy Chief Nursing Officer DoH
NR, Director of Performance Western Trust
NR, Consultant Medical Microbiologist
NR Consultant in Global Public Health PHE seconded part-time to DoH COVID Response
NR, DoH Nursing (Secretariat)

3.2 Given the short timescales and the need to restrict social contact particularly in the health care setting a mixed methodology was used in this review. This included desktop review, questionnaires to the five HSC Trusts, NIAS, Private Nursing and Residential Homes and Domiciliary Care Providers, a limited number of site visits and a number of teleconference calls. Additional advice and input was sought from a number of personnel / experts, refer to **Annex 3**.

Desktop Review

3.3 A desktop examination of documentation was completed across the review areas to provide a wide ranging baseline of evidence. This included a desktop review of the following documents:

- Review of Guidance on use of PPE;
- Governance Structures (refer to **Annex 4**);
- PPE demand Modelling undertaken by IPC Cell;
- PPE demand and projected supply modelling undertaken by PaLS; and
- PPE Stock and Supply Reports.

Questionnaires

3.4 A questionnaire was developed (refer to **Annex 5**) to gain feedback on user experience of systems currently in place to manage the supply and distribution of PPE across the levels in the supply chain, at key distribution points, and as close as possible to end users of PPE in hospital and community settings. The purpose of the questionnaire was to obtain direct feedback from a wide range of sources on their experience of the current system of distribution, and to identify primary challenges to effective supply and factors to be addressed in the immediate period and to inform planning for PPE management and distribution going forward. **Annex 6** outlines the organisations and specific operational areas to which the questionnaire was issued. Questionnaire responses were received from 108 personnel, these responses provided rich and valuable information from a wide range of operational areas. The feedback has been summarised and informed the themes identified in this review and the subsequent recommendations (for further information see section 7).

A breakdown of the 108 responses received are included below:

Private Nursing/Residential Homes	9
Domiciliary Private Providers	5
GPs	6
NIAS	9
Trust (range of operational areas)	79

Questionnaire Follow up Telephone Calls

3.5 A random sample of returned questionnaires were based on area and feedback were followed up with telephone discussions. We attempted to follow-up 20 questionnaires by telephone and 11 follow-up calls were completed.

Site Visits

3.6 Given the time and personnel constraints, a sample approach was taken to draw representative information from across the different levels in the supply chain. Site visits to PPE stores, distribution centres and a Care Home were completed. These included:

- PIPP – DoH Emergency Stockpile warehouse;
- BSO – PaLS Main Hub Boucher Road;
- City Hospital – Main PPE Store;
- NHSCT – Antrim, Trust HQ; and
- Hutchinson's – Care Home Antrim.

3.7 A summary of the key findings and good practices from these sites visits are detailed at **Annex 7**.

4. MUTUAL AID

4.1 Pandemic stockpiles are owned by the respective nations (they are not a central UK resource), however recent central/UK procurement arrangements have been established in response to the current pandemic and global supply/purchasing challenges. The difficulty specifically in relation to COVID-19 is that none of the nations have much stock to provide each other under mutual aid, the principles are more easily applied when there are adequate supplies.

4.2 For many years, there has been a principle across all four nations within the UK to offer and provide mutual aid, this has been confirmed by Health Ministers in each country. This principle was agreed on 12 March 2020.

4.3 There is also a working/governance group chaired by the Department of Health and Social Care (DHSC) which all four nations participate in/attend. DHSC is working with the Cabinet Office on procurement of pandemic stockpiles for all nations; this arrangement was only put in place recently in response to global challenges with procurement. NI is also sourcing PPE to avoid any reliance on central procurement and supply.

4.4 The Department are also involved in a number of different groups and fora which engages all four nations in relation to mutual aid and stock levels.

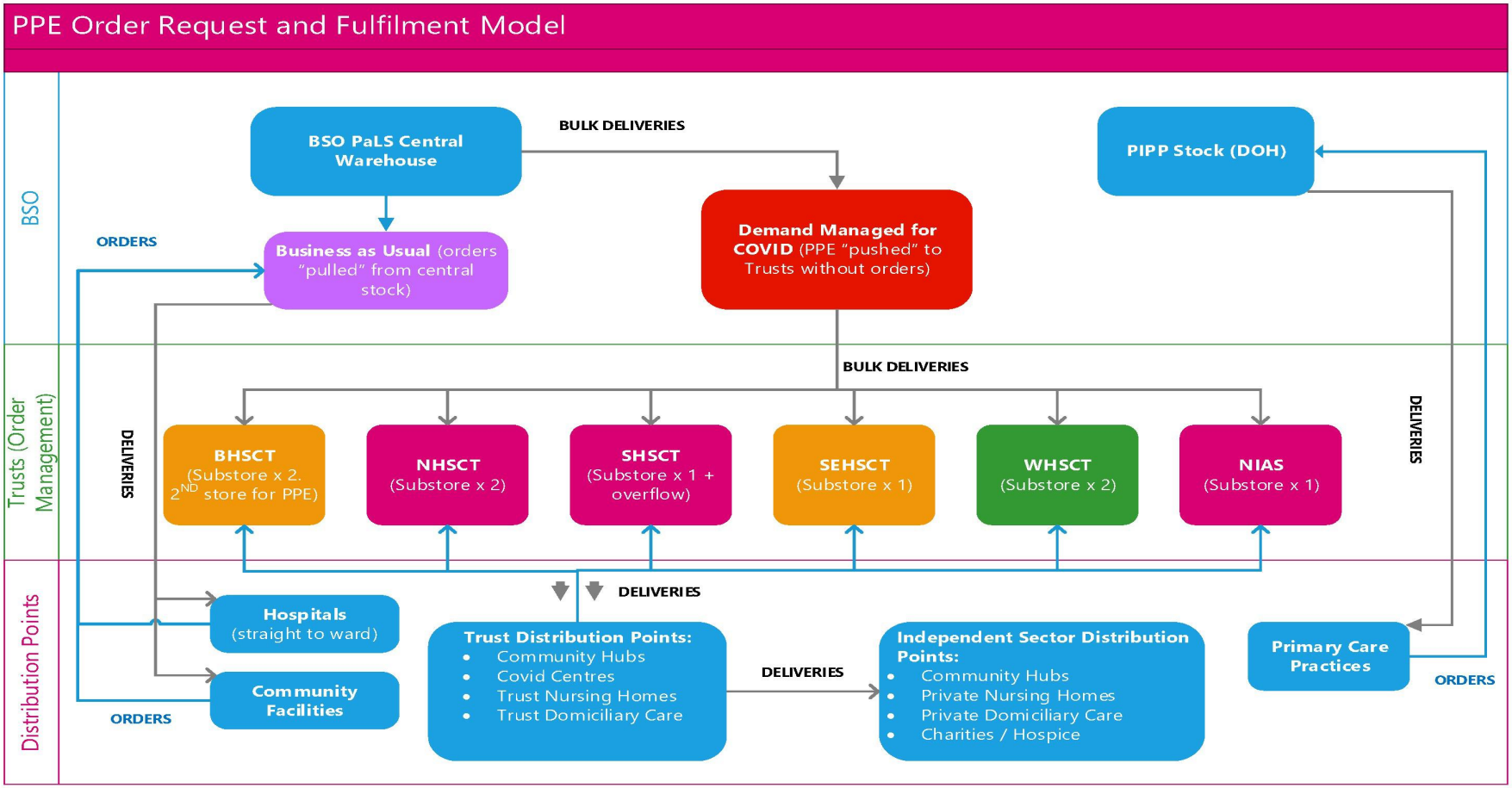
4.5 As part of these arrangements, NI has received approximately 5.5m PPE items provided from central stores in the UK and over 125k frames and lenses from Wales in the last two weeks. NI provided 250k gowns to England. This is in the context of approximately 34m items having been issued to Trusts and the Independent Sector in NI from BSO PaLS since 23 March 2020. Stock available in UK is tightening in a number of areas

and further mutual aid for these specific items is unlikely to be available in the short term.

4.6 There is also a Memorandum, signed on 8 April 2020, between NI and Republic of Ireland to work together on COVID-19 Response. Regular meetings occur to discuss areas of collaboration through emergency planning channels.

4.7 We found evidence that there are ad-hoc local arrangements which exist between Trusts on a case by case basis. We also note that the Western Trust which borders the Republic of Ireland (ROI) have ad-hoc arrangements in place with ROI for the sharing of PPE. Some formal structure processes are also in place within Trusts which link into the 'Silver' command. These are underpinned by customary processes of collaboration between Trusts which have been strengthened during the COVID-19 pandemic.

5. PPE SUPPLY CHAIN FROM SUPPLY THROUGH DISTRIBUTION TO FRONTLINE USE



Central Stores and Distribution

5.1 In NI HSC Logistics had become a largely centralised service in the late 1990's in the HSC and during the early 2000's a solid system of electronic ordering, just-in-time supply which "**pulled**" product to defined points of use, usually hospital wards, ICUs and theatres, or community facilities such as day centres and community hospitals. Requirements were submitted to BSO using an electronic catalogue order, or a real time ordering system using bar-coding and scanning (referred to as Electronic Materials Management). This is commonly referred to as the "Business As Usual" (BaU) supply chain for high volume consumable products in HSC. Many PPE items were already handled via this system, albeit in much smaller volume before the COVID-19 pandemic.

5.2 There are two BSO PaLS central stores in NI located in Boucher Road and Campsie.

Trust Stores and Distribution

5.3 The Trust BaU system of supply is a centrally sourced highly streamlined supply chain of fast moving consumable products which carries minimal inventory in its central store or at Trust distribution points. This allows full electronic ordering as well as a pick/pack/deliver service to the point of use in hospital wards/departments and delivery direct to community facilities. Two Trusts also avail of distribution and put away services in their hospital sites. Other Trusts have a small retained procurement and stores function and distribution points and small stores facilities (the configuration of Trust Local Stores is detailed at **Annex 8**).

The Introduction of "Demand Management"

5.4 In the early weeks of the pandemic it was clear that large quantities of PPE were being ordered by Trusts through BAU systems to ward level, in anticipation of demand, without centralised control or co-ordination. As a result BSO PaLS expressed concern that PPE was becoming deployed on a first come first served basis rather than on a needs basis, subsequently, on 23 March 2020 the Department wrote to Chief

Executives to advise that it was important that good practices were in place to ensure that products were:

- Only ordered when needed, not over-ordered or stockpiled;
- Only used for those most at risk and in line with published guidance;
- Not wasted;
- Stored safely and securely to prevent theft or loss; and
- Appropriately accessible by HSC/Trust managed services, including adult social care providers and charitable organisations within the Trust area.

5.5 The Department advised that new demand management measures were needed to manage designated BSO stock products, included in a COVID-19 "High Demand Management List" which included all PPE.

5.6 Urgent action was needed and from 24 March this meant that BSO PaLS would no longer process ward level orders for products included on the list. Trusts were asked to work with BSO PaLS to establish a centralised system with nominated contact points for managing the ordering and delivery of these products. All orders received to 23 March were delivered to ward level.

5.7 These would involve moving away from a "pull" system, where Trusts initiated the order based on requests for products generated at ward or department level, and would transfer to a "**push**" system of supply where BSO would push bulk supplies of a designated list of products (including PPE) to Trusts based on an apportionment of stock. This then allowed Trusts to prioritise deployment of appropriate PPE to areas in need and do this in accordance with PHE guidance. Operational details for this new system were agreed between BSO and Trusts.

5.8 In effect this meant that Trusts would no longer order PPE direct from BSO's BaU system, but rather would receive a "pushed" order from BSO available stock which was supplemented by approved access to PIPP

stockpiles where appropriate. This would result in all Trusts securing a share of available product and prevent localised stockpiling thus delivering equity in a climate of global short supply and exponentially increased demand.

5.9 The new system of "pushing" product to Trusts did not initially attempt to match supply from BSO with demand from Trusts. It came with a set of new responsibilities for Trusts:

- Trusts were expected to store and manage any oversupply of product (where supply was higher than demand from within the Trust);
- Some Trusts managed distribution of PPE within their organisation, stepping away from the well established pick/pack/distribute service managed by BSO for them;
- Trusts then became the point of focus for all PPE queries;
- Trusts established ordering systems for PPE from their internal customers, and set up a system of receipting, and responding to PPE orders;
- Trusts then had to develop systems to allow them to undertake daily stock checks, and escalate supply problems to their local "bronze" control hubs;
- Trusts latterly have been working with BSO and other Trusts to secure additional supply by agreement, or relinquish supply to other Trusts; and
- Trust have now become the "intelligent customer", making judgements on how best to spread PPE supply across all customers within the Trust.

5.10 In short, Trusts had a short period (a number of days) to establish a local manual system for orders, identify suitable stores/storage and develop associated distribution processes. Trusts were also required to set up their own system of PPE distribution where internal customers "pulled" from a Trust store using a separate and newly established ordering and

fulfilment system. The new stores put in place by Trusts acted as the buffer between the BSO "push" in bulk, and the Trust customer "pull" of requirement/need.

5.11 There was little evidence that this requirement was clearly articulated to, or well understood by Trusts in the early weeks of the pandemic. It was however clear that within a few short weeks Trusts had established the broad capability required, albeit through different approaches and by using existing assets.

5.12 Only two Trusts (Northern and Southern Trusts) had retained stores capacity and physical stores estate. These Trusts have been able to respond quickest to a revised supply approach which expected additional capacity and a rapid stores footprint to enable bulk delivery.

The Addition of New PPE Customers and High Demand Products

5.13 New customers and distribution points have been required for Trusts and BSO to manage, which had never before been part of the supply chain. This has created a much more diverse and complex system of supply to manage.

5.14 For BSO, GP supply chains had to be set up, including new ordering systems.

5.15 Independent Nursing homes, independent hospitals, and GP COVID-19 centres are all new supply requirements for Trusts, with no previous or predicted pattern of usage available to enable planning and management of demand.

5.16 Common consumables such as cleaning products as well as more distinctive products such as hand sanitisers were quickly included in the revised "demand management" approach, requiring Trusts to spread their limited capability to a wide range of products.

Single Point of Contact (SPOC)

5.17 Trusts operate a "SPOC" approach for the management of the receipt and distribution of PPE. The constantly evolving COVID-19 pandemic demands and ensuring 'unknowns' has meant that the SPOC role has had to expand very quickly. Since the establishment of new demand management arrangements Trusts have been required to take responsibility for the establishment of new stores and distribution processes, handling considerable volumes and values of PPE, and being a gateway to the effective (appropriate) use of PPE by end users.

5.18 Recently (in the last 7-10 days) the SPOC in each Trust has been a key link to BSO through a daily Supply Chain Cell call, chaired by PaLS, which covers the operational detail and decision making regarding supply of products and subsequent push of stock from PaLS.

The Challenges of an Unstable Pipeline of Supply

5.19 Prior to COVID-19 BSO PaLS managed the BaU needs of PPE within the HSC through a number of regional contracts which drew stock from different sources including the NHS Supply chain.

5.20 Supply chains across HSC are set up on a principle of "just in time". On average hospitals hold two weeks stock of fast moving consumables. Central stores hold a further two weeks on average. The system operates primarily on the principle of stable and predictable demand, balanced by stable and reliable supply. This enables a sophisticated and streamlined pick/pack/distribute to point of use, through a professional central logistics operation with low margins of adjustment.

5.21 Capability and capacity at a local level (either through physical storage or staff capacity/capability) have progressively been diminished over the years to deliver efficiencies and reduce management costs and overheads.

5.22 Securing supply product has progressively become a global sourcing process. It has resulted in some types of product gravitating to countries with particular economic models, e.g. high volume, low value consumables in low wage economies. The importance of evidencing value for money (VFM) through widely competitive procurement processes is a core policy of public sector procurement, and is enshrined in legislation. Procurement policy aims to maximise the buying power of public procurement by aggregating demand and sourcing with smaller numbers of suppliers. This has resulted in a narrow super-specialised supply chain, without a broad and diverse supply base.

5.23 The unpredictability in supply of PPE disrupted this system, with shortages common in the early weeks of the pandemic as national governments moved to secure product from their national supplies and export of product, particularly from China, was withdrawn. The sources of supply were not sufficiently resilient to enable supply to be maintained. It is recognised that this pandemic has had an unprecedented impact on supply globally.

5.24 Independent sector providers and Independent contractors such as GPs and community pharmacists are expected to provide PPE for their staff, and are critical public services which need to continue to operate during a pandemic. Many are however small businesses without expertise or training in the handling of PPE. Small organisations cannot realistically secure PPE supplies when competing with global sourcing players during a pandemic.

DoH Emergency Stockpile - PIPP

5.25 BSO manages and is custodian of the DoH-owned stockpile of emergency products. The arrangements for the management of this stockpile is laid out in a Service Level Agreement between the two parties. Levels of stock held in emergency stockpiles is agreed at a UK level.

5.26 The use of this stock is a "last resort" source of product which is normally released by named authorised staff within the Department and there is commonly a level of recycling of some products to minimise obsolescence where possible. However, due to global supply shortages the DoH stockpile of some products was quickly depleted in the early weeks of the pandemic. It was therefore decided that any release from the stockpile during the pandemic must be escalated to and approved by the Chief Medical Officer (CMO).

Fast Track Procurement

5.27 A new 'Fast Track Procurement' initiative had to be established in a collaboration between the Departments of Health, Finance and Economy. The initiative was developed to address soaring demand for PPE and other products by Northern Ireland public services in both the health and non-health sectors. The aim being to identify suppliers that are not currently under contract with either, the BSO PaLS or the Central Procurement Directorate (CPD) and to encourage manufacturers to re-purpose to produce PPE.

Quality Assurance

5.28 PPE received by BSO is quality assured by the Medicines Optimisation and Innovation Centre (MOIC) team and items which do not pass assessment are not accepted into HSC.

6. DEMAND MODELLING

Planning for and Understanding Demand

6.1 The need for PPE has been a rapidly evolving and changing picture. It is not well understood and there has been limited data or analysis to determine need. In the early weeks of the pandemic, historical demand was used as a proxy for determining need and this quickly proved to be radically short of demand. For this reason, efforts began during March 2020 to model the likely demand based on available sources of data. PPE demand is affected by a range of variables, but primarily:

- The number of patients requiring or likely to require care and treatment as a result of COVID-19;
- The product or set of products to be used in particular clinical or care settings;
- The rate of use of products used (burn rate) for care and treatment; and
- The adequacy and effectiveness of the supply system, including its ability to procure sufficient product and supply it reliably to meet need so that contingency stocks are not required.

6.2 While other variables will be at play, these are the primary issues which the Review Team have considered in line with the Terms of Reference of the review.

Early Efforts to Predict PPE Demand

6.3 In the early weeks of the pandemic, historical demand was used as a proxy for contemporaneous data for determining need and this quickly proved to be radically short of demand. For this reason, efforts began during March 2020 to determine PPE needs through modelling likely demand based on available sources of data.

6.4 In the interim, and while a more sophisticated predictive demand model was being worked on, Trusts agreed a new allocation formula based on

population. This was applied immediately to allocations issued by BSO.

6.5 Over this period of time a number of modelling processes were developed independently. There have been three main sources of modelling data identified by the review team:

- The DoH Expert Modelling Group (this did not specifically address PPE needs);
- The Infection Prevention Control Cell of Health Silver; and
- Modelling undertaken independently by BSO and a number of Trusts to support planning efforts and their governance and distribution processes locally.

The DoH Modelling Group

6.6 The CMO commissioned predictive modelling from an expert modelling group, chaired by the Chief Scientific Adviser with the primary objective to assist in the planning of the response to the pandemic. It was accepted at the outset that the modelling would change over time, as evidence was gathered globally and on the progression of the pandemic in NI. A "reasonable worst case" scenario was agreed for planning purposes and this was published and regularly updated. The modelling provided a peak surge projection for ICU and Acute beds required, not a projection of demand over time (a demand "curve").

To date three modelling outcomes have been published by the DoH Expert Group, and are summarised below:

Categories	Reasonable Worst Case Models		
	2 April 20	8 April 20	16 April 20
Peak of COVID-19 patients requiring ventilation	180	140	90
Peak number of covid19 hospital admissions in the 1st wave (7 days)	500	500	500

IPC Cell of Health Silver

6.7 An expert Cell of Health Silver (Infection Prevention Control Cell) was formed on 20 March 2020. This Cell was subsequently tasked with providing professional advice on use and supply of PPE, as a collective effort between Surge Planning Cell, IPC Cell, and Supplies and Logistic Cell. The Review Team was advised that the modelling has been shared with Trusts and assumptions were being tested against Trust models.

Trust Modelling of Predicted Demand

6.8 The Review Team was provided with some information on demand modelling by Trusts and that this was done in the absence of an early regional model on PPE consumption in various care settings. This modelling appeared to be based on demand at the "peak" of the surge, but data was also available on consumption trends, and was undoubtedly useful in predicting critical shortages and necessary responses at a local Trust level and with BSO.

Modelling of "Surge" Over Time

6.9 The Review Team was not able to see evidence of modelling which mapped demand over time, or integration of the various approaches. The main concern with all these models is that they estimated consumption at peak surge, and did not make adjustments for lower case numbers and the impact on PPE consumption.

6.10 However, in the last week the IPC Cell model (originally developed on the basis of hospital care interactions requiring PPE, using PHE PPE guidelines and European Centre Disease Control recommendations) has developed a graduated demand profile, based on three levels, medium, high and extreme demand. This has now been shared with Trusts and BSO on 15 April 2020.

6.11 The IPC cell also undertook modelling for community services, which was based on a crude estimate of the number of care interaction/packages. The profile was based on PHE guidelines,

particularly taking account of PPE requirements in the context of 'sustained community transmission' and the need to protect vulnerable and shielded clients from infection. It also included protecting staff working with vulnerable/shielded clients and/or those with suspected or confirmed COVID-19.

Demand Modelling Predictions

6.12 BSO undertook demand modelling based on early versions of the above material, and provided visibility of this to the Supply cell and to Trusts during w/c 13 April 2020. The demand assumptions were converted to weekly consumption rates for all PPE items.

6.13 Processes have now been established between BSO and Trusts which embed the BSO demand model, and provide daily discussions with Trusts on the supply outlook. This process does not yet use demand assumptions that take into account and constantly review the position on the epidemic curve (see ICU bed usage at **Annex 9**). Some discussion on this appears to be emerging, but no revised modelling has as yet been produced.

7. VIEWS OF STAKEHOLDERS WITHIN THE HSC SYSTEM

7.1 A range of methodologies were used by the Review Team to gather feedback from operational staff across Trusts, GPs, Domiciliary Care, Private Care Homes and NIAS. The tools utilised to collate information included: questionnaires, interviews and site visits. This rich information provided detail of staff actual experience of accessing and using PPE at the frontline.

7.2 The questionnaire (para 3.4 refers) was a key part of the stakeholder feedback with 108 individuals taking time to complete the questionnaire. One of the questions on the questionnaire asked:
"How has your experience of PPE been on a scale of 1-10 overall?"
(1= poor and 10 = excellent).

7.3 Our results of the questionnaire indicated an overall experience average was 7. There was a variation in levels of satisfaction across the sectors. Further information can be found at **Annex 10**.

7.4 This section summarises the key themes from the questionnaires and other methodologies used to engage with stakeholders during the review.

Application of Guidance

7.5 The main PPE Guidance was issued by PHE, agreed by the four nations, and based on PHE and the HSE recommendations. This guidance outlines three levels of PPE (refer to **Annex 11**) and has been changed on a number of occasions depending on the dynamic changing environment and situation. Whilst these changes have been made in the context of changing scientific evidence, this rationale has not always been apparent to staff on the ground. It appears from feedback during the review that the Guidance was generally confusing, with too many

changes and there was a perception that protection was being "stepped down" in response to either cost or availability of certain items.

7.6 More recently, changes appeared to have been made in response to pressure from other stakeholders, such as the Academy of Medical Royal Colleges (for example, the changes within Table 4) and appear to contradict the advice given previously by local IPC Teams. The current guidance now includes a risk assessment which states that: "Ultimately where staff consider there is a risk to themselves or the individuals they are caring for they should wear a fluid repellent surgical mask with or without eye protection, as determined by the individual staff member for the episode of care or single session". Given these concerns it is possible that the threshold for increasing from droplet to aerosol precautions may be low, thus putting additional strain on the supply of key items such as respirator masks or fluid resistant surgical gowns.

7.7 Although PPE guidance and awareness training and support for the community care sector has been given a number of those interviewed stated that more was needed to allay anxiety and the possibility that this might be driving less than effective utilisation of PPE.

Confidence in the Supply Chain

7.8 The Review Team were advised by many participants that much of the anxiety is caused by uncertainty about whether or not their supply requirement would be met. The new ordering and delivery processes put in place at short notice have affected confidence in the system.

7.9 Reports of PPE shortages resulted in increased anxiety of frontline staff.

7.10 Assessment of need for PPE outside the hospital setting is less well developed / mature then in the acute hospital setting and in COVID-19 pandemic has had to develop rapidly. A major factor in this is that the need for PPE in the community setting pre-COVID-19 pandemic was significantly lower that now in the COVID-19 situation.

7.11 Changes in the requisition processes for PPE in Primary Care have had to adapt rapidly in the last few weeks to ensure the effective utilisation of PPE.

Quality

7.12 Feedback from the HSC and the Independent Sector has reported that poor and unacceptable quality of some PPE supplies. An example of this was recent complaints about long sleeve gowns which led to the recall of one supplier's product. However it is a recurring theme across a number of PPE items.

7.13 Staff also reported the challenges caused by repeated requirement for 'Fit testing' of respirator masks as products became obsolete or had passed their expiry date.

IPC Capacity

7.14 The review team received significant feedback regarding the lack of capacity with IPC teams to meet the increased in demands presented by COVID-19.

7.15 In particular Independent Sector, Community Care and Primary Care needs have significantly increased in the COVID-19 context. Workforce Planning had not profiled for this in the IPC teams.

7.16 The profile of patients in the community care sector pre-COVID resulted in the need for IPC expertise and support in the past to be less than in the acute setting. In COVID-19 the support required has increased significantly and specialist IPC teams are very stretched.

CONCLUSIONS AND RECOMMENDATIONS

8.1 Oversight Arrangements

Recommendation 1 – Strategic Approach

A strategically aligned governance structure for the whole system, across HSC, Primary Care and Independent Sector should be put in place for the duration of the pandemic to enable the right PPE to get to the right place at the right time.

Recommendation 2 – PPE Review Action Plan

A strategic approach should be taken to the implementation of the recommendations contained below, with an oversight function (led by a Senior Official) established to ensure that established governance structures work collaboratively so that integrated recommendations are aligned with the system as a whole.

Each recommendation should be allocated to responsible officers and have agreed dates for implementation in line with the priority ratings indicated, with the oversight function obtaining regular progress updates against the agreed implementation dates. Any slippage in the implementation dates should be supported by valid reasons and subject to approval by the oversight function leader.

Annex 12 includes an outline action plan, table of recommendations and suggested timescales for implementation i.e. critical (2-4 weeks), essential (4-8 weeks) and recommended (8-12 weeks). This can be used by the oversight function (recommendation 2 above refers) in taking forward the recommendations detailed within this section.

8.2 Adequacy of Current PPE Stock Levels

There has been considerable attention in the media and from staff and their representatives on the adequacy (or inadequacy) of PPE stock

levels over the period of the pandemic. The evidence available to the Review Team showed:

1. Overall confidence in the PPE supply is low;
2. There is instability in the supply outlook as advised by BSO;
3. The quality of PPE supplied and its usability is variable. The scale of this problem is becoming better understood, particularly on key products such as long sleeved gowns;
4. There were initial delays in the process for the release of the PIPP stockpile;
5. Masks held at the PIPP Emergency Stockpile have passed their expiry date (July 2019), and although they were re-validated and have the expiry date extended on the batch, the expiry date is still visible on the item received by the end user and this may affect staff confidence and result in public criticism;
6. Governance mechanisms to scrutinise and challenge stock management are in their early stages;
7. Resilience was improved in some products through the initiative of local businesses to step forward with potential solutions to supply shortages. Established contracts and sources of supply were interrupted, slow to increase demand, and generally insufficiently resilient to provide reliable supply in the pandemic; and
8. Donations provided to BSO are subject to quality assurance by the MOIC team. Only PPE items which meet the required standard are issued for use by BSO within the HSC system.

Recommendation 3 - Short Term PPE Shortage Response

A review of DoH PIPP arrangements should be undertaken to ensure a more simplified and timely request and approval process. This will build confidence, and avoid sporadic stock shortages which currently undermines end user confidence.

Recommendation 4 – Contingency Plans in Event of Supply Shortages

A formal assessment of the supply risks for each PPE product should be undertaken alongside the contingency actions.

This assessment should prioritise the most vulnerable supply lines (Long sleeved gowns and FRSM) to come to decisions on potential or accepted contingency measures in the event of an impending stock crisis.

Consideration should be given to the appropriateness of the decontamination and re-use of some products in a period of critical shortage, and the availability of "donated" or unconventional sources of PPE which may be available.

Recommendation 5 - Quality

Systems should be developed to enable feedback from end users around the quality of PPE across all HSC and Independent Sector. The results of this feedback should be analysed to better inform procurement decisions going forward.

Recommendation 6 – Replenishment / Re-validation of PPE Equipment

The expiry date for all PPE stock should be recorded and logged and this log should be used to inform replenishment of PPE stock (including items in the PIPP store) nearing its expiry date. Management should ensure that this is a continuous process and expiry dates are monitored on an ongoing basis.

When PPE stock that has been re-validated is issued, management should ensure that all end users are fully aware that these items remain safe to use and fully compliant with standards.

Recommendation 7 - Strategic Assessment of Critical Supply Chains

(Note: Risk Assessment is covered in recommendation no. 4)

DoH in conjunction with BSO should liaise with CPD and other key stakeholders as appropriate in relation to considering local, national and international supply and manufacturing chains for PPE.

This work should be overseen at a pan-government level by the NICS Procurement Board, and inform any required adjustments to NI Procurement policy.

Recommendation 8 - Procurement

The quality assurance process for PPE should be strengthened in particular in relation to the procurement process, including local businesses and private donations.

8.3 **Appropriate Use of PPE in Line with Extant Guidance**

1. There appeared to be a number of factors driving the current levels of use of PPE such as:
    - The frequency of change of guidance;
    - Anxiety and confidence in the supply chain; and
    - The risk assessment process now being advised on a case by case basis in the context of ongoing community transmission;
2. Application of new guidance requires a level of IPC support that is not in place;
3. We have received assurance from frontline staff including the IPC Leads that there are processes in place to ensure PPE is being used appropriately. This includes the new monitoring processes that have been established, however these are not mainstreamed into the HSC governance structures and processes; and
4. The anxiety of staff, and the natural inclination to be prudent in the risk assessment is a clear feature of PPE use.

Recommendation 9 - Guidance on Effective Use of PPE

Before changes in guidance are issued consideration should be given to the impact on practical implementation of the guidance which may require urgent modelling of stock, supply and distribution.

Recommendation 10 - IPC Capacity

During the pandemic action should be taken to reinforce IPC capacity and deployment across the system.

Recommendation 11 - Assurance and Monitoring Processes

Assurance and monitoring processes should be introduced in areas least accustomed to the use of PPE, in particular Primary Care and Independent providers.

8.4 **Receipt, Storage, Distribution and Delivery of PPE**

1. A significant amount of work has progressed in a very short period of time in this area. For example, PaLS have shipped around 34 million items to Trusts during the period March 23 – 15 April since Demand Management went fully live with Trusts;
2. The evidence suggests that the storage and distribution systems set up by Trusts in response to this decision have been fit for purpose; rudimentary systems of control and stock management which were stood up rapidly have been effective in the short term;
3. Processes should continue to improve as users become accustomed to new supply arrangements as they embed, and as Trust staff gain more experience;
4. There is a considerable commitment to continuing improvement, and plans to implement sound new systems such as electronic ordering and automated stocktaking would indicate that solid improvements are planned; and
5. In general, the alacrity with which demand management of PPE was delivered should be acknowledged as a considerable achievement.

Recommendation 12 - Building on Achievements to Date

Trusts should continue to work collaboratively, sharing information on what is working well across the six Trust's operational processes and systems in relation to the receipt, storage, distribution and delivery of PPE. Effective operational approaches and examples of good practice should be integrated across HSC where possible. The operation of supply chains particularly with new customers should be kept under review and periodically stress tested.

Recommendation 13 - Stock Management

An electronic stock management system should be put in place throughout the supply chain.

8.5 **Demand Modelling**

1. Analysis of demand and limited modelling has been undertaken by BSO, some Trusts, and the PPE cell of Health Silver;
2. In an evolving pandemic where need is not well understood or predictable, there is a high level of reliance on modelling to assess the potential of PPE future demand at a regional and local level;
3. The current PPE modelling assumptions do not recognise the present Northern Ireland context in relation to our position on the epidemic curve;
4. The speed of consumption of the stock levels (the "burn rate") is not well understood; and
5. The IPC Cell work on modelling has started to more realistically assess need however as reported there are limitations to the work.

Recommendation 14 - Improve Demand Modelling

Significant expertise should be applied to rapidly bring forward a more sensitised predictive demand model for PPE, covering hospital and community predictions. This model should be regularly recalibrated, based on the experience of actual demand and the assessed surge level, to provide a regular and formal review of demand planning assumptions.

Improved demand modelling will enable Trusts to predict demand, fulfil requirements, and challenge any apparent ineffective use of PPE or stockpiling. It is an important tool in considering contingency/continuity options at points where stock crisis is predicted, enable mutual aid decisions and sharing of PPE across Trusts, and scrutinising/challenging requests for PPE at a local level.

Recommendation 15 - Interim Approach

The graduated model recently prepared by the IPC Cell should be modelled by BSO, and a collective HSC view taken of the realistic planning level for PPE demand in the upcoming weeks in hospitals and Community settings. There should be agreement that this model is regularly reviewed and adjusted based on any changing advice. This

should provide a more realistic “burn rate” which can be adopted for planning purposes by BSO and Trusts, as well as primary care, Nursing Homes and domiciliary care contractors.

8.6 **Mutual Aid**

1. UK mutual aid principles exist however, they are not based on distribution means, comparisons / analysis and no modelling;
2. Having received 5.5 million from the UK under the mutual aid principles would suggest the processes is working however this has not been tested at a time of short supply;
3. Feedback from stakeholders has indicated that mutual aid principles with ROI have worked; and
4. The mutual aid across Trusts that has been operating through the HSC Silver is an effective mechanism for sharing PPE.

8.7 **Assessment of Readiness for Second Wave**

1. A number of stakeholders noted they were considering the preparation required for the second wave however this must be a higher priority going forward;
2. Many stakeholders concluded that more work is needed to consider the lessons learnt and adequately plan for the second wave. However, recognition needs to be given to the impact on staff wellbeing and resilience to date;
3. Support will be needed to take PPE planning forward in a structured manner. The Review Team has reflected on the measures which could be taken to improve readiness for a second and future waves, and may be needed for the longer term; and
4. A pragmatic view has been taken of those actions which address significant gaps pointed up by the review, or present a real opportunity in the short term to improve readiness.

Recommendation 16 – Systems and Processes in Preparation for Second Wave

In order to sustain effective PPE management into the next surge, a 'rethink' of the current systems i.e. demand modelling, procurement and stock management processed is needed.

Recommendation 17 - Supporting Staff and Resilience

DoH needs to ensure that plans are established to support management as they consider the implications of the new processes that need to be put in place in the longer term. This should include professional logistics advice, staff skills and resources, equipment and advice on integration of electronic systems.

Recommendation 18 – Self-assessment of Preparedness

DoH should undertake a regular self-assessment of its preparedness to respond to the requirements for PPE in a major pandemic. This should also form part of the established governance and assurance

mechanisms between DoH and arm's length bodies, and independent contractors.

Lessons learned in relation to PPE from its response to the first wave should be captured in preparation for the second wave. Lessons learned should be captured on an ongoing basis.

Glossary of Terms

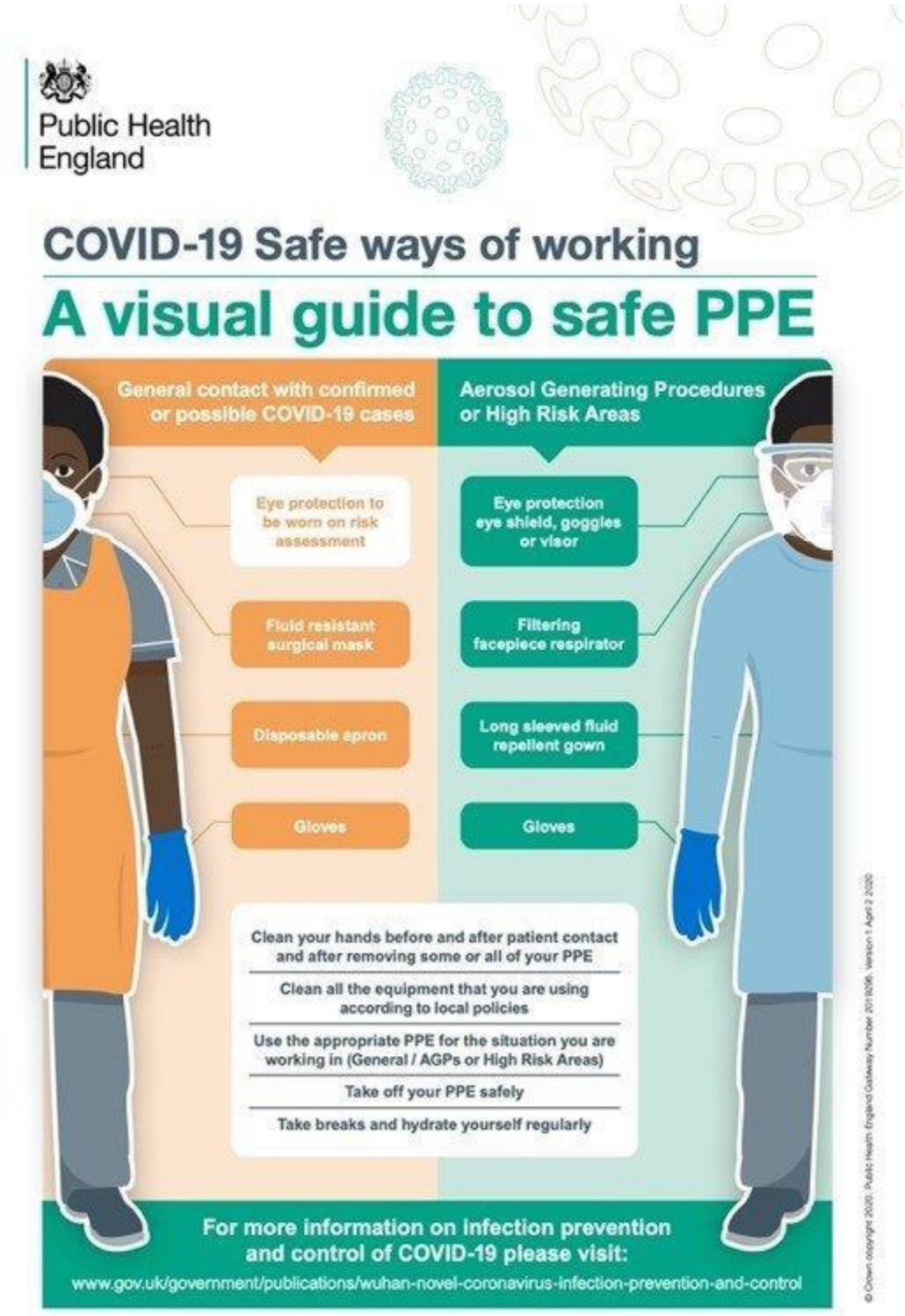
BaU	Business as Usual
BSO	Business Services Organisation
CPD	Central Procurement Directorate
COVID-19	Coronavirus Disease
CMO	Chief Medical Officer
DoH	Department of Health
DHSC	Department of Health and Social Care
FRSM	Fluid Resistant Surgical Mask
FFP3/FFP2	General term for types of respirator masks
GP	General Practitioner in Primary Care
HSC	Health and Social Care
HSE	Health and Safety Executive
ICU	Intensive Care Unit
IPC	Infection Prevention and Control
MOIC	Medicines Optimisation and Innovation Centre
NIAS	Northern Ireland Ambulance Service
PaLS	Procurement and Logistics Service
PIPP	Pandemic Influenza Preparedness Programme (Emergency Stockpile)
PHA	NI Public Health Agency
PHE	Public Health England
PPE	Personal Protective Equipment
RPA	Review of Public Administration
RQIA	Regulation and Quality Improvement Authority
SPOC	Single Point of Contact

Annex 1

Breakdown of Volume of PPE Issued

Trust	Volume of PPE Issued from 23 March 2020 to 15 April 2020 (Demand Management period)
Belfast HSCT	9,957,518
Northern HSCT	5,773,157
South Eastern HSCT	4,948,229
Southern HSCT	5,961,367
Western HSCT	5,832,910
NIAS	1,702,547
Total items issued	**34,175,728**

Annex 2


Public Health England
COVID-19 Safe ways of working
A visual guide to safe PPE
General contact with confirmed or possible COVID-19 cases
Aerosol Generating Procedures or High Risk Areas
Eye protection to be worn on risk assessment
Fluid resistant surgical mask
Disposable apron
Gloves
Eye protection eye shield, goggles or visor
Filtering facepiece respirator
Long sleeved fluid repellent gown
Gloves
Clean your hands before and after patient contact and after removing some or all of your PPE
Clean all the equipment that you are using according to local policies
Use the appropriate PPE for the situation you are working in (General / AGPs or High Risk Areas)
Take off your PPE safely
Take breaks and hydrate yourself regularly
For more information on infection prevention and control of COVID-19 please visit:
www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevention-and-control
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Annex 3

ADVICE AND INPUT TO THE REVIEW WERE SOUGHT FROM THE FOLLOWING PERSONNEL

Name	Organisation
Rodney Morton	Director of Nursing, Midwifery and AHPs (PHA)
Patricia Donnelly	Independent Consultant to COVID-19 DoH Gold Command
Lourda Geoghegan	Senior Medical Advisor COVID-19 DoH
Sharon Gallagher	Deputy Secretary DoH
Cathy Harrison	Chief Pharmaceutical Officer
Names Redacted	Grade 7 DoH
	Grade 7 DoH
	Grade 7 DoH
	PPE Store Manager Belfast City Hospital
Peter Wilson	Assistant Director Procurement and Logistics BSO
Name Redacted	Head of Logistics BSO
Breige Donaghy	Director of Performance Northern Trust
Eddie Kerr	Operations Manager Hutchinson Care Home
Names Redacted	IPC Lead Western Trust
	IPC Lead Northern Trust
	IPC Lead South Eastern Trust
	IPC Lead Southern Trust
	IPC Lead Belfast Trust
Suzanne Pullins	Deputy Director of Nursing Northern Trust
Margaret O'Brian	Assistant Director Integrated Care HSCB
Alan Stout	Chair of NIGPC
Janet Johnston	Director in Belfast Trust

Annex 4

GOVERNANCE STRUCTURES

The enormity of the situation brought about by the COVID-19 pandemic has required changes to elements of the HSC governance system. In order to understand the system the review team explored the current and evolving structures and processes of governance to support communication, escalation and dissemination of information.

1. DoH 'Gold' Arrangements

1.1 The DoH Strategic Cell operates as the Gold Command's strategic decision making body. It's remit, as set out in the Emergency Response Plan, is to provide strategic direction, advice and leadership to HSC organisations and, where appropriate, to emergency responders, and to provide wider strategic health advice to:

- DoH (including Minister and senior officials);
- Other Government Departments (Executive or UK departments such as NIO);
- Emergency responders;
- UK-wide emergency response structures (including NSC / COBR / NIOBR / CMG / NICCMA); and
- The media and wider public.

1.2 The DoH Strategic Cell also:

- Provides oversight of surveillance and infectious disease control for the duration of a Health Gold Command level 2 (serious) or level 3 (catastrophic) emergency for which DoH is the Lead Government Department;
- Assesses the viability of critical health and social care infrastructures, including medical /clinical supply chains, stockpiles and countermeasures, and based on recommendations received from HSC Silver, making strategic policy decisions about service delivery and surge capacity; and

- In conjunction with the Departmental strategy for Business Continuity Management, to manages any disruption to critical health services and assist the return to normality for the DoH when pragmatic and safe to do so.

2. Regional Health 'Silver' Command and Control Arrangements

2.1 The role of HSC Silver is to provide a coordinated approach to ensure there is an appropriate and proportionate level of preparedness across the health and social care sector to enable an effective public health and HSC response to COVID-19. In doing so it oversees work with a range of key stakeholders, including: the other UK countries; the Republic of Ireland; independent health and social care providers and those with responsibility for port health. HSC Silver report and escalate relevant issues through the Chair to DoH GOLD.

3. Trusts 'Silver/Bronze' Command and Control arrangements

3.1 Each Trust has established a local command and control and incident management team, which is set out in their Pandemic Plans. The role of that team is to provide overall management of the Trust response including:

- Determining, with others, priorities in allocating resources and obtaining further resources as required;
- Planning and co-ordinating tasks, and adjusting existing plans where necessary;
- Responding to emergencies and escalating those which affect the Trust's ability to continue to effectively discharge duties within the Covid19 plan to Health Silver;
- Overseeing the day to day operational response to ensure close out of key issues and action log management; and
- Sign off and submission of daily SitRep to HSCB/PHA.

3.2 Within these arrangements, each Trust has established a process to identify and escalate operational issues with PPE supply, delivery and

distribution which link directly to their internal command and control processes, and enable critical issues to be escalated to Health Silver.

3.3 From a review of Health Silver and Trust Bronze reports it was clear that Trusts had utilised the required escalation processes. The primary issues in evidence in Trust SIT reps to Health Silver were:

- Supply shortages, actual or impending;
- Requests for clarification of guidance, or escalation of the impacts of guidance; and
- Introduction of new supply channels and demands arising.

4. DoH Strategic Supply Cell

4.1 All Trusts have provided assurances at CEO level to the DoH Strategic Supply Cell lead that they have appropriate processes in place to manage the receipt, safe storage and distribution of PPE across the Trust sites and wards and also to the Independent Sector, Domiciliary Care and hospices/charities in their area.

5. Specific to PPE – Health Silver Infection Prevention Control Cell performs the following role and function

5.1 The Infection Prevention Control Cell was formed on 20th March 2020 and it is designed to oversee the co-ordination of infection prevention and control interventions across the HSC systems, Primary Care and including services provided by community, voluntary and the independent sector care providers.

Annex 5

Department of Health
An Roinn Sláinte
Männystrie O Poustie
www.health-ni.gov.uk

PPE REVIEW QUESTIONNAIRE

Introduction

The Health Minister has requested a review of the arrangements across the health and care system for the supply of PPE to those working in health and social care. This review is aimed at understanding the systems set up to manage supply and distribution of PPE, agreeing areas for improvement or change, and adjusting systems for management of PPE at the earliest feasible point in the pandemic. It is expected that the review will identify challenges or blockages and recommend ways for improvement. It is expected that the review will enable improved planning for the management of PPE across the health and social care system going forward over a potentially prolonged pandemic. We would be grateful if you could take the time to complete this questionnaire by **3pm tomorrow, 18 April 2020 and return to internal.audit@health-ni.gov.uk.** I would also be grateful if you could provide a contact number below as we wish to follow-up a sample of questionnaires for further discussion.

By way of background, this PPE questionnaire refers to the following 7 PPE items:

Disposable Gloves;
Disposable Plastic Apron;
Disposable fluid-resistant coverall/gown;
Surgical mask;
Fluid-resistant Surgical Mask (FRSM);
Various ranges of respirator masks; and
Eye/face protection.

Name:

Role description:
(examples – nurse on covid ward; care assistant – domiciliary care; GP etc.)

Type of Organisation:

Name of Organisation:

Location:

Contact Number:

1.	OVERALL EXPERIENCE OF PPE	N/A
1a)	How has your experience of PPE been on a scale of 1-10 overall (1= poor and 10 = excellent)	
	Response:	
1b)	Are you confident that you know what the appropriate PPE is for your role?	
	Response:	
1c)	How do you know it is appropriate?	
	Response:	
2.	**CONFIRMATION OF SUPPLY CHAIN SYSTEM**	
2a)	Where do you get your PPE from? What is the process if you can't get it?	
	Response:	
2b)	How is the PPE stored?	
	Response:	
2c)	Are you aware of the key contact point for PPE within your organisation?	
	Response:	
3.	**CHALLENGES**	
3a)	What challenge if removed, would unlock problems you have experienced within the PPE supply chain? If this was resolved, are there other problems that would need attention (and what are they?)	
	Response:	

4.	**PPE**	
4a)	What is working well with PPE that could be shared with other areas to promote good practice?	
	Response:	
4b)	Do you feel you or your organisation has appropriate levels of that PPE? If no, what is the main issue?	
	Response:	
4c)	In relation to the PPE stock management system work - is it manual or electronic and is it working well? (PERHAPS TRUSTS ONLY)	
	Response:	
4d)	Did you have to change your stock management system for COVID-19? If yes – ask if any problems were encountered due to the change	
	Response:	
4e)	How long approximately does it take to order PPE from the point of order to receipt?	
	Response:	
4f)	Are there any challenges to ordering PPE?	
	Response:	
5.	**GUIDANCE**	
	We are aware that the Guidance on PPE issued by Public Health Agency / Public Health England has been changing with the most recent version issued 2 weeks ago.	
5a)	Did you have to change the PPE you used due to the new guidance?	
	Response:	
5b)	In your experience, is the new guidance easy to understand and is it being adhered to?	
	Response:	
5c)	Do you think the guidance meets your needs? (Explain)	
	Response:	
5d)	Is there any additional PPE guidance issued from your own organisation?	

	Response:	
6.	**BUSINESS NEED**	
6a)	In this constantly changing COVID situation it must be challenging to work out how much PPE you need. How do you assess how much PPE you need for you/your area?	
	Response:	
6b)	How often do you assess need - daily/weekly/monthly basis?	
	Response:	
6c)	How do you feedback or communicate if you do not have enough and does this get rectified quickly?	
	Response:	
6d)	When you are re-ordering do you take account of what stock you are holding?	
	Response:	
6e)	Have you taken any specific measures to plan for a longer term demand for PPE due to COVID-19?	
	Response:	
7.	**ANY OTHER COMMENTS**	
7a)	Have you any other comments or suggestions?	
	Response:	

Annex 6

QUESTIONNAIRES WERE ISSUED TO THE FOLLOWING

Chief Executives of all Trusts:

Area	Member of Staff
Critical Care	Ward Sister/Medical Lead
COVID-19 Ward	Ward Sister/Medical Lead
Emergency Department	Sister/Medical Lead
Theatre	Ward Sister/Surgeon
Paediatric Ward	Ward Sister/Medical Lead
District Nursing	Sister/Staff Nurse
Community Social Work	Team Lead
Trust Domiciliary Care	Team Lead
Trust Residential Homes	Manager
Prison Healthcare (SE Trust Only)	Lead Nurses

Lead Directors for Infection Prevention Control:

Area	Member of Staff
IPC	Nursing
Microbiology	Medical

Chief Executive of NI Ambulance Service:

Area	Member of Staff
Logistics	Manager
Infection Prevention Control	Lead
Paramedics	At least 5

Independent Care Homes and Domiciliary Care:

Area	Member of Staff
Independent Care Homes	Manager/Frontline Staff
Domiciliary	Manager/Domiciliary Care Workers

Annex 7

RESULTS OF VISITS COMPLETED

Location Visited / Type of Setting

PIPP – DoH Emergency Stockpile Warehouse

BSO – PaLS Main Hub Boucher Road

City Hospital – Main PPE Store

NHSCT – Antrim, Trust HQ

Hutchinson's – Care Home Antrim

Themes / Findings

Throughout this review, several different sites were visited within the HSC supply chain to gather an understanding of how the PPE was being, distributed, stored, accounted for and to identify any potential shortfalls/problems that could be smoothed out with recommendations to enable the supply chain from suppliers all the way down to the end user to be a smoother process.

The first finding at the start of the HSC supply chain, was there was no demand model being used/generated. We believe if the modelling against demand was produced earlier (instead of 10 April 20), it would have put PaLs in a greater position to demand against the model and forecast appropriately to meet the needs of the Trusts. Without this, there was no scientific approach, the anticipating and preparing for demand at the various levels in the supply chain. Ultimately, this made PaLs create a 'Push' system down to the Trusts.

BSO and Trusts are operating a hybrid system, which is not utilising the BaU systems of managing stock but must be reconciled back to BAU systems to enable financial processes to operate adequately. There is a strong view that these PPE products cannot be reintegrated into BaU systems of supply until demand and supply both stabilise and are broadly in balance. No-one can predict when that may happen, or if indeed it is possible/foreseeable. Therefore, these new supply management systems must be in operation for a

considerable period and should be changed where necessary (in both BSO, Trusts and end users) to operate optimally.

Independent sector providers (care homes) are expected to provide PPE for their staff. Many are however small businesses without expertise in the handling of PPE in high demand. Small organisations cannot realistically secure PPE supplies when competing with global sourcing players during a pandemic. Trusts are supplying them with adequate PPE, but sometimes just in time as it was about to run out prior to a new shift starting.

New distribution points have been activated for Trusts and BSO to manage, which had never been part of the supply chain. This has created a much more diverse and complex system of supply to manage. For BSO – GP supply chains had to be set up, including new ordering systems. For Trusts, Independent Nursing homes, independent hospitals, GP COVID-19 centres are all new requirements, with no previous or predicted pattern of usage available to enable planning and management of demand. BSO, would also put a request into the emergency planning branch of the DoH, to release stock from the PIPP to enhance any shortfalls of PPE being distributed. The DoH would scrutinize the request and ask for BaU stock holdings, usage rates to determine if the stock can be released, timeframes for the DoH to release stock from the PIPP can vary from one day to a week.

It was also noted that the 3M FFP masks held in the PIPP were showing to be expired 31/07/19 on the primary packaging. BSO highlighted, the masks are inspected by a company called 'Inspect' who complete a quality assurance process on all batches to ensure there fit for purpose. A company called 'Medline' conduct the enhancement of the mask shelf life, and this is communicated through Gold.

Once the PPE stock leaves the Trusts there is no electronic system that the Independent providers can manage their stock onto. It is all done on manual excel spreadsheets. This can lead to non-accurate accounting and could

potentially lead to false figures being displayed as data and not have a true reflection on current holdings.

Some of the storage space at some of the Trusts, are not big enough and if Trusts were to receive a surge of PPE, they might not be able to cope with the sheer volume of stock against their capacity.

There seems to be a lack of qualified personnel within the supply chain, some of the Trusts workers are taking on the PPE as secondary role. Some of the warehouse staff come from Governance, Quality Improvement, podiatrist, and one site only got a forklift on 17 April 2020.

Site Visits - Good Practices

There has been a lot of staff adaption and willingness to lean into the PPE distribution from all levels, and a far cry from their normal daily rolls. It would be good to see a HSC portal where Trusts, care providers etc can share their ideas and promote a 'Good Ideas' forum, that can be shared throughout the Province.

The Northern Trust and Belfast City Trust uses a process for working with Independent Providers through a single point of contact, a Partner hub. A Single point of contact for their independent provider PPE customers. They use email to send Providers a COVID-19 PPE stock ordering form, which is then processed through a vetting system. Attached is the forms Northern Trust use for their customers.

The staff within the Trusts are involved in daily 'cell call' with other stores to see other Trusts pressures / easements and if necessary they will assist each other where possible.

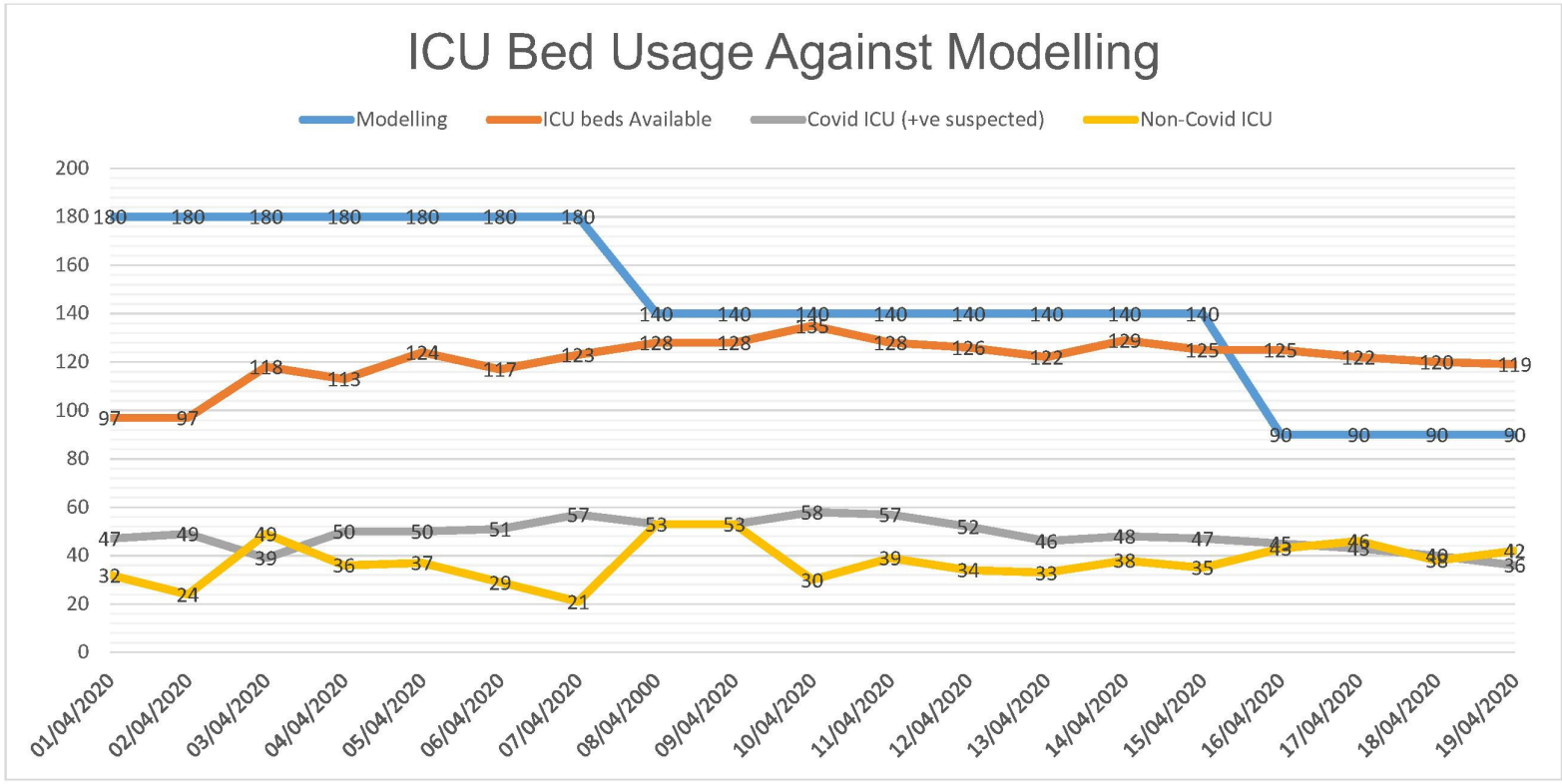
Annex 8

Configuration of Trust Stores

	BHSCT	NHSCT	SHSCT	SEHSCT	WHSCT	NIAS
Store set up	**PPE** – BCH small warehouse managed by Corporate Risk & Governance Team **CHH & OxT** – Large ward area at KHCP managed by Finance	**PPE & OxT** – using existing Pharmacy Store plus additional storage units **CHH** - Dennisons	**ALL** – 1 store at CAH, overspill secured locally from other Public body. Extended opening times 7.30am to 12 midnight.	**ALL** – Old UH hospital store plus commercial storage	**ALL** – 2 main stores at Altnagelvin and SWAH, 6 Acute stores, 9 Community sub stores. Exploring commercial space.	**ALL** – 1 central store location for onward collation and distribution to Ambulance Stations. Extended opening times.
Order administration	Dedicated email addresses for PPE and for CHH and OxT	**PPE & OxT** – using existing JACs system **CHH** – manual requisition overseen by corporate service leads (triage requests)	**PPE** – working with a push system, backed up by emergency order process. **CHH & OxT** – Analysis manual EMM tick sheets and supplement CHH & OxT. Comty manual requests to central store.	Manual orders to central mailbox for FFP3 masks. Moved to online order system w/c 13/4/20. Clinical order triage	Central mailbox. Orders triaged by Bronze.	**ALL** – Processes outside of main FPL system accommodating increased requirements.
Operational management (Stores and distribution)	**PPE** – Clinical Governance Team & Emergency Planning Team **CHH & OxT** - Finance	**PPE & OxT** – Pharmacy **CHH** - Dennisons	**ALL** – Finance with Stores Manager but additional resource required.	**ALL** – Finance. Now identifying other SMgers across Trust as not sustainable	**ALL** - Perf & Service Improvement / Emergency Planning	**ALL** – Existing Stores Manager supported by additional resources

Key: CHH - Cleaning and hand hygiene. OxT - Oxygen Therapy. ALL – PPE, CHH and OxT

Annex 9


ICU Bed Usage Against Modelling
Modelling
ICU beds Available
Covid ICU (+ve suspected)
Non-Covid ICU
200
180
160
140
120
100
80
60
40
20
0
01/04/2020
02/04/2020
03/04/2020
04/04/2020
05/04/2020
06/04/2020
07/04/2020
08/04/2000
09/04/2020
10/04/2020
11/04/2020
12/04/2020
13/04/2020
14/04/2020
15/04/2020
16/04/2020
17/04/2020
18/04/2020
19/04/2020

Annex 10

SUMMARY OF RETURN OF QUESTIONNAIRES

Organisation	No of Returns Rec'd	Score (Avg.)	Challenges	Working Well
Trusts (all areas)	79	7	• Supply of PPE will continue and reassurance of stock availability • Quality of PPE • Too many FIT testing for different products. • Frequently changing Guidance • Reassurance that FFP3 masks stock will be available	• Single points of Contact established • Coordinated approach • Appropriate usage, guidelines being adhered to • Local registers of stock • Donning and Doffing – areas and supervisors
Private Nursing & Residential Homes	9	4	• Supply of PPE • Admin burden caused by range of different suppliers. • No co-ordinated planned response with poor communication from Trusts. • Regional stock control and access to PPE • Getting PPE that was requested • Better guidance on nursing homes PPE use • Variable guidance across Trusts • Changing guidance centrally • Access to PPE – being ring-fenced for NHS • Lack of preparedness by the region • Getting PPE delivered – would be prepared to drive and collect	• Home staff compliance with guidance – good training • Willingness of staff to help • Good communication with Trust

Organisation	No of Returns Rec'd	Score (Avg.)	Challenges	Working Well
Domiciliary Care Agencies	5	7	• Concerns regarding central availability of stock • Lack of understanding of Trusts of Burn rate of masks – only get stock for 3 days – better logistics to have 10 days' advance supply • Clear guidance with agreed usage across NI • Logistics of timeliness of supply – only receiving stocks on the same day as supply runs out. • Poor quality PPE e.g eye goggles • PPE manufacturer guidance for use need • Costs incurred – some providers wanting payment in advance • Stock holding by Trusts – logistic issues for onward distribution across large geographical area	• Having a tight monitoring system for ordering and usage of PPE • Going forward having Trusts provide PPE to providers
GPs	6	6	• Adequate supply both locally and globally • Guarantee of delivery of PPE	• Mobilising donations and private source of PPE • Appeals on social media • Practices have developed networks
NIAS	9	7	• Ensuring a constant supply of PPE considering the global shortage. • Quality of PPE – e.g. flimsy gowns and requirement for regular FIT testing – frequent change of mask type	• the robust processes for daily communication and ordering stock, including the role of the SPOC, Bronze, Silver and Gold Command • no problem with stock level

Annex 11

LEVELS OF PPE

The PPE Guidance (17 April 2020) outlines three levels of PPE, based on the requirements of Transmissions-based precautions, are defined for care settings:

Contact Precautions: Used to prevent and control infection transmission via direct contact or indirectly from the immediate care environment (including care equipment). This is the most common route of infection transmission. PPE normally used for contact precautions would be a fluid resistant apron and gloves.

Droplet Precautions: Used to prevent and control infection transmission over short distances via droplets (>5μm) from the respiratory tract of one individual directly onto a mucosal surface (nose and mouth) or conjunctivae (eyes) of another individual. The maximum distance for cross transmission from droplets has not been definitively determined, although a distance of approximately 2 metres (6 feet) around the infected individual has frequently been reported in the medical literature as the area of risk. Droplets cause contamination of the environment within this area and can be a source of indirect transmission. PPE normally used for droplet precautions would be as above, with the addition of a fluid-resistant surgical mask and optional eye/face protection.

Airborne Precautions: Used to prevent and control infection transmission without necessarily having close contact via aerosols (≤5μm) from the respiratory tract of one individual directly onto a mucosal surface or conjunctivae of another individual. Aerosols stay in the air for a prolonged period of time and can penetrate the respiratory system to the lower levels of the lungs. Interrupting transmission of COVID-19 requires both droplet and contact precautions; if an aerosol generating procedure (AGP) is being undertaken then airborne precautions are required in addition to contact

precautions. PPE for airborne precautions includes a fluid-resistant gown, FFP3 or FFP2 respirator mask (properly fit tested), gloves, and eye/face protection.

Annex 12

PPE Review Action Plan

Recommended Implementation Timescale

Critical = 2-4 weeks
Essential = 4-8 weeks
Recommended = 8-12 weeks

Ref.	Recommendation	Timescale	Actions Required	Responsible Officer	Imp. Date
Oversight Arrangements					
1	**Strategic Approach** A strategically aligned governance structure for the whole system, across HSC, Primary Care and Independent Sector should be put in place for the duration of the pandemic to enable the right PPE to get to the right place at the right time.	Critical			
2	**PPE Review Action Plan** A strategic approach should be taken to the implementation of the recommendations contained below, with an oversight function (led by a Senior Official) established to ensure that established governance structures work collaboratively so that integrated recommendations are aligned with the system as a whole. Each recommendation should be allocated to responsible officers and have agreed dates for implementation in line with the priority ratings	Critical			

Ref.	Recommendation	Timescale	Actions Required	Responsible Officer	Imp. Date
	indicated, with the oversight function obtaining regular progress updates against the agreed implementation dates. Any slippage in the implementation dates should be supported by valid reasons and subject to approval by the oversight function leader.				
Adequacy of Current PPE Stock Levels					
3	**Short Term PPE Shortage Response** A review of DoH PIPP arrangements should be undertaken to ensure a more simplified and timely request and approval process. This will build confidence, and avoid sporadic stock shortages which currently undermines end user confidence.	Critical			
4 a) b)	**Contingency Plans in Event of Supply Shortages** A formal assessment of the supply risks for each PPE product should be undertaken alongside the contingency actions. This assessment should prioritise the most vulnerable supply lines (Long sleeved gowns and FRSM) to come to decisions on potential or accepted contingency measures in the event of an impending stock crisis. Consideration should be given to the appropriateness of the decontamination and re-use of some products in a period of critical	 Critical Critical			

Ref.	Recommendation	Timescale	Actions Required	Responsible Officer	Imp. Date
	shortage, and the availability of "donated" or unconventional sources of PPE which may be available.				
5	**Quality** Systems should be developed to enable feedback from end users around the quality of PPE across all HSC and Independent Sector. The results of this feedback should be analysed to better inform procurement decisions going forward.	Critical			
6 a) b)	**Replenishment / Re-validation of PPE Equipment** The expiry date for all PPE stock should be recorded and logged and this log should be used to inform replenishment of PPE stock (including items in the PIPP store) nearing its expiry date. Management should ensure that this is a continuous process and expiry dates are monitored on an ongoing basis. When PPE stock that has been re-validated is issued, management should ensure that all end users are fully aware that these items remain safe to use and fully compliant with standards.	Critical Critical			
7	**Strategic Assessment of Critical Supply Chains** (Note: Risk Assessment is covered in recommendation no. 4)	Essential			

Ref.	Recommendation	Timescale	Actions Required	Responsible Officer	Imp. Date
	DoH in conjunction with BSO should liaise with CPD and other key stakeholders as appropriate in relation to considering local, national and international supply and manufacturing chains for PPE. This work should be overseen at a pan-government level by the NICS Procurement Board, and inform any required adjustments to NI Procurement policy.				
8	**Procurement** The quality assurance process for PPE should be strengthened in particular in relation to the procurement process, including local businesses and private donations.	Essential			
Appropriate Use of PPE in Line with Extant Guidance					
9	**Guidance on Effective Use of PPE** Before changes in guidance are issued consideration should be given to the impact on practical implementation of the guidance which may require urgent modelling of stock, supply and distribution.	Critical			
10	**IPC Capacity** During the pandemic action should be taken to reinforce IPC capacity and deployment across the system.	Essential			

Ref.	Recommendation	Timescale	Actions Required	Responsible Officer	Imp. Date
11	**Assurance and Monitoring Processes** Assurance and monitoring processes should be introduced in areas least accustomed to the use of PPE, in particular Primary Care and Independent providers. Established systems of quality assurance should be considered.	Critical			
Receipt, Storage, Distribution and Delivery of PPE					
12	**Building on Achievements to Date** Trusts should continue to work collaboratively, sharing information on what is working well across the 6 Trust's operational processes and systems in relation to the receipt, storage, distribution and delivery of PPE. Effective operational approaches and examples of good practice should be integrated across HSC where possible. The operation of supply chains particularly with new customers should be kept under review and periodically stress tested.	Critical			
13	**Stock Management** An electronic stock management system should be put in place throughout the supply chain.	Essential			
Demand Modelling					
14	**Improve Demand Modelling** Significant expertise should be applied to rapidly bring forward a more sensitised predictive demand model for PPE, covering hospital and community predictions. This model should be regularly	Critical			

Ref.	Recommendation	Timescale	Actions Required	Responsible Officer	Imp. Date
	recalibrated, based on the experience of actual demand and the assessed surge level, to provide a regular and formal review of demand planning assumptions. Improved demand modelling will enable Trusts to predict demand, fulfil requirements, and challenge any apparent ineffective use of PPE or stockpiling. It is an important tool in considering contingency/continuity options at points where stock crisis is predicted, enable mutual aid decisions and sharing of PPE across Trusts, and scrutinising/challenging requests for PPE at a local level.				
15	**Interim Approach** The graduated model recently prepared by the IPC Cell should be modelled by BSO, and a collective HSC view taken of the realistic planning level for PPE demand in the upcoming weeks in hospitals and Community settings. There should be agreement that this model is regularly reviewed and adjusted based on any changing advice. This should provide a more realistic "burn rate" which can be adopted for planning purposes by BSO and Trusts, as well as primary care, Nursing Homes and domiciliary care contractors.	Critical			

Ref.	Recommendation	Timescale	Actions Required	Responsible Officer	Imp. Date
Assessment of Readiness for Second Wave					
16	**Systems and Processes in Preparation for Second Wave** In order to sustain effective PPE management into the next surge, a 'rethink' of the current systems i.e. demand modelling, procurement and stock management processes is needed.	Critical			
17	**Supporting Staff and Resilience** DoH needs to ensure that plans are established to support management as they consider the implications of the new processes that need to be put in place in the longer term. This should include professional logistics advice, staff skills and resources, equipment and advice on integration of electronic systems.	Essential			
18 a) b)	**Self-assessment of Preparedness** DoH should undertake a regular self-assessment of its preparedness to respond to the requirements for PPE in a major pandemic. This should also form part of the established governance and assurance mechanisms between DoH and arm's length bodies, and independent contractors. Lessons learned in relation to PPE from its response to the first wave should be captured in preparation for the second wave. Lessons learned should be captured on an ongoing basis.	Essential Critical			